

**CHAPTER 6****Practical Rules for Pricing  
Access in Telecommunications**

---

*J. A. Ordover and R. D. Willig*

During the past several years, many countries have embarked on a process of liberalizing their telecommunications. The key element in this process entails opening up the sector to market competition. In some cases, telecommunications services are already fully competitive, although a monopoly provider continues to control other services. Often, access to the local network—to the loops and wires—that connects subscribers is fully controlled by the incumbent telecommunications services provider. This stranglehold on access creates public policy challenges for those responsible for regulating the sector and for ensuring its continued development as well as progress toward full-fledged competition.

Two main policy problems stem from monopoly control over access. In the first place, it creates the ability and incentives to overprice access to those who need it. This problem is not unique to telecommunications. In fact, in many network industries, some elements of the network are likely to be monopolized, either for cost or regulatory reasons, or both. Many countries have developed regulatory mechanisms for constricting the monopoly power of incumbents.

The second policy challenge stems from the fact that the incumbent provider of network access is likely also to compete with the new entrants who require access as a necessary input into the provision of final telecommunications services. In this case, the incumbent may have insufficient incentives to offer new entrants access to the network on nondiscriminatory terms, both in terms of the price that it charges for access as well as the level of quality of access. Consequently, by abusing access to the input, the incumbent may stymie or even derail the development of competition in the provision of end-user services. At the same time, if the incumbent is allowed to charge a full monopoly price for access, its incentive to discriminate against new entrants is likely to be less as compared

with a regime in which the access price is tightly regulated. This confronts the regulator with a difficult trade-off: on one hand, tight regulation of access enhances incentives to discriminate, especially if the new entrants are likely to divert lucrative end-user customers from the incumbent; on the other hand, relaxed regulation of access creates the danger that access—hence end-user prices—will be set significantly above the competitive level.

Regulation of access must reflect all these concerns plus several others. First, access regulation should create incentives for efficient entry into the provision of end-user telecommunications services. That is, access rates should not be so low as to encourage entry from potential vendors that are less efficient than the incumbent. Second, access rates should not be so high as to discourage efficient entry or create incentives for inefficient bypass of the incumbent's access network. Third, access rates should be sufficient to ensure that the incumbent has correct incentives to invest in the network both by installing new access lines (loops) as well as by deploying economically efficient technologies in the network.

It is also important to emphasize here that access prices cannot correct all the inefficiencies that are present in the sector. For example, in many countries, end-user prices are significantly distorted from the underlying true economic costs. In particular, local rates are frequently set below cost and long-distance (inter-urban) rates are set above cost. This being the case, it is critical that regulators should engage in rate rebalancing, possibly even prior to full liberalization of telecommunications services. Economically sound end-user and access prices are required to ensure that competition takes root and generates the desirable outcomes.

### **Basic Methodological Approaches to Access Prices**

The economic literature has proposed a variety of different methods for setting access prices. The methods can be roughly divided along two key dimensions. The first dimension pertains to the institutional setting in which access rates are determined. In particular, the regulator can set access rates directly (that is, an independent body determines the rates according to some well-defined and transparent set of rules), or the parties can voluntarily negotiate the prices (subject to some general legal principles, such as competition laws that guard against abuse of dominance). We know of no country in which there are no regulatory or antitrust constraints on the terms on which access can be obtained. This makes perfect sense in view of the fact that there is little or no competition in the provision of access. Until such competition develops at a workable level so that market forces can keep access rates at competitive levels, there have to be some other means for ensuring that access is not denied or priced excessively.

However, it also follows that once a workably competitive market in the provision of access develops, regulatory strictures on the pricing of access will not be required.

The second dimension pertains to whether access rates are *built up* from costs (the bottom-up approach) or *derived from* end-user prices (the top-down approach) of services that have access as an input. Both methods have been used in practice. Neither one is unambiguously superior to the other as a practical tool for setting access rates. It is commonly agreed, however, that the top-down approach provides a tool for gauging whether the seller of the access deals with itself on a preferential basis. It is also important to note that neither regulation nor negotiation is unambiguously superior to the other. Regulation may be desirable in those countries in which antitrust laws are poorly developed or nonexistent and in which the agency (and the courts) enforcing the competition policy may lack the required expertise to resolve disputes regarding access. Alternatively, the incumbent (or potential entrants) may gain control of the regulatory agency and pursue access policies that are not necessarily in the public interest. In sum, from the policy perspective, there is no single correct method for setting access rates in all circumstances.

### **Some Relevant Cost Concepts for Setting Access Rates**

Access prices should be based on true economic costs. In most countries, it is difficult to estimate the economic costs of providing telecommunications services—including access services.<sup>1</sup> This is so for many reasons. First, there is no reason to believe that the costs as reported by the government-owned incumbent telecommunications monopolist in any way approach an efficient level. It is more likely than not that the incumbent has not been operating efficiently. And there is no reason to believe that its embedded technology is the proper measure of forward-looking costs (that is, costs that will be incurred as the network is built using the currently available technology). Second, in previously planned economies in transition to the market, accounting costs are often fictional inasmuch as they reflect nonmarket-determined valuations of inputs.

These difficulties in estimating the pertinent levels of cost obviously constrain the degree of precision with which access prices can reflect underlying costs. However, these difficulties should not cause the regulator to set the rates in a haphazard manner or in a manner that pays only lip service to the requirement that rates be efficient. Given that much of the technology used in providing

<sup>1</sup> In fact, such costs are generally difficult to estimate, as is evidenced by the ongoing debate in the United States following the passage of the Telecommunications Act of 1996.

access is available on world telecommunications equipment markets, some cost elements of providing access should not differ greatly from country to country. Consequently, regulators should rely on international benchmarks for determining the (forward-looking) costs of providing access services (principle 6-1). The pertinent costs should be forward-looking in the sense that they ought not reflect the distorted current accounting measures, but, instead, should reflect the costs as they likely will be incurred in the future as telecommunications networks are built in a cost-efficient manner.

***Principle 6-1.*** *Regulators should utilize world cost benchmarks (appropriately modified to reflect specific domestic conditions) that reflect forward-looking costs rather than historic costs as reported by the incumbent telecommunications service provider.*

What types of costs does the regulator have to know in order to implement a rational, pro-competitive access regime? It is important to remember that whether access prices are calculated using a bottom-up or top-down methodology, much of the same cost information is necessary.

In a competitive market, prices tend toward (long-run) marginal costs. Since regulation should mimic the workings of a competitive market, the policy prescription is that access should be priced at the level of long-run marginal cost. Assume that it costs 0.05 cents to provide one incremental unit of access (say, one minute). If access were priced at less than marginal cost (that is, less than 0.05 cents per minute), its usage would be over-stimulated (other things equal) relative to the efficient level. Note that the marginal benefit from this additional minute of access would (approximately) equal the price of access, but the social cost of additional access would be less than that. Conversely, the provision of access would be repressed below the socially efficient level if access were priced at more than 0.05 cents. Ideally, long-run marginal cost is the (first-best) efficient level of the access price (principle 6-2).

