

FACILITIES COMPETITION AND LOCAL NETWORK INVESTMENT:

Theory, Evidence and Policy Implications*

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June 1998

Abstract

A new approach has emerged in the U.S. and elsewhere in the world for promoting investment in local communications networks. Competition, especially facilities-based entry, has become a principal means to encourage the efficient amount and timing of investment in local exchange infrastructure and adoption of advanced technologies. Despite the popularity of open entry policies, the logic underlying these policies has never been worked through. Nevertheless, we find preliminary and incidental studies that support the claim that facilities-based entry stimulates investment by both incumbents and entrants. The message for policy makers is, first, to remove artificial restrictions on facilities-based entry and on incumbent investment, both as a response to competition and in advance of entry, and second, to take account of the possibility of a virtuous cycle of investment deriving from incumbent-entrant interaction. These measures promise to supplement the ordinary benefits of facilities competition that will aid in building the next generation advanced communications network.

* - I am grateful to the Consortium for Research on Telecommunications Policy (CRTP) for financial support. This paper expands on remarks given at the fourth annual CRTP conference at the University of Michigan at Ann Arbor, June 5-6, 1998.

I. NEW POLICY TOWARD LOCAL NETWORK INVESTMENT

Policy makers in the U.S. and throughout the world have voiced concerns over the level of investment taking place in local communications networks which they see as critical to regional and national economic development. They blame administrative regulation of private carriers and government ownership of telecom infrastructure for distorting incentives for network modernization. In response, many jurisdictions have privatized state-owned monopolies and replaced heavy-handed regulation with market-oriented policies. Liberalization of rate setting and opening of telecommunications markets to competition are popular approaches to correcting investment disincentives. Specifically, entry by facilities-based competitors, both domestic and foreign, is seen as a particularly effective means to support the efficient capital investment and adoption of advanced technologies. Vigorous competition among network owners is also believed to safeguard consumers against incumbents' attempts to extend their monopoly power into adjacent markets.

In the U.S., federal law makers and regulators have turned to competition to improve performance in a succession of telecommunications markets, beginning with customer premise equipment and moving on to enhanced services and long distance. The Federal Communications Commission took steps to open local exchange markets to facilities-based entry with its Competitive Carrier Order and its two Expanded Interconnection decisions. The initiative to open the local exchange culminated with the Telecommunications Act of 1996. As its Preamble states, the law is designed to:

“... provide for a pro-competitive, deregulatory national policy framework designed to accelerate rapidly private sector deployment of advanced telecommunications and information technologies and services to all Americans by

opening all telecommunications markets to competition ...”

The Act returns to this theme in Section 706 where the roles of rate liberalization and open entry to spur investment are made more explicit:

“...shall encourage the deployment on a reasonable and timely basis of advanced telecommunications capability ... by utilizing ... price cap regulation, regulatory forbearance, measures that promote competition in the local telecommunications market, or other regulating methods that remove barriers to infrastructure investment.”

Several states had made progress toward deregulation of local exchange markets well before the Telecom Act was passed. By the end of 1994, 35 states and the District of Columbia had adopted some alternative to traditional regulation.¹ Included among these policies are price caps, rate freezes, revenue sharing and deregulation of competitive services. States opened local service markets to new entry as well, though at a slower pace.² Gradually the states have allowed switched local competition, required intraLATA toll presubscription, permitted central office collocation and unbundled local network services.³ Roughly speaking, those states which had liberalized rate regulation had also relaxed entry restrictions into switched local services, albeit with a lag.⁴ In pursuit of greater telecommunications infrastructure development, several states

¹ Another nine states were considering alternative regulation of some form. See Table 1 in Witkind-Davis, Zearfoss and Reed (1995).

² For a visual comparison of the spread of alternative regulation and open entry across the states, see Figure 1 in Greenstein, McMasters and Spiller (1995).

³ By the end of 1994, a total of 13 states permitted entry into switched local services. At that time an additional 21 states and D.C. were formally or informally considering this move. See Table 3 in Witkind-Davis, et. al. (1995), op. cit.

⁴ Of the six states that decided against considering alternative regulation, none had allowed local switched competition and only two of these had proceedings to consider such competition. Witkind-Davis, et. al. (1995), Ibid.

went so far as to extract commitments from incumbent local exchange carriers (ILECs) to make certain investments in exchange for pricing freedom or in place of rate reductions.

