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WHEN DOES AN OPTIONAL TARIFF NOT LEAD TO A PARETO IMPROVEMENT? THE AMBIGUOUS EFFECTS OF SELF-SELECTING NONLINEAR PRICING WHEN DEMAND IS INTERDEPENDENT OR FIRMS DO NOT MAXIMIZE PROFIT

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ABSTRACT

Optional or self-selecting tariffs allow customers to choose between an established tariff and an alternative outlay schedule. The possibility of making the vendor and at least one consumer better off, without making any other consumer worse off, makes optional tariffs appealing to both economists and regulators. In economic terms, the introduction of optional tariffs makes possible a Pareto improvement in the allocation of resources. Unfortunately, the presumed desirability of such tariffs depends crucially on assumptions that may not be fulfilled in the case of a state-owned enterprise—in particular, profit-seeking behavior on the part of the monopoly vendor and independence of consumer demand functions. We analyze the economic implications and potential consequences, in general, of introducing negotiated rate and service terms available to a sole user into a preexisting regulatory regime of uniform tariff rates and conditions of service. We identify the conditions under which it is economically desirable to introduce declining-block rates or other rate structures that discriminate among users of the affected services, with or without any basis in identifiable cost differences. We address the specific economic implications and potential consequences of introducing negotiated rate and service terms available to a sole user where the affected service is provided under a monopoly established by federal statute, taking into account that such negotiated arrangements may include preferential pricing terms; that access to the negotiated terms may be limited to a small number of users for administrative or other reasons; and that competition may exist among users of the affected service or services. Finally, we identify and describe regulatory measures that might be taken to accommodate potential concerns regarding the impact of such negotiated rate and service arrangements on fairness in regulation and competition. We conclude that it is not possible to derive sweeping propositions about the efficiency of

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optional tariff offerings. Instead, the welfare effects of such pricing plans must be evaluated empirically on an individual basis. Our analysis has practical significance for pricing policies in network industries, particularly those industries served by state-owned enterprises that enjoy statutory monopolies.

I. INTRODUCTION

Optional tariffs, also known as self-selecting tariffs, allow customers to choose between an established tariff and an alternative outlay schedule. Robert Willig's seminal article in 1978 showed how optional tariffs can be used to achieve allocations that improve the welfare of the firm and all of its customers.[1] Optional tariffs therefore have had great theoretical and practical appeal. That appeal is not surprising, because the economic logic behind optional tariffs is quite intuitive.

Consider the relationship between a vendor and any of its large customers. The customer makes his purchase decision on the basis of the vendor's established tariff. But before the customer reveals his decision, the vendor makes the following offer: "You may select a quantity and pay the corresponding outlay specified by my established tariff schedule. However, you may, instead, choose a quantity and pay the outlay from an alternative, specially designed tariff." If the customer chooses to use the alternative tariff, he does so because he expects to be better off. That is, the customer expects that the surplus he obtains from the specified combination of quantity and outlay chosen from the alternative tariff is higher (or at least as high) as the surplus resulting from the combination of quality and outlay that he *would have chosen* from the established tariff.

What about the vendor? Presumably, he would not introduce the alternative tariff option unless he expected that any choice the consumer might make would be more profitable for the vendor than what the consumer would have chosen under the established tariff.

Finally, how are the vendor's other customers affected by the introduction of the optional tariff? With respect to their purchases, they can be no worse off *as long as the established tariff option remains available.* This result follows from the fact that consumers retain the option to select the same combination of quantity and outlay (and obtain the same level of surplus) that they would have selected had the alternative tariff never been introduced.

[1] Robert D. Willig, *Pareto Superior Nonlinear Outlay Schedules*, 11 BELL J. ECON. 56 (1978). Self selection was introduced into the nonlinear pricing literature in Gerald Faulhaber & John C. Panzar, Optimal Two Part Tariffs with Self Selection (Bell Laboratories Economics Discussion Paper 1977). For an application of this analysis to postal ratemaking, see Experimental Rate and Service Changes to Implement Negotiated Service Agreement with Capital One, Opinion and Recommended Decision, Dkt. No. MC2002-2 (Postal Rate Comm'n, May 15, 2003).