***Principle 6-2.*** *Access should be priced based on long-run incremental costs of provision.*

However, even if we set aside the fact that the regulator may lack precise knowledge of the long-run marginal costs of access, there are other reasons why pricing access at marginal cost may not be feasible (or even desirable). Provision of access might entail significant fixed costs. Fixed costs are those types of costs that do not vary with the amount of access provided. For example, the cost of the switch is not sensitive to the volume of switching that it actually performs. The cost of the switch depends on the number of loops that are attached to it. Costs of local transport—that is, transport between local wire centers—or transport

between the point-of-presence of the long-distance carrier and a local switch are also likely to be insensitive to usage (at least on the margin). Principle 6-3 addresses these issues.

**Principle 6-3.** *The regulator needs to be familiar with the underlying technologies and the pertinent costs as a precondition for setting economically rational access rates.*

In referring to the fixed costs of providing access, we do not mean the costs associated with installing and maintaining a loop (a pair of copper wires) that connects the end user to the switch (or to some point between the customer's premises and the switch). These costs should in principle be recovered from the customers by means of installation fees and monthly line charges. In many countries, revenue from these charges together with (local) usage fees generated by customers do not recover the full costs of the loop. This situation has policy relevance for pricing access.

When there are significant fixed costs, marginal cost pricing of access need not generate enough revenue to recover the full costs of providing access.<sup>2</sup> The presence of fixed costs can create scale economies in the provision of access. In this case, marginal cost pricing is not feasible because it generates revenue that does not cover the associated total costs (principle 6-4).<sup>3</sup>

**Principle 6-4.** *When there are scale economies in the provision of access (or any other service), marginal cost pricing is not feasible. In such a case, the prices of some services sold by the access provider must deviate from the pertinent marginal costs.<sup>4</sup> That is, if access is priced at marginal cost, the prices of some other services must be set above marginal cost.*

The total amount of costs that can be directly attributed to any service, in particular, the provision of access, is termed the total long-run incremental cost (LRIC).<sup>5</sup> It seems a reasonable requirement that revenue from the provision of access (or any other service) should at least cover the LRIC of access or any

<sup>2</sup> This revenue includes implicit revenue that the vertically integrated telecommunications service vendor charges itself for access. Of course, a vertically integrated vendor does not charge itself for access. However, these implicit charges (and the concomitant revenue) can be calculated using observable data.

<sup>3</sup> See Baumol and Sidak (1994).

<sup>4</sup> We do not advocate that the revenue shortfalls be covered by general subsidies from the budget. In any case, such subsidies will not be politically sustainable once the incumbent monopoly telecommunications service provider is privatized.

<sup>5</sup> For example, the monthly flow of costs directly attributable to usage could be  $LRIC = \$1 \text{ million} + (\$0.0005) \times (\# \text{access minutes})$ .

other service (principle 6-5). The rationale for this requirement is that if access revenue did not cover the LRIC of access, then the vendor would run a deficit that would have to be made up from the other services it sells. Those services would have to be priced above levels that would be required if access covered its own direct costs. Such a situation would not be tenable in the long run if the vendor faced effective competition in the provision of the overpriced services. Rivals who were not burdened with the need to subsidize access could charge lower prices and steal the vendor's business. It also follows that if the regulator desired to subsidize access, it would have to either find some other source of subsidy or prevent competition from undercutting the access provider.

**Principle 6-5.** *The revenue from access (including the implicit revenue that the access provider charges itself) should at least cover the total long-run incremental cost.*

However, revenue from access should not be excessive relative to the cost of providing access (principle 6-6). The stand-alone cost of access provides a correct revenue ceiling.<sup>6</sup> Stand-alone cost is defined as the cost that would be incurred by a vendor that provides only access service. By definition, it includes both the direct costs as measured by the LRIC and all the other costs that cannot be directly attributed to any other services offered by the vendor. Hence, by definition, stand-alone cost cannot be lower than the LRIC as long as there are *scope economies* in the provision of access and other telecommunications services.<sup>7</sup> By the same reasoning as before, if the vendor were to earn in revenue more than the stand-alone cost of providing access in a liberalized telecommunications market, another vendor could come in and under-price the incumbent.

**Principle 6-6.** *The revenue from access (including the implicit revenue that the access provider imputes to itself) should not exceed the stand-alone cost of providing access.*

We have now presented the various cost concepts that are pertinent to the process of setting access rates. To sum up our discussion so far, access rates should be set in such a manner that revenue from access should not fall below the LRIC floor or exceed the stand-alone cost ceiling. If rates (hence revenue) are outside of these bounds, it means that full competition in the provision of access and other telecommunications services is impeded either by government regulation or by some other entry barriers.

<sup>6</sup> Of course, the stand-alone cost can be calculated for any service, not only access.

<sup>7</sup> It is not likely that there should be diseconomies of scope because provision of access does not impinge negatively on the technological ability of the firm to provide other telecommunications services.

### ***Pricing Principles in the Presence of Scale Economies***

We now proceed to a more detailed analysis of pricing principles when there are significant scale economies (that is, declining average costs) in the provision of access. When there are scale economies, setting prices equal to marginal (or incremental) cost does not generate enough revenue to cover the vendor's full costs of its operations. Consequently, prices have to diverge from marginal (incremental) costs. The extent of such divergence is determined by the extent of the revenue shortfall. In any case, since prices in excess of marginal costs distort usage levels away from efficient levels, the regulator ought to keep the aggregate economic cost of these distortions to the minimum.

The regulator can employ several strategies. It can allow the vendor to implement more sophisticated pricing schemes, such as two-part tariffs.<sup>8</sup> A two-part tariff is a pricing scheme whereby the purchaser of access pays a (monthly or quarterly) fixed fee that does not depend on the volume of access (as measured in minutes of switched access, for example) and a variable fee that depends on volume. This pricing scheme reduces the inefficiencies from nonmarginal cost pricing by bringing the usage price closer to the pertinent marginal cost. This stimulates usage and thereby improves allocative efficiency. However, if the fixed fee is the same for all potential buyers of access, some potential purchasers—especially the smaller ones—might be unable to afford the fee. This would foreclose them from the market(s) in which they intended to participate. Thus, the fixed fee would diminish competition and reduce allocative efficiency. Hence, we have principle 6-7.

***Principle 6-7.*** *Sophisticated pricing schemes (such as two-part tariffs) can alleviate the inefficiencies caused by the need to price access above the marginal cost, but generally cannot solve all the inefficiencies engendered by such departures from marginal cost pricing.*

Besides two-part tariffs, the regulator could also approve (or recommend) volume discounts, whereby the usage charge varies with the amount of access purchased. Again, this pricing scheme reduces the unavoidable distortions, but, of course, cannot eliminate all of them. The discussion thus far leads to an important point, principle 6-8.

***Principle 6-8.*** *In the event that marginal cost pricing of access is not feasible, the regulator should consider more complex pricing schemes in order to ameliorate the inefficiencies caused by deviations from marginal costs.*

<sup>8</sup> See Laffont and Tirole (2000).

