Chapter 7

LOCAL TELEPHONE PRICING IN A COMPETITIVE ENVIRONMENT

JANUSZ A. ORDOVER*
AND
ROBERT D. WILLIG**

This article makes the following three main points. First, neither the divestiture by AT&T of its operating companies (BOCs)[1] nor competition in interexchange markets will be the fundamental cause of increased prices for local telephone services. Hence, such price increases should not be viewed as a social cost that counterbalances the genuine social gains available from divestiture and competition for long distance services.

---

*Janusz A. Ordover is Professor of Economics at New York University. Previously he taught at Lehman College, and was a member of the technical staff at Bell Labs. His research is concentrated in the area of legal rules and imperfect information, antitrust policies and optimal taxation. He is the author of numerous articles on regulation and antitrust. He received a PhD from Columbia University.

**Robert D. Willig is Professor of Economics at Princeton University. He has previously taught at Stanford, worked at Bell Labs as supervisor of economics research, and has been a research fellow at the University of Warwick. He was a member of the organizing committee of the Telecommunications Policy Research Conference (1977–78) and of the Aspen Institute Task Force on economic research. He has authored numerous articles and books, including, with Baumol and Panzar, the recent *Contestable Markets and the Theory of Industry Structure*. He has contributed articles to professional journals. He received an AB from Harvard and an MS and PhD from Stanford.

Second, local telephone rates must rise as a result of advances in "bypass" technology that offer increasingly stiff competition to basic exchange services. Another consequence of this trend is that the mechanism by which the exchange carriers (ECs)[2] derive revenue from interexchange services must be designed with great care to avoid socially wasteful bypass of the local telephone network.

Third, as local rates must rise, the implementation of Local Measured Service (LMS) is increasingly in the public interest.

DIVESTITURE AND INTEREXCHANGE COMPETITION

In this section, we discuss some of the social benefits and costs of divestiture, and show that increased local telephone rates are not among the necessary costs.

The divestiture by AT&T of the present Bell Telephone Operating Companies entails a highly complex apportionment of product and service lines, physical assets, employees, financial assets and liabilities. The newly created ECs will be independent corporations, and each is likely to be subject to traditional rate-of-return regulation. To the extent that the divestiture provisions will result in ECs with relatively favorable endowments[3] (i.e., low operating costs, secure capitalization, and lucrative sources of net revenues), then the future local telephone service rates will be relatively low. Under these circumstances, the divested ECs would be able to achieve independent financial viability even at relatively low rates, and rate-of-return regulation would constrain them from charging higher rates.

Thus, it is clear that the details of divestiture will have a substantial impact on local telephone rates, and that the less favorable the apportionment of the Bell System is to the divested ECs the higher those rates will be.[4] At the same time it must be realized that by itself, the divestiture need not affect the local rates.

The essence of the divestiture is the separation in ownership and control of the assets that produce local telephone services (basic exchange and intraexchange) from those that produce long distance services (interexchange) and those that produce telephone equipment. There are three fundamental aspects of this separation that warrant discussion here.

First, the separation would eliminate any existing incentives for BOCs to engage in or acquiesce to anti-competitive practices that harm consumers and disadvantage rivals of the Bell System in markets for interexchange services and telephone equipment.[5] Before the divestiture, total Bell System profit might have been raised by preferential treatment and purchasing accorded Long Lines and Western Electric by the BOCs. This would hold if the advantaged services and products were priced above short-run marginal cost, and if the BOCs could recover any associated costs through the "separations" process and through prices for local services that are higher than they would otherwise have to be. Further, the Bell System could have, in principle, profited from excluding rival interexchange carriers (even more efficient ones) if the additional Bell capacity that would have been needed as a result added more than it cost to the revenues that Bell was permitted and able to earn under rate-of-return regulation.

Divestiture of the BOCs would eliminate any such incentives for socially harmful conduct. Independent ECs that specialize in local services would have socially beneficial incentives to choose the highest-quality and least-costly equipment and interexchange services, without regard for the identity of the supplier. It must be noted, however, that some of the modifications introduced by Judge Greene may blunt these incentives inasmuch as they will allow BOCs to provide customer premise equipment and operate in some unregulated markets.

The second fundamental aspect of the separation is that these pro-competitive benefits of divestiture should be weighed against possible increases in production costs resulting from the loss of economies of scope.[6] Divestiture may lead to wasteful duplication of facilities and work force that could otherwise be utilized for joint production of both local and other services. And divestiture may render impossible or more costly efficient planning and coordination of the local and interexchange networks.

Third, the pro-competitive benefits of divestiture need not be weighed against increases in local telephone rates that are feared to result from lost support of local services by separations and settlement payments and by net revenues earned on intrastate Message Toll Service (MTS).[7] It is well known that prices currently charged by ECs for local services are substantially lower than they would otherwise have to be because of the net contributions from intrastate and interstate services. However, these net revenues from intrastate services and separations and settlement payments received from Long Lines could be replaced, dollar for dollar, absent other problems, by network access fees levied by the ECs.

To accomplish this goal, a divested EC would have to establish a system of prices that must be paid by any interexchange carrier for its interconnections with the EC's local network.[8]

As noted above, an EC that is independent of all interexchange carriers has incentives to levy such charges equally on all carriers; as a result, competition among carriers will not be impaired.[9] The system of network access fees could be designed to replicate, to a first approximation, the flow of support that would otherwise be forthcoming under the pre-divestiture arrangements.[10] For example, if an intrastate MTS call now contributes 25¢ to the support of local facilities, the BOCs could charge any interexchange carrier the same 25¢ for the local interconnections it would need to supply the same call. Similarly, if an interstate call now generates 50¢ in separations payments, the ECs could charge any interexchange carrier the same 50¢ for the local interconnections that would be needed to supply that call.