The possibility of making the vendor and at least one consumer better off, without making any other consumer worse off, makes optional tariffs appealing to both economists and regulators. In economic terms, the introduction of an optional tariff makes possible a *Pareto improvement* in the allocation of resources.[2]

In this article, we analyze the economic implications and potential regulatory consequences of introducing negotiated rate and service terms available to a sole user into a preexisting regulatory regime of uniform tariff rates and conditions of service. We identify the conditions under which it is economically desirable to introduce declining-block rates or other rate structures that discriminate among users of the affected services, with or without any basis in identifiable cost differences. We address the specific economic implications and potential consequences of introducing negotiated rate and service terms available to a sole user where the affected service is provided under a statutory monopoly. In doing so, we take into account (1) that such negotiated service agreements (NSAs) may include preferential pricing terms, (2) that access to the negotiated terms may be limited to a small number of users for administrative or other reasons, and (3) that competition may exist among users of the affected service or services. Finally, we identify and describe regulatory measures that might be taken to accommodate potential concerns regarding the impact of such negotiated rate and service arrangements on fairness in regulation and competition. Our analysis has practical significance for pricing policies in regulated network industries, particularly those industries served by state-owned enterprises that enjoy statutory monopolies.

II. HOW PROFIT MAXIMIZATION AND A BREAK-EVEN CONSTRAINT AFFECT THE PARETO EFFICIENCY OF AN OPTIONAL TARIFF

The argument that optional tariffs can be used to generate Pareto improvements seemed to depend on the preexistence of an established tariff to which the consumer could resort as an alternative to the optional tariff offering. Yet, for firms subject to a break-even constraint, the cost and revenue effects of the established tariff and the optional tariff must be assessed jointly and simultaneously. This requirement is not a problem as long as one can presume that the vendor is a profit maximizer. In that case, the vendor will expect to make additional profit whenever any customer accepts the vendor's optional tariff offering. Then, the expected additional profits can be "spent" by lowering the vendor's overall rate structure, including the established tariff. Thus the notion that the established tariff in some sense "precedes" the optional tariff is ultimately used only for expositional purposes. Indeed, in this case, imposition of the break-even constraint strengthens the appeal of optional tariffs. The lowering of the overall rate structure

[2] *See, e.g.*, WILLIAM J. BAUMOL, SUPERFAIRNESS 7–9 (MIT Press 1986).

provides a mechanism that benefits users who are not parties to the optional tariff offering.

However, this feedback effect works in the opposite way if the customer accepts an optional tariff that causes a reduction in the vendor's profits. Then, imposition of the break-even constraint necessitates an increase in the vendor's overall rate structure, which makes worse off those customers who are not a party to the optional tariff offering. Thus, the automatic presumption of the desirability of optional tariffs relies heavily on the assumption that the vendor seeks profit.

However, is the assumption of profit maximization a reasonable one when the supplier is a state-owned enterprise (SOE)—as in the case of a typical postal operator such as the U.S. Postal Service or Canada Post? As recent research has indicated, an SOE may have stronger incentives than a private firm to engage in anticompetitive activities.[3] If an SOE values an expanded scale of operation in addition to profit, it will be less concerned than its private, profit-maximizing counterpart with the extra costs associated with increased output. Consequently, the SOE may find it optimal to pursue aggressively anticompetitive activities that expand its own output and revenue at the expense of profits. For example, the SOE might set the price it charges for a product below its marginal cost of production, particularly if the product is one for which demand increases substantially as price declines. Another way the SOE might execute such a pricing strategy is through an optional tariff.

An SOE may also have a greater ability than a private firm to pursue this pricing strategy successfully. The SOE may not need to recoup losses by ultimately raising prices in the market receiving the reduced price through the optional tariff. Unlike a private utility subject to rate-of-return or price-cap regulation, an SOE may have substantial ability to carry forward losses into future periods of the ratemaking process. More important, unlike a private firm, an SOE may have substantial ability to recoup its losses by raising prices in reserved markets where it has a statutory monopoly, or via direct expenditures from the public treasury.

In short, a state-owned firm that does not maximize profit may have both the ability and the incentives to use optional tariffs to achieve outcomes that are anticompetitive and *not* Pareto improving.