We consider this an important point for two reasons. First, some countries might lack familiarity with more sophisticated pricing mechanisms. Lack of familiarity could create suspicions as to the motives behind such pricing, especially when proposed by a concessionaire whose goal is to maximize profits. Second, in some countries, sophisticated pricing schemes could be viewed as evidence of dominance and its abuse. While it is true that only firms with some market power can deploy complex pricing schemes, it does not follow that such pricing is tantamount to abuse of dominance.<sup>9</sup> This is especially true if the regulator constrains the overall earnings of the provider (either through price caps or some other regulatory mechanism).

So far, we have implicitly assumed that "access" is required by all users to produce the same final service, such as long-distance calling or data transport. This is not the case in reality. Access is required by vendors selling rather distinct products, such as long-distance, international, or local calls; data transmission; mobile services; and a host of other end-user telecommunications services. However, to the provider of access, "access" is a homogeneous product whose marginal cost is the same irrespective of the identity of the buyer. It costs the same amount to provide one minute of switched access to an international carrier as it does to a long-distance carrier or to a switched data vendor. This raises the question of whether access should be priced equally for all buyers. The answer would be "yes" if marginal cost pricing were feasible. If marginal cost pricing were not possible, then economic theory suggests that the answer would be negative. Economic theory suggests that different users may pay different rates for access depending on the service they provide (principle 6-9).

***Principle 6-9.*** *When there are significant fixed costs in the provision of access, differential pricing of access to different user groups could be in the public interest.*

The extent to which different users may be required to pay different rates is determined by the differences in their (derived) demand elasticities for access (principle 6-10).<sup>10</sup> Those buyers of access who have low derived demand elasticity may end up paying more for access compared with those buyers whose demand for access is more elastic.

<sup>9</sup> By definition, any firm that faces less than perfectly elastic demand for its service has some market power.

<sup>10</sup> Two forces determine the extent of derived elasticity of demand for access by any particular user. First is the ability to substitute away from buying access from the incumbent access provider to some other sources (such as bypass). Second is the elasticity of demand for the end-user service itself. For the (derived) demand elasticity to be low, both of these forces have to be weak. That is, both the demand elasticity must be low and the substitution elasticity must be small.

**Principle 6-10.** *Roughly speaking, prices for access charged to different classes of buyers should be inversely proportional to the buyers' elasticity of demand for access.*

Several comments on principle 6-10 are in order. First, in many countries, there is already discrimination in the pricing of access. In particular, operators of local networks charge each other different rates for completing local calls on their networks compared with what they charge third parties for completing a long-distance call. That is, one-way access rates are different from two-way access rates. Second, although in many countries price discrimination could be challenged as abuse of dominance, regulators should be sensitive to the fact that price discrimination may be a necessary evil.

Third, having said that, we note that there are sound public policy reasons to insist on uniform rates for access for all classes of users (principle 6-11). It is quite plausible that—for one reason or another—inelastic users may be especially valuable to the society. Then the application of the inverse elasticity rule stated in principle 6-10 does not lead to the socially most desirable outcome. In addition, price discrimination creates incentives for its avoidance. There are social costs associated with such avoidance that need to be reflected in the assessment of feasible price discrimination.<sup>11</sup> The regulator (and the provider) will likely not know the requisite elasticities precisely. As a result, there will arise errors in the calculations of optimal rates for access. The more severe these errors, the less desirable the price discrimination.

**Principle 6-11.** *Although discriminatory pricing of access is in theory socially optimal (in the sense that it reduces the social cost of nonmarginal cost pricing), in practice there are sound public policy reasons why uniform pricing of access to all users is likely to be the most prudent public policy.*

### ***The Implications of Scope Economies for Pricing: The Ramsey Pricing Rule***

Here we focus on general implications for pricing that arise in the presence of joint and common (network) costs. When there are scope economies, the prices charged by the vendor must recover not only the fixed costs that can be directly attributed to any particular service, but also fixed costs that are joint and common

<sup>11</sup> A great deal of evidence from telecommunications markets indicates that service providers are quite skilled in getting around market price distortions. Services such as call-back, hubbing, and others aim to reduce the costs of international calls, which are significantly above marginal cost. In the future, voice and data calls will be most likely indistinguishable. The growing presence of Internet and cellular telephone service also puts severe limits on the extent of sustainable market distortions.

to several services (we call them network costs). Among experts on the costing of telecommunications networks, there is no agreement yet about whether these joint and common costs are significant or whether most of the costs can in fact be attributed to individual services.

We assume that joint and common costs exist and consider the implications for the pricing of services (including access). Building on our discussion in the preceding section, we observe that the presence of such fixed costs requires that all prices be marked up above marginal costs. And, in principle, revenue from each and every service offered by the firm should exceed the LRIC of that service.<sup>12</sup> The rule for marking up services (including access) above marginal costs is summarized in principle 6-12.

***Principle 6-12 (Ramsey optimal pricing rule).*** Prices should be marked up above the corresponding marginal cost in an inverse relationship to the corresponding elasticities of demand. That is, services that have inelastic demand should be marked up by more in percentage terms than services that have elastic demand.

Some general conclusions follow from principle 6-12. First, this rule applies to all the services offered by the incumbent, including access that the incumbent sells to third parties. Second, the access price derived from the application of the Ramsey (or "inverse elasticity") rule is generally sufficiently high to contribute to the recovery of the fixed (network) costs incurred by the incumbent provider of access. From this, it follows that a buyer of access cannot justifiably complain to the regulator (or to the court) that the incumbent is exercising market power (or abusing its dominant position) in the provision of access merely because the incumbent sets the access charge above the long-run marginal cost (or even the LRIC) of providing access (principle 6-13).<sup>13</sup>

***Principle 6-13.*** When there are (significant) network joint and common costs, pricing access above LRIC does not constitute abuse of market power and should not be prohibited either by the regulator or by the courts.

The third implication from the Ramsey pricing principles is that when new entry occurs, the entrant will be required to contribute to the recovery of network

<sup>12</sup> The more precise statement is that each price should exceed the corresponding product's marginal cost. However, if there are no impediments to entry, then each price should exceed the product's average direct cost.

<sup>13</sup> In some countries, access rates are determined through arms' length negotiations between the parties, subject only to scrutiny under the antitrust rules. The mere fact that the incumbent refuses to sell access "at cost" should not be the basis for a valid antitrust complaint.

costs. This is for two reasons. First, the entrant is likely to divert sales from the incumbent. To the extent that those sales contributed to the recovery of the network costs, the incumbent would suffer a revenue shortfall and might be forced to raise prices on which there is no competitive pressure. Second, even if the new entrant does not divert sales from the incumbent (because it offers a brand-new service), the ability to sell access to the entrant relieves some of the pressures on the incumbent to cover all of the network costs from the mark-ups on preexisting services.

These observations still leave open the question of the magnitude of the markup on access that the incumbent can justifiably levy. Economists have advanced two distinct approaches to this issue, the bottom-up approach, which invokes the Ramsey pricing principles, and the top-down approach, which utilizes the efficient component pricing rule (ECPR).

