EVOLVING MARKET STRUCTURE, CONDUCT, AND POLICY IN LOCAL TELECOMMUNICATIONS

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EXECUTIVE SUMMARY

The local telephone industry is beginning a transition from a regulated monopoly market structure to a competitive market structure. During this transition, the industry will most likely pass through several different market structures. An important issue for state commissions to consider is market power in each market structure during this transition. Market power is the ability of a firm, or group of firms, to profitably sustain prices above competitive levels. Market power and the conditions that give rise to it have important implications for both the development of competitive local telephone markets and consumer protection. Competition may develop slowly if incumbent local exchange carriers (ILECs) are able to impede entry or effective competition. Moreover, if workable competition is more mirage than reality, regulatory regimes that assume its existence will not protect consumers from the exercise of market power.

This report *examines several models of markets characterized by limited competition*. By providing a background for state commissions as they evaluate various market structures, the models described in this report will provide state commissions with insights that can prove helpful in analyzing market power and understanding the behavior or conduct of market participants as competition develops in the local telephone industry.

As technology and market conditions change, industry evolution is inevitable. The local telephone industry will most likely evolve from a monopoly structure through the emerging competitive and oligopoly structures before developing a workably competitive structure. Each market structure will induce

rational, self-interested firms to engage in specific behaviors that influence market power. Although the models described in this report are often abstract and deviate from "reality," they can help state commissions understand and predict strategic firm behaviors and develop preemptive policy responses to mitigate the resulting market power problems.

Lacking either existing or potential competitors, an unregulated monopolist's behavior is constrained only by market demand. Thus, unregulated monopoly markets are unsurpassed in the presence of market power. Indeed, one rationale for the existence of traditional regulation was to control the exercise of market power in markets that were not thought susceptible to competition. The current movement toward opening former monopoly markets to competitive entry is accompanied by a movement toward reduced regulation of retail rates, based on the belief that competitive forces will promote consumer welfare. Nevertheless, to the extent that they continue to be the largely uncontested domain of incumbent local exchange carriers and demand in them is highly inelastic, residential and small business telephone markets remain ripe for the exercise of market power.

Moreover, the local telephone industry is a network industry in which the ILEC provides the linchpin network and provides services and facilities to its competitors. The Telecommunications Act of 1996 (the 1996 Act) creates unique mechanisms whereby entry deterrence may be a profit maximizing strategy for ILECs. By imposing high costs and strict conditions on interconnection, unbundled network elements (UNEs), and resale, ILECs can deter entry by reducing or eliminating potential competitors' profit opportunities. State commissions have valid concerns about ILECs' ability to maintain market power through strategies of entry deterrence and their ability to exploit their market power as traditional regulation that formerly constrained their behavior recedes.

Traditional tools available for monopolists to deter entry include strategic pricing of final outputs and investment in excess capacity. In the absence of asymmetric information problems, however, economic theory predicts that monopolists generally will not engage in entry deterrence with these traditional tools, because they will tend to be counterproductive. Thus, while state commissions might safely ignore these simple output price and capacity strategies, *strategic pricing of inputs sold to competitors should remain an area of ongoing concern*. This is especially for inputs based on control of essential or bottleneck facilities controlled by the ILEC. In addition, non-price variables, including carrier-to-carrier quality of service and provision of operation and support systems (OSS) functions, will continue to be of concern to regulators.

Since the 1996 Act was enacted, state commissions have worked to ensure that the prices of inputs provided to competitors (interconnection, UNEs, and services provided for resale) were at levels that facilitated competition and that carrier-to-carrier quality of service OSS functions promoted competition. Nonetheless, continued monitoring and enforcement will be needed to ensure that control of these elements or functions is not used to reinforce market power.

Assuming the ILEC is not successful in deterring entry, the local telephone industry will exhibit an emerging competitive market structure. In this situation, the most applicable industry model is the dominant firm-competitive fringe model, which assumes that there is a single large firm and a group of small fringe firms. In the local telephone context, ILECs are dominant firms because of their competitive advantages, which may include lower costs, brand-name recognition acquired because of their former monopoly position, and their existing monopoly or near-monopoly status. Competitive local exchange carriers (CLECs) are the competitive fringe firms. The dominant firm establishes

the market price based on its costs and the residual demand (market demand less supply from the competitive fringe). *As the competitive fringe supply increases, the dominant firm establishes a lower price and its market power will decline.* This model provides two important insights for the local telephone industry. First, if the ILEC possesses significant competitive advantages, market power problems will remain, and state commissions will need to respond with some form of economic regulation or take direct steps to eliminate the problem. Second, if an ILEC's competitive advantages are not significant and decline as competitors become established in the market, the ILEC's market power should decline. If this happens, there will be little need for regulation of the ILEC's retail rates, but there will still be a need for oversight of interconnection, wholesale, and UNE rates, as well as carrier-to-carrier quality of service and consumer protection such as enforcement of anti-slamming rules.

As some competitive fringe firms grow and prosper, the local telephone industry will exhibit an oligopoly market structure with several large firms operating interdependently, each taking the others' responses into consideration when making decisions. There are a variety of models that describe oligopoly markets; these models differ with respect to the attribute of competition (for example, price or quantity) and sequence of action (for example, single-period or repeated interaction).

The model of single-period price competition described in this report predicts that *intense price competition may emerge with as few as two firms in the market.* If this happens, market power will evaporate. However, firms may attempt to avoid being locked into pure price competition by adopting strategies of product differentiation to make their products unique in consumers' eyes. If successful, product differentiation can mitigate or soften the intensity of price competition and preserve some market power.

For the local telephone industry, the most appropriate model is an infinitely repeated price model. This implies that firms will compete via prices over an extended period with no pre-specified end date. Although single-period competition does not facilitate collusion, once infinite repeated interaction is assumed, firms can engage in various forms of implicit collusion. This implicit collusion can include relying on trigger mechanisms or price leadership. Implicit collusion enables firms to set prices above competitive levels and facilitates the joint exercise of market power. Based on experiences from the long-distance industry, under certain conditions *state commissions should expect to encounter potential implicit collusion as the local telephone industry evolves an oligopoly structure*. One way to limit such implicit collusive behavior is to eliminate asymmetric rules and regulations that require ILECs to file tariffs or changes to them well in advance of their effective date. Although such rules are undoubtedly well intentioned, they can have the unintended consequence of facilitating price leadership, signaling, or umbrella pricing, which may lead to implicit collusion.

This report examines three principal market environments – monopoly, emerging competition or dominant/fringe competition, and oligopoly – and their corresponding market power implications. Table 2 at the end of the report provides a summary of these market environments, identifies the likely strategic behaviors state commissions are likely to observe, and lists some appropriate regulatory responses.

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FOREWORD

Technological change, federal legislation, market forces, and state commission policies are transforming the local telephone industry. As this transition continues, the competitive process will require continual oversight to promote competitive markets and ensure consumer protection. The ongoing transition suggests it will not progress smoothly or quickly to something that can be called workable competition and providers will have different incentives in different types of markets. This report identifies these incentives and their impact on competition.

Sincerely,

Raymond W. Lawton
Director, NRRI
February 2000

ACKNOWLEDGMENTS

INTRODUCTION

As the local telephone industry begins the transition to a more competitive market structure, state commissions will confront different forms of behavior and different levels of market power. Market power, which is defined as the ability of a firm, or group of firms, to profitably sustain prices above competitive levels, affects both the development of competitive local telephone markets and consumer protection. State commissions charged with seeking to promote local telephone competition while protecting captive consumers must understand how the existence and exercise of market power will influence the likelihood of achieving these goals and develop and adopt appropriate policy tools to mitigate the negative aspects of market power. To properly evaluate market power and its potential abuses in their local telephone markets, state commissions can call on a broad array of analytical tools. This report provides state commissions with several basic models that can prove helpful in the analysis of market power and further understanding of the behavior or conduct of market participants as the local telephone industry changes.[1]

Because market power provides a firm, or group of firms, the ability to profitably sustain prices above competitive levels, it is generally associated with profits above competitive levels and reduced consumer welfare.[2] Profits are

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[1]Some of the models discussed below are also discussed in David Chessler, *Determining When Competition is "Workable": A Handbook for State Commissions Making Assessments Required by the Telecommunications Act of 1996* (Columbus, OH: The National Regulatory Research Institute, 1996).

[2]Because economic cost includes a normal risk-adjusted return on invested capital, prices in excess of marginal cost imply higher than competitive profit levels. Thus, prices in excess of marginal cost imply supranormal profits. In markets without

(continued...)

above competitive levels because the firm's per-unit margin (the difference between price and marginal cost) increases with higher prices, and consumer welfare decreases because consumers incur higher prices and consume lower quantities.

Whether market power is desirable at a societal level depends on one's perspective. In a static framework, market power is undesirable because it is accompanied by lower total welfare. Welfare declines because the higher prices and resulting lower quantity create a divergence between marginal benefits, as represented by price, and marginal costs. Total welfare would increase with lower prices and higher quantity. Alternatively, market power can be desirable in a dynamic framework where the greater profits provide resources for technological development and incentives for innovation.[3] With profits exceeding competitive levels, firms have sufficient resources to develop and implement uncertain technologies. Greater profits also provide an incentive for other firms to innovate in the hope that they could join or supplant the current firms earning profits in excess of competitive levels.

The models described in this report provide state commissions with tools to examine behavior under various market conditions. These models assume firms are rational, in both their beliefs and actions, and behave in their own best interest – typically implying behavior to maximize profits. Additionally, the models emphasize strategic interdependence in which each firm's actions influence its competitors, and firms incorporate their beliefs about their competitors' responses into their decision process. The essential question is:

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[2](...continued)
entry barriers, the existence of supranormal profits would induce entry, driving profits to the competitive level.

[3]Monopoly or market power's potential to induce greater innovation and lead to faster growth were stressed in Joseph Schumpeter, *Capitalism, Socialism, and Democracy* (London: Unwin University Books, 1943).

How will a rational, profit-maximizing firm behave in various market environments if the firm incorporates its competitors' actions into its decision process? The models discussed in this report can provide important insights on how the interplay of strategic behavior and market structure determine market power. By understanding the implications of these models, state commissions can more accurately understand likely firm behaviors and their impact on market power. Moreover, this understanding can aid in the promotion of local telephone competition and consumer protection. Thus, the models can help state commissions direct their policy initiatives, including preemptive ones, to where they are most needed.

The remainder of this report examines three principal market environments – monopoly, emerging competition or dominant/fringe competition, and oligopoly – and their corresponding market power implications. The second section discusses monopoly markets, specifically the monopolist's incentives to deter entry and maintain existing levels of market power; the third section examines the emerging competitive market, where a dominant firm interacts strategically with many smaller competitors; the fourth section discusses oligopoly markets, with a focus on market power arising from noncooperative and cooperative behavior; and the final section provides some concluding remarks.

MONOPOLY MARKETS

Other things being equal, market power is maximized in a monopoly market. Figure 1 illustrates the monopoly market power problem. With neither existing nor potential competitors, a monopolist's only constraint is market
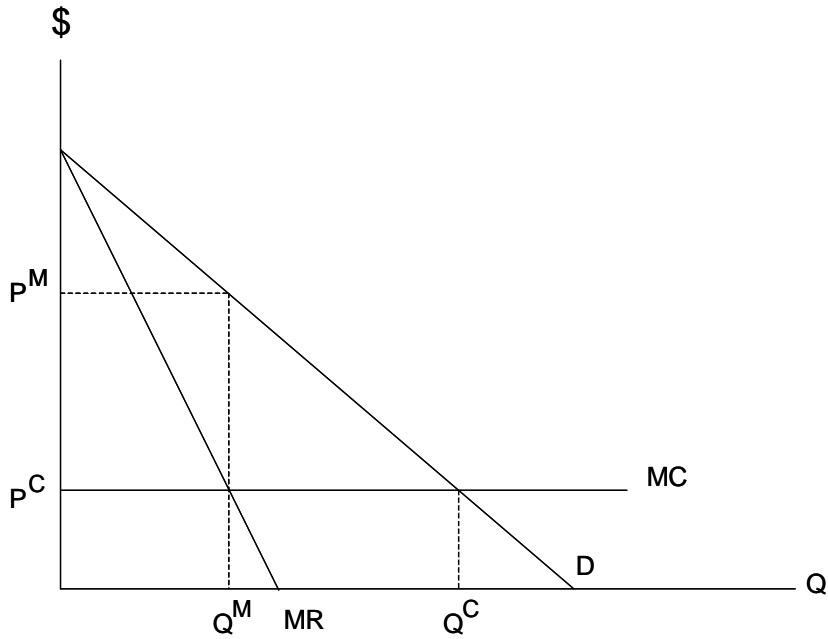
Figure 1. "Baseline" monopoly result.

demand (D). The monopolist will select a quantity and price that maximizes

profits; this occurs when the firm equates its marginal revenue (MR) and

marginal cost (MC).[4] The result is a reduction in quantity, from the competitive

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[4]The diagram in Figure 1 is based on the assumption that the monopolist has a constant marginal cost and, by implication, a constant average cost. This example also assumes that the cost curves of a competitive industry would be identical to those of a monopolist so that the competitive equilibrium quantity would equal the monopolist's P = MC quantity. This is an unlikely situation and is provided only to simplify the exposition.

level, Q^C, to the monopoly level, Q^M, and an increase in price, from P^C to P^M.[5] This situation clearly exhibits market power, since the monopolist can profitably sustain prices above competitive levels. The only constraint on its degree of market power, as represented by the vertical distance between P^C and P^M, is the elasticity of market demand. The greater the elasticity of market demand, the lower the degree of market power as measured by the value of the Lerner Index at the firm's profit maximizing price.[6]

One fact of local telephony markets is that, until recently, they were near total monopoly markets controlled by the ILECs. Indeed, nearly four years after passage of the 1996 Act, it is clear that, although competition exists, especially for larger business customers in metropolitan areas, it can generally be described as still in the emergent phase. Moreover, true network-based

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[5]In a competitive market in long-run equilibrium, price will equal marginal cost ($P = MC$). If there are no externalities in production or consumption, this result will yield allocative efficiency in the sense that the price consumers are willing to pay for an incremental unit of a good or service just equals the cost incurred to produce that unit. One measure of the relative degree of market power is the Lerner Index (L), measured by the expression, $L = (P - MC)/P$. Thus, the greater the relative spread between P and MC, the greater the implied degree of market power. Note that $L = 0$ under competition.