III. QUANTITY DISCOUNTS WITH INDEPENDENT USER DEMANDS

The use of quantity discounts has long been widely practiced in both monopoly and competitive environments. Analysis of the practice also has a

[3] *See* David E.M. Sappington & J. Gregory Sidak, *Incentives for Anticompetitive Behavior by Public Enterprises*, 12 REV. INDUS. ORG. 183 (2003); David E.M. Sappington & J. Gregory Sidak, *Competition Law for State-Owned Enterprises*, 71 ANTITRUST L.J. 479 (2003); David E.M. Sappington & J. Gregory Sidak, *Are Public Enterprises the Only Credible Predators?*, 67 U. CHI. L. REV. 271 (2000).

long history in economic theory. Long classified as "second-degree price discrimination,"[4] the modern term "nonlinear pricing" more clearly describes the effect of quantity discounts. It refers to the use of a price schedule under which the total outlay is *not* the simple product of a constant price times the quantity purchased. That is, the graph of a consumer's total outlay is *not* a straight line through the origin, but rather some increasing *nonlinear* function. The practice of nonlinear pricing is not inherently discriminatory because the same outlay schedule is available to all consumers. As discussed in more detail below, although all customers may be free to choose any point on the proffered outlay schedule, they will typically *not* have an equal ability to avail themselves of the quantity discounts incorporated in that schedule. A vast theoretical economic literature exists on the subject.[5] Here, we shall focus on the nonlinear pricing policies that can be used to establish optional tariff offerings of the type that might be encouraged in a network industry served by a regulated monopolist.

Figure 1 depicts the situation of a monopoly vendor serving two types of users: a large user with a demand schedule given by D_{Large} and some number of small users, each of whom has a demand schedule given by D_{Small}. Assume that, under its established tariff, the monopolist serves these users at a uniform price of p, measured by the distance $0p$ in the diagram. Assume also that the monopolist's (constant) marginal cost is c, measured by the distance $0c$. At this price, the large user would choose to purchase Q^0 units (measured by the distance $0Q^0$). Each small user would choose to purchase q^0 units (measured by the distance $0q^0$). In this situation, the large user is making a contribution to the monopolist's recovery of its institutional costs (fixed costs, including common costs in the case of a multiproduct

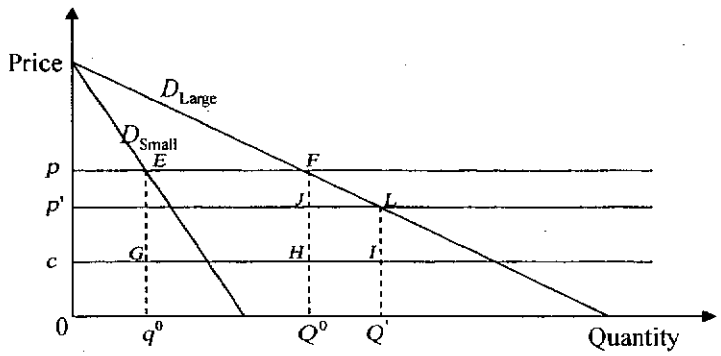

Figure 1. Monopoly vendor serving two types of users.

[4] The classic reference is A.C. PIGOU, THE ECONOMICS OF WELFARE (London, Macmillan 1920).

[5] The most comprehensive reference is ROBERT WILSON, NONLINEAR PRICING (Oxford University Press 1993). A more accessible, less technical exposition of most of the issues can be found in S.J. BROWN & DAVID S. SIBLEY, THE THEORY OF PUBLIC UTILITY PRICING (Cambridge University Press 1986).

monopolist) equal to area *pFHc*, the amount by which the revenues received from the large user exceed the cost of providing that user with service. Similarly, each small user makes a contribution to the monopolist's recovery of fixed costs that is equal to the area *pEGc*.

Now suppose that the monopolist offers its consumers the following optional tariff plan: All consumers may continue to purchase their desired quantity at price p, but any consumer who agrees to purchase *more* than Q^0 units will pay a price of p' on those additional units, with $c < p' < p$. Small consumers will not be interested in changing their behavior. Their valuation of an additional unit purchased (measured by the vertical height of their demand curve) falls below p' even before reaching output level Q^0. However, the large customer would eagerly accept this offer. For each unit between Q^0 and Q', the large customer's valuation exceeds the price paid. The large customer would therefore expand its purchases to Q', the quantity at which its valuation of an additional unit exactly equals the incremental price p'.