Economists have generally favored rate liberalization and open entry to improve the performance of the local telephone industry. Typically they point to likely social benefits from lower costs and prices, improved service, higher productivity and quicker deployment of new services and technologies. Importantly, these reforms are seen as creating more powerful incentives to make large capital outlays and deploy risky technologies—as well as to retire outmoded and inefficient plant and equipment. Promotion of facilities competition has, on occasion, been recommended by economists as the *preferred* policy to accomplish this modernization and to build the communications network of the future.⁵

Despite the reputed benefits of facilities competition, and its popularity among economists, surprisingly little is known about its relationship to firms' investment behavior. Lacking is any empirical test comparing investment efficiency in local exchange markets following facilities-based entry against investment patterns under the status quo.

Moreover, the notion that facilities-based competition stimulates investment in the local network has its detractors and their arguments are not without merit. To begin with, competition in price and services is likely to reduce the returns on investment. Given the size of these expenditures, and the fact that they are highly sunk and highly risky, diminished returns could greatly reduce incentives to invest. Traditional forms of regulation, properly implemented, are designed to preserve investment returns while reigning in monopoly abuse. And there is no unambiguous support, theoretical or empirical, that traditional regulation discourages investment.

⁵ For an example, see Crandall (1997).

Arguably, a monopoly protected from competition will have necessary incentives to make the capital expenditures required for universal service. Related to this, it is likely that in many small cities and countries, local telecommunications markets constitute a natural monopoly, in which case facilities-based entry necessarily raises the overall cost of service by duplicating network investment.

This paper evaluates the economic foundations underlying the use of facilities competition to promote efficient local network development. Preliminary and incidental investigations of this relationship lend tentative support for an open entry policy. Implications that emerge from this research advise regulators to remove artificial restrictions on facilities-based entry into local services markets and on incumbent investment—both in response to, and in anticipation of, facilities-based competition. Policy makers should also take account of the added benefits of facilities competition when pricing network services sold by incumbent carriers to the various kinds of entrants. Through these measures the possibility of a virtuous cycle of investment deriving from incumbent-entrant interaction could be realized.

II. DOES FACILITIES COMPETITION AFFECT INVESTMENT?

What does economic theory predict about the effects of facilities competition on industry investment patterns? The short answer is that industry investment likely will rise in response to entry. But while facilities-based entry necessarily adds to industry capital, the impact on incumbent investment could go either direction. Deeper answers to this question would depend on the interaction between incumbents and entrants, the nature of pre-entry and post-entry regulation, and market factors affecting investment returns.

This section reviews what theoretical models say about the effects of facilities-based entry on investment in any industry. By limiting attention to facilities-based entry, we may neglect the impact of service-based entry such as resale. Incumbents may tend to reduce their capital outlays in the face of significant expansion by these competitors. On the other hand, incumbent must necessarily invest in certain facilities to accommodate the entrants such as collocation facilities or added capacity at network interconnection points.

To an extent, our emphasis on investment is excessive since policy makers should be more concerned with price and service quality since they more directly affect the ultimate measures of market performance: consumer and producer surplus. But while investment may be an “intermediate” variable, it is crucial because it has long-term implications for which services will be available and the cost of providing those services for years to come. It is well known how long-term cost reductions and service enhancements easily swamps the gains from eliminating static allocative inefficiency.⁶

Before proceeding it may help to make a distinction between investment and innovation. The term “investment” will refer to expenditures on durable productive assets including the purchase, installation and maintenance of structures and equipment.⁷ “Innovation” refers to the creation of intellectual property.⁸ While we do not consider models that seek to explain

⁶ Several studies have demonstrated that increased investment in telecommunications infrastructure has sizable social benefits. See, e.g., Greenstein and Spiller (1996).

⁷ We will lapse into imprecision when we use the term to refer to capital stock and other times for adjustment in capital stock. The context should make the intended meaning clear.

⁸ In between durable capital investment and intellectual property creation are expenditures of “effort” by carriers to reduce costs which creates human capital or organizational knowledge.

incumbent and entrant expenditures on research and development, we will be interested in the deployment of new technologies licensed from their owners or embodied in purchased equipment.⁹ As described below, entrants into the local exchange markets were among the earliest adopters of new network technologies even though they did not invent those technologies.