#### ***Ramsey (Efficient) Access Pricing Rule***

The Ramsey pricing rule directs the decisionmaker to set prices by taking into account the pertinent marginal costs, the pertinent demand elasticities, and the tightness of the budget constraint facing the incumbent. With respect to the pertinent marginal costs, we reemphasize the fact that the current costs of the incumbent operator need not be efficient. Thus, care must be exercised in using them for setting efficient prices for access or for any other services.

Consideration of the tightness of the budget constraint basically reflects the fact that the extent to which prices must deviate from the underlying marginal costs depends on the magnitude of the fixed costs. The fixed costs can be divided into two categories: those that can be attributed to a particular service (or a group of services) and those costs that are joint and common to all the services. The magnitudes of the costs in the various cost categories are not known with exact precision. Moreover, the current levels of fixed costs incurred by the operator may be excessive, as compared with efficient, forward-looking levels (principle 6-14).

***Principle 6-14.*** *Current rates incurred by the operator are likely to be a poor guide for setting Ramsey prices and determining the tightness of the budget constraint.*

The standard feature of Ramsey pricing has to do with the pertinent demand elasticities (principle 6-15). The novel element that enters into the calculation of efficient access rates is the effect of access fees on the demand for end-user services offered by the incumbent operator. To illustrate, assume that the services offered by the incumbent and by the competitor are substitutes in the eyes of the consumers. For example, assume that both carriers offer long-distance (inter-

urban) service. In this case, an increase in the access fee above marginal cost has three effects. First, it reduces demand for access. Second, it increases revenue from access above the initial point. Third, the novel effect is that the increase stimulates demand for the long-distance service offered by the incumbent, which contributes to the recovery of the fixed costs.

*Principle 6-15. When setting efficient access rates, the regulator must account for the effect of the level of the access rate on the demand for the incumbent operator's end-user service(s). In particular, the markup should reflect the fact that the entrant's service can compete with the incumbent's offerings, which reduces the contribution that the incumbent operator earns on the sale of its services.*

Another case arises when the entrant adds a service that does not compete with that of the incumbent operator. In this case, access is just another source of revenue that potentially contributes to the recovery of the fixed costs. It is reasonable that access revenue should be required to make such a contribution and thereby lessen the burden carried by other services (principle 6-16).

*Principle 6-16. Even if the entrant's offering does not compete with those of the incumbent, there are sound public policy reasons to burden access rates with some contribution toward the recovery of the fixed costs.*

In general, the optimal access price,  $a$ , can be expressed by means of a simple formula:<sup>14</sup>

$a =$  [marginal cost of providing access] + [revenue impact on the incumbent's sales of end-user services from end-user offerings of the competitor] + [contribution from access to the recovery of the network costs].

Although the elements of the formula seem simple enough, the calculation of the terms in the square brackets is far from simple. It is also clear that the incumbent operator and the purchaser of access will have incentives to misrepresent the magnitudes of the effects. For example, the incumbent will overstate the amount of diversion of sales to the rival (hence, the magnitude of lost contribution), and the rival will try to convince the regulator that its product does not compete with that of the incumbent and will only stimulate the use of the network. Similarly, the new entrant will try to argue that its product should

<sup>14</sup> See Armstrong, Doyle, and Vickers (1996).

x from : 203 972 3615

not contribute significantly to the recovery of fixed costs, either because these are small in any case or because, as a new entrant, it is already at a competitive disadvantage vis-à-vis the incumbent.

**Global Price Caps**

The application of the Ramsey principles developed in the preceding sections leads to the so-called *global price cap* rule for pricing access. Under that rule, the regulator sets all the rates including access at the (Ramsey) efficient level and then determines the appropriate permissible price increases for every basket of services, including access, as well as for the total basket of services offered by the operator.<sup>15</sup>

An important point to bear in mind here is that it is necessary to "start" the price caps using proper exogenous weights in the formula for calculating the average price (principle 6-17).<sup>16</sup> In particular, these weights must be proportional to the level of output that would be realized if Ramsey prices were set initially. Otherwise, the operator will not be given the right incentive to set the efficient level of prices, including the access price. In this respect, global price caps are no different from other price caps. If the regulator does not start the price cap regime with appropriate weights, there is no assurance that the actual price path will ultimately converge to efficient prices.

**Principle 6-17.** *For the global price cap regulation to implement efficient prices (including the price of access), it must assign proper weights to the services included in the cap.*

In some countries, the problem of choosing the proper weights is made rather complicated by the fact that the level of penetration of telecommunications services is low. Consequently, the assessment of the correct weights in the formula may require a good deal of guessing. Moreover, current prices are totally distorted so that current consumption levels of telecommunications services are very poor indicators of future levels.

The problem of selecting the correct weights in the formula is also exacerbated in the case of global price caps because the calculation of the global price cap requires that the regulator estimate the likely future sales of the new

<sup>15</sup> That is, the regulator develops the appropriate CPI (consumer price index) for each basket of services and for the total basket of services.

<sup>16</sup> If there are two services plus access, the global price cap formula is  $(w_1)(p_1) + (w_2)(p_2) + (w_3)(a) \leq p^*$ , where the  $w$ 's are weights for the services, including access, sold by the incumbent, and  $a$  is the price of access.

ost has  
venue  
ncrease  
t, which  
  
must  
the  
ould  
ent's  
arns  
  
t compete  
source of  
osts. It is  
tribution  
6).  
  
hose  
ccess  
  
ans of a  
  
the  
the  
ork  
  
culation  
that the  
ives to  
ent will  
tude of  
product  
use of  
should

entrants. (This is because access revenue enters into the price cap formula.) This is not a trivial undertaking, especially because the level of sales could be affected by the strategic behavior of the incumbent operator. Indeed, the incumbent operator may have an incentive to manipulate the access price during the transition to disadvantage its rivals. However, principle 6-18 indicates that the opposite effect may result.

**Principle 6-18.** *The application of the global price cap regime lessens the incentives for the incumbent to discriminate against its rivals because the global price cap enables the incumbent to earn some portion of the monopoly profit from selling access.<sup>17</sup>*

In general, the more constrained is the access price toward cost, the stronger is the incentive for the incumbent to exclude rivals (or disadvantage them in competitive downstream markets).

In sum, the global price cap rule offers an attractive policy mechanism for setting access prices. However, it may be informationally too demanding in countries with poorly developed telecommunications. It is also a rather sophisticated regulatory rule that requires careful revisions in the event that the initial weights are not chosen optimally at the start. The value of the rule is especially obvious when it comes to pricing access for services that do not compete with the services of the incumbent. Although we have argued that "access is access" so that uniform access fees may be an appropriate policy to follow, it is also plausible that an exception can be made for services that do not compete (or compete only very weakly) with those of the incumbent (principle 6-19).