Of course, the nature of market demand would place limits on the revenues that ECs could derive from network access fees. But these limits would apply with equal force to the revenues ECs could have earned absent divestiture. The point here is simply that, under divestiture, network access fees can substitute for the present mechanisms by which interexchange revenues contribute to the costs of local facilities. As such, divestiture itself need not raise the portion of these costs borne by local services, nor cause prices of local services to rise.[11]

BYPASS COMPETITION AND LOCAL TELEPHONE RATES

The previous section established that divestiture need not cause local telephone rates to increase, because network access fees can replace the contribution to local costs otherwise available from intrastate MTS, separations, and settlements. In this section, we argue that local telephone rates will have to increase as a result of the decreasing costs of bypass technologies, methods that permit interexchange telephone communications without the use of existing and traditional local telephone facilities.[12]

Before the economic and policy implications of such bypass can be comprehended, it is necessary to distinguish between efficient and inefficient bypass. From the narrow perspective of a vendor, bypass occurs whenever his product becomes unnecessary as an input into production of a good or service. Thus, the advent of telephones made it possible to bypass many of the services of couriers. Similarly, the arrival of television permitted bypass of movie theaters as purveyors of film entertainment. Pocket calculators bypass slide rules. Such examples can be provided *ad infinitum*. Their thrust is quite clear: existing products become obsolete when their costs to users—either measured in terms of price alone or in terms of price adjusted for quality—exceed the costs of new, substitute products. The consumer, in making his choice between existing goods or services and newly introduced substitutes, is guided by the relative costs to him associated with the available alternatives. In the simplest scenario, the relevant costs are simply the prices of the alternatives. When the prices track closely the true economic costs of the alternative products, buyers' choices coincide with those that would be made if social interests, rather than private gain, were the guiding objective. Thus, we conclude that whenever the prices of products reflect their true social costs, the bypass of an old product in favor of a new product is consistent with the social interest and with the goal of economic efficiency.

Yet, in many situations, private choices among alternative products are not conducive to efficient resource allocation. This is likely to occur if the existing product is priced substantially above its true social cost, a deviation that may be caused by the exercise of market power, by taxes, by externalities in consumption or production, or as a result of regulatory procedures and constraints. Whatever the reason for the deviation, a buyer confronted with distorted relative prices may opt for a product whose social cost is higher than the cost of the bypass product.[13]

This concept can be illustrated with the help of a simple numerical example. Consider a telecommunications customer who spends $100,000 annually for interexchange services. Let us assume that the portion of the Non-Traffic-Sensitive costs (NTS)[14] caused by the customer and allocated to interexchange is $20,000 annually and that the traffic-sensitive cost of his interexchange services is $30,000 per year. Thus, the account contributes $50,000 ($100,000-$20,000-$30,000) annually to the EC in excess of the costs that it causes. This sum contributes toward covering the NTS costs caused by other customers who purchase few interexchange services. The large customer has incentives, then, to bypass the local distribution facilities of the EC if the cost to him of alternative methods of securing equivalent services is less than $100,000. However, such bypass may be efficient only if the annual cost of the alternative is less than $50,000. It will be inefficient if the annual cost exceeds $50,000.

For example, suppose the customer is offered equivalent services for $99,000 by a bypass carrier who incurs interexchange transport costs of $35,000 and annual costs of $63,000 for the local facilities needed to interconnect the customer with the carrier's interexchange network. The diversion of the customer's traffic would save him $1,000 and would earn the bypass carrier a profit of $1,000, but would cause the EC a loss of $50,000 in net revenues. This loss either falls on the owners of the EC or must ultimately be borne by other EC customers in the form of rate increases. The economic calculus indicates that this bypass is highly inefficient and socially disadvantageous, despite its appeal to the customer and to the bypass carrier, because its benefits total $2,000 a year while its costs total $50,000 a year.

The disparity between private incentives and social outcomes in this example arises from the overly high, cross-subsidizing rates charged to the customer by the EC. All such disparities would be eliminated only if the customer were charged $50,000 a year by the EC for these services. This, then, is an example of the general principle that prices equal to costs eliminate incentives for inefficient bypass. At the same time, cost-based pricing (together with nondiscriminatory access) can help ensure that efficient bypass will be privately profitable.

The example can also be used to clarify our assertion that, as bypass technologies become cheaper, ECs will be forced to lower charges for interconnection between the local and the interexchange networks and to allocate an increasing portion of its NTS costs to local services. In the example, despite the cross-subsidizing rates charged the large user, bypass would not have been a threat to the EC if the bypass facilities had necessitated annual costs in excess of $65,000. However, as those costs fall from $65,000, the EC must correspondingly lower the $50,000 cross-subsidy obtained in order to keep the large user as its customer. This loss of contribution to the NTS costs of others must then be made up by increases in rates charged for other less vulnerable services, or by charges assessed directly on the other customers for their basic exchange service. This conclusion at first appears paradoxical, because bypass technologies compete with the basic exchange offered by ECs. And it is a common-place that increasingly stiff competition drives down the price of a good or service. Yet, here, the increasing competition from ever more available and economic bypass options will cause basic exchange and other local rates to increase.

The resolution of the seeming paradox lies in the fact that basic exchange provides joint products: access to local calling and access to interexchange services. Bypass technologies are far better substitutes for the latter than for the former. This follows from the fact that local calling is generally diffused over a large number of different parties. Consequently, in order to bypass local distribution facilities, a user would have to install a large number of parallel bypass facilities. On the other hand, in order to bypass an EC for his interexchange calls, the customer needs only to reach the origination or receiving facilities of an interexchange carrier.