The original exposition of what has come to be called the Lerner Index may be found in Abba P. Lerner, "The Concept of Monopoly and the Measurement of Monopoly Power," *Review of Economic Studies* 1, no. 3 (June 1934): 157-75. What Lerner called the "index of the degree of monopoly power" is discussed at 169. This article is also available in reprint in W. Breit and H. M. Hochman, eds., *Readings in Microeconomics*, 2nd ed. (Hinsdale, IL: Dryden Press, 1971), 207-223.

[6]The Lerner Index is inversely related to the elasticity of demand. In fact, $L = -(1/g)$ where g is the elasticity of demand for the firm's product. Also, another well-known result of economic theory is that a profit-maximizing unregulated monopolist with $MC > 0$ will always choose a price/quantity combination so that it operates on the *inelastic* portion of its demand curve (where $|g| < 1$).

competition for residential and smaller business customers is rare.[7] A recent FCC report noted that in local telephone service markets, CLECs are growing rapidly but remain a small portion of the overall market.[8] The FCC reported that based on data filed during the second quarter of 1999:

> Even under the most expansive definition of local service competition – which includes competitive local exchange carriers (CLECs), competitive access providers (CAPs), and also long distance and other telecommunications carriers to the extent they report local service revenues – the ILECs retain 96% of local service revenues. Further, even within their relatively small share of the market, the revenues of local competitors come primarily from special access and local private line services rather than from switched service to end users. [9]

The FCC reported that about 1.7 percent of nationwide ILEC switched voice-grade lines were being provided to CLECs under total service resale arrangements; 0.2 percent of lines were being provided to competitors under other resale arrangements at the end of 1998; and lines provided under resale outnumbered unbundled network element (UNE) loops 8 to 1 nationwide.

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[7]For some discussion of the nature of competition, especially "workable" competition, see Chessler, *Determining When Competition Is "Workable,"* Chapter 1. Also, for some sense of how a more fully competitive telecommunications market might function as an intermeshed "network of networks," see Phyllis Bernt, *Regulatory Implications of Alternative Network Models for the Provision of Telecommunications Services* (Columbus, OH: The National Regulatory Research Institute, 1994).

[8]FCC, *Local Competition: August 1999* (Washington, D.C.: Federal Communications Commission, Common Carrier Bureau, Industry Analysis Division, August 1999), 1.

[9]Ibid.

Although a comprehensive estimate of CLEC lines was not available, the FCC reported that CLECs may be providing 2 to 3 percent of switched access lines nationally using their own facilities.[10] Based on this evidence, it is safe to say that most residential and small business local telephone markets remain the domain of monopoly ILECs.[11] Nevertheless, in spite of the slow progress of competition to date, there is no doubt that it is increasing. In fact, the FCC reported that, as of the second quarter of 1999, CLECs held 20 percent of numbering codes nationwide, and approximately 1.5 million numbers had been ported between carriers as of May 1999.[12] The percentage of numbering codes held by CLECs has increased by nearly 50 percent from the 14.3 percent of numbering codes assigned to CLECs through the third quarter of 1998.[13] Furthermore, the percent of numbering codes assigned to CLECs has increased dramatically from the 0.1 percent figure through 1994.[14]

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[10]Ibid., 21 and 23 and Tables 3.1 and 3.3.

[11]For example, at the end of 1999, the Ohio Consumers' Counsel stated that only 6,110 of a total of 3.8 million residential customers had switched from an ILEC to a CLEC. This represented less than .2 percent, which he felt did not signify competition. The picture was somewhat better for business customers – it was reported that Ameritech had switched or resold more than 100,000 of its 4.1 million business lines. See Alan Johnson, "Phone deregulation criticized," *The Columbus Dispatch*, December 21, 1999, 5D.

[12]Ibid., Table 4.3 and Table 5.1. The FCC noted that not all ported numbers represent customers who have switched local carriers, since some numbers have been ported as part of number conservation plans.

[13] Federal Communications Commission, *Local Competition* (Washington, D.C.: Federal Communications Commission, 1998), Table 4.9.

[14]Assignment of numbering codes does not, in and of itself, signify *actual* competition, nonetheless it does provide an indication of the *emergence* of competition, since acquiring numbering codes is a precondition for competition.

Local telephone service is highly price inelastic.[15] Thus, conditions were, and in residential and small business markets remain, fertile for significant market power to exist. Historically, state regulators have constrained exercise of this market power through various forms of economic regulation, including ratebase rate-of-return and price cap regulation. With the new deregulatory legislation and administrative regulations, competition is increasingly relied upon to constrain the ILECs' market power in place of economic regulation. However, if the ILECs are able to both impede competitive entry and have their level of regulation reduced, they may be able to exercise previously constrained market power. Thus, a valid concern for state commissions is an ILEC's ability to deter entry and sustain its existing degree of market power in the new deregulatory environment.

Maintaining Market Power by Deterring Entry—Baseline Scenario

To frame the analysis, consider a baseline scenario. An incumbent monopolist faces entry from a group of potential competitors prepared to supply an identical product with similar cost functions. These competitors can enter the market swiftly, with little or no sunk costs. *Will the incumbent monopolist take actions to deter entry or eliminate entrants? The answer is generally not.*[16]

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[15]The price elasticity of basic measured rate access service has been estimated at -.0052. Thus, a one percent increase in local measured service rates would induce virtually no reduction in market demand. See Jerry Hausman, Timothy Tardiff, and Alexander Belinfante, "The Effects of the Breakup of AT&T on Telephone Penetration in the United States," *American Economic* Review 83, no. 2 (May 1993): 178-184.

[16]This scenario of quick entry and no sunk costs is similar to that of contestability theory. See William Baumol, "Contestable Markets: An Uprising in the Theory of Industry Structure," *American Economic Review* 72, no. 1 (March 1982): 1-15.

Assume one competitor enters. To eliminate this entrant, the former monopolist must set a price below marginal cost, implying that it must operate at a loss until the entrant is driven from the market.[17] If it succeeds in eliminating this entrant, it must subsequently raise its price above competitive levels to recoup the losses it incurred to eliminate the first entrant. However, unless there are significant barriers to entry, these higher prices will induce another competitor to enter the market. If all potential entrants have cost functions similar to the incumbent's, the monopolist will never be able to recoup losses incurred to eliminate an entrant from the market. *Given these conditions, the monopolist's profit maximizing response is to accommodate entry rather than attempting to deter entry*.

Potential entrants would ignore any pricing threats the monopolist might make to deter entry. Such threats lack commitment value because the monopolist is free to deviate from the threatened behavior once entry occurs; furthermore, such threats may also lack *credibility* in the sense that potential entrants would correctly infer that, once entry occurs, the now-former monopolist would not actually set price below its marginal cost, since it is not in its interest to do so. In this case, the monopolist must incorporate the actions of its potential competitors into its pricing decision, and its effective market power will be substantially lessened.

While the preceding outcome is desirable from a static market power perspective, this conclusion is not likely to hold in many real world situations. More to the point, these conclusions are unlikely to hold in local telephone markets for several reasons. First, entry into the local telephone industry is not

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[17]In general, a strategy of pricing below cost with the intent of driving a competitor from the market in order to obtain or protect a monopoly position would be categorized as "predatory pricing" and would be illegal under antitrust law.

swift and generally involves a large investment, some of which can be described as sunk. At a minimum, entrants must incur sunk advertising expenses to make their presence known to consumers. Second, entrants' marginal costs are likely to be higher than the ILEC's. Assuming "learning-by-doing" occurs in the local telephone industry, ILECs will have benefitted from years of monopoly provision, so the preceding result that entry deterrence will not be a problem is unlikely to hold in the local telephone industry. The remainder of this section examines cases in which entry deterrence *is* in the monopolist's best interest and helps sustain its market power.

Maintaining Market Power by Deterring Entry—Other Scenarios

There are several mechanisms through which a monopolist *could* deter entry. The first, and probably most obvious, mechanism is using price as a strategic variable. Although as the preceding example illustrates, the price mechanism is often not effective in deterring entry, Milgrom and Roberts show that *limit pricing*, the act of charging below the monopoly profit-maximizing price to deter entry, can be rational when the monopolist has information that the potential entrant lacks.[18] In this instance, lower prices are designed to signal that the monopolist *could* have lower costs than the entrant initially believes. Assuming that the potential entrant updates its beliefs based on the monopolist's lower prices, a *limit pricing* strategy could discourage a potential competitor from entering the market.

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[18]Paul Milgrom and John Roberts, "Limit Pricing and Entry Under Incomplete Information: An Equilibrium Analysis," *Econometrica* 50, no. 2 (March 1982): 443-459. Note that *limit pricing* does not imply that the price is set *below* marginal cost. Limit pricing is pricing below the short-run profit maximizing level to make competitive entry unattractive (unprofitable). See Dennis Carlton and Jeffrey Perloff, *Modern Industrial Organization* (New York, NY: Harper Collins College Publishers, 1994), 394-404.

This scenario assumes that the incumbent has accurate information on the potential entrant's cost structure, but the potential entrant does not know the incumbent's cost structure. In this case a limit price strategy may cause the potential entrant to believe that the incumbent's costs are lower than they actually are. Without asymmetric information, however, limit pricing is not likely to be effective, because it lacks commitment value. If a potential entrant knows the monopolist's cost structure, it will correctly infer that once entry occurs the former monopolist will raise prices to a post-entry profit-maximizing level.[19]

Is limit pricing a viable strategy for ILECs in the local telephone industry? With ratebase, rate-of-return regulation, ILECs' costs are subject to public review and incomplete information will be less of problem. However, the movement towards price-cap regulation and towards deregulation makes ILECs' costs less visible. This increases the possibility of a limit pricing strategy. Nevertheless, most price cap plans constrain the ILEC's ability to lower prices, and *constraints on downward pricing flexibility would tend to blunt the opportunity to adopt a limit-pricing strategy*. Another factor militating against this strategy is the fact that state commissions commonly have incremental cost-based retail price floors on competitive services. On the other hand, to the extent that it is successful in lowering the retail price of ILEC services, price-cap regulation might act like a form of limit price, and the extent and rate of competitive entry may be decreased.[20]

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[19]Because entry will result in a decrease in the demand for the incumbent's output, the post-entry profit-maximizing price will be lower than the profit-maximizing price.

[20]This result flows from the idea that the lower the ILEC's price, the less attractive is a strategy of competitive entry. See Jaison R. Abel, *Pricing and Competition in Local Telephone Markets Under Price-Cap Regulation*, Unpublished Ph.D. Dissertation (Columbus, OH: The Ohio State University, 1999).

Investment in excess capacity is another mechanism through which a monopolist can attempt to deter entry. Unlike limit-pricing strategies, capacity investment strategies have commitment value because they are irreversible. Spence argues that a monopolist can deter entry by maintaining sufficient capacity to make additional entry and capacity unprofitable.[21] By investing in excess capacity relative to its short-run profit maximizing level, a monopolist can deter entry through the implicit threat to utilize its available capacity to increase output and lower price to an unprofitable level. However, the credibility of this threat depends critically on the assumption that the monopolist would actually *use* the excess capacity to lower price if another firm enters the market.[22] Furthermore, the local telephone networks currently have sufficient capacity to handle all traffic, and demand elasticities are fairly low, so adding additional capacity is unlikely to significantly lower market price. If potential entrants understand this, investment in excess capacity is not likely to prove to be an effective entry deterrence strategy.

