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PRODUCT DIFFERENTIATION AND IMPERFECT INFORMATION:

POLICY PERSPECTIVES

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Product Differentiation and Imperfect Information: Policy Perspectives

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I. What is Product Differentiation?

A. A Definition

Product differentiation refers to the fact that different sellers typically sell different products, even though they are in the same general market. Product differentiation is prevalent throughout the economy. Markets in which sellers differentiate their products are much more common than those in which a homogeneous product is offered by many sellers. This study both summarizes what economists have to say specifically about product differentiation and its role in a free market system, and highlights the policy conclusions which flow from this type of analysis.

B. Spurious vs. Real Product Differentiation

While different brands within a given product class are typically at least somewhat different in their physical characteristics, consumers may perceive the differences to be much greater than they truly are. This exaggeration of product differences is known as spurious product differentiation. The extreme (but very rare) cases where two products are physically identical yet consumers perceive them to be different will be referred to as purely spurious product differentiation. Naturally, the concept of spurious product differentiation only arises in the context of imperfect consumer information about products. In such a context there is at least the potential for seller to manipulate consumers preferences through advertising in order to strengthen brand loyalty.

Most of this report focuses on product differentiation with imperfect information by consumers. The analysis is organized around the various sources of information available to consumers about differentiated products. After all, the social benefits of product diversity only arise when products are in fact different and when most consumers can identify and partronize

identical commodity. In reality each seller has his own niche and exerts some market power over those consumers who are most attracted to his product. Traditional monopoly can be viewed as an extreme case of this where a single seller has a large niche to himself, while perfect competition refers to the opposite extreme where there are many sellers with products essentially identical to those of any given seller. The useful middle ground of product differentiation is known as differentiated oligopoly if entry barriers are present and monopolistic competition if there is free entry. The term monopolistic competition emphasizes that such markets have elements of both monopoly and competition in them.

It should be clear that studying monopolistic competition is more complex than studying perfect competition or pure monopoly. For one thing, we must keep track of a whole set of different products. That is inevitable in analyzing product differentiation. Furthermore, each product may sell at a different price, and each seller has some market power, i.e. faces demand which is not perfectly elastic. The analysis will bring out the fact that this market power, while leading to inefficiencies just as it does in the case of monopoly, is a necessarily evil to support a system in which product diversity is provided. Diversity by definition means that each seller faces rivals with only imperfect substitutes, and therefore has market power over those consumers who find his product particularly attractive. Limited market power may also have advantages in promoting informative advertising, stimulating research and development, encouraging a socially desirable product type to be produced, and rewarding risk taking. This issues will be touched on below.

the brand which suits their tastes. The ability of consumers to obtain information which limits the extent and dangers of spurious product differentiation is addressed below. Basically, if consumers have information about true product performance in the long run, spurious product differentiation will be limited, but not necessarily avoided entirely.

C. Product Differentiation and Market Structure

Recognizing that each seller has unique product, at least in name, highlights the fact that each one has a type of limited monopoly.* It is important to emphasize that "monopoly" as used here, is not necessarily a bad thing. Monopoly is traditionally viewed as undersirable because a monopolist will raise price and restrict output. The extent to which this is possible depends on the monopolist's control over his customers, as measured by his elasticity of demand. While McDonalds has a monopoly on the Big Mac (due to trademark protections), its control over price is limited by its rivals' offerings. The demand curve facing McDonalds is elastic (due to McDonald's rivals), but not perfectly elastic as it would be if perfect substitutes were available. In fact, even a traditional monopoly, e.g. the sole railroad between two cities, is limited by the presence of rivals, e.g. bus transportation.

The point here is that recognizing that products are differentiated is of critical importance in viewing many realistic market environments which fall between the extremes of perfect competition and pure monopoly. Perfect competition is defined as a situation where each seller is so small relative to the market that he faces perfectly elastic demand, i.e. takes price as given. This presumes that many other sellers market the

* A monopoly in that it can raise price without losing all its customers, but limited in that close substitutes are available so that each seller faces rather elastic demand.

D. Product Differention, Diversity, and Scale Economies

Product differentiation is the market's way of meeting the diverse needs of consumers. (Indeed, a stubborn problem in the consumer goods sectors of centrally planned economies is a lack of sufficient product diversity.) Clearly individuals differ quite substantially in their preferences for anything from shampoo to bicycles. Since different consumers have different tastes, the following question naturally arises: Why not simply produce a tailor-made product for each individual which meets his or her most preferred specifications? The obvious answer is that tailor-made products are too expensive, i.e. that there are economies of scale to be exploited by producing the same product for many consumers. This points out the fundamental tradeoff in selecting which products should actually be produced (from either the public or private interest view point): economies of scale versus diversity of preferences.

E. Empirical Importance of Product Differentiation

Almost all consumer goods markets are markets for differentiated products. As we will see, applying principles from homogenous good, perfectly competitive analysis to actual cases in such markets can easily be misleading. Product selection is a particularly important aspect of a private firm's marketing strategy. Economies of scale are also prevalent, especially due to fixed costs of product design and marketing. Therefore it is imperative for the F.T.C. to understand how markets with product heterogeniety and scale economies operate, and what efficiency means in such a setting, especially when advertising plays a prominant role in firms' strategies.

II. The Major Economic Policy Issues Regarding Product Differentiation

A. Product Differentiation with Perfect Information: Summary

With perfect information and no economies of scale, the market equilibrium will be Pareto Optimal. Economies of scale are typically a critical consideration in differentiated product markets, however. The basic question is thus the following one: Will the market equilibrium with scale economies lead to a socially desireable set of products and socially desireable quantities of those products? In making social welfare statements of this kind below, we will implicitly be using the standard welfare measure of aggregate consumers' surplus plus profits.

As indicated below, even if the conditions of entry into the product group in question are those of free entry, the market equilibrium with scale economies, which is called the monopolistically competitive equilibrium, will not be generally conincide with the socially optimal allocation. Neither the set of products produced nor the amounts produced of those products can be expected to be socially optimal. The nature of the biases in the market are outlined below.

Another potential problem with scale economies (retaining the perfect information assumption) is that they can create entry barriers. This can lead to an oligopoly industry structure. Furthermore, established firms can strategically utilize scale economies to heighten entry barriers.

It is important to recognize that a presumption that the market operates in an ideal fashion should not be made in the presence of scale economies and product diversity. On the other hand, the shortcomings of the market are typically not of the type of justify a policy response, in the perfect information case. Indeed the direction of bias in the market, towards too many or too few products for example, is typically very hard to

identify empiricially. There is general agreement among economists that, absent information problems, the presence of product differentiation alone does not justify policy intervention. Substantial economies of scale may justify policy action on traditional antitrust grounds, however.

B. Product Differentiation with Imperfect Information: Summary

A whole new set of issues come into play when the assumption of perfect information by consumers is removed. The possibility of profitable but socially undesirable spurious product differentiation arises whenever consumers' beliefs about products' attributes may be in error. Therefore sellers may have incentives to produce inferior products yet lead consumers to believe that these products are of high quality or superior in some way to other products on the market.

The role of advertising is quite complex under imperfect information. Of course it is in just such a setting that advertising must be viewed if it is to be treated as anything more than a method of manipulating tastes. Advertising strategy interacts with product choice and therefore is related to the efficiency issues outlined above.

When information is costly for consumers to obtain and process, an additional tradeoff emerges as well as the economies of scale vs. diversity issue discussed above: additional diversity may make it more rather than less difficult for a potential buyer to locate his or her preferred brand. For example, the presence of low quality products, which may be appropriate for consumers who value quality attributes relatively little, may make the search for high quality items more costly or impossible for those who are willing to pay for higher quality. The reason is that more low quality items (on average) must be sampled before a high quality brand is found.

In addition the presence of a variety of products may limit the credibility and therefore efficacy of advertising.

The analysis of imperfect information in differentiated product markets is organized around the several potential sources consumers have for information about products. The ability of consumers to obtain accurate information about product attributes is critical to achieving a socially beneficial set of products. In this author's view, there is usually a good information source available for any given product. Policies which improve consumer information directly, or reduce the costs of information via private sources or market signals, are discussed.