Clearly, the large user is better off as a result of the optional tariff offering. Is the monopolist? It finds that its sales have expanded. Although sold at a discount, the increased quantities are sold at a price above marginal cost, so that the contribution received from the large user has increased, by the amount equal to area *HILJ*—that is, the amount $(p'-c)(Q'-Q^0)$. Next, consider the impact on the monopolist's other customers. The small users do not directly benefit from the optional tariff offering, but they are no worse off, because they retain the option to make a purchase at the initial uniform price p. The consumers of the monopolist's other service are no worse off because their rates are not affected.

However, *both* user groups can be made strictly better off when an overall break-even condition is imposed on the monopolist. The large user's acceptance of the optional tariff offering resulted in an increase in "contribution"—the portion of revenues in excess of marginal cost, which contributes to the recovery of the monopolist's fixed costs. If the monopolist were just covering its total costs at the initial price p, it would then be over-recovering its costs after its introduction of the optional tariff. To restore the desired balance would require the monopolist to reduce the uniform rate p and/or its other prices. This reduction in the rate structure would result in *all* of the monopolist's customers benefiting from the optional tariff offering.

This example illustrates both the simplicity and appeal of optional tariff offerings. Although the analysis is straightforward, some points warrant further discussion.

A. Independence of User Demands

An implicit assumption underlying the basic welfare analysis of optional tariff offerings is that the demand schedules of various users are *independent*. The purchase decisions of one user do not affect the purchases of any other user.

What if demand is interdependent for the monopolist's end product? In many industries for which optional tariffs would be a useful tool for regulation of natural monopoly, it may be more reasonable to ask how demand could *not* be strongly interdependent. In Section IV, below, we explain the negative effects of such interdependence when the regulated firm sells an input to firms competing in the same final product market. However, demand interdependence may also have positive effects. A large body of work—starting in 1974 with Jeffrey Rohlfs' seminal article[6] and continuing through the 1980s with the influential articles by Michael Katz, Carl Shapiro, and others[7]—has advanced our understanding of the importance of positive network externalities created by interdependent demand. This insight has direct relevance to any industry characterized by two-way network effects, such as networks for telecommunications, postal, software, and credit card services. Positive network externalities arise from higher levels of network access and usage. These network externalities are benefits to society that accrue as the size of a network grows. For example, an individual consumer's demand to use the telephone network increases with the number of other users on the network whom he can call or from whom he can receive calls.[8] Usually, we think of the network externality in telecommunications as occurring when another access line or another node (exchange) is added to the network.

Some regulations, such as policies promoting universal service, are justified in economic terms as a means to capture for consumers as a whole the benefits of network externalities that accrue as the size of the network grows beyond the scale that would be optimal for a profit-maximizing firm that was not subject to a regulatory obligation to serve all interested customers. Therefore, in any industry that evokes universal service concerns, it is appropriate to examine the extent to which regulators implicitly assume the existence of interdependent demand for the end product.

Network effects change the analysis of optional tariffs. The basic Willig analysis made the standard partial-equilibrium assumption that the preferences (and demand curves) of consumers are independent. In contrast, to our knowledge no one has built network externalities into an optional tariff

[6] Jeffrey H. Rohlfs, *A Theory of Interdependent Demand for Communication Services*, 5 BELL J. ECON. 16 (1974). For a nontechnical presentation, see JEFFREY H. ROHLFS, BANDWAGON EFFECTS IN HIGH-TECHNOLOGY INDUSTRIES 177–79 (MIT Press 2001).

[7] Michael L. Katz & Carl Shapiro, *Technology Adoption in the Presence of Network Externalities*, 94 J. POL. ECON. 822 (1986); Joseph Farrell & Garth Saloner, *Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation*, 76 AM. ECON. REV. 940 (1986); Joseph Farrell & Garth Saloner, *Standardization, Compatibility, and Innovation*, 16 RAND J. ECON. 70 (1985); Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424 (1985).

