Toward Economically Efficient Pricing of Telecommunications Services

Michael A. Einhorn

Columbia Institute for Tele-Information
Graduate School of Business
809 Uris Hall
Columbia University
New York, New York 10027
(212) 854-4222

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by

Michael A. Einhorn

Rutgers University
Newark, NJ

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Michael A. Einhorn
Rutgers University
Newark, New Jersey

Introduction

Amid considerable concern, much has been written on the possible consequences of economically inefficient pricing of regulated telephone services. In particular, if regulators continue to price usage of local company switched access facilities by long-distance callers above its associated marginal cost, there is evidence that large long-distance users can profitably interconnect with their interexchange carriers via bypass technologies that completely circumvent the local exchange. 1,2 As a result, local companies could lose substantial amounts of customer revenue and face serious problems with stranded investment.

Nevertheless, inefficient pricing of usage seems to be the order of the day for two reasons. First, subscriber line charges to single-line customers are unlikely to increase sufficiently to cover the associated nontraffic-sensitive (NTS) costs of a switched access line; as a result, some kind of subsidy from toll usage is necessary if the local companies are to remain whole. Second, current separations procedures provide estimates of per minute traffic-sensitive costs which are well above their associated marginal costs.

This paper will offer an interim solution for the NTS cost recovery problem. It will demonstrate that the local company should offer to each customer a choice between (at least) two calling plans for using a switched access (or WATS) line to reach its long-distance carrier's point of presence; this is nearly equivalent to designing a nonuniform price scheduce for usage on each line. Within reason, regulators may design subscriber line and usage charges in the first calling plan using guidelines which might satisfy some prescribed social goals. For a somewhat higher subscriber line charge that must be above its associated marginal cost, users can purchase access to a second calling plan which is designed for larger users; in this calling plan, per minute switched access price must be below its associated marginal cost. Under an optional calling plan strategy, NTS costs can be recovered and no interexchange carrier will be given an advantage in stimulating minutes-of-use or bringing on additional

subscribers. All uneconomic bypass can be eliminated under an optional calling plan approach but all economic bypass will still result.

While NTS cost assignment has attracted a considerable amount of attention, in order to price telephone service properly, it is also necessary to measure accurately the true marginal costs of customer access and usage. Indeed, if these costs are overestimated, the harmful effects upon demand repression and uneconomic bypass could be as great as the effects from inefficient NTS cost recovery. There is evidence that current separations procedures provide a per minute traffic-sensitive cost estimate which is well above its associated marginal cost. The second part of this paper considers the consequences of current separations procedures and reasonable ways in which regulation can be reformed to produce more efficient results.

An important related topic which involves serious social and political consequences is the appropriate pricing of new communications services by regulated utilities. Many of these services will be offered in a market where other sellers will be free to enter and compete as well. Regulators must take steps to ensure that the most efficient technology indeed prevails; the third part of this paper suggests some guidelines for pricing these new services.

NTS Cost Recovery

Ideally, subscriber line charges and switched access usage prices for long-distance callers should be set at their associated marginal costs. However, if ideal pricing were implemented, combined interstate and intrastate subscriber line charges for single-line customers could increase to approximately $25 to cover the associated nontraffic-sensitive cost of each line; due to political considerations and concerns about customer attrition, these high subscriber line charges can not be implemented, at least in the foreseeable future. Consequently, subscriber line charges for single-line customers are now kept below their associated costs; the resulting shortfall in revenues is recovered by carrier common line charges for switched access usage which are assessed to long-distance carriers on a per access minute-of-use basis. As implemented, this recovery process raises the cost of usage of switched access well above its associated marginal cost and provides the largest interexchange carrier (AT&T) a distinct cost advantage in stimulating additional minutes-of-use.