Thus, as bypass technologies become more widely available, they will drive down prices for access to interexchange services. These prices must, in combination with prices for local services cover the costs of local facilities. Hence, as a result of this downward pressure on access charges, the prices for local services must simultaneously increase so as to ensure cost coverage.[15]

A more direct way to establish this general conclusion is to consider the options available to a customer in more detail. The customer can follow the traditional route of paying the EC's price for local services and the prices of interexchange services that include mark-ups for contribution to the costs of local facilities. Alternatively, he can pay the EC's prices for local services, bear the fixed set-up costs of a bypass technique, and pay a carrier prices for interexchange services that are free of contribution to local costs. In deciding which alternative to choose, he compares the set-up cost of bypass with the mark-up for local contribution multiplied by the amount of interexchange service he demands. If the former is smaller, he will bypass the local network for access to interexchange services. As a result, his contribution to local facility costs will be lost, and real social resources will be wastefully devoted to bypass facilities that, from the social perspective, accomplish little more than the duplication of EC capacity.

To better understand bypass incentives, we present here some data from the BOCs and AT&T Comments (1982)[16] that discuss at length the economic impacts of various NTS recovery procedures outlined in the FCC's Docket 78-72 Fourth Supplemental Notice[17] (1982). Table 1 provides, in the first column, summary information on present contributions to NTS by service category. For example, under the existing recovery procedures, customers of MTS/WATS (Wide Area Telephone Service) (open ends) contribute 7.2¢ per minute of interstate usage to NTS costs for each end. This means that each minute of interstate usage costs the originating subscriber 14.4¢ per minute in access fees. Private line customers contribute an average of $24 per end on a monthly basis, independently of usage. Some customers do not contribute at all to interstate NTS costs.

The last three columns in Table 1 display an estimate of the access costs attributed by present separations and settlements formulae to interstate services for each identified customer category. For example, a system-wide average MTS customer adds $7 per line per month to the NTS costs attributed to interstate services. However, this cost attribution figure varies greatly among states. It reaches a low of $3 in Kentucky (Cincinnati Bell) and rises to $27 in Nevada. The cost attribution figure for a two-wire private line end is only $20 per month in Pennsylvania, but is as high as $43 in Wyoming; the system-wide average is $24.

It can be inferred from Table 1 that the heavy users of interstate services contribute the most to the interstate allocation of NTS. This is so because, under the present recovery procedures, the access costs are largely defrayed through usage charges. As it is noted in BOCs and AT&T Comments:[18]

> The existing recovering procedures coupled with the wide variation in levels of use result in about 1% of the nation's business telephone customer locations accounting for approximately 40% of business in-

Table 1. Contribution to Interstate NTS Costs by User Category and Interstate Access Costs (1981).

	Present	Access Cost		
	Nationwide	Nationwide	Range of De-averaged Costs	
	Average	Average	Low	High
Jointly Used Lines (MTS/WATS Open Ends)	7.2¢/min.	\$ 7/line	\$ 3/line	\$27/line
Jointly Used Lines	4.0¢/min.*	\$ 7/line	\$ 3/line	\$27/line
Jointly Used Lines (FX/CCSA-ONAL:** Open Ends)	0	\$ 7/line	\$ 3/line	\$27/line
Private Line	\$24/end**	\$24/end**	\$18/end**	\$43/end***
WATS Access Lines	7.2¢/min.	\$26/end	\$20/line	\$45/line
FX/CCSA-ONAL Access Lines	0	\$24/end	\$18/line	\$43/line

*55% of 7.2¢/min.
**Foreign Exchange Line/Common Control Switching Arrangement–Off Network Access Line.
***Two-wire private line.
Source: BOCs and AT&T Comments (1982, Table III, p.44).[19]

> terstate MTS revenues. About 20% of the nation's business customers and 30% of the residence customers, taken together, defray more than 80% of the $7 billion in non-traffic sensitive subscriber plant costs allocated to interstate.

As such, other things equal, it is the heavy users of interexchange services who will find it advantageous to invest in bypass facilities. Unfortunately, but not coincidentally, it is also they who presently make the largest contribution to local NTS costs. Further, the lower the set-up costs necessary for bypass technologies, the greater the number of customers who will find it advantageous to utilize them, or, alternatively, the lower the contribution toward local costs that an EC will be able to obtain per customer that it keeps. Thus, as bypass technologies become more widely available and less expensive, the less contribution toward local costs will an EC be able to obtain from interexchange services, and the higher will local rates be driven. Consequently, in order to minimize the adverse effects of bypass on local rates, recovery procedures must be devised that would prevent inefficient bypass without repressing the development and introduction of new cost-efficient technologies. In the rest of this section, we discuss some of the possible methods for defraying NTS costs that attempt to cope with the problems of inefficient bypass and the long-run erosion of the subscriber base.

As we have seen, the cause of inefficient bypass lies in the present recovery procedures that recoup NTS costs through mark-ups on usage. It follows, therefore, that inefficient bypass could be minimized, or even entirely avoided, if usage were not taxed to raise revenues for financing the NTS costs. Of course, the lost contribution would have to be replaced. Considerations of economic efficiency, narrowly conceived, suggest that the needed revenues be raised via a Customer Access Line Charge (CALC) set equal to the access cost caused by the customer. In the current regulatory parlance, this recovery mechanism is referred to as Pure II.[20] Under Pure II, NTS costs would be recovered from customers by means of a fixed NTS charge per line. Hence, heavy users of interexchange services would not be required to contribute more to the NTS costs than the actual costs that they cause. As a result, these customers would have no incentives to engage in inefficient bypass. They would stay with the local EC if the NTS costs they caused the EC to incur were less than the costs of bypass facilities. Conversely, if the (quality adjusted) costs of bypass were lower than the EC's costs of service, the customer would have an incentive to engage in bypass. Thus, Pure II could encourage efficient bypass and suppress inefficient bypass.