[8] *See, e.g.*, INGO VOGELSANG & BRIDGER M. MITCHELL, TELECOMMUNICATIONS COMPETITION: THE LAST TEN MILES 51–53 (MIT Press & AEI Press 1997); LESTER D. TAYLOR, TELECOMMUNICATIONS DEMAND IN THEORY AND PRACTICE 9 (Kluwer Academic Publishers 1994).

model. Because the Rohlfs and Katz-Shapiro network effects are positive externalities, we would expect them to amplify the Willig Pareto-improvement effect of optional tariffs rather than dampen it. In other words, we would expect that a model of optional tariffs that explicitly accounted for positive network externalities arising from interdependent demand would make optional tariffs look even more attractive than Willig's original analysis did.[9]

B. Absence of Resale

The success and desirable attributes of optional tariff plans are predicated on the absence of resale between customers. If it were practical for the favored customer to transfer the quantities purchased under the optional tariff plan to other customers facing the established tariff, the vendor would find its profits eroded. In the limiting case of costless resale, arbitrage by customers would ensure that the sole effect of the optional tariff offering would be to convert high-priced sales into low-priced sales.[10]

C. Discrimination

The basic argument demonstrating the desirability of optional tariff schedules applies to negotiated service agreements that are not available to all customers, and are therefore overtly discriminatory. Thus, despite any initial appearance to the contrary, discriminatory optional tariffs may be useful tools for promoting the public interest. They may even make possible Pareto improvements that leave all parties better off. A firm could even formalize discriminatory optional tariff offerings through the use of a niche tariff classification: any user can receive an X percent discount by expanding its volume by Y percent.

However, the use of optional tariffs and/or NSAs whose provisions are not available to all potential users may well be viewed as "unduly discriminatory" under a traditional rate regulation statute, such as the Communications Act[11] or the Postal Reorganization Act.[12] Fortunately, it is not necessary to resort to discrimination (in the economists' sense) to achieve the benefits of optional tariff offerings.[13] As we discuss in detail below, the use of nonlinear outlay

[9] For additional reasons why interdependent demand may exist within a Ramsey-pricing framework for a multiproduct firm, even without explicitly recognizing positive network effects, see JEAN-JACQUES LAFFONT & JEAN TIROLE, COMPETITION IN TELECOMMUNICATIONS 63 (MIT Press 2000).

[10] *See, e.g.*, Ronald R. Braeutigam, *Optimal Policies for Natural Monopolies*, in 2 HANDBOOK OF INDUSTRIAL ORGANIZATION 1289, 1332 n.62 (Richard Schmalensee & Robert D. Willig, eds., North-Holland 1989).

[11] 47 U.S.C. § 202.

[12] 39 U.S.C. § 3622(b).

[13] To an economist, price discrimination occurs when two consumers have different ratios of price to the net cost of serving the consumer. *See, e.g.*, JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION 133–34 (MIT Press 1988).

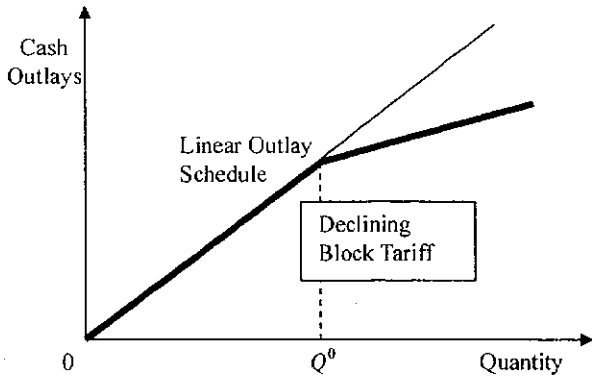

Figure 2. Declining block tariff.

schedules (quantity discounts) can make possible Pareto improvements without discriminating between users.

Despite the fact that it is, in a very real sense, *designed for* the large user, the resulting optional tariff offering is inherently nondiscriminatory. It merely replaces the established tariff with a nonlinear price schedule that is, in principle, equally available to all. A graph of total outlay as a function of volume illustrates this point about nondiscrimination most clearly. In Figure 2, the initial established tariff is just a straight line through the origin with slope equal to the price p. The outlay schedule in effect after the introduction of the optional tariff offering coincides with the original schedule through output level Q^0. There the outlay schedule develops a "kink" and continues along a straight line with the (lower) slope given by the discount price p'. Any customer is free to select any point along this resulting (nonlinear) outlay schedule.