A. Nonstrategic Motivations for Investment

Incumbents have many nonstrategic motivations for investing quite independent of any threat of competition. Convention has divided these investments into three categories:

“replacement,” “growth” and “modernization.” We are especially interested in the last category because these investments tend to be very costly and very risky, yet hold the promise of great benefits for consumers through lower operating costs and faster deployment of new services.

Regulation is a big factor in evaluating investment opportunities even when competition is not imminent. Regulation of incumbent investment behavior (e.g., through certification procedures) has a direct impact on infrastructure development. Rate regulation plays a more indirect, but no less important, role as it alters the pattern of returns expected from any project. In all cases uncertainty as to how regulators treat durable investment once in place affects its expected returns and hence the willingness to invest—for both the incumbent and entrants.¹⁰

Entrants also have discretion over the amount and kind of investments they make.

⁹ An example illustrates the distinction. The invention of techniques for optical transmission over fiber cable and for compression of traffic over copper loops are innovations whereas installation of fiber in the feeder and distribution plant and xDSL equipment on copper loops are investments.

¹⁰ Woroch (1988) computes the effects of “regulatory risk” on the level of an incumbent monopolist’s investment under rate-of-return, price and entry regulation.

Naturally, they decide on the scale of entry and the choice of technology as well as which markets to enter and when to enter. In an open network environment, competitive local exchange carriers (CLECs) also have the option to buy services from the ILECs in the form of unbundled network elements and/or bulk retail services rather than build their own facilities. Potential entrants also vary in terms of the investment necessary to enter on a facilities basis. The incremental investment needed to enter local telephony may be relatively small for firms such as cable TV operators and interexchange carriers who already own embedded local facilities.

Among the earliest facilities-based entrants into the local exchange were the “competitive access providers” (CAPs) that built advanced fiber networks providing interexchange carriers and large customers an alternative to incumbents’ high capacity access and transport services. Other entrants include cable television operators who retrofit their coaxial and fiber networks to carry telephony and data services. “Personal communications services” provide an alternative that competes directly with existing cellular carriers but which is increasingly a substitute for landline service. Increasingly, “wireless loop” and “wireless fiber” services offer standard and high capacity alternatives to wireline access. Still other providers upgrade ILEC loops which they lease from ILECs to give business and residential phone customers high-capacity access to the Internet and other data services as well as ordinary dialtone service.

What makes potential entrants believe facilities-based entry will be profitable? The usual drivers include rapid growth in demand, and falling costs of providing service along with poor service quality and high, inflexible rates offered by incumbents. The typical off-the-shelf oligopoly model concludes that, compared to the monopoly outcome, the oligopoly equilibrium will have lower prices, lower industry profits and higher output levels. Assuming that capital is a normal

input, we should expect more industry investment after entry whereas the incumbent will reduce its capital stock as it accommodates additional firms.

This stark comparison of monopoly and oligopoly does not involve any regulation, and as a result, it does not shed light directly on the situation that interests us. Unfortunately, existing models give little guidance on the investment effects of open entry since they compare regulated monopoly against unregulated monopoly. More sophisticated models may not help much since deregulation of local exchange prices and entry has been haphazard and piecemeal dashing any hope for a clean natural experiment.

B. Strategic Models of Facilities Competition and Investment

The monopoly-oligopoly comparison looks only at long-run industry equilibria before and after entry and does not allow for strategic maneuvering by incumbents and entrants.¹¹ In particular, forewarned about the entry threat, an incumbent may engage in preemptive investment to deter competitors. Besides additional investment, the incumbent also accelerates deployment since the project must be at least partially irreversible by the time the entrant arrives, for otherwise it would not realize its strategic intent.

After entry, incumbents may invest to meet the competition, building more capacity to accommodate the increased demand realized as prices fall. Investment in new equipment and new technology may also be used to differentiate the incumbent's services from the entrant's as well as to provide interconnection services to CLECs.

¹¹ See Woroch (1990) for an early survey of strategic issues that arise as a result of open entry into the local exchange.

