"TWO ESSENTIAL CHARACTERISTICS OF RETAIL MARKETS AND THEIR ECONOMIC CONSEQUENCES"

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Two Essential Characteristics of Retail Markets and Their Economic Consequences*

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ABSTRACT

In this paper we explore the economic consequences of two essential characteristics of retail markets, namely, (1) the bundling of distribution services with the market goods and services that retailers sell and (2) the shifting of distribution costs between households and retailers. Building from a formalisation of retail demand and supply, we then consider in some detail the economic implications for pricing and competitive behavior.

Introduction

One fundamental characteristic of all retail enterprises is that they deliver goods or services to customers together with a variety of distribution services. This bundling, i.e., of distribution services with whatever goods or services the firm offers, is not unique to retailing activities. Indeed, it is possible to argue that, to some extent, all firms must bundle some distribution services with the products they sell. Nevertheless, we emphasize this characteristic in the context of retail markets because it is in these markets that the consequences are more transparent and amenable to analysis.

Early literature, e.g., Tucker and Yamey (1973), emphasized jointness in supply as one of the characteristics of retailing. One strand of the modern literature, Bliss (1988), continues this emphasis and stresses the jointness within the goods and services explicitly available for sale at the shop. Instead, the jointness in supply that we are emphasizing lies within distribution services and between these services and the goods or services explicitly provided for sale by the retailer. In our prior work, Betancourt and Gautschi (1988a), we have identified five broad categories of distribution services: namely, accessibility of location, product assortment, assurance of product delivery, information and ambience. Furthermore, we have analyzed some implications of jointness in the supply of these distribution services for a retailer who offers a single product for sale. Here, we also consider jointness in the supply of products available for sale, or the multiproduct retailer; hence, in this respect the present contribution is an integration as well as a generalization of our earlier work and that of Bliss (1988).

Another fundamental characteristic of retail markets lies in the possibility of shifting distribution costs between consumers and retailers. This shifting of distribution costs can also occur in transactions between firms, but our emphasis on retail markets stems, once again, from the view that it makes the issue more transparent and amenable to analysis. The notion of shifting of costs between consumers and retailers has been present in the marketing literature for some time, e.g., Bucklin (1966), Ingene (1984). What has been absent from that literature, however, is a formal way of capturing this shifting. In our earlier work, Betancourt and Gautschi (1988a), we described the distribution costs that consumers may incur in their interactions with the retail system. Moreover, we incorporated the shifting of these costs formally into the analysis by treating distribution services as one of the outputs of the retail enterprise, which in turn becomes an input that lowers distribution costs in a household production model of the consumer. We preserve this formalization in the present paper and use it to show, among other things, that the shifting of costs between consumers and retailers has a dramatic impact on one of the standard results of location theory emanating from the Hotelling (1929) model: namely on the conclusion that when prices are given, competition on location is always detrimental to consumers.

Several narrowly defined problems specific to retailing have been investigated recently in the literature. One topic, for example, is resale price maintenance under conditions of product diversification, Perry and Groff (1985), and Perry and Porter (1986); another topic is clearance sales and markdowns, Lazear (1986) and Pashigian (1988). These issues will not be explicitly pursued here to facilitate analyzing the consequences of the previous characteristics. Similarly, it facilitates our analysis if we ign< e, following Bliss (1988), issues of imperfect information as inv. stigated by Stiglitz (1979), Varian (1980), and Salop and Stiglitz (1982). An example illustrates our rationale for this approach. Consumers patronize a convenience store and a supermarket at two different times of the week and purchase the same item at two different prices. The consumers are fully informed, and rational, and the two types of institutions can coexist in equilibrium. While the insights derivable from the analysis mentioned above do not address this issue directly, they are not necessarily inconsistent with our approach. For instance, one of the most interesting implications of Varian's model, from our point of view, is that it shows how sales can be viewed as a mechanism for shifting the storage function between consumers and retailers. An important aim of our analysis is to bring out the consequences of the assertion that in retail settings such shifting takes place constantly and in many other different ways.

In the next section (I) of the paper, we present the model of demand underlying our analysis. Since we have elaborated this aspect of the model in considerable detail elsewhere (1988b, 1989a), our presentation is succinct and highlights those results that are needed in subsequent sections. The demand for retail products is derived by postulating a household production model for the consumer. In this model, the distribution services provided by retailers act as fixed inputs in the household's production of commodities that yield satisfaction and it is this mechanism that captures the shifting of distribution costs between consumers and retailers on the demand side. More specifically, the modelling implies that higher levels of distribution services lower the distribution costs experienced by consumers in their consumption activities.

Section II of the paper contains a discussion of supply issues. It specifies the joint cost function of a retailer, treating distribution services as outputs. Thus, it is capable of capturing the potential shifting of distribution costs between consumers and retailers. In addition, it provides the framework for formalizing and, in empirical contexts, measuring various aspects of jointness in supply between distribution services and items in the assortment, as well as within distribution services. Indeed, we show how the standard definition of cost subadditivity must be modified in order to accommodate these issues. These modifications suggest that the condition for cost subadditivity is less likely to be met when making comparisons across different assortments than at a given level of assortment. Finally, we introduce some notation in providing the relevant definition of multiproduct returns to scale.