Although Pure II can be recommended on these narrow efficiency grounds, since it relates access fees to the costs of access, its implementation in its purest form could impede attainment of other goals of telecommunications regulation. In particular, universal service may be weakened by the introduction of Pure II. Indeed, the calculations reported in the BOCs and AT&T Comments[21] show that "based on Bell operating company nationwide averages, charges would be raised for approximately 60% of business customers and 85% of residence customers who pay less than about $7 in interstate non-traffic sensitive access costs, the Pure II average per line on a nationwide basis."

The increases in monthly charges stemming from the implementation of Pure II may be particularly jarring in rural areas if the CALC is established on a de-averaged basis. A perceptible fall-off in residential telephone penetration might result. Such an outcome might be viewed with alarm from the perspective of the social goal of universal service as well as from the perspective of economic efficiency, broadly conceived. The latter view incorporates the notions of network externalities: subscribers throughout the network benefit from high penetration and incur an economic loss when disconnection precludes them from readily communicating with former residential subscribers.

It may be important, therefore, to moderate Pure II in its purest form, at least on a transitional basis. Purposeful cross-subsidies could be maintained in a system of averaged CALCs to diminish the adverse impact of Pure II on high-cost rural areas and on low-income residential subscribers. In addition, some portion of NTS costs could continue to be defrayed through surcharges on usage. Whatever its details, a "mixed" system of this kind should be designed to recoup total NTS costs, avert inefficient bypass, and minimize the adverse effects of CALCs on the subscribership of customers with low interexchange usage.

It is inevitable that a mixed alternative to Pure II that meets these criteria would induce heavy users of interexchange services to contribute more to total NTS costs than the costs they cause, and yet not so much that they are motivated to engage in inefficient bypass. To see that such a cost recovery mechanism might be possible, suppose an EC could offer each customer a choice between two methods of paying the contribution to local costs through his utilization of interexchange services.[22] The first method would be an ordinary mark-up per unit of interexchange service. The second would be a variant of a two-part tariff that applied to each unit of interexchange service a low, or zero, contribution to NTS costs. However, it would require a fixed-sum contribution chosen to be somewhat less than the set-up costs of bypass technology.

Faced with such a system of charges, no customer would elect to invest in bypass facilities. Heavy users of interexchange services would find the two-part tariff arrangement less costly than bypass, and light users would prefer the standard mark-up per unit of interexchange service. Consequently, socially inefficient investment in bypass facilities would be deterred, and the BOC would not unnecessarily lose the contribution to local fixed costs. This scheme is depicted in Figure 1. For the sake of illustration, we assume that each subscriber will pay a CALC of at least $2 per line per month. Option A has a high tax on usage built into it. Option B has no surtax on usage but has a substantial CALC of $45. We assume that the annual cost of the bypass technology is $50 per month. The consumers whose interexchange usage is less than some quantity "S" (in Figure 1) would choose Option A, and those whose usage is S or more would opt for B. As a result, inefficient bypass is forestalled.

While this cost recovery mechanism was just described as a "self-selecting two-part tariff," it could equally well have been posed in other forms. For example, Figure 1 could represent a non-optional system whereby all customers face Option A, but where the surtax on usage is capped at $45 per line per month. Alternatively, a tapered system could be developed with a surcharge on usage that declines with succeeding levels of utilization. The resulting outlay schedule—which relates the level of usage to payments for access—could be that illustrated in Figure 2 below.[23] Here, subscribers whose usage levels are less than S* make payments for access that are less than the average NTS cost, while heavier users pay more. However, due to the design of the taper, the payments of heavy