Investment is one of many available strategic variables to respond to entry. Price, product design and advertising are a few of the other means at its disposal to discourage facilities-based entry. While other decisions are more easily reversed, local network investments are large, durable and highly sunk which makes them relatively risky way to respond to entry. On the other hand, sunkness confers a degree of commitment that can be very effective in convincing potential entrants that the incumbent is willing and able to engage in fierce competition should entry occur.¹²

Entrants also invest strategically. An example of this is “entry for buyout” which has been especially popular among CAPs. In this scenario the entrant builds facilities anticipating that other firms will buy those facilities or acquire the firm itself. Many CAPs were acquired first by cable television companies and more recently by long distance carriers.¹³ Despite the motive, this kind of entry continues to add to local network infrastructure.

III. FACILITIES COMPETITION AND INVESTMENT, IN GENERAL AND IN THE CASE OF TELECOMMUNICATIONS

While theory points to a strong presumption that facilities competition stimulates investment, empirical evidence is far from air tight. Many of the hypotheses coming out of

¹² Salant and Woroch (1992) provide a long-run analysis of the role of a regulated monopolist’s sunk investment, along with a regulator’s commitment to pricing, in sustaining the efficient path of infrastructure development.

¹³ One of the first and largest CAPs, Teleport Communications Group, was purchased by four large cable MSOs—Cox, TCI, Comcast and Continental. Teleport was subsequently purchased by AT&T. MCI-Worldcom has purchased two of the other large CAPs, MFS and Brooks Fiber Properties.

theoretical models have not withstood empirical scrutiny across a broad range of industries.¹⁴

Many case studies and inter-industry econometric tests, for instance, fail to conclude that increased entry lowers price before or (immediately) after entry or lowers the incumbent's profit rate. However, as we will see, the evidence tends to be stronger with respect to investment effects.

Most studies in this literature are aggregated to the industry level. An exception is Lieberman (1989b) who finds using plant level data that incumbents and entrants in chemical processing industries obey similar investment rules; in particular, incumbents do not build excess capacity to deter entry, and in the few cases where they appear to do so, the strategy is not effective. In another study of the same industries, he finds that incumbents accelerate their investment after entry—at least in the more concentrated industries.¹⁵

The entry studies are drawn from a wide range of industries, most of which are unregulated, making them less applicable to local telephone markets. And while there have been many attempts to empirically measure deregulation's effects, few of these look at the consequences for capital investment.¹⁶ This is somewhat surprising if only because the effects on other factors of production, especially employment and wages, have received considerable

¹⁴ Geroski (1995) gives an extensive account of the empirical work on the causes and consequences of entry.

¹⁵ Lieberman (1989a).

¹⁶ Winston (1993) surveys the various predictions regarding changes in price, service quality, profitability, employment and productivity for a long list of deregulated industries including long distance telephone and compares them to actual post-deregulation levels. No results are reported on predicted or actual effects on investment level or growth. An exception is Meyer and Strong (1992) who provide some informal evidence that investment in aircraft grew rapidly following the opening of U.S. domestic airline markets.

attention.

Given the short history of local exchange competition, it is no wonder that so little research has been conducted on the relationship between entry and investment. With the exception of some very recent results, the focus has been on how liberalized rate regulation led to increased investment by incumbent carriers. Studies of the effects of facilities competition on local telephone investment have begun to appear only recently.

In an early contribution, Crandall (1991) computes the difference between total industry equipment sales and regulated phone company purchases, finding that it grew significantly following the AT&T divestiture in 1984. He concludes that a large fraction of capital expenditures went to build private networks. Facilities-based entrants into the local exchange would account for a portion of this amount, albeit a small one over the sample period that ended in 1988.

Taylor, Zarkadas, Zona (1992) find that the Regional Bell Operating Companies (RBOCs) that are subject to one of several forms of alternative regulation are more likely to modernize their networks and to do so earlier. Over the period 1980 to 1994, they find that deployment of digital switching and fiber transmission facilities are particularly accelerated, and deployment of ISDN and Signaling System 7 somewhat less so.

Greenstein, McMaster and Spiller (1995) came to the same general conclusion where they are careful to identify ILEC-specific, state-level regulation and control for local economic conditions. They find that introduction of price regulation (e.g., price caps) is particularly effective in inducing investment in fiber optic transmission, ISDN, digital switching and SS7.