The general theme which comes out of the analysis is that potential inefficiences abound in markets with imperfect information and product differentiation, yet it is unlikely that policy action, beyond, say, preventing false and misleading advertising, will improve matters. One set of policy actions advocated below involves government subsidization of or direct involvement in the market for product information. This is due to well known failures in that market. Conditions under which quality standards improve welfare are also identified.

III. Product Differentiation with Perfect Information

While the main thrust of this report is a discussion of the behavior of markets for differentiated products under conditions of imperfect information, it is necessary to first examine such markets under conditions of idealized consumer information. That is the purpose of this section.

A. The Socially Optimal Products and Prices

Before looking at market performance, let us consider how an ideal allocation would look, i.e. what products would be produced and what prices they would be sold at. To do this we will use the standard welfare measure of (aggregate) consumers' surplus plus total industry profits. This is equilivant to the gross benefits received by consumers (as measured in dollars) less production costs. The social optimum is thus the set of products (in the given product group being analyzed) and the associated levels of production which maximize benefits less costs.

The optimal set of products is generally quite complicated to describe theoretically. It depends upon the distribution of preferences in the population as well as the relative costs of the different potential product designs. One general principle which does emerge is that the products which are produced are sold at marginal cost in the socially optimal allocation. This reflects a standard efficiency principle from microeconomics. When there are economies of scale, however, marginal costs fall short of average costs (by an amount reflecting the fixed costs of production). Therefore, the social optimum entails negative profits for the sellers; marginal cost pricing does not permit them to recoup their fixed costs.

This highlights the fact that, while the social optimum (also called the first-best) allocation is a useful benchmark, it is not a feasible arrangement in a decentralized economy. A more reasonable goal is the second-best allocation which maximizes benefits less costs subject to the additional restriction that sellers do not lose money. Some cases have been analyzed in the literature (see Dixit and Stiglitz, and Spence) in which the market outcome coincides with this second-best allocation. These cases, to the extent they in fact reflect actual market outcomes,

should be interpreted as a triumph for the market mechanism (under perfect information). They are, however, rather special cases from a technical viewpoint, so this happy outcome cannot be considered robust. In the next subsection we will discuss the qualitative differences between the market and the optimal allocations in more general cases.

Another basic principle, which applies to both the first- and second-best allocations, reflects the tradeoffs between diversity and scale economies. It is not generally socially optimal to produce each product at a scale which minimizes the average costs of production. This is a good example of how the textbook, perfect competition analysis can be misleading. While minimizing the cost per unit output is optimal with homogeneous products, with differentiated products it is typically* worth sacrificing at least some scale economies in order to produce a greater variety of goods. Such an arrangement involves production on the downward sloping portion of the average cost curve. The general principle is this: if the addition of a new product reduces average production costs, such an addition is certainly worthwhile, while it may be worthwhile (i.e. increase social welfare) even if it raises average costs. This reflects the value of diversity.

It is important to keep in mind that when optimality involves production on the decreasing portion of the average cost curve, the fact that scale economies are not fully exploited does not mean that production is being carried out inefficiently. Rather a choice is being made to enjoy somewhat more product variety at the expense of additional fixed costs of production.

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* The exception arises when the addition of a single firm (starting from an an allocation which minimizes average costs) raises average costs so much as to offset the benefits from the increased diversity. This is most likely when scale economics are the greatest.

With free entry, the market outcome will typically* involve production at a scale less than that which minimizes the average cost per brand. While this was originally thought to prove that the market equilibrium involved an excessive number of products, each produced at inefficiently small scale, this is incorrect. Such an argument only applies when the products are homogenous. With perfect consumer information, however, homogenous products would lead to the classic case of perfect competition in which no firm enjoys any market power. With imperfect information the conclusion that the market leads to too many brands each producing inefficinetly little output will carry over when there is spurious product differentiation; that will be treated below. First we present the correct comparison of the market and the optimal outcomes in the case of perfect information. The goal is to qualitatively identify product selection biases in the market.

B. The Monopolistically Competitive Equilibrium

So long as the economies of scale are non-trivial in comparison with the size of the market, each firm will have non-trivial market power and hence set price in excess of marginal costs. Each active firm therefore acts like a mini-monopolist. Yet the (presumed) free entry of brands into the market drives (excess) profits to zero. Equilibrium occurs when each firm's share of the market is driven down, via entry, until it just covers its costs. Such a configuration of products and prices is what is meant by a monopolistically competitive equilibrium. It is due originally to Chamberlian. In the equilibrium configuration each firm's demand curve, given what other firms are doing, is just tangent to the firm's average cost curve at its output/price point of operation.

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* The exception occurs when economies of scale are large relative to the market.

C. Comparing the Market Equilibrium with the Social Optimum

It is immediately apparent that the market equilibrium cannot possibly coincide with the first-best social optimum. The reason is that each seller prices in excess of marginal cost . At least some vestige of the standard monopoly inefficiency persists in equilibrium. If each firm has only a small niche in the whole product class, however, its market power will be correspondingly small.

While the previous paragraph indicates that, given the set of products produced, these products are priced too high (i.e. higher than is socially optimal, which is at marginal cost), we have yet to compare the set of products produced in equilibrium with the optimal set. This is the question of "product selection bias". Roughly, the question is whether there are "too many" or "too few" products provided by the market* [In fact the problem is somewhat more difficult than this statement suggests. It glosses over the fact that the market may provide the wrong set of products even if it happened to provide the proper number of them. For example, the market may undersupply specialty items in preference to mass market items.]

A basic force which tends to lead the market to produce too few products is the inability of a seller to appropriate all the social benefits which arise due to his introduction of a new product. For example, if a product costs $10 to develop and market, and when sold will generate revenues net of production costs of $8 and consumer surplus (gross benefits to consumers less payments made to the producer) of $6, then the private firm will not introduce the product (because $10 exceeds $8). From a social

*Some readers may be wondering why with perfect information the market does not function in a socially optimal manner,as is suggested in basic microeconomics courses. The underlying reason is the presence of scale economies. In general the private market outcome is not first-best when there are substantial economies of scale, relative to the size of the market. Modest scale economies will cause the equilibrium outcome to be approximately optimal, however, so all the results in this section should be considered in proportion to the relevant scale economies.

or public interest viewpoint, however, this product does pass the cost/ benefit test: the total benefits are $14=$8+$6, and these exceed the development costs of $10. This example illustrates a general point. The net benefits to society are given by

$$\begin{aligned}\text{Social Net Benefits} &= \text{Gross Benefits to Consumers} - \text{Production Costs} \\ &= [\text{Gross Benefits to Consumers} - \text{Payments to Seller}] \\ &\quad + [\text{Payments to Seller} - \text{Production Costs}] \\ &= \text{Consumers' Surplus} + \text{Profits.}\end{aligned}$$

The firm will develop and market the product if it generates positive profits, i.e. if revenues exceed the manufacturing, marketing, and development costs (which are summarized as "production costs" above). It is socially optimal to develop the product if consumers' surplus plus profits are positive. Since consumers' surplus is always positive (with perfect information) there is a distinct bias towards too few products due to producers' inability to appropriate the consumers' surplus.

This bias against marginal products will be particularly strong for those products for which consumers' surplus is relatively large relative to the firm's net revenues. Such products will not be served well in the marketplace. See Spence (1976) for a detailed analysis. This applies particularly for those goods which display relatively inelastic demands.

Another force which leads to an undersupply of product types by the market enters into the analysis when different products complement one another. The key insight is that the entry of an additional product generally influences the demands for existing products in the market and therefore the profits of the firms selling those products. This externality (which is not significant in the absence of scale economies) can lead to an undersupply of products if the demands for different products are positively connected.

For example, if the entry of an additional automobile model stimulates the demand for tires, there are social benefits of entry which are not appropriated by the automobile manufacturer. This type of effect, which applies when products are complements, tends to lead to an undersupply of product variety in the market. It does not appear to be an important force in most differentiated product industries, however. This is for two reasons. First, if these effects are important there is an incentive for diversification to occur: a single firm can enter and produce both of the complementary products.* Second, it is quite rare for two products in the same product group or class to be complements. Therefore we turn next to the more common case of substitute products.