Systematic attention to the pricing practices of retailers has a long tradition in economics and marketing. A convenient starting point is Preston (1962) who, building on the work of Bailey (1954) and Holdren (1960), noted that given constant marginal costs and price elasticities markup pricing is consistent with profit maximization. He suggested that retailers engaged in market basket pricing, i.e., taking account in pricing strategy of the own and cross-price elasticities of demand. This aspect of the pricing problem is now well understood and has been incorporated into textbooks, for example Montgomery (1988) and Nagle (1987), and specialized works, for example Corstjens and Doyle (1981) and Bultez and Naert (1988). In addition, modifications of the idea to take into account variations and interdependencies in the marginal costs of the explicit items offered for sale have also been discussed in the literature, for example Albion (1983) and Coughlin (1987). What is missing from the literature is the recognition of the effect that distribution services have on pricing policies.

In Section III, pricing implications, we fill this gap in the literature by bringing together the demand and supply considerations of the previous two sections in the context of a profit maximizing firm. We establish several propositions which highlight the main implications of our analysis. Among our most salient findings are: there will be a significant tendency for retailers who follow a low price policy to provide low levels of distribution services; an exception to this tendency will be provided by retail forms that accommodate very broad assortments, in which case low price policies will be consistent with providing high levels of a common distribution service as in the case of supermarkets and accessibility of location; retail firms that provide high levels of specific distribution services, for example department stores, will require larger retail margins than those that provide low levels of these services, for example supermarkets; finally, technical and environmental characteristics that affect the demand for and supply of distribution services will have systematic effects on pricing policies.

A much smaller subset of the literature on retail pricing has proceeded from the analogy to price discrimination by a public utility. One important recent contribution, already mentioned, is Bliss (1988) who credits Holton (1957) with an early statement of the problem. In this paper we adapt one idea from Bliss to analyze the welfare implications of competitive behavior in retail markets. This fundamental idea can be usefully stated as follows: "An obvious equilibrium condition" is that the retailer must offer the customer good value in order to retain patronage. We define good value in terms of the expenditure function of Section II whereas Bliss defines it in terms of an indirect utility function, but this difference is not a substantive one. More significantly, we generalize Bliss' model by our inclusion of the shifting of distribution costs between consumers and retailers and through the endogenous determination of the levels of distribution services (hence costs) that prevail in the market. In addition, as already indicated, we also differ from Bliss in the bundling of the distribution services with the products directly available for sale.

In Section IV we present the general results of allowing for competition in the model of Section III through the mechanism described above. The main result of this section is to show that competition in retail markets will be beneficial in the sense of lowering prices and can but need not be beneficial in the sense of raising distribution services. The degree of competition affects the pricing policies of retailers in a manner similar to the parameter that determines the amount of revenue needed to cover fixed costs under Ramsey pricing for public utilities. Its effect on the equilibrium levels of distribution services is more complex but the qualitative aspects of the results in Section III continue to hold. Finally, economic conditions that are likely to make competition unambiguously beneficial, in the sense of raising distribution services, are identified, e.g., geographical areas where wage rates and thus the opportunity cost of time for households are high.

One distinguishing feature of our analysis is the emphasis on the role of distribution services. Therefore, in Section V we consider explicitly how the results are modified in one special case where these services are exogenously determined and in another one where prices are fixed. These two cases highlight the implications distribution services have for positive and normative analysis. The second one in particular allows us to show that, under standard assumptions, the introduction of competition in distribution services is always beneficial to consumers (Proposition 8). Moreover, this case also allows us to demonstrate the importance of the shifting of distribution costs between consumers and retailers. When this shifting is eliminated by assuming marginal costs to be constant at the zero level competition is not feasible (Proposition 9). A comparison of these two propositions casts serious doubts on the merits of the conclusion in the location literature mentioned earlier, because it is based on the same restrictive assumption of zero marginal cost for the distribution service.

Finally, we conclude our discussion by examining in Section VI the mutual conditions that must be satisfied for different types of retail firms to co-exist in equilibrium when consumers are identical. We consider two cases in detail: one with a generalist and two specialists, where assortment is the only difference; another one with a generalist and a generalist and a specialist that differ in the levels of at least one distribution service other than assortment. What our discussion of these two cases illustrates is that the bundling of distribution services for pricing purposes and the shifting of distribution costs between consumers and retailers generate the possibilities of equilibria with many different types of retail forms, each of them providing different combinations of distribution services and products explicitly offered for sale. Not surprisingly, we think it is an attractive feature of our approach that the richness of these equilibria reflects the variety of retail forms we actually observe.

I. Demand Considerations

Our starting point in formalizing the demand for retail products is the household production model developed by Becker (1965), Lancaster (1966) and Muth (1966). Briefly, we depict the household as producing a variety of outputs or commodities (denoted Z) that yield satisfaction. These consumption activities generating the Z's are undertaken with a household technology that uses among other inputs (1) the household's time, (2) capital services from the fixed stock of durables available within the household, (3) market goods and services, including those purchased from retailers, and (4) distribution services provided by the retailers patronized by the household.

