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Thomas M. Jorde,[†] J. Gregory Sidak,^{††} and David J. Teece^{†††}

In this Article, we examine the neglected tradeoff between innovation and mandatory unbundling of telecommunications networks. Our analysis is prompted by the Supreme Court's 1999 decision in AT&T Corp. v. Iowa Utilities Board and by the Federal Communications Commission's Second Further Notice of Proposed Rulemaking released later the same year, which address which network elements in the local telecommunications network shall be subject to compulsory sharing among competitors at regulated cost-based rates. Economic analysis indicates that mandatory unbundling at prices computed on the basis of the total element long-run incremental cost of the various network elements belonging to an incumbent local exchange carrier will adversely affect the ILEC's incentives not only to upgrade or maintain existing facilities, but also to invest in new facilities. Mandatory unbundling at TELRIC prices will also encourage competitive local exchange carriers to deviate from the socially optimal level of investment and entry. Finally, the confluence of mandatory unbundling and other FCC policies aggravates the distortion of investment decisions.

Introduction	2
I. The Effect of Mandatory Unbundling on the ILEC's Investment Decision	7
A. <i>How Mandatory Unbundling at TELRIC Prices Affects Expected Returns</i>	8
1. Investments To Lower the Marginal Costs of Existing Services	8
2. Investments in Unproven Technologies To Provide New Services	10
B. <i>How Mandatory Unbundling Affects the Weighted-Average Cost of Capital</i>	19
1. Mandatory Unbundling Raises the Cost of	

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- Equity Capital 19
- 2. Mandatory Unbundling Raises the Cost of Debt Capital 20
- II. The Effect of Mandatory Unbundling on the CLEC’s Investment Decision 21
 - A. *Optimal Entry Delay* 21
 - B. *The Possibility of Regulatory Gaming* 23
 - C. *Diminished Provision of “Traditional” Services Using Innovative Means* 24
- III. Further Distortions of the Investment Decision Caused by the FCC’s Mandatory Unbundling Rules 25
 - A. *The Relation Between Retail Rates and Costs Affects the CLEC’s Entry Decision* 25
 - B. *Input Unbundling Eliminates Procompetitive Output-Bundling Opportunities That Would Benefit Consumers* 26
 - C. *The FCC Should Solve the Commitment Problem Associated with Its Discretion To Unbundle Additional Network Elements in the Future* 27
- IV. The Effect of Mandatory Unbundling on Innovation in Particular Network Elements 30
 - A. *Switching* 31
 - B. *Loops* 32
 - C. *Digital Subscriber Line Access Multiplexers* 33
 - D. *Transmission Facilities* 34
 - 1. Fixed-Link Innovations 34
 - 2. Wireless Innovations 35
- Conclusion 36

Introduction

In 1996, Congress enacted the most sweeping revision of American telecommunications law in more than six decades. The stated purpose of the Telecommunications Act of 1996 is to “promote competition and reduce regulation in order to secure lower prices and higher quality services for American telecommunications consumers and encourage the rapid deployment of new telecommunication technologies.”¹ With respect to promoting competition in local exchange telephony, the Telecommunications Act imposed on incumbent local exchange carriers (ILECs) the obligation to

¹ Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56, 56 (codified in scattered sections of 47 U.S.C.).

share the use of their network infrastructure with competitors.² The local telecommunications network consists of various “network elements,” such as switches, transport capacity, and the loop that connects the customer to the nearest switch. The Telecommunications Act, by adding § 251(c)(3) to the Communications Act of 1934,³ requires that an ILEC offer competitors access to its network elements on an “unbundled” basis.⁴ In turn, § 251(d)(2) requires the Federal Communications Commission (FCC) to consider, when determining whether to mandate the unbundling of particular network elements under § 251(c)(3), “at a minimum, whether—(A) access to such network elements as are proprietary in nature is necessary; and (B) the failure to provide access to such network elements would impair the ability of the telecommunications carrier seeking access to provide the services that it seeks to offer.”⁵ How, then, should the FCC give content to these “necessary” and “impair” requirements, as they are known? Which network elements must the ILEC unbundle and offer to competitors—at regulated prices if the incumbent and entrant cannot negotiate mutually satisfactory terms?

The FCC attempted to answer these questions in 1996 through its issuance of the *Local Competition First Report and Order*,⁶ which established, among other rules, the minimum list of network elements that an ILEC must offer to other telecommunications carriers on an unbundled basis pursuant to the newly enacted §§ 251(c)(3) and 251(d)(2). In effect, the FCC found that, if it were technically feasible for an ILEC to unbundle a particular

2 The Telecommunications Act also seeks to promote local competition in two other ways that are not the principal focus of this Article. It requires the ILEC to offer its services for sale on a wholesale basis to competitors, who may then resell those services under their own brand name, and it requires the ILEC to provide interconnection to a competitor that builds its own network facilities. See 47 U.S.C. §§ 251-252 (1996). For an analysis of these provisions, see J. GREGORY SIDAK & DANIEL F. SPULBER, DEREGULATORY TAKINGS AND THE REGULATORY CONTRACT: THE COMPETITIVE TRANSFORMATION OF NETWORK INDUSTRIES IN THE UNITED STATES (1997); J. Gregory Sidak & Daniel F. Spulber, *The Tragedy of the Telecommons: Government Pricing of Unbundled Network Elements Under the Telecommunications Act of 1996*, 97 COLUM. L. REV. 1081 (1997).