When competing brands within the product class are substitues there is a bias in the market in the opposite direction of the two just described. In particular, there is a tendency for the market to provide excessive variety in the case of substitutes. The reason is that entry exerts a negative (pecuniary) externality on the existing firms in the substitutes case. The addition of a new brand reduces profits at established firms, an effect ignored by the new brand. Just as a positive externality led to insufficient entry in the complements case, there is a bias towards excessive entry of marginal brands in the substitutes case.

Since a single firm fails to account for the adverse impact on the profits of other firms caused by its entry, it may choose to enter even when such entry is not in the public interest. For example, if the new product increases consumer surplus by $2, yields a profit of $2, and reduces profits at other firms by $5, then overall it reduces welfare (by $1) yet is privately attractive.

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*This is a method of internalizing the externality between the two products.

More realistically, a new product may be slightly superior to an older one, enough to be able to take much of the market from the older brand. Yet the true social benefits may be small since it is only slightly better. At the same time the private benefits may be very large. If the private benefits (net revenues) from developing the product exceed its development costs, such a product will be developed by the market. Yet the social benefits may be insufficient to cover the development costs; excessive entry of product varieties is the result.

D. Differentiated Oligopoly

When entry barriers are substantial, established firms in a differentiated product market can not only price in excess of marginal cost (as above), but enjoy positive (economic) profits as well. In such cases there is an additional presumption that prices are set too high. It is unclear whether differentiated oligopoly tends to lead to insufficient diversity (due to entry barriers) or excessive diversity (as an entry barrier).* While elimination of entry barriers as a stimulant to competition is an attractive policy, there is no general relationship suggested by economic theory between product differentiation and entry barriers. One argument (e.g. the cereals case) is that differentiation can erect barriers. Another is that successful entry relies heavily on differentiating oneself from the competition. In summary, the mere fact that an oligopoly is a differentiated one is not an argument for acting more aggressively towards it in an antitrust context.

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* The idea that excessive product differentiation can be used as an entry barrier was part of the theory behind the Cereals Case.

E. Policy Implication of Product Differentiation With Perfect Information

These arguments should alert the reader that the analysis of markets with scale economies and product differentiation is quite different and considerably trickier than the perfectly competitive analysis. The theory tells us that the market will typically not coincide with the socially ideal (first- or second-best) allocation. Some of the sources of product selection bias have been explored. Certainly prices will be in excess of marginal costs in the monopolistically competitive equilibrium. Yet very few economists would recommend an active policy response based merely on this analysis. The problem is really one of fine tuning. Until we know a great deal more about how to identify and quantify such biases empirically, an active policy of encouraging entry or exit of particular types of products, for example, would probably be at least as likely to reduce welfare as to increase it, especially when one includes the direct costs of policy implementation. Therefore, given the current state of knowledge, if policy is called for in differtiated product markets, it must be on the basis of informational considerations rather than the ones described so far. It is to such considerations that we now turn.

IV. Product Differentiation With Imperfect Information

Once the (unrealistic) assumption of perfect information by consumers about all products and their attributes is removed, a much wider range of market imperfections and associated policy issues comes into play. Indeed, the very idea of spurious product differentiation presumes imperfect information. This report does not pretend to give an exhaustive analysis of differentiated product markets with imperfect information. Rather it seeks to identify the issues which the author judges to be the most

important, and indicate which of the many theoretically identifiable market imperfections are likely to be significant enough to warrant a policy response.

Imperfect consumer information is a much more prevelant problem in differentiated goods markets than in homogenous goods markets. By definition, there are significant differences in product attributes across brands, so there is a great deal of relevant information. Furthermore, this information is usually relatively costly to acquire, particularly is comparison with, for example, price information. Making matters worse is the fact that in consumer goods markets the costs of information acquisition are especially large relative to the expenditures made on the products themselves. This is the case because each consumer spends a relatively small amount on each product class, yet his or her information acquisition costs are fixed costs, i.e. they are independent of the scale of purchases. For large buyers, e.g. commercial users, information costs are much smaller relative to total expenditures.

All of these arguments suggest that consumers in differentiated product markets are likely to have significantly less than perfect information, even after they undertake such information acquisition as is cost effective. It does not pay for consumers to acquire perfect information, even when such information is available. The rest of this paper explores the implications of this fact for the performance of differentiated product markets. The analysis is divided into three main parts: First we discuss the different sources of information available to consumers and comment on the effectiveness of each. Then the implications of imperfect information for firms' product choice and pricing policies are studied. Finally, the policy implications of imperfect information in differentiated goods markets are discussed, in light of the analysis which has come earlier.

A. Sources of Consumer Information About Differentiated Products

The importance of buyers having imperfect information about product attributes is proportional to the costs such buyers face in acquiring information. Therefore, a careful analysis of the many potential information sources is called for. In the subsections below we consider a number of both direct and indirect sources of information, given the set of products in the market. The effect of imperfect information on the quality of products provided in the market is treated in part B below. The sources of information analyzed in this section are (1) Reputation, (2) Search and Inspection, (3) Prices, (4) Other Signals of Quality, (5) Third Party Suppliers of Information, and (6) Advertising. It is important to recognize that, while direct observation of product qualities, (2), may be quite expensive or impossible, the possibility of using alternative signals or indicators of product quality usually exists. By looking at how these different signals work we can understand when the market is likely to perform particularly poorly in supplying product information.

1. Reputation as a Quality Assuring Mechanism

A natural and often used indicator of the quality of a firm's product is the quality of products produced by the firm in the past. The expectations which prevail in the marketplace today about a seller's quality, and which arise on the basis of the seller's previous performance are what we mean here by the seller's reputation.

Several questions naturally arise in the study of reputations: (a) If consumers use reputation as a guide, will they be taken advantage of or fooled? In other words, does it pay for a manufacturer to maintain his reputation? (b) What are the implications of reputations for the prices of goods of different qualities? (c) For what products is reputation an

efficient source of brand specific information? and (d) Does reputation constitute a barrier to entry? Two previous papers by the author, "Consumer Information, Product Quality, and Seller Reputation," and "Premiums for High Quality Products as Rents to Reputation" have analyzed these issues in some detail. The results and lessons from this analysis will now be summarized with an emphasis of their policy implications.

(a) Roughly speaking, the first question about reputation is this: Under what circumstances does reputation "work"? or When will a profit maximizing firm live up to its reputation (i.e. fulfill consumers expectations about its quality)? The critical factors which affect the answer to this question are the costs to the seller of changing his product's quality, and the speed with which consumers update a seller's reputation in response to changes in his quality. If product redesign is costly, if quality reductions generate only minor cost savings, if consumers adjust their expectations rapidly to changing quality, or if the interest rate is relatively low, then firms will find it in their own interest to fulfull consumers' expectations at relatively high quality levels.

The difference between a situation of perfect information, in which consumers can (costlessly) observe product attributes prior to purchase, and one of reputation, in which consumers rely on previously purchased products for information about the item they are now considering is one of timing and reliability of the information. When reputations are used by consumers, they are limited by the extent to which consumers can evaluate products quickly and reliably on the basis of use.

Potential problems arise with reputation as a information source when it is difficult for consumers to evaluate product performance even after use of the product. This applies specifically to many services such as

medical or legal services, or other services which require expertise to evaluate. Reputation is also unlikely to function effectively when it is very easy for firms to alter the quality of their product. For example, consider the case of a restaurant which can build up a fine reputation by producing a small number of high quality meals and relying on word-of-mouth to carry this information to many potential patrons. Suppose also that this establishment can then milk its good reputation by selling a great many inferior meals before its demand returns to the initial level. In such a case consumers who used reputation as a signal of quality would be disappointed. In general, reputation cannot work properly if a seller can earn more in the process of running down his reputation than it costs to build it up again. Eventually, if this type of repeated milking of reputation became common in a given industry, consumers would come to rely less on reputation and more on other sources of information. Casual empiricism suggests, however, that reputations are generally very good predictors of current quality. To the extent that this is so, consumer information, a least about established brands, will be very good.

When reputation works properly it can provide an excellent indication of a seller's quality. The fact that quality reductions by sellers are punished (via a reduction in demand) only with a lag, however, means that markets in which reputations are important information sources will not work as well as markets with perfect information. This is not a justification for policy intervention, however, because information is costly and perfect information is only an ideal, not an achievable (or necessarily desireable) state of affairs. When maintaining reputation provides the incentive for a seller to keep his quality high, it cannot generally induce the seller to maintain quality at as high a level as he would under perfect information.