Without loss of generality, the optimization problem of the household is characterized, following our earlier work (Betancourt and Gautschi, 1988b), in terms of a two-stage process. In the first stage expenditure minimization, subject to the technology and given the Z's, results in the following expenditure function

$$E = E(P^*, \tilde{P}, D, Z) \quad . \tag{1.1}$$

E is nondecreasing in retail prices (P^*) as well as in other prices relevant to the household ($\tilde{P}$), which include the opportunity cost of time, increasing in the given levels of outputs or commodities that yield satisfaction (Z), and nondecreasing in distribution services (D). The last property follows from assuming that the distribution services provided by a retailer act as fixed inputs into the household's consumption activities. Application of Shephard's Lemma results in the conditional (Hicksian) demand function for a retail item, i.e.,

$$Q_k = E_k = \partial E/\partial P_k = g_k(P^*, \tilde{P}, D, Z) \qquad k = 1, \ldots, K \tag{1.2}$$

In the second stage the household maximizes utility, by choosing the optimal levels of the commodities (Z) that yield satisfaction, subject to the constraint that the household's full income (W) be sufficient to cover the costs of producing the optimal levels of the commodities. Insertion of the optimal solutions (Z^0) into (1.1) and (1.2) yields

$$E = E(P^*, \tilde{P}, D, Z^0(P^*, \tilde{P}, D, W)) \tag{1.3}$$

$$Q_k = g_k(P^*, \bar{P}, D, Z^0(P^*, \bar{P}, D, W)), \qquad k = 1, \ldots, K \tag{1.4}$$

where (1.4) represents the Marshallian demand function for the k^{th} retail item.

From (1.4) we obtain the price elasticity of demand, $\epsilon_{k\ell} = (\partial Q_k/\partial P^*_\ell)(P^*_\ell/Q_k)$, and the distribution services elasticity of demand, $\epsilon_{kj} = (\partial Q_k/\partial D_j)(D_j)/Q_k)$. In our earlier work, Betancourt and Gautschi (1988b), we demonstrated the existence of a tendency toward complementarity ($\epsilon_{k\ell} < 0$) between items in the assortment of a given retailer as well as between the distribution services of a retailer and the items in his assortment ($\epsilon_{kj} > 0$).[1] We also distinguish between common and specific distribution services as follows: a common distribution service is one that is available to all the items in the assortment, for example accessibility of location; a specific distribution service is one that is available to one particular item, or a subset of items, in the assortment, for example information on the price of an item. While this distinction is needed on the demand side primarily for completeness, it has a more substantial economic impact on the supply side. To conclude our discussion of demand, it is useful to indicate that our formalization of the shifting of costs between consumers and retailers yields a shadow price (r_j) for the distribution services. Namely, from the expenditure function in (1.3) we obtain

$$r_j = -(\partial E/\partial D_j) \geq 0 \tag{1.5}$$

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[1]The reason for the opposite sign in describing complementarity is that in the first case ($\epsilon_{k\ell}$) we are considering the response to a price change and in the second case (ϵ_{kj}) we are considering the response to a quantity change.

As the level of a distribution service increases, the consumer's expenditure is reduced and the absolute value of this reduction represents what the consumer should be willing to pay for a unit of the service in the market if it were available at an explicit price.

II. Supply Considerations

Just as any other firm in the economy, the retail firm's problem can be formulated as the production of given levels of outputs demanded by its customers at the lowest possible cost. Cost minimization subject to technological restrictions results in the following cost function

$$C = C(V,Q,D) \ , \tag{2.1}$$

where V are input prices, Q is a vector of outputs or retail items and D is a vector of distribution services. This function is nondecreasing, linear homogeneous and concave in prices, increasing in at least one price, the levels of outputs and in the levels of distribution services. The latter are treated as outputs of the retail firm in order to capture on the supply side the potential for shifting of costs between consumers and retailers. To illustrate, if in a given market area a retailer provides two stores instead of one that retailer is providing much higher levels of accessibility of location, one of the most important elements of the D vector, but this decision will entail much higher levels of costs.

Jointness in supply between distribution services and items in the assortment is the reason one must distinguish between common and specific distribution services. If the level of a common distribution service is increased, it becomes available to all the items provided by a retailer and the cost savings are likely to lead toward multiproduct natural monopoly over some output ranges. For instance, increasing accessibility of location by expanding a parking lot provides this higher level of the distribution service to all the items in the assortment and generates cost savings over the alternative of increasing it for every item under stand-alone production. By contrast increasing a specific distribution service such as providing a better description of an item will not furnish strong incentives for multiproduct natural monopoly. Jointness in supply within distribution services is also a source of cost savings driving a retailer toward natural monopoly. For instance, if a retailer increases the depth of assortment by adding one line of products closely related to another one already in the assortment the assurance of product delivery in the desired form also increases, since consumers will view both lines as close or perfect net substitutes.[2]

One consequence of our view of retail markets is the need to modify the conditions for cost subadditivity and, hence, natural monopoly in the literature, for example Baumol, Panzar and Willig (1982) or Sharkey (1982). Since the distribution services are also outputs of the firm, they must be considered explicitly and it must be indicated whether or not they are being kept constant. Let Q_1 and Q_2 be equal length vectors of outputs or retail items (these vectors are not necessarily equal), then a natural extension of the standard definition of cost subadditivity would be

$$C(V,Q_1 + Q_2,D) \leq C(V,Q_1,D) + C(V,Q_2,D) \tag{2.2}$$

This definition would be the only one needed if Q_1 and Q_2 contain no zero

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[2] For additional discussion and examples on the nature of distribution services and distribution costs, the reader is referred to Betancourt and Gautschi (1987, 1989).

elements, so that assortment is kept constant.[3] If Q_1 and Q_2 are allowed to contain zero elements, so that assortment may change, then the definition needs to be modified as follows:

$$C(V, Q_1 + Q_2, D^0) \leq C(V, Q_1, D^1) + C(V, Q_2, D^2) \ , \tag{2.3}$$

where $D^0 \geq D^i$, $i = 1, 2$.