3 Communications Act of 1934, ch. 652, 48 Stat. 1064.

4 Section 251(c) provides that “[i]n addition to the duties contained in subsection [251(b)], each incumbent local exchange carrier” has certain other duties, including:

(3) Unbundled access. The duty to provide, to any requesting telecommunications carrier for the provision of a telecommunications service, nondiscriminatory access to network elements on an unbundled basis at any technically feasible point on rates, terms, and conditions that are just, reasonable, and nondiscriminatory in accordance with the terms and conditions of the agreement and the requirements of this section and section 252. An incumbent local exchange carrier shall provide such unbundled network elements in a manner that allows requesting carriers to combine such elements in order to provide such telecommunications service.

47 U.S.C. § 251(c)(3).

5 *Id.* § 251(d)(2).

6 Implementation of the Local Competition Provisions in the Telecommunications Act of 1996 and Interconnection Between Local Exchange Carriers and Commercial Mobile Radio Service Providers, First Report and Order, 11 F.C.C.R. 15,499 (1996) [hereinafter *Local Competition First Report and Order*].

network element, it would impair competition for the ILEC not to offer that unbundled network element for sale to competitors, implicitly at an FCC-regulated price.⁷ The FCC defined “necessary” to mean that “an element is a prerequisite for competition,”⁸ and “impair” to mean “to make or cause to become worse; diminish in value.”⁹

In January 1999, the Supreme Court struck down, in *AT&T Corp. v. Iowa Utilities Board*,¹⁰ the FCC’s interpretations of “necessary” and “impair” and ordered the agency to “determine on a rational basis which network elements must be made available taking into account the objectives of the 1996 Act and giving some substance to the ‘necessary’ and ‘impair’ requirements.”¹¹ On remand, the FCC thereafter sought public comment, in its *Second Further Notice of Proposed Rulemaking*, on “how the unbundling obligations of the [Telecommunications Act of 1996] can best facilitate the rapid and efficient deployment of all telecommunications services, including advanced services.”¹²

To answer that question, we analyze in this Article how the FCC’s interpretation of the “necessary” and “impair” standards likely will affect innovation, investment, and product development in the U.S. telecommunications industry. As noted above, § 251(d)(2) of the Telecommunications Act directs the FCC to consider “at a minimum” the “necessary” and “impair” standards when deciding whether to mandate unbundling of a network element. It is a sign of the FCC’s blindness to the costs of mandatory unbundling that the *Second Further Notice of Proposed Rulemaking* can only envision the phrase “at a minimum” adding considerations that would *increase* the likelihood of mandatory unbundling.¹³ Any considerations that might decrease the likelihood of mandatory unbundling, such as the effect of unbundling on innovation, appear outside the scope of the current debate. Yet, the *Antitrust Guidelines for the Licensing of Intellectual Property* recognize that the

7 See 47 C.F.R. § 51.319 (1999).

8 Local Competition First Report and Order, *supra* note 6, ¶ 282, at 15,641-42.

9 *Id.* ¶ 285, at 15,643 (quoting RANDOM HOUSE COLLEGE DICTIONARY 665 (rev. ed. 1984)). The FCC ordered that an ILEC make seven unbundled network elements available to a requesting telecommunications carrier: local loops; network interface devices; local switching; interoffice transmission facilities; signaling networks and call-related databases; operations support systems; and operator services and directory assistance. See *id.* ¶ 366, at 15,683 (codified at 47 C.F.R. § 51.319).

10 119 S. Ct. 721 (1999).

11 *Id.* at 736.

12 *In re Local Competition Provisions in the Telecommunications Act of 1996 and Interconnection Between Local Exchange Carriers and Commercial Mobile Radio Service Providers*, Second Further Notice of Proposed Rulemaking, 14 F.C.C.R. 8694, ¶ 3, at 8696 (1999) [hereinafter SFNPRM].

13 *Id.* ¶ 30, at 8705 (“Commenters should specifically identify any factors deemed sufficiently important in meeting the goals of the 1996 Act to require the unbundling of a network element, even if such unbundling did not otherwise meet the ‘necessary’ or ‘impair’ standards of sections 251(d)(2)(A) or (B) standing alone.”).

goals of encouraging innovation and promoting the public interest are inextricably connected.¹⁴ We submit, therefore, that innovation is exactly the “something more” that the FCC should consider when identifying which network elements shall be subject to mandatory unbundling at regulated prices.