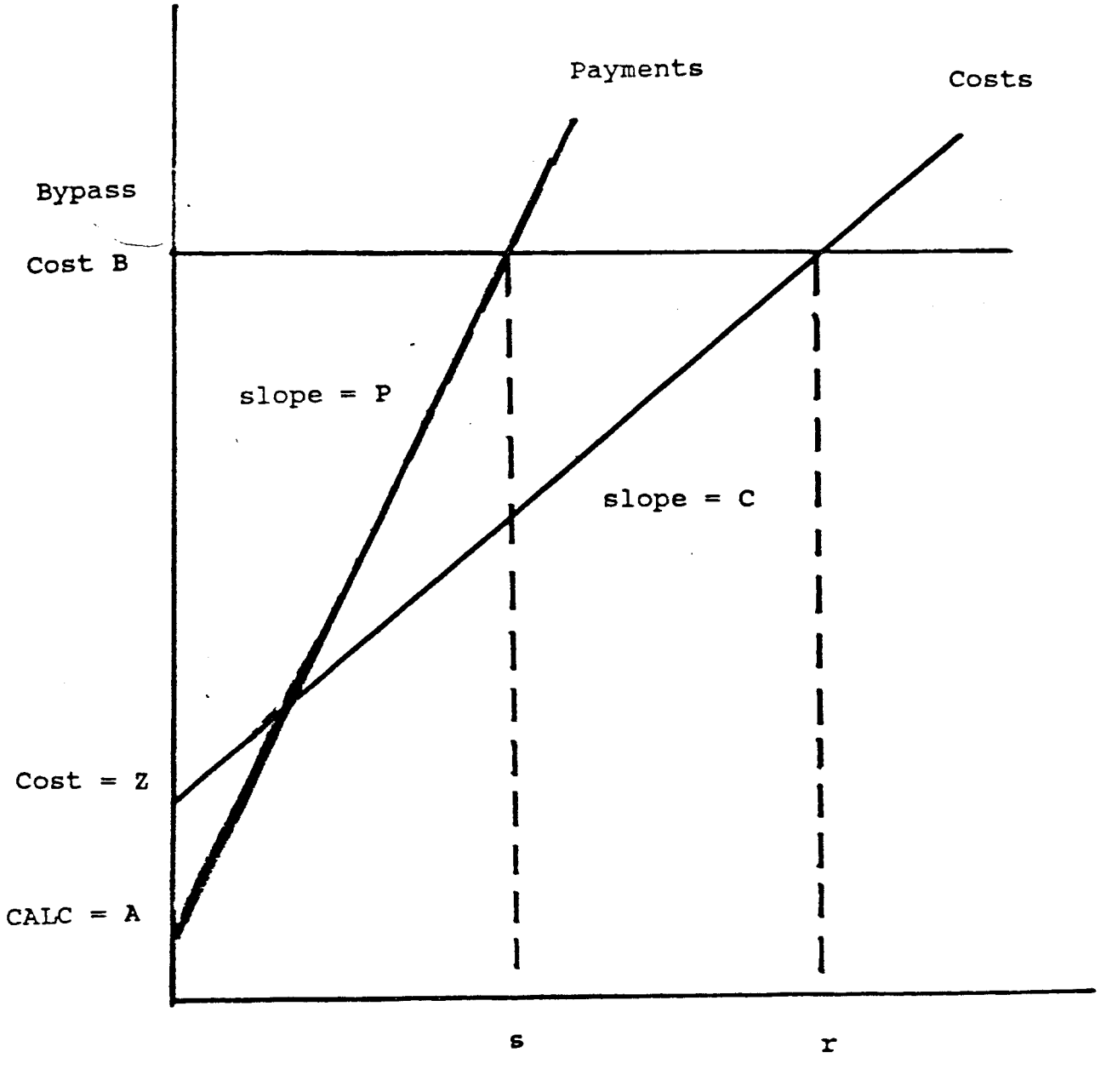
If per-minute carrier common line charges are set too high, large long-distance callers and interexchange carriers (IXC) may interconnect with one another through channels other than switched access lines; i.e., they can bypass the local company's switched access facilities altogether by installing special access lines, microwave systems, or other bypass technologies. The access minutes accrued on bypass systems are not used as a basis for NTS cost assignment. Consequently, long-distance phone calls over these bypass systems do not provide any contribution toward the local company's NTS revenue requirements. As a result, a diminished base of smaller users must pick up the NTS cost burden; this can set off additional rounds of bypass and attrition. 3

There are four desirable properties of any NTS cost recovery scheme. First, necessary NTS costs must be recovered in some fashion. Second, the "playing field" in IXC competition must be level; no carrier can be given an advantage in stimulating minutes or securing more subscribed callers. Third, while economic bypass is to be encouraged, uneconomic bypass (defined below) should be eliminated. Fourth, the customer access line charge (CALC) to small lines cannot now be raised to its associated marginal cost.