The distinction between (2.2) and (2.3) has substantive implications. First, (2.2) is the relevant definition to apply when all distribution services, including assortment, are being kept constant. In these circumstances, the condition for natural monopoly is likely to be met over some range of output levels for the various items in the retailer's given assortment. The range of outputs over which this result holds is likely to be broader the higher the level at which assortment is kept constant, because of the possibilities for cost savings as a result of providing the other common distribution services (especially if these are being provided at high levels). When assortment changes, however, (2.2) is not valid and (2.3) must be employed. Since production by a single firm entails as high or a higher level of assortment than production by two or more firms, costs will be at least as high or higher for the single firm on these grounds alone and the incentive toward natural monopoly will be lower as a result. To sum up, condition (2.3) provides a more general definition of cost subadditivity than what exists in the literature; it contains (2.2) as a special case and it is less likely to be satisfied than (2.2).

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[3]One difference between this definition and the standard one is that the nonadditivity between the distribution services and the retail items is being explicitly indicated through the cost function.

One concept that needs to be defined carefully in the multiproduct case is returns to scale. We will apply the definition used by Laitinen and Theil (1978) and Baumol, Panzar and Willig (1982) to our situation and introduce some notation in the process. Multiproduct returns to scale, SE, can be defined from (2.1) as

$$SE = \sum_{k=1}^{K} S_k + \sum_{k=1}^{K} S_k^s + \sum_{j=1}^{J} S_j \, , \tag{2.4}$$

where $SE = (dC/C)/dx/x$ and dx/x represents the same proportionate increase in all outputs, including distribution services. $S_k = (\partial C/\partial Q_k)Q_k/C$ and it can be interpreted, following Laitinen and Theil (1978), as the proportionate contribution of the k^{th} type of retail item to total marginal costs. $S_k^s = (\partial C/\partial D_k^s)D_k^s/C$, where we have defined D_k^s as the level of a specific distribution service that affects only the k^{th} item. In general one can have a specific distribution service that affects several items, but not all of them, and more than one specific distribution service affecting the same item, but to simplify the notation we are assuming there is only one specific distribution service per item and that it affects only that item. $S_j = (\partial C/\partial D_j)D_j/C$ and it represents the proportionate contribution of the j^{th} common distribution service to total marginal costs. There will be increasing, constant, or decreasing multiproduct returns to scale as $SE \lesseqgtr 1$, respectively.

III. Pricing Implications

In this section we develop the implications of the prior specification of the demand and supply side for a profit-maximizing retail firm. Profits will be given by

$$\pi = P^*Q - C(V,Q,D) - PQ \tag{3.1}$$

where P is a vector of prices at which the retailer purchases the items fro suppliers. Since the behavior of other producers is being ignored, this formulation is consistent with either a natural monopoly or a monopolistically competitive representative firm.[4]

Maximization of (3.1) by choosing prices (P^*_ℓ), specific distribution services (D^s_k) and common distribution services (D_j) leads to three different sets of first-order conditions which, after manipulation, can be written as

$$\alpha_\ell = \sum_k \alpha_k M_k (-\epsilon_{k\ell}) \qquad \ell = 1,\ldots,K \tag{3.2}$$

$$S^s_k = \alpha^*_k M_k (\epsilon_{ks}) \qquad k = 1,\ldots,K \tag{3.3}$$

$$S_j = \sum_k \alpha^*_k M_k (\epsilon_{kj}) \qquad j = 1,\ldots,J\ . \tag{3.4}$$

Most of the terms have been defined in the previous two sections. The ones that have not are: $\alpha_k = P^*_k Q_k / \Sigma\, P^*_k Q_k$, the share of the k^{th} item in total revenues; $M_k = [P^*_k - C_k - P_k]/P^*_k$, the marginal profit rate on the k^{th} item (also referred to in the industrial organization literature as the price-cost margin or the Lerner index of monopoly power); $\alpha^*_k = P^*_k Q_k / C$, the share of revenues from the k^{th} product in the costs of retailing (notice that $\sum_k \alpha^*_k >$ 1); ϵ_{ks} is the distribution services elasticity of demand with respect to the specific distribution service that affects the k^{th} item in the assortment (D^s_k).

An important although straightforward consequence of these conditions is summarized in the following proposition.

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[4]Extensions to other market structures may modify some of the results below. Of course, some of them would not be affected, e.g., proposition 1.

Proposition 1: In general, the optimal pricing policy of a retailer affects and is affected by the optimal levels of specific and common distribution services provided to customers.

This proposition simply follows from the fact that equations (3.2)-(3.4) represent a system of equations in three sets of endogenous variables. The main economic implication of this proposition is that statements about optimal pricing policy need to be accompanied by statements about the levels of distribution services.

One consequence of the previous proposition is elaborated in terms of the following one:

Proposition 2: Retailers that sell items with high (absolute) values of the own price elasticity of demand and/or that are gross complements will have lower prices, retail and profit margins and, under standard assumptions, lower levels of distribution services than retailers without these characteristics.

This proposition is most conveniently established by considering (3.2) first. Given the α's and gross complementarity, an increase in the absolute value of the price elasticities ($-\epsilon_{k\ell}$) requires a consequent decrease in profit margins (M_k) which in turn, given suppliers prices (P) and the marginal cost of producing the k^{th} item (C_k), implies lower prices and also lower retail margins.[5] If the marginal cost of producing the item is not given but instead increases with Q_k, then the same result holds but neither prices nor retail margins will fall by as much. These results in (3.2) are consistent

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[5]Incidentally, $M_k = R_k - C_k/P_k^*$ and $R_k [= (P_k^* - P_k)/P_k^*]$ is the retail margin, also referred to in the retailing literature as the gross margin.

with the ones available in the literature cited in the introduction; but our current analysis brings in additional considerations.