Unique Characteristics of Local Telephone Markets

The nature of the local telephone industry and the provisions of the 1996 Act combine to create several unique characteristics that could provide an opportunity for an ILEC strategy of entry deterrence. The local telephone

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[21]A. Michael Spence, "Entry, Capacity, Investment, and Oligopolistic Pricing," *Bell Journal of Economics* 8, no. 2 (Autumn 1977): 534-544.

[22]F. M. Scherer, *Industrial Market Structure and Economic Performance, 2 ed.* (Chicago: Rand McNally College Publishing, 1980), 246-248.

industry is a network industry.[23] As such, competition could be hindered if various networks do not work well together, or if the cost of switching between providers or networks was excessive.[24] Moreover, the ILEC's network generally functions as the "linchpin" network, and CLECs use the ILEC's service elements and facilities as inputs in their production process.[25] The ILEC controls vital bottleneck or essential facilities and could use this position to raise its rivals' costs or impose other conditions that impede competition.

The 1996 Act has provisions to facilitate local competition by mandating interconnection, unbundling, and resale.[26] These provisions are intended to allow potential competitors to enter the market on a more or less equal footing with the ILEC without having to construct a proprietary network.[27] However, the

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[23]One characteristic of a network industry is that many components may be required to provide service. Although network components may be produced by different providers, they must work together to provide service. This is sometimes referred to as "interoperability." For example, in a competitive local telephone industry, a call may traverse several networks between the calling and called party.

For more discussion of network industries, see Michael L. Katz and Carl Shapiro, "Network Externalities, Competition, and Compatibility," *American Economic Review* 75, no. 3 (June 1985): 424-40; Nicholas Economides and Steven C. Salop, "Competition and Integration among Complements and Network Market Structure," *Journal of Industrial Economics* 40, no. 1 (March 1992):105-23; and Nicholas Economides, "The Economics of Networks," *International Journal of Industrial Organization* 14, no. 6 (October 1996): 673-99.

[24]The imposition of rules requiring local number portability between carriers is an example of an attempt to reduce the cost or difficulty of switching local carriers.

[25]For a fuller description of a market that relies on a linchpin network and how a more fully competitive intermeshed "network of networks" telecommunications industry might function, see Bernt, *Regulatory Implications of Alternative Network Models.*

[26] 47 U.S.C. 251(c).

[27]In its *Local Competition Order*, the FCC observed that:
It is possible that there will be sufficient demand in some local telephone markets to support the construction of competing local exchange

(continued...)

efficacy of these provisions depends critically on the prices and conditions ILECs impose on the services. By imposing high costs and strict conditions on interconnection, collocation, UNEs, and resale, ILECs could deter entry by reducing or eliminating potential competitors' profit opportunities.[28] In addition, it might be possible for an ILEC to impede competition under certain

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[27](...continued)
facilities that duplicate most or even all of the elements of an incumbent LEC's network. In these markets new entrants will be able to use unbundled elements from the incumbent LEC to provide services until such time as they complete the construction of their own networks, and thus, no longer need to rely on the facilities of an incumbent to provide local exchange and exchange access services. It is also possible, however, that other local markets, now and even into the future, may not efficiently support duplication of all, or even some, of an incumbent LEC's facilities. Access to unbundled elements in these markets will promote efficient competition for local exchange services because, under the scheme set out in the 1996 Act, such access will allow new entrants to enter local markets by leasing the [ILEC's] facilities at prices that reflect the incumbents' economies of scale and scope.

See FCC 96-325 "First Report and Order" in CC Docket 96-98 *In the Matter of Implementation of the Local Competition Provisions in the Telecommunications Act of 1996 and CC Docket 95-185 Interconnection between Local Exchange Carriers and Commercial Mobile Radio Service Providers* (August 8, 1996), Para. 232.

[28]The UNE and resale provisions are intended to help jumpstart competition. Nevertheless, the FCC recently noted that facilities-based competition between networks is important:

. . . in the long term, the most substantial benefits to consumers will be achieved through facilities-based competition, because only facilities-based competitors can break down the incumbent LECs' bottleneck control over local networks and provide services without having to rely on their rivals for critical components of their offerings. Moreover, only facilities-based competition can fully unleash competing providers' abilities and incentives to innovate, both technologically and in service development, packaging, and pricing.

See FCC 99-141, "Notice of Proposed Rulemaking and Notice of Inquiry" in WT Docket 99-217, In the Matter of Promotion of Competitive Networks in Local Telecommunications Markets, and "Third Further Notice of Proposed Rulemaking" in CC Docket 96-98, In the Matter of Implementation of the Local Competition Provisions in the Telecommunications Act of 1996 (July 7, 1999), para. 4.

circumstances by manipulating local termination charges via reciprocal compensation arrangements. Moreover, the unique relationship between the ILEC and the CLECs (that they must simultaneously act cooperatively by interconnecting their systems and act as rivals for local subscribers) might lead to collusion among the parties to maintain high interexchange access charges or to intense competition among the players to offer low interexchange access charges. In addition, left on its own, a dominant incumbent might attempt to deter entry by manipulating local access charges or arrangements.[29] The implication is that competition among providers who must also cooperate might not promote consumer welfare, and some regulatory oversight of voluntary arrangements is needed.

The ILEC has an incentive to engage in entry deterrence to the extent that the expected profits from such behavior exceed the expected profits from accommodating entry and serving both the intermediate goods market (UNEs and resale) and the final market (retail). Roycroft shows that an ILEC will indeed strategically alter its final prices and the potential competitors' input prices to maximize profits in a manner that could reduce the competitors'

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[29]See Timothy J. Brennan, "Industry Parallel Interconnection Agreements," *Information Economics and Policy* 9, no. 2 (June 1997): 133-149 and Jean-Jacques Laffont, Patrick Rey, and Jean Tirole, "Competition Between Telecommunications Operators," *European Economic Review* 41, no. 3-5, (April 1997): 701-711.

Note that the compensation game can be played in two directions. In the early days of implementation of the 1996 Act, ILECs favored reciprocal compensation for local traffic, while CLECs tended to favor bill-and-keep arrangements. Recently, however, some CLECs have built a business strategy around serving internet service providers (ISPs) whose traffic is almost completely terminating. This has put the ILECs in the uncomfortable position of having to pay call termination charges to competitors from whom they receive few offsetting payments. To exacerbate the situation, flat-rate pricing of local residential service keeps them from collecting from originating customers. This has created an issue for the ILECs and some state regulators, since the FCC ruled that such traffic is interstate in nature but still subject to existing reciprocal local compensation agreements or rules.

output.[30] Even if such strategies do not completely deter entry, however, the ILEC's actions will influence the potential competitors' input and output decisions in a manner not consistent with a competitive market.

State commission oversight of interconnection, UNE, and resale pricing is important to prevent ILECs from engaging in entry deterrence. The prices chosen are crucial if an efficient allocation of resources is to result. One view is that:

> This involves, among other things, creating proper
>
> conditions for entry into the competitive segment while not inducing excessive entry, not expropriating previous investments or discouraging future ones in the monopolized segment, and not generating inefficient bypass.[31]

Regulators have a difficult task. If UNE and/or resale prices are too high, competition will be slow to develop, because entry via resale and UNEs will be delayed. In addition, excessive investment in duplicate networks will be promoted. On the other hand, if UNE and/or resale prices are too low, true facilities-based competition will be slow to emerge because CLECs will have weak incentives to build their own networks. Moreover, under this scenario the ILEC might have weak incentives to upgrade its network.[32] Indeed, an iterative

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[30]Trevor Roycroft, "A Dynamic Model of Incumbent LEC Response to Entry Under the Terms of the Telecommunications Act of 1996," *Journal of Regulatory Economics* 14, no. 3 (November 1998): 211-227.

[31]Jean-Jacques Laffont and Jean 6 "Creating Competition Through Interconnection: Theory and Practice," *Journal of Regulatory Economics* 10, no. 3 (November 1995): 227-256, at 227.

[32]The question of incentives is not an easy issue. For example, some ILECs have argued that they lack incentives to deploy advanced capabilities if they must provide them to their competitors on a nondiscriminatory basis under the unbundling or

(continued...)

regulatory approach might be called for. Under this approach, UNE and resale prices are set and the extent and type of competitive entry is monitored to see whether a change should be made.

State commissions should not ignore the potential for entry deterrence behavior, as there is evidence across industries of attempted entry deterrence. It is, however, important to understand that such strategies are not likely to have long-term success given the state and federal policy commitment to promote competition. Nevertheless, state commissions should keep a watchful eye for possible entry deterrence behavior, especially relative to pricing of essential facilities. Possible pricing restrictions include incremental cost-based price floors for the retail prices of competitive services, incremental cost-based rates for essential interconnection services and UNEs provided to competitors, and imputation tests to ensure that the ILEC's retail rates cover the UNE rates it charges its competitors. There are also non-price issues, and state commissions should monitor carrier-to-carrier service quality provided by the ILEC and such other nonprice factors as provision of OSS and collocation arrangements to ensure that they continue to meet nondiscrimination standards.[33]

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[32](...continued)
resale requirements of the 1996 Act. On the other hand, there is some concern that if ILECs (or their affiliates) are allowed to build advanced networks that are not subject to unbundling and resale provisions, the public switched telephone network (PSTN) could eventually become a technological laggard and virtually useless.

[33]Some strategies employed to deter entry when a firm competes with its customers are discussed in Nicholas Economides, "The Incentive for Non-Price Discrimination by an Input Monopolist," *International Journal of Industrial Organization* 16, no. 3 (May 1998): 271-84.

There is at least one further feature of local telephone markets and the 1996 Act that merits attention. The Bell Operating Companies (BOCs) were excluded from providing inter-LATA service by the line-of-business restrictions imposed at the time of the AT&T Divestiture. Section 271 of the 1996 Act[34] provides that BOCs may petition the FCC for permission to enter the in-region inter-LATA toll market on a state-by-state basis, but they have the burden of demonstrating that their local markets are open to competition. Thus, the ILECs serving approximately four-fifths of the country's telephones have a positive incentive not to engage in entry deterrence. There has been considerable debate as to whether they have had the welcome mat out for competitors. Not unexpectedly, a recent FCC study found that entry was more likely in large urban markets. However, even when market size factors were accounted for, facilities-based entry was more likely in BOC service areas. This may provide some support for the hypothesis that the carrot contained in Section 271 is having the desired result.[35]

EMERGING COMPETITIVE MARKETS

State and federal telecommunication policies are pro-competitive, and competition in local telephone markets is emerging, albeit slowly. As competition emerges, the predictions derived from models assuming the existence of a monopoly become less useful. State commissions will need new analytical tools to assess the behavior or conduct of participants in the new

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[34]47 U.S.C. 271.

[35]See James Zolnierek, James Eisner, and Ellen Burton, *An Empirical Examination of Entry Patterns in Local Telephone Markets* (Washington, D.C.: FCC Common Carrier Bureau, Industry Analysis Division, August 23, 1999).

environment. The dominant firm-competitive fringe model fills the gap between monopoly and oligopoly models.[36]

The Dominant Firm-Competitive Fringe Model

Although the dominant firm-competitive fringe model is applied mainly to markets with a single large firm and a group of small firms, it is also applicable to markets with a group of firms acting in concert and a group of small, uncoordinated firms. The model assumes that entry has occurred and that the dominant firm takes no explicit action to deter further entry. The dominant firm's control of a large market share results because of its competitive advantages. Often, *the dominant firm's competitive advantages are associated with its status as the first mover*. By entering the market early, the dominant firm acquires cost advantages through economies of scale and learning-by-doing, and it may acquire consumer goodwill or "brand-name capital" through long-term involvement with customers or through advertising.[37]

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[36] Many industrial organization textbooks include a discussion of the dominant firm-competitive fringe model. For a more in-depth treatment, see Carlton and Perloff, *Modern Industrial Organization,* 157-169.

[37]Strictly speaking, brand name capital does not result in a cost advantage. Nevertheless, entrants may have to expend resources to acquire their own brand name capital or to overcome the incumbent's brand name capital, so the effect of historic investments in these assets may result in something analogous to a cost advantage.
Note also that, although advantages may result from early commitment to a market, there may also be advantages to entering a market partially or late, especially if the technology is in flux or if the size and growth of the market is uncertain. Considerable work has recently been done regarding the advantages of waiting or not making a full commitment initially. Such topics are considered in recent work on "real options theory." See Avinash K. Dixit and Robert S. Pindyck, *Investment Under Uncertainty* (Princeton, NJ: Princeton University Press, 1994), and Martha Amram and Nalin Kulatilaka, *Real Options: Managing Strategic Investment in an Uncertain World*

The competitive fringe firms are much smaller in scale than the dominant firm.[38] While each competitive fringe firm supplies a relatively small segment of the overall market demand, collectively *the competitive fringe can control a sizeable segment of market share.* The competitive fringe firms lack the competitive advantages the dominant firm possesses, often because of their later market entry. The structure assumed in the dominant firm-competitive fringe model shares many characteristics with the current and emerging local telephone industry in which the ILEC has the vast majority of customers and CLECs are just becoming established.

