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I. INTRODUCTION

Few phrases in public policy have become so overused so quickly as the "information superhighway." Although it is unclear to many what that superhighway is or will be, this uncertainty has not prevented proposals to regulate the superhighway from being made. In this Article, we examine the economic principles that should govern competition and regulatory policies concerning the development and operation of the information superhighway.

In Part II of this Article, we discuss the evolution of technology for interactive broadband networks. We explain the economic implications of technological advances in electronics, fiber optics, digital signal compression, and software. These developments will allow some networks to deliver not only narrowband services, but also one-way and switched broadband services. The development of new uses for the network will encourage entry by a number of potential competitors for voice telephony, data transmission, distributive video (currently regarded as broadcasting or cable television), interactive video, and other electronic services such as banking, shopping, and advertising. We next analyze the alternative delivery systems for such networks, including completely fiber-optic networks, fiber/coaxial-cable networks, fiber-coax-wireless networks, direct-to-the-home satellite

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networks, and "wireless cable" systems (including wireless cellular systems). For each delivery system we provide a rough estimate of the prospective cost of network construction and operation as found in recent studies.

A major conclusion of this analysis is that no one currently knows which system or systems will be technologically and financially viable in the foreseeable future. Although it is regularly reported in the business press that a "convergence" of telecommunications technologies is occurring, it may actually be the case that a *divergence* of such technologies is taking place in the sense that a number of alternative architectures may simultaneously evolve for the delivery of various combinations of narrowband and interactive broadband services. A corollary of this analysis is that one should not assume that a system that is viable in 1995 will not be superseded by a superior technology introduced only a few years later. Consequently, government policy in this arena must proceed cautiously, lest it impede the process by which superior production technologies displace inferior ones. In particular, policymakers should not overlook the potential competitive significance of wireless networks.

While Part II analyzes the production (or supply) side of interactive broadband networks, Part III examines the demand side and asks: What is the likely market for interactive broadband services? The potential services that we evaluate are pay-per-view movies and sporting events, home shopping, video games, interactive information services, video conferencing, distance learning, and telemedicine. We conclude, as in the case of production technologies, that the demand for interactive broadband services is highly uncertain. Again, this uncertainty should counsel government policymakers to recognize that current predictions of what consumers will or will not want delivered over the network may prove to be erroneous.

In Parts IV through VIII, we address the economic principles that should inform policies concerning interactive broadband networks. We assume for purposes of our analysis that the paramount objective of such policies is the maximization of economic welfare.

In Part IV, we explain the economic principles for open entry and efficient, subsidy-free pricing that are now widely accepted for regulating network industries. We argue that reliance on these general principles is appropriate for interactive broadband networks. In the current environment of uncertainty on both the supply side and demand side, vigorous competition rather than government planning will

best identify not only which delivery technologies for interactive broadband services are superior, but also which services consumers actually demand. In particular, we recommend that the government not attempt to fund universal service goals (or other social policies) by restricting entry into the market for interactive broadband services or by regulating the price of such services such that one consumer pays an inflated price to subsidize other consumers. If subsidies are deemed necessary, we recommend that the government employ more direct financing methods that subsidize service to targeted constituencies while minimizing the harm to consumers as a whole. However, we caution that the case for any subsidies is likely to be quite weak.

In Part V, we analyze regulatory policies intended to prevent incumbent, regulated firms (such as local exchange carriers) from cross-subsidizing their deployment and operation of interactive broadband services to the detriment of equally efficient rivals—and, eventually, consumers. In particular, we describe the salutary effects of price-cap regulation and of an efficiency-based rule for the pricing of inputs sold to competitors of a vertically integrated monopolist.

In Part VI, we examine whether new interactive broadband services should be regulated. We conclude that it would be counterproductive to do so and that such services are not likely to be necessities of life of the sort that government has traditionally regulated. We next examine whether there should be mandatory interconnection to competing providers of interactive broadband services. We conclude that such mandatory interconnection is unlikely to be necessary and that, if ordered by statute or regulation, it would present exceedingly difficult questions of what the prices, terms, and conditions of such interconnection should be.

In Part VII, our discussion turns to the Canadian telecommunications market because of our familiarity with certain policies raised there recently in a major regulatory proceeding. Nonetheless, our analysis is directly applicable to developments in the United States, which, so far as the deployment of interactive broadband technology is concerned, closely resemble those in Canada. We examine how policies toward foreign investment in the Canadian telecommunications industry are likely to affect the extent of competition in the delivery of interactive broadband services. We conclude that removal of even the recently relaxed limits on foreign ownership would benefit Canadian

consumers by enlarging the number of competitors having the technical expertise and financial resources to build interactive broadband networks in Canada.

In Part VIII, we examine whether the Canadian cable television industry should be protected from competition while it upgrades its network to provide interactive broadband services, including services that would compete with the voice and data services of local exchange carriers. We conclude that a prohibition or moratorium on telephone company entry into video would be unlikely to benefit consumers. We further conclude that consumers probably would not benefit from a policy of temporary subsidies to cable television operators in the price that they must pay to interconnect their voice and data services to the network of the local exchange carrier. However, we do note that this issue is more ambiguous in its consumer welfare effects than is a prohibition or moratorium on telephone company entry into video. In any event, we recommend that Canada's policies toward interactive broadband networks *not* emulate the approach of the Modification of Final Judgment—the consent decree in the United States that has created its own layer of judicially administered regulation over the Regional Bell Operating Companies since the divestiture of the American Telephone & Telegraph Company. In devising its policies for regulating interactive broadband networks, Canada should avoid adopting expansive line-of-business restrictions on certain kinds of telecommunications firms, the deleterious effects of which for consumers will supposedly be mitigated through a litigious case-by-case waiver process.

II. THE EVOLUTION OF INTERACTIVE BROADBAND TECHNOLOGY

Telecommunications involves the encoding, transmission, and decoding of signals transmitted through wires, cables, or the electromagnetic spectrum. These signals may carry voice messages, data, or video signals. Indeed, all three types of communications may move through any of the various media in either analog or digital form.

A. CURRENT NETWORKS

Traditionally, the distribution of voice and data signals was the responsibility of "telephone" networks, while video signals were distributed by broadcasters or cable television networks. The former technology moves information at a much slower speed than the latter.

As a result, less bandwidth is required for telephony than for video transmissions. For this reason, traditional voice/data telephony has generally been referred to as "narrowband" telecommunications, while video distribution has been referred to as "broadband" communications. To complicate matters further, voice communications involve two-way transmissions between separate points connected by a switching system. Data transmissions may also take place over a switched narrowband network, but the transmission of large amounts of data quickly requires more bandwidth—which often results in a dedicated broadband channel that allows for bidirectional communications. Video distribution, on the other hand, developed first in a broadcast mode, radiating broadband signals through the electromagnetic spectrum. Later, video signals would be distributed in far greater number through a network of coaxial cables. In either mode, video transmissions have been largely one-way communications of entertainment and information.

Recent technological breakthroughs in the areas of fiber optics, digital switching, digital signal compression, and spectrum transmissions have expanded the scope of telecommunications and have blurred the distinctions among the different types of networks. Because so much more information can be moved through any communications medium in digital form with modern electronics, the telephone network is no longer restricted to simple narrowband services. And with the development of relatively low-cost digital switching equipment, video services may now be offered on a two-way, interactive basis in addition to the standard one-way broadcast or "distributive" mode. Today, all types of narrowband and broadband services can be distributed through the spectrum via terrestrial or satellite links. The great distance to the geostationary orbit of a communications satellite is an impediment to interactivity because of the delay between transmission and reception, but even this handicap can be overcome through the use of multiple low-orbit satellites.[1] Finally, the use of low-power transmissions in terrestrial spectrum communications allows for the repeated use of frequencies with relatively small geographic separation in a "cellular" network design for narrowband and even broadband communications.[2]

1. Edmund L. Andrews, *An Orbiting System Is Planned to Link Most of the Globe*, N.Y. TIMES, Mar. 21, 1994, at A1; *see* Edmund L. Andrews, *The New Space Race in Satellite Communications*, N.Y. TIMES, Mar. 27, 1994, at F9; *LEO Project Update*, SATELLITE COMM., May 1994, at 10.

2. *See* GEORGE CALHOUN, DIGITAL CELLULAR RADIO 115 (1988).

The electronics and digital revolutions have also expanded the capacity of the electromagnetic spectrum. New developments in digital signal compression have increased the capacity of all distribution media. For example, technology available today allows video signals to be distributed through the paired copper wires that only a few years ago were thought to be capable of distributing only voice-grade signals.