First, the marginal cost of producing an item (C_k) may be sensitive to the levels of distribution services. If so, the same results as above would hold as long as the indirect effects generated by the changes in these levels associated with equilibrating (3.3) and (3.4) do not outweigh the direct ones already analyzed, in the sense of leading to a decrease in C_k that outweighs the decrease in P_k^*. Second, and most importantly, equations (3.3) and (3.4) imply that the levels of distribution services must change. The lowering of the profit margins requires changes in either the cost side (S_k^s, S_j) or the demand side ($\epsilon_{ks}, \epsilon_j$). If one makes the standard assumptions that the proportionate contribution to total marginal costs are nondecreasing in the distribution services and that the distribution services elasticity of demand is nonincreasing in the distribution services, then the lower profit margins imply the lower levels of distribution services asserted in the proposition.

Not surprisingly, the recognition of the existence of distribution services also leads to new insights that are not linked to what exists in previous literature. The first one follows from an analysis of (3.4) and is summarized in the following proposition.

Proposition 3: Under standard assumptions, high levels of common distribution services are consistent with low <u>profit</u> margins and low prices if retailers expand their assortments.

The rationale is as follows: anything that leads to low margins in (3.4) requires an adjustment in the other terms. Given α_k^*, such adjustments would entail a lowering of the optimal levels of distribution services to decrease

the LHS of (3.4) (S_j) or raise the RHS of (3.4) (ϵ_{kj}) under standard assumptions. Nonetheless, since $\sum_k \alpha_k^* > 1$, it is feasible to add new product lines or new varieties to a product line, and, as long as their profit margins are positive, to increase the value of the RHS of (3.4). In doing so, the retailer can then bring the equation into equilibrium by providing higher levels of the common distribution service which, under standard assumptions, raises the LHS of (3.4) and lowers the RHS through its effect on ϵ_{kj}.

What is the economic significance of this proposition? It provides a logical justification for the ability of retail firms to offer very high levels of a common distribution service while experiencing low profit margins. Hence, it explains, for example, the ability of supermarkets to offer high levels of a common distribution service, such as accessibility of location, while experiencing low profit margins and offering low prices and low levels of specific distribution services. In general, it points to the importance of differences in assortment as an explanatory factor in the behavior of different retail institutions.

Continuing along the same vein, we consider now a result on retail margins that arises out of a comparison between equations (3.3) and (3.4). To wit,

Proposition 4: Under standard assumptions and given profit margins, high levels of common distribution services are consistent with low <u>retail</u> margins whereas high levels of specific distribution services are not consistent with low <u>retail</u> margins.

The mechanics of the result can be established somewhat simply. One line of argument is the following one. Given S_k^s, ϵ_{ks} and M_k in (3.3), an increase in the level of a specific distribution service (D_k^s) will increase the marginal cost (C_k) of providing item k. In turn this requires an increase in the retail margin (through a rise in P^*) if the profit margin is to remain the same. By contrast, under the same circumstances, a comparable increase in the level of a common distribution service in (3.4) increases the marginal costs of providing each of the k items by relatively small amounts. Therefore, it requires smaller increases in retail margins in order to keep the same profit margins. Parenthetically, other variants of this argument also lead to a similar conclusion.

Why is this result interesting? Because it provides a logical explanation for a well known characteristic of retailing and it challenges one piece of conventional wisdom that purports to explain this characteristic. The fact is that supermarkets have low retail margins and department stores have high retail margins.[6] Both types of institutions have broad assortments and in the retailing literature the high retail margins of department stores are attributed to their providing many 'services.' Proposition 4 suggests that supermarkets, given their broad assortments, can provide very high levels of accessibility of location and maintain low retail margins because accessibility of location is a common distribution service and supermarkets do not offer high levels of specific distribution services. In contrast, department stores, given their broad assortments, provide high levels of specific distribution services for each item or subsets of items in their assortments through their sales personnel, who provide information services and assurance of product delivery in the desired form; consequently, department stores must operate at high retail margins in order to provide

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[6]For example, in the 1982 U.S. Census of Retail Trades grocery stores had a retail margin of .23 and department stores had a retail margin of .35.

these specific distribution services. Thus, the difference in retail margins is not due to one type of store providing services and the other not providing them, but due to the different nature of the services that are provided. Note that department stores offer fairly low levels of accessibility of location compared to supermarkets.[7]

Explicit inclusion of distribution services into the analysis provides a mechanism for a set of exogenous factors to affect the determination of prices, margins and distribution services: namely, technological factors on the cost side, which operate through (S_j, S_k^s); and wage rates and other household characteristics on the demand side, which operate through $(\epsilon_{kj}, \epsilon_{ks})$. We encompass the role of these factors in the following proposition.

Proposition 5: The higher is the services elasticity of demand for distribution services or the smaller is the proportionate contribution to total marginal costs of distribution services, (A) the more likely is the retail firm to select low prices and thus experience low margins for given levels of distribution services, and (B) under standard assumptions, the more likely is the retail firm to choose high levels of distribution services for given prices.