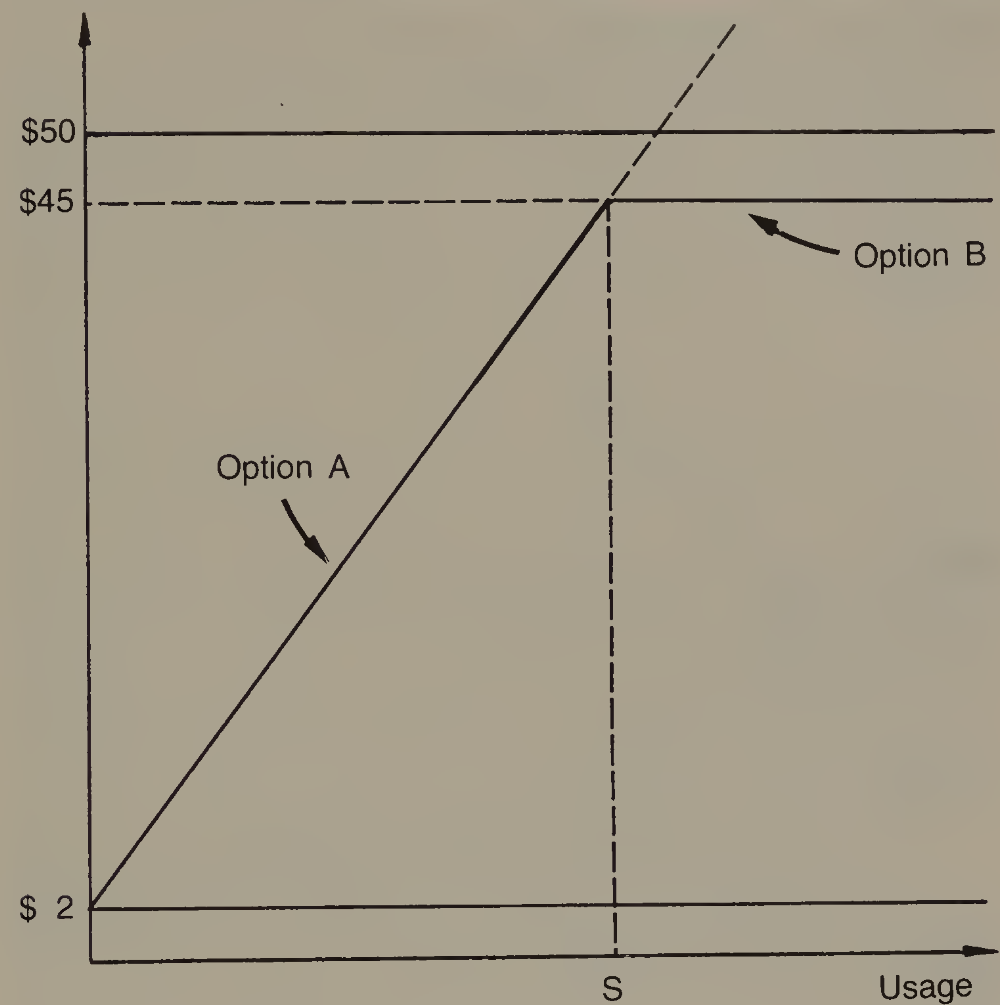

Figure 1. Choice between tariff options.

users do not surpass the cost of bypass, so that inefficient bypass is deterred.

Despite their virtues, it should be recognized that mixed mechanisms of this kind present problems of implementation, and also perpetuate forms of economic inefficiency. First, it is inevitable that averaged CALCs distort to some extent customers' incentives to engage in efficient bypass and to avoid inefficient bypass. Those who face a CALC that is less than the real NTS cost of their access may be deterred from substituting an alternative that causes less real cost. And those who face a CALC that exceeds the real cost of their access may be motivated to invest in inefficient bypass that costs less than the inflated CALC but more than the real cost incurred by

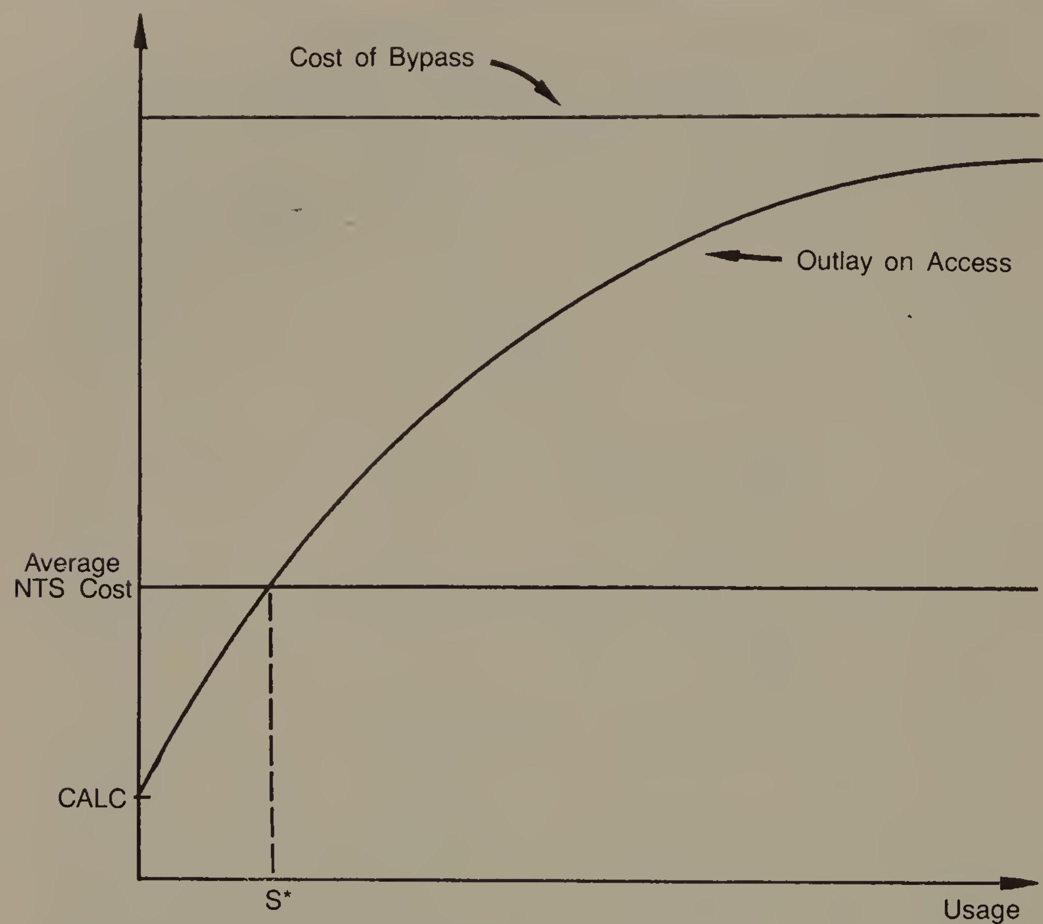

Figure 2. Capped Access Charges.

the EC. Similarly, even the most carefully designed systems of self-selecting two-part tariffs, caps, or tapers must inevitably distort some bypass decisions in view of the fact that the costs of bypass must vary among customers. For example, a cap that lies below the average cost of customer bypass may nonetheless exceed the bypass costs of some customers whose usage is heavy. Then, the cap will not deter the inefficient bypass of this group, even though it succeeds in forestalling the inefficient bypass of the average customer.