Although these studies concentrate on the regulation-investment connection, they may

have much to say about the relationship between facilities-based entry and local network investment. First, during all or part of the studies' sample periods, facilities-based entry occurred in many of the same places as rate liberalization. To this extent, a portion of the changes in investment registered over this time can be attributed to local competition, and not rate liberalization alone.

Second, several of these studies control for regulatory policy towards competitive entry, and estimate effects on infrastructure deployment. For instance, Greenstein, McMaster and Spiller (1995) include several independent variables for state entry. Estimates of their coefficients leads to mixed conclusions, however. Allowance of competitive access providers has no statistically significant effect while permission for intraLATA competition and resale of local exchange services depresses ILEC deployment of fiber. Removal of restrictions on "bypass," a form of facilities-based competition, encourages fiber investment by the ILEC but this relationship is only weakly significant.

In a cross-national study, Ros (1998) estimates the effect of privatization and open entry policies on telephone penetration measured in lines per population. Allowing entry into local, long distance or international services is found to have a positive (but weakly statistically significant) effect on penetration, and also complements privatization of state-owned telecom firms as a means to increase penetration. Interestingly, the 14 of 84 countries that had opened some telecom markets to competition during the 1986-1995 period had significantly lower rates of investment but significantly higher penetration than those that protected their incumbent carriers. Apparently, the efficiency-enhancing effect of competition results in reduced spending on all factors of production including infrastructure at the same time service coverage expands.

A serious problem with making inferences from these results is that they control only for a policy of open entry; they do not measure the extent of actual entry, facilities-based and otherwise. It is unlikely that an open entry policy is randomly adopted across jurisdictions. It is the product of political processes and market conditions, themselves likely related to the likelihood and success of entry.

A few studies examine the effect of facilities competition on telecommunications investment, either directly or as a by-product of another research goal. The OECD (1995) surveyed its member countries on the relationship between facilities competition and infrastructure development. Using informal comparisons, the report concluded that countries that permitted “infrastructure competition” realize the benefits of lower prices, improved quality and variety of services and greater penetration. It did not find that competition harmed efforts to promote universal service.

In another cross-national comparison, Dekimpe, Parker and Sarvary (1998) find that the initial penetration rate of cellular mobile service (measured by lines per population) as well as the rate of diffusion increased with the number of competitive cellular carriers—though the coefficients were not always precisely estimated. While cellular is a specialized local services, its importance as a substitute for landline service is growing.

In terms of landline services, Tomlinson (1995) documents the emergence of CAPs in the U.S. and how their deployment of urban fiber ring networks added to the quality and reliability of the public network. He also charted how the ILECs responded to this competition by building advanced networks of their own and boosting the reliability of their services.

Woroch (1998) examines the pattern of deployment of these fiber rings by ILECs and

CAPs using a panel of large U.S. cities over the period 1984 through 1992.¹⁷ This study finds that construction and operation of urban fiber networks by CAPs (statistically) cause subsequent deployment of similar facilities by the ILECs in the same metropolitan area. The reverse is also confirmed: ILEC deployment of fiber rings (statistically) causes CAP entry.¹⁸

We might expect incumbents to match entry threats by building their own facilities, a pattern confirmed by Lieberman (1987a) in an unregulated oligopoly. On the other hand, many theoretical models of large-scale entry predict that incumbents would preemptively deploy these networks to discourage entry. More elusive is an explanation for the result that ILEC investment in fiber networks “causes” CAP entry in these same markets.

Caution is advised when drawing implications from these studies. The results are usually obtained for a specific technology (e.g., optical fiber or digital switching) and they do not necessarily apply to some or all of the other advanced telecommunications technologies. Furthermore, most of the studies have been conducted on U.S. data with no guarantee the findings will apply to other countries given their unique market and institutional characteristics.

¹⁷ Note that here the “city” is the unit of observation, not the state or the local exchange company, avoiding problems with mis-measurement. The panel structure allows for different possibilities of the interaction between incumbents and entrants over time.

¹⁸ In fact, the bi-directional causality is not uncommon in tests of this sort including where telecom infrastructure is one of the causal variables. For instance, Cronin, et. al. (1991) conclude that U.S. telecom infrastructure investment is both the cause of, as well as caused by, the level of economic activity.