Once again the logic of the proposition is straightforward: if distribution services are given, as in part A, then adjustments in (3.2) through (3.4) must come through a lowering of prices and profit margins; on the other hand, if prices are given, as in part B, adjustments in (3.2) through (3.4) must come through an increase in distribution services under

[7]For instance, using number of establishments as a measure of accessibility of location, the same U.S. Census of Retail Trade shows grocery stores with 128,494 units and department stores with 9,981 units.

the standard assumptions. In general, both types of adjustment will take place. From an economic perspective, this proposition identifies how exogenous factors that influence distribution services on the demand and supply side will affect the determination of prices, margins and the levels of these distribution services. More specifically, other things equal, economies of scale and scope in the provision of distribution services lead to lower prices and/or higher levels of distribution services through their effects on the cost side; and high wage rates and other factors raising the opportunity cost of time also lead to lower prices and/or higher levels of distribution services through their effects on the demand side.

IV. Competitive Behavior: The General Case

In this section, we explore the implications for market equilibrium and welfare of the two characteristics of retail markets emphasized earlier.

Consider the position of an individual firm in a long-run equilibrium where all consumers are identical and all firms are the same. All consumers being identical in our context means that they have the same household production functions and utility functions as well as full income. It also means that the distribution costs of consumers in patronizing any one retail firm must be the same for all consumers. All firms being the same implies that they have the same technology and that the distribution services provided to consumers are the same for all firms. In this setting one can think of the equilibrium in terms of one firm one customer or in terms of identical firms of predetermined sizes that when added up yield the demand from all customers in the economy, which in the extreme leads to the case where one firm serves all customers. In either case, firms may or may not experience zero profits, depending on whether or not there are any fixed costs to entry and exit. More importantly for our present purposes, an obvious equilibrium condition in either case is that the expenditure of a consumer to attain his maximum level of utility while patronizing a retailer, $E(P^*, \bar{P}, D, Z^0)$ from (1.3) in Section I, be less than or equal to the lowest cost of attaining this maximum level of utility from any other retail firm (E^0).

Therefore, we can characterize the behavior of the retail firm in equilibrium as choosing prices and distribution services to maximize profits subject to the above constraint, which can be described, paraphrasing Bliss' (1988) terminology, as maximizing profits while offering as equally good value for money as any other firm.

Formally, we have as the objective function

$$L = P^*Q - C(V, Q, D) - PQ + \lambda[E^0 - E(P^*, \bar{P}, D, Z^0)] \tag{4.1}$$

where λ is the Lagrange multiplier. The necessary conditions for an optimum solution to this problem generate the equilibrium levels of prices and distribution services for the retail firm. These are given in (4.2)-(4.5) after some manipulation to facilitate comparisons with the literature and Section III. That is,

$$\alpha_\ell(1 - \lambda) = \sum_k \alpha_k M_k(-\epsilon_{k\ell}) \qquad \ell = 1, \ldots, K \tag{4.2}$$

$$S_k^s = \lambda\left(r_k \frac{D_k^s}{C}\right) + \alpha_k^* M_k \epsilon_{ks} \qquad k = 1, \ldots, K \tag{4.3}$$

$$S_j = \lambda(r_j D_j/C) + \sum_k \alpha_k^* M_k \epsilon_{kj} \qquad j = 1, \ldots, J \tag{4.4}$$

$$E^0 = E(P^*, \bar{P}, D, Z^0) \ . \tag{4.5}$$

The interpretation of the Lagrange multiplier is that it represents the marginal contribution to profits of lowering the competitive standard that the firm must meet, since a higher value of E^0 makes it easier for the firm to maximize profits while meeting the consumer's best alternative situation. If $\lambda = 0$, we have a sustainable multiproduct natural monopoly and the analysis of Section III is unaltered in a long-run equilibrium representation. In general, λ will be positive and we will have some degree of competition regardless of the number of firms in the market. Below, we consider its implications for the analysis in Section III. Finally, note that $\lambda \geq 1$ is not feasible as it would require prices to be negative or equal to marginal cost in the presence of downward sloping demand curves. Hence, the analysis below only considers situations where $0 \leq \lambda < 1$.

We will analyze the role of competition by comparing a situation in which the constraint is not binding, $E^0 > E(P^*, \tilde{P}, D, Z^0)$ and $\lambda = 0$, to one where the constraint is binding, $E^0 = E(P^*, \tilde{P}, D, Z^0)$ and $\lambda > 0$. In going from the former situation to the latter, we have an increase in competition and the numerical value of E^0 must decrease. In general, if equilibrium prices decrease (increase) and equilibrium distribution services increase (decrease) in going from the former situation to the latter, consumers are better (worse) off, because with the same full income they can attain a higher (lower) level of utility at the new prices and distribution services, and we say that competition is beneficial (detrimental). If equilibrium prices increase (decrease) but equilibrium distribution services increase (decrease) in going from the former situation to the latter, one cannot tell in general whether competition is beneficial or detrimental, as it would depend on the offsetting effects of these two tendencies on the expenditure function of the consumer. With specific functional forms, however, the question could be answered.

Proceeding to the comparison directly, our main result is contained in the following proposition.

Proposition 6: Competition in retail markets is beneficial to consumers in the sense of lowering prices and it can but need not be beneficial to consumers in the sense of raising distribution services.

The simplest way of establishing this proposition is to apply the methodology suggested in the previous paragraph, which amounts to a comparison of (3.2)-(3.4) with (4.2)-(4.5). This comparison reveals that competition ($\lambda > 0$) operates in (4.2) as an increase in the absolute value of the price elasticities; hence, the statements in Proposition 2 with respect to prices are applicable, which establishes that competition lowers prices. The situation with respect to distribution services, however, is a bit more complex. The logic of Proposition 2 suggests a lowering of the level of distribution services but this tendency will now be counteracted by the term $(\lambda r_j D_j/C)$ in (4.4), for example, and the corresponding term in (4.3). Whether this tendency is sufficient to lead to an increase in distribution services will obviously be determined by the magnitude of this term.