Second, any system of NTS cost recovery that imposes surcharges on usage necessarily causes economic inefficiency by distorting usage decisions. A surcharge represses usage that would yield customer benefits exceeding the real costs that it causes. Thus, net benefits otherwise available from the provision of usage services are lost. The larger the repression caused by the surcharge, and the larger the wedge that the surcharge drives between the marginal cost of usage and its price to customers, the greater that loss is.

These, then, are the forms of economic inefficiency that are caused by a mixed system of NTS cost recovery and that are avoided by the Pure II system of de-averaged CALCs. The consequent social costs should be weighed against the social costs of whatever loss of penetration and network externalities would be caused by the Pure II alternative.

The question remains as to how a mixed system designed to deter inefficient bypass could be practically implemented by an EC.[24] Perhaps it would be feasible to levy network access fees on interexchange carriers that diminish per unit as usage per customer increases. If so, then perhaps these fees would be passed through to customers in a manner that similarly tapers, so that heavy users would face a lower fee per unit of usage and thereby be discouraged from inefficient bypass. However, it is unclear whether the EC could effectively monitor the usage per customer of interexchange carriers. It is also unclear whether these carriers would have incentives to pass through their network access fees in this form.

Alternatively, the EC could charge interexchange carriers for only the costs that they directly cause. And it could charge customers an interexchange usage fee that both covers the traffic-sensitive costs and provides contribution to the fixed costs of local facilities. This fee would be tapered so that the mark-up per unit of usage would decline with usage, thereby discouraging heavy users from inefficient bypass.

An attractive combination of these alternatives would be a tapered surcharge on the interexchange usage of the party who originates the communication within each local area (exchange or LATA, Local Area Transport Area). Thus, each business or residence customer would help defray the NTS costs incurred in his local area through surcharges tapered on the basis of his total originated interexchange usage. And an interexchange carrier would pay a fee for its access to a local area that would be tapered on the basis of the traffic that it originated in that area. This traffic would be originally generated by a residence or business customer elsewhere, and would terminate in the local area in question, but within the local area its origin would be the point of interconnection with the interexchange carrier.

The apparently desirable feature of this system is that the taper is applied to likely concentrations of traffic that would otherwise, without a taper, be prone to incentives for inefficient bypass. And this system avoids the costs and difficulties of having BOCs monitor the composition of traffic carried by interconnecting interexchange carriers.

Analysis of this kind can certainly be useful in designing relatively efficient mixed systems of charges to defray NTS access costs. Additional analysis and judgment are necessary to determine how far a mixed system should deviate from the Pure II alternative. While further conclusions pertaining to these difficult matters are beyond the modest scope of this article, one central conclusion is clear: the trend toward less expensive bypass must cause prices for local services, inclusive of any CALCs, to rise. The final section of this paper explores some of the implications for the pricing of local calls.

THE INCREASING URGENCY OF LOCAL MEASURED SERVICE

There is little doubt that where the costs of implementation are reasonably low (as they certainly are in exchanges with advanced switching technologies), the public interest mandates the adoption of Local Measured Service (LMS). In this section, we briefly show why this is so. We emphasize the fact that as the industry becomes more competitive, and as the necessary overall level of local rates rises, the benefits of LMS increase rapidly, as do the costs of failing to implement it.

The salutary effects of LMS on the allocation of resources can, for the sake of analysis, be divided into three parts:[25] (1) efficient repression of local calls; (2) efficient generation of contribution to fixed and common costs; and (3) protection of universal service.

LMS results in socially beneficial repression of those local calls whose benefits to consumers are less than their marginal costs. The public interest is served by maximizing the net benefits from the utilization of the telephone network, and those net benefits are reduced when a call is made whose cost exceeds its benefits. Such calls are eliminated by LMS rate plans that incorporate a price per local call that equals or exceeds marginal cost, because consumers will then choose to repress the calls in preference to paying for them.

While this familiar argument is correct as a matter of logic, its significance depends on the facts that pertain to the sizes of the marginal costs of local calls and consumers' elasticity of demand for local calling. The marginal cost of a call is a function of its duration, distance, and especially of its time of day (whether or not it is placed during the busy hours of the facilities needed to complete it). Consequently, an optimal LMS rate plan will include prices that are sensitive to these usage elements. Nonetheless, for present purposes, it suffices to note that a study by Rohlfs[26] estimated the average marginal cost of a local call to be 3.5¢, where the average was taken over distance, time of day, and region of the U.S. A study for the New York Telephone Company[27] and a Rand Corporation study of data generated by the Illinois GTE experiment[28] indicate price elasticities of demand for local calling between −0.3 and −0.4 (measured at LMS levels of rates). Applying the numbers to an average base of some 120 local calls per residential subscriber per month, under flat rate pricing, yields a very rough assessment of the efficiency gain from replacing a zero price for local calls (a flat rate plan) with an LMS price that is equal to marginal cost. The calculated gain contribution to common costs, less the calculated loss in consumer surplus, is some 55¢ per residential subscriber per month.

As we shall discuss below, this measure represents only a portion of the efficiency gain from replacing flat rate with measured pricing. Nonetheless, it is useful to compare this portion with an estimate of the cost of implementing LMS. National Telecommunications and Information Administration has estimated the capital costs of metering to be $2 to $5 per line for electronic switches and $20 to $30 for nonelectronic switches.[29] The same source cites a figure of .001¢ per message for the costs of accounting, billing, data processing, and record keeping. Then, amortizing capital costs at 1 percent a month and using the figure of 120 messages per residential subscriber per month yields a total implementation cost of 14¢ to 42¢ per residential subscriber per month.