In short, technological progress is now undermining all traditional assumptions about specialization in communications. Telephone companies can modify their terrestrial networks to offer standard television services and interactive broadband services. Cable companies can move not only from one-way to two-way, interactive video services, but also into the market for voice and data communications. And various types of spectrum-based systems can offer any or all of these services, from the simplest switched voice service to interactive video.

B. New Network Designs

In response to these technological changes, a wide variety of new systems is about to populate the telecommunications landscape. Unfortunately, most of these new systems are only in an experimental stage or in the early stages of commercial development, making any economic assessment of their likely viability very difficult. Nevertheless, we can offer some crude estimates of the likely cost of a few of the more promising alternatives.

Virtually all current designs for full-service, interactive voice/data/video networks involve the use of fiber-optic cable for the network backbone as a replacement for the copper wire in telephone networks and the coaxial cable in cable television systems. It was once thought that such advanced networks might be constructed entirely of fiber-optic cables, but the expense of this option and the difficulties in providing standby power for the subscriber loops (the connections between the network switches and the customer premises) in such a network forced network planners to consider alternative designs. A 1992 study by David Reed suggested that the foreseeable future cost of building a switched fiber-optic network would likely be $2000 per

household passed, assuming sixty percent penetration of video services.[3]

The most likely terrestrial architecture for a full-service network is now thought to be a "fiber-to-the-pedestal" network. Such a network would utilize fiber-optic distribution to a set of remote interfaces from which coaxial cable would be extended to final consumers.[4] Such designs generally anticipate serving about 500 subscribers from each remote interface. Pacific Bell has announced a major capital spending program to upgrade its urban California telephone systems and enable it to deliver one-way and switched video in addition to traditional voice/data services.[5] The likely cost of Pacific Bell's upgrade is subject to some dispute, particularly because the company argues that the incremental cost of facilities required to provide *video* services is only $50 per home passed. The cost of the entire fiber/coaxial-cable upgrade for Pacific Bell appears to be about $850 per access line.[6]

The estimates of the cost of new fiber/coaxial-cable networks vary considerably. Perhaps the most thorough analysis of the prospective costs of such a network are those of David Reed.[7] He estimates that the costs of building such networks are likely to fall into the range of $750 to $1000 per home if fifty percent of homes subscribe. Obviously, greater prospective penetration would lower these estimates. It should be stressed that these are *prospective* costs: No one has built such a system yet. In fact, there may be several false starts in constructing such a network, particularly as firms gain experience with the switching equipment and consumer interfaces. For example, Time Warner Enterprises has apparently spent as much as $7000 per set-top converter for its full-service network in Orlando, Florida. But the company expects these devices to fall into the $200 to $300 range as it expands coverage and exploits learning economies.[8]

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3. DAVID P. REED, RESIDENTIAL FIBER OPTIC NETWORKS: AN ENGINEERING AND ECONOMIC ANALYSIS 298–301 (1992); *see* LELAND L. JOHNSON, TOWARD COMPETITION IN CABLE TELEVISION 31–35 (1994).

4. *See, e.g.*, Joan Brightman, *Hybrid Fiber/Coax: Front Runner in the Broadband Transmission Race*, TELEPHONY, Nov. 28, 1994, at 42.

5. Jerry Swenson, *A New Concept for Roadwork on the Superhighway*, TELEPHONY, Mar. 21, 1994, at 30.

6. *See* Testimony of Robert G. Harris in support of Pacific Bell's Section 214 Application to the Federal Communications Commission (Dec. 14, 1993) (on file with author).

7. DAVID P. REED, THE PROSPECTS FOR COMPETITION IN THE SUBSCRIBER LOOP: THE FIBER-TO-THE-NEIGHBORHOOD APPROACH (FCC Office of Plans & Policy, Sept. 1993).

8. Edmund L. Andrews, *Time Warner's Ordinary People Plug Interactive TV*, N.Y. TIMES, Dec. 18, 1994, at F9 ($7000 estimate); Frank Beacham, *Hype, Hope and Reality: Why the Video*

An alternative to the full fiber/coaxial-cable network is to upgrade existing telephone networks on a line-by-line basis with asynchronous digital subscriber line (ADSL) technology. Using advanced digital-compression techniques, ADSL allows telephone companies to deliver two video-grade signals over existing paired copper wires. The advantage of ADSL is that it allows a telephone company to deliver video services to a small number of homes without completely rebuilding its existing local network. The disadvantage is that ADSL has limited channel capacity and costs between $1500 and $2000 per line. Bell Atlantic is experimenting with this technology in Arlington, Virginia,[9] and Rochester Telephone has received authorization from the Federal Communications Commission (FCC) to conduct a smaller ADSL trial.[10] In addition, Puerto Rico Telephone Company has applied for FCC authorization to test video dial tone services employing both ADSL and "fiber-to-the-curb," a network structure similar to "fiber-to-the-pedestal" whereby optical fiber is extended even further in the network to a curbside vault, to which approximately ten to fifteen homes can be connected with coaxial cable.[11]

Many other prospective networks exist for delivering voice, data, video, or some combination of the three, but none appears as close to commercial reality for offering all three services simultaneously as ADSL. Current direct-to-the-home (DTH) systems—or direct broadcast satellite (DBS), as it is called in the United States—may offer limited interactivity, but they are not likely to offer voice/data services. DTH systems with low-orbiting satellites may eventually provide a full array of telecommunications services, but not in the next few years.[12]

Superhighway Will Take Longer & Cost More than Anyone Believed, VIDEO MAG., Aug. 1994, at 36 ($7000 estimate); Cynthia Bournellis, *Changing Channels: Interactive Television*, PC WK., Nov. 21, 1994, at A14 ($3000 estimate).

9. Chesapeake and Potomac Tel. Co. of Va., 8 F.C.C.R. 2313 (1993) (application to test video dial tone services in Virginia); *see also* Letter from James D. Schlichting, Chief, Policy and Program Planning Division, Common Carrier Bureau, Federal Communications Commission to Marie Breslin, Director, FCC Relations, Bell Atlantic Network Services, Inc., 1994 FCC LEXIS 4938 (Sept. 27, 1994) (granting a six-month extension of Bell Atlantic's trial).

10. Rochester Tel. Corp., 9 F.C.C.R. 2285 (1994) (application to test video dial tone in New York); *see also* Rochester Tel. Corp., 9 F.C.C.R. 3568 (1994) (denying MCI Telecommunications' petition for suspension and investigation or rejection of Rochester's plan).

11. Puerto Rico Tel. Co., 10 F.C.C.R. 156 (1994) (application to test video dial tone services in Puerto Rico).

12. LORAL CORP., 1994 ANNUAL REPORT 9-10; Scott Chase, *Interview: Loral Chairman and CEO Bernard Schwartz*, DEFENSE DAILY, July 15, 1992, at S1.

Terrestrial wireless services have the potential to offer a full complement of interactive voice/data/video services, but none has yet been developed to do so, perhaps because of the absence of efficient markets for allocating the requisite spectrum. Fixed wireless designs are limited in the United States because of spectrum availability. Newer cellular wireless systems operating in the 28 GHz band have been installed in New York City and Calgary for a limited one-way video service known as local multipoint distribution service (LMDS), although their developer asserts that those systems can be modified to offer two-way, interactive services.[13] The current cellular telephony services and the newer personal communications services (PCS) are simply not designed for broadband applications.

III. THE DEMAND FOR NEW SERVICES

Much of the interest in the new full-service networks is driven by network users, policymakers, and engineers who see a potentially vast array of new services that could be offered over a "superhighway." The commercial forces behind these new networks, however, are concerned about the development of services over a short horizon. In the words of Viacom's chief executive officer, "whatever the superhighway is . . .—fiber optic, copper, satellite—it is in the final analysis a distribution technology which will only work if what's on it is what the consumer wants and is willing to pay for."[14]

The cable and telephone industries are now positioning themselves to deliver standard video entertainment services as well as switched voice/data services. The most important innovation in the near term is likely to be pay-per-view or "video jukebox" services. The latter are motion pictures or other film/tape entertainment delivered to addressable customer converters from a central library by means of a remote server. Viewers may be permitted to start, stop, or rewind these tapes from their living rooms. These services may be delivered today with current asynchronous transfer mode (ATM)

13. *See* Rulemaking to Amend Part 1 and Part 21 of the Commission's Rules to Redesignate the 27.5–29.5 GHz Frequency Band and to Establish Rules and Policies for Local Multipoint Distribution Service; Notice of Proposed Rulemaking, Order, Tentative Decision and Order on Reconsideration, CC Dkt. No. 92-297, 8 F.C.C.R. 557 (1993); Second Notice of Proposed Rulemaking, 9 F.C.C.R. 1394 (1994); Edmund L. Andrews, *A New Microwave System Poses Threat to Cable TV*, N.Y. TIMES, Dec. 11, 1992, at A1; WIC WESTERN INT'L COMMUNICATIONS LTD., 1993 ANNUAL REPORT 28.

