Chapter 2

The Political Economy of Entry Into Local Exchange Markets

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1. INTRODUCTION

Regulated monopolies are constantly under the threat of entry; often regulatory protection constitutes the only barrier to potential entrants. One explanation for such protection derives from Posner's (1971) view of regulation as a taxation scheme. According to this view, regulators set prices as if the overall market were divisible into two (or more) segments: In one segment prices are set artificially high in order to generate profits, which are then used to subsidize the other segment in which prices are set artificially low. The regulator's incentive to thus tax one segment and subsidize the other could be driven by a variety of motives: a sense of equity, a desire to ensure universal service, or by the fact that the subsidized segment constitutes a stronger political base.

In such an environment, an entrant would appear to be an anathema from the regulator's standpoint; the (unregulated) entrant would be attracted only to the market in which the regulated price is artificially high so subsequent to entry the regulated firm's profits from this market would decline, thereby eroding the "tax base" and reducing the social cross-subsidy.

The basic elements of the scenario just presented conform well with the local exchange market of today. Rates charged to one set of consumers are abnormally high, whereas another set pays a price below the cost of the service it receives.[1] A U.S. Telephone Association study argued that the subsidies that are built into the current pricing system of phone services totaled more than $20 billion a year.[2]

A typical example of such segmentation is between *commercial* and *residential* consumers. Palmer (1992) uses data from New England Telephone to test for cross-subsidization between commercial and residential consumers. She finds that the former cross-subsidizes the latter at 54% of all central offices in her sample (with nearly 65% of all suburban central offices exhibiting this phenomenon). The average minimum monthly subsidy contribution per commercial line for central offices in suburban areas is approximately $6.41, whereas the average minimum monthly subsidy benefit per residential line is $2.22. In fact, FCC data show that the national average rate for residential unlimited local telephone service for 1992 was $13.08, compared with $32.38 for single-line unlimited service for businesses. Similarly, the national average basic residential connection charge in 1992 was $41.51, compared with $72.61 for businesses.[3]

Other forms of segmentation for the purposes of cross-subsidization are also evident. Daniel, Shin, and Ward (1993) report that in a comment filed with the Federal Trade Commission (FTC) in March 1993, Federal Communications Commission (FCC) staff members concluded that the price of local service was less than half its long-run marginal cost, whereas the price of toll service was at least twice its long-run marginal cost.

A classic case study is that of Pacific Bell, which offers one of the highest subsidies for local rates in the United States. The basic service fee for residential consumers is $8.35 per month, whereas the marginal cost of providing basic local service is $22 per month, according to Pacific Bell estimates. The subsidies are funded by artificially high intraLATA toll charges, access charges, and rates for the Yellow Pages. An average intraLATA toll call in California costs 20 cents, whereas the allocated direct cost of the call is merely 5–6 cents. The California Public Utilities Commission is considering opening up the local exchange market to entrants. Pacific Bell has proposed that toll rates be brought down so that an average intraLATA toll call would cost 8–9 cents; it estimates that it is likely to lose over $100 million of toll business to the emerging competition. On the other hand, local residential rates are proposed to be increased to $13.35 per month. Although it is unlikely that all of the proposals put forward by Pacific Bell regarding the redesigning of the rate structure will be accepted, it is quite clear that there is a fundamental tension from the regulator's standpoint between promoting competition and maintaining local cross-subsidies.

In light of the Posnerian view of regulation as a taxation scheme, it is indeed somewhat surprising to observe the rate at which regulatory barriers to entry in local exchange markets are being dismantled. Entry has taken a variety of forms; the competitors to Local Exchange Companies (LECs) include interexchange carriers, competitive access providers (CAPs), cable TV companies, and wireless and satellite-based communications. The objective of this chapter is to investigate the reasons that may explain this apparent anomaly and their implications for social welfare and for the variety of services available to consumers.

We identify two factors that are crucial to the explanation. The first is the demand for enhanced "quality" of services. For instance, it is no longer the case

that all telephone connections are the same. New technologies have made a menu of additional services possible. In addition, given the complexity of the modern telephone network, and the breadth and scope of its uses, the deployment and maintenance of both the relevant hardware and associated software provide a wide range in the quality of service offerings.

The second factor is that of differentiation between the services provided by the regulated firm and by an entrant. A key aspect of the competition in local exchange is that the firms do not compete exclusively on price. Competitive access providers (CAPs) promote their services by offering to connect commercial customers with high-speed lines in a short period of time, greater degree of reliability, and route diversity. These features differentiate the CAPs' services from those of the incumbent firm; the latter have other characteristics to offer such as an established reputation, and brand name recognition.

Our basic model rests on the following arguments. The regulator is modeled as an entity whose objective function depends on the welfare of two classes of consumers, which, for the sake of convenience, we label *residential* and *commercial*. The regulator places a relatively higher weight on the welfare of the residential consumers. The regulated firm is allowed to charge prices in the commercial market that could potentially exceed the marginal cost of service, and a proportion of the profits are transferred to the residential consumers in the form of a price subsidy. Larger profits yield larger transfers and increase the utility of residential consumers. On the other hand, if the regulated commercial price is set high, then the utility of residential consumers is diminished.