The dominant firm and competitive fringe firms are assumed to behave differently. The difference in behavior is a direct result of the dominant firm's competitive and market share advantages (possibly arising from history or incumbency) and the profit maximizing opportunities of all firms. The dominant firm is often assumed to have accurate information on the costs of the competitive fringe firms. Given information on the fringe firms' costs, the dominant firm can predict fringe supply at different prices and make its output and pricing decisions accordingly. As the name implies, competitive fringe firms behave as though they were in a competitive market. Each fringe firm is a price

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[37](...continued)
(Boston: Harvard Business School Press, 1999). One of the lessons derived from this literature is that few decisions are "all or nothing," and that incremental or reversible actions may be preferable to irreversible actions. These notions may also contain lessons for regulators and other policy makers.

[38] The central criterion for a competitive fringe firm is that it individually produces a small share of the relevant market supply. This does not preclude a large firm (for example, AT&T) from being classified as a competitive fringe firm in markets where it does not possess competitive advantages and thus has a relatively small market share (as it currently has in local telephone markets).

taker, and each fringe firm chooses its output so that its marginal cost equals the market price, P, which it takes as given.[39]

The competitive fringe's aggregate supply function, S^F, is the horizontal summation of the individual competitive fringe firms' supply functions. This aggregate fringe supply determines the portion of market demand that the dominant firm expects the competitive fringe to serve. S^F is the sum of individual fringe firms' supplies – determined by their individual marginal costs in the sense that each fringe firm will supply the level of output for which its marginal cost equals the market price, which it takes as given.[40]

The dominant firm behaves as a monopolist over its residual demand, D^R. In this instance, D^R is market demand, D, less aggregate competitive fringe

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[39]If firm i is a member of the competitive fringe, it will choose its output so that $MC(q_i^F) = P$, where P is the market price of output, which it takes as given. If its marginal cost increases with output, firm i's profit-maximizing output will be a nondecreasing function of market price, so we may also write: $q_i^F = q_i(P)$ and $\partial q_i/\partial P \geq 0$. These expressions express the concept that firm i's desired output is a function of market price and its desired output will not decrease as market price increases.

In addition, firm i will produce no output if it cannot recover at least its short-run marginal cost, so that $q_i^F = 0$ if $P < \min(MC_i)$. In this case, firm i would be better off producing zero output than producing any positive amount.

There is one caveat to these assumptions: A firm *might* stay in a market for a short-time, even though it incurs losses, if it believes that its long-run interests are served by doing so. This could happen if the firm believes that its costs will decline or that price will increase sufficiently to provide current operating profits and allow for recovery of the accumulated short-run loss.

[40]Each fringe firm acts as if it faces a horizontal (infinitely elastic) demand curve at the market price set by the dominant firm.

supply S^F, so that D^R is the portion of market demand not served by the competitive fringe at various prices, and $D^R = D - S^F$.[41]

To maximize its profits, the dominant firm will produce the quantity that equates its marginal revenue, derived from the residual demand function, and its marginal cost. And it will set the market price based on the residual demand function. Thus, the dominant firm is a price maker and the extent of its market power is determined by the residual demand function. This has important implications for the degree of market power present in the market.

In the dominant firm-competitive fringe model, the dominant firm and the competitive fringe behave in an interdependent manner, incorporating each other's best response function into their strategic decisions. In particular, *the dominant firm makes its price and output decision based on the anticipated response of the competitive fringe.* If the dominant firm's beliefs about the fringe's response is correct, the result may be a Nash Equilibrium in the sense that both the dominant firm and the competitive fringe are carrying out their best strategy given the other's behavior, even though the dominant firm and the competitive fringe firms are not cooperating.[42]

Figure 2 illustrates the dominant firm-competitive fringe framework. Consider the competitive fringe's response. Fringe firms are price takers in the sense that they respond to the price set by the dominant firm. Thus, the

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[41]Note that S^F is the level of supply the dominant firms expect the fringe to supply at various prices. It is implicitly assumed that the dominant firm has good information on market demand as well as fringe costs, which determine their behavior.

[42]The Nash Equilibrium concept comes from game theory. In the current setting, the dominant firm and the competitive fringe may be viewed as participants in a market game. The behavior of the dominant firm and the competitive fringe results in a Nash Equilibrium if none of the participants has an incentive to change her behavior unless another player changes her behavior. A Nash Equilibrium represents a "no regrets" situation in which no player believes she can do better given the behavior of the other players.

Competitive Fringe   Dominant Firm
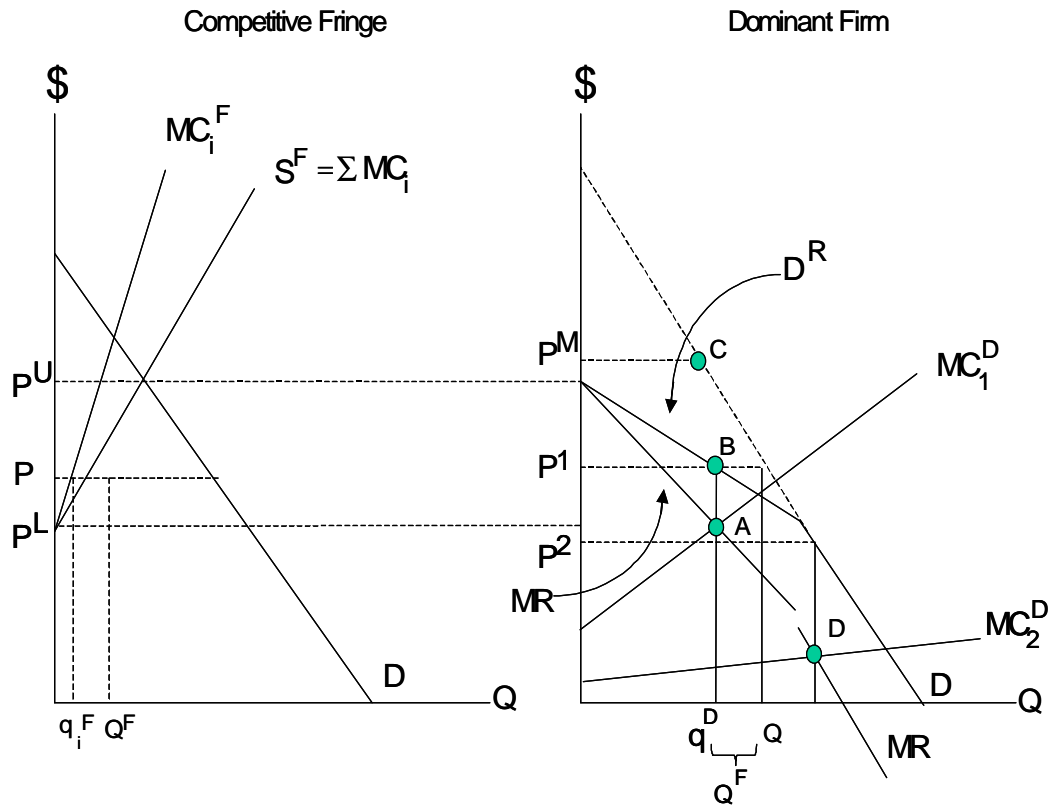
Figure 2. Dominant firm – competitive fringe framework.

competitive fringe's best response is to supply no output when price is below P_L, serve a portion of market demand if price is between P_L and P^U [43], and serve the entire market demand if price is above P^U. This is represented by the intersection of S^F and the market demand curve, *D.* [44] At P, each competitive

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[43]Below P_L, the competitive fringe's best response is to supply no output because the price is below short-run marginal cost, and the competitive fringe consistently incurs losses.

[44]This outcome is an artifact of the model and would likely not occur in the current local telephone industry, because the competitive fringe, even in total, does not

fringe firm's best response is to supply $q_i{}^F$ and the aggregate competitive fringe supply will be Q^F. [45]

In the dominant firm-competitive fringe model, the dominant firm must also develop best responses to the competitive fringe's behavior. This is reflected in the kinked demand curve. For prices below P_L the fringe will supply no output, and the dominant firm need consider only the market demand function, *D.* At prices between P_L and P^U, however, the dominant firm must consider the residual demand function D^R, which is flatter (that is, exhibits greater price elasticity) than the market demand function, because the competitive fringe is now supplying part of the market demand. In fact, at prices above P^U, the fringe would serve the entire market demand. Note that the existence of a kinked demand function creates a discontinuous marginal revenue function, MR.

First, consider a dominant firm with a relatively high marginal cost function $MC^D{}_1$. This marginal cost function is lower and flatter than the marginal cost function for the representative competitive fringe firm, reflecting the dominant firm's cost advantages arising from economies of scale and scope. The dominant firm will maximize profits by equating its marginal revenue and marginal cost at point A. Thus, the dominant firm will select P^1 and supply q^D based on the residual demand function. At price P^1, total demand is Q, with the competitive fringe supplying Q^F and the dominant firm supplying $q^D = Q - Q^F$.

Now, consider a dominant firm with a relatively low marginal cost function $MC^D{}_2$. In this case, the dominant firm has a substantial cost advantage

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[44](...continued)
possess sufficient capacity to serve the entire market.

[45]An implicit assumption in this example is that all fringe firms have identical cost structures. The model is easily revised to allow fringe firms to have heterogeneous costs.

vis-a-vis the competitive fringe. Again equating marginal revenue and marginal cost, the dominant firm's profit-maximizing price will be P^2. In this case, the dominant firm behaves as a monopolist, since P^2 is below P_L. The competitive fringe supplies no output, and the dominant firm need consider only the market demand function, D. This is a natural monopoly outcome consistent with Figure 2: Fringe entry is not feasible since the dominant firm's cost advantages allow it to exclude competition and continue to earn monopoly profits.[46]

The dominant firm-competitive fringe model is an appropriate mechanism to analyze the current local telephone industry. *While entry and competition are emerging, the market participants are clearly not equals*. The ILECs are dominant firms and possess competitive advantages arising from years of monopoly provision. The competitive advantages include lower costs and brand-name recognition. The resale and unbundling requirements imposed on ILECs recognize this asymmetry. The competitors entering the local telephone industry are far smaller than the ILECs, at least in their local telephone operations. As such, because they lack the accumulated operating knowledge and economies of scale, these competitors likely have higher costs and have lower brand-name recognition.[47] The only exception would be the incursion of one ILEC into another ILEC's territory; this would more closely involve competition between equals, and the original ILEC in a location might have a

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[46]The possibility of this outcome is one justification for the unbundling and resale provisions contained in the 1996 Act.

[47]It should be noted that large, well-established entrants may bring their own brand-name capital from other markets. As an example, there is anecdotal evidence that some consumers identify AT&T as their phone company, although AT&T has not provided local telephone service since 1983. Brand-name capital may be a two-edged sword: If a firm has a reputation for providing poor customer service or being unresponsive, it may have accumulated "ill will" rather than goodwill, and customers may be eager to switch to an alternative provider.

home-field advantage.[48] However, minimal cross-territory incursions have occurred to date.[49] Thus, the dominant firm-competitive fringe model appears applicable to the local telephone industry at present, and it can be used by state commissions to understand the behavior or conduct of market participants in the current and emerging environment.

<u>Market Power in the Dominant-Fringe Model</u>

How does the dominant firm-competitive fringe model relate to market power? By definition, competitive fringe firms possess no market power, because each fringe firm supplies a quantity, q_i^F, such that its marginal cost equals price. In contrast, the dominant firm generally retains *some* degree of market power. Nevertheless, because it must incorporate the competitive fringe's response to its actions, the dominant firm's market power will be reduced. This is reflected in the fact that residual demand function, D^R, is flatter or more elastic than the market demand function, D, at prices above P_L.

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[48]This could lead to a duopoly (two firms), a special case of oligopoly (few firms), which is discussed below.

[49]One condition imposed on the recent SBC/Ameritech merger is that within 30 months of the merger closing date the combined firm will enter at least 30 major markets outside SBC's and Ameritech's incumbent service area as a facilities-based provider of local telecommunications services to business and residential customers. See FCC 99-279, "Memorandum Opinion & Order," in CC Docket 98-141, <u>In re Applications of Ameritech Corp. and SBC Communications Inc. for Consent to Transfer Control of Corporations Holding Commission Licenses and Lines</u> (October 8, 1999), Para 398.
These commitments made by SBC and Ameritech to obtain FCC merger approval will increase the extent of this form of competition and may encourage other ILECs to expand their out-of-area CLEC activities as well.