14. Sumner Redstone, Chairman and Chief Executive Officer, Viacom, Inc., Speech at the National Press Club, Washington, D.C. (Oct. 19, 1994) (transcript available in LEXIS, Nexis Library, CURNWS file).

switches, servers, and set-top converters. The large-scale fiber/coaxial-cable networks allow a large number of video signals to be delivered in a traditional one-way direction and a large number of channels to be set aside for interactive uses, such as the video jukebox or more sophisticated services.

A serious question is whether simply providing more motion pictures and sports will support expenditures of $750 to $2000 per subscriber line. If only a small share of subscribers elect the video service and if these viewers only order two to four motion pictures per month, as some experiments appear to suggest, more than pay-per-view movies and sports must be offered to support the construction of the information superhighway.[15]

We can only speculate as to the nature of new services, and we obviously have no evidence on the intensity of demand for them. In the near term, more sophisticated home-shopping services may develop, including home financial services. Consumers will be able to pay their bills, make deposits, and transfer funds through these interactive networks. The more adventurous may connect to a variety of interactive information services such as those now offered by commercial operations and the Internet. Interconnection with distant electronic libraries and long-distance video games are also near-term possibilities.

The exciting new uses of interactive networks also involve scientific and medical applications. The practice of telemedicine, however defined, is a likely possibility.[16] Team surgery could be practiced with

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15. A recent study illustrates most subscribers' reticence in using these services:

> In an extensive test of movies on demand completed [in 1993] by U S West and Tele-Communications Inc. in Denver, customers bought fewer than three movies a month on average. In surveys, moreover, viewers have proved unwilling to pay much more for a movie than the $3 or $4 charged by video stores.

Edmund L. Andrews, *Time Warner's 'Time Machine' for Future Video*, N.Y. TIMES, Dec. 12, 1994, at D1. This low level of demand

> leads to basic cost problems for a telephone or cable service, said Robert Alexander, head of Alexander & Associates, a New York consultant. "A movie can tie up your line for two hours," he said. "[I]f you can only charge about $4, and Hollywood is going to take about half of that, it means you're getting about 1.6 cents a minute for the line." That is less than what telephone companies often charge for ordinary phone calls.

Id. at D1, D7.

16. *See* Francis J. Cronin, Mark A. Gold, John L. Sigalos & Beth Burnham Mace, *Telecommunications and Cost Savings in Health Care Services*, 61 S. ECON. J. 343 (1994); Kathy Chin Leong, *Enlarging the Mind of the Network: ATM Proves to Be a Valuable Asset to Medical Professionals and Others Who Need Critical Information Transmitted Quickly and Efficiently*, COMM. WK., Sept. 19, 1994, at 67.

a number of surgeons adding their input from remote locations to which real-time monitoring data such as MRIs or CAT scans would be delivered. Scientists may be able to adjust large-scale models in real time from remote locations or download large amounts of data in a very short period of time with only limited need for advanced error-correction programs.

The large amounts of bandwidth could also be used for multi-point video conferencing. Educational institutions, in particular, could conduct "classes" among students in various remote locations at reasonable cost. This "telelearning" might, for example, expand the participation of adults in higher education.

There will be little evidence of the market demand for new interactive services until firms actually build the networks and experiment with new service offerings. In this start-up environment, it is essential that policymakers allow a wide range of new network designs and new service offerings so that consumers may be afforded as wide a range of choices as possible.

IV. THE REQUISITES OF PUBLIC POLICY FOR INTERACTIVE BROADBAND NETWORKS

A competitive market is the best mechanism for identifying which technologies are most efficient for building and operating interactive broadband networks and which services consumers demand from such networks. Beginning here and continuing through Part VIII, we address public policies that are necessary to ensure that the market can indeed perform this screening function.

A. Open Entry and Avoidance of Subsidies

There are two traditional economic rationales for regulating an industry. First is the existence of externalities. Some telecommunications regulations, such as policies promoting universal service, are justified as a means of capturing for consumers as a whole the benefits of "network externalities" that accrue as the size of the network grows.[17] Such externalities will vary with both the number of consumers having access to the network (access externalities) and the amount by which

17. *See, e.g.*, Lester D. Taylor, Telecommunications Demand in Theory and Practice 9 (1994).

each consumer uses the network (usage externalities). Network externalities become less important as more and more subscribers are connected to the network. With respect to the narrowband network for voice telephony, once subscription rates exceed ninety-five percent of all households, these externalities become quite small.

It is possible that interactive broadband applications will generate network externalities of both the access and usage varieties. For example, the benefit to society from telemedicine applications may rise, first at increasing and then at diminishing marginal rates of access and usage, as additional hospitals and research laboratories subscribe to the broadband network. It is not clear, however, that any market imperfection is likely to arise in this instance. Producers of new word-processing software, for example, have been able to use promotional pricing strategies to stimulate the consumer acceptance of their products necessary to create the desired network externalities. If government nonetheless were convinced that its intervention was necessary to ensure that access to, and usage of, interactive broadband networks attained the socially optimal scale, the superior instrument of public policy would be a direct subsidization of the broadband applications at issue, rather than an attempt to regulate entry, pricing, investment, or service quality.

The second and more pervasive economic justification for regulating telecommunications is natural monopoly that derives from economies of scale and scope. When formulating policies for interactive broadband networks, however, regulators should be cautious about assuming that natural monopoly will necessarily characterize such networks. What was once a naturally monopolistic method for delivering a particular kind of telecommunications service may be supplanted over time by a lower-cost method that does not necessarily have large sunk costs and low incremental costs.[18] This kind of transformation appears to be occurring today in local telephony with the development of various wireless technologies. Moreover, as Part II indicated, the number of alternative technologies that might be employed to build and operate interactive broadband networks leaves unanswered the question of whether such networks will have the cost characteristics of a natural monopoly. The wiser course for regulators, therefore, is to encourage competition among technologies and firms.

18. For a concise explanation of why the theory of natural monopoly poorly describes the current market for local telecommunications services, see Daniel F. Spulber, *Deregulating Telecommunications*, 15 YALE J. ON REG. 25 (1995).

For there to be a true tournament among all potential providers of interactive broadband services, it is necessary that the market be free of regulatory barriers to entry; that is, barriers created artificially by statute or regulation, rather than by the economies of scale and scope inherent in the industry's cost structure. Opposition to new entry, of course, is a predictable response among incumbent firms in any industry. Since at least the 1930s, incumbent firms in the United States have repeatedly entreated regulators to prevent, or at least to circumscribe, entry by rival firms exploiting new communications technologies. For example, newspapers resisted the growth of radio broadcasting, radio broadcasters resisted the growth of over-the-air television, over-the-air television broadcasters resisted the growth of cable television, cable television operators resisted the entry of telephone companies into video, and so forth.[19]

An additional factor has frequently inclined regulators toward the suppression of entry. Typically, regulators have used the pricing structure for the services of the regulated firm as an off-budget means of subsidizing the delivery of such services to politically favored groups of consumers, such as residential customers or rural customers.[20] But if the incumbent is to remain financially solvent while being obliged to sell services below cost to a particular set of customers, it must charge at least one other set of customers prices that exceed the cost of serving them. Open entry, however, frustrates such pricing: The more that prices for a group of customers exceed the cost of serving them, the greater the incentive for a rival firm to enter the market and "cream skim" by underpricing the incumbent (even if the entrant's costs exceed the incumbent's). To preserve the incumbent's ability to recoup losses on its forced sale of services to the regulator's preferred class of customers at uncompensatory prices, the regulator typically enables the incumbent to earn monopoly rents on the sale of its services to other customers. But the regulator can do so only by restricting entry and by impeding the ability of consumers to substitute rival services (often ones made possible by an advance in technology) for the regulated service. The result is a kind of market allocation by regulatory fiat: The regulator defends, though not in so many words, a policy of permitting incumbent firms to earn supracompetitive returns on sales to certain customers, a portion of which the

19. *See, e.g.*, BRUCE M. OWEN & STEVEN S. WILDMAN, VIDEO ECONOMICS 14–18 (1992).

20. *See, e.g.*, ROBERT W. CRANDALL, AFTER THE BREAKUP: U.S. TELECOMMUNICATIONS IN A MORE COMPETITIVE ERA 16–42 (1991).

incumbent will be obliged to sacrifice at the regulator's behest to subsidize service to those classes of customers whom the regulator deems to be deserving.