Figure 1 illustrates the per line installation and per minute-of-usage costs (Z and C) associated with a telephone line connected through local company switched access facilities. Alternatively, a bypass line may be installed with monthly costs of B. Minutes-of-usage r is the usage level where switched access costs Z + Cr just equal bypass costs B. From a standpoint of economic efficiency, a customer that uses q minutes should select switched access if $Z + Cq < B$; -- i.e., $q < r$ --, and bypass if $Z + Cq > B$ -- i.e., $q > r$. Under these circumstances, bypass can be justified by comparing the actual costs of each option and can therefore be said to be economic.

If usage prices do not equal their associated costs, then customers may make economically inefficient decisions regarding bypass installation. In Figure 1, suppose that a caller incurs expenses of A per month for a switched access line and P per switched access minute (now recovered, respectively, via CALCs and carrier common line charges). If bypass can be priced at cost B, a customer with usage s where $A + Ps = B$ will be indifferent between bypass and switched access technologies. Lines with usage less (greater) than s will choose switched access (bypass).

Figure 1: Bypass Illustrated



The serving IXC can save itself money by inducing lines that use between r and s access minutes per month to bypass; however, this bypass is not justified by the true relative costs of switched access and bypass technologies. Consequently, it is uneconomic. Uneconomic bypass can result when installation and usage prices are not equal to their actual costs.

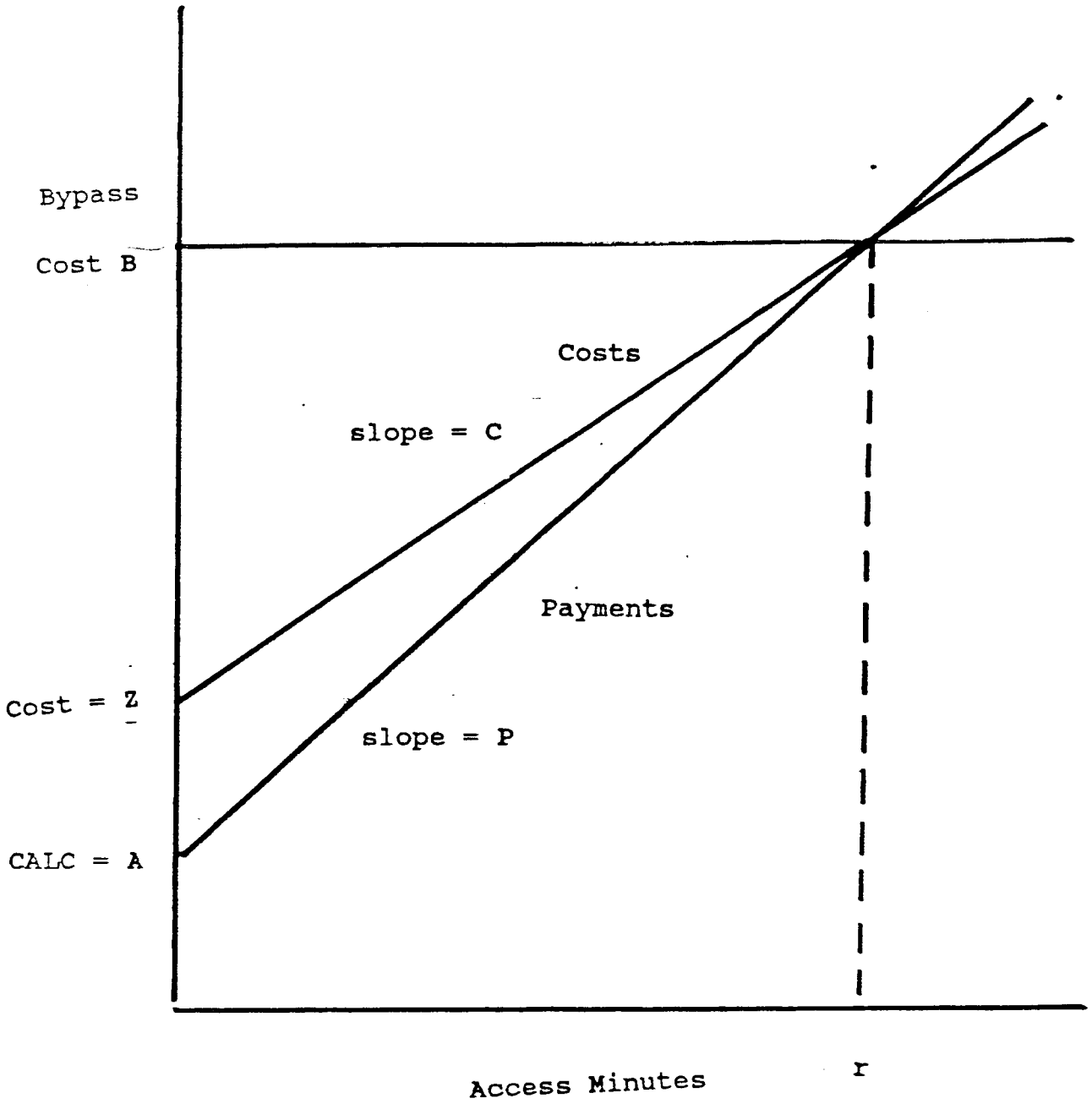
If the CALC is below its associated marginal cost, no one calling plan can provide enough revenue to cover its costs and simultaneously eliminate uneconomic bypass. This point is illustrated with Figure 2; the CALC A is below its associated cost Z. To eliminate uneconomic bypass, the local company must set usage price P as shown. Revenue from each line that retains switched access is less than its associated installation and usage costs. As a result, the costs of a line can not be recovered. To recapture costs, the local company must then raise price P above marginal cost C; uneconomic bypass will then result.