Mandatory unbundling of network elements at total element long-run incremental cost (TELRIC) prices will diminish the incentives of both incumbent local exchange carriers (ILECs) and competitive local exchange carriers (CLECs) to invest in existing facilities and new technologies.¹⁵ The FCC therefore must carefully weigh that cost against the putative benefits of any limiting principle that it promulgates to implement the “necessary” and “impair” standards of § 251(d)(2) of the Telecommunications Act. A firm’s investment decisions are based on its careful weighing of the expected returns from the investment against the firm’s weighted-average cost of capital. The mandatory unbundling rules that the FCC tentatively adopts, or hints at in the *Second Further Notice of Proposed Rulemaking* that it will adopt, would decrease the incentives of both ILECs and CLECs to invest in existing facilities and new technologies by lowering the expected returns and increasing the weighted-average cost of capital for each group of firms.

In Part I of this Article, we explain that government-mandated unbundling decreases an ILEC’s incentives to invest in the upgrade and maintenance of *existing* facilities by reducing the ex ante payoffs of such investments.¹⁶ Mandatory unbundling also distorts an ILEC’s incentives with respect to investment in *new* technologies. In addition to lowering the expected returns of investment in existing facilities and new technologies,

14 See U.S. DEP’T OF JUSTICE & FTC, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY § 1.0 & n.1 (patents, copyrights, trade secrets, and know-how agreements) [hereinafter INTELLECTUAL PROPERTY GUIDELINES]. The *Guidelines* state: “The intellectual property laws and the antitrust laws share the common purpose of promoting innovation and enhancing consumer welfare.” *Id.* § 1.0.

15 For a critique of TELRIC pricing of unbundled network elements, see SIDAK & SPULBER, *supra* note 2, at 403-26; and J. Gregory Sidak & Daniel F. Spulber, *Givings, Takings, and the Fallacy of Forward-Looking Costs*, 72 N.Y.U. L. REV. 1068 (1997).

16 The passage of the Telecommunications Act of 1996 has caused this disincentive to ILEC investment to be analyzed extensively in the scholarly literature on regulatory economics. See ALFRED E. KAHN, LETTING GO: DEREGULATING THE PROCESS OF DEREGULATION, OR: TEMPTATION OF THE KLEPTOCRATS AND THE POLITICAL ECONOMY OF REGULATORY DISINGENUOUSNESS (1998); SIDAK & SPULBER, *supra* note 2; Jerry Hausman, *Valuing the Effect of Regulation on New Services in Telecommunications*, BROOKINGS PAPERS ON ECON. ACTIVITY: MICROECONOMICS (1997) [hereinafter *Valuing the Effect*]; Robert G. Harris & C. Jeffrey Kraft, *Meddling Through: Regulating Local Telephone Competition in the United States*, 11 J. ECON. PERSP. 93 (1997); Jerry Hausman, *Regulation by TELRIC: Economic Effects on Investment and Innovations*, MULTIMEDIA UND RECHT, Mar. 1999, at 22 [hereinafter *Regulation by TELRIC*]; Debra Aron et. al., *The Impact of Unbundled Network Elements and the Internet on Telecommunications Access Infrastructure* (submitted to Harvard Information Infrastructure Project Dec. 4, 1997); Robert W. Crandall, *Managed Competition in U.S. Telecommunications* 17 (Mar. 1999) (unpublished manuscript, on file with author).

mandatory unbundling at regulated prices also raises an ILEC's weighted-average cost of capital.

In Part II we examine how mandatory unbundling distorts the investment incentives of CLECs. First, mandatory unbundling at TELRIC prices encourages CLECs to delay entry into the local services market. Second, a generous unbundling policy encourages CLECs to demand a "bug free" version of the ILEC's network element and to request, at no cost to the CLEC, the offering of unbundled network elements (UNEs) from the ILEC with no intention of actually using them. Third, mandatory unbundling at TELRIC prices diminishes a CLEC's incentive to provide "plain old telephone service" (POTS) by innovative means. For example, an ill-conceived unbundling policy can undermine a CLEC's efforts to deploy POTS over a digital subscriber line (DSL) without the use of any circuit-switching apparatus.

In Part III we discuss how mandatory unbundling and other FCC policies adversely interact to further distort the investment decisions of ILECs and CLECs. Relying on intellectual advances in antitrust analysis,¹⁷ innovation markets,¹⁸ and real-option theory,¹⁹ we discuss, in qualitative terms, the direction and potential magnitude of those various effects. First, we demonstrate that the relationship between retail rates and costs in a particular geographic market strongly influences the entry decision of CLECs. Second, unbundling requirements at the input level eliminate bundling opportunities in the end-user market that would increase competition and, thus, benefit consumer welfare. Third, the FCC should address and resolve the commitment problem associated with its discretion to unbundle additional elements in the future.

In Part IV we examine recent innovations in several network elements, including switches, loops, transmission facilities, and digital subscriber line access multiplexers. Mandatory unbundling of these elements at TELRIC prices would jeopardize each of those innovative developments and, therefore, threaten consumer welfare over the longer term.