The process is imperfect, however, from the regulator's perspective. As a legal matter, the new technology for bypassing the incumbent's service may not lie within the regulator's existing jurisdiction, for the regulator's authorizing legislation may have been drafted long before anyone could have expected the new technology at issue and comprehended its implications for competition in the regulated arena. Thus, the incidental effect of this process is that the regulatory agency has a recurring incentive to expand its jurisdiction over new, competing technologies. Apart from being harmful to consumer welfare to the extent that it thwarts competitive entry, this outcome is ironic because it was the *absence* of competitive alternatives that provided the ostensible purpose for regulating the incumbent in the first place. Now, to preserve the incumbent's supracompetitive returns, the regulator must regulate the incumbent's nascent competitors.[21]

In the United States, the particular policies that have had the effect of suppressing competitive entry or substitution in communications are almost too numerous to list. They include the newspaper-television cross-ownership rule;[22] the statutory prohibition preventing a telephone company from providing video programming within its area of telephone service;[23] the regulatory barrier to cross-ownership of a television network and a cable television system;[24] the financial interest and syndication rules restricting television network entry into program production and ownership;[25] regulations limiting the horizontal sale of a television or radio broadcasting firm and thus limiting its ability to enter new markets without divesting itself of stations elsewhere;[26] the Modification of Final Judgment in the American Telephone & Telegraph Co. (AT&T) antitrust case, which imposes line-of-

21. *See, e.g.*, J. Gregory Sidak, *Telecommunications in Jericho*, 81 CAL. L. REV. 1209, 1227–34 (1993).

22. 47 C.F.R. § 73.3555(c) (1993).

23. 47 U.S.C. § 533(b)(1) (1988). *But see* Chesapeake & Potomac Tel. Co. v. United States, 42 F.3d 181 (4th Cir. 1994) (holding cable-telephone company entry ban to be an unconstitutional infringement of speech).

24. 47 C.F.R. § 76.501(a)(1) (1993).

25. 47 C.F.R. § 73.658(j) (1992). *But see* Schurz Communications, Inc. v. FCC, 982 F.2d 1043 (7th Cir. 1992) (Posner, J.) (vacating and remanding financial interest and syndication rules of FCC as arbitrary and capricious).

26. 47 C.F.R. § 73.3555(d) (1993).

business restrictions that prevent the Regional Bell Operating Companies from providing transmission service across local access and transport area (LATA) boundaries;[27] and state statutes and regulations forbidding competitive entry into telephone exchange service.[28] In addition, the protracted process by which the FCC allocates spectrum and the inability of a licensee to redeploy its spectrum to a more highly valued use act as generic barriers to entry into any new wireless telecommunications service that threatens to compete with wireline services.[29] To be sure, American regulators have cloaked each of these policies in some public-interest rationale at one time or another. The *effect* of each such policy, however, is to impede entry by rivals or efficient substitution by consumers.

Today, the cost of such protectionist policies is much higher than in previous decades because the pace of technical change has accelerated. The costs of blocking new entrants with new technology are rising sharply. The inescapable conclusion is that regulators should avoid repeating this history of entry barriers and subsidies when devising the competition and regulatory policies for interactive broadband networks. The market for the provision of such services should be open to entry. Legislation or regulation should be drafted to minimize the likelihood that the regulatory framework will enable the incumbents of tomorrow to impede the entry of firms employing as yet unforeseen technologies for the delivery of interactive broadband services in the future.

B. Defining and Funding Universal Service

If, as a matter of social policy, regulators decide to subsidize a particular group of consumers in its use of interactive broadband services, it is preferable for government to fund those subsidies explicitly through its power to tax and appropriate funds from the public treasury. Regulators should resist the temptation to fund the subsidies by

27. For a thorough discussion and critique of the inter-LATA ban, see Michael K. Kellogg, John Thorne & Peter W. Huber, Federal Telecommunications Law 295–314 (1992).

28. *See* National Ass'n of Regulatory Util. Comm'rs, Utility Regulatory Policy in the United States and Canada Compilation 1992–1993, at 360–61 tbl. 165 (1993) (identifying nineteen states as of 1993 that prohibited competition in local exchange service).

29. The decade-long delay in allocating spectrum for mobile cellular telephony in the United States is estimated to have cost at least $86 billion in lost consumer welfare. *See* Jeffrey H. Rohlfs, Charles Jackson & Tracey Kelly, Estimate of the Loss to the United States Caused by the FCC's Delay in Licensing Cellular Telecommunications (National Econ. Res. Assoc., Inc., Nov. 1991).

distorting the prices charged other consumers of interactive broadband services.

In the United States, some of the most notable statements by senior policymakers concerning the information superhighway have referred to information "haves" and information "have-nots."[30] These remarks imply that any disparity in access to interactive broadband services must be avoided as part of a technologically revised policy of universal service. There are several risks in viewing universal service through this lens. First, for the reasons already mentioned, it is doubtful that, relative to private firms, government policymakers will have superior knowledge of the interactive broadband services that consumers will ultimately demand. If we do not even know what the information "haves" are likely to demand, the government can hardly know what to prescribe to improve the relative standing of the information "have-nots."

Second, consumer tastes are heterogeneous across the population. Consequently, it does not necessarily reflect a failure of government policy or an inequitable distribution of income that some consumers demand sophisticated communications products while others do not. Forcing all consumers to receive the same package of services is likely to cause providers of interactive broadband services to gravitate to the lowest common denominator. Interactive broadband services would be less diverse and less responsive to niche markets, such as those involving research laboratories, medical facilities, and large private corporations.

Third, the information "have-nots" may lack other important resources that impede their economic advancement, such as literacy, education, and work experience. If so, then the substantial cost of subsidizing interactive broadband access to their homes may actually divert the public's attention and financial resources from other policies that would materially improve conditions for these persons in a shorter period of time. It may be counterproductive as well as foolhardy to oversell the ability of the information superhighway to cure social ills.

Fourth, if universal service becomes the predominant public policy concern regarding the deployment and operation of interactive

30. Edmund L. Andrews, *The Media Business: New Plan for Phone and Cable*, N.Y. TIMES, Dec. 22, 1993, at D1 (reporting on a speech by Vice President Albert Gore).

broadband networks, then regulators, in their attempt to use the information superhighway as a tool to redistribute income, may inadvertently foreclose the possibility of intermodal competition among rival networks. A recent report by McKinsey & Company explains how this state of affairs might come about:

> [T]he [Clinton] Administration has . . . stressed the need for universal access as a way to avoid the segregation of society into information "haves" and "have nots." This goal is likely to conflict with facilities-based competition. Market forces may well lead to the early deployment of two full-service networks in affluent areas, but preclude investment in costly-to-serve rural areas or impoverished inner-city neighborhoods. As the potential for conflict becomes more apparent, there may be a shift in regulatory policy toward a more heavily regulated, "one wire" approach, which avoids redundant investments in a second broadband network and gives greater emphasis to the policy objective of universal access.[31]

From the perspective of maximizing consumer welfare, it would be regrettable if the commitment to empowering disadvantaged segments of the population were to have the unintended effect of denying *all* segments of the population the substantial benefits that would flow from having two or more facilities-based providers of interactive broadband services rather than one. This point holds even more forcefully when one considers that the government has available to it less costly alternative means of ensuring that impoverished segments of the population have access to interactive broadband services—such as access through public libraries and schools.

Fifth, policymakers should consider that advertisers are, in a manner of speaking, a potential source of subsidies for access to, and usage of, interactive broadband networks. Advertisers, of course, have long subsidized the consumption of "free" programming offered by radio broadcasters and over-the-air television stations. Similarly, the presence of advertising on cable television enables consumers to pay a lower subscription fee than they otherwise would be charged. Moreover, the interests of advertisers are closely aligned with those of consumers of programming in the sense that both groups seek policies that expand output and reduce prices for telecommunications services of all kinds, irrespective of the technological mode of signal delivery. Regulation that restricts output in telecommunications markets impairs the welfare of both viewers and advertisers. This commonality

31. John Hagel III & Thomas R. Eisenmann, *Navigating the Multimedia Landscape*, MCKINSEY Q., June 22, 1994, at 45.

of interests arises from the fact that the demand for broadcast programming—and, by extension, the demand for interactive broadband services—is the vertical summation of two demand curves: the viewers' demand for programming and the advertisers' demand for audiences. As in the case of any multiproduct firm, the provider of interactive broadband services will likely have common fixed costs of production that are high relative to the incremental costs of programming or infrastructure deployment. Those common fixed costs are optimally distributed in inverse relation to the elasticity of demand. Access charges and usage charges can be borne either by the advertiser or the subscriber. If, however, the advertiser has the more price-inelastic demand, it is optimal from the perspective of economic efficiency for the advertiser to bear the disproportionate share of those costs. This result may also be considered equitable in the sense that it advances the goal of universal service by keeping the prices of access to, and usage of, interactive broadband networks lower than they would be in the absence of advertiser support.