D. Threshold for Quantity Discount

The example illustrates the key role typically played by the large user's initial volume, Q^0, in the design of an optional tariff offering. It is no accident that this quantity determines the beginning of the quantity discounts (and the kink in the outlay schedule). In the theoretical analysis, this quantity guarantees that, *whatever the shape of the large user's demand curve*, the large user will find it desirable to expand its purchases, and the monopolist's profits will increase as a result. This outcome may not be the case if the threshold for the declining block tariff is set at other than Q^0. Consider the situation in Figure 3, in which the demand curve of the large user is nearly vertical. Then, the large user would not change its quantity much in response to the lower price available under the optional tariff. If the threshold for quantity discounts lay significantly beyond Q^0, say at Q^1, the optional tariff would not be selected. On the other hand, if the threshold for the declining block tariff were set significantly below Q^0, say at Q^2, the large user would avail itself of the

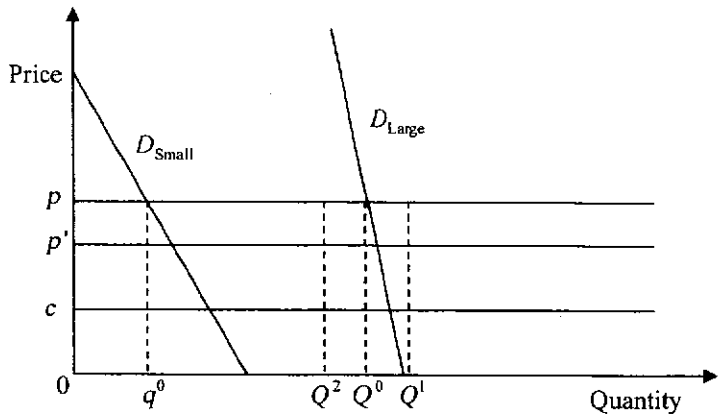

Figure 3. Threshold for quantity discount.

lower price for quantities it had previously purchased at the established rate, thereby decreasing the monopolist's profit contribution from this market. Although the quantity discount would induce a slight expansion in volume beyond Q^0, the contribution earned from the increment would not offset the losses resulting from discounting the "original" volumes.

In practice, there will typically be a range of quantity discount threshold levels around Q^0 that will result in an optional tariff offering that is both attractive to the large user and profitable for the monopolist. The difficulty is that, for any threshold level other than Q^0, these issues become empirical questions. When the optional tariff offering results from negotiation between the two parties, it is reasonable to assume that the selected quantity threshold is satisfactory to the large user. One would have similar confidence about the impact on profits *if* the monopolist were a profit maximizer. However, if one cannot assume the firm's objective function to be profit maximization, then it would be necessary to forecast the expected effects on the monopolist's profits in order to evaluate the desirability of a negotiated optional tariff arrangement, even before considering the issue of demand interdependence (discussed below).

Finally, it is important to recognize that the above theoretical analysis presumed stable, unchanging demand curves. When, as in reality, demand schedules change over time, the focal point becomes the quantity that the large user *would have demanded* at the established rate. Thus, in any practical application, the evaluation of any optional tariff offering will always be an empirical question, but perhaps no more so than many other elements of the typical rate proceeding.

IV. QUANTITY DISCOUNTS FOR INPUTS

As is the case in most of the economics literature, the preceding discussion of optional tariff offerings posited a situation in which a good or service is sold to

final consumers. However, in the case of many goods (such as postal services), volume discounts are likely to be offered to business users. For these mailers, postal services are used as an *input* in the provision of other products and services to other businesses and final consumers. This distinction between inputs and final products, explained in articles by Ordover and Panzar in the early 1980s, complicates the welfare analysis of optional tariffs considerably.[14]

The input demand curves of firms that compete in the final product markets are necessarily interdependent. Ordover and Panzar demonstrated that this interdependence can be viewed as a negative externality of one user's consumption on another. That negative externality defeats Willig's elegant Pareto-improvement argument in support of optional tariff offerings. Indeed, one cannot even presume that the introduction of optional tariff offerings will increase total surplus in the market. Thus, assessing the desirability of optional tariff offerings requires the detailed analysis of (forecasted) demands and costs typical of rate proceedings.

A. Market-Induced Demand Interdependence

Figure 1 and the subsequent analyses incorporate the assumption that the demand schedule of each small user is not affected by the price and quantity choices available to the large user. This standard assumption is quite reasonable when the service in question is being sold to final consumers or as an input to firms operating in different final product markets. Suppose that the large user is a bank that mass markets credit cards through its use of the mail. There is no reason to expect that, if the bank makes use of a quantity discount, there will be any effect on the demand curves for mail delivery of other users that are individual consumers or small firms in, say, the floral industry.