NTS costs could be recovered and uneconomic bypass could be eliminated simultaneously if a second calling plan were implemented. Each telephone line could be priced with either of two plans (customer's choice) shown in Figure 3. The CALC is larger but the usage price is lower in the second calling plan. The first (second) calling plan will appeal to lines that use less (more) than t access minutes per month. r access minutes is the bypass point, which we note is economically appropriate. The first calling plan will be referred to as the small-line plan and the second the large-line plan.

If the second plan were not implemented, lines using between r and s access minutes per month would bypass; with two calling plans, these lines will retain switched access. The threat of uneconomic bypass is then eliminated. In the second plan, usage price P2 is less than its associated marginal cost C. However, because the CALC A2 exceeds its cost Z, each of these lines would still provide a positive net contribution toward the NTS subsidy.

Unless bypass is outlawed or restricted, the only way that the local company can profitably curtail economic bypass -- i.e., usage q > r -- is by lowering the costs of switched access usage. To prove, consider Figure 1. Payments on a particular switched access line must equal or exceed costs if the line is to at least break even. For usage above r, the costs of switched access Z + Cq exceed the comparable costs of bypass B. Lines which use more than r minutes per month would consequently pay more on switched access than on a bypass alternative.

Figure 2: Economic Bypass with a Subsidized CALC



Consequently, the customer will choose bypass.

Theoretically, all switched access lines which use more than r will convert to bypass. However, long-distance usage on some switched access lines might exceed r sometimes, perhaps due to temporary surges in demand. With below-cost usage prices that would prevail on a large-line calling plan, net revenues on a switched access line would then be negative if usage were to exceed r. To ensure against subsidization, all access minutes above r should then be priced at marginal cost C. The large-line plan should then be modified to include two usage-sensitive blocks as well as a subscriber line charge; the cost per minute of long-distance originating access is below (equal to) marginal cost for minutes below (above) r.

As noted, each switched access line would contribute some amount toward NTS cost recovery. Consequently, if NTS costs had been recoverable with one calling plan, adding a second makes the process that much easier. Once the large-line plan is designed, its net contribution could be used to reduce prices elsewhere. If NTS cost recovery is not possible with one calling plan, it may yet be possible with two.