V. PROTECTIONS AGAINST CROSS-SUBSIDIZATION BY INCUMBENT, REGULATED FIRMS THAT BUILD AND OPERATE INTERACTIVE BROADBAND NETWORKS

When a rate-regulated monopolist enters a competitive market, there is a risk that it will underprice its rivals by attributing some of the costs of producing the competitive product to its rate-regulated activities, passing the misallocated costs along to its captive rate payers. The potential for cost misallocation reflects the asymmetry of information between the regulated firm and its regulator: The regulator has imperfect information about the firm's true costs and the appropriate allocation of common fixed costs among regulated and unregulated operations. Thus, the regulator is at a disadvantage when seeking to link the firm's profits on regulated operations to its cost of service.

Cross-subsidization has been a recurrent concern whenever local exchange carriers (LECs) propose to enter other lines of business.[32] The concern, however, should not bar LECs from developing interactive broadband networks, nor cable companies from offering switched

32. *See, e.g.*, CRANDALL, *supra* note 20, at 157–60 (describing the cross-subsidization concerns underlying the line-of-business restrictions imposed on the Regional Bell Operating Companies by the Modification of Final Judgment).

voice services, because various safeguards have been devised to remove the incentive or ability of regulated firms to misallocate costs.

A. Replacement of Rate-of-Return Regulation with Price-Cap Regulation

A frequent policy prescription to reduce the incentive and opportunity for cost misallocation is to replace rate-of-return regulation with price caps.[33] Price caps build on a virtue that derives from the phenomenon of regulatory lag—that is, the general delay in the responses of regulators to changes in cost or market conditions. The pertinent delay here is the regulator's time lag in adjusting permitted prices to changes in costs.

Suppose that the firm's prices are set on the basis of current costs, and the firm succeeds in reducing those costs substantially. Suppose further that two years elapse before regulators require the firm to cut its prices correspondingly. In such a situation, the firm will enjoy two years of superior profits as its reward for improving efficiency. That process mimics a competitive market, where a cost-cutting innovator enjoys superior but temporary profits. Those higher profits end when rivals introduce their own cost-reducing innovations, wiping out the competitive advantage temporarily enjoyed by the earlier innovator.

The built-in regulatory lag at the heart of the price-cap approach must be substantial; otherwise, firms will have no effective incentive to undertake the heavy costs and risks of innovation, and society will bear the costs of inefficiency. On the other hand, the lag, like the life of a patent, must not be infinite, lest the consuming public be forced to forgo the benefits of lower prices that the competitive market normally provides.

Regulatory lag thus supplies the incentive required to elicit innovation and productivity growth, with one critical exception. When inflation is substantial, regulatory lag delays the adjustment of output prices to compensate for inflationary increases in nominal input costs. This delay squeezes the profits of the regulated firm and undercuts

33. *See* Bridger M. Mitchell & Ingo Vogelsang, Telecommunications Pricing: Theory and Practice 167–75, 276–85 (1991); Ronald R. Braeutigam & John C. Panzar, *Diversification Incentives Under "Price-Based" and "Cost-Based" Regulation*, 20 RAND J. Econ. 373, 387–90 (1989); Ronald R. Braeutigam & John C. Panzar, *Effects of the Change from Rate-of-Return to Price-Cap Regulation*, 83 Am. Econ. Ass'n Papers & Proc. 191 (1993); Tracy R. Lewis & David E.M. Sappington, *Regulatory Options and Price Cap Regulation*, 20 RAND J. Econ. 405 (1989).

both its incentive and its ability to invest in innovation. To deal with the inflation problem, the price-cap arrangement uses the following procedures. First, an initial price ceiling is determined on the basis of stand-alone cost or a defensible proxy. Second, the price ceiling is permitted to rise automatically each year by a percentage equal to the rise of some widely accepted index of inflation, such as the consumer price index (CPI), after subtracting some number, X, from the percentage increase in that price index. The resulting index is often referred to as "CPIX." Third, X is calculated from the industry's differential rate of productivity growth in the past or as a target rate of productivity growth for the future.

The logic of price caps is straightforward: The firm is permitted a percentage increase in the profit margin on its product that precisely equals the amount by which its productivity performance exceeded the target. The opposite is experienced by a firm whose productivity performance falls short of the target. In sum, under price caps, the firm whose productivity increase exceeds the norm will enjoy higher returns exactly commensurate with its achievement, while the firm with poor productivity performance will correspondingly be penalized.

Price caps do more than induce the firm to minimize its cost ot production. They also eliminate the incentive for the firm to cross-subsidize new lines of business through the misallocation of costs, for the firm may charge up to its maximum price whether or not its accounting costs for the regulated service change. In this manner, price caps sever the link that rate-of-return regulation creates between the regulated firm's realized production costs and its allowed earnings. Under rate-of-return regulation, the firm can raise its allowed earnings by one dollar whenever it can mischaracterize a dollar of costs incurred in the production of unregulated products as having been incurred in the production of regulated products. Under price-cap regulation, however, the firm is not allowed higher revenues from regulated services when the costs of those activities rise; thus, the firm cannot increase its earnings by assigning accounting costs from its unregulated services to its regulated services. This inability to profit from cost misallocation correspondingly reduces the firm's incentive to attempt cross-subsidization.

In its September 1994 decision on the regulatory framework for telecommunications, the Canadian Radio-television and Telecommunications Commission (CRTC) succinctly summarized the benefits to

consumers from the shift by regulators from rate-of-return regulation to price caps:

> Price caps allow for more efficient and effective regulation in a number of ways. First, price caps reduce incentives and opportunities for companies to over-invest or misallocate costs. Once caps are established, prices cannot exceed them (apart from the operation of a limited number of exogenous variables), even if the investment base is increased. Second, price caps reduce opportunities to cross-subsidize or engage in anti-competitive pricing, because price changes in one basket cannot be offset by changes in other baskets. Third, price caps provide incentives for telephone companies to be more efficient and innovative, since shareholders assume more of the risks and rewards of business decisions and retain the benefits of higher levels of productivity. Fourth, price caps can eliminate the need for regulatory assessment of investment, expenses and earnings between price cap performance reviews.[34]

To the CRTC's concise summary one need only add the caveat that price caps are superior to rate-of-return regulation in providing incentives for efficiency as long as the productivity improvement factor is not readjusted periodically in response to actual carrier performance. The regulator must credibly commit itself to the policy that, after the fact, the fruits of superior performance by the regulated firm will not be appropriated, nor will inferior performance elicit a government bailout.

B. Other Regulatory Safeguards

Several other regulatory safeguards can reduce the likelihood of anticompetitive behavior by a local exchange carrier when it introduces interactive broadband services.

1. *Accounting Separations*

One safeguard is a uniform system of accounts by which a local exchange carrier must separate the revenues and costs of its unregulated activities from the revenues and costs of its regulated activities. However, as Leland Johnson, a respected telecommunications economist, has noted, accounting safeguards by themselves do not ensure that the portion of total costs attributed by the LEC to its video services is indeed the correct measure of the LEC's incremental cost of providing such service: "Accounting rules are designed to assign costs

34. Review of Regulatory Framework, Telecom Decision CRTC 94-19 (1994).

incurred to the proper accounts, not to evaluate the appropriateness of these costs in light of alternative ways the LEC might have operated."[35] Thus, accounting safeguards are most beneficial in preventing cost misallocation when used in conjunction with other regulatory tools that shed light on the incremental cost to the regulated firm of providing interactive broadband services.

2. *Separate Subsidiaries*

A second safeguard is to require that the LEC provide interactive broadband services through an entity that is structurally separated from the entity providing local exchange service. Typically, a firm proposes a separate subsidiary for its entry into the new line of business. Again, as Leland Johnson has noted, this form of structural separation may facilitate the separation of cost accounts, but it does not make the regulator's task of determining whether the LEC has correctly reported its incremental cost of providing interactive broadband services any easier.[36]

At the same time, there would be costs to economic welfare if the structural separation frustrates the exploitation of economies of scope between the LEC and its subsidiary providing interactive broadband services. The more synergistic the LEC's regulated and unregulated activities, the more extensive would be the common fixed costs that, on the one hand, give rise to concerns of cost misallocation and, on the other hand, reflect the economies of scope between the two activities. Given that structural separation is likely to offer limited benefits in terms of preventing cross-subsidization, and given the possibility that such separation would cause consumers to forgo cost savings arising from economies of scope, there would seem to be little justification for requiring the LEC to offer interactive broadband networks through a separate subsidiary.