Thus, the assessed efficiency gains from repression effects alone outweigh the assessed costs of implementing LMS for residential subscribers, even where capital needs are most costly. And for electronic offices, this conclusion has a very substantial margin for error, and indicates a substantial net benefit from moving to LMS.

In addition to inducing efficient repression of local calls, LMS permits efficient stimulation of other services. This is so because LMS generates contribution to fixed and common costs that allows prices of other services to be lower and closer to their corresponding marginal social costs.

The above calculation of the efficiency gain from LMS understated the full gain also because it neglected to consider the use to which the telephone system could put the added contribution. For example, this sum could be used to compensate for decreased prices of interexchange services. Then, there would be an additional efficiency gain forthcoming from LMS due to the stimulation of interexchange services as a result of their prices being lowered toward marginal costs. In the divestiture scenario discussed earlier, such price decreases would take the form either of decreases in the network access fees charged by BOCs, or of decreases in the charges levied by ECs on their customers for interexchange usage.

This additional efficiency gain is substantial because interexchange services have demands that are more elastic than the demand for local calling.[30] Consequently, dollars of contribution shifted to local calling from interexchange services stimulate the latter more than they repress the former. Moreover, the repression of local calling that results from raising its price from zero to marginal cost is efficient in itself. And further repression from LMS prices above marginal cost, while inefficient in itself, would be outweighed by the corresponding stimulation to interexchange services.

These effects, already significant, will become more pronounced as bypass competition becomes stiffer. This competition will substantially raise the elasticity of demand faced by ECs for access to interexchange services. That is, the less expensive bypass is, the more sensitive an EC's customers will be to its price for access to interexchange services. As a result, dollars of contribution shifted to local calling from interexchange access will yield increasingly important efficiency gains. Consequently, the ratio of the optimal prices for local calling relative to the marginal costs will be increasingly large.

Of course, contribution cannot be obtained from local calling without LMS, and prices above zero cannot be charged for local calling without LMS. Thus, our conclusion is now clear: as bypass opportunities become more widely available and economical, the implementation of LMS, already in the public interest, will become increasingly urgent.

The final category of efficiency gains from LMS is the protection of universal service. This is simply a label for the efficiency gains possible from using contribution from local calling to hold down prices for residential connection to the telephone network, i.e., unbundled basic exchange rates. These efficiency effects have two parts. The first part is the gain to those additional subscribers who connect to the network because of lower basic exchange rates. This is analogous to the stimulation effect discussed above. The second part is comprised of the benefits that accrue to others as a result of their ability to communicate by telephone with those additional subscribers. It is these "network externalities" that express in economic terms the public interest in universal service, and that lower the marginal social cost of residential network access below the physical marginal cost.[31]

Thus, as the competitive pressures from bypass require more contribution to common and fixed costs from local services, the optimal rates for local calling will rise increasingly above marginal costs so as to prevent the full brunt from falling on prices for connection to the network. As a result, the efficiency gains from the implementation of LMS that is necessary to levy such rates will grow correspondingly. The alternative for residential basic exchange is increasingly high and inefficient prices, prices that will unduly repress membership in the network and threaten universal service.

CONCLUSION

In these times of revolution in telecommunications technology, in the industry structure, and in the nature of government regulation, it is especially critical that policy decisions pay close attention to the efficient utilization of telecommunications resources. We have argued in this article that in order to promote social productivity and ensure the welfare of the users of telecommunications services, pricing of these services must track costs more closely than it did in the less competitive market environment. In particular, it is necessary that expenditures incurred by subscribers for their access to the local network approximate the non-traffic-sensitive costs their access causes. We are heartened to see that the Federal Communications Commission is willing to consider implementation of NTS cost recovery mechanisms, such as Pure II and Mixed II, which are conducive to more efficient allocation of telecommunication resources.

In the area of pricing of local usage, we have argued that the implementation of local measured service is becoming increasingly necessary to stem inefficient increases in the prices for residential basic service.

It is our conclusion that the pricing policies we have outlined will enable the telephone operating companies to achieve the goal of efficient universal service in the competitive environment without endangering their financial viability. The goal of efficient universal service has three key characteristics. It gives proper weight to the network externalities that characterize residential basic exchange; it ensures proper incentives for the development of less costly and innovative bypass techniques; and it discourages inefficient bypass that merely duplicates the function of existing facilities for the sake of avoiding inappropriately high charges.

FOOTNOTES

1. See *United States v. Western Electric Co.* (Modification of Final Judgment), 1982-2 Trade Cas. (CCH) 91 64,900 at 72555 (D.D.C. August 24, 1982).

2. Exchange carriers (ECs) include the newly divested Bell Operating Companies (BOCs) as well as the independent local operating companies. Our discussion in the first and second sections applies to all exchange carriers.

3. The modifications requested by Judge Greene, and accepted by both AT&T and the Department of Justice, are likely to strengthen the economic viability of the divested BOCs. In particular, the separated BOCs will be permitted to provide customer premise equipment but not to manufacture it, to publish and distribute the Yellow Pages Telephone Directories, and to enter into the hitherto restricted markets upon showing that such entry will not impede competition.

4. It should be noted that the incentives of present AT&T shareowners in determining this apportionment might have been system-

atically at odds with the public interest. Total system-wide profits after divestiture would be greater the more favorable the apportionment to the unregulated corporate entities and the correspondingly less favorable the apportionment to the regulated entities. This holds to the extent that the regulated entities are able to obtain levels of net revenues from their markets that compensate for their unfavorable endowments.