Alternatively, consumers must pay more for items of a given quality under the reputation mechanism than under perfect information in order to induce production of that quality by the seller.

In these senses reputation can only work imperfectly. Yet in the long run when reputations work at all they do provide almost perfect information about quality. One reason reputation will not provide a perfect signal of quality is that the environment in which a firm operates is constantly changing. If, for example, the cost of high quality ingredients goes up, a restaurant may well select to reduce the quality of its food. During the transition process consumers will find their expectations of quality to be overly optimistic, i.e. the firm's reputation will diverge from its actual quality. In the longer run, however, the two will coincide again.

(b) While reputations may provide excellent information about a seller's quality, they can only do so at a (social) cost. Indeed, a crucial principle emerges in the study of reputations which emphasizes the differences between perfect and imperfect information analysis: Even if firms with reputations have no market power, they will sell high quality items at prices in excess of marginal cost. This apparantly paradoxical result warns us that market outcomes where reputation is important will not be ideal (although they may be as good as possible given the very real information costs in such markets).

The reason why prices must exceed marginal costs under imperfect information is that a firm must value its customers if it is to have an incentive to keep them by maintaining its reputation.* To see this, consider two alternative strategies available to a firm with a good reputation: the honest strategy of quality maintenance, and fly-by-night strategy of quality

* In the standard competitive analysis firms can sell as much as they wish at prevailing prices. With reputations, firms are customer constrained. Realistically, they value their customers.

deterioration. Since profits can be earned in the short-run via the fly-by-night strategy (due to the cost savings associated with this strategy), quality reduction will always be more attractive to the seller than quality maintenance unless the seller can can also earn profits with the honest strategy. But an honest seller can only make profits on a customer if the price paid by the customer exceeds the marginal cost of providing the item to that customer. A model which demonstrates that high quality items must sell at prices in excess of their costs, even with perfect competition, is given in the appendix.

The divergence between price and marginal cost necessary to induce honesty by the seller will be large if consumers find it difficult to observe quality (so that quality reduction may go unpunished) or if quality can only be observed with a long lag (so that the consumer's response will be slow following quality deterioration). An example of the former is automobile repair, while consumer durables provide an example of the latter. The fact that price does not equal marginal cost should alert us that there is a bias in the market against high quality products, since they must sell for a premium above marginal costs. This will generally cause consumers to substitute towards lower quality products. Some consumers may choose not to purchase the product at all because the information premium drives up the price. Social welfare is therefore reduced.

Because improved consumer information leads to a reduction in the gap between price and marginal cost, it generates additional social benefits, i.e. improved information leads to a welfare gain. The reason is that good information on the part of consumers reduces the attraction of the fly-by-night strategy and therefore reduces the price necessary to induce honesty. Another policy which will reduce the premium for high quality products is the

imposition of a minimum quality standard.* By limiting the quality reduction which is legal (and therefore limiting the cost savings which are possible via quality reductions), the attractiveness of the fly-by-night strategy is reduced. This again reduces the price necessary to make honesty attractive to the seller, bringing this price closer to the seller's marginal cost.

(c) A key principle to keep in mind is that a seller will balance the cost savings from quality reductions against the (future) losses in customer goodwill (reputation) which such reductions will invoke. If consumers cannot accurately judge quality even after purchase (or are unlikely to be able to do so) or if quality detection is a slow process, the costs to the seller of quality reduction are quite low (although the social costs may be high). In such cases reputation is limited as a mechanism in that it cannot, without very large premiums for high quality items, induce production at reasonable quality levels in the absence of other incentive mechanisms (e.g. prodcer liability or third party quality certification).

For products which are frequently purchased and easily evaluation reputation alone substanitally solves consumers information problems. This is especially true if there is an easy way for consumers to communicate product attributes to one another or if consumers tend to value the same attributes similarly (so that the statement by one consumer that "Restaurant X has fine food," carries a lot of information to other customers).

For products which are infequently purchased, (e.g. big ticket items) or which consumers have difficulty judging the quality of after use (e.g. doctors), reputation is less likely to be an effective information source. This is especially true of products for which "quality" is reliability (i.e.

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* Examples of standards which operate in this fashion are occupational licensure requirements and health codes at restaurants; safety standards for toys and automobiles also function in this manner, but liability considerations as well as reputations are prominant in these examples.

the probability of the product not breaking down). In such cases many consumers who observe no breakdown of the product have no way of accurately estimating its true reliability. Clearly they need some centralized source of information about the product's performance in the population as a whole. Reputation is also of limited usefulness when the "quality" of an item is its durability. By definition it will take a long time for consumers to determine the product's true qualtiy. As noted above, long detection lags hinder the reputation mechanism.

(d) The fact that firms with good reputations price above marginal cost and earn positive profits may suggest that reputations inevitably imply barriers to entry. This is not the case. The "profits" a highly reputable firm earns can well be nothing more than a fair (competitive) rate of return on the investment initially made in the reputation asset. Over such a firm's lifetime its profits (in present value terms) are zero; this reflects underlying conditions of free entry. But there is a specific time profile of these profits: A seller initially incurs (operating) losses while establishing his or her reputation.* This is the period of market penetration and investment in goodwill. Once the firm has established its reputation it enters its mature phase during which it sells its product at a price in excess of marginal cost, as decribed above, and therefore earns a flow of net revenues. Yet this markup does not reflect market power at all.

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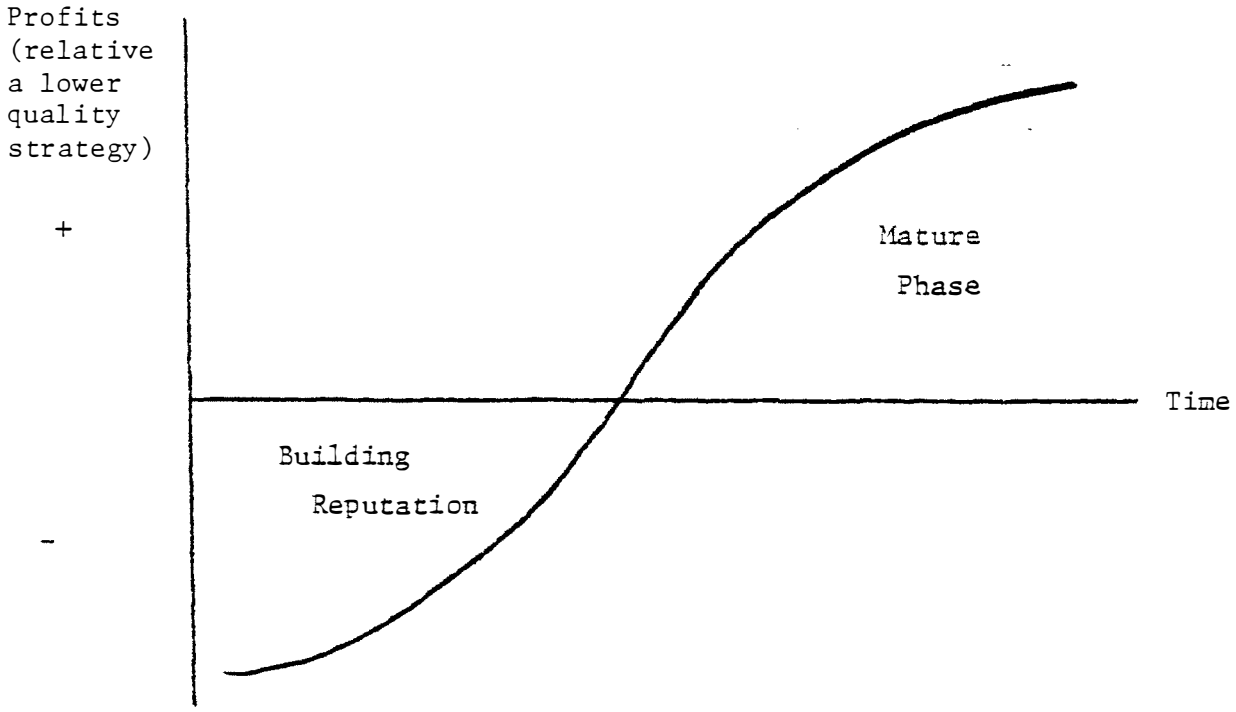
* These are "losses" relative to the adoption of a lower quality strategy. In the case of a new product which is a successful innovation, profits may be positive throughout the entire product life cycle. These overall profits are returns to the (good) idea embodied in the product. Yet for any high quality product there is an initial phase of investment in reputation followed by a (mature) phase during which the reputation is enjoyed. That time pattern is shown in the figure below.

Rather it reflects the premium necessary to induce honesty; equivalently, it is the competitive return on the initial investment in reputation.

The typical time profile of profits of a firm in a market where reputation is important is shown in the Figure below. The present value of profits over the firm's lifetime (or the brand's lifetime) are zero. This reflects the forces of free entry and competition. It would be easy to mistakenly infer that the firm had market power by observing it only during its mature phase, however. Reputation is only a barrier to entry here to the extent that an initial outlay is necessay to enter the market. But this outlay is no bigger for late entrants than for early entrants, so it is not really a barrier to entry as this term is usually defined; it is simply a cost of entry.



Time Pattern of Profits for a High Quality Product

In summary, reputation can be an excellent and reliable source of information about product qualities, so long as consumers have a reasonable ability to evaluate products after they use them, and so long as they can communicate this information amongst themselves. Its effectiveness relies on a divergence between price and marginal cost which causes sellers to value their customers. Therefore the reputation mechanism is not without its social costs. Yet these costs reflect true information costs in markets where direct information about product attributes is costly for consumers to obtain. Policies designed to minimize the social costs associated with the reputation mechanism are discussed below.

2. Search and Inspection as Sources of Information

While reputation utilizes product experience as an indicator of quality, for some products it is possible to judge quality without actually using the item. Nelson has labelled such goods search goods, in contrast with experience goods.

To the extent that searching for and inspecting products is inexpensive and yields complete and reliable information about product characteristics, the problem of imperfect consumer information is mitigated. Very often, however, the most important product attributes cannot be judged by inspection alone. This is especially true of services, but applies to many complex consumer durables as well. Indeed, it is hard to think of significant consumer goods which can be evaluated carefully without actual experience with them. For many important consumer goods, therefore, search and inspection are of rather limited usefulness.

The major product attribute which is emenable to search is price. There is a very well developed economics literature analyzing market equilibria in a setting where consumers search for the lowest price, but it is usually

assumed that consumers have very good information about all other product attributes (or that the good in question is homogenous, which amounts to the same thing). From a policy viewpoint, since the cost of price search is quite low, often no more than the cost of a telephone call, imperfect information about prices is unlikely to present a serious problem. This is so despite many now standard results about inefficiencies in the search process due to externalities.* The reason is that the quantitative significance of such effects is probably very small. A possible exception to this is the case where consumers are simply unaware of the existence of some brands, expecially if this applies to new entrants.

For products which are inexpensive and frequently purchased, and which do not cause substantial harm in the event of failure (or poor quality), information problems about product attributes are minimal, as they are with respect to prices. Basically, the cheapest way to carefully inspect such products is to simply buy them and try them out. It seems highly unlikely, for example, that consumers can be consistently or significantly misled about the quality of a candy bar or a brand of soap.**

Where search and inspection are cheap and effective, as they are for learning product prices or the qualities of inexpensive items, imperfect information is not an important element. It is useful to narrow the range of our study by ruling out such products; a very large group of proudcts remain, however.

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* For example, additional search by one group of consumers will generally lead to a more competitive market and hence lower prices for all consumers, including those who did not search: there is a positive externality associated with search.

** It does seem desireable to this author to require disclosure of difficult to observe attributes such as nutritional content or the number of calories, however. A temporary period during which such disclosure is mandatory may be an attractive policy option. It facilitates communication with less heavy-handed regulation.

3. Prices as Signals of Quality

It is well known that consumers use price as a guide to product quality. The question thus naturally arises as to whether, in the face of self-interested, profit-maximizing sellers, consumers who adopt such a buying strategy will find their expectations fulfilled. Specifically, if consumers judge product quality by price, will high price firms in fact provide better products?

Recently Joseph Farrell and the author have formulated theoretical models in which prices accurately signal or predict product quality. The key to this mechanism is the repeat purchase process by which consumers tend to return to firms with high quality products. Basically the mechanism works in the following way: a firm charging a high price tends to have a relatively large markup. Therefore it values each customer relatively highly, i.e. it has a large incentive to try to keep its customers. The method by which it can do so is by increasing the quality of its products. The result is that high priced firms have the incentive, in the process of maximizing their own profits, to provide higher quality items than do lower priced firms. This is so despite the fact that consumers cannot observe quality prior to purchasing the item. Indeed, quality may be difficult to detect even after purchase; the mechanism works so long as the probability of a customer's returning to a given firm is positively related to that firm's quality. This is proven in the appendix. Consumers who expect higher quality to go along with higher prices will therefore not be disappointed. The higher prices themselves change the quality incentives of the sellers in a way such that price can serve as a signal of quality.

When prices serve as a signal of quality there will be a specific price-quality schedule in the market equilibrium. In the long run consumers will come to know this schedule and hence each consumer can pick his most

preferred price-quality package on the schedule. Some consumers will select low price and low quality, while others will select high price and high quality. Which of these is the "better buy" depends on the consumers preferences (i.e. sensitivity to quality).

In the simple model just described, prices serves as a perfect signal of product quality. In reality, while this effect is important, it is obscured somewhat by a number of complicating factors, including heterogeniety on the part of consumers and firms and a generally changing environment. Therefore the data on price/quality correlations are likely to show a distribution of products in price and quality space rather than a perfect correlation. This would come out of a more complete theoretical model in which consumers differed in their tastes for quality attributes and in their likelihood of returning to purchase from a given firm. Consumer diversity in the frequency of purchase would lead to the same outcome. Another factor leading to a distribution of prices and qualities is the fact that firms differ in their costs so that the quality which it is optimal for one firm to provide at a given price will not necessarily be the same as that chosen by another firm.

What is important is that this theory predicts a significant, positive correlation between prices and qualities, even when it is impossible for consumers to observe qualities before use. The only behavioral requirement is that the probability of repeat purchase be directly related to product quality. This prediction of a positive price/quality correlation, and a rather tight correlation as well, is the same as that which comes out of the reputation theory described above.

4. Warranties and Market Shares as Signals of Product Quality

In addition to prices and reputations, consumers may be able to observe other aspects of products which provide indirect information about quality. An important piece of information is provided by a product's warranty. Since substantial warranties are more costly for sellers with poor quality items, who must make good on the warranty more often, such warranties can serve as signals of quality. Indeed, some sellers advertise their warranties as proof that they produce superior products.

An important limitation on warranties as signals of quality is the fact that consumers themselves can influence the likelihood of a product breakdown and subsequent warranty payment. See Shapiro and Stiglitz for a complete analysis. Washing machines illustrate this type of problem nicely. Consumers are concerned with whether a given machine will last for five or for ten years (for example). A two year warranty does not provide much information about the durability of the machine in the longer run.* Yet the manufacturer of the more durable (ten year) machine may be unwilling to offer a complete ten year warranty as a way of signalling his superior product.

One reason for his reluctance is that some consumers use the machine more intensively than others and will be most strongly attracted by his impressive warranty. Their use will tend to cause the machine to fail sooner than average, requiring the manufacturer to make significant payments under the warranty despite the high quality of his machine. This is what is known as an adverse selection problem in the economics literature.

A second reason why extensive warranties may not be feasible is that many users may fail to take proper care of the machine when faced with

* Especially if sellers know that consumers use the two-year warranty provisions as a signal of durability. It may be possible to design products which perform very well for two years yet are unlikely to be long lived.

such a generous protection package. Again the manufacturer may be forced to make payments under the warranty which are excessive in view of the machine's inherent quality. This is known as a moral hazard problem.

A final problem with warranties as signals of quality is that many consumers do not take advatage of the provisions of warranties, even when they are eligible to do so. Therefore the warranty is not a credible signal of quality, since a reduction of quality by the seller will not substantially increase his payments made under the warranty. See Golding for a more complete discussion of this issue.

The upshot of this is that the usefulness of warranties as signals of product quality is likely to be significally diminished by the moral hazard and adverse selection problems described above. Therefore, while warranties may signal minimal acceptable quality, they cannot signal quality in the higher range (where moral hazard and adverse selection become significant forces). It is exactly this higher quality range which is likely to be the relevant one for consumers' information needs.*

Another potential signal of quality is market share. It seems plausible that heavily used brands are the superior ones. But to assume this is to presume that consumer information is fairly good for some other reason. Market shares can work as a signal of quality in conjunction with another information provision mechanism, but not alone. At least some consumers must have a source of information about product attributes apart from market share, if such shares are to have information content. One mechanism which has been studied in this context is the repeat purchase mechanism, outlined above in the subsection on prices as signals of quality. See Smallwood and Conlisk.

The principle is that so long as some minimum fraction of the consuming population has a good information source, then brand choice by others on the

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* A similar phenomenon is the ability of medical malpractice to protect patients from very poor medical care, but not from merely mediocre care.

basis of market share will tend to reward superior brands. In order for this process to work it is important that consumers basically agree about which products are good and which are bad. For example, if an individual with rather unusual tastes knew he was atypical, it might well be optimal for him to purchase a brand with a small market share.

It appears that warranties and market shares have some ability to provide consumers with information about product's attributes, but probably not as much information or as accurate information as reputation, or even prices. If consumers had to rely on warranties and/or market shares alone there would be substantial information problems in differentiated product markets. As information sources in conjuction with the others described in this report, however, they play a useful role.

5. Third Party Provision of Information

Substantial information about consumer goods is provided by private and public publications. This is a generally underrated source of information. For example, detailed information about high fidelity stereo equipment is available in magazines, and considerable information about automobile attributes, particularly safety features, is provided by the U.S. government. Retailers frequently provide considerable information about manufacturer's products to consumers as well, both directly in the retail establishment and indirectly through their choice of inventories.

Economists have typically focused their attention on the potential problems in the market for information about product characteristics, especially to the extent that such problems tend to lead to an undersupply of information. These problems include the following market imperfections:

(a) There are high fixed costs and low or zero variable costs of information production and provision, (b) It is difficult to prevent the resale or simple the passing along for free of information from one consumer to another (so the provider of information faces an active "secondary market"), (c) When one buyer becomes informed he or she creates a positive externality on other buyers by increasing qualities and/or reducing prices in the market, and (d) There are credibility problems for private information sources. Another reason given for an active consumer information policy is that the establishment of a standardized scale on which to measure quality constitutes a public good and is therefore an appropriate public sector activity.*

These are all correct and important arguments. A general belief in the workings of the market does not justify the position that the market provides information of a socially optimal content or in socially optimal quantities. At the same time, a healthy respect for the diversity and sophistication of private information sources is called for. This suggests to this author that a policy designed to encourage rather than replace private information sources is the appropriate one.

6. Advertising as a Source of Consumer Information

One of the most significant sources of consumer information (and perhaps misinformation) is advertising, to which we now turn. We consider three specific questions about advertising as an information source: (a) Can advertising overcome credibility problems and serve as a direct source of information? Similarly, is the content of advertising messages likely to be socially optimal? (b) Is the quantity of advertising in differentiated product markets the socially optimal quantity, and if not what is the direction of the bias? and (c) Can advertising serve as a signal of quality, i.e. can advertising provide information indirectly?

* Tar and nicotine measures for cigarettes and the R-value scale for insulation are examples of highly beneficial standard scales promoted by the public sector.

(a) Information provision by the seller himself is naturally suspect. His incentives simply do not match up with either those of the buyer or those of the public when it comes to providing information about his product. In the absence of laws controlling false and misleading advertising, this credibility problem might seriously handicap advertising as an information source. At the very least sellers would have to establish reputations for telling the truth. Given the existing restraints on deceptive advertising, however, one's view of the ability of advertising to directly transmit information hinges critically on one's view of consumer behavior.

A viewpoint that consumers are quite sophisticated and able to screen out the fluff and the flash from the facts goes hand in hand with a view that advertising is primarily informational. On the other hand, a view that consumers are gullible and make brand choices mechanically on the basis of which brand has projected the most favorable image into their brains leads to a conclusion that advertising is mostly persuasion and very little information indeed. It is this latter viewpoint which underlies the notion of spurious product differentiation.

In this writer's opinion neither of these views is completely right nor wrong. Indeed, to speak of "advertising" as a homogenous activity is itself misleading. Many network television advertisements would seem to involve primarily persuasion, or the manipulation of preferences, in order to alter consumers' demands. Yet most print media advertisements seem to be primarily informational. It does seem to be the case in general, however, that advertising messages carry an informational content which is heavily biased in favor of the product. This is hardly surprising, but makes it clear that the content of advertising is far from the socially optimal content.

For example, an undesireable attribute of a given product which matters quite a lot to many consumers is unlikely to ever be communicated through

the use of advertising, despite a high social value to consumers having that information. Given that we choose to live in a free, decentralized society, with a special place reserved for free speech, the only way to improve on this state of affairs is to augment private information with public information, something which is actually done to a considerable extent. There is at least some check on the concealment of unfavorable information by private parties, however: What is one brand's weakness is another's strength, so consumers may indeed receive the relevant information from a rival's advertisements.

There is one informational function of advertising which is not subject to the credibility problems discussed above. That is the information conveyed by an ad that a particular product exists. Advertisements can also convey basic information about what the product is designed to do and where or how one may find the product for sale. So long as the laws against fraud are enforced, it is unlikely to be in a seller's interest to mislead consumers about his product's basic attributes (although he may easily choose to play up its capabilities considerably).

On net, advertising seems well suited to alerting consumers that certain products exist and are for sale at certain places or for certain prices. Problems with advertising are more likely to arise when advertising is used to convey information about specific product attributes or capabilities, especially in comparison with its competitors. Yet it is exactly information of this latter kind which consumers need to shop intelligently in differentiated product markets. An optimistic view would be that advertising serves an initial, informative function which must then be augmented by some of the other information sources discussed above, such as reputation and inspection or a discussion with a salesperson.

(b) We now turn from the issue of advertising content to that of advertising intensity, i.e. the level of advertising expenditures. While economists have identified a number of factors tending to bias the market towards too little or too much advertising (i.e. less or more than the socially optimal amount), there is no real consensus on how these factors balance out. The situation is therefore much like the attempt above to determine whether the monopolistically competitive equilibrium involved too many or too few products.

A fundamental factor pushing the market towards too much advertising is the persuasive function of advertising in changing consumers' tastes. In a recent study of advertising and welfare, Dixit and Norman have shown that, even if the preferences after advertising are accepted as the "correct ones" for measuring benefits, then advertising which causes prices to rise is carried out excessively. This is so in a monopoly or in a monopolistically competetitive setting.

Another factor suggesting that advertising levels are excessive is the "zero sum" character of advertising. To the extent to which advertising simply shuffles consumers around among brands it seems quite wasteful. This certainly reflects a popular attitude towards advertising. This is not an entirely accurate characterization, however, for advertising may help consumers find their most preferred products even if it does not increase total industry demand. By improving the matching process between consumers and firms advertising may promote efficiency.

Obviously, however, if the products are objectively very similar and advertising serves mainly to help firms (spuriously) differentiate themselves, there will be virtually no social benefits from the realigning

of consumers among brands. Indeed the social benefits of such advertising are quite likely to be negative for yet another reason: if advertising reduces the cross-elasticities of demand among brands it will lead to increased market power by each brand and therefore price increases. In sum, then, to the extent which advertising is simply a method of attracting customers from one's rivals and (spuriously) convincing one's own customers how special one's own brand is, it is likely to have significant private returns yet very small or negative social returns.

In contrast to this view of persuasive advertising, there is an alternative argument which indicates that informative advertising may be undersupplied by private sellers (Shapiro, 1980). The reason is that advertising which informs consumers of a product's existence may generate consumer surplus which is not appropriated by the firm doing the advertising. Therefore the private gain from an ad (net revenues from a new customer) falls short of the social gain (net revenues plus consumer surplus). An inadequate supply of informative advertisements is the result.