3. *Nondiscriminatory Pricing by the Vertically-Integrated Monopolist in the Sale of Inputs to Competitors: The Efficient Component-Pricing Rule*

A third regulatory safeguard against cross-subsidization is to require that the LEC, when providing interactive broadband services, impute to itself the same price for access to the local exchange (or to

35. JOHNSON, *supra* note 3, at 73.
36. *Id.* at 76.

its unbundled components) that the LEC charges to competing providers of such services, such as operators of cable television systems.

A critical requirement for economic efficiency is that the price of any product be no lower than that product's marginal cost or its average-incremental cost. The pertinent marginal cost as well as the average-incremental cost must include all *opportunity costs* incurred by the supplier in providing the product; that is, all potential earnings that the supplying firm forgoes, either by providing inputs of its own rather than purchasing them, or by offering services to competitors that force it to relinquish business to those rivals, and thus to forgo the profits on that lost business. In a competitive market, price always includes compensation for such opportunity costs. The "efficient component-pricing rule" states simply that the price of an input should equal its average-incremental cost, *including all pertinent incremental opportunity costs*. That is, the efficient component price equals the input's direct per unit incremental cost plus the opportunity cost to the input supplier of the sale of a unit of input.[37]

In the presence of universal-service obligations, financial solvency requires the owner of a network to charge more for interconnection than merely the direct incremental cost of using the network. If the network owner does not receive compensation for providing universal service when selling access to a competing service provider, each unit of access sold will entail an opportunity cost in the amount of the contribution that the network owner would have earned on the implicit self-sale of the unit of access. The opportunity cost might consist of even more than the forgone contribution to universal-service obligations: If the network owner earns positive economic profit (such as monopoly rent) on the sale of a final telecommunications product of which access is a component, then this sale of access to a competing service provider causes a loss of this amount as well.

The Judicial Committee of the Privy Council recently held in *Telecom Corp. of New Zealand Ltd. v. Clear Communications Ltd.* that the efficient component-pricing rule is compatible with New Zealand's antitrust statute prohibiting abuse of a dominant market position.[38] The case involved the pricing of inputs sold by the incumbent

37. *See* WILLIAM J. BAUMOL & J. GREGORY SIDAK, TOWARD COMPETITION IN LOCAL TELEPHONY 93–116 (1994); William J. Baumol & J. Gregory Sidak, *The Pricing of Inputs Sold to Competitors*, 14 YALE J. ON REG. 171, 178-88 (1994). The term "direct costs" refers to all costs that, from the point of view of the supplier firm, are not opportunity costs.

38. Telecom Corp. v. Clear Communications Ltd., Privy Council Appeal No. 21 of 1994, slip op. at 23–24 (P.C. 1994). For a discussion of this decision, see William J. Baumol & J.

LEC to a new competitor. The principal dispute was whether the opportunity cost component of the interconnection charge could include the incumbent's forgone monopoly rent on the sale of an unregulated final product of which access was a component. Their Lordships observed that the purpose of the efficient component-pricing rule is to remove the incentive of the vertically-integrated monopolist to discriminate in the sale of access. The rule's purpose is not to eradicate monopoly rents; rather, that is the job of price regulation, should legislators or regulators deem it necessary.

In the case of an interactive broadband network seeking interconnection to the current narrowband network of an incumbent LEC, the most difficult aspect of *Telecom*—the permissibility of recouping monopoly rents—is unlikely to be a major concern because the LEC will likely be subject to price-cap regulation, or at least rate-of-return regulation. Moreover, the LEC's ability to price at supracompetitive levels will likely have been constrained by the entry of numerous providers of local telephony services, an issue we shall address presently. Consequently, monopoly rent will represent little, if any, of the magnitude of the opportunity cost component of the efficient component price in this situation.

C. Competitive Pressures in the Regulated Market

Competition in formerly sheltered markets constitutes perhaps the greatest constraint on the ability of LECs to cross-subsidize their construction and operation of interactive broadband services. Cross-subsidization requires that the LEC have a set of captive customers who contribute positive revenues to the firm. If some customer services are subsidized by regulatory fiat, these services cannot be providing the LEC incremental profits that can be used to subsidize customers of interactive broadband services. This will be true even if, as one would expect, the LEC has a one hundred percent market share for the provision of such services.

The question then becomes: To what extent can the LEC subsidize interactive broadband services by raising the price of those services that contribute positive incremental profit to the LEC? In the United States, business customers have an expanding range of alternatives to voice and data services traditionally provided by the LECs.

Gregory Sidak, *The Pricing of Inputs Sold to Competitors: Rejoinder and Epilogue*, 15 Yale J. on Reg. 177, 179-85 (1995).

Competitive local telephony for business customers (and even many residential customers) is in its early stages in the United Kingdom, where foreign telephone and cable television companies have built cable telephony networks, and in New Zealand. More recently, Time Warner announced plans to offer local exchange service in Rochester, New York City, and Ohio;[39] and Sprint (with its cable partners' ownership of Teleport) and MCI have each announced plans to offer local exchange service in the suburbs of Chicago.[40] Other potential alternatives to services supplied by the LECs include competitive access providers (CAPs), local-area networks (LANs) and metropolitan-area networks (MANs), basic exchange telecommunications radio service (BETRS), wireless wide-area networks (WANs), and very small aperture terminal (VSAT) satellite networks.[41] Advances in telecommunications equipment also facilitate substitution away from the LEC's network; the most obvious example is the substitution by customers of private branch exchange (PBX) equipment for the LEC's Centrex service.[42] Similarly, the development of affordable high-speed cable modems may encourage the migration of data traffic from local telephone networks to cable television systems before interactive broadband networks are introduced.[43]

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39. Edmund L. Andrews, *Ameritech Forcefully Stays Home*, N.Y. TIMES, Nov. 22, 1994, at D1 [hereinafter Andrews, *Ameritech*]; Edmund L. Andrews, *Nynex Faces Yet Another Competitor*, N.Y. TIMES, Nov. 10, 1994, at D1.

40. Andrews, *Ameritech*, *supra* note 39, at D1; Richard Ringer, *MCI Submits Local Phone Service Plan*, N.Y. TIMES, Aug. 18, 1994, at D3.

41. *See* GEORGE CALHOUN, WIRELESS ACCESS AND THE LOCAL TELEPHONE NETWORK xv (1992).

42. *See* CRANDALL, *supra* note 20, at 92–93; PETER W. HUBER, MICHAEL K. KELLOGG & JOHN THORNE, THE GEODESIC NETWORK II: 1993 REPORT ON COMPETITION IN THE TELEPHONE INDUSTRY 6.2, 6.45 (1992).

43. *See* Russell Shaw, *Business Gets Wired for Cable: Cable Systems Offer Corporate Users High-Speed Data Transmission*, INFO. WK., Nov. 21, 1994, at 80; Carol Wilson & Richard Karpinski, *Cable Operators Rebound with New Strategies*, TELEPHONY, May 30, 1994, at 10; Larry J. Yokell, *Cable TV Moves Into Telecom Markets*, BUS. COMMUN., Nov. 1994, at 45 ("A number of vendors are developing cable modems that will deliver 64 Kbps to 10 Mbps."). The prospect of high-speed cable modems is significant as well for household consumption of interactive broadband services because a significant percentage of cable subscribers are also owners of personal computers:

> Currently, [in the United States] 32 million homes (31%) have PCs. In comparison, the number of homes that are passed by cable is three times that, and the number of cable subscribers is almost twice as high. Perhaps most importantly, in urban markets, two-thirds of cable subscribers have a home-based PC, enabling PC-based communications systems to take advantage of high-bandwidth coaxial cable needed for computer-based interactive applications.

Douglas C. Ashton, *Investing in the "Emerging" Telecommunications Industry*, SPECIAL REPORT (Hancock Inst. Equity Services), Dec. 2, 1994, at 8.

Although it is difficult to evaluate the extent to which these competitive developments will render cross-subsidization by the LECs infeasible in Canada, Leland Johnson, who has long expressed concern over the potential of LECs to cross-subsidize their provision of video services, observes that in the United States, "evolving market pressures are reducing the ability of LECs to cross-subsidize."[44] "The threat of cross-subsidization," he reasons, "is constrained because the pool of potential LEC monopoly revenues available to absorb cost shifting is shrinking."[45] This reasoning will apply even more conclusively by the time interactive broadband networks become operational. "The threat of cross-subsidy is less today than previously," Johnson concludes, "and it will continue to diminish."[46]

VI. REGULATION OF INTERACTIVE BROADBAND SERVICES AND NETWORKS

We consider now whether it is necessary or appropriate to regulate either interactive broadband services or competitive access to the networks that deliver such services. Our analysis suggests that both forms of regulation should be avoided.