However, there is reason to question the validity of this assumption of independent demand when the service at issue is purchased by firms for the purpose of producing goods or services for final consumers—that is, when the service being sold is itself a factor of production. In the case of a service that is an input, the demands of customers that compete in the same final product markets are necessarily interdependent. A discount offered to one competitor puts its rivals at a cost disadvantage relative to that input. This cost advantage, in turn, leads to an erosion of rivals' sales in the final product market and a decrease in their derived demands for the input. One can trace the impact of a quantity discount received by *one* firm through the chain of market interactions. A reduction in the price that a firm pays at the margin for a normal input causes it to increase its supply of output. In deciding whether or not to supply one more unit of output, the firm considers the

[14] *See* Janusz A. Ordover & John C. Panzar, *On the Nonexistence of Pareto Superior Outlay Schedules*, 11 BELL J. ECON. 351 (1980); Janusz A. Ordover & John C. Panzar, *On the Nonlinear Pricing of Inputs*, 23 INT'L ECON. REV. 710 (1982).

relevant input price to be that of the incremental unit of input required. This incremental input price is the discounted price for a firm that accepts a quantity discount offer. The economic definition of the term "normal input" corresponds well to everyday usage. It refers to a productive input whose utilization increases when the firm's output increases, all other factors being held constant. Intuitively one would expect that input and output quantities "normally" increase and decrease together.

In turn, this price reduction for a normal input leads to a reduction in the market price of the final product. This lower price affects other firms participating in the output market that, because of their small size, do not take advantage of the quantity discount for the input. Those firms respond to the lower market price by reducing their quantity of output sold. *Normally*, this output reduction results in a corresponding reduction in the quantity of input demanded.

A familiar example of an input with interdependent demand is mail delivery: the vast majority of mail is sent by businesses that use postal services as an input in the production of their final products or services. A bank that issues credit cards, for example, purchases mail services so that it can mass market its services to consumers. Below, we will discuss the topic of quantity discounts for inputs in some detail. Here, it is sufficient to recognize that competition between mailers in their final product market makes possible a form of indirect arbitrage. The competitive process allows final consumers' purchases and associated mail volumes to shift from mailers purchasing according to the standard tariff toward mailers availing themselves of the discounts incorporated in the optional tariff offering. Thus, like resale between customers, competition in final product markets can transform high-priced sales into low-priced sales for the monopolist.

The above discussion applies literally to the outcome in a textbook perfectly competitive industry. The story is only slightly more complicated in imperfectly competitive industries. A game-theoretic analysis of an oligopolistic industry is based on the firms' reaction functions, which specify the relationship between the firms' output or price choice and other market variables, including the prices that the firm pays for inputs. When the price that a particular firm pays for a normal input decreases, that firm's reaction function "shifts out." That is, the firm chooses a larger quantity (lower price), everything else being equal. In the new market equilibrium: (1) the market price of output falls; (2) the output of the favored firm increases; and (3) the output, input purchases, and profits of firms not receiving the discount decrease.

B. The Inability to Presume a Pareto Improvement

This network of feedback interactions has profound implications for the evaluation of optional tariff offerings. Recall that, when user demands are

independent, any optional tariff offering to which a user and a profit-seeking monopolist voluntarily agree can be *presumed* to be efficient because it can make possible a Pareto improvement. No such presumption is possible when there are downstream competitors of the favored user. The elegant, simple argument of the previous section breaks down because the output expansion of the favored user will be (to some extent) offset by an output contraction of users who do not avail themselves of the discount. It does not matter whether the small users choose not to avail themselves of the quantity discount (because it is not profitable) or whether the quantity discount is simply not offered to them. They are made worse off in either case.

Of course, a prescient monopolist would take such feedback effects into account when designing an optional tariff offering, ensuring that it would be attractive to the prescient large user and profitable if selected. However, the negative effect on small users will remain, *even if the established tariff remains available.*

In some circumstances it may be possible to design an optional tariff offering that makes feasible a reduction in the established tariff that results in benefits to the monopolist and *all* users.[15] The problem is that there can be no presumption that such is the case when the quantity discounts are offered for inputs.