**Principle 6-19.** *For services that do not compete with the services of the incumbent operator, the incumbent should be free to select any access fee it wishes, subject only to the global price cap constraint. That is, the revenue that the incumbent earns from selling access to noncompeting users will be debited against the revenue earned elsewhere. The result will be that the operator will be forced to lower prices on these other services in order not to violate the global cap.*

The bottom-up approach to setting access fees starts with the LRIC for access and builds on additives that reflect the need to cover the operator's revenue deficit. The deficit would be realized by the operator if it were to charge

---

<sup>17</sup> In fact, if the incumbent operator earns the same profit by selling access as by selling its final product that competes with the product of the rival, the incumbent's incentive to increase the costs of its rival disappears. See Ordover and Willig (1981).

marginal cost prices for all of its services. This approach leads to markups over pertinent incremental costs that reflect both the demand-side considerations (through various elasticities) as well as the size of the deficit that needs to be recovered. It is essential to recognize that whatever surpluses or (more likely) deficits the operator is running (or was running) before privatization and liberalization are largely irrelevant to these considerations. These surpluses (or deficits) likely do not reflect the types of considerations that enter into the construction of efficient prices. Of course, the big problem facing the regulator is that the current prices are frequently vastly distorted, which makes it especially important that prices be rebalanced as much as possible prior to liberalization.

### ***The Efficient Component Pricing Rule***

An alternative approach to setting access rates starts with the vector of rates charged by the incumbent operator and recovers from these end-user prices the implicit rates that the operator charges itself for access. This is the top-down approach that some countries have used, most notably New Zealand. The United States uses this approach for setting wholesale rates.<sup>18</sup>

Principle 6-20 states the efficient component pricing rule (ECPR).

***Principle 6-20.*** *The access price charged by the incumbent to a rival on a competitive segment should not exceed the opportunity cost to the operator from forgoing the sale of the competitive service.*

The only novel concept in this principle is the notion of the opportunity cost. This can be defined as the amount of net revenue that the incumbent loses as a result of selling one unit of access to the rival operator. To illustrate, assume that one minute of a long-distance call sells for 10 cents. Assume that the incumbent incurs a cost of three cents in producing one unit of long distance, excluding the cost of providing access (that is, originating and completing the long-distance call). Then, if the incumbent loses one minute of long-distance sales to the rival, it loses seven cents in contribution (or gross revenue). To the incumbent operator, seven cents is the opportunity cost of providing access to the rival. It is important to note that the cost of providing access does not enter into this calculation. This is because the operator has to incur that cost regardless of whether it sells the final product (one minute of long distance) or whether it sells access to the rival who then sells the final product. This leads to principle 6-21.

<sup>18</sup> Following the passage of the U.S. Telecommunications Act of 1996, incumbent local exchange carriers are required to sell at wholesale local exchange service to new entrants who can resell these services to final consumers.

**Principle 6-21.** *Under the ECPR, the access price should not exceed the direct cost of providing access plus the opportunity cost of providing access.*

This access pricing rule ensures nondiscriminatory treatment of the rival by the incumbent operator. Indeed, since the operator recovers the full opportunity cost of providing access to the rival, in principle it should be indifferent between selling one unit of a final service itself or selling the necessary input to the rival. The ECPR provides a meaningful test of whether the incumbent is engaging in rate discrimination against the rival.

The regulator first *derives* the level of the opportunity cost from the price and cost information that pertains to the incumbent's operations. This is calculated as the margin that the operator earns on the end-user service in question. In the second step, the test considers whether the incumbent *imputes* to itself the same access charge as it charges the rival. If the access charge is set higher than the imputed charge that the operator sets for itself, then we have *prima facie* evidence of discrimination (principle 6-22).

**Principle 6-22.** *If the operator charges itself less for the provision of access than it does another operator, there is a presumption of price discrimination. The operator now has the burden of proving why it should charge itself a lower access charge than it charges the other operator.*

To rebut this presumption, the incumbent must offer a convincing demonstration that the cost of providing access to the rival is significantly higher than the cost of serving itself. Although there may be reasons why this is so, the regulator (or the court) should not accept such cost evidence without thorough examination. For example, one reason why such a cost differential could arise may be because the incumbent's network and operation support systems are not equipped to serve a rival. This creates a serious public policy issue regarding whether entrants should be burdened with the costs of equipping the incumbent for a liberalized marketplace. Whatever the outcome of the public policy debate, it should clarify the incumbent operator's cost burden. Ideally, this type of information should be provided at the time of the concession bid.

Although there are legitimate reasons why the incumbent may be required to charge the other firm more for the provision of access, there are also reasons why a lower charge may be appropriate. For example, if the new entrant offers a service that does not compete with the current offerings of the incumbent, the opportunity cost to the incumbent is zero. In such a case, the ECPR would set the access fee just at the level of the direct cost of providing access (principle 6-23).<sup>19</sup>

<sup>19</sup> Recall that the bottom-up Ramsey pricing approach would set the fee at a higher level to reflect the fact that the access fee should be used to relieve some of the budget constraint facing the incumbent operator.

**Principle 6-23.** *When the entrant's service is an imperfect substitute for the service(s) of the incumbent, the opportunity cost component of the access fee should be reduced to less than the net revenue that the incumbent earns on the service that is the closest substitute for that of the rival.<sup>20</sup>*

The application of principle 6-23 offers a realistic upper bound on the opportunity cost additive that can be charged by the incumbent to the new entrant. Of course, as we noted before, the extent to which the entrant's new service competes (or will likely compete) with that of the incumbent is not easy to determine. Perhaps some pertinent information can be gained by analyzing competitive interactions in other countries. The relevant information can also be revealed through the burden-shifting procedure of setting the level of the access fee in the top-down procedure.

In particular, we suggest that such a procedure can be implemented in a situation where the level of the access fee is fixed by means of arms' length negotiations between two parties, subject to some sort of judicial oversight. During the negotiations, each party would have a shifting burden to demonstrate the appropriate level of the opportunity cost additive. The default rate could be set at the dollar-for-dollar amount, which would be appropriate if the new entrant were proposing to offer a service that (in broad terms) looks like the current offering of the incumbent. For example, if the entrant proposes to compete with the incumbent in the provision of long-distance service, the starting point for the negotiations could be a dollar-for-dollar additive. Then the entrant could offer evidence why a lower additive should be appropriate (for example, because of imperfect substitutability or demand stimulation). In turn, the burden would shift to the incumbent to explain why the reduction would be inappropriate. There is no reason why such a process could not be readily implemented in most countries.

We should comment also on the fact that some economic models of access indicate that the opportunity cost component of the access fee should be further adjusted for the ability of the entrant to substitute away (to another input).<sup>21</sup> In

<sup>20</sup> To illustrate, assume that the incumbent offers five different end-user services. Assume that the entrant's service is most competitive with service #2. By this we mean that the cross elasticity of demand between the service of the incumbent and the price charged by the entrant is the highest for service #2. Cross elasticity is defined as the percentage change in demand for a particular service of the incumbent when the entrant changes its price by 1 percent. Often, the evidence on cross elasticities will not be precisely available. However, the fact-finder may be able to determine which of the products is the closest substitute for what the entrant proposes to offer.