Our previous discussion naturally leads to an additional proposition.

Proposition 7: Other things equal, competition in retail markets is more likely to be beneficial, in the sense of raising distribution services, the higher is the shadow price of distribution services (r_j) and the lower is the average cost of providing a unit of distribution services (C/D_j).

This proposition follows logically from the previous discussion, as it merely identifies the two independent economic factors that make the term $(\lambda r_j D_j/C)$ large in magnitude (λ makes this term large but it also makes the decrease in margins large in absolute value). Its economic significance is the following. One of the main determinants of the price consumers are willing to pay for distribution services is the opportunity cost of their time. From our analysis of the demand side (Betancourt and Gautschi, 1988b) almost all distribution services are to be viewed as substitutes for the household' time. Therefore, the higher the opportunity cost of time for households, as in high wage countries with multiple income earners, the higher the shadow price of distribution services and the more likely is competition to be beneficial by raising the level of distribution services. On the cost side this proposition suggests, for example, that competition is more likely to be beneficial by raising distribution services in small easily traversed countries than in large, spread out ones, or in those with difficult topographies. Of course, other things such as population must be kept equal in these comparisons.

Finally, since the new term in the equations for distribution services, (4.3) and (4.4), enters additively, the qualitative results embedded in Propositions 3-5 of Section III continue to hold, although their quantitative magnitude would be affected by the degree of competition.

V. Competitive Behavior: Special Cases

In this section we consider explicitly two special cases that help relate our results to those available in the literature.

First, let us assume that the levels of distribution services are exogenously determined. This assumption makes equations (4.3) and (4.4) irrelevant. Thus, the only relevant equations are (4.2) and (4.5). On the side of positive economics, this special case eliminates all the results contained in Propositions 1 and 3-5 as well as those referring to distribution services in Proposition 2. What is left then is what existed in the prior literature cited in the introduction. On the normative side, what is left as a result of this assumption is the result that competition is always beneficial, because it lowers prices. This is the main normative implication of the Bliss model.

Secondly, let us assume that the levels of prices are exogenously determined. This assumption makes equation (4.2) irrelevant. Hence, the relevant equations are (4.3)-(4.5). It is straightforward to see that, on the side of positive economics, this special case generates slightly modified versions of Propositions 2-5. Perhaps more importantly, on the normative side the introduction of competition requires, under standard assumptions, an increase in distribution services to increase the term on the LHS and/or to decrease the second term on the RHS of (4.3) and (4.4). Therefore, the introduction of competition is always beneficial in this case, which suggests that the conditions for detrimental competition in the general case are unlikely to be met. This result is sufficiently important to put it in terms of a proposition.

Proposition 8: Under standard assumptions, if prices are given the introduction of competition in distribution services is always beneficial to consumers.

An interesting aspect of the second special case lies in its implications for an issue addressed in the location literature emanating from the Hotelling model. To see this connection in its simplest form, let us further assume that there is only one common distribution service, let us say accessibility of location, so that equations (4.4) for $j = 1$ and (4.5) are the only relevant ones. We can then establish the following proposition.

Proposition 9: If the marginal costs of providing a distribution service are assumed constant at the zero level, a monopolist will provide the highest level of the distribution service consistent with a nonnegative distribution services elasticity of demand and competition is not feasible.

To establish this proposition, note that if the marginal cost of providing distribution services is zero, then the LHS of (4.4) must be zero under both competition ($\lambda > 0$) and monopoly ($\lambda = 0$). Under monopoly and standard assumptions on ϵ_{kj}, the only way to bring the RHS into equilibrium with the LHS is to increase the level of accessibility of location until ϵ_{kj} is down to zero. Hence, the highest feasible level of accessibility of location is being provided and competition is not feasible because it requires higher levels of accessibility of location in order to make the second term in (4.4) negative, through a negative ϵ_{kj}.

Why is this proposition of economic significance? Because of the insight it provides into one of the standard results for the Hotelling model, e.g., Sharkey (1982, ch. 4). There, it is argued that competition on location when prices are fixed is always detrimental to the consumer, but the argument assumes that the marginal costs of providing accessibility of location are zero. Our argument shows that this assumption leads to the provision of the highest feasible level of the distribution service by a monopolist and to competition not being feasible. Hence, the relevance of the conclusion reached in the location literature is put into serious doubt by its use of the same assumption. More generally, this assumption eliminates the shifting of distribution costs between consumers and retailers, which is one of two essential features of retail markets that we stress in this paper, and the contrast between Propositions 8 and 9 reveals the dangers of doing so.

VI. Competition Between Different Types of Retailers

Is it possible for different types of retailers to coexist in equilibrium? One way to answer this question is to consider the conditions that must be met for different types of firms to coexist and ascertain their mutual consistency under various assumptions. We begin by considering a situation in which two specialists may coexist with a single generalist.

On the demand side, this case must satisfy the following condition

$$E(P_0^*, \bar{P}, D^0, Z^0) \geq E(P_1^*, P_2^*, D^1, D^2, \bar{P}, Z^0) \tag{6.1}$$

That is the expenditures in attaining the optimal level of the Z's must be at least as large when the consumer patronizes the generalist as when the consumer patronizes the two specialists. This condition implies that the lower levels of assortment of the specialists raise expenditures over what they would be for the generalist and, consequently, the specialists must offer lower prices in order to be able to satisfy (6.1).