We conclude that the FCC should not interpret the "necessary" and "impair" requirements of § 251(d)(2) to mandate unbundling of facilities that an ILEC has created through new or relatively recent investments. In such cases, the disincentive effects on both ILECs and CLECs are so great

17 See INTELLECTUAL PROPERTY GUIDELINES, *supra* note 14.

18 See THOMAS M. JORDE & DAVID J. TEECE, ANTITRUST, INNOVATION, AND COMPETITIVENESS (1992); see also THOMAS M. JORDE ET AL., INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE (1997).

19 See, e.g., Hausman, *Valuing the Effect*, *supra* note 16. For the fundamentals of decisionmaking under uncertainty, see AVINASH K. DIXIT & ROBERT S. PINDYCK, INVESTMENT UNDER UNCERTAINTY (1994); and Avinash K. Dixit & Robert S. Pindyck, *The Options Approach to Capital Investment*, HARV. BUS. REV., May-June 1995, at 105.

that the damage that would be done to the competitive process would be severe. Moreover, excessive unbundling of that sort would violate the stated policies in the Telecommunications Act of 1996 “to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by Federal or State regulation”²⁰ and to “encourage the rapid deployment of new telecommunications technologies.”²¹ The FCC should, therefore, decline to promulgate, and a reviewing court should decline to uphold, rules mandating the unbundling of network elements in which the ILEC has invested to provide advanced services,²² as the agency proposed to do in a proceeding in 1998.²³

I. The Effect of Mandatory Unbundling on the ILEC’s Investment Decision

Investment results from voluntary exchange.²⁴ A firm’s decision to invest in facilities and innovative activity depends upon its weighing the probability of earning excess return from the investment against the risk of investment loss.²⁵ For example, any basic textbook on corporate finance will instruct managers to make an investment only if that investment has a positive net present value (NPV), or alternatively, if the expected rate of return on that investment exceeds some appropriate measure of the firm’s weighted-average cost of capital.²⁶ Other texts are even more explicit: “[S]enior management’s most important job must be to maximize its firm’s current market value.”²⁷

To formalize that investment rule, one must define several parameters. Let $p(b)$ be the probability of the “bad state of the world” and $p(g)$ be the probability of the “good state of the world.” Similarly, let $r(b)$ be the return in the “bad state of the world” and $r(g)$ be the return in the

20 47 U.S.C. § 230(b)(2) (Supp. II 1996).

21 Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56, 56.

22 See 47 U.S.C. §§ 10(a), 11, 403.

23 See *Deployment of Wireline Services Offering Advanced Telecommunications Capability, Mem. Op. and Order, and Notice of Proposed Rulemaking*, 13 F.C.C.R. 24,011, ¶¶ 95-96, at 24,055-57 (1998) [hereinafter *Advanced Capability Memorandum Opinion and Order*]. In that proceeding, the FCC established seven conditions to govern the circumstances under which an ILEC’s “advanced services affiliate” is deemed not to be an ILEC and, therefore, not subject to the unbundling requirements of § 251(c)(3). See *id.* ¶ 96, at 24,055-57.

24 See *SIDAK & SPULBER*, *supra* note 2, at 109.

25 See *id.* at 423-25.

26 See, e.g., RICHARD A. BREALEY & STEWART C. MYERS, *PRINCIPLES OF CORPORATE FINANCE* 14 (5th ed. 1991). The weighted-cost of capital for a firm is a weighting of the common equity and debt cost of capital according to the capital structure of the individual firm. See, e.g., STEPHEN A. ROSS ET AL., *CORPORATE FINANCE* 161-88 (5th ed. 1999).

27 G. BENNET STEWART III, *THE QUEST FOR VALUE: A GUIDE FOR SENIOR MANAGERS* 1 (1990).

“good state of the world.” Finally, let c be the ILEC’s weighted-average cost of capital. The *expected* return to the investment is simply the average return over all possible outcomes (in this case, we have assumed for simplicity only two possible outcomes), weighted by their respective probabilities, or $p(b) \times r(b) + p(g) \times r(g)$. An ILEC will invest in a project if and only if, $p(b) \times r(b) + p(g) \times r(g) > c$.²⁸

Many economic theories cannot be practically applied to the real world. The investment rule described above, however, represents a guiding principle in the discipline of corporate finance. Telecommunications executives making multibillion-dollar investments recognize and act upon the importance of that fundamental principle. In late 1998, for example, AT&T’s chief executive officer succinctly described the effect that mandatory unbundling of the cable television infrastructure would have on his company’s incentives to invest: “No company will invest billions of dollars . . . if competitors which have not invested a penny of capital nor taken an ounce of risk can come along and get a free ride in the investments and risks of others.”²⁹