Continuing with the example, the opportunity cost additive should be bound by the difference ( $P_2 - C_2$ ), which is the margin that the incumbent earns on service #2. In this expression,  $C_2$  is the cost that the incumbent would save if it were to reduce by one unit its supply of service #2.

<sup>21</sup> Note that if the price that the incumbent charges to end users makes a contribution to the recovery of joint and common costs, the access fee calculated using this price as a starting point will also make such a contribution. The point is that under the ECPR, wholesale services (such as access) do not make a different level of contribution than does the incumbent's own service.

addition, these models indicate that the fee could be adjusted to reflect the degree of post-entry competition between the incumbent and the entrant. With respect to the first adjustment, we suggest that the parties themselves should in principle have the correct incentives to ensure that the entrant does not substitute away to the less efficient input. Since both parties gain from using the most efficient access mode, there are strong private reasons to ensure that the efficient arrangement will be implemented.

The second adjustment is more difficult to implement. Clearly, the intensity of ex-post competition cannot be determined before entry occurs. Moreover, since the intensity of competition will likely change over time, there is no obvious benchmark for making the appropriate choice when the level of the additive is determined for the first time. Principle 6-24 addresses this issue.

***Principle 6-24.** As under the global price cap regime, the regulator should be required to review the level of the opportunity cost additive after some pre-specified period of time. Alternatively, if the fee is negotiated between the parties, the provisions for renegotiations should be explicitly built into the contract. Moreover, the parties should have access to the courts to reopen the contract.*

In sum, the top-down approach using the principles of the ECPR is well suited to the private negotiations for access. The bottom-up approach, with its concomitant adjustments to overhead recovery, is better implemented in a full-blown regulatory setting. Indeed, there is no obvious way to implement the various adjustments required by the Ramsey pricing mechanism in the private negotiations. We note also that the ECPR provides a useful test for ensuring that the incumbent does not abuse the global price cap mechanism during the transition phase.

#### ***Efficiency of Entry***

We did not consider in the analysis of rules for access fees the desirability of entry (principle 6-25). We assumed that entry was in the social interest and that the public policy concern was to ensure that the entrant could compete on a fair footing with the incumbent. Indeed, the ECPR ensures that the entrant who is at least as efficient as the incumbent in the provision of the retail (end-user) service can compete with the incumbent. This is true provided, of course, that the entrant has already expanded the costs necessary to enter the provision of the retail service. In a sense, then, the ECPR ensures that on the margin the (more) efficient firm will provide the service. That is, if the entrant can pay a compensatory access fee (direct cost plus opportunity cost) and still take the business away from the incumbent, then the efficiency criterion is satisfied. The

same problem plagues the Ramsey pricing approach: the standard models seem to assume that the entrant has no fixed costs. If there are fixed costs, welfare optimization needs to account for them.

**Principle 6-25.** *Entry may not be socially desirable, counting the fixed costs of entry and the fact that the incumbent already invested in the sunk costs. Duplication of facilities has its social costs.*

Entry and the threat of entry are the most potent economic mechanisms for inducing efficient behavior by the incumbent and for lessening the grip that the incumbent may have over the political-regulatory regime. Consequently, even if entry may result in some duplication of facilities and even if it may result in stranding some of the incumbent's assets, public policy should be biased—if only mildly—toward favoring entry rather than discouraging it.

The danger here is that the incumbent could be a recently privatized, former state-owned monopolist with significant foreign participation. The presence of foreign capital could encourage the policy of (partial) expropriation through entry. Such temptations ought to be discouraged because they lead to strong disincentives for future participation of foreign capital in the process of economic transformation. Such participation is especially important in network industries (see Ordovery and Uribe 1999).

This analysis does not fully address the question of the level at which entry should be allowed or promoted, or which types of technologies should be encouraged. It may sound circular and obvious, but as a rule public policy should promote competition in those segments of the network where competition is, in fact, viable. The temptation to create parallel networks early in the development process should be avoided. Instead, entry should be directed toward those parts of the network where scale and scope economies are small (relative to demand), where the incumbent's presence is not well established, and where new technologies can trump the entrenched position of the incumbent. In all instances, it is important to ensure that at least the rudiments of an access regime are in place.

For example, if entry is allowed into local telecommunications markets, such entry would waste social resources in the absence of an interconnection agreement. Still, we often see in countries in transition that entry into local telecommunications is promoted because penetration rates are low and the government seeks sources of capital other than the incumbent to finance development. As we mentioned, this should not be a source of concern as long as interconnection rules are in place. However, regard must be paid to the fact that such entry could frustrate the reasonable business plans of the incumbent. For example, its investment in switches and local transport facilities could have been based on expectations of exclusivity. This creates the problem of stranded

investments. ECPR rules can be deployed to compensate the incumbent not only for the sales actually diverted (as in the standard setting), but also for sales that it would have made but for entry.

### ***Additional Considerations in Designing Access Pricing Rules***

Our discussion thus far has focused on rather streamlined models of access pricing. Even in these simple situations, there are many considerations that impinge on the design and choice of the rule for pricing access. In reality, the regulator/policymaker must deal with many additional considerations that further complicate the assessment and selection of access pricing rules.

### ***Nonlinear Pricing of End-User Services***

In network industries characterized by significant fixed costs and diversity of consumers, linear pricing is in general not optimal.<sup>22</sup> That is, the service provider can do better (in terms of profits and overall social welfare) if it deploys sophisticated pricing schemes. For example, the service provider can offer volume discounts whereby the marginal (or average) price falls with the volume of purchases. The service provider can also offer a variety (menu) of purchase plans for the service in question. For example, Plan 1 might offer the consumer a low fee for the right to access the network and a high price for usage and Plan 2 might offer a high fee for accessing the network and a very low fee for usage. Offering such a menu of choices—with many intermediate versions—will be optimal when consumers have variegated tastes for the service in question (public policy prescription 6-1).<sup>23</sup>

***Public policy prescription 6-1. Differentiated access fees are necessary if the regulator wants to implement differential pricing for the final service to consumers. Differentiated pricing is welfare-desirable when consumers have variegated tastes and marginal cost pricing is not feasible.***

To make matters concrete, assume that the vendor offers two plans  $\{P_1:(F_1, r_1), P_2:(F_2, r_2)\}$ , where plan  $P_1$  entails a higher entry fee,  $F_1$ , than plan  $P_2$ , and  $r_1 < r_2$  is per unit price.<sup>24</sup> Under the simple interpretation of the ECPR, the access fee paid by the entrant could be either  $a_1 = r_1 - m$  or  $a_2 = r_2 - m$ , where  $m$  is the

<sup>22</sup> Linear pricing entails charging a consumer the same price irrespective of the volume of purchases.

<sup>23</sup> We can write  $v(q, \theta)$  to denote the willingness to pay by consumer of type  $\theta$  for  $q$  units of service. The type reflects the consumer's taste for service or income.

<sup>24</sup> Where the unit of service could be a telephone call or an impulse.