A. SHOULD INTERACTIVE BROADBAND SERVICES BE REGULATED?

Interactive broadband services will far transcend simple dial tone service and over-the-air television reception. Such services are therefore not likely to be regarded as necessities of modern life. It is not clear why any market imperfection would be likely to arise with respect to the competitive provision of interactive broadband services that would require government regulation of price or product quality. Any market power in such services would likely be ephemeral, given the rapid rate of technological change in broadband communications.

Nor is it clear that government intervention in the market for interactive broadband services would be efficacious. The difficulty of predicting which interactive broadband services consumers will demand makes it virtually impossible to prescribe at this time ways to regulate such services. In particular, attempts to regulate the pricing

44. JOHNSON, *supra* note 3, at 80.

45. *Id.*

46. *Id.* at 81.

of broadband services are likely to encounter the same kinds of difficulties that arose in the implementation of the 1992 legislation reregulating cable television in the United States. Cable programming is far from a homogenous product and thus its quality is not easily regulated.[47] Consequently, the price reduction for cable television service ordered by the FCC pursuant to the 1992 legislation is likely to prompt a reduction in programming quality that regulators are powerless to prevent.[48] Interactive services would be even harder to regulate because, by definition, they will be unique, heterogeneous products.

B. Should Interactive Broadband Networks Be Subject to Mandatory Interconnection?

In considering the question of the interconnection of interactive broadband networks, the earlier discussion of efficient component pricing is again relevant. Compared to interconnection between two providers of narrowband services, however, a more complicated case presents itself when one provider of interactive broadband services seeks interconnection to a competitor's interactive broadband network. Now the opportunity cost to the first service provider of granting interconnection to the second may include the forgone rents that the former would earn on highly differentiated (but not monopolistic) interactive services. The interconnection issues become even more complicated because of a potential free-rider problem. Suppose that the incumbent has built the necessary infrastructure and identified which niches of consumers demand particular interactive broadband services. If required to provide interconnection to its rival, the incumbent in effect would be forced to subsidize the rival's entry unless the interconnection charge included (in addition to the economic rents forgone on highly differentiated interactive services) a recoupment of the sunk costs that the incumbent incurred in developing the interactive broadband services that consumers ultimately did *not* demand. Exploratory risk is a familiar feature of other industries: Many oil wells are dry holes, many movies flop, and many promising drugs fail

47. Indeed, it would arguably violate the First Amendment of the United States Constitution for the United States government to try to regulate program quality to any appreciable extent.

48. Thomas W. Hazlett, Reregulating Cable Television Rates: An Economic Analysis 55-67 (Working Paper Oct. 1994) (on file with author).

to receive regulatory approval. In each case, financial solvency requires that the firm be able to recoup the sunk costs associated with its unsuccessful efforts to develop new products.

Mandating interconnection for interactive broadband networks is thus complicated by the fact that *such networks do not even exist today*. If all networks terminate in a very sophisticated customer converter, developed at a very large cost, that allows the network owners to ration one-way and two-way services in a customer-friendly manner, are competitors to be permitted to share in the use of this converter? If so, how is the appropriate rental rate for such sharing to be determined by regulators? If not, is the network to be required to provide another terminus for its network that is outside its set-top converter? How would such an arrangement be priced?

Given the uncertainty over future technology, we do not know if two or more fiber-optic, copper-wire, or coaxial-cable subscriber drop lines will be extended to most consumers. We do not know if various wireless technologies will replace or compete with these lines. Thus, we cannot possibly conclude that the current coaxial-cable drop line is an "essential facility." If such a line proves to be the bottleneck for interactive broadband networks that the copper-wire drop line became for voice communications, mandatory interconnection policies could be considered. However, we view this prescription as premature in the current unsettled environment.

VII. FOSTERING COMPETITION THROUGH FOREIGN INVESTMENT

As Part IV explained, politics has dominated the resource allocation decisions in the telecommunications industry for decades, hindering or favoring particular players in the marketplace. Although such a state of affairs is always wasteful, its social cost was not so apparent over the many decades when one could safely assume that an inefficient regulatory apparatus was at least superior to a state-owned telephone monopoly. Over the past decade, however, the privatizations and deregulatory initiatives in other nations, especially the United Kingdom and New Zealand, have allowed a more extensive comparison of the costs and benefits of the telecommunications policies of Canada and the United States, where private ownership subject to regulation has taken the place of nationalized ownership.

The experiences of the United Kingdom and New Zealand suggest that one of the most efficacious policies that Canada—and for that matter the United States—could adopt to promote the development of interactive broadband services would be to eliminate restrictions on foreign investment. Steven Globerman has forcefully presented the theoretical arguments as to why restrictions on foreign ownership of telecommunications carriers fail to advance consumer welfare.[49] Our purpose here is not to repeat his analysis, with which we concur, but rather to draw attention specifically to the experience of the United Kingdom. That experience suggests that unrestricted foreign investment in Canadian and American telecommunications might hasten the introduction of interactive broadband networks and increase the likelihood that two or more competing networks would emerge.

The elimination of foreign investment restrictions in the United Kingdom has facilitated competitive entry into local telephony by expanding the universe of potential entrants to include foreign telephone and cable companies that have the necessary technical expertise and financial resources to compete against an incumbent as formidable as British Telecom (BT). Indeed, in the United Kingdom it has been Canadian and American firms—Bell Canada, Nynex, Sasktel, US West, Southwestern Bell, and TCI—that have introduced (along with Singapore Telecom) the same competition in local telephony and broadband services that regulators in the United States and Canada seek to nurture in their home markets.

Most video customers in the United Kingdom currently receive their multichannel programming not by wire but by satellite transmission, principally from British Sky Broadcasting (BSkyB), to small home receiver dishes.[50] As cable television operators entered the U.K. market, they simultaneously laid coaxial cables and copper twisted pairs so that they could offer customers telephony service as well as television service. Between July 1, 1993 and July 1, 1994, the number of cable telephony lines in the United Kingdom grew from 190,000 to 416,000.[51]

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49. Steven Globerman, *Foreign Ownership in Telecommunications: A Policy Perspective*, 19 TELECOMM. POL'Y 21 (1995).

50. *See* TELEWEST COMMUNICATIONS PLC, PROSPECTUS FOR 108,000,000 ORDINARY SHARES 50 (Nov. 7, 1994) [hereinafter TELEWEST].

51. *Id.* at 52.

To be sure, Oftel, the regulatory agency in the United Kingdom, has favored entrants. BT is constrained to charge a uniform price across the country, and thus may not reduce prices in an individual location to deter entry or match competitors there.[52] In addition, cable telephony providers receive a subsidy in their interconnection charge to BT's network (discussed in Part VIII.B),[53] and BT is subject to a ten-year moratorium (lasting until 2001) on entry into the video market.[54]

Notwithstanding these preferences for entrants, it is possible that the greatest stimulus for the U.K. cable and cable telephony markets has been foreign investment by telephone companies. Lehman Brothers reports that "the UK has become a model for how the cable television and telephone industries are expected to converge in the U.S. and in other countries, because the ability to offer dual services is so compelling."[55] As of January 1, 1994, over ninety-eight percent of cable subscribers in the United Kingdom who were also subscribing to cable telephony service were served by cable operators owned in whole or in part by a foreign telephone company.[56] Moreover, the rapid growth in cable subscribership did not begin until these telephone companies entered the market:

> Until 1990–91, cable television had been slow to develop in the UK, and there had been limited expertise in broadband networks among domestic companies. However, U.S. and Canadian cable and telephone companies were more familiar with wireline transport and cable television, and viewed the UK as a growth opportunity not just because of the underlying market potential but also because of its applicability to their domestic core business . . . . [T]he potential to offer telephony along with video services provided North American operators with a sophisticated network platform which could be utilised to test both technical and marketing applications of a full service network several years in advance of their introduction in the U.S.[57]

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52. *Id.*

53. *Id.* at 75.

54. *Id.* at 76.

55. LEHMAN BROTHERS, THE UK CABLE MARKET: BREAKING NEW GROUND 2 (1994).

56. Affidavit of Oliver E. Williamson, at 14 (May 31, 1994), submitted on behalf of Motion of Bell Atlantic Corporation, BellSouth Corporation, Nynex Corporation, and Southwestern Bell Corporation to Vacate the Decree, United States v. Western Elec. Co., No. 82-0192 (D.D.C. filed July 6, 1994).