A. *How Mandatory Unbundling at TELRIC Prices Affects Expected Returns*

1. Investments To Lower the Marginal Costs of Existing Services

Mandatory unbundling decreases an ILEC’s incentive to invest in upgrading its existing facilities by reducing the *ex ante* payoffs of such investment. Requiring a firm to grant to its competitors unbundled access to its facilities at TELRIC-based rates greatly reduces, if it does not eliminate entirely, the probability of excess return; such mandatory unbundling thus eliminates the ILEC’s incentive to invest in existing facilities.³⁰ It makes no economic sense for the ILEC to invest in technologies that lower its own marginal costs, so long as competitors can achieve the identical cost savings by regulatory fiat. Thus, by ensuring that the ratio of marginal costs between an ILEC and its competitors is always constant, mandatory unbundling at TELRIC prices destroys the ILEC’s incentive to continue investing in cost-reducing improvements to its own existing network facilities.³¹ The regulator may respond by *compelling* investment—that is, conscripting private capital. But that “fix” would

28 See, e.g., BREALEY & MYERS, *supra* note 26, at 181.

29 C. Michael Armstrong, Address before the Washington Metropolitan Cable Club (Nov. 2, 1998) <<http://www.att.com/speeches/98/981102.maa.html>>.

30 See, e.g., Sidak & Spulber, *supra* note 2, at 1158-61.

31 See KAHN, *supra* note 16, at 101-03; SIDAK & SPULBER, *supra* note 2, at 545-57; Harris & Kraft, *supra* note 16, at 93; Sidak & Spulber, *supra* note 2, at 1158-61.

merely heap one regulatory distortion upon another and hasten disinvestment.

The disincentive that mandatory unbundling creates for investment has direct consequences on competition. For example, over the past several years, ILECs have been extending fiber in the network and replacing copper in the loop. Those upgrades have produced a number of positive benefits for end-users. Fiber is more reliable than copper wire, and it has higher quality in terms of cross-talk, signal-to-noise ratios, and other factors.³² The investment has also had the advantage of decreasing the ILEC's marginal costs. That cost reduction has made the ILEC's network more competitive with the networks that CLECs have been constructing. For example, one competitive access provider (CAP), Teleport Communications Group (TCG), stated in a 1996 securities prospectus:

The Company uses the latest technologies and network architectures to develop a highly reliable infrastructure for delivering high-speed, quality digital transmissions of voice, data and video telecommunications. The basic transmission platform consists primarily of optical fiber equipped with high capacity SONET equipment deployed in self-healing rings. These SONET rings give TCG the capability of routing customer traffic simultaneously in both directions around the ring[,] thereby eliminating loss of service in the event of a cable cut.

....

Redundant electronics, with automatic switching to the backup equipment in the event of failure, protects against signal deterioration or outages. Continuous monitoring of system components focuses on proactively avoiding problems rather than just reacting upon failure.³³

TCG further stated that one factor that promoted competition in local telecommunications markets after the AT&T divestiture was "technological advances in the transmission of data and video requiring greater capacity and reliability levels than copper-based ILEC networks were able to accommodate."³⁴ TCG, which has since merged into AT&T, noted in 1996 that "CAPs generally offered . . . improved reliability in comparison to [sic] the ILECs," but that "[i]n recent years, the ILECs steadily have been increasing the amount of fiber used in their networks, thereby decreasing the competitive advantage held by the CAPs in the

32 For a comparison of the quality characteristics of fiber-optic networks and copper-based networks, see REGIS J. BATES & DONALD GREGORY, VOICE AND DATA COMMUNICATIONS HANDBOOK 631 (1998).

33 TELEPORT COMMUNICATIONS GROUP, INC., PROSPECTUS FOR 23,500,000 SHARES OF CLASS A COMMON STOCK 50 (June 3, 1996). Since the enactment of the Telecommunications Act, the acronym CAP has given way to CLEC, which is a term of art in the 1996 legislation.

34 *Id.* at 42.

special access and private line markets.”³⁵

The existing and planned entry by CLECs into local telecommunications markets demonstrates that the new technologies available to CLECs offer cost and performance advantages over existing technologies currently used by ILECs. Moreover, because the largest of the CLECs have been acquired since 1996 by interexchange carriers (IXCs)—MFS by what is now MCI WorldCom, and TCG by AT&T³⁶—the disincentive that mandatory unbundling creates for ILEC investment in network upgrades directly affects the robustness of competition between ILECs and the nation’s two largest IXCs. More than three years after the passage of the Telecommunications Act, the FCC seeks comments on the relevance, if any, of these developments to the interpretation of the “necessary” and “impair” standard.³⁷ The recent entry of the major IXCs into the local access market should force the FCC to reexamine the meaning of “impairment” in that new competitive context.

If the FCC were to adopt a nationwide rule mandating unbundling of the loop at a TELRIC price, then the ILEC’s benefits from investing in fiber upgrades would decrease. In particular, any advantages that the ILEC might achieve in marginal costs would be eliminated. Therefore, according to the investment decision articulated above, the ILEC’s economic justification for incurring that cost would erode. Consumer welfare would decrease in the amount of the portion of the cost savings that the ILEC otherwise could pass onto consumers. Moreover, end-users would have to defer the benefit of increased quality and reliability.