C. The Impact of Discriminatory Discount Policies

The analysis thus far has focused on the case in which the optional tariff offering takes the form of a quantity discount plan available to all consumers, at least in principle. Of course, an NSA might involve a quantity discount provision that is not made available to others. Here, we shall discuss the economic efficiency results under the assumption that such input tariffs can be negotiated individually with *all* firms competing in a given output market—for example, all credit card companies. Although such tariffs might seem to be "unduly discriminatory," the analysis provides a useful efficiency benchmark.

Consider a situation in which a profit-seeking monopolist serves heterogeneous firms that compete in the same output market. Initially, an established uniform price has been determined through the ratemaking process. The monopolist is then permitted to offer different NSAs to each of these customers. The outcome of this process would be the efficient transfer of the input to each and every customer. The gains from this increased efficiency would be divided between the monopolist and the firms. Economic theory does not provide a definitive prediction about the nature of this division, except to say that it will be determined by relative bargaining power. If the

[15] Ordover and Panzar, *On the Nonexistence of Pareto Superior Outlay Schedules, supra* note 14, present plausible circumstances in which Pareto improvements are *impossible.*

firms were not in the same market, this negotiation process would make possible a Pareto improvement.

However, when the customers are competitors in the same final output market, a Pareto improvement will not necessarily result. The NSAs result in the lowering of the input price facing all firms at the margin, causing them to expand supply. As above, the end result of this feedback effect is that the equilibrium output price falls. This fall in output price may harm *some* of the firms more than the benefits they obtain through their NSA.

However, in this example it seems likely that economic efficiency will improve. That is, the *sum* of the contribution received by the monopolist, profits of the firms, and the consumers' surplus of final consumers (their customers) will increase. We are not aware of a formal demonstration of this result in the literature. But, the intuition seems clear: NSAs allow each firm to receive its services without distortion at the margin. This freedom from distortion, in turn, makes possible increased productive efficiency downstream, which makes possible both a lower final product price and increased firm profits.

D. Evaluating Negotiated Service Agreements for Inputs

The economic literature on quantity discounts almost always assumes that the product or service in question is being sold to final consumers. In the case of an NSA for postal services, mail services are an input used in the provision of products and services to the final consumer. This complication eliminates the strong efficiency results associated with the introduction of optional tariff offerings. This caveat is unfortunate, because those strong efficiency results provided a justification for a very permissive regulatory policy toward optional tariff offerings, and toward NSAs more generally: any agreement voluntarily reached by the firm and any of its large customers was likely to be "in the public interest." Therefore, the details of such an agreement would not need the elaborate scrutiny of the ratemaking process. Alas, this situation is more complicated. The NSAs and other types of optional tariff offerings may be useful policy tools. In some circumstances they can be used to increase economic efficiency. However, they must be subject to the usual scrutiny of the ratemaking process.

On the basis of the preceding analysis, we make the following general observations regarding the evaluation of optional tariff offerings. First, the impact of the tariff on the profitability of the monopolist must be evaluated. If, like the Postal Service, the monopolist is not a profit-seeking enterprise, it cannot be presumed that any NSA it offers will improve its bottom line. Ensuring the profitability of any optional tariff offering is a legitimate concern of all customers.

Second, competitors of the firm receiving the NSA should have standing to participate in proceedings for evaluating its provisions. Competitors may be adversely affected notwithstanding the profitability of the NSA. The NSA

may be in the public interest even if competitors are damaged, but their concerns are an important part of the evaluation process.

Third, a niche tariff approach may be a pragmatic approach to deal with the issue of fairness to competitors of any firm that is a party to an NSA. This approach is likely to have desirable efficiency properties without requiring smaller competitors to incur the costs of initiating and undertaking lengthy negotiations. In the case of the Postal Service, we do not suggest making quantity discount plans available to all mailers. Rather, we recommend that they be made available only to firms competing with a mailer benefiting from an NSA.

V. CONCLUSION

Economists have praised optional tariff offerings as an innovative policy tool whose use can achieve Pareto improvements without requiring significant regulatory scrutiny. Unfortunately, the presumed desirability of optional tariffs depends crucially on assumptions that may not be fulfilled in the case of a state-owned enterprise (in particular, profit-seeking behavior on the part of the monopoly vendor) or in the case of interdependence of consumer demand functions. As a result, one cannot make sweeping conclusions about the efficiency of negotiated service agreements and other optional tariff offerings. Instead, one must evaluate the welfare effects of this form of nonlinear pricing in each individual case, using empirical procedures familiar to the ratemaking process generally.