Customers could be billed directly for their usage; alternatively, costs could be passed back to the IXCs. Each IXC must be required to bill each of its customers for the customer's individual usage. If the per minute usage charge is the same to each IXC, there are no relative advantages provided to any long-distance carrier to stimulate additional minutes-of-use or to bring on more subscribed customers.

Further Complications

If regulators and local companies are willing to complicate matters yet more, the local company can offer to each multiline customer a choice between three or more calling plans. Indeed, further improvements in economic welfare are always possible when more calling plans are offered. 4 Regardless of how many plans are offered, the large-line plan should always have two blocks. Usage in the first (second) block of this plan should be priced below (equal to) its respective marginal costs.

Offering each line a choice between two calling plans is basically equivalent to designing a nonuniform price schedule for usage on the line. 5 Suppose that a nonuniform price schedule for a particular switched access line were designed as follows. The customer pays A1 per

month as a subscriber line charge. For each minute of long distance access usage up to t minutes per month , the usage charge is P1 cents per minute. For each minute of long distance access above t, the per minute usage charge is P2 cents. If plotted, this nonuniform price schedule would look identical to the schedule in Figure 3. The advantage of a nonuniform price schedule to the user is that he is automatically transferred to the calling plan that is most favorable for him in the event that his ex post monthly demand does not cost-justify his ex ante choice. The disadvantage is the administrative nightmare of keeping track of where usage is on each line relative to the breakpoints.

Actually designing a strategy for NTS cost recovery would involve measuring the associated costs of bypass. If the most efficient bypass alternative is special access service that is offered by the local company, measurement may be relatively easy. However, if the prevalent bypass alternative is some other alternative (e.g., microwave), measuring the relevant costs could be quite difficult. Under these circumstances, it would be unrealistic to talk of a truly optimal tariff design. Nonetheless, regardless of the structure of a particular NTS cost recovery plan, it can be shown that offering a large-line calling plan with a usage price that is below marginal cost can make some customers better off while making no one worse off.

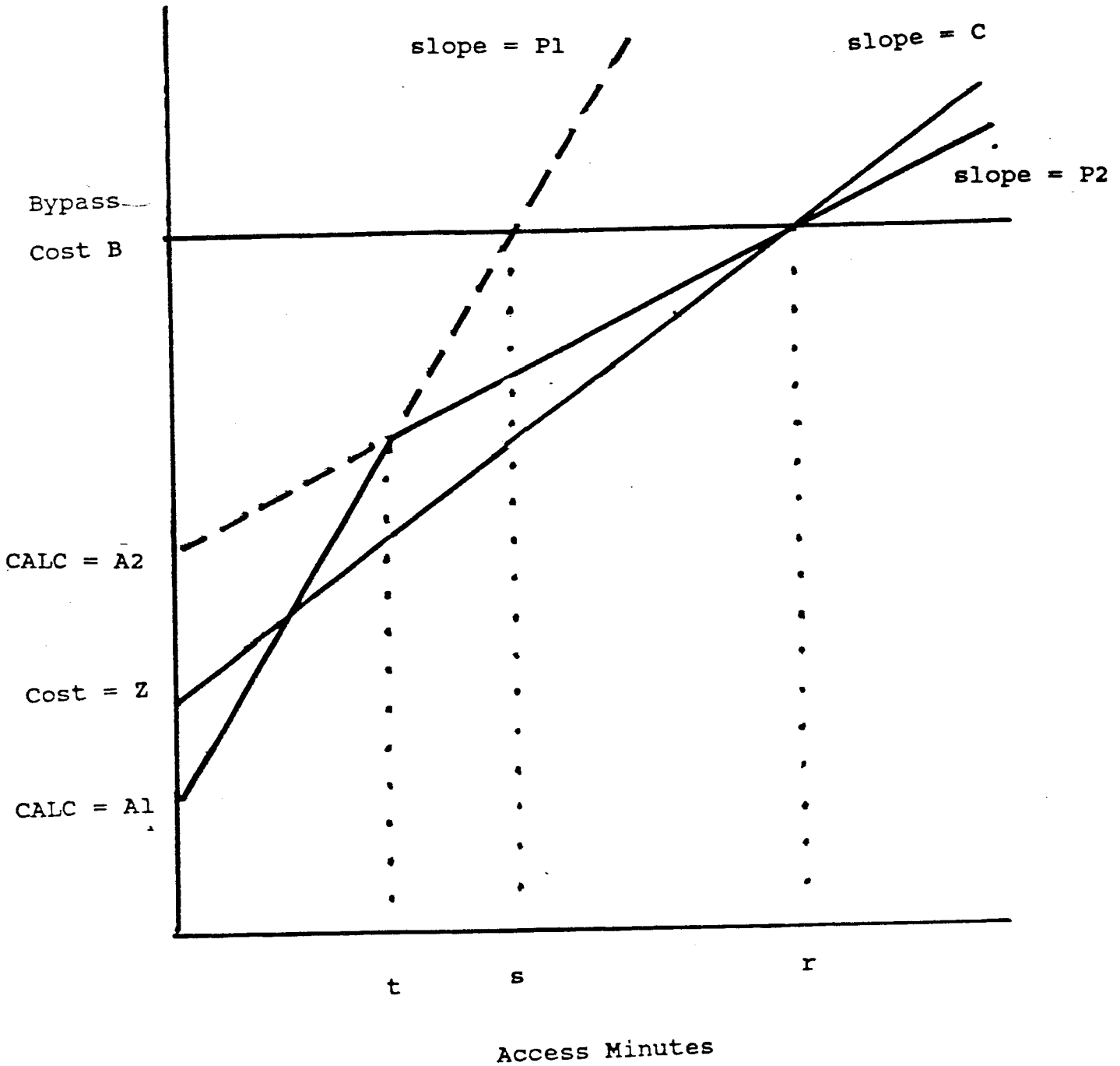
To this moment, we have assumed that customer usage of a particular line is inelastic with respect to changes in the price of access minutes. However, the basic conclusions of this paper also hold when line demand is price-sensitive. The math is somewhat more calculated. 6