57. LEHMAN BROTHERS, *supra* note 55, at 43.

In response, BT cut weekend rates by as much as sixty percent.[58] In addition, BT recently entered into an agreement with BSkyB pursuant to which the DTH company would offer its video subscribers discounts on BT's telephony services.[59]

Eliminating the remaining restrictions on foreign investment in telecommunications in Canada[60] would expand the number and intensify the rivalry of sophisticated firms seeking to build interactive broadband networks. Canadian consumers would be the beneficiaries. Given its high level of cable penetration, and its high levels of income and education, the Canadian market would offer foreign telecommunications firms a valuable laboratory in which to test network designs and service offerings. The successful designs and offerings subsequently could be replicated in the United States and in European and Asian nations that currently have substantial cable television infrastructures from which interactive broadband networks might be fashioned.

VIII. TRANSITIONAL POLICIES FOR CABLE TELEVISION

The development of interactive broadband networks will pit one set of competitors against another. It will also prompt one or more sets of competitors to ask regulators to "manage" the transition from the current market structure to the next. For the reasons given in Parts II and III, however, regulators cannot know what the future market structure will be. Thus, their attempts to manage the unknowable seem as likely to reduce economic welfare as to enhance it. We will now examine several questions concerning protections that regulators might be asked to offer to the Canadian cable television industry during the transition to interactive broadband networks.

58. Richard L. Hudson, *BT Cuts Rates on Phone Calls As Much as 60%*, WALL ST. J., Nov. 2, 1993, at A19.

59. Raymond Snoddy, *BT Links with BSkyB to Beat Cable Challenge*, FIN. TIMES, Nov. 12, 1994, at 4.

60. *See Invitation to Provide Comments on a Proposal to Amend the Direction to the Canadian Radio-television and Telecommunications Commission (CRTC) (Eligible Canadian Corporation)*, CAN. GAZETTE part I, Oct. 8, 1994, at 4158.

A. Should Telephone Companies Be Subject to a Prohibition or Moratorium on Entry Into the Provision of Interactive Broadband Networks?

As mentioned in Part VII, Oftel, the British telecommunications regulatory agency, has attempted to nurture the cable telephony industry in the United Kingdom by forbidding BT's entry into video delivery for ten years. One can imagine calls being made for a similar prohibition or moratorium on telephone company entry into video in Canada. Such an entry barrier would most likely harm consumer welfare for the reasons given in Part IV with respect to regulatory barriers to entry generally.

In addition, a strong argument against the adoption of an entry prohibition or moratorium can be found in the experience of the United States with the line-of-business restrictions in the Modification of Final Judgment (MFJ).[61] Today, the MFJ broadly prohibits the Regional Bell Operating Companies (RBOCs) from manufacturing telecommunications equipment and engaging in inter-LATA telecommunications services. At earlier times during the eleven-year period that the MFJ has been in effect, the decree was even broader in its proscriptions and forbade the RBOCs from entering all lines of business other than telecommunications and exchange access.

The MFJ allows for both contested and uncontested modification of its line-of-business restrictions through a waiver process. That process has proven to be slow and, consequently, costly in terms of delaying the benefits to consumers of greater price competition and new service introductions. By 1993, the average age of pending waiver requests before the Department of Justice was thirty-six months, despite the fact that the Department had opposed relief in only six of the 266 waiver requests filed by the RBOCs.[62] By the end of 1993, the average age of pending waiver motions before the district court having jurisdiction over the MFJ had grown to forty-eight months, despite the

61. United States v. American Tel. & Tel. Co., 552 F. Supp. 131, 226–28 (D.D.C. 1982), *aff'd sub nom.* Maryland v. United States, 460 U.S. 1001 (1983).

62. Affidavit of Paul H. Rubin, at 4 (June 14, 1994), submitted on behalf of Motion of Bell Atlantic Corporation, BellSouth Corporation, Nynex Corporation, and Southwestern Bell Corporation to Vacate the Decree, United States v. Western Elec. Co., No. 82-0192 (D.D.C. filed July 6, 1994).

fact that the court had approved in full ninety-six percent of all waiver requests filed.[63]

The delay in obtaining waivers of the MFJ's line-of-business restrictions suggests the kinds of costs that Canadian consumers would likely incur if the government's regulation of interactive broadband networks included a prohibition or moratorium on telephone company entry into video. The process of construing such a prohibition or moratorium, and of granting waivers, would invite litigation. Because such litigation would determine whether a firm would have the opportunity to compete in potentially lucrative product markets, it would be fiercely contested and heavily financed. While such litigation would be costly in its own terms, its greater cost would surely be in terms of delayed or forgone price competition and product innovation in the market for interactive broadband services. These insights drawn from the unsatisfactory experience of the MFJ should reinforce the Canadian government's natural aversion to restraining competitors until the market is deemed to be ready for competition.

B. Should Cable Television Operators Receive an "Infant Industry" Subsidy When Interconnecting to the Existing Local Telephone Network?

In the United Kingdom, where cable television systems with telephony capabilities compete against BT in the provision of voice and data services, Oftel in effect has allowed the entry of these cable telephony systems to be subsidized. Although the charge for interconnecting to BT's network includes a component representing the entrant's compensation for BT's contribution to universal-service obligations, the Director General has exercised his discretion to rule that this "access deficit contribution" need not be paid until the interconnecting operator (a term that includes cable telephony firms, among others) has achieved a market share of ten percent.[64] Because the United Kingdom is the only country in which cable telephony is operational, it is unclear whether such entry would have occurred without this interconnection subsidy allowed by Oftel. Further, if such a subsidy is necessary to induce entry, it is unclear whether a similar policy should be followed more generally to encourage the development of

63. *Id.* at 5.

64. *See* TeleWest, *supra* note 50, at 75; Wissenschaftliches Institut für Kommunikationsdienste & European-American Center for Policy Analysis, Network Interconnection in the Domain of ONP: Study for DG XIII of the European Commission, Final Report 191 (1994).

interactive broadband systems needing to interconnect with the existing networks for local telephony or cable television.

Economists generally oppose infant-industry policies, but as a practical matter governments do adopt such policies periodically. It is therefore useful to identify considerations that would reduce the likelihood of harm to consumer welfare if it were deemed to be desirable government policy to subsidize interconnection by cable television firms to either the narrowband or interactive broadband networks of LECs.

It may be possible in a given case for the social benefits from increasing competition in a market (whether narrowband local telephony or interactive broadband services), through the use of an interconnection subsidy for new entrants, to exceed the social costs of such a subsidy, inducing inefficient entry. This tradeoff of social benefits and costs will depend on the specific circumstances of the product market. It seems unlikely that a sweeping conclusion can be made about the desirability of subsidizing interconnection by cable television operators in every situation.

The question of whether an interconnection subsidy should be given to cable television operators is separate from the question of who should pay the subsidy. The subsidy need not be a wealth transfer from the incumbent firm to the entrant, as appears to be the case with BT and cable telephony's current exemption from the access deficit contribution in the United Kingdom. Instead of extracting the subsidy from the incumbent, it would be preferable for the subsidy to be direct and transparent. For example, taxpayers could subsidize entrants by paying the incumbent the difference between the price that the entrant pays and the full interconnection price implied by the efficient component-pricing rule. Needless to say, for the reasons discussed in Part IV.A, it is better for consumer welfare for government explicitly to subsidize the interconnection deficit than for government to assign entrants protected segments of the market in the expectation that they will thereby earn monopoly rents with which to pay the incumbent the full interconnection charge required by the efficient component-pricing rule.

The government's commitment to ending the entrant's infant-industry status at a date certain or upon the attainment of some objective level of market penetration must be credible and binding. This political task will not be easy to accomplish. It would probably help if

the level of subsidy were withdrawn gradually so that incumbents, entrants, and their customers could plan for—and would have less incentive on the margin to lobby and litigate about—the ultimate arrival of the subsidy-free interconnection price.

Finally, there is a symmetric quality to interconnection subsidies for cable television operators building interactive broadband systems. If cable television firms succeed in building the network of choice for local distribution of interactive voice, data, and video, they will soon face requests for interconnection from telephone companies. Interconnection policies that appear advantageous to the cable television industry today may turn out to be disadvantageous in the future. The opposite may prove to be the case for LECs.

Indeed, subsidization of interconnection may prevent competition from emerging among separate, viable networks for the delivery of interactive broadband services. This consideration, along with the traditional concern about weaning a mature industry from its infant-industry subsidy, should suffice to convince regulators that it would be imprudent to order an interconnection subsidy for a Canadian cable television industry that bears no resemblance to its nascent counterpart in the United Kingdom.

IX. CONCLUSION

Policies for the development and operation of interactive broadband networks will be most likely to benefit consumers if they rely on competitive forces to identify the lowest-cost delivery system and the services that consumers actually demand. Government will likely continue to play a role in setting the framework for interconnection and ensuring that subsidies for groups of consumers are precisely targeted and funded through methods that least distort the choices of unsubsidized consumers. Ultimately, consumers will benefit if government encourages a tournament of competing firms and technologies.