A key distinction between the commercial and the residential consumers in our model is that the former derive utility from the investments that the firm has made in quality-enhancing technologies. Examples of such investments include the deployment of digital-switching equipment, fiber-optic cables, and enhanced software capabilities for increased reliability, repair records, and route diversity. Such enhancements permit, for example, the provision of high-speed private lines that can carry up to 672 voice channels, video conferencing, lines that can carry high-volume data traffic, and non-dial-up features of private lines that are particularly attractive to financial trading firms. We argue that given the difficulties of defining "enhanced" quality in a subjective and unambiguous manner, and given the difficulties of monitoring its provision, regulators may be unable to mandate the level of quality-enhancing investments directly. Thus, regulators would only be able to use prices as a way to induce optimal investment. But, because prices are also used to generate social cross-subsidies, they will not lead to an optimal investment. In equilibrium, the firm will invest too little from the regulator's perspective. This underinvestment problem provides regulators with an incentive to invite entrants, in the hope that competition would drive up such investments.

Entry, however, comes at a cost: The regulated firm's profits in the commercial market are diminished, which in turn erodes the base from which transfers are

made to the residential market. A priori, the benefit of entry is clearly the positive effect on investment in quality. The regulator's incentive to permit entry and the resulting change in the market structure is therefore derived from an evaluation of this trade-off. This trade-off is apparent from the statement of Reed Hundt, Chairman of the FCC, before the U.S. House of Representatives Subcommittee on Telecommunication and Finance: "Enthusiasm for promoting new competitive markets and encouraging new technologies and services must not distract our attention from the critical task of ensuring that all Americans have access to basic telephone service."[4]

However, there is an additional element that profoundly affects the regulator's decisions. As mentioned previously, typically, the entrant's output is likely to be differentiated from the output of the regulated incumbent. Our analysis characterizes precisely how such differentiation affects the decision to permit entry into a regulated market.

In the following section we provide a brief review of the local telephone industry that has motivated our study. The review is selective in the sense that we focus on the aspects of the industry that pertain to the specific question that we seek to address.

2. INSTITUTIONAL BACKGROUND

2.1 LECs and CAPs

The local telephone industry is dominated by the seven Regional Bell Operating Companies (RBOCs) and GTE. The RBOCs collectively account for 76.7% of the total access lines in the United States in 1992 and about 80% of total revenues from local exchange services.[5] Each of these firms is virtually a monopoly in its own operating region. Potential competitors for these local exchange carriers (LECs) are interexchange carriers (such as AT&T, MCI, and Sprint), cable TV companies, competitive access providers (CAPs; such as Metropolitan Fiber Systems, Teleport), cellular telephone companies, and the next generation in wireless communications, called PCS. Often the lines between these different firms are blurred; a classic example being Teleport Communications Group, which is a CAP that originated as an agreement between Merrill Lynch and AT&T in the mid-1980s and is now jointly owned by several cable TV companies including TCI, Cox Enterprises, and Time-Warner. The threats posed by the various entrants are quite different from each other. They can roughly be put into three categories: network access services, intraLATA (local access and transport area) toll services, and unregulated services such as wireless communications and broadband and cable operations.

Rather than examining the potential rationale and implications for permitting all varieties of entrants, our focus is on the first of the three categories listed

earlier—network access services. In 1992, 23.4% of the revenue of an average RBOC was from providing interstate access, and 6.7% of the revenue was from providing intrastate access.[6] All interstate traffic and access rates are regulated by the FCC, whereas intrastate traffic and access rates are regulated by the states' public utility commissions (PUCs). IntraLATA traffic is predominantly regulated by state PUCs. Approximately $13.75 billion out of the $15.75 billion earned by the average RBOC from providing interstate network access in 1992 was from end-user revenues and from switched-access revenues. End-user revenues are FCC subscriber line charges that represent a federally tariffed flat fee independent of usage. In 1992, the subscriber line charge for residential and single-line businesses was $3.49 per month, whereas the charge applicable to a multiline business was $4.76 per month. This differential is considerably less than that in 1985 when the charges were $1.00 and $4.99, respectively. Switched-access revenues are federally tariffed charges assessed to interexchange carriers for interstate access to LEC facilities.

The primary entrants in network access services business are CAPs who have been nibbling away at the profit margins of the LECs, derived mainly from the commercial market, by facilitating *bypass*.[7] There are two forms of bypass: Customer bypass involves the leasing of a private line from the LEC and connecting it to an interexchange carrier, or another location of the consumer's businesses, thereby avoiding the switched-access services provided by the LEC. Facility bypass involves the installation of a facility that is connected to an interexchange carrier or to another location of the consumer's businesses. The installed facility is usually a high-capacity private fiber-optic "ring," private microwave radio, or via satellite, and is operated by a CAP or by the consumers themselves.

CAPs have been in operation since the mid-1980s and are concentrated in major metropolitan areas providing bypass services to large-volume commercial users. The leading CAPs are Metropolitan Fiber Systems and Teleport Communications Group.[8] Over the years, regulatory agencies across the country have been steadily dismantling barriers to entry in the access services market. A key decision was made in September 1992, when the FCC Expanded Interconnection Order required LECs to allow CAPs to physically co-locate in LEC central offices and interconnect to the LEC network for special access services. Previously, CAPs would have had to physically connect consumers to their own network; with co-location they can directly connect to the entire universe of LEC customers by routing their private traffic through the LEC central office and eventually connecting to their own network or to the interexchange carriers point of presence. By offering co-location to the CAPs, the regulators have virtually opened the door to entrants in the local access business, even though many details need to be worked out and co-location tariffs need to be set.

The CAPs' primary interest is in the revenues to be earned from special-access and private-line services. Special-access charges are for nonswitched private-line access. Private lines provide a dedicated point-to-point connection for the sole

use of a single party. These lines are usually available in varying capacity increments ranging from DS-1 circuits that carry 24 voice channels to DS-3 circuits that can carry up to 672 voice channels. These capabilities make such lines ideal for multiline commercial consumers.

Even though CAPs have attracted a lot of attention primarily because of their focus on the lucrative segment of the local telephone business—the high-volume commercial customer—the CAPs themselves have not enjoyed high profit margins. Their business is extremely capital intensive and requires the laying of fiber in congested (and hence, expensive) downtown areas. The fiber ring that encircles an area must then be physically connected to each office building it serves. In fact, several CAPs have had severe liquidity problems and often had to be acquired or merged with other providers (e.g., ICC in Washington, DC and NEDD in Boston).

A key observation that should be made is that the CAPs have attracted customers not on price alone; in fact, frequently, their services have been more expensive than those of the LEC. Service quality and provisioning time coupled with higher reliability and route diversity have been the primary selling points of the CAPs' high-capacity fiber rings. The LECs have responded by making quality improvements themselves. The quality improvements have been taking place simultaneously with the improved services being provided by CAPs; for example, NYNEX, whose major metropolitan areas have been prime targets for CAPs, has responded by introducing high-speed private lines that can provide bandwidth on demand that can be obtained by a customer within an hour. On the other hand, some LECs have made quality enhancing investments in anticipation of such investments by CAPs; for example, Southwestern Bell (whose territory has not yet been subjected to the intensity of competition as has been the case with NYNEX) has built self-healing fiber rings in its major metropolitan areas in advance.

Finally, it must be noted that the degree of substitutability between the package of services offered by an incumbent LEC and a CAP varies significantly. In general, the CAP specializes in providing high-speed private lines and rapid connection of such lines, whereas the LEC has its established set of services and maintenance record and reputation to offer its customers. Given the federal collocation order and with NYNEX's bandwidth-on-demand service or Southwestern Bell's preemptive construction of fiber-optic rings in its major metropolitan areas, the services of several LECs and CAPs are being brought closer together; hence, there is pressure on both the incumbent and the entrant to distinguish their product from that of their rival in other ways. A precedent for such differentiation exists in the interexchange telecommunications industry, in which MCI promotes novel packages such as the Friends and Family program (due to its lead in billing software capabilities), U.S. Sprint's customers have the vital ability to hear pins drop across the globe (due to its lead in fiber optics),

and AT&T claims that its services are different for no particular reason other than the fact that they are provided by AT&T.

2.2 The Regulatory Climate

The traditional form of regulation in local telecommunications is rate-of-return (ROR) regulation, which allows the regulated firm to earn a "reasonable" rate of return on its rate base or investment in the telecommunications network within a particular state. The state's PUC determines what is included in the rate base, the depreciation rate, and the acceptable return on the rate base. The allowed ROR is generally an average of the costs of debt and equity weighted by the relative proportions of debt and equity, usually measured at book value (see Phillips, 1988).[9] Any earnings in excess of the allowed ROR must be rebated to rate payers.

ROR regulation is believed to provide the LEC with little incentive to innovate and promote efficiency. For this reason, recently over 65% of states have adopted some form of "incentive" regulation. Each state has its own unique incentive plan that includes combinations of price caps, profits sharing plans, and some partial deregulation of telecommunications services that are deemed to be competitive by the PUCs.

Typically, price cap regulation rather than profits sharing plans provides the best incentives, provided they are implemented properly. Under a pure price cap plan only the price is regulated, and there is no limit set for the maximum that the LEC can earn. These plans commonly adjust for inflation less a specified productivity factor on an annual basis. Typically, the LEC has some flexibility in the sense that several services are grouped together in a basket and only the composite price for the basket is set by the regulator. Even though relatively few states currently employ price cap regulation, it is clearly the wave of the future, especially as competition heats up. For this reason, we use a modified form of price caps in our model of regulation. That is, we assume that the regulator sets up a binding price cap for the regulated firm's service.

With regard to entry policy, currently both the U.S. Senate and House of Representatives are considering legislation that is aimed at fostering competition in local exchange and exchange access services.[10] This federal initiative is in addition to the FCC's Expanded Interconnection Order mentioned earlier. At the state level, by 1993, nine states have already opened their local exchange markets to competition, and 14 additional states have done so on a partial basis.[11] Thus, it seems that regulatory barriers to entry are being rapidly dismantled.

In the following section we consider a simplified version of the model that appears in Chakravorti and Spiegel (1994). Although this is admittedly a highly stylized model, it nonetheless captures key aspects of the rich variety of institutional factors associated with entry in the network access business, mentioned in the preceding paragraphs.

3. THE MODEL AND RESULTS

3.1 The Basic Model

We consider an industry that is initially a regulated monopoly. A key factor in our analysis is the objective of the regulator; we assume that the latter segments the market into two distinct classes which, for the sake of convenience, we label as *residential* and *commercial*. We postulate that the regulator's objective is characterized by a utility function that depends on the welfare of both classes but assigns differential weights to them. Letting U_0 and U denote, respectively, the utilities of the residential consumer and the commercial consumer, the regulator's utility function is given by:

$$W = U_0 + \alpha_1 U, \quad \text{where } \alpha_1 < 1. \tag{1}$$

The regulator sets the price that the incumbent monopoly can charge (i.e., sets a binding price cap) subject to the constraint that the incumbent monopoly can retain at least a fraction $(1 - \alpha_2)$ of its profits, where α_2 is some exogenously negotiated parameter.

For simplicity, we assume that residential consumers demand a fixed quantity, normalized to one unit, and their utility is given by $U_0 = q - p_0 + \tau$, where q is some constant representing the level of the innate quality of the firm's output net of the cost to the firm of providing it, p_0 is the price in the residential market, and τ is a potential transfer payment. The *net price* paid by residential consumers is given by $p_0 - \tau$. We assume that the regulator sets $p_0 = q$; hence, the residential market attracts no entrants. Given this simplification, the utility of residential consumers is captured entirely by the amount of transfer payments they receive, that is, $U_0 = \tau$.

Next, we turn to the source of the transfer payments: the commercial market. The commercial consumers' utility function is different from that of residential consumers. Commercial consumers care not only about the basic service and its quality, q, but also about the extent to which the firm makes quality-enhancing investments, denoted q_r. Examples of such investments in the case of local telecommunications include fiber deployment, provision of private lines that can carry multiple voice channels for high-volume users, enhanced software and personnel capabilities for increased reliability, repair records, and route diversity. The demand for the commercial service as a function of quality-enhancing investment, q_r, and the price in the commercial market, p_r, is:

$$\tilde{x}_r(q_r, p_r) = q + q_r - p_r. \tag{2}$$

The associated indirect utility of commercial consumers is:

$$\tilde{U}(q_r,p_r) = \frac{(q + q_r - p_r)^2}{2}. \tag{3}$$

Assuming that the cost of investing in quality level q_r is $q_r^2/2$, and assuming without a loss of generality that the regulated commercial service can be provided at zero marginal cost, the regulated firm's profits in the commercial market are:

$$\tilde{\pi}(q_r,p_r) = p_r\tilde{x}_r(q_r,p_r) - \frac{q_r^2}{2}. \tag{4}$$

Because the regulator is constrained to let the firm retain at least a proportion $(1 - \alpha_2)$ of its profits, and because $U_0 = \tau$ and $U = \tilde{U}(q_r,p_r)$, his maximization problem is:

$$\underset{p_r,\tau}{Max}\, W = \tau + \alpha_1\tilde{U}(q_r,p_r), \quad s.t.\ \tau \le \alpha_2\tilde{\pi}(q_r,p_r)\,. \tag{5}$$

It is easy to verify that at the optimum the constraint will be binding. Letting $\alpha \equiv \alpha_1/\alpha_2$, the regulator's problem can therefore be written as:

$$\underset{p_r}{Max}\, W = \alpha_2\,[\tilde{\pi}(q_r,p_r) + \alpha\tilde{U}(q_r,p_r)]\,. \tag{6}$$

The parameter α captures the regulator's marginal rate of substitution between the welfare of commercial consumers and the firm's profits. We assume that $\alpha < 1$. This reflects the assumption that the marginal utility to the regulator of a unit of profits (used to generate cross-subsidies to residential consumers) is higher than the marginal utility of a unit increment in the welfare of commercial consumers.[12]

3.2 The Monopoly Case

In this subsection we consider the case in which the regulator protects the monopoly position of the regulated firm by blocking entry. Throughout, we assume that investments in enhanced quality cannot be regulated directly, primarily because the costs of verifying the myriad quality-enhancing investments by the firm are too high from a third party's (such as a court's) standpoint, and hence cannot be credibly enforced. We therefore model the strategic interaction between the regulator and the regulated firm as a two-stage game in which the firm makes quality-enhancing investments in Stage 1, and the regulator sets prices in Stage 2. Given the firm's investment in quality and the regulated prices, consumers choose their level of final purchases. The assumption that regulated prices are set after the firm has already invested reflects the fact that adjustments of regulated prices are typically made on a much more frequent basis than firms' investments. The latter, therefore, can be viewed as a long-term decision, whereas the former can be viewed as a short-term decision. These assumptions regarding

the sequencing of events also capture the lack of regulatory commitment to prices that characterize the regulatory framework in the United States.

Given our framework, we examine the subgame perfect-equilibrium outcome of the two-stage game. That is, we solve the game backwards by assuming that at each stage players choose their strategies optimally given the history of the game and their correct expectation regarding the outcome of subsequent stages. Note that we do not need to solve directly for τ, because once p_r is set it determines the regulated firm's profits in the commercial market and hence τ, which is a fraction $(1 - \alpha_2)$ of profits.

In Stage 2 of the game, the regulator sets the regulated price for the commercial service. Solving the regulator's maximizing problem, the pricing strategy of the regulator as a function of the quality of the commercial service is:

$$p_r^M(q_r) = \frac{(1-\alpha)(q+q_r)}{2-\alpha}, \tag{7}$$

where the superscript M is used to index the case of a monopolistic industry.

Anticipating $p_r^M(q_r)$, the regulated firm chooses in Stage 1 the level of quality-enhancing investment, with the objective of maximizing its profits. The resulting investment level is:

$$q_r^M = \frac{2(1-\alpha)q}{H}, \tag{8}$$

where $H \equiv 1 + (1 - \alpha)^2 > 0$.

Given the equilibrium level of quality-enhancing investment, the equilibrium regulated price and transfer payment made to the residential market are given as follows:

$$p_r^M = \frac{(1-\alpha)(2-\alpha)q}{H}; \quad \tau^M = \frac{\alpha_2(1-\alpha)q^2}{H}. \tag{9}$$

This outcome can be compared with an outcome that would have been realized if in Stage 2 of the game the regulator could control not only the price but also the level of quality-enhancing investment that the firm makes. We refer to this as the complete monitoring outcome. The quality-enhancing investment, regulated price, and transfer payment made to the residential market that emerge from the decisions made in the complete monitoring outcome are given as follows:

$$q_r^* = \frac{q}{1-\alpha}; \quad p_r^* = q; \quad \tau^* = \frac{\alpha_2 q^2}{2(1-\alpha)}. \tag{10}$$

These outcomes yield the following insight:

Proposition 1: *For all* $\alpha \equiv \alpha_2/\alpha_1 > 0$, *relative to the complete monitoring outcome, the regulated firm underinvests in quality-enhancing technologies;*

moreover, prices in the commercial market and cross-subsidies to the residential market are lower.

Proposition 1 has simple intuitive foundations. The regulator cares about the impact of increased quality on the utility of commercial consumers and the impact of quality on profits in the commercial market. The regulator's interest in profits is motivated by the fact that these profits constitute the tax base from which transfers to the residential market are made. The firm, on the other hand, is simply concerned about the second of the two effects, that is, on profits; therefore, it underinvests. As a result both the regulated commercial price and the transfer are lower than they would be in the complete monitoring outcome.

3.3 The Case of Entry

We postulate that the underinvestment in quality that we have identified in the previous subsection provides the regulator with the motivation to exercise the lever that it does have control over: whether or not to permit entry. A priori, one would expect that the presence of competitors would induce the incumbent firm to attract consumers by investing in quality. However, the regulator must weigh this benefit of competition against the potential cost due to the erosion of the regulated firm's profits, which in turn erodes the transfers made to the residential market. This trade-off is further complicated by the possibility that the entrants' product may be differentiated from that of the regulated firm.

An important element in the market for local exchange is the "horizontal" differentiation between the services of different providers.[13] Consider the case of access services with NYNEX, the regional Bell company, and a competitive access provider such as Metropolitan Fiber Systems (MFS). On the one hand, some types of consumers place a high value on the product offered by MFS—a high-speed T1 line within 24 hours, but without the reputation of a long service and repair record—whereas other types place higher value on the longer record of NYNEX, even though their ability to provide high-speed lines within a short time frame is currently limited.

To capture these aspects of entry, we modify the basic model as follows. We assume that the potential entrants constitute a competitive fringe, that is, they are identical to each other (in terms of costs, quality investments, etc.) and play a Bertrand pricing game against each other. This assumption simplifies the analysis considerably. It implies that when entry takes place, entrants will charge a price equal to marginal cost and will therefore have no market power. In the case of the local exchange, this assumption can be justified on the ground that entrants are quite small relative to the size of the market and hence do not have significant market power. In what follows we can therefore focus on a model in which there is a single unregulated firm that considers entry. In addition, we assume that the quality of the service that the entrant can offer is chosen by

nature; in other words, the entrant is limited by the technological capabilities available exogenously (such as a fiber-optic ring together with co-location opportunities in the incumbent's central office) and cannot expand its quality offerings. Moreover, it must be noted that because the regulated price in the residential market p_0 is set equal to marginal cost c_0, entry, if it occurs, would be a factor only in the commercial market.

To distinguish the relevant variables of the regulated firm from that of the unregulated entrant, we use the subscripts r and u throughout. Because the entrant charges a price equal to marginal cost, $p_u = c_u$. Assume that if entry occurs, commercial consumers have a quadratic utility function which gives rise to the following demand system:

$$x_r(q_r,p_r) = \left[\frac{q + q_r - p_r - \gamma(q_u - c_u)}{1-\gamma^2}\right]^+; \; x_u(q_r,p_r) = \left[\frac{q_u - c_u - \gamma(q + q_r - p_r)}{1-\gamma^2}\right]^+, \tag{11}$$

where $[\,\cdot\,]^+ \equiv \text{Max}\,\{\,\cdot\,,0\}$, and $\gamma < 1$. The associated indirect utility function of commercial consumers is given by:

$$U(q_r,p_r) = \frac{(q + q_r - p_r)^2 - 2\gamma(q + q_r - p_r)(q_u - c_u) + (q_u - c_u)^2}{2(1-\gamma^2)}. \tag{12}$$

The parameter γ plays a crucial role in determining the degree of (horizontal) differentiation between the services of the two firms. As γ approaches 1, the degree of differentiation decreases and the two services become closer substitutes except for differences in their quality. Note that when $\gamma = 0$, $x_r(q_r,p_r) = \tilde{x}(q_r,p_r)$. Thus, the demand system specified in Equation 11 extends the demand system specified earlier to the case in which the two services are (at least to some degree) substitutes.

Given $x_r(q_r,p_r)$, the regulated firm's profits are:

$$\pi(q_r,p_r) = p_r x_r(q_r,p_r) - \frac{q_r^2}{2}. \tag{13}$$

We now add to the sequence of events considered in the previous subsection a new stage, Stage 0. In this stage, nature first selects a quality level for the entrant, q_u, and then, after observing q, the regulator decides whether or not to permit entry. The rest of the game (i.e., Stages 1 and 2) is without change. In keeping with the logic of backward induction, we begin with the Stage 2 and solve the regulator's pricing problem as a function of the choices made in earlier stages. Subsequently, we proceed to Stage 1 and solve for the regulated firm's investment problem as a function of the regulator's entry decision made in Stage 0 and assuming that the firm correctly anticipates the regulator's pricing strategy in Stage 2. Finally, we solve for the regulator's entry decision in Stage 0, given the entrant's quality and assuming that the regulator correctly anticipates the regulated firm's investment in enhanced quality in Stage 1.

Stage 2. Replacing $\tilde{U}(q_r,p_r)$ with $U(q_r,p_r)$ and $\tilde{\pi}(q_r,p_r)$ with $\pi(q_r,p_r)$ in the regulator's maximization problem given by Equation 6, and solving for p_r, we have (using the superscript E to denote entry):

$$p_r^E(q_r) = p_r^M(q_r) - \frac{\gamma(1-\alpha)(q_u - c_u)}{2-\alpha}, \tag{14}$$

where $p_r^M(q_r)$ is given by Equation 7. Observe that the regulator's interest in the commercial market price is driven by two factors: A reduction in price increases the welfare of commercial consumers but diminishes the regulated firm's profits and consequently the cross-subsidy to residential consumers. A priori, one cannot be sure how the regulator would respond to the competitive pressure that the entrant exerts. Equation 14 yields a precise answer to this question: The regulated price is lower in the presence of an entrant.

Several key insights are obtained by examining the formula for the price reduction. First, the extent of reduction increases as the regulated and unregulated services become closer substitutes; this simply reflects the intuition that the intensity of competitive pressures are eased as the outputs of the two firms are increasingly differentiated.

Second, the extent of the reduction is greater as the quality of the unregulated firm increases. This is consistent with the observation that if the demand for the regulated service decreases with the quality of the unregulated service (which in turn has a negative effect on the regulated firm's profits and consequently on transfers to the residential market), then the regulated price must be lowered further to bolster demand and improve on the welfare of commercial consumers and thereby offset the decrease in the regulator's utility due to the potential reduction of transfers. The full impact of a higher quality of the unregulated service on the regulated price is not entirely obvious, however, because in the chain of consequences just described we did not factor in the change in the regulated firm's choice of enhanced quality in response to a higher quality of its competitor's service.

Stage 1. In Stage 1 of the game, the regulated firm's profits in the commercial market may be written as $\pi(q_r) \equiv \pi(q_r,p_r^E(q_r))$. Maximizing this expression with respect to q_r, we have:

$$q_r^E = \left[\frac{2(1-\alpha)[q - \gamma(q_u - c_u)]}{H - \gamma^2(2-\alpha)^2}\right]^+. \tag{15}$$

The second-order condition for maximization requires that the denominator of this expression be positive, that is, $\gamma < \tilde{\gamma} \equiv \sqrt{H}/(2-\alpha)$. This condition implies that the regulated service has to be sufficiently differentiated from the unregulated one. We therefore restrict attention to parameter values such that $\gamma < \tilde{\gamma}$.[14] Equation 15 indicates that in equilibrium the regulated firm invests less in enhanced quality as the quality of the unregulated service increases. In fact,

when $q_u \geq c_u + q/\gamma$, the regulated firm stops investing in enhanced quality altogether. Also note that $q_r^E > q_r^M$ if and only if $q_u < c_u + \gamma(2-\alpha)^2/H$. When this condition fails, entry will lead to less investment in enhanced quality, not more as is often assumed by policymakers.

Assuming that $q_r^E > 0$ and substituting from Equation 15 into 14, the equilibrium regulated price in the commercial market is:

$$p_r^E \equiv p_r^E(q_r^E) = \frac{(1-\gamma^2)(1-\alpha)(2-\alpha)[q-\gamma(q_u-c_u)]}{H-\gamma^2(1-\alpha)(2-\alpha)}. \tag{16}$$

Given q_r^E and p_r^E, the equilibrium level of subsidy to residential consumers is:

$$\tau^E = a_2\,\pi(q_r^E, p_r^E) = \frac{\alpha_2(1-\alpha)[q-\gamma(q_u-c_u)]^2}{H-\gamma^2(2-\alpha)^2}. \tag{17}$$

Similarly, the outputs of the regulated and unregulated firms in the commercial market are:

$$x_r^E \equiv x_r(q_r^E, p_r^E) = \frac{(2-\alpha)q_r^E}{2(1-\alpha)}, \tag{18}$$

and

$$x_u^E \equiv x_u(q_r^E, p_r^E) = [q_u - c_u - \gamma x_r^E]^+. \tag{19}$$

Notice that if $q_r^E = 0$, then $\tau^E = x_r^E = 0$. In other words, if the quality of the unregulated service, q_u, exceeds the threshold, $c_u + q/\gamma$, the regulated firm exits the commercial market. In this case, the commercial market is served by an unregulated monopoly providing an output $q_u - c_u$, and residential consumers receive no cross-subsidies. On the other hand, when $q_u \leq c_u + \gamma x_r^E$, the unregulated firm cannot penetrate the commercial market because $x_u^E = 0$.

We summarize this discussion in the following proposition:

Proposition 2: *There are three different cases to consider depending on the size of* q_u*:*

(i) *For all* $q_u \leq c_u + \gamma x_r^E$ *no entry occurs.*

(ii) *For all* $c_u + \gamma x_r^E < q_u < c_u + q/\gamma$, *the market is served by both firms.*

(iii) *For* $q_u \geq c_u + q/\gamma$, *the regulated firm exits the commercial market.*

Proposition 2 demonstrates the clear link between the entrant's quality and its ability to penetrate the commercial market and affect the decisions of the regulated firm. As the entrant's quality increases, its impact increases: At low-quality levels, the entrant is kept out of the market.[15] At intermediate quality levels, entry takes place, and for high-quality levels, it is the regulated firm that is forced out of the commercial market, and the industry becomes an unregulated monopoly. Furthermore, observe that $\partial(\gamma x_r^E)/\partial\gamma > 0$ and $\partial(q/\gamma)/\partial\gamma < 0$. Hence, as the regulated and unregulated products become closer substitutes: (a) the

regulated firm expands its output, so the unregulated firm needs to offer higher quality to penetrate the market; and (b) the unregulated firm is more likely to monopolize the commercial market once it enters.

Stage 0. Now consider the regulator's decision on whether or not to permit entry. The regulator's decision is based on a direct comparison between the value of his or her payoff with and without entry, for each one of the cases discussed in Proposition 2. As it turns out, this comparison depends in a complex way on the parameters of the model. A detailed analysis of the regulator's decision is given in Chakravorti and Spiegel (1994) to which the reader is referred. In what follows, we briefly review some of the main results. To simplify matters, we consider here only cases in which $q_u > c_u + \gamma x_r^E$, that is, cases in which entry occurs if it is allowed.

To decide whether or not to permit entry, the regulator must perform the following cost-benefit evaluation: The cost of permitting entry is the loss of cross-subsidies to residential consumers due to erosion of monopoly profits in the commercial market. The benefit of permitting entry is the increase in welfare of commercial consumers due to changes in quality, price, and greater product variety.[16]

We begin by considering the case in which the entrant's quality is so high that he drives the regulated firm out of the commercial market. Intuitively, it is clear that the regulator would permit entry whenever the quality of the entrant's service is sufficiently high to ensure that the benefit to commercial consumers from having a superior service outweighs the loss to residential consumers from having to concede their cross-subsidies. Note, however, that this argument depends on the relative weights that the regulator assigns to the welfare of each group of consumers. For instance, if the regulator cares only about residential consumers ($\alpha = 0$), then he completely ignores the benefits of entry to commercial consumers and would therefore always block entry. On the other hand, if the regulator cares about the welfare of commercial consumers ($\alpha > 0$), then he would permit entry if the quality of the unregulated service is sufficiently high. To illustrate these points, we therefore consider the following example. Let $\gamma = 1/2$, $q = 10$, and $q_u - c_u = 20 + \delta$, where $\delta \geq 0$ (note that in order to drive the regulated firm out of the market, the unregulated firm must have $q_u - c_u \geq q/\gamma = 20$). Given these values, a tedious but straightforward calculation reveals that the regulator will permit entry if and only if:

$$\alpha(20 + \delta)^2(2 - 2\alpha + \alpha^2)^2 > 100[4(1 - \alpha) + \alpha^2(2 - \alpha)]. \qquad (20)$$

Note that when $\alpha = 0$, the left side vanishes so the condition fails. On the other hand, when $\alpha = 1$, the left side equals $(20 + \delta)^2$, whereas the right side equals 100, so the condition holds. Moreover, note that the left side of the expression increases with δ. From this we conclude that the regulator will allow entry only

if α and δ are relatively large (i.e., the regulator places a relatively high weight on the welfare of commercial consumers, and the net quality of the unregulated service is relatively high).

Proposition 3: *Suppose that the entrant's quality is so high that if entry is allowed, he drives the regulated firm out of the commercial market, and let* $\gamma = 1/2$, $q = 10$, *and* $q_u - c_u = 20 + \delta$, *where* $\delta \geq 0$. *Then, the regulator will allow entry if and only if* α *and* δ *are sufficiently high to ensure that condition (20) is satisfied.*

Next, consider the case in which q_u is intermediate so that both firms are active in the commercial market. Recall that entry into the commercial market improves on the welfare of commercial consumers but makes residential consumers worse off. Thus, it is intuitively clear that the regulator would block entry if he places a small weight on the welfare of commercial consumers (i.e., α is small). On the other hand, when the regulator places a high weight on the welfare of commercial consumers, the reverse holds. The reason for this is that as α approaches 1, the regulator's objective approaches the maximization of social welfare. Consequently, the regulator will set the regulated price equal to marginal cost, leaving the firm with zero profits and, hence, no cross-subsidy is being generated (note from Equation 17 that $\tau^E \to 0$ as $\alpha \to 1$). Thus, in this case, only the welfare of commercial consumers matters. But, because entry provides commercial users with more variety, it makes them, and therefore the regulator, better off. Similarly, when the two services are poor substitutes, the entrant has a negligible effect on the regulated firm's profits and consequently the cross-subsidy to residential consumers (note from Equations 17 and 9 that $\tau^E \to \tau^M$ as $\gamma \to 0$). But, because entry improves on the welfare of commercial users by providing them with more variety, the regulator will allow it. Hence,

Proposition 4: *Suppose that* q_u *is intermediate in the sense that both the regulated and unregulated firms are active in the commercial market. Then the regulator will allow entry if* α *is close to 1, or* γ *is close to 0. On the other hand, the regulator will block entry if* α *is close to 0.*

The conclusion from this analysis can be summarized as follows: The regulator is more inclined to permit entry as α—the measure of relative weight attached to the welfare of commercial consumers—increases,[17] as the quality of the unregulated service increases, and as the degree of differentiation between the regulated and the unregulated products increases.

4. CONCLUSION

Our central conclusion is that the question of whether or not there is a dismantling of regulatory entry barriers in protected markets, such as that for network access services in local telecommunications, hinges on three factors: (a) the

extent to which the regulator cares for residential consumers versus his concern for commercial consumers, (b) the innate quality of the entrant's service, and (c) the extent to which the entrant offers a service that is not a close substitute of the one available from the incumbent firm.

Although the first two factors appear to be intuitively obvious, it is quite interesting to note the key role that is played by the third factor—product differentiation between entrant and incumbent. The impact of such differentiation can be summarized as follows: Greater differentiation (a) expands the product space; (b) reduces the erosion of the regulated firm's profits and thereby reduces the decline in cross-subsidies; (c) increases the probability that the unregulated firm will enter by lowering the minimal quality investment needed to penetrate the market; (d) conditional on entry, decreases the probability that the unregulated firm will be a monopoly by raising the minimal quality threshold which the unregulated firm must attain in order to induce the regulated firm to exit; and (e) reduces the decline in the regulated post-entry price in the commercial market.

These general conclusions provide a valuable guide both to strategic planners in incumbent firms as well as to policymakers. The message to the former is that if the firm's objective is to lower the probability that regulatory entry barriers are lifted, then the firm should try to offer as close a substitute for the entrant's service as possible. This strategy is not without risks, however, because our analysis shows that as the two services become closer substitutes, the entrant is more likely to drive the regulated firm out of the market if entry occurs after all. The message to policymakers is that in considering whether or not to permit entry of unregulated firms, one needs to consider not only the quality of the entrants' service, but also how close of a substitute it is for existing services. This consideration is going to affect not only the emerging market structure (i.e., whether there will be one or more providers of services in the market), but also the the regulated firm's investment incentives and its ability to generate cross-subsidies.

ACKNOWLEDGMENTS

The views expressed in this chapter are those of the authors and do not represent the views of Bellcore or any one of its owner companies. We thank Bill Lehr for helpful comments.

ENDNOTES

1. For a historical account of the origins of cross-subsidies in the U.S. telecommunications industry, see Temin (1990).
2. "Potential Impact of Competition on Residential and Rural Telephone Service," USTA Study, July 21, 1993.

3. Source: Table 6 in "Trends in Telephone Services," Industry Analysis Division, FCC, October, 1993.
4. Statement of Reed Hundt, Chairman of the FCC, before the Subcommittee on Telecommunication and Finance, U.S. House of Representatives, on H.R. 3636, the "National Communications Competition and Information Infrastructure Act of 1993," and H.R. 3626, the "Antitrust Reform Act of 1993" and "Communications Reform Act of 1993," January 27, 1994.
5. The RBOCs' access lines in the contiguous United States were 105.7 million out of a total of 137.7 million (source: Table 14, "Trends in Telephone Services," Industry Analysis Division, FCC, October, 1993). The RBOCs reported revenues from local exchange services of $31.2 billion in 1992 as compared with $39.2 for all LECs (source: Tables 2 and 7, "Telecommunication Industry Revenue: TRS Fund Worksheet Data," Common Carrier Bureau, Industry Analysis Division, FCC, March 1994).
6. Source: Table 7, "Telecommunication Industry Revenue: TRS Fund Worksheet Data," Common Carrier Bureau, Industry Analysis Division, FCC, March 1994.
7. In January 1994, MCI announced its own plan to enter the local exchange market via a newly created subsidiary, MCI Metro. In entering the market, MCI can take advantage of its recent acquisition of Western Union, whose underground conduit system runs throughout the downtown areas of most major metropolitan areas.
8. As of 1992, Metropolitan Fiber Systems served 14 major metropolitan areas operated in 12 different states, and Teleport Communications Group served 12 major metropolitan areas in 8 different states (source: "Fiber Deployment Update—End of Year 1992," by Jonathan Kraushaar, Industry Analysis Division—Common Carrier Bureau, FCC, April 1993).
9. In fact, this procedure is followed not just under ROR regulation, but also under price cap regulation because price caps are set on the basis of the firm's cost of capital. For example, the FCC sets price caps on interstate access rates so as to ensure local exchange carriers a rate of return on their investment of 11.25%. Similarly, the FCC has tentatively concluded to establish price caps on cable TV services so as to ensure cable operators a rate of return on their investment of approximately 10%–14%.
10. This legislation includes S. 1822, the Communications Act of 1994, and H.R. 3636, the National Communications Competition and Information Infrastructure Act of 1993.
11. States that allow competition in local exchange include Illinois, Iowa, Michigan, Montana, Nebraska, New York, Oregon, Pennsylvania (nonswitched local), and Washington. States that allow partial competition include California, Colorado (nonswitched local service), Washington, DC, Florida, Maryland (not switched), Massachusetts, Missouri (nonswitched local service), New Jersey (not basic local exchange), North Dakota, Texas (certain nonbasic services), Virginia, West Virginia (not basic local), Wisconsin (nonswitched local), and Wyoming (source: Table 165, "Competition in Local Exchange Service," NARUC, Compilation of Utility Regulatory Policy 1992–1993).
12. This assumption is consistent with Kaserman and Mayo (1994), who argue that residential customers appear to be in a better position to exert political pressure on regulators than commercial customers. Thus, regulators care more about residential customers due to their concern over the political repercussions of infringing on the rights of this group's interests.
13. The difference between horizontal and vertical differentiation is the following. When services are vertically differentiated, all consumers agree on which service is better. In contrast, when services are horizontally differentiated, there is no unanimous agreement between consumers on which service is better: some consumers prefer the attributes of one service more than the other, while other consumers have the reverse preferences.
14. Differentiating $\tilde{\gamma}$ with respect to α reveals that $\delta\tilde{\gamma}/\delta\alpha = \alpha\tilde{\gamma}/H > 0$. Hence, $\tilde{\gamma}$ increases from $1/\sqrt{2}$ when $\alpha = 0$, to 1 when $\alpha = 1$.
15. In our related paper (Chakravorti and Spiegel, 1994) we show that even if the unregulated firm stays out of the market, its presence induces the regulated firm to increase its investment in enhanced quality nevertheless, provided that the quality of the unregulated service is not

too low. The reason for this is that the unregulated firm stays out of the market precisely because the regulated firm invests more than it would otherwise.

16. In Chakravorti and Spiegel (1994), we prove formally that entry always makes commercial consumers better off and residential consumers worse off than they respectively are when entry is blocked. Note that the first result is not obvious a priori because entry may lead to a reduction in the regulated firm's investment in enhanced quality. As it turns out, however, the reduction in the regulated price and the increase in variety are sufficient to compensate commercial consumers for the reduction in quality if it occurs.
17. In other words, the regulator is less inclined to allow entry if he places a relatively high weight on profits (i.e., α is small). This is reminiscent of Weisman (1993), where the regulator can rebate to consumers a share of the regulated firm's profits (rather than use them as a cross-subsidy as in our chapter). Weisman shows as the regulator can rebate to consumers a larger share of profits, he becomes less inclined to permit entry.

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