2. Investments in Unproven Technologies To Provide New Services

By reducing returns to investment in general, mandatory unbundling at TELRIC prices is likely to reduce direct innovation by the ILEC in the form of research and development, creation of intellectual property, and general product development. As two of us have previously written: “To maintain adequate incentives to invest in innovative activity, without providing government subsidies, free riding must be curtailed. This rationale is how economists justify patents, copyrights, trade secrets, and other aspects of intellectual property law.”³⁸ The *Intellectual Property Guidelines*, echo this concern and emphasize that it is consonant with the consumer welfare goals of the antitrust laws:

35 *Id.*

36 For a review of the consolidation in the CLEC industry, see Sterling Perrin, *The CLEC Market: Prospects, Problems, and Opportunities*, TELECOMMUNICATIONS, Sept. 1998, at 41.

37 SFNPRM, *supra* note 12, ¶ 14, at 8700.

38 JORDE & TEECE, *supra* note 18, at 52.

Innovation, Investment, and Unbundling

The intellectual property laws and the antitrust laws share the common purpose of promoting innovation and enhancing consumer welfare. The intellectual property laws provide incentives for innovation and its dissemination and commercialization by establishing enforceable property rights for the creators of new and useful products, more efficient processes, and original works of expression. In the absence of intellectual property rights, imitators could more rapidly exploit the efforts of innovators and investors without compensation. Rapid imitation would reduce the commercial value of innovation and erode incentives to invest, ultimately to the detriment of consumers. The antitrust laws promote innovation and consumer welfare by prohibiting certain actions that may harm competition with respect to either existing or new ways of serving customers.³⁹

Firms undertake innovative activities in the pursuit of higher returns through the development of products having either unique qualities or superior quality-to-price ratios. Any requirement to share those innovative developments will therefore reduce the incentives to create them in the first place. In his separate opinion concurring in the Court's holding on "necessary" and "impair" in *Iowa Utilities Board*, Justice Breyer warned that "a sharing requirement may diminish the original owner's incentive to keep up or to improve the property by depriving the owner of the fruits of value-creating investment, research, or labor."⁴⁰ He further observed that this disincentive to investment increases with the technological sophistication of the network elements potentially subject to the mandatory unbundling rule:

[A]s one moves beyond the sharing of readily separable and administrable physical facilities, say, to the sharing of research facilities, firm management, or technical capacities, these problems can become more severe Nor can one guarantee that firms will undertake the investment necessary to produce complex technological innovations knowing that any competitive advantage deriving from those innovations will be dissipated by the sharing requirement. The more complex the facilities, the more central their relation to the firm's managerial responsibilities, the more extensive the sharing demanded, the more likely these costs will become serious. And the more serious they become, the more likely they will offset any economic or competitive

³⁹ INTELLECTUAL PROPERTY GUIDELINES, *supra* note 14, at § 1.0 (internal citation omitted).

⁴⁰ *AT&T Corp. v. Iowa Utils. Bd.*, 119 S. Ct. 721, 753 (1999) (Breyer, J., concurring in part and dissenting in part).

gain that a sharing requirement might otherwise provide.⁴¹

As Justice Breyer makes clear, the long-term harm to consumer welfare from reduced innovation may vastly exceed the short-term benefits from more rapid imitation of the fruits of prior innovative activity.

Technological progress in telecommunication network services has yielded new techniques, such as asymmetric digital subscriber line (ADSL), which has enabled ILECs to deliver advanced data services. ADSL uses the existing copper pair serving homes and businesses “to provide customers network access to the Internet and other popular multimedia and data services at speeds 50 times faster than an ordinary phone line.”⁴² Several ILECs have deployed ADSL, and, as of May 1999, consumers had begun to adopt the services supported by that technology.⁴³ Because of such progress, the FCC is now considering whether it should lengthen the list of network elements subject to mandatory unbundling pursuant to the “necessary” and “impair” standards of § 251(d)(2). The *Second Further Notice of Proposed Rulemaking* states:

We also see nothing in the statute or the Supreme Court’s opinion that would preclude us from requiring that loops that must be unbundled must also be conditioned in a manner that allows requesting carriers supplying the necessary electronics to provide advanced telecommunications services, such as digital subscriber line technology (xDSL).⁴⁴

Under such a scenario, an ILEC would be compelled to share the following network elements with its competitors:

- *Dark fiber.* This is fiber that does not have connected to it the electronics required to transmit data on the fiber.⁴⁵
- *Packet switching.* This is a method of transmitting messages as digitized bits, assembled in groups called “packets” or “cells.” These packets and cells contain industry-standard defined numbers of data bits, along with addressing information and data integrity

41 *Id.* at 753-54 (citing 1 HAROLD DEMSETZ, OWNERSHIP, CONTROL, AND THE FIRM: THE ORGANIZATION OF ECONOMIC ACTIVITY 207 (1988)).