On the supply side, we have

$$C(V, Q_1 + Q_2, D^0) \leq C(V, Q_1, D^1) + C(V, Q_2, D^2) \tag{6.2}$$

That is, costs cannot be strictly subadditive, otherwise the generalist could always drive the specialists out of the market. Note that by definition $D^0 > D^i$ $(i = 1,2)$, so that the costs of the generalist will be higher on these grounds, but economies of scale can compensate.

Finally, revenues must be sufficient to cover costs for both types of firms, i.e.,

$$(P_0^* - P_0)Q \geq C(V, Q, D^0) \quad \text{and} \quad (P_1^* - P_1)Q_1 \geq C(V, Q_1, D^1)$$

$$\text{and} \quad (P_2^* - P_2)Q_2 \geq C(V, Q_2, D^2) \;, \tag{6.3}$$

where $Q = Q_1 + Q_2$.

Since retail prices are lower for the specialists, revenues will be lower and the specialists need to have lower costs than the generalist. This will be the case in general because the level of assortment will also be lower for the specialist. In addition, if the assortments were to overlap then the number of items (i.e. the value of an element of Q_i for the items that overlap) would be small for the overlapping products in the specialists assortment and costs could also be lower on these grounds.

What this argument suggests is that one can attain various types of equilibria: a generalist type of retailer, when there is strict cost subadditivity; two specialist retailers, if there are diseconomies of scope in the process of expanding assortment; even a generalist and two specialists, when the equalities hold, but this situation occurs over a small range of parameter values with identical consumers.

It is useful now to consider another situation in which we ask if coexistence is possible. Thus, consider a generalist who offers one particular distribution service at a high level and two other types of stores: a generalist who offers a relative low level of the same distribution service and a specialist who offers a very high level of the same distribution service.

On the demand side we have the condition

$$E(P_0^*, \bar{P}, D_1^0, \bar{D}^0, Z^0) \geq E(P_1^*, P_2^*, D_1^1, \bar{D}^1, D_1^2, \bar{D}^2, \bar{P}, Z^0) \qquad (6.4)$$

where $D_1^0 > D_1^1$ and $D_1^2 > D_1^0$ and $\bar{D}^i$ consists of the remaining distribution services. Clearly for (6.4) to hold the generalist with the low level of distribution services must offer lower prices or the other generalist would drive him or her out of business (without necessarily driving the specialist out). The specialist, however, will be able to charge higher prices on his or her subset of products because of the higher level of the distribution service being provided.

On the supply side, we have

$$C(V,\ Q_0,\ D_1^0,\ \bar{D}^0) \leq C(V,\ Q_1,\ D_1^1,\ \bar{D}^1) + C(V,\ Q_2,\ D_1^2,\ \bar{D}^2) \qquad (6.5)$$

where $Q_0 = Q_1 + Q_2$ and the conditions on distribution services have been stated already. The generalist on the LHS of (6.5) will have greater costs than the generalist in the RHS of (6.5), because he or she produces a higher Q and a higher D_1^0, assuming $\bar{D}^0 = \bar{D}^1$. Of course, it is possible that when adding the costs of the specialist the strict inequality will hold.

Finally, we must also require revenues to cover costs. Thus, we have

$$(P_0^* - P)Q_0 \geq C(V,\ Q_0,\ D_1^0,\ \bar{D}^0) \quad \text{and}$$

$$(P_1^* - P_1)Q_1 \geq C(V,\ Q_1,\ D_1^1,\ \bar{D}^1) \quad \text{and} \quad (P_2^* - P_2)Q_2 \geq C(V,\ Q_2,\ D_1^2,\ \bar{D}^2) \qquad (6.6)$$

This condition will be satisfied for the generalist on the LHS. The generalist on the RHS will have lower retail prices and lower volumes, thus lower revenues, but his costs will also be lower, because of the lower level of distribution service and of items sold. Hence, this condition can also be satisfied. The specialist has higher costs because the distribution service is higher but since higher prices are being charged revenue will also be larger. Moreover, assortment has by definition decreased thus lowering costs and volume will also be lower.

What is the significance of these results? Once again, different type of equilibria are feasible. One is a generalist type of retailer who provides relatively high levels of a particular distribution service. This is likely to be the case if high levels of this service are desired by all consumers over all the items in the broad assortment. A second type of equilibrium is also possible, one in which a generalist simply provides high levels of assortment but low levels of another distribution service. In turn, a specialist provides low levels of assortment but high levels of a particular distribution service, which is desired in conjunction with a subset of the items in the assortment. Once again, it is even possible for the generalist and generalist-specialist combination to coexist but this will happen over a very limited range of parameter values.

The type of equilibrium just considered is interesting because it corresponds broadly to a real world situation in which you may have the following: a supermarket operating at high volumes that stays open all night (thus providing high assurance of product delivery at the desired time over a broad range of items), or you can also have a supermarket with limited hours and lower volume coexisting with a convenience store (the specialist) that stays open all night and offers assurance of product delivery at the desired time over a subset of items. Both types of equilibria can happen, depending on demand and supply considerations, even when all consumers are identical. This richness of possibilities is due to the two essential characteristics of retail markets that we have been stressing in this paper. Introducing heterogeneous consumers would obviously expand the range of outcomes. To sum up, the bundling of distribution services with the products directly available for pricing purposes and the shifting of distribution costs between consumers and retailers provide the basis for the coexistence of different retail forms in equilibrium even when all consumers are identical.

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