Consider the dominant firm supplying q^D. Here, the dominant firm's market power is illustrated by the vertical distance between price, point B, and marginal cost, point A. If there were no competitive fringe, the dominant firm would set price at P^M (see Figure 2), resulting in a greater spread between price and marginal cost. Thus, the presence of the competitive fringe lessens the dominant firm's market power. Notice that greater competitive fringe supply will further flatten the dominant firm's residual demand function and reduce its market power.[50] This scenario does not hold if the dominant firm possesses significant cost advantages. With the marginal cost function MC^D_2, the dominant firm possesses full market power because it can sustain a monopoly price that is below the level necessary to support competitive fringe entry. Again, this result is consistent with Figure 2.

The dominant firm-competitive fringe model can provide state commissions with several insights regarding market power in the local telephone industry. First, if the ILEC possesses significant cost advantages compared with entrants, market power problems are likely to remain. Competitive fringe supply, if any, will be insufficient to substantially reduce the ILEC's residual demand function. This implies minimal change in the ILEC's market power. In this instance, some form of economic regulation (for example, price cap regulation) will remain important to rein in ILEC market power. Second, if the ILEC's cost advantages are not significant and decline as the competitive fringe firms become established in the market, the dominant firm's market power will be reduced.

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[50]Some versions of the dominant firm-competitive fringe model allow for additional fringe entry. If there are n fringe firms with identical costs, total fringe supply, S^F, will equal n times the individual fringe firm's supply, s_i^F. As the number of fringe firms increases, S^F will shift to the right and become more elastic (flatter). Moreover, if entry is easy, the dominant firm will have to consider the behavior of *potential* entrants as well as established fringe firms in making its decision.

The rate at which the dominant firm's market power will decline depends on the size of the competitive fringe, which depends on the fringe firms' ability to become cost competitive through economies of scale and learning-by-doing as well as by developing their own consumer goodwill. Total fringe supply will increase as entrants become more numerous, more cost competitive, and develop their own goodwill. This will lower the ILEC's residual demand function and erode the ILEC's market power. State commission policies on competitive entry, pricing, and conduct that encourage competitors to enter and quickly become cost competitive and known to consumers will increase the likelihood that the competitive fringe will significantly reduce the ILEC's market power. These policies will be asymmetric in the sense that the ILEC may operate under more restrictions than its competitors for some time.[51] To the extent that the asymmetries reflect differences in market power, they are reasonable. However, as competition becomes more established and the special position of the ILECs becomes less of an advantage, the degree of asymmetry may be reduced.

The Structural Separation or Divestiture Option

The dominant firm-competitive fringe situation is complicated in local exchange markets because the ILEC is both wholesale supplier to and retail competitor with the CLECs. Although the 1996 Act, as well as federal and state policy toward local competition, has attempted to create a level or

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[51]The interconnection, unbundling, and collocation requirements imposed on ILECs by Section 251(c) of the 1996 Act and by FCC and state commission implementations of those provisions represent asymmetric treatment reflecting the fact that ILECs have market power and entrants do not. For some discussion of asymmetric quality-of-service obligations, see Michael Clements, *Quality-of-Service and Market Implications of Asymmetric Standards in Telecommunications* (Columbus, OH: The National Regulatory Research Institute, October 1998).

nondiscriminatory playing field that is pro-competitive, there may be some question as to whether nondiscriminatory interconnection and access pricing rules, unbundling requirements, and codes of conduct will be sufficiently strong to lead to the efficient level of competition. To a certain extent time will tell, since we are in the midst of an experiment in bringing competition into formerly monopolized markets. Nevertheless, it might be necessary to consider whether a vertically integrated ILEC can be truly even handed in its wholesale dealings with its retail competitors. If it cannot do so, or if the ILEC's vertical integration inhibits the development of retail competition, it may become necessary to separate the functions.[52] The important principle is that structural separation arrangements reduce or eliminate incentives for the loop owner to discriminate for or against service providers. One approach would create an entity to own the last-mile bottleneck facilities or local loop. The "LoopCo" would be restricted to providing access to the loop to any authorized service provider, or "ServeCo," but it would not offer retail services of its own, other than loop access. The cost of loop access could be charged either to ServeCos or to end users, and those charges would continue to be regulated so long as the loop is a bottleneck

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[52]Both antitrust and regulation approaches to controlling market power have relied upon conduct remedies (nondiscriminatory access and pricing rules, for example) and structural remedies (divestiture and line-of-business restrictions, for example). Whether overall welfare is higher when a vertically-integrated firm is allowed to act as the wholesale supplier to its retail competitors or when separation of retail and wholesale functions is required, is a complex question. The results are ambiguous and depend on cost and demand conditions in the wholesale and retail markets. There are likely to be incentives for the integrated monopolist to raise its retail competitors' costs by manipulating wholesale prices or quality of service provided to its retail competitors. This problem may be exacerbated by information asymmetry, product differentiation, and difficulties regulators face in monitoring and enforcing compliance with conduct rules. See John Vickers, "Competition and Regulation in Vertically Related Markets," *The Review of Economic Studies*, 62, no. 1 (January 1995): 1-17; Jean-Jacques Laffont and Jean Tirole, "Creating Competition Through Interconnection: Theory and Practice," Journal of Regulatory Economics 10, no. 3 (November 1996): 227-256; and Jean-Jacques Laffont and Jean Tirole, *Competition in Telecommunications* (Cambridge, Massachusetts: The MIT Press, 2000), 80-84 and 97-178.

facility. Another approach would transfer ownership of the loop to customers, who would determine which service providers to connect to.[53]

Such steps should not be taken lightly, as economies of scope and coordination would be lost.[54] However, if competition does not develop under a vertically-integrated situation, it might be useful to consider the structural separation option, and state regulators might wish to keep structural separation as an arrow in their policy quivers. The AT&T Divestiture can be used as one model, but there are others, including one that is operational and two that have been proposed.

<u>The Rochester Plan</u>

In 1994, the New York Public Service Commission approved the Open Market Plan under which Frontier Telephone of Rochester separated its local exchange operations in Rochester into retail and wholesale functions and fully opened its local telephone franchise to competition on January 1, 1995. The then-existing operating LEC was subdivided into: (1) a price cap-regulated network operating company that retained the Rochester Telephone Corp. name and offered wholesale network services; and (2) a lightly regulated retail service provider, Frontier Communications of Rochester, Inc. Both the wholesale and retail operations became part of a new holding company named Frontier Corp.

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[53]See P.B. Schecter, "Customer Ownership of the Local Loop: A Solution to the Problem of Interconnection," *Telecommunications Policy* 20, no. 8 (October 1996): 573-84.

[54]See the discussion in Edwin A. Rosenberg, Carl E. Hunt, John D. Borrows, Rohan Samarajiva, and William P. Pollard, *Regional Telephone Holding Companies: Structures, Affiliate Transactions, and Regulatory Options* (Columbus, OH: The National Regulatory Research Institute, March 1993).

Rochester Telephone was required to open its network to full CLEC interconnection. Other affiliates, IXC operations, adopted variants of the Frontier name.[55] At the end of 1998, the New York Public Service Commission reported that CLECs served 4 percent of lines and generated 10 percent of revenues in the Rochester area, and 44 percent of CLEC lines were facilities-based.[56]

<u>The Pennsylvania Public Utility Commission's</u>
<u>Global Telecommunications Order</u> [57]

The Pennsylvania Commission recently ordered Bell Atlantic-Pennsylvania (BA-PA) to structurally separate its network functions from its retail functions.[58] In addition, the *Order* requires BA-PA's retail arm to follow the same procedures as CLECs in accessing the wholesale unit's network. The PUC was led to this action because BA-PA controlled more than 90 percent of

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[55]See "Shareowners OK Rochester Tel 'Open Market Plan'; AT&T to Resell Local Services, Seeks Rehearing," *Telecommunications Reports,* December 26, 1994; and "Rochester Tel's 'Open Market Plan' Approved in New York; Telco's Rates Will Drop by $21 Million over Seven Years," *Telecommunications Reports,* October 17, 1994.

[56]See New York Public Service Commission, *Analysis of Local Exchange Service Competition in New York State, Reflecting Company Reported Data and Statistics as of December 31, 1998*, accessed at http://www.dps.state.ny.us/telanalysis.htm January 6, 2000. Of note is the fact that a CLEC (Teleport Communications Group) was serving the fourth greatest number of lines and had the third highest revenues in the state. See Ibid., 5-8.

[57]See Pennsylvania Public Utility Commission, *Order and Opinion in Dockets P-00991648 and P-00991649* (entered September 30, 1999), Section XVI. See also, Brian Hammond and Lynn Stanton, "Bell Atlantic To Appeal 'Radical' Pennsylvania Ruling Requiring Wholesale-Retail Split, UNE Rate Reductions," *Telecommunications Reports* 65, no. 35 (August 30, 1999).

[58]The PUC's *Order* did not follow the AT&T Divestiture model in requiring full divestiture, but it did require that the functions be offered by separate subsidiaries.

the local retail service market and controlled bottleneck facilities such as local loops and switches. The PUC expressed a belief that structural separation was the most efficient means of opening and maintaining truly competitive local exchange markets. In its *Order*, the PUC stated that:

> The functional/structural separation issue arises because of BA-PA's dual role as both supplier and competitor to other local exchange carriers who must rely on BA-PA for the ordering, provisioning, maintenance, and operation of network elements that BA-PA's competitors need to provide their own local services to customers. If the potential conflict of interest created by this dual role is not adequately addressed, an unlevel playing field will be created, which will severely hamper the development of a new, vibrant and effective competitive telecommunications market in Pennsylvania.[59]

> . . . we conclude that structural separation is the most efficient tool to ensure local telephone competition where a large incumbent monopoly controls the market. The record in this proceeding shows that BA-PA controls over 90% of the local exchange access lines in its service territory at this time, and continues to control bottleneck facilities in most, if not virtually all, local exchange markets where it currently operates. This overwhelming competitive presence and concomitant ability to exercise market power, including the ability to provide itself with anticompetitive cross-subsidies and the opportunity and incentive to discriminate against competing telecommunications carriers in the provision of wholesale services, strongly supports our conclusion that structural separation is necessary . . . .[60]

> . . . the effect of this structural separation requirement is to remove barriers to entry by creating a level playing field for all LECs, including BA-PA's own retail operations, in

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[59]Pennsylvania Public Utility Commission, *Order and Opinion* in Dockets P-00991648 and P-00991649 (entered September 30, 1999), Section XVI, A.

[60]Ibid., Section XVI, C. 1., footnote omitted.

obtaining necessary services from BA-PA's wholesale
operations on a nondiscriminatory basis.[61]

Subsequently, Bell Atlantic appealed the *Order* then proposed a
compromise that would keep it from having to implement the *Order's* structural
separations provisions. [62] Under the proposed compromise, Bell Atlantic would
wall off its high-speed data services in a separate business affiliate, but it would
not have to split retail from wholesale functions.[63] Nevertheless, the
Pennsylvania Commission's concerns are well worth noting.

<u>The LCI Proposal</u>

In 1998, LCI proposed a form of partial divestiture or spin-off of the
wholesale from the retail operations of the BOCs.[64] The LCI plan was claimed
to speed the process of opening local exchange markets so that the BOCs
could gain inter-LATA service permission under Section 271. Under LCI's plan,
the regional holding companies would split their wholesale network functions
from their retail service functions. In addition, via a partial spin-off, the public
would be allowed to purchase a substantial portion of the stock in the retail
service company. This partial public ownership of the retail service company

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[61]Ibid.

[62]See "BA Offers Pa. Competition Compromise if PUC Lifts Structural
Separation Requirement," *State Telephone Regulation Report* 18, no. 2 (January 21,
2000).

[63]See "Pennsylvania PUC Can't OK Proposed Change To Order Splitting Bell
Atlantic Ops, AT&T Says," *Telecommunications Reports* 66 no. 4 (January 24, 2000).
and "Pennsylvania Court Retains Jurisdiction over `Global' Order," *Telecommunications
Reports* 66, no. 6 (February 7.2000).

[64]See *Petition of LCI International Telecom Corp. for Expedited Declaratory
Rulings*, filed with the Federal Communications Commission, January 22, 1998.

would enhance the arms-length nature of the relationship between retail and wholesale functions without requiring total divestiture.

OLIGOPOLY MARKETS

The term *oligopoly* signifies a market structure in which a few firms serve the entire market or the great majority of it.[65] Unlike the dominant firm - competitive fringe model discussed above, an oligopoly generally has no single dominant firm. Instead, the market is made up of a few firms, each of which recognizes that they are interdependent in the sense that (1) each firm believes its actions affect market price and (2) it must take other firms' reactions into account when predicting the result of changes in the price or quantity of its output.[66]

This situation differs from either competition or monopoly. Under competition, rivalry is anonymous: competitors do not feel that their individual actions affect market price.[67] Similarly, a monopolist has no close rivals whose

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[65]Some oligopoly models allow for a few large firms to behave as oligopolists and a fringe of small firms behaving as competitors. Each oligopolist believes that its actions influence price, and it must consider the reaction of the other oligopolists when making decisions. As in the dominant firm - competitive fringe model, fringe firms, individually, take market prices as given.