5. For a fuller discussion of these incentives, see Ordover, J.A., and Willig, R.D., "Notes on Non-Price Anticompetitive Practices by Dominant Firms," Paper presented at Ninth Annual Telecommunications Policy Research Conference, 1981.

6. See Willig, R.D., Testimony in Re Monopolization and Competition in the Telecommunications Industry: Hearings Before the Committee on the Judiciary, United States Senate, July 29, 1981. For a fuller discussion of economies of scope, consult Baumol, W.J., Panzar, J., and Willig, R.D., *Contestable Markets and the Theory of Industry Structure*, New York: Harcourt Brace Jovanovich, 1982, Chapter 4, section B.

7. For a further discussion of this point, see Cornell, N.W., and Pelcovits, M.D., "Access Charges, Costs, and Subsidies: The Effect of Long Distance Competition on Local Rates," this volume.

8. BOCs already assess such charges to non-Bell carriers under the Exchange Network Facilities for Interstate Access tariff.

9. See Willig, R.D., "The Theory of Network Access Pricing," in Trebing, H.M., ed., Issues in Public Utility Regulation, East Lansing: Michigan State University, 1979.

10. As discussed below, the precise effects of such fees may depend on the ability and incentives of carriers to pass them through to the consumers in equivalent forms.

11. In fact, to the extent that divestiture is likely to enhance competition in interexchange markets without raising system-wide costs, the total output of interexchange services will rise, the contribution of these services to local costs could rise, and the prices of local services could fall.

12. Examples include a roof-top antenna that permits a microwave link-up, broad-band (perhaps fiber optic) two-way cable link-up, or cellular mobile radio link-up to the facilities of an interexchange carrier. For a more extensive discussion, see Comments of the Bell System Operating Companies and American Telephone and

Telegraph Company in Response to MTS and WATS Market Structure Inquiry, Fourth Supplemental Notice, 1982, BOCs Access Charges Study Group, New York, August 6, 1982.

13. It is possible that the existing product can be priced below its true economic cost, because the seller is pricing it predatorily. Alternatively, the new product may be a predatory innovation, in the sense that its introduction would not be profitable if it were not for its adverse effect on the manufacturer of a rival product. For an extensive discussion of predatory pricing and predatory product innovations, see Ordover, J.A., and Willig, R.D., "Economic Definition of Predation: Pricing and Product Innovation," *Yale Law Journal 91*, November, 1981, pp. 8-53.

14. NTS subscriber plant includes the telephone, some inside wiring, the lines that connect the subscriber's telephone to the local switching office, and the connections that terminate those wires in the local switching office. See BOCs and AT&T Comments, *op. cit.*, note 11, p. 8, fns. 13, 14.

15. Readers of A. Marshall's 1925 classic, *Principles of Economics*, London: Macmillan, may recognize that this is the same effect he identified in his pastoral examples. As better substitutes for wool become available and drive down its price, the price of mutton must correspondingly increase in order for sheep-raising to remain economically viable.

16. See BOCs and AT&T Comments, *op. cit.*, note 12.

17. MTS and WATS Market Structure Inquiry, Fourth Supplemental Notice FCC Docket No. 78-72, 1982, 90 FCC 2d 135.

18. *Ibid.*, p. 11.

19. See BOCs and AT&T Comments, *op. cit.*, note 11, table III, p. 44.

20. See the Fourth Supplemental Notice, *op. cit.*, note 14B, for a description of Pure II and other alternative access pricing mechanisms: Pure I, Mixed I, and Mixed II. For an extensive discussion of these mechanisms, see BOCs and AT&T Comments, *op. cit.*, note 12.

21. See BOCs and AT&T Comments, *op. cit.*, note 12, p. 46.

22. We are grateful to G.R. Faulhaber for suggesting this approach. See also the discussion of Mixed II in BOCs and AT&T Comments, *op. cit.*, note 12, p. 51 ff.

23. For a more general discussion of outlay schedules, see

Willig, R.D., "Pareto-Superior Nonlinear Outlay Schedules," *Bell Journal of Economics 9*, Spring, 1978, pp. 56-69; Ordover, J.A., and Panzar, J., "On the Nonexistence of Pareto Superior Outlay Schedules," *Bell Journal of Economics 12*, 1980, pp. 351-354; and Ordover, J.A., and Panzar, J., "On the Nonlinear Pricing of Inputs," *International Economic Review 23*, October, 1982, pp. 701-717.

24. The resemblance to the outlay schedule generated by customer choice between MTS rates and WATS suggests that, absent legal problems, a mixed system with a tapered outlay schedule could be implemented in a straightforward manner by a fully integrated telecommunications firm.

25. This viewpoint is more fully expounded in Willig, R.D., and Shapiro, C., *The Public Interest in LMS: An Economic Analysis*, Princeton University, 1982.

26. See Rohlfs, J., "Economically Efficient Bell System Pricing," Economic Discussion Paper No. 138, Bell Laboratories, 1979.

27. See Cordo, S.F., Testimony and Exhibit, FCC Docket No. 27100, December 11, 1976.

28. See Park, R., and Wetzel, B., "Charging for Local Telephone Calls: Price Elasticities from the GTE Illinois Experiment," Rand Corporation, 1980.

29. See National Telecommunications and Information Administration (NTIA), "Evaluating Local Measured Telephone Service: Elements of Benefit/Cost Approach," U.S. Department of Commerce, Washington, D.C., 1981.

30. Typical estimates of the price elasticity of demand for interstate MTS range from −.5 to −1.0.

31. For fuller treatments of these concepts, see Willig, *op. cit.*, note 9, and the prior references cited there.