42 AMERITECH CORP., 1998 SEC FORM 10-K, at 21 (1999).

43 For example, it is reported that 20% of Bell Atlantic customers in New York and Boston will be served by central offices equipped for ADSL by the end of 1999, and that 80% are expected to be served by the end of 2000. See Brian Quinton, *ADSL Picks Up More Speed*, TELEPHONY, Apr. 5, 1999, at 6.

44 SFNPRM, *supra* note 12, ¶ 32, at 8706; see also *id.* ¶ 34, at 8707 (seeking comment on whether to “modify the definition of ‘loops’ or ‘transport’ to include dark fiber”); *id.* ¶ 35, at 8707 (seeking comment on mandatory unbundling of DSLAMs and packet switches).

45 See INTERMEDIA COMMUNICATIONS INC., 1999 SEC FORM 10-K, at 53 (1999).

bits. The switching (or routing) of the packets or cells of data replace the circuit-switching of traditional voice telephone calls. Packet and cell switching is considered to be a more cost-efficient method of delivering voice and data traffic than circuit switching.⁴⁶

- *Digital subscriber line access multiplexers (DSLAMs)*. The DSLAM concentrates the data traffic from multiple DSL loops onto the backbone network for connection to the rest of the network. The DSLAM provides back-haul services for packet, cell, and/or circuit-based applications through concentration of the DSL lines onto 10Base-T, 100Base-T, T1/E1, T3/E3, or ATM outputs.⁴⁷

In addition, some CLECs, and even state lawmakers, have urged that an ILEC be subjected to mandatory unbundling of the portion of spectrum above four kilohertz (kHz) on its subscriber line, a practice that has been dubbed "spectrum sharing," "bandwidth sharing" or "line splitting."⁴⁸ In 1999, the FCC found that this proposed regulatory intervention would be technically feasible.⁴⁹ That conclusion was portentous, for it is a prerequisite to any subsequent FCC order of mandatory unbundling of wireline bandwidth at regulated prices.

When investing in a particular technology to support a new service, an ILEC bears two risks. First, consumers may not adopt the service as widely as informed parties envision at the time that the ILEC must commit

46 See *id.* at 54. See generally J. Gregory Sidak & Daniel F. Spulber, *Cyberjam: The Law and Economics of Internet Congestion of the Telephone Network*, 21 HARV. J.L. & PUB. POL'Y 327 (1998) (discussing packet-switched and circuit-switched networks).

47 See PARADYNE CORP., THE DSL SOURCE BOOK 27 (2d ed. 1998) (visited Dec. 1, 1999) <http://www.paradyne.com/sourcebook_offer/index.html>.

48 For example, the California State Legislature is considering such a policy: If the Federal Communications Commission does not adopt an order on or before January 1, 2000, with regard to its proceeding entitled "In the Matters of Deployment of Wireline Services Offering Advanced Telecommunications Capability," CC Docket No. 98-147, adopted March 18, 1999, that the Public Utilities Commission expeditiously examine the technical, operational, economic, and policy implications of line sharing and, if the Public Utilities Commission determines it to be appropriate, adopt rules to require incumbent local exchange carriers in this state to permit competitive data local exchange carriers to provide high bandwidth data services over telephone lines with voice services provided by incumbent local exchange carriers.

A.B. 991, 1999-2000 Leg., 1st Reg. Sess. (Cal. 1999). See also Comments of Covad Communications Co., Deployment of Wireline Services Offering Advanced Telecommunications Capability, FCC 98-147, available in 1999 FCC LEXIS 3578, at *48 (1999). The label "spectrum sharing" is unfortunate because it is likely to cause confusion about the access line (wireless versus wireline) being unbundled.

49 See In re Deployment of Wireline Services Offering Advanced Telecommunications Capability, First Report and Order and Further Notice of Proposed Rulemaking, 14 F.C.C.R. 4761, ¶ 78, at 4801, ¶¶ 102-07, at 4809-12 (1999) [hereinafter Advanced Services FNPRM].

to its investment. Second, consumers may adopt the product, but with a different supporting technology. In the best-case scenario, when the new service is widely adopted by consumers and the technology chosen by the ILEC proves to be the most effective, a policy of mandatory unbundling enables the CLEC to purchase the ILEC's unbundled element at cost, as set by TELRIC. Alternatively, if either of the risks eventuates, then the CLEC does not bear any of the cost; to the contrary, the ILEC's shareholders bear the entire cost of the unsuccessful investment. Thus, mandatory unbundling at TELRIC is equivalent to the government's grant to the CLEC of a *free option* to consume, at incremental cost, the fruits of the ILEC's investment.⁵⁰ Of course, that option is not "free" in terms of either its private costs to ILEC shareholders or its social costs to consumer welfare, because of the ILEC's diminished levels of investment in innovation.