## PRICING ACCESS IN TELECOMMUNICATIONS 169

marginal cost of the (potentially) competitive service. It is easy to see that if the entrant's access fee is set at  $a_1$ , the entrant cannot compete for consumers choosing  $P_2$ . On the other hand, if the fee is set at  $a_2$ , it is now the incumbent that cannot compete against the entrant for customers who choose  $P_2$ .

Thus, either ECPR-based fee causes the sophisticated pricing scheme to unravel. In fact, the scheme will also unravel if the fee is cost-based (that is, based on the LRIC). The problem stems not from the basis for the fee, but, rather, from the fact that entrants are offered a single access fee while the opportunity cost to the incumbent depends on which customer switches to the entrant—whether it is a customer selecting  $P_1$  or  $P_2$ . Indeed, this is an issue that is familiar in the U.S. long-distance telecommunications market. In the United States, facilities-based carriers (such as AT&T or Sprint) sell wholesale long-distance minutes to resellers. Basically, the facilities-based long-distance carriers sell access to their networks at rates that are below retail rates. Resellers are then in a position to arbitrage against the sophisticated tariff schemes deployed by the underlying carriers, thereby making these schemes less feasible.

Getting back to our problem, we note that a sophisticated version of the ECPR would reflect the fact that the incumbent's opportunity cost that is pertinent to the derivation of the access price is the cost of losing a particular customer. The opportunity cost of losing a marginal unit of demand for a competitive service (such as a minute of long-distance calling or a kWh of energy) varies with the customer. The entrant should be presented with a different fee depending on which customer it diverts from the incumbent. Note also that a cost-based access fee cannot be made to vary with the customer unless it is augmented by additives such as those described above (which, in essence, transform the LRIC access fee into an ECPR-based access fee). In addition, in principle, the Ramsey access fee scheme can also be made to depend on the customer served.<sup>25</sup>

In sum, the problem facing the policymaker stems from downstream price discrimination. If the policymaker wants to replicate such price discrimination in a competitive regime, it cannot do so with a single access price for offer to the entrant. However, if the policymaker is not convinced (as much as we are) of the social benefits deriving from complex pricing schemes, the concern discussed here may not be that relevant. In addition, in many countries, the information available to the incumbent monopolist that is necessary to implement such pricing schemes may not be available in the first place, in which case the issue will be moot.

<sup>25</sup> If there is a continuum of customers with different tastes, then the incumbent should offer a continuum of two-part tariffs. Each customer would self-select the optimal tariff. This means that the entrant would in effect end up paying a different access fee depending on which customer it captures.

*Peak and Off-Peak Pricing*

Demand for a service may differ also by the time of day (morning/evening) and by season (summer/winter). In this case, like in the case discussed above, it may be necessary to vary the access fee to the network to reflect these demand shifters. There are additional considerations that affect the setting of rates in these types of situations.

We start with a very stripped-down, peak/off-peak model of the electricity industry. We assume the relevant network is the transmission grid for the provision of electric power. We assume that the cost of building a unit of transmission capacity is  $r$ . Once capacity is built, it costs nothing to transmit power over the grid up to capacity. Generation has a constant short-run and long-run marginal cost of  $g$ , whether it is used for base load or peaking usage. We also assume that demands are independent so that there is no shifting peak as a function of electricity prices.

With these assumptions, we obtain efficient unit prices for electricity as  $p^l = g$  and  $p^h = r + g$ , where  $p^l$  is off-peak and  $p^h$  is a peak price, in the event that all the demand is satisfied by the incumbent. Clearly, if the access fee were set at zero (consistent with off-peak margin), then the entrant would divert all the business from the incumbent during the peak period (by charging a price lower than  $p^h$ ). This, in turn, would impose a strain on the network with a capacity chosen to serve the efficient level of demand. Moreover, the entrant would be able to gain sales even if its unit generation costs were higher than those of the incumbent. Alternatively, if the fee were set at  $(p^h - g)$ , then an efficient entrant would not be able to serve off-peak demand. This leads to our public policy prescription 6-2.

**Public policy prescription 6-2.** *Different access fees should be set for peak and off-peak periods in order to induce efficient use of the network. All other things equal, the peak access fee should be higher than the off-peak access fee.*

In this example, we assumed that peak and off-peak periods are independent of each other. Often consumers can (imperfectly) substitute consumption between periods. In such a case, the level of the access fee can affect the distribution of demand between the periods. Using the same example, if the entrant has low generation costs, it can reduce the off-peak price, stimulate demand during the off-peak period, and divert some demand from the peak period. The result might be that the incumbent would be stranded with excess capacity at the peak period although it has been charging efficiently for peak usage.

Alternatively, if the entrant lowers the peak price because its operating costs are lower, then it will impose additional demand on transmission both from stimulated peak demand and diverted off-peak demand. Stimulated demand

## PRICING ACCESS IN TELECOMMUNICATIONS 171

lowers quality (brownouts, more blocked calls) and creates consumer dissatisfaction, which undermines support for opening markets to competition (public policy prescription 6-3).<sup>26</sup> Note, however, that if the incumbent receives access price  $a^H = r$  during the peak period (as calculated before), it should have the correct incentive to expand the size of the network to accommodate the stimulated demand. Over the long term, this should alleviate the capacity constraint. The obvious problem occurs during the transition period from monopoly to competition. The extent of the problem depends on the level of congestion in the network before competition opens up.<sup>27</sup> It also depends on how immune the incumbent is to incentives to expand the network.

**Public policy prescription 6-3.** *The regulator should set the peak access fee at a level high enough to induce appropriate investment in the network to accommodate stimulated demand at the peak due to competitive entry. Otherwise, quality will fall and public support for competition will erode. This would be an adverse outcome for transition to a market-based regime. Hence, the access fee should cover (at least) the incremental cost of expanding capacity. However, such a fee is inefficient in the off-peak period.*

#### *Technological Choices for Serving Peak and Off-Peak Demand*

We have assumed that serving peak and off-peak demand can be accomplished with identical technology (which can be deployed more efficiently either by the incumbent or by the entrant(s)). In some industries, such as electricity, the reality can be quite different. Hence, the access fee must also drive the correct choice of the technology for serving the two periods (public policy prescription 6-4).

**Public policy prescription 6-4.** *The peak access prices should reflect efficient use of technology (as is the case in all other circumstances).*

To illustrate, assume that base-load demand is 300 MWh and peak demand is 350 MWh with a load duration of four hours a day. Given the data, the generator can choose between a generator of 300 MW capacity and a 50 MW peaker, or a 350 MW generator that will be underutilized for 20 hours a day.<sup>28</sup>

<sup>26</sup> In the United States, one still hears the sentiment that the telephone system worked better when AT&T was the monopoly. There have also been concerns with the performance of electricity markets after even limited deregulation. Some commentators have expressed the view that deregulated markets will experience more brownouts and higher prices during peak demand periods.

<sup>27</sup> We are concerned that in many countries moving from (state) monopoly to competition, transmission may be tight (and also inefficient).

<sup>28</sup> This could be power purchased elsewhere.

With these data, it is likely that the incumbent will install a 300 MW generator and the entrant will try to compete for the incremental peak demand. In order to be able to compete, the entrant should be charged an access fee that reflects the net revenue foregone by the incumbent on the incremental peak demand. Obviously, if the calculation reflects only the saved variable cost on the energy that will be replaced by the entrant, the (hourly) access fee is likely to be high (since the peak price also covers the cost of the peaking generating capacity). If the fee reflects the total cost that would be saved if the peaking capacity were removed and sold elsewhere, the fee would be low.

A high fee might discourage entry of an efficient entrant whose technology may be different from that of the incumbent; a low fee might induce entry and strand investment (peaking generating capacity).

Another complication arises when the incumbent and the entrant can select from the menu of technologies with different fixed (base) and variable costs. The total cost is given by

$$\phi(Q;K) = rK + v(K; w)Q, \quad Q \geq K \text{ and } v' < 0,$$

where  $r$  is per unit cost of capacity,  $K$  is installed capacity,  $Q$  is output,  $w$  is a vector of input prices, and  $v(\cdot)$  is a function defining variable cost. By moving first and installing the technology, the incumbent may have an incentive to use a very capital-intensive technology with low variable cost. The markup forgone on sales lost to the entrant would be  $p - v'$ , which may be artificially high and may preclude a less capital-intensive entrant with somewhat higher variable cost. The incumbent could strategically over-invest in order to foreclose entry. In this case, the best guidance for the regulator is to rely on the LRIC as the base for assessing the proper level of the fee. This issue has been debated in the United States following the passage of the Telecommunications Act of 1996, regarding the proper basis for access fees.

#### *Avoided or Avoidable Cost in Setting Access Fees*

The discussion above hints at a possible problem when the incumbent cannot immediately shed all the costs. In the example, the incumbent will likely not be able to divest itself of the generating capacity the moment the entrant comes in. In other circumstances, there may even be long-run fixed costs that may be incurred in the provision of the competitive service (that is, service that can be contested in the marketplace). For example, local exchange carriers have argued that they will continue to incur significant costs of providing local calling. Thus, in contrast to the standard model, the competitive service cost is:

$$TC = f + cQ$$

where  $f$  is fixed cost,  $c$  is marginal cost, and  $Q$  is output. The average cost is  $f/Q + c$ .<sup>29</sup> Now the issue is how access should be priced when an entrant diverts only a portion of the incumbent's sales. A possible approach is to use the avoided cost standard as advocated by the local exchange carriers in the United States. Under this standard, access would be priced at  $(p-c)$ , which in principle yields enough in margin for the incumbent to recover the fixed cost (possibly more, but also possibly less). At this price, an entrant who has yet to invest in the provision of the competitive service will likely not be able to earn an adequate return. Note that the entrant's total cost is

$$TC^E = f_E + (c_E + a)Q^E,$$

where  $E$  denotes the entrant and  $a$  is the access charge. Hence, on the assumption that the entrant captures all of the incumbent's sales, the profit of the entrant is

$$pQ - (f_E + [(c_E - c) + p]Q) < 0$$

if the entrant's variable cost is not significantly lower than that of the incumbent. Thus, even if the entrant's long-run, forward-looking costs are lower for the same volume of output than those of the incumbent, the entrant will not be able to participate in the market.

Alternatively, the access fee could be based on the avoided cost standard in which the entrant pays the fee that reflects long-run savings in cost that would be realized by the incumbent if it were to exit the competitive function and only provided the network function. Thus, under this standard, the access fee would be set at

$$a = p - (f/Q + c).$$

Note that here the fee is sensitive to the pre-entry level of output produced by the incumbent. This is the case because the average cost depends on the scale of output. Constant returns to scale would obviate this problem. This access fee induces the efficient choice of the supplier (that is, the one with the lowest long-run cost), but potentially leaves the incumbent stranded with the amount equal to the fixed cost.

<sup>29</sup> We are not implying that this is necessarily a realistic cost function in actual applications. In fact, it is perhaps more plausible to assume that the cost function exhibits constant returns to scale (in the long run).

### Conclusions

This chapter has reviewed some important issues in the analysis of access pricing. Although we have provided some answers to the problems facing regulators in countries that have embarked on deregulation of telecommunications (and other network industries), many thorny policy questions remain. Indeed, economic analysis of access issues is one of the most important research topics in regulatory and antitrust economics. From the work thus far, several important regulatory prescriptions emerge.

First, access arrangements should be designed to promote efficiency, including entry of new firms into the segments of the network industry where competition should and can flourish.

Second, access arrangements should not be used to maintain the incumbent's market power.

Third, access arrangements must reflect economic costs to the maximum extent possible. Insofar as there are inefficiencies in the manner that the network is arranged and costed out, the regulator should deal with these inefficiencies separately.

Fourth, if the retail prices charged by the incumbent are distorted for public policy or other reasons, then an efficient access pricing rule must account for these distortions. In particular, if the incumbent is required to cross subsidize some customer groups, then the entrant should also be required to bear the same burden; otherwise, efficiency will not be realized.

Fifth, access prices cannot be expected and should not be relied upon to solve all the industry problems during the process of transition from monopoly to competition. The regulator must deploy a full range of regulatory instruments to guide the transition process toward effectively competitive market arrangements, including rebalancing of retail rates.

Sixth, the access regime should create incentives for the incumbent firm to innovate and to lower its costs.

Seventh, as far as possible, the access regime should rely on voluntary contractual arrangements between the affected parties. The regulator should step in when private negotiations are not likely to be successful or conducive to efficient allocation of scarce economic resources.

These desiderata for an efficient access regime are far from simple or easily satisfied. However, given the importance of the access regime in fostering competition, access rules should be at the center of public policy concerns.

**Bibliography**

- Armstrong, M. Forthcoming. "The Theory of Access Pricing and Interconnection." In M. Cave, S. Majumdar, and I. Vogelsang, eds., *Handbook of Telecommunications Economics*. Amsterdam, Holland: North-Holland.
- . 2001. "Access Pricing, Bypass and Universal Service." *American Economic Review, Paper and Proceedings* (May).
- Armstrong, M., C. Doyle, and J. Vickers. 1996. "The Access Pricing Problem: A Synthesis." *Journal of Industrial Economics* 44(2): 131–50.
- Baumol, W. J., J. A. Ordover, and R. D. Willig. 1997. "Parity Pricing and Its Critics." *Yale Journal on Regulation* 16(1): 145–164.
- Baumol, W. J., and J. G. Sidak. 1994. *Toward Competition in Local Telephony*. Cambridge, MA: MIT Press.
- Laffont, J. J., and J. Tirole. 2000. *Competition in Telecommunications*. Cambridge, MA: MIT Press.
- Ordover, J. A., and R. D. Willig. 1981. "An Economic Definition of Predation: Pricing and Product Innovation." *Yale Law Journal* 91(1): 8–53.
- Sidak, J. G., and D. F. Spulber. 1997. *Deregulatory Takings and the Regulatory Contract*. Cambridge, U.K.: Cambridge University Press.