[66]For a discussion of various models of oligopoly behavior, see James W. Friedman, *Oligopoly Theory* (New York: Cambridge University Press, 1983).

[67]Agricultural markets are often used as examples of anonymous rivalry or competition. Neighboring farmers are competitors, but they do not generally view each other as rivals. In fact, neighboring farmers often share equipment and help with planting or harvesting, and whether a neighbor has a good or bad crop is not seen as affecting your own prospects.

reactions must be considered when making decisions.[68] *In an oligopoly environment, strategic actions become crucial because of the interdependence among firms.* There are many models of oligopoly behavior, and oligopolies are often characterized by forms of price and non-price competition. Price competition may lead to price wars, which may cause some producers to exit the market or merge with other producers to strengthen their position. Non-price competition strategies include product differentiation and advertising campaigns. If risk-adjusted profit rates are high[69] in an oligopoly, and there are no significant entry barriers, new firms would be expected to move the industry towards competition or a looser oligopoly. However, some industries might be "natural oligopolies" in which an entrant would have to capture a large market share before the minimum efficient scale of production is approached. Existing oligopolists might attempt to deter entry, but such strategies are not likely to be successful unless the incumbent firms have some form of cost advantage over potential entrants.

As noted above, the major distinguishing feature of an oligopoly is the high combined market share of a few firms. In fact, some industries have four-firm concentration ratios in excess of 75 percent.[70] A number of industries are viewed as oligopolies including the cereal, beer, airline, automobile, and cigarette industries. As it has developed since divestiture, the long-distance

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[68]A monopolist may consider the prices, availability, and closeness of substitute products when making decisions, but it does not have to consider the strategic reactions of other firms.

[69]Profit rates would be considered to be "high" if the rate of return on invested capital in an industry is greater than in other industries after considering the riskiness of the various industries.

[70]See, for example, Carlton and Perloff, *Modern Industrial Organization*, Table 9.5 (page 345), which presents information derived from the 1987 *Census of Manufacturers*.

telephone industry in the United States has the appearance of an oligopoly. Indeed, the three largest carriers have a combined market share of nearly eighty percent. The 1984 and 1998 market shares for the long-distance carriers are shown in Table 1.[71]

A major feature of an oligopoly is that each firm considers its opponent's response to any strategy it contemplates. While the emerging competitive model best describes the *current* local telephone industry, a transformation similar to that witnessed in the long-distance industry could bring oligopoly characteristics to the local telephone industry. For example, through its purchase of TCI and MediaOne, AT&T is positioning itself to provide local telephone service, along with a bundle of other services.[72] This could well usher in an oligopoly environment, with AT&T and ILECs dominating many local telephone markets. Thus, an understanding of oligopoly markets is important for the analysis of market power in the *future* local telephone industry.

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[71]Market shares are calculated from total U.S. toll service revenues for long-distance carriers only. See *Trends in Telephone Service* (Washington, D.C.: Federal Communications Commission, Common Carrier Bureau, Industry Analysis Division, September 1999), Table 11.3.

Market shares can also be calculated using data on minutes of use or number of presubscribed lines. For example, in 1998 AT&T had 51.9% of total interstate switched access minutes, 45.9% of interstate switched terminating minutes, and 63.3% of presubscribed lines. See James Zolnierek, Katie Rangos, and James Eisner, *Long Distance Market Shares Fourth Quarter 1998*, (Washington, D.C.: Federal Communications Commission, Common Carrier Bureau, Industry Analysis Division, March 1999), Tables 3.2., and 2.2. (The minutes-of-use share is for 1998; the presubscribed line share is for December 1996 – the last year for which that data was available.)

[72]Paul Farhi, "AT&T Poised to Regain Long Reach, Via Cable," *The Washington Post*, May 6, 1999, page A1.

Table 1 Long-distance Carrier Market Shares (based on toll service revenues)		
Carrier	1984	1998
AT&T	90.1%	43.1%
MCI WorldCom	4.5%	25.6%
Sprint	2.7%	10.5%
All Other Carriers	2.6%	20.8%

Source: FCC*, Trends in Telephone Service September 1999*, Table 11-3 (1998 data) and Zolnierek, Rangos, and Eisner, *Long Distance Market Shares Fourth Quarter 1998*, Table 3-2 (1984 data).

There are many models that can be applied to oligopoly markets, with each model imposing different assumptions or rules of play. Models differ with regard to the firms' primary strategic decision variable: the most common models involve choosing either prices or quantities, but other strategic variables (advertising expenditures, product differentiation, or quality) may be used. Models also differ in their sequence of play: some assume that all firms make simultaneous decisions; others assume a sequential-move pattern. Models may also differ with respect to the assumed time horizon: some models assume a single decision period; others assume multiple or infinite time periods. Models also differ with respect to the number and identity of the firms in the market. Finally, models may differ with respect to the amount of information each firm has: all firms could have the same information; some firms could have more complete information than others. The behavioral predictions derived from application of the model depend on the assumptions made, so it is important to use oligopoly models that correspond with the specific environment under consideration.

Price Competition

Although firms may compete using many strategic variables (quantity, quality, or features, for example), prices are one of the most common attributes. Thus, it is important to understand price competition when evaluating market power. Prices are strategic complements. This means that an aggressive action, or an accommodating action, taken by one firm will induce a similar response by its competitors.[73] For example, an aggressive action such as a price decrease by firm A will induce its competitors to decrease their prices also. This has important implications for the type of behavior state commissions should expect to see.

<u>The Bertrand Model</u>

The basic Bertrand model is a simultaneous move price game that is one of the more common price competition or rivalry models. Firms are assumed to provide a homogeneous good, and each firm is assumed to have sufficient capacity to serve the entire market demand. Firms select their prices simultaneously, and they do know their rivals' prices before selecting their own. Each firm must incorporate its expectations or beliefs about its rivals' prices when setting its own price. Since the goods are homogeneous, demand will converge on the firm, or group of firms, that selects the lowest price, P_{MIN}, and firms that set their price above P_{MIN} will sell no output. If a single firm has the

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[73] Jean Tirole, *The Theory of Industrial Organization* (Cambridge, MA: MIT Press, 1988), 207-208.

lowest price, it will capture the entire market. If multiple firms select P_{MIN}, they will split the market equally.

There are two main scenarios in the basic Bertrand model. In the first scenario, firms are homogeneous in the sense that no firm possesses a cost advantage over its rivals. In the second scenario, one or more firms do possesses a cost advantage. The Nash Equilibrium in the first scenario is marginal cost pricing, implying that no firm has market power. This outcome is easily seen by examining the firms' price decision. Because profit maximization is an assumed goal, each firm would set its price to cover its marginal cost. No firm will price *below* its marginal cost, as this would lead to continual losses. Moreover, because demand converges to the firm, or group of firms, with the lowest price, prices above marginal cost are not sustainable. Thus, firms have an incentive to undercut any price above their marginal cost. Each firm will have an incentive to undercut its rivals and capture the entire market demand. Since all firms are assumed to understand this and incorporate their beliefs regarding their rivals' prices into their decision, each firm will set its price at its marginal cost.

High-cost firms will never select a price below their marginal cost as this is not consistent with maximizing their profits. Therefore, the low-cost firm can profitably select a price above its own marginal cost but slightly below the high-cost firms' marginal cost. By doing this, the low-cost firm will capture the entire market and earn a profit on each unit sold. Thus, *the low-cost firm will have market power, but its ability to exercise or exploit that power will be limited by the existence of high-cost firms that would capture all or part of market demand if its price is too high*.

The basic Bertrand model has profound implications. In the first scenario, the Nash Equilibrium is marginal cost pricing, and no firm – or group of firms – can exercise market power. Indeed, market power will pose no problem

when at least two firms are present.[74] Should a comparable firm (for example, AT&T or MCI WorldCom) join the ILECs in local telephone markets, the basic Bertrand model posits that the ILECs' market power will quickly evaporate.[75] In the second scenario, price will be between the low-cost firm's marginal cost and the high-cost firm's marginal cost. This implies some market power is being exercised. However, unless the cost advantages are significant, market power will be limited because the high-cost firm's marginal cost serves as a price ceiling.[76] *The threat of supply from high-cost firms keeps the low-cost firms in check in a manner similar to price cap regulation or the theory of contestable markets.*

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[74]The firms might recognize that they could maximize *total* profits and jointly choose prices above marginal cost. This would involve overt or tacit cooperation between them. However, the desire of each firm to maximize its own profits would provide an incentive to "cheat" or defect, and neither firm could trust the other to stick with the cooperative strategy. This is a version of the "prisoners' dilemma" game in which cooperation would be mutually and jointly beneficial, but short-run considerations lead to non-cooperative behavior. Cooperation becomes more likely the greater the number of times the game is to be repeated. See Carlton and Perloff, *Modern Industrial Organization*, 254-262.

[75]Unlike the dominant firm-competitive fringe model, this assumes that AT&T would enter with sufficient presence or capacity to be an "equal."

[76]If one firm has significant cost advantages over its rivals, it may be useful to consider the cause of advantages. Cost advantages resulting from greater efficiency or better management cause no problems. Advantages that result from the ability to shift costs from more to less competitive products may require policy intervention. In addition, because facilities-based competition might initially be slowed by cost differences resulting from economies of scale, scope, and density, the FCC adopted a policy that the prices of unbundled network elements should reflect the costs an entrant would face if it deployed a network using best available technology taking into consideration the economies of scale and scope available to the ILEC. The FCC stated [FCC 96-325, para. 679] that:
> As a result of the availability to competitors of the [ILEC's] unbundled elements at their economic cost, consumers will be able to reap the benefits of the [ILEC's] economies of scale and scope, as well as the benefits of competition.

Is there any empirical support for these dramatic theoretical predictions? Bresnahan and Reiss [77] examined entry and competition in concentrated markets (monopolies and duopolies). For five service-oriented industries, they found that virtually all the variation in competitive conduct occurs with the entry of the second or third firm. Beyond the second or third firm, entry had minimal impact on competitive conduct; at this point, virtually all the margin between price and marginal cost (that is, market power) had been competed away. This lends support to the basic Bertrand model's result that market power will evaporate rapidly with entry and price competition.

While the basic Bertrand model appears applicable to some industries, its powerful results are not certain to occur in local telephone markets. A critical assumption in the Bertrand model is that all firms possess sufficient capacity to serve the entire market demand. Without this assumption, the incentive for undercutting one's rivals decreases if the rivals' capacity is limited. At present, the ILECs alone possess sufficient capacity to serve the entire local telephone market. Further, it is unclear whether it is economically efficient for one or more competitors to deploy a network of their own sufficient to induce the full benefits of Bertrand competition. The basic Bertrand model will, however, become more applicable as cable television providers and fixed wireless networks expand their telephone facilities. Nevertheless, state commissions should not expect intense Bertrand competition in the local telephone industry in the near term.

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[77] Timothy Bresnahan and Peter Reiss, "Entry and Competition in Concentrated Markets," *Journal of Political Economy* 99, no. 5 (October 1991): 977-1009.

Softening Price Competition

The basic Bertrand model predicts elimination of market power and profits that do not exceed competitive levels. Therefore, it is rational to expect that firms would seek to soften the intense nature of Bertrand price competition. There are several non-collusive mechanisms by which firms can soften price competition and increase their market power and profitability. Some models may not be applicable to the long-distance or local telephone industry.[78]

One mechanism for softening price competition is product differentiation. This behavior is observable in the long-distance market, where AT&T, MCI WorldCom, and Sprint proffer an array of special calling plans and services. Each calling plan or service provides a slightly different service to consumers. The variety of plans, features, and bundles makes it difficult for consumers to make head-to-head price comparisons and makes the products appear to be somewhat non-homogeneous and not fully substitutable for one another.[79] With product differentiation, each firm's service appears slightly different from its competitor's, so it can raise price above marginal cost without losing its entire market. Thus, *product differentiation can soften price competition and create a degree of market power for each firm.*

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[78] For example, see Patrick Rey and Joseph Stiglitz, "The Role of Exclusive Territories in Producers' Competition," *RAND Journal of Economics* 26, no. 3 (Autumn 1995): 431-451. In this model, the price competitive duopolist producers establish exclusive franchises to soften the degree of price competition.

[79]The existence of multiple options may also increase consumer welfare by allowing each consumer the opportunity to choose a package that best fits his needs. For example, the range of pricing plans available from wireless providers allows occasional users to choose a package with a low minimum cost and usage and higher usage charges, while heavy users can choose a plan with a higher minimum cost and lower usage charges.