IV. WHAT SHOULD POLICY MAKERS DO?

What policy makers can take away from this line of research depends on their objectives and the instruments under their control. Ideally, they would attempt to use their powers to ensure that only those investments that, on net, contribute to social welfare would be undertaken, and that the least-cost builder and operator would construct and operate these facilities. Attempting to fine tuning policy in this way is always unrealistic and ill-advised, but here it is particularly dangerous. First, the rapid pace and unpredictable direction of innovation increases the risk that policy makers will steer outcomes in favor of an inefficient technology (e.g., xDSL on copper loops v. two-way digital transmission over coaxial cable) or one type of entrant (e.g., ILEC v. cable). Second, as just spelled out, research supporting the relationship between facilities-based entry and local network investment is tentative.

With these provisos, and while we await further research in the area, it is nevertheless worthwhile to draw out some of the policy implications from these preliminary findings. After all, policies promoting facilities competition are well underway and, at least in the short run, these initiatives are irreversible. Policy makers encharged with implementing these policies stand to benefit from what is known about this relationship.

We proceed under the assumption that there is too little investment in advanced local networks, whether that is the product of the dead-hand of regulation or complacency of a monopolized industry. This is not to say that traditional incumbent monopolies are not capital intensive. In fact, casual and statistical evidence reveals large capital stocks and hefty investment

budgets among incumbents.¹⁹ At the same time, there is good reason to believe this investment pattern is highly inefficient.²⁰

We do not mean to diminish the usual benefits associated with competition (e.g., lower prices). Facilities-based entry, however, has more to offer. To begin with there are the direct benefits from the added capacity built by both incumbents and entrants, as well as the benefits from new process and service technologies. Beyond these first-order effects, there is some evidence of a “virtuous cycle” in which incumbents and entrants respond to the other’s investment with more investment.

In this situation it behooves policy makers to encourage facilities competition by supporting facilities-based entry and capital investment by incumbent carriers. Gains to facilities competition could be severely truncated if one kind of investment was permitted but not the other. As always, the challenge is deciding to what extent each kind of investment should be encouraged through financial incentives, relative to other uses of funds such as competitors entering as resellers, or incumbents diversifying into other markets.

As a first step, regulators should remove artificial restrictions to investment by both types of firms. Elaborate certification procedures for capital programs undertaken by incumbents (and entrants) result in fewer projects and longer delays. Streamlined regulation that often accompanies regulatory reform can eliminate the need for careful scrutiny of these investments.

¹⁹ In a simple comparison of means, Ros (1998, Table 3) found that countries subject to competition had three times the penetration but only one-sixth the annual investment when compared to those where competition was forbidden.

²⁰ For instance, Ros (1998, Table 3) also finds that countries that are open to competition have less than half the number of employees per line, indicating significantly greater efficiency and capital intensity.

In addition, regulators should not single out investments made in anticipation of facilities-based competition; the empirical evidence consistently refutes its effectiveness as a deterrent to entry and may even invite competition. In addition, investments should be allowed that clearly a reaction to successful facilities-based entry. Regulators will have to exercise uncommon discipline to resist the temptation to intervene when ILECs make investments to serve high-margin customers who are targeted by cream skimming entrants.

Regulators should also refrain from imposing line of business restrictions that shrinks the pool of potential facilities-based entrants into the local exchange markets. The 1996 Telecom Act paved the way to eliminating these artificial barriers but restrictions still remain.

In an environment of unbundling and sharing of incumbent networks, the possibility of a “virtuous cycle” of investment suggests added benefits of facilities competition should be taken into account when setting rates for incumbent network services sold to entrants.²¹ It is not possible to say at this time how large this discount should be, only that it is a factor that argues for encouraging facilities-based entry relative to resale or the use of unbundled network elements.

Construction of the next generation local network is now underway. Various technologies compete in their promises of expanded bandwidth and sophisticated digital services. All are very expensive and very risky relative to the status quo of the current technology. To complete this modernization will require powerful financial incentives for both new and established firms. For these reasons, further research into the implications of facilities competition and its alternatives is badly needed to make for better regulatory policy.

²¹ Assuming incumbent retail rates continue to be regulated, it would also be possible to structure them to re-balance incentives to enter on a facilities basis.

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