Thus, the FCC's imposition of mandatory unbundling aimed at unproven technologies necessary to support new services would severely damage the ILEC's incentives to invest. Suppose, for example, that an ILEC has an opportunity to make a \$100 investment in a new technology such as asynchronous transfer mode (ATM) switches.⁵¹ Suppose further that, in the absence of mandatory unbundling, the firm will receive with equal probabilities a payoff of \$90 or \$150. We hypothesize that the \$90 payoff corresponds to a future where internet protocol (IP) routers are the superior packet-switching technology, while the \$150 payoff corresponds to an outcome where ATM switches are indeed the superior technology.⁵² Assuming that the ILEC's cost of capital is 15%, the ILEC would make that investment in the absence of mandatory unbundling at TELRIC prices, as its expected rate of return would exceed its cost of capital. The expected revenue would be \$120 (= 50% x \$90 + 50% x \$150), an expected return of 20%. The expected excess return does *not* imply or assume that the ILEC possesses market power of any sort.⁵³ As noted above, any rational firm will seek to invest in projects when the expected return exceeds the firm's cost of capital.

To extend the example of an ILEC's investment in ATM switches, consider now the case where the ILEC must provide CLECs unbundled

50 See Hausman, *Valuing the Effect*, *supra* note 16; Hausman, *Regulation by TELRIC*, *supra* note 16.

51 ATM is a high-bandwidth, low-delay, connection-oriented, packet-like switching and multiplexing technique. See BATES & GREGORY, *supra* note 32, at 693-94.

52 For an overview of the pros and cons of these two packet-switching alternatives, see Susan Breidenbach, *Switching Grows Up: The Entire Report*, NETWORK WORLD FUSION, May 4, 1998 (visited Dec. 1, 1999) <<http://www.nwfusion.com/news/0504switch9.html>>.

53 See David J. Teece & Mary Coleman, *The Meaning of Monopoly: Antitrust Analysis in High-Technology Industries*, 43 ANTITRUST BULL. 801, 820-22 (1998) (distinguishing monopoly rents from Schumpeterian returns from innovation).

access to ATM switches at TELRIC prices. In the adverse case, where the ILEC selects a technology that turns out to be inferior in hindsight, its payoff is likely to remain the same, as CLECs will not demand access to an inferior technology. The payoff in the favorable case, however, is substantially lower than it would be in the absence of mandatory unbundling. TELRIC is based upon the ILEC's current effective cost of capital, which is 15% in our example. Therefore, the TELRIC-based price for the network element will be set to permit an ex post rate of return on capital of 15%. Thus, the ILEC will be limited to earning a 15% return on the network element that the ILEC uses to supply new services to end-users, as well as only a 15% rate of return on compulsory access to the network element that the ILEC provides to CLECs. A rational ILEC will expect that outcome and correctly calculate that the introduction of mandatory unbundling with TELRIC prices will cut the ex ante expected return on investment from 20% to 2.5%. The calculation is straightforward. Half of the time, IP routers are the preferred technology, giving the ILEC a payoff of \$90. The other half of the time, ATM switches are the better technology, but TELRIC unbundling lowers the ex post payoff to \$115 (an ex post return of fifteen percent). The ex ante expected return is therefore 2.5% ($50\% \times \$90 + 50\% \times \$115 = \$102.50$). Given a cost of capital of 15%, the ILEC rationally will decline to invest in ATM switches. In addition, the amount of investment in ATM switches would fall relative to investment in IP routers. Thus, mandatory unbundling of selected elements not only lowers overall investment in that element, but also distorts investment choices toward elements that are believed to be less susceptible to mandatory unbundling.

Through a second example, we can further explore the asymmetric effect of mandatory unbundling on investments in advanced services and new technologies. Suppose that the FCC requires an ILEC to offer unbundled access to DSLAMs. If DSL is not widely adopted by consumers, perhaps because it becomes eclipsed by cable modems, then CLECs will not demand unbundled access to the DSLAMs, and the ILEC unilaterally will bear the risk of consumer rejection. Alternatively, if DSL is widely adopted by consumers, then CLECs, by obtaining unbundled DSLAMs at TELRIC prices, will be able to eliminate any risk reward that the ILEC would hope to earn on its investment in an uncertain technology. In practice, the ILEC will earn, at most, its cost of capital. The ILEC cannot know with certainty, however, whether DSL will be adopted widely by consumers. Therefore, in the presence of mandatory unbundling, the ILEC will expect rationally that regulation will greatly diminish the reward for successful innovation. The ILEC, therefore, will choose to reduce investments in the new technology or avoid such investments altogether.

An additional disincentive can arise from the interplay of TELRIC

pricing rules and the declining path of costs over time in markets subject to technological progress. Regulators set TELRIC prices on the basis of their estimates of the forward-looking cost of investment.⁵⁴ Telecommunications equipment is generally subject to its own version of Moore's Law,⁵⁵ with rapidly declining costs over time for capacity.⁵⁶ Indeed, this kind of productivity growth is the premise for ILEC price-cap regulation.⁵⁷ An ILEC will expect correctly that (1) the forward-looking cost of investment in a facility will decline over time; and (2) