

A Theory of Competitive Cross Subsidies

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Abstract: Competition and cross subsidies in pricing are ordinarily regarded as incompatible. However, many examples of below marginal cost pricing of some goods are evident in relatively competitive industries. This article offers a theory to explain and characterize such anomalous pricing. To buy from a vendor, a consumer incurs a sunk “commitment” cost. Vendors act as weak monopolies towards committed customers, but their pricing must satisfy an *ex ante* consumer expected welfare constraint. Exchange is idiosyncratic so no consumer knows *ex ante* how good a fit a given vendor will be. When consumers are risk averse and competition intense, equilibrium pricing can involve subsidies (relative to Ramsey pricing) for those goods for which “low expenditure” customers have *relatively* greater demands, although such consumers may buy less of all goods in an absolute sense. Variations and extensions are discussed.

I. Introduction

Competition between firms selling multiple products with joint or common costs and/or transaction costs is quite common in market economies. It is, in fact, rare to find firms that sell a single product, and it is equally rare to find market circumstances in which competitive rivalry can be totally ignored. Recognition that special analytic problems can arise in the analysis of multiproduct competition is commonplace. The theory of contestable markets, for example, is interesting because it illustrates the curious effects of multiproduct operations under scale economies when entry is possible. Likewise, the multiproduct oligopoly analyses of, e.g., Okuguchi and Szidarovsky (1990) highlight the great technical difficulties that can arise when sellers of multiple products are mutually interdependent.

Despite recognition of these problems, however, relatively little work has gone into analyzing those price structures that are feasible equilibria in multiproduct competition. The primary theoretical result in this area is the well-known “Weak Invisible Hand Theorem” (WIHT) of Baumol, Bailey, and Willig (1977). A multiproduct monopoly faces the possibility of entry by an equally efficient rival which can choose to serve any subset of the incumbent’s market demands. Entry has some sunk cost that may be very low. What sorts of prices are sustainable, and how are the prices of individual “components” (goods) set?

As Baumol et al. show, Ramsey prices emerge as the only possible sustainable prices, with the sizes of the price-cost mark-ups for different products reflecting elasticity differences and the level of sunk entry cost.¹ No cross subsidies arise in these equilibria. On the other hand, with perfect competition and decreasing returns, multiproduct competitive equilibrium without transaction costs implies that every product must be sold at its marginal cost (MacDonald and Slivinski, 1987).

An examination of actual pricing practices in a large variety of industries, however, suggests that the WIHT and marginal cost pricing (MCP) are not adequate theories of competitive, multiproduct pricing in general. Both the WIHT and MCP models imply that, when a firm facing price competition (or a credible threat of “entry”) selects prices for individual goods, all goods are ordinarily sold at marginal cost or higher prices. In the WIHT case, Ramsey prices are always above marginal costs for all goods if they are for any good.

Actual pricing practices in competitive industries strongly suggest that equilibria with some goods priced below marginal costs are possible and, indeed, are commonly observed. For example, bars often give food away while charging prices far above (short run) marginal costs for alcohol; restaurants provide water, bread, service, seating, and other theoretically priceable commodities for free, while charging two or three times full retail prices for wine; record (music) and video clubs often provide new members with free CDs or cassettes upon enrollment, and charge high prices for subsequent sales. Telecommunications providers offer “free minutes” to new subscribers. The Ramsey logic is not applicable to these cases because goods that would informally appear to have the highest reservation values (e.g., the first CDs, water and restaurant service, the first minutes of calling) are free, while “frills” (e.g., wine, later CDs, later calls) have high prices. Further, it is difficult to argue that these firms enjoy meaningful monopoly power. Why, then, do such businesses simultaneously give some goods away while charging near monopoly prices for others? Even if one called such activities “promotional”, why do the promotions take these specific forms? When many goods are sold, what determines which are subsidized?

This paper offers a simple theory, consistent with the assumption of fully rational behavior by all market participants, that explains how below marginal cost pricing can emerge in competition. Importantly, the explanation proposed here requires neither strong (or any) demand complementarities, permanently

¹ That is, prices are Ramsey prices, but the degree to which prices are marked up depends on the level of sunk entry costs.

differentiated consumers and asymmetric equilibria, nor vendor-specific internal transactions costs that cause some goods to be “not worth pricing.” Rather, the model offered here posits only that there exists an idiosyncratic element to the transaction between buyer and seller, so that the utility associated with the vendor’s pricing is uncertain ex ante. For example, a buyer incurs a (presumably small) sunk cost to contact or visit the seller’s establishment. Such contact is necessary to buy goods. Once there, the consumer determines the degree of “fit” between herself and the vendor. Such “fit” can refer to purely idiosyncratic elements such as horizontal quality variation or the like. The consumer’s demands for the seller’s products depend on the degree of “fit.”

When the demands for products vary between states so that one product is relatively more intensely demanded in the “mismatched” (poor fit) state, then that product can be “subsidized” in equilibrium via higher prices for the other products(s). In other words, very low pricing of goods that are more relatively intensely demanded in the “poor fit” state can be an efficient form of insurance to induce consumers to contact the seller. Thus, for example, free food at a bar implies that, even if the buyer is not favorably impressed with the atmosphere or other patrons, the buyer enjoys at least a certain minimally favorable experience. Under these conditions, below marginal cost pricing can emerge in equilibrium when competition is sufficiently intense. Importantly, this result is not dependent on the actual probability of a good or bad “fit”, and requires intense competition.

This paper includes 5 sections. Section II provides background. Section III outlines the model proposed here and presents the results. Section IV considers complications while a conclusion summarizes the results.

II. Background

We begin by considering the following simple model. There are many sellers, each selling various similar products. There are very many consumers, each of whom is individually powerless and thus acts as a price taker. Prices at any given establishment are observable ex ante, although to buy from a given vendor a consumer must “commit” in some way to that vendor, an act we interpret as a payment of a “small” sunk cost $K > 0$. Thus, there are “common costs” on the buyer’s side, and these costs can lead consumers to buy all products from a single vendor even if one of these products sells at a lower price elsewhere. The commitment cost K implies that a small amount of monopoly power resides with the seller once a buyer has committed. Sellers, for simplicity, produce under

conditions of constant marginal costs, but do incur some joint/common costs independent of the individual quantities sold.

It is apparent that potential demand interdependencies can importantly affect this analysis. As is well known from the theory of monopoly pricing, when goods are complements, price cuts for one good can sufficiently stimulate demand for another to justify at least relatively concessionary prices on the first good. One might point to bars giving away salty food as an example of this phenomenon, so that sub-marginal cost pricing may in some cases be explained in this way.

Clearly, though, demand interdependencies cannot explain most of the heavily subsidized pricing one observes in otherwise competitive markets. For example, restaurants give away bread and water, and these would appear to be substitutes for entrees and desserts. Record clubs “give away” some initial number of CDs, selected by the buyer, and these are surely good substitutes for other CDs the club hopes subsequently to sell to members at higher retail prices. Thus, while demand relationships may explain some distortions, they surely cannot explain them all.

The model presented here is based on the idea that transactions between any vendor and its customers involve an idiosyncratic element which one might interpret either as so-called “horizontal” quality variation (variations in quality that cannot be unambiguously ranked by all consumers), or an exogenous state variable, unknown to the consumer prior to incurring a sunk cost of contacting the vendor, that materially affects the customer’s welfare and demands. In particular, any buyer does not know, prior to “committing” to a vendor, whether that vendor will be a “good fit”. Such subjective quality is similar to that evaluated by Farrell (1986).

For simplicity, we view buyers as undifferentiated ex ante . One implication of this assumption is that in any symmetric equilibrium, the expected welfare offered by any vendor must be equal for all customers. Further, once a buyer commits to a seller, she learns whether there is a good or bad “fit,” but this information is relevant only to the vendor to which she has committed. This implies that defection of a committed buyer from one vendor to another will occur only if the actual utility obtained by a consumer at the first vendor is less than the expected utility obtained by committing to another, taking account of further commitment costs.

The model of competition adopted here is similar to that envisioned by Baumol, et al., in the WIHT analysis, with the important difference that

consumers are assumed to be unable to buy anything from a vendor to which they are uncommitted. This assumption, which appears to be quite realistic with respect to most retailing and service industries, is important since it implies that vendors enjoy several degrees of freedom with respect to the prices of individual goods (“components”) in competition. Rather, the operative constraint on sellers refers to the welfare implications of pricing the entire spectrum of goods offered, rather than the prices of individual components. This does not, by itself, imply that any particular pattern of deviations in prices is inevitable, however.

The model of competition adopted here thus reflects the commitment process of consumers, but otherwise resembles the competition that arises in a contestable market with a sunk entry cost of the WIHT type. In particular, firms behave as monopolies, selecting prices to maximize profits, subject to (potentially quite severe) welfare constraints. Hence, every firm maximizes its profits, but is required by the rigors of competition to offer consumers a market equilibrium determined level of welfare ex ante, to assure commitment, and a similar market equilibrium level of welfare ex post, in order to prevent defections by consumers who discover they are “bad fits.” Although both such constraints are applicable, they are, in fact, quite different in character. The first constraint – that a given level of expected welfare obtains ex ante – always applies in any sort of equilibrium because consumers are identical ex ante. The second constraint, however, may be nonbinding on the firm’s price choices, and is an endogenous aspect of the equilibrium, rather than a constraint that must be applicable in any equilibrium. This occurs because poor fit consumers, who may have smaller demands, may be unprofitable to keep. In such an equilibrium, consumers could continue switching among vendors until either they find a “good fit”, or else the marginal cost of further switches becomes so high that they abandon the market entirely. This latter problem is a search phenomenon, and is not a primary focus of this paper. Further, most consumers do not ordinarily go from restaurant to restaurant, for example, in a single evening. Thus, in what follows attention focuses primarily on ex ante welfare constraints only, although some discussion of the defection issue is included below.

The “exogenous” welfare level that the seller must offer ex ante to assure commitments by consumers is exogenous in the sense that the seller takes it as given, and so acts as a “price taker” with respect to it. Presumably, however, this level of welfare is determined by equilibrium in the relevant market. This process is not the focus of this paper. One useful conceptualization, however, is that competitive behavior is merely monopoly behavior under a suitably severe welfare constraint.

III. Analysis

The model has the following components. Consumers are identical *ex ante*, with preferences given by $V(p, y; s)$ where $V(\cdot)$ is (indirect, state-dependent) utility, p are prices (including prices of component goods in the market of interest), y is income, and s is the state: $s \in \{0, 1\}$ where $s = 0$ is interpreted as a "bad fit" and $s = 1$ as a "good fit."² Further, s is an "idiosyncratic" variable that assumes a value for each consumer for each commitment to a vendor. The probability of a given consumer-vendor pairing being a bad fit is denoted θ , while a good fit occurs with a probability $1 - \theta$, $0 < \theta < 1$. The ordinary consumer demands are nonidentical across states.

For simplicity, we assume vendors sell two products, denoted x_1 and x_2 , at uniform prices p_1 and p_2 .³ All vendors' prices are announced in advance and observable to consumers. Vendor costs are given by

$$c = c_1x_1 + c_2x_2 + c_0 \quad (1)$$

where $c_1 > 0$, $c_2 > 0$, and c_0 is some positive joint cost invariant with output.⁴ Competition between vendors involves selecting prices to maximize profits subject to assuring favorable consumer commitments. We restrict our attention to symmetric equilibria.

We begin by stating the vendor's basic profit maximization problem. Let \bar{v} be the equilibrium determined level of expected (indirect) utility. As in the WIHT analysis, this level is determined by the sunk costs of entry. The value \bar{v} is taken as given by the individual seller. The vendor selects prices p_1, p_2 to solve:

$$\begin{aligned} \max_{p_1, p_2} = & (p_1 - c_1)[\theta x_1^0(p_1, p_2) + (1 - \theta)x_1^1(p_1, p_2)] \\ & + (p_2 - c_2)[\theta x_2^0(p_1, p_2) + (1 - \theta)x_2^1(p_1, p_2)] - c_0 \end{aligned} \quad (2)$$

$$\text{s.t. } \theta v(p_1, p_2, y; 0) + (1 - \theta)v(p_1, p_2, y; 1) \geq \bar{v}$$

² Alternatively, one could regard "fit" as a continuous variable θ , $0 \leq \theta \leq 1$. This alternative does not alter the insight.

³ Generalization of the analysis to many goods is straightforward.

⁴ The issue of scale economics is discussed in Section 5.

where x_j^i is demand for product j in state i . We denote the solution to (2) as (p_1^*, p_2^*) , and note that (2) makes use of an unimportant simplification by ignoring the gross number of customers. Inclusion of this number would merely scale the nonconstant terms in the maximand.⁵

Our interest focuses on the possibility of obtaining a result (p_1^*, p_2^*) such that, for example, $p_1^* < c_1$, $p_2^* > c_2$, i.e., below marginal cost pricing of some good occurs in equilibrium. As was noted above, demand complementarities can produce such results. However, the purpose of this paper is to show that, even in the absence of such interdependencies, below marginal cost pricing distortions can be an equilibrium phenomenon when consumers incur sunk commitment costs and transactions are idiosyncratic.

Firm profits are constrained by the equilibrium welfare constraints, and any positive profit to sellers is interpreted as the flow-equivalent of the capitalized value of the initial market positions of incumbents, as in Baumol, Bailey, and Willig (1977). Thus, should the expected welfare constraint allow some profit, that profit equals the sunk cost of entry of a new rival in a symmetric equilibrium.

Ignoring cross price effects, the optimal prices p_i^* satisfy

$$\begin{aligned} & \theta x_1^0 + (1 - \theta)x_1^1 + (p_i - c_i) \left[\theta \frac{\partial x_i^0}{\partial p_i} + (1 - \theta) \frac{\partial x_i^1}{\partial p_i} \right] \\ & = \lambda \left[\theta \frac{\partial v^0}{\partial p_i} + (1 - \theta) \frac{\partial v^1}{\partial p_i} \right] \end{aligned} \quad (3)$$

where arguments are suppressed, λ is the multiplier, and v^0 and v^1 are utility as a function of prices in states 0 and 1, respectively. Equation (3) can be suggestively rewritten as:

$$\bar{x}_i [1 + L_i \bar{\varepsilon}_i] = \lambda \left[\theta \frac{\partial v^0}{\partial p_i} + (1 - \theta) \frac{\partial v^1}{\partial p_i} \right] \quad (4)$$

⁵ Scale economies would alter this conclusion, but would not qualitatively affect the results.

where \bar{x}_i is expected demand $\bar{x}_i = (\theta x_1^0 + (1-\theta)x_1^1)$, $\bar{\varepsilon}_i$ is similarly the expected (average) price elasticity, and L_i is the Lerner index ($L_i = (p_i - c_i) / p_i$).

It is useful here to demonstrate a result parallel to the WIHT, in order to illustrate exactly which characteristics of preferences are needed in order to generate a below MCP result for some good i . Suppose that preferences are approximated by expected consumer's surplus, so we have:

$$v_i = \theta \int_{p_1}^{\infty} x_1^0(s) ds + (1-\theta) \int_{p_1}^{\infty} x_1^1(s) ds + \theta \int_{p_2}^{\infty} x_2^0(s) ds + (1-\theta) \int_{p_2}^{\infty} x_2^1(s) ds \quad (5)$$

In this case, we obtain the optimality condition for prices given by:

$$L_1 \bar{\varepsilon}_1 = L_2 \bar{\varepsilon}_2 \quad (6)$$

Since $\bar{\varepsilon}_i < 0$, we conclude immediately that $\text{sgn}(L_1) = \text{sgn}(L_2)$. This, in turn, implies that no good can be priced below its incremental cost unless all goods are, and such an outcome, which implies negative profits to vendors, can occur only if the welfare constraint is inconsistent with at least zero long run profits. We do not have one good subsidizing another.

We turn next to the main result. We interpret the states $s \in \{0, 1\}$ as the degree of "fit," or coincidence between the idiosyncratic characteristics of the vendor and the preferences of the consumer. This leads to the following characterization. First, since $s = 1$ means a "good fit," we assume that $x_1^1(p_1) - x_1^0(p_1) > 0$ and $x_2^1(p_2) - x_2^0(p_2) > 0$ for all p_1, p_2 : consumers buy more of both products in the good fit state than in the bad fit state for any price system. Consistent with the above, we also assume that $v(p_1, p_2, y; 0) < v(p_1, p_2, y; 1)$ for all price systems and income.

Given that utility is always higher in the good fit state, it is clear that, under general conditions, there exists some monetary equivalent $z, z > 0$, such that we have $v(p_1, p_2, y + z; 0) = v(p_1, p_2, y; 1)$ where, in general, $z = z(p_1, p_2, y)$. This reasoning, in turn, suggests the following assumption. Consider, for example, the derivatives $\partial v(p_1, p_2, y + z; 0) / \partial p_1$ and $\partial v(p_1, p_2, y + z; 1) / \partial p_1$. Roy's identity applies to V in any state. Thus, using the superscript notation for states, $\partial v^0 / \partial p_1 = -x_1^0 \partial v^0 / \partial y$ and $\partial v^1 / \partial p_1 = -x_1^1 \partial v^1 / \partial y$. Consistent with the above "income gamble" interpretation, risk-aversion in the ordinary sense implies that $\partial v^0 / \partial y > \partial v^1 / \partial y$ for any fixed price system. This is not the only possible

assumption, but it appears consistent with the interpretation of states as outlined here. We therefore assume in what immediately follows that $\partial v^0/\partial y > \partial v^1/\partial y$: in any circumstance, we presumably have $\partial v^0/\partial y \neq \partial v^1/\partial y$ in general. We consider the alternative assumption $\partial v^0/\partial y < \partial v^1/\partial y$ later.

Using the above formulation, we again solve the firm's pricing problem as given in (2). For simplicity, we continue to focus on the special case for which we can write $x_1^i = x_1^i(p_i)$ alone.⁶ This yields the following condition when the multiplier λ is solved out:

$$\frac{\bar{x}_2(1 + L_2\bar{\varepsilon}_2)}{\bar{x}_1(1 + L_1\bar{\varepsilon}_1)} = \frac{\theta x_2^0 v_y^0 + (1 - \theta)x_2^1 v_y^1}{\theta x_1^0 v_y^0 + (1 - \theta)x_1^1 v_y^1} \quad (7)$$

where $v_y^i = \partial v^i/\partial y$ and the other notation is as before. Equation (7) incorporates the risk attitude of buyers "correctly": because a consumer does not know ex ante which state will apply, risk attitude is relevant in the welfare evaluation. This observation will, in fact, motivate our interpretation of the resulting conclusion.

Under the assumption that $v_y^0 > v_y^1$, division of the right hand side of (7) by v_y^{0-1}/v_y^{1-1} yields the result:

$$\frac{\bar{x}_2(1 + L_2\bar{\varepsilon}_2)}{\bar{x}_1(1 + L_1\bar{\varepsilon}_1)} = \frac{\theta x_2^0 + \delta(1 - \theta)x_2^1}{\theta x_1^0 + \delta(1 - \theta)x_1^1} \quad (8)$$

where $\delta = v_y^0/v_y^1$, $0 < \delta < 1$. Next we note that, under the conventional assumptions the expression $1 + L_i\bar{\varepsilon}_i$ is a decreasing function of p_i so that $1 + L_i\bar{\varepsilon}_i > 1$ for $p_i < c_i$, $1 + L_i\bar{\varepsilon}_i = 1$ for $p_i = c_i$ (MCP), and $1 + L_i\bar{\varepsilon}_i = 0$ at the unconstrained monopoly price of good i .

Simple comparative statics establishes that $\partial p_i/\partial \bar{v} < 0$. Thus, we consider here the case in which the welfare constraint is "severe" and the resulting profits "low." We wish to establish the existence of an equilibrium such that $p_1^* < c_1$ and

⁶ We rule out cross price effects not because such effects are implausible, but because we wish to show that below MCP is possible for some goods even with independent demands.

$p_2^* > c_2$. In this case we must have $1 + L_1\bar{\epsilon}_1 > 1$ and $1 + L_2\bar{\epsilon}_2 < 1$. This, in turn, requires that

$$\frac{\bar{x}_2}{\bar{x}_1} < \frac{\theta x_2^0 + \delta(1-\theta)x_2^1}{\theta x_1^0 + \delta(1-\theta)x_1^1} \quad (9)$$

must be true in equilibrium. By algebraic manipulation, this requirement is identical to the simpler condition:

$$(x_2^1/x_1^1) > (x_2^0/x_1^0) \quad (10)$$

whenever $0 < \delta < 1$. Thus, any equilibrium in which $p_1^* < c_1$ and $p_2^* > c_2$ requires that good 2 be relatively more demanded in the good fit state than the bad. This shows that competitive price distortions, as envisioned here, require that there exists a product (such as x_2) that is relatively more highly demanded in one state than the other. It is also important to note that condition (10) is independent of the size of δ .

We may now reverse the procedure. Suppose that condition (10) applies for any price system. Then we must have condition (9). This then implies that $(1 + L_2\bar{\epsilon}_2)/(1 + L_1\bar{\epsilon}_1) < 1$, a result in contrast to (6), which illustrates the consequences of risk attitude on prices. Next, to show that $p_1 < c_1$ and $p_2 > c_2$ may occur, let joint costs c_0 be zero, and let the welfare constraint impose zero profits on the seller. Then the requirement that $(1 + L_2\bar{\epsilon}_2)/(1 + L_1\bar{\epsilon}_1) < 1$ implies that $p_1 < c_1$ and $p_2 > c_2$. It is clear, however, that this result does not require $c_0 = 0$, nor zero profits. The prices p_1^* and p_2^* are, by elementary analysis, continuous functions of \bar{v} and c_0 . Thus, for small changes in these values, our conclusion must remain valid.

The economic interpretation of this result is immediate: the good (e.g., x_1) that is in relatively greater demand in the poor fit state (by more “poorly served” consumers) is subsidized by price increases to the other good. Thus, with commitment and idiosyncratic exchange, pricing provides a form of insurance to consumers, and the firm finds this insurance to be cost effective in assuring commitments. This occurs because consumers discount benefits (informally, consumer surplus $-x_j^i$) differently in the two states, while the firm, which has very many consumers, doesn’t care per se whether a dollar is earned from a consumer in one state or another.

In terms of the empirical examples discussed earlier, our results appear consistent with observed pricing practices. In general, goods subject to below cost pricing appear to include “basic” goods, such as restaurant service, water, bread, etc., that everyone consumes in similar quantities, while “luxury” goods (such as wine or fancy specials) are both “overpriced” and consumed in greater relative quantities by a fraction of high expenditure consumers.

The most important theoretical point established here is that cross subsidies may exist in equilibrium in “competitive” industries. In fact, competition is essential to this result because only sufficiently severe welfare constraints can force a component price below its incremental cost. In industries for which competition is weak, the corresponding welfare constraints for customer commitment will allow all component prices to exceed marginal costs.

It is also important to note that commitment costs are crucial to this analysis. If commitment were free, then only the lowest price for any good could persist. Thus, if a vendor priced one good below cost and subsidized this by setting high prices for another, consumers would buy only the subsidized good from that vendor, who would then go bankrupt. An unrestricted ability to “pick and choose” among sellers will always destroy subsidized pricing, as the WIHT illustrates. Yet, in most service industries, commitment costs, which can take the form of travel to the vendor’s premises, are real, nontrivial economic costs. Consumers rarely order appetizers from one restaurant, move on to another for salads, and so on. The existence of commitment costs allows a cross subsidy to exist, but does not, by itself, imply such subsidies must exist.

We consider now the alternative assumption that $\partial v^0/\partial y < \partial v^1/\partial y$. In this case, condition (10) becomes the contrary requirement:

$$(x_2^1/x_1^1) < (x_2^0/x_1^0) \tag{11}$$

but otherwise the analysis is similar to that presented above. In the case represented by (11), the good x_2 is subsidized, rather than x_1 . Although one might intuitively argue that $\partial v^0/\partial y < \partial v^1/\partial y$ is more plausible in the sense that the marginal utility of income should be greater when the fit is “good”, this is questionable. The analysis presented here surpresses the prices of all other goods consumers buy. An additional dollar provided to a consumer in the bad fit state will not be solely spent at a vendor the consumer does not particularly favor. Rather, the poor fit can be interpreted as a price increase for that class of goods offered by the seller. Price increases ordinarily increase the marginal utility of income since they involve deleterious income effects in general. The analysis in

this paper focuses on the more plausible case given by (10), although the methods of analysis work equally well with (11).

IV. Complications and Extensions

The existence of systematic cross subsidies in a competitive pricing equilibrium is a very anomalous result. Thus, it is important to examine the consequences of relaxing or altering some of the assumptions used in the last section in order to determine the robustness of this conclusion. In this section we briefly examine, in turn, demand complementarity, defections by poor fit consumers, scale economies, *ex ante* consumer differentiation, and repeat purchases.

Demand complementarity is not, in itself, an important factor in the feasibility of subsidized competitive pricing. As is well known, the existence of such effects alters the resulting formulae for Ramsey-type prices.⁷ In extreme cases, strong complementarities can induce subsidized pricing in unconstrained monopoly markets. An examination of equation (8), however, illustrates that such effects, should they exist, would not alter the underpricing result. The addition of cross price effect terms in (8) occurs symmetrically on the left; the right hand side is unaffected. Thus, although cross price effects alter optimal prices, and could produce below cost pricing, this affect is independent from, and different than, the phenomenon considered here. Rather, the point of the analysis of the previous section is that such effects are not needed to produce subsidized pricing.

Defections by poor fit consumers clearly impose an additional restriction on feasible equilibrium price systems. Given some candidate equilibrium prices (p_1, p_2) , a poorly fitting consumer would “defect”, i.e., incur a “second round” commitment cost k_2 , whenever we have:

$$k_2/(1-\theta) > v^1 - v^0 \tag{12}$$

where indirect utility is evaluated at (p_1, p_2) , and k_2 is denominated in utility-equivalent terms. (An alternative statement in terms of money costs is available.) Clearly, sufficiently large k_2 assures no defections occur, and “sufficiently large” here is understood in terms of the utility a good fit provides. Thus, defections are

⁷ See Train (1991), Chapter 4, for an extended discussion of demand complementarity and efficient pricing.

not a problem, and condition (11) is not binding, when the costs of commitments are either large enough, or else rise sharply enough for subsequent commitments. If defections do arise, then preventing them, if that is optimal, requires greater subsidies to poor fit buyers.

Scale economies are also untroubling. In any symmetric equilibrium, the mere existence of scale economies imposes no pathologies on the resulting analysis because, unlike the case of centralized market clearing, the analysis here uses a model of “competing monopolies,” in the WIHT sense, in order to accommodate the critical notion of consumer commitment cost. Competition then refers to a welfare constraint on pricing. However, with scale economies, the number of a vendor’s committed customers will affect incremental costs, and will therefore affect prices. In symmetric equilibria, this again is irrelevant to the underpricing issue. However, if firms differ in sizes, and these differences are economically important, then the conceptualization of competition used here must be modified, no easy task. Further, one would then need to explain the sources of the size differences of firms.

Additionally, *ex ante* differentiation of consumers would substantially alter the analysis. One possibility, though, is to specify three types of consumers, “state 0 buyers”, “state 1 buyers” and those buyers unsure of their state in any arbitrary transaction. The issue then would be establishing the existence of equilibrium in which some vendors “specialize,” so that multiple price systems would exist simultaneously in equilibrium. The mechanism illustrated here relies on uncertainty arising from some idiosyncratic aspect of exchange. Without such uncertainty, it is difficult to see how subsidies could be sustained. On the other hand, uncertainty of the sort contemplated here seems a likely characteristic of virtually all industries in which customer service is important.

The existence of repeat purchases and learning would also importantly affect the analysis offered here. The model described above is a static one which contemplates a one-time commitment of consumers to sellers. Cross subsidies in competitive pricing require both commitment costs and idiosyncratic exchange. However, the mechanism developed in this paper is presumably applicable to any customer switching, so the idea is quite general. For example, the long distance telecommunications marketplace exhibits considerable subsidization in promotional price plans. Paying customers to switch is an obvious example. Yet such price offers almost always apply to new customers, while existing customers remain with whatever tariffs they accepted when they enrolled. The ability of vendors to offer multiple price plans simultaneously would appear to make the cross subsidy strategy for assuring commitments by “new” customers far more important than the static analysis might suggest.

V. Conclusion

The prevalence of cross subsidies in the price structures of many competitive industries cannot be explained by conventional models. This article presents an explanation for such subsidies, and provides a testable theory of the nature of such pricing distortions. The competitive industry is modeled as a collection of multiproduct, profit-maximizing monopolies which operate under equilibrium determined welfare constraints, a formulation in the spirit of the Weak Invisible Hand analyses of Baumol et al. (1977). Because consumer purchases require costly “commitments” on the part of buyers, sellers enjoy a modicum of freedom to vary prices. However, distortions with some prices below marginal costs and others above do not occur without explicit incorporation of the affects of risk attitude on consumer behavior. It is posited that transactions involve an idiosyncratic component that introduces uncertainty among consumers as to whether a particular vendor will be a “good fit.” Demands depend on the consumers’ degrees of fit. Under plausible conditions, this uncertainty leads to distortions from Ramsey pricing that produce competitive equilibrium subsidies of some goods. Further, goods that are subsidized can be those that low expenditure consumers use relatively more intensely. Conversely, goods that high expenditure (“good fit”) consumers buy more intensely can have their prices increased above ordinary Ramsey mark up levels, funding the subsidy.

The mechanism examined here is related to analyses of competition with uncertain product qualities. In particular, sellers of “good” quality products may have an incentive to offer free samples or other subsidized deals.⁸ In a sense, the results in this paper extend that idea to a multiproduct setting, in which quality is a general characteristic of the offered bundle.

The model of competition used here would appear to be applicable to many retail industries with geographically differentiated vendors, and to multifaceted service industries, such as telecommunications providers, for which “competition for customers” is important. In most such relationships, the complexity of buyer-seller interaction produces more utility-relevant dimensions than there are prices for goods. This can support uncertainty among consumers about the consequences of commitment even if prices are observable.

The analysis presented here is admittedly static. Search and learning (about “fit”) is omitted. However, both consumers and vendors undergo changes, so that a “good fit” one day may not be attractive tomorrow. This suggests that

⁸ See Tirole (1988), Chapter 2, for an overview of quality competition.

certainty by the consumer in regard to the goodness of a vendor fit may not be a permanent status.

References

- Baumol, W., E. Bailey, and R. Willig, "Weak Invisible Hand Theorems on the Sustainability of Natural Monopoly." *American Economic Review*, June, 1977, pp. 350-366.
- Farrell, J., "Moral Hazard in Quality, Entry Barriers, and Introductory Offers." Discussion Paper 334, M.I.T., 1984.
- MacDonald, G. and A. Slivinski, "The Simple Analytics of Competitive Equilibrium with Multiproduct Firms," *American Economic Review*, Dec. 1987, pp. 941-953.
- Okuguchi, K. and F. Szidarovsky, *The Theory of Oligopoly with Multi-Product Firms*, Berlin: Springer-Verlay, 1990.
- Tirole, J. *The Theory of Industrial Organization*. Cambridge: M.I.T Press, 1988.
- Train, K., *Optimal Regulation*. Cambridge: M.I.T. Press, 1991.