The interaction of these two effects in a differentiated product setting has only very recently been carried out by the author (Grossman and Shapiro). Preliminary results indicate that the monopolistically competitive equilibrium involves an insufficient level of advertising expenditures at each firm. The number of firms in the market is excessive, however, so the aggregate amount of advertising may nonetheless be excessive.

(c) Advertising as a Signal of Quality

Proponents of advertising argue that, while credibility problems make it impossible for advertising to directly communicate product quality,

the mere fact that a firm has advertised indicates that its product is likely to be of high quality. In other words, advertising is a signal of quality. This argument is often attributed to Nelson. We first summarize the Nelson argument and then indicate its weaknesses.

The idea is that advertising functions as a way of attracting new customers to the firm. Therefore, firms which value customers the most will be those who advertise the most. And which firms will these be? Nelson argues that firms with high quality products will value new customers the most highly because they will get the most repeat business (on average) from such a new customer. This last claim only requires that customers tend to return more to firms with high quality products. If high quality firms do in fact value customers more, then they will advertise more, and consumers who make their brand choices on the basis of advertising levels by sellers will be acting rationally. Therefore it is sensible for consumers to respond to advertising despite the lack of any information in the ads themselves.

This is a very ingenious argument in that it accepts the fact that many advertisements appear to contain no information ,and yet still comes to the conclusion that consumers are rational to pay attention to such ads! The argument, however, both as given here and as proposed by Nelson, relies on some very strong assumptions which are not likely to be met in reality. In particular, it assumes that all firms have the same markup over cost, whatever quality product they happen to produce. In the more realistic case where low quality firms have higher markups (since their costs are low), the Nelson conclusion fails to follow. Advertising and quality are not necessarily related. A more complete discussion of the Nelson argument and its faults appears in the Appendix. Attention is paid there to the case where all the products sell at the same price. In sum, then, while

the Nelson argument is plausible, it is hardly a complete or airtight theoretical position. What is really needed is an empirical test of the Nelson hypothesis.

B. Imperfect Information and Product Selection

We now consider how the existence of imperfect information effects the production selection bias results described earlier. The major identifiable impact of imperfect information is that it causes sellers to favor those attributes which are easily observable and identifiable, while reducing quality along those dimensions of products which are difficult to observe and evaluate. For example, if regulations require disclosure or a product's qualtiy along one dimension, then as consumers come to rely more heavily on that measure to judge the product's overall quality, it is likely that there will be deterioration along other dimensions. The mere fact that consumers have difficulty evaluating a product along a given dimension does not mean that they care little about that dimension (e.g. the reliability of a surgeon).

In general the quality of products is reduced as a result of the imperfect information (see Shapiro (1982)). This seems to be an inevitable consequence of asymmetric information (i.e. of the fact that firms but not consumers know the product's qualities). The perfect information quality is generally not sustainable in the private market under limited information. There is a strong theoretical case that improved information does indeed lead to increased quality, as intuition suggests. It is considerably less clear what happens to the set of products when product diversity rather than simply quality is involved and the perfect information assumptions are removed.

Prices are likely to rise as a result of imperfect information. This will lead to a reduction in social welfare, some of which reflects the very real costs of information which are assumed away in the perfect information analysis. The price increases come about for at least two reasons: First the maintenance of reputations require prices to be in excess of marginal costs, even in the absence of market power. Second, imperfect information tends to increase the amount of market power enjoyed by each of the sellers in a differentiated product market. If a consumer knows of only a few other brands, then his regular brand has a stronger hold over him, i.e. his cross-price elasticity of demand is lower, than it would be with more information.

C. Policy Implications of Product Differentiation with Imperfect Information

While market imperfections have been identified for a variety of reasons, the direction of bias in the market with respect to advertising in particular is unclear. While a deterioration of quality can be expected due to imperfect information, there is reason to believe that this effect is not so significant in view of the variety of sources of information consumers may potentially use. And the methods by which this or other marekt imperfections can be corrected are far from clear.

The most attractive policies are (1) Subsidization or encouragement in some way of suppliers of information, (2) Government supply of some information when other sources are inadequate, e.g. in the case of health or safety attributes, (3) Mandatory disclosure of information where it is inexpensive yet the information is valuable (as in currently done for many food items), (4) Selective use of occupational licensure and certification requirements, (5) An ongoing search for products in need of a standardized system to

promote the communication of product information, and (6) A continued policing of advertisements to prevent false and misleading commercial speech.

V. Conclusions

Markets with differentiated products have been studied under the assumptions of perfect and then imperfect information. In general such markets do not perform in a ideal fashion, yet the exact manners in which they fail to do so are generally quite difficult to identify empirically or correct with active policy. The major policy recommendation run along the lines of existing policies, with some additional emphasis on improved consumer information. A major shift in policy towards advertising or product differentiation is unwarranted.

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Appendix: Reputations for Product Quality

In this appendix we show how reputation can serve as a perfect indicator of product quality. There is a social cost to this mechanism, however: all items above minimal quality sell at a price in excess of marginal cost. This premium is the seller's return on his reputation. Conditions under which reputation can work as a signal of product quality with a relatively low social cost are identified. For a more complete treatment of reputations, see Shapiro (1981).

For simplicity assume that each seller can produce a fixed number of items per period, all of a quality of his choice. For ease we normalize units of the product such that each seller produces one unit per period.

Each seller selects the quality, q, of his product each period. The cost of producing an item of quality q is denoted by $c(q)$, where $c'(q) > 0$. Liability laws or quality standards require that product quality be at least at the level of "minimum quality," q_o .

Consumers cannot determine quality prior to purchase, but a seller's quality becomes common knowledge after a consumer buys and uses his product. Quality can then be incorporated into a seller's reputation. By a seller's reputation we mean exactly buyers' expectations about his quality. Initially, assume that quality is perfectly observable immediately after use of the product and is immediately incorporated into the sellers reputation. Specifically, assume that consumers expect a firm at a given date to produce the same quality as it did the previous period (this quality having since been observed through use of the product).

We now demonstrate that there is a unique price-quality schedule , $p(q)$ such that each seller finds it desireable to produce the same quality as he

has in the past. Therefore consumers' expectations are fulfilled: reputations do indeed indicate quality itself.

Consider the quality choice of a firm which has been producing a given quality q in the past. The "honest strategy" for such a firm is the one of quality maintenance. If items of expected quality q sell for p(q), the honest strategy will earn a flow of "profits" of p(q) - c(q) per period. Assuming an infinite horizon for this profit stream, the present value of this stream of returns is given by $(p(q) - c(q)) \frac{1 + r}{r}$. Alternatively, such a seller could persue the "fly-by-night" strategy of reducing quality to q_o, milking its reputation, and exiting the market. This will earn profits of $p(q) - c(q_o)$ in the initial period, and nothing thereafter.

The seller will find "honesty" attractive if and only if the return from that strategy exceed the fly-by-night profits. This condition $(p(q) - c(q)) \frac{1 + r}{r} \geq p(q) - c(q_o)$ can be rewritten as the

$$\underline{\text{No-Cheating Condition}}: \quad p(q) \geq c(q) + r(c(q) - c(q_o)).$$

This condition states that prices must be high enough to cover direct production costs <u>and</u> the opportunity cost of running down reputation.

The no-cheating condition puts a lower bound on the price at which items of quality q can sell, given the fact that sellers can reduce quality without immediate detection by consumers. An <u>upper</u> bound on p(q) arises from competition provided by potential entrants. Consider the profits of an entrant who produces a product of quality q forever. Assuming that consumers are skeptical of entrants and initially expect minimal quality, q_o, of an entrant,* the entrant earns $p(q_o) - c(q)$ in the initial period and $p(q) - c(q)$ in all subsequent periods. Since $p(q_o) - c(q_o)$ (there is no credible threat to reduce quality below q_o; see the no-cheating condition

* If consumers expect quality in excess of q_o they will be open to fly-by-night entrants who produce q_o for a single period, making positive profits.

above), the present value of profits to such an entrant is

$$c(q_o) - c(q) + \frac{1}{r}(p(q) - c(q)).$$

The lower bound on $p(q)$ is derived from the condition that profits of such an entrant not be positive. This condition can be written as the

Free Entry Condition: $p(q) \leq c(q) + r(c(q) - c(q))$.