Even if the products are essentially identical, advertising expenditures that create brand name capital are often used to create the perception, if not the reality, of differences between products. Indeed, products as generic as aspirin, banana, and chicken have been branded. To the extent that such endeavors create customer loyalty (or inertia), they create market power in the sense that consumers may be willing to pay a somewhat higher price for preferred brands.[80]

Product differentiation and advertising promote some degree of market power, but state commission policies should not necessarily seek an end to the practice. Product differentiation reduces welfare by allowing firms to sustain price above marginal cost, but it can increase welfare by allowing disparate consumers' preferences to be more closely met.[81] Thus, state commissions should perceive some degree of product differentiation as both inevitable and potentially desirable. Allowing firms to compete by offering a variety of services, bundles, and pricing plans from which consumers select those that best fit their preferences may be better than requiring all firms to provide identical products and compete on price alone.

There are additional modifications to the basic Bertrand model that mitigate against this sanguine assessment of market power. Most importantly, the basic Bertrand model has a simultaneous-move, single-period focus and does not consider repeated interaction. Repeated interaction introduces the possibility of tacit or overt collusion.[82] Once the possibility of cooperative or

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[80]Consumers may be willing to pay more because brand-name products may have a reputation for or implicit assurance of quality.

[81] Lawrence Abbot, *Quality and Competition: An Essay in Economic Theory* (New York: Columbia University Press, 1955), 77-79.

[82]Forms of collusion are discussed below.

collusive behavior is incorporated, market power problems return and firms can cooperate to profitably select a price above marginal cost. Studies from the long-distance industry reveal that pricing behavior far from Bertrand has been prevalent and signifies continued market power problems, even with competition.[83] Therefore, product differentiation and possible collusion[84] appear to be softening the degree of long-distance price competition.

Quantity Competition

Unlike prices, output levels are strategic substitutes. This means that if one firm makes an aggressive move such as increasing its output, other firms will generally find it optimal to decrease their output.[85] Unlike strategic complements, with strategic substitutes there *are* advantages to aggressive action.

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[83] See William E. Taylor and Lester D. Taylor, "Postdivestiture Long-Distance Competition in the United States," *AEA Papers and Proceedings* 83, no. 2 (May 1993): 185-190; and William E. Taylor and J. Douglas Zona, *An Analysis of the State of Competition in Long-Distance Telephone Markets* (Cambridge, MA: National Economic Research Associates, 1995).

[84]This collusion may result from a few firms interacting over time and across markets. Under close interaction, each firm may develop beliefs about its rival's behavior and responses to its behavior. The process of mutual adaptation may lead to a form of cooperative behavior that creates a period of relative stability. From time to time, however, technology or other conditions may shift, inducing a period of more intense rivalry (price wars, new bundles or plans, or increased advertising) until a new period of stability emerges.

[85] Tirole, *The Theory of Industrial Organization*, 207-208.

The Cournot Model

The Cournot model is a common approach to model quantity competition. In the basic Cournot model, firms are assumed to produce a homogeneous product and make simultaneous decisions about the quantity of that good they will produce. Applying this framework to the telecommunications industry, the Cournot model assumes that firms decide what level of output they will bring to the market. Similarly to the Bertrand model, firms select their output based on their beliefs regarding their opponents' output. Firms do not control price directly; instead, interaction between their output decisions and market demand determines the market price.[86] Since the goods are homogeneous, firms are assumed to evenly split the market demand.

Each firm's best response is a function of both demand and cost conditions, as well as the number of competitors. In the Cournot model, total output will increase and price will decrease as the number of firms increases. Indeed, as the number of firms increases, price approaches marginal cost (the competitive result).[87] However, unlike the basic Bertrand model, where market power evaporates very rapidly, market power declines in a slower and steadier pattern in the Cournot model.

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[86]The market is assumed to clear in the sense that the price adjusts so that the total amount of output producers bring to the market is sold.

[87]As the number of firms in the market increases, equilibrium supply increases, but each firm reduces its output. Moreover, equilibrium price will approach marginal cost as the number of firms becomes "large." For a discussion of the properties of the Cournot model, see Carlton and Perloff, *Modern Industrial Organization,* 233-44.

There is a range of market environments, associated with a relatively small number of firms, where market power would remain a concern to state commissions. Even when market power is present, it should be noted that this market power arises from non-cooperative behavior. There is no overt collusion among the firms; each firm is simply playing its best response to its opponents' strategies. Thus, instances of market power can exist even when firms are competing.

While the Cournot quantity competition model possesses interesting properties, its applied value may be relatively minor. Most economists will argue that firms compete over prices rather than over quantity. Especially in the local telephone industry, where capacity investments are of a very long-term nature, it is unlikely that firms will compete based on capacity levels. Firms simply cannot alter capacity, especially downward, quickly enough to justify the assumption of capacity competition. It is far more likely that firms with installed capacity will compete via prices.

One justification for the Cournot quantity competition model as a representation of an actual market outcome arises from a two-stage game. In stage one, the firms simultaneously install their desired level of capacity. In the second stage, firms bring their quantities to market and a price results that equates supply and demand. Kreps and Scheinkman [88] show that the outcome of this two-stage game will be consistent with the outcome of a simultaneous, single-stage Cournot game. Again, this game scenario may not be particularly applicable to the local telephone industry, and state commissions should not expect to see much Cournot competition. Rather than choosing capacities

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[88] David Kreps and Jose Scheinkman, "Quantity Precommitment and Bertrand Competition Yield Cournot Outcomes," *Bell Journal of Economics* 14, no. 2 (Autumn 1983): 326-337.

simultaneously, the ILEC already has its capacity installed, and competitors must decide whether to add additional capacity. This implies that a more sequential structure is necessary for a quantity game in local telephone markets. In addition, requirements that ILECs share their capacity with entrants complicates entrants' capacity decisions.

REPEATED INTERACTION AND COLLUSION

In the discussion of basic Bertrand and Cournot models, the analysis assumed a single-period game. The firms compete in the market only once. This scenario does not resemble the local or long-distance telephone industries. In these markets, firms compete repeatedly in the market. For example, long-distance firms are continually interacting with different promotional offers. This suggests that repeated interaction models could provide further insights on market power in the local and long-distance telephone industries.

Single-Period Interaction

Single-period models do not allow for collusion that could create and enhance market power. In the first (and last) period, the firms will select a best response for that single interaction. This implies that no collusion will occur because cheating on one's opponent will dominate behaving in a cooperative manner. For example, if two long-distance carriers engage in a single-period price competition, each carrier's best strategy is to undercut its opponent's price and capture the entire market demand in the first and last period – assuming that price remains at or above its marginal cost. Any pre-play negotiations,

assumed to involve an agreement for joint pricing above marginal cost, are fruitless because the pre-play agreements are not credible. If the players will never meet again, each firm's best response involves undercutting the predetermined price and capturing the entire market. Since each firm is aware of the other's incentive to cheat, they will not cooperate and marginal cost pricing should prevail.[89]

Finite-Period Interaction

The same outcome holds for finite-period repeated interaction models.[90] This is best seen through the process of backward induction. In backward induction, the sequential decision process is displayed as a time-line. We begin at the final period and work backward to the current period, at each period considering the players' best responses. As seen above for price competition, in the final period the best response involves marginal cost pricing. Now at the second-to-last period, players understand that marginal cost pricing will occur in the last period regardless of what occurs in previous periods. Since the final period's outcome is fixed, the second-to-last period becomes the "new final period," and marginal cost pricing will occur in that period, as well. The same result will hold for the third, fourth, fifth, etc. -to-last periods, as each becomes the "new final period." By backward induction, marginal cost pricing will occur in

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[89]As seen above, single-period Bertrand price competition results in a price equal to marginal cost with as few as two firms (assuming no product differentiation). Notice also that there is generally no means to enforce agreements to collude, especially since they are illegal under antitrust statutes. This is another example of the prisoners' dilemma problem.

[90]The finite-period interaction model is applicable in any situation in which the participants believe that the interaction will come to an end at some fixed or estimable time.

every period, including the initial period. Thus, the incentive to cheat will overcome collusive agreements and market power will not be a problem in a finite-period repeated interaction model.

Infinitely Repeated Interaction

In an infinitely repeated model, collusion becomes a viable strategy. If there is no predetermined final period when firms are certain to defect from the collusive strategy, a viable opportunity for collusion arises. The collusive mechanism must specify the desired strategy (for example, monopoly pricing) and penalties (for example, marginal cost pricing forever) for defection. When appropriately established, the desired strategy and penalties ensure that no firm has an incentive to defect. For example, consider two long-distance firms contemplating collusion. The collusive agreement could specify monopoly pricing, with marginal cost pricing for K periods following defection. With an appropriate value for K, both firms would prefer sharing the market under monopoly pricing to capturing the entire market demand for one period and enduring marginal cost pricing for the following K periods.[91] Thus, neither firm will find it desirable to defect.

The critical components to be devised include a viable collusive strategy and a trigger mechanism to provoke the retaliatory behavior to punish violators. For example, the retaliatory behavior might require firms to adopt marginal cost pricing for K periods if price drops below the monopoly level. With perfect information, K can be set such that no firm defects from the agreed strategy.

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[91] This decision is made by comparing total present value of the firm's profits from both acting consistent with the collusive strategy and deviating from it. Collusion would be the dominant strategy so long as the rate at which a firm's discount future profits relative to current profits is not extremely high.

However, imperfect information could result in the trigger being activated from time to time even if no firm actually defects.[92] Green and Porter show that a trigger could be activated by an unanticipated decline in demand.[93] Maintaining the pricing context, when demand declines, prices will fall below the previous monopoly levels – assuming that firms do not foresee the decline in demand and alter their strategies. The price decline will cause the trigger mechanism to be activated, and a period of marginal cost pricing will ensue even though no firm has defected.

Ellison finds evidence of this effect in an empirical analysis of a 1880's railroad cartel;[94] when demand fell, firms were more likely to engage in intense price competition. This is important for state commissions because it illustrates the idea that *intermittent price competition does not necessarily imply vigorous competition.* Rather, this pricing behavior could signify noncooperative collusion of which state commissions should be wary.

Infinitely repeated price interaction appears to be applicable in local and long-distance telephone markets. Managers, regulators, and the financial industry generally assume that telephone firms are infinitely lived, or "going concerns" in accounting parlance. Telephone firms do not operate under the assumption that a certain date signifies the final period of market interaction. Further, these firms interact repeatedly in the market. With capacity established, this interaction is most likely to involve price competition.

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[92]This might be viewed as being similar to a "launch on warning" strategy in a "mutually assured destruction" game of missile defense.

[93] Edward Green and Robert Porter, "Noncooperative Collusion Under Imperfect Information," *Econometrica* 52, no. 1 (January 1984): 87-100.

[94] Glenn Ellison, "Theories of Cartel Stability and the Joint Executive Committee," *RAND Journal of Economics* 25, no. 1 (Spring 1994): 37-57.

Given these conditions, the literature posits two possible outcomes. First, intense price competition could occur in perpetuity. Under this scenario, minimal to no market power would exist and prices would approach marginal cost. Second, some form of noncooperative collusion with a trigger mechanism could develop. This scenario would result in market power problems, with minor interruptions induced by forces beyond the firms' control. Which scenario is most likely? This is difficult to answer. However, the long-distance industry does appear to illustrate properties of collusive behavior.[95] Thus, state commissions will need to remain watchful for signs of potential collusion, including intermittent price wars, as the local telephone industry progresses towards an oligopoly environment.

Sequential-Move Games

The basic Bertrand model assumes one-shot simultaneous play. As the previous subsection noted, repeated interaction can upset the results of the basic model. The same situation applies to simultaneous versus sequential-move environments. In a sequential-move game one firm moves prior to the other firms. The most well-known sequential-move game is the Stackelberg model. The outcome of the Stackelberg model depends critically upon the attributes that the firms are competing over and whether the interaction is one-shot or repeated.

In a one-shot, sequential-move price game one firm establishes its price and other firms subsequently establish their prices.[96] The firms will meet just

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[95]This collusive behavior is most likely not overt collusion. Rather, it is more consistent with mutual behavior by long-term rivals, a form of tacit or implied collusion.

[96]In local telephone markets, the first mover is most likely to be the ILEC. In effect its price provides the target for other firms to aim for.

once in the market. Which firm has the advantage in this scenario? In the basic Bertrand model, the firm, or group of firms, with the lowest price serves the entire market demand. In a sequential game, the follower always sees the first mover's price. If it sets a price above the first mover's price, it sells nothing. Alternatively, the follower can undercut the first mover's price and capture the entire market demand. Thus, *if the first mover establishes any price above the follower's marginal cost, the follower can undercut the first mover's price by an arbitrarily small amount and capture the entire market demand.*[97] The first mover does not have the advantage of seeing the follower's price before establishing its price. Thus, there is a follower, or second mover, advantage.[98] How does this impact market power? Assuming rationality and common knowledge, *the first mover should incorporate the follower's best response into its strategy choice.* This being the case, the first mover should establish a price equal to marginal cost. The follower will respond with an identical price. Thus, market power continues not to be a problem with price competition. Even though the follower has a potential advantage, the nature of price competition keeps market power in check.