Measuring Marginal Costs of Telephone Usage

By giving each customer the choice of subscribing any switched access line to one of several calling plans, local companies can simultaneously eliminate the danger of uneconomic bypass and recover NTS costs. Bypass of switched access facilities can and will occur only when it is justified by comparing alternative actual costs of using and installing switched access lines and bypass channels; marginal costs provide the signals upon which an economically optimal decision should be based.

Let us derive what this breakpoint might be. Suppose the cost B of a bypass (special access) line is $150 per month and the directly assigned cost of a WATS line is $30 per month. NECA's estimate of the average per minute traffic-sensitive cost is approximately 3.5 cents per

Figure 3: Two Calling Plans Illustrated



access minute. Using this per minute traffic-sensitive cost as an estimate of the per minute marginal cost, the economic crossover point from switched access to bypass is $r = (B - Z)/C = (150 - 30)/.035 = 3429$ minutes per month. If marginal cost were accurately measured at 3.5 cents, all lines that use more than 3429 minutes per month should economically bypass; furthermore, there is no way that the local company could profitably retain them.

The bypass crossover point derived above may seem somewhat low; since the average large WATS line uses 5500 minutes per month, the threat of mass conversions of WATS lines to bypass alternatives seems imminent. 7 However, the current traffic-sensitive cost of 3.5 cents per minute seriously overstates the true marginal cost of additional usage; a lower estimate of C should be used.

When measured correctly, the marginal cost of line usage should include the costs of setting up and transmitting a phone call. Set-up costs would include the costs of transmitters and receivers, tone and ringing circuits, call store and program store memory, and processor investments. Transmission costs would include trunk costs, which are mileage-sensitive, and termination and tandem costs, which are not. Relevant costs include material and labor expenses, physical depreciation of existing plant, and a component for the capital costs of future investments.

As currently measured, traffic-sensitive costs for switched access minutes include the following major components:

1. Directory Assistance (partially directly assigned)
2. Local Switching
3. Local Transport
4. Intercept
5. Line Termination

If not directly assigned, these costs are now allocated to interstate and intrastate revenue requirements (based on subscriber plant factors, dial equipment minutes, minutes-of-use, minute-miles, etc.) and then passed on to carriers on a per access minute basis.

There are two reasons why per minute traffic-sensitive costs do not accurately reflect marginal costs of usage

minutes. First, some components are not really traffic-sensitive at all. Line termination is the most obvious example; other costs would include distributing frames, tools and test sets, power equipment, alarm and signal apparatus, land and buildings, furniture and office equipment, motor vehicles, tools and machinery, nonrecurring local transport charges, directory assistance, and meet point billing. Because fiber-optic channels will replace existing trunk channels once upgrading becomes necessary, existing pole lines and underground conduit will provide sufficient plant for future trunk capacity needs; investments in existing pole lines and underground conduits then are insensitive to future increases in traffic as well.

In the second place, the costs of capital are based on the embedded costs of local switching and transport equipment; becuse embedded costs are based on historic data, they have no relationship to the incremental costs of providing the next unit of service. In theory, this incremental cost of the next unit should serve as the measure of the marginal cost. Marginal cost is a forward-looking process which should consider, among other things, future technological possibilities.

Recent unpublished estimates of the marginal usage cost that I have seen suggest that marginal cost per minute-of-use may be between 1.0 and 1.5 cents per minute. If marginal cost C were 1.5 cents per minute, r = (150 - 30)/.015 = 8000 minutes per month. No switched access line which uses less than 8000 minutes per month would be converted to bypass; this would exclude the average sized large WATS line. If C = 1.0 cent per minute, r = 12000 minutes per month; this might largely eliminate the threat of bypass altogether. Accordingly, the marginal cost of a usage minute must be measured accurately if telephone usage prices are to provide the correct signals for long-distance users to bypass or not. Indeed, the resolution of the celebrated issue of NTS cost recovery will not save local companies from considerable amounts of bypass unless regulators more accurately measure these marginal usage costs.

A Practical Proposal

Accurately measuring the marginal costs of switched access usage may require an extensive examination and overhaul of the current separations process. While this may be a long time coming, there are some reasonable piecemeal steps which can be taken today to reform, however simply, current regulatory procedures. In particular,

regulators should always consider the possibility of removing from traffic-sensitive costs certain components which can be more appropriately directly assigned. This section illustrates this idea with line termination costs.

Line termination costs entail the non-traffic sensitive costs of the central office; these costs vary with the number of switched access lines and are unaffected by usage minutes on a particular line. Consequently, they are ideally recovered with subscriber line charges. Because these costs involve central office equipment, they are nonetheless classified as traffic-sensitive and recovered as such.

Presumably, line termination costs could not immediately be allocated to subscriber line charges because of the harmful effects upon residential and small business customers that would result. Granting this objection, line termination costs for WATS lines to multiline customers certainly could be directly assigned on a per line basis. Furthermore, the economic effects of this direct assignment would be small compared with the economic effects of the FCC's decision -- in June, 1986 -- to directly assign the closed end of interstate WATS lines.

A few numbers will illustrate the above point. Prior to June, the NTS costs of an interstate WATS line (say, $25 per month) was assigned to interstate or intrastate NTS revenue requirements. Following the FCC decision on direct assignment, 100% of these line costs will be removed from the NTS category, directly assigned, and recovered instead through WATS access line (WAL) charges; these charges will be billed on a per-line basis to the long-distance carriers. For each WATS line, a total of $25 per month per line will then be reassigned from interstate and intrastate NTS revenue requirements to WAL charges.

Furthermore, WATS access line extension (WALE) costs had been classified, prior to June, as traffic-sensitive costs and allocated to interstate and intrastate components. As a result of June's ruling, WALE costs will now be directly assigned to carriers on a per line basis. A total of $25 per month per line extension will then be reassigned from interstate and intrastate traffic-sensitive costs to WALE charges.

Nothing has yet been done with the line termination costs of WATS lines. At present, these costs are classified as traffic-sensitive and allocated to interstate and intrastate components by a subscriber plant factor;

they are recovered from carriers on a per access minute basis.

Compared with the magnitudes of WAL and WALE direct assignment, direct assignment of line termination costs would be small. The interstate line termination revenue requirement for New York Telephone this year is $122 million. With a 28% subscriber plant factor, the total revenue requirement from line termination is $435 million (435 = 122/.28). The company has approximately 7 million telephone lines; the annual cost per line is then $62, or $5 per month. If line termination costs were reassigned, only $5 per month per line would be removed from traffic-sensitive costs and charged directly on a per line basis. This magnitude is small relative to the numbers involved in direct assignment of WAL and WALE charges.

While the magnitude of directly assigned WATS line termination costs would be small relative to other WATS components, the effects upon per minute traffic-sensitive costs would be dramatic indeed. New York Telephone analysts estimate that line termination costs constitute .8 cents/minute of a 3.3 cents/minute total for traffic-sensitive costs. Taken just by itself, this reduction in the per minute price can then seriously reduce the incentive for customer bypass.

Pricing Competitive Services

With the continued advent of competition into the markets for new telecommunications services, regulators must now consider how to design prices for the regulated utility which may offer these services as well (e.g., enhanced services as in Computer Inquiry III). We may adopt two criteria as the basis for rational ratemaking for competitive services. First, the most efficient provider of telecommunications services will prevail in the long run; i.e., the winner deserves victory. Second, the revenues from each offered service must be sufficient to cover the incremental cost which offering the new service imposes upon society; i.e., every service pays its own freight and no service, regulated or competitive, is subsidized.

To price competitive services properly, we must distinguish between the utility's basic monopolized services (e.g., local exchange) and its new competitive products (e.g., enhanced services, Centrex). Associated with its monopolized services are the attendant costs of its basic network. Competitive services entail additional incremental costs above and beyond the costs of the basic

network. To avoid being subsidized by revenues from regulated services, competitive products must generate sufficient revenue to cover their associated incremental costs; incremental costs then represent the minimum revenue amount that a competitive service must provide to the utility. As a corollary, the maximum revenue amount which regulated services could provide -- without subsidizing competitive services -- is equal to the costs of the basic network.

Having established a revenue floor for competitive services, we then may ask: how much more money should competitive services provide above and beyond their incremental costs? Is there a fair share of common costs which competitive services should carry as well? From an economic perspective, there is no reason why revenues generated from competitive services must be above incremental costs; furthermore, some problems could result if such an attempt were made.

For example, suppose that the basic cost of the monopoly network is 100 and the regulated utility can offer a new service with an incremental cost of 20. A competitor can offer the same new service with a cost of 30. Clearly, the regulated utility is the more efficient provider of the new service and would prevail in a free market.

If regulators were to set the revenue requirement for the new service at 10, the competitor would not be able to compete and the regulated utility would win. However, in this case, the new service would not be able to cover the incremental costs (20) which it imposes; consequently, basic services must subsidize the new service. This is neither competitive nor desirable. If regulators were to set the revenue requirement for the new service at 20, the regulated utility would still prevail over its less efficient competitor; however, no subsidy is necessary from basic services because new service revenues now cover their associated incremental costs. Now if regulators were to decide that the new product should pay some "fair share" above incremental cost (say, 40), then problems arise. Rather than pay the revenue burden of 40 for the utility's new service, customers will instead select the utility's less efficient competitor, which can competitively offer the new product as long as it can cover its costs of 30. As a result, people will move to the competitor, although it is less efficient and provides new services at a cost that is above the regulated utility's true cost.

When viewed from a social or political standpoint, the inefficient provision of new services can have very

serious consequences. As the communications revolution continues, our nation must get new communication technologies into the hands of as many people and businesses as possible in order to avoid, in Congressmen Dingell's words -- the erection of a two-tiered information society -- the information-rich and the information-poor. 8 Wealthy individuals and large businesses will be able to afford new technologies at considerably higher costs than less affluent people and smaller businesses. Consequently, keeping down the costs of a new technology is necessary in order to insure the quick diffusion of the technology to as wide a market as possible. To aid in this process, regulators must be cautious of any attempts to make new services pay anything beyond their associated economic costs, which are, in fact, the incremental costs of service.

Conclusion

Further research, development, and innovation by competitors will lower bypass costs yet further and make these services available to more customers. In opposition, future technical advances by operating companies will continue to reduce yet further the cost of local company services. This technological competition is perfectly consistent with the spirit of policy-making in the contemporary regulatory arena. To the victor may go the spoils, but a responsible regulator will ensure that the spoils are deserved.

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