Between the no-cheating and the free-entry conditions, the equilibrium price quality schedule can be derived as

$$\boxed{p(q) = c(q) + r(c(q) - c(q_o))}$$

The text discusses the implications of this price-quality schedule in detail.

Two points discussed in the text can be established easily here using the model: (1) An increase in the minimum quality standard q_o reduces prices for all items of quality in excess of the standard. Simply differentiate $p(q)$ with respect to q_o to get $\frac{dp(q)}{dq_o} = - rc'(q_o) < 0$. (2) Frequently purchased products will be subject to small premiums an hence reputation will work nearly perfectly. Observe that frequent purchase means that the one period interest rate r is very small. As r approaches 0, $p(q)$ approaches $c(q)$, as it would be under perfect information. The premiums are larger when quality detection is slow or uncertain or when quality is integrated only gradually into a seller's reputation. In these cases there is a relatively high social soct associated with the use of reputation as a mechanism for

providing firms with an incentive to produce high quality items and consumers with information about product quality.

Appendix: Prices as Signals of Product Quality

In this appendix it is proven that so long as a consumer's probability of returning to a given brand is positively related to that brand's quality, there will be a positive relationship between prices and qualities offered in the market, despite the inability of consumers to observe quality directly.

Denote by q the quality of a given firm's product. Since quality has no natural units, it is convienent to equate quality with the probability of a consumer being satisfied with the product. Denote by c(q) the cost of producing one item of quality q; we assume constant returns to scale.

Consumers purchase the product once per period (this defines the length of the period). The one period discount factor is given by d, which lies between 0 and 1. The probability that a given consumer will still be in this market next period, given that he is in it this period is denoted by s (for survival rate). s also lies between 0 and 1.

Consider the choice of product quality by a seller who is selling items at a price of p. If he selects quality q then his markup is given by p-c(q). He will choose quality to maximize the expected profits per new customer who walks in the door of his store. If quality q is provided, the probability that the customer will return next period is given by the product of his survival probability, s, and the probability he is satisfied with the brand, q. The expected profits from selling to this customer in the second period are therefore given by dsq (p-c(q)). The factor of d reflects the fact that profits earned in the second period must be discounted. In a like fashion, the expected profits in the third period are given by $d^2s^2q^2$ (p-c(q)).

The total expected profits per customer are the sum over all future periods of expected profits per period, appropriatly discounted. They are given by

$$\text{Expected Profits} = (p-c(q))\,(1 + dsq + d^2s^2q^2 + \ldots)$$

$$= (p-c(q))/(1 - dsq).$$

A firm selling at price p will select q to maximize this expression. We are assuming a stationary environment so that the price p will remain constant over time, so the optimal quality will as well.

Differentiating expected profits with respect to q and setting equal to zero, the following first-order condition emerges:

$$p = c(q) + c'(q)\left(\frac{1}{ds} - q\right).$$

So long as c''(q) is positive, i.e. so long as increasing consumer satisfaction becomes increasingly expensive, there will be a positive relationship between price and quality implied by this equation. Notice again that an item of quality q sells at a price in excess of marginal cost, c(q).*

The idea here is that the price at which a firm is selling a product affects its own incentives as far as quality are concerned. Consumers need not know just how this mechanism works no long as they learn over time they will come to know the price/quality relationship given by the equation of above.

As a final note, this theory also provides a fine explanation of why firms engage in <u>sales</u>, i.e. temporary reductions of prices. The explanation suggested here is that a permanent price reduction would signal lower quality but a temporary one need not. This may help explain the use of coupons in consumer goods markets as well.

* The second term in the equation, $1/ds - q$, is positive because d and s and q all lie between 0 and 1.

Appendix: Advertising as a Signal of Product Quality

This appendix explores the "Nelson Hypothesis" that advertising can indirectly provide information about product quality. Basically the question is this: Given that consumers choose brands on the basis of advertising, but cannot observe quality directly, is there some mechanism by which heavily advertised brands will tend to be of relatively high quality?

A simple theoretical model which captures the Nelson hypothesis is specified. This highlights both the structure of the argument and the special assumptions needed to make it work correctly. In particular, the ability of advertising to signal quality depends critically on the relationship between product quality and markups. If markups are independent of quality, the Nelson hypothesis is very strong. An alternative specification is studied in which all brands sell at the same price. Conditions under which the Nelson hypothesis is valid are derived under this specification.

The idea behind Nelson's original argument is that high quality sellers will value new customers more because new customers provide a whole stream of purchases for such sellers. In contrast, low quality sellers enjoy fewer repeat purchases and thus value their customers less. If this is so, then high quality sellers will advertise more in order to attract new customers: the benefits of advertising are higher for such sellers. Advertising is viewed here a method of attracting first-time users.

A simple model brings out this point. Let q denote the quality of a given brand, which is defined as the probability that a user of that brand will be satisfied with it in a single use. Consumers who are satisfied are assumed to repeat purchase, but dissatisfied customers go elsewhere to buy the good. Consumers are assumed to buy one unit of the good each period; discounting is ignored.

Consider the value of a new customer to a firm which produces a product of quality q and has a markup per unit of m. In the initial period the firm earns m from a new customer. In the second period the firm earns m again, provided the customer returns, which occurs with probability q. In the third period the customer will return again with probability q^2. Continuing this process, the firm's expected profits from a new customer are given by

$$V(q,m) = m(1 + q + q^2 + \ldots)$$

which can be simplified to

$$V(q, m) = m/(1 - q).$$

Now consider the advertising policy of this firm. A firm which values new customers at V, and can attract f(A) customers at an advertising expense of A dollars, will earn profits p given by

$$P = Vf(A) - A.$$

The profit maximizing level of A is the one which satisfies $P'(A) = 0$, i.e.

$$Vf(A) = 1.$$

The second order condition is $f'' < 0$, i.e. that it becomes increasingly expensive to attract more and more customers.

By differentiating this equation with respect to V, we find that $\frac{dA}{dV}$ is positive, i.e. <u>firms which value new customers more advertise more.</u>

The question thus boils down to whether in fact high quality firms value new customers more highly than do firms with low quality products. If the markup m is independent of q then we can check from the formula for V(q,m) that V is increasing with q, and therefore A is as well. This verifies the Nelson hypothesis: <u>if markup is independent of quality, then the Nelson hypothesis is theoretically correct</u>.

In general, however, markups vary with quality. Call the markup earned by a firm with quality q, m(q). Then in place of V(q,m) we can use V(q,m(q)). Now the value to a firm producing quality q of attracting a new customer is

$$V(q, m(q)) = \frac{m(q)}{1 - q}$$

Differentiating, we find that V, and therefore advertising intensity, will be increasing with quality if and only if the following inequality holds:

$$(1 - q)m'(q) + m(q) > 0$$

When markups <u>increase</u> with quality, m'(q) is positive, the Nelson hypothesis is strongly supported by this model. The possibility of violating the hypothesis theoretically arises when markups <u>decline</u> with quality. Consider therefore the case where all brands sell for the same price, p. Then m(q) = - c(q), where c(q) is the cost of providing one unit of quality q. In this case m'(q) = -c'(q), and a necessary condition for advertising to be a signal of product quality is given by

$$p > c(q) + (1 - q)\, c'(q) .$$

For a given price p, this inequality will hold for all qualities below some critical level q*, and fail to hold for qualities in excess of q*. Basically, if markups are generally high, as they will be for a large price p, then advertising will signal quality. But firms with very high qualities find that their production costs cut into their markups enough to reduce the value of consumers and therefore advertising. Advertising can provide a signal of quality, but only up to a point (q*).

An interesting relationship between advertising and <u>profits</u> emerges in this model, independent of the relationship between markups and qualities. Those firms which value customers a great deal are exactly those firms which make the most profits; they are also the firms which advertise the most. Therefore, advertising and profits will be correlated whenever advertising serves as a method of attracting new customers. Those firms which have the good fortune (or foresight) to have selected products which maximize their return on a new customer will be the ones to make the highest profits. Anad the very fact that they make a lot of money on each consumer will lead them to advertise heavily.