With repeated interaction, however, the sequential-move structure can prove beneficial to the oligopolists. As before, repeated interaction introduces the possibility of collusion. Trigger mechanisms could be used, but they may prove difficult to design or require costly retaliatory behavior.

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[97]Provided, of course, that the follower is capable of serving the entire market. If the follower cannot serve the entire market, the leader will still be able to price above marginal cost.

[98]See Roy Gardner, *Games for Economics and Business* (New York, NY: John Wiley and Sons, 1995), 167-168.

Another coordination method is for one firm to act as a price leader, setting a price that other firms follow. Collusive price leadership (even if tacit rather than overt) can support pricing above competitive levels without costly price wars.[99] By moving first, the price leader signals the collusive price to the remaining firms in the industry. In the long-distance industry, AT&T has been regarded as a price leader; AT&T's FCC tariff filings were a very public mechanism by which AT&T could legally signal its prices and price changes.[100] The price leadership is a relatively costless method of oligopoly coordination that can arise with a sequential-move structure. Thus, a repeated sequential-move structure that encourages price leadership and oligopoly coordination can create market power problems.

In a sequential-move quantity game (one firm establishes its quantity level and other firms subsequently establish their quantity levels) there is a tendency for the leader's first mover status to confer an advantage – the leader can commit to a quantity first and capture a larger share of the market. Relative to the simultaneous move model, aggregate output will rise and price will fall. Nevertheless, market power remains a potential problem with sequential-move quantity competition.

Does the sequential-move framework provide any insights for state commissions? Based on the previous discussion, the repeated-interaction sequential move Bertrand model is most applicable to the future local telephone

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[99] Scherer, *Industrial Market Structure and Economic Performance*, 176-184.

[100] Taylor and Zona, *An Analysis of the State of Competition in Long-Distance Telephone Markets* (1995) considers this situation. In addition, the role of posted tariffs, price-cap regulation, and dominant-firm regulation in promoting price leadership and signaling behavior is discussed in Paul W. MacAvoy *The Failure of Antitrust and Regulation to Establish Competition in Long-Distance Telephone Services* (Cambridge, MA: The MIT Press and Washington, DC: The AEI Press, 1996), 61-77 and 99-102.

industry. Firms will be competing over prices in an infinite process. If sequential price leadership develops, the ILEC will most likely serve as the price leader similar to AT&T in the long-distance market. This could induce collusive behavior that state commissions should prevent. One method to help reduce the likelihood of this form of collusion is to eliminate mechanisms by which a price leader (that is, the ILEC) can legally announce or signal price changes. *As competition becomes the driving force in local telephone markets, state commissions should consider removing the requirement that ILECs file rate notices in advance, as these can serve to facilitate price leadership or collusion.*

EVIDENCE OF CONDUCT IN LONG-DISTANCE MARKETS

The relative "tightness" of the long-distance oligopoly and the dominant carrier regulation applied to AT&T until recently may have worked against intense price rivalry. MacAvoy found that, even though AT&T's market share declined and long-distance markets appeared to be more competitive, the estimated price-cost margin or Lerner index for long-distance services increased during the 1987-1994 period.[101] MacAvoy argued that vigorous competition in long-distance markets will result from BOC in-region entry.[102] MacAvoy concluded that

> ... AT&T acts to restrict supply and increase its price while
> assuming that the supply of the other two large carriers
> [MCI and Sprint] is fixed. The other two large carriers use

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[101]See Paul W. MacAvoy, *The Failure of Antitrust and Regulation to Establish Competition in Long-Distance Telephone Services,* 105-74.

[102]Ibid., 179-190.

> that condition to decrease their sales by disproportionate amounts, which implies that they seek even higher prices. Their coordination takes levels of price-cost margins toward higher levels than would result from independent price setting.[103]

Other authors have found differing degrees of competition. Crandall and Waverman[104] examined several studies of long-distance competition. Their analysis led them to the following general conclusions:

> The intra-LATA toll market does not appear to be intensely competitive, but there is little analysis as to whether competition or regulation is at fault . . . . the degree of competition in the interstate toll market is unclear. Three studies conclude that there is little competition; three others suggest little market power on behalf of AT&T. The problem is to distinguish between the effects of the number of firms and their market shares and the effects of regulation.[105]

For their own part, Crandall and Waverman analyzed intrastate inter-LATA message toll markets and found that:

> ordinary tariffed [message toll service] rates during peak
>
> hours reflect substantial competition in the longer mileage bands. This is not to say that even more competition would not put greater downward pressure on long-

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[103]Ibid., 156.

[104]A number of these studies are summarized in Robert W. Crandall and Leonard Waverman, *Talk is Cheap: The Promise of Regulatory Reform in North American Telecommunications* (Washington, D.C.: The Brookings Institution, 1995), 120-187.

[105]Ibid., 131.

distance rates in both the intrastate inter-LATA and interstate markets.[106]

In their 1997 paper, Taylor and Zona [107] state that:

> . . . we do *not* find evidence of effective competition in the
>
> interstate long-distance market; rather we find evidence more consistent with noncompetitive behavior. While competition for larger customers appears to be aggressive and regulated competition has reduced prices for these types of customers, on an aggregate basis AT&T's price reductions have failed to match reductions in access charges. The adverse effects appear to have been experienced disproportionately by low-volume residential (the majority of residential users) and small business customers.[108]
>
> The preponderance of evidence presented here—prices not moving toward costs, limited price competition, increased advertising, evidence of continuing entry, increased margins and earnings—demonstrates that it is very unlikely that the interstate long-distance market is effectively competitive. The other evidence—pricing at the cap, [AT&T's] market shares settling near sixty percent—suggests that regulation and the threat of antitrust intervention is the constraining force in the market.[109]

The jury is still out. One problem with several of the studies is that regulation was changing over the period in question. If changes in regulation

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[106]Ibid., 165-66.

[107]William E Taylor and J. Douglas Zona, "An Analysis of the State of Competition in Long-Distance Telephone Markets," *Journal of Regulatory Economics* 11, no. 3 (May 1997): 227-55. Taylor and Zona examined seven indicators of competitiveness: relative price performance; pricing behavior; productivity; quality; advertising; entry; and financial performance.

[108]Ibid., 229, emphasis in the original.

[109]Ibid., 251.

are not accounted for, the estimates of the degree of competition may be invalid because firms may be responding to changes in regulatory regime as well as to changes in costs and industry structure. Clearly more analysis and time are required before we have a clear understanding of the competitiveness of long-distance markets, much less local telephone markets. Nevertheless, the evidence does tend to lead to the view that consumers could benefit from increased competition in long-distance markets; this could support the view that BOC entry into those markets will have positive effects.

CONCLUSIONS

As technology, policy, and market conditions change, industry evolution in inevitable. Former monopoly markets can evolve into dominant firm-competitive fringe markets; dominant firm-competitive fringe markets may evolve into oligopolies; oligopolies may evolve into competitive or nearly competitive markets – or they may become tight oligopolies. Assuming that firms act in their own best interest, each market structure will exhibit different behaviors. A monopolist's profit maximizing strategy will be different from that of an oligopolist, so firm behavior will change as market structures evolve.

Responding to technological shifts and a sea change in policy that promotes competition, *local telephone markets are being transformed*. They will likely pass through several different market structures before settling into an equilibrium structure determined by cost and demand conditions. State commissions should be aware of the way self-interested firm behaviors will produce different outcomes under each market structure. If the outcomes are not consistent with broad notions of the public interest, state commission policy intervention will be necessary.

As the local telephone markets evolves away from a regulated monopoly, state commissions will still be concerned with market power. In the

past, state commissions constrained the ILECs' absolute market power through various forms of economic regulation (rate-of-return or price-cap regulation). Competition is now expected to partially, or fully, fulfill this role. If the environment is becoming one of emerging competition, it is important for commissions to welcome competitive entry and competitors' market advances. Only in this manner will the ILECs' market power subside.

Understanding behavior under differing conditions will provide commissions with important insights that may be used to inform market analysis and policy decisions. This paper has provided some analysis of behavior and market power in three different market environments, each of which presents different concerns. In the monopoly environment, entry deterrence is a concern because a monopolist may attempt to maintain market power by deterring entry. A long run strategy of entry deterrence is not in the monopolist's interest and is not likely to prove successful, especially given public policy aimed at promoting competition. Thus, it is likely that market power will be largely dissipated over time. Nevertheless, the special characteristics of local telephone markets and the current position of the ILECs may make some forms of entry deterrence or delay profitable.

Local telephone markets are moving from monopoly (first *de jure* monopoy then *de facto* monopoly) to having emerging competition with a dominant incumbent firm and a competitive fringe. *In emerging competitive markets, the dominant firm's market power is, to a large extent, determined by its competitors' supply.* If the dominant firm has a cost advantage, it will still have market power, although it will be constrained by the existence of the competitive fringe. As the number of competitors grows and as competitors gain experience in the marketplace, their cost characteristics may become similar to the dominant firm's, and the dominant firm's market power will erode further. The FCC and state commission policies aimed at promoting local

competition include many provisions (resale, unbundling, line sharing, collocation, number portability, and others) that limit the ILECs' ability to exploit their linchpin position or exploit cost advantages to engage in pricing policies that deter entry. More radical approaches include structural separation of the ILEC's retail and wholesale functions or divestiture.

Oligopolies can exhibit either a little or a lot of market power. Intense price competition between two or more firms can erupt and dissolve market power in short order. However, firms may recognize that intense price competition is painful and engage in cooperative and noncooperative collusion that facilitates a shared exercise of market power.

A truly competitive market requires that the various providers make their decisions independently. Such independence provides consumers with a range of options. Commissions might consider monitoring prices, features, and service offerings. If all providers change prices at the same time and in the same direction, offer very similar packages (including local calling scope), or if one firm consistently sets the pace with others closely following its lead, regulators might consider whether providers are engaging in some form of cooperative behavior. Even if cooperative behavior is not overt, it may not be in the consumers' interests. Thus, firms should be encouraged to innovate in their pricing plans and service offerings.

As local telephone markets take on the characteristics of oligopolies, state commissions must remain wary of collusion or cooperative behavior among ILECs and major rivals that could facilitate exercise of market power. In addition, it is possible that policies designed for a monopoly environment (requiring advance filing of tariff changes, asymmetric or dominant-carrier regulation, and price-cap regulation, for example) may tend to facilitate cooperation among oligopolists.

Table 2 provides a summary of the market environments discussed in this report, identifies the likely strategic behaviors state commissions are likely to observe in each environment, and lists some possible appropriate regulatory responses.

Table 2 — Market Structures, Market Power, and Strategic Behavior				
Market Structure	Local Telephone Application	Degree of Incumbent Market Power	Firms' Likely Strategic Behavior	Appropriate Regulatory Response
Monopoly — a single service provider	ILECs before CLEC entry	High — unless constrained via state commission regulation	Possible entry deterrence strategies using prices; capacity; and high prices and strict conditions for interconnection, unbundled network elements, and resale.	Rate-of-return regulation, price-cap regulation, social contract regulation
Emerging Competition — a dominant ILEC and a group of smaller firms, with the ILEC providing the linchpin network	ILECs after CLEC entry	Range from high to low depending on the competitiveness of smaller firms	Large firm establishes the market price based on residual demand and smaller firms adopt the large firm's price.	Asymmetric regulation of dominant firm — concern over input prices, carrier-to-carrier quality of service, price floors for competitive services. Codes of conduct. Possible structural separation or divestiture of wholesale network functions from retail service functions.

Table 2 *(continued)* Market Structures, Market Power, and Strategic Behavior				
Market Structure	Local Telephone Application	Degree of Incumbent Market Power	Firms' Likely Strategic Behavior	Appropriate Regulatory Response
Oligopoly — several large firms operating interdependently	ILECs and large CLECs (for example, AT&T	Depends on type of interaction		
Simultaneous Price Competition		Low to none if all firms can serve the entire market. Increases if some firms face supply constraint.	Product differentiation & advertising	Oversight of advertising, consumer education, anti-slamming, cramming, and jamming provisions
Simultaneous Quantity Competition		Range from high to low depending on the number of firms in the market	Minimal	Oversight of advertising, consumer education, anti-slamming, cramming, and jamming provisions
Infinitely Repeated Sequential Competition		Range from high to low depending on the extent and success of collusion	Multi-firm collusion facilitated by trigger mechanisms (for example, sporadic "price wars" followed by periods of price stability) or by price leadership.	Relaxation of asymmetric regulations on tariff filings, notice, and other requirements.

Source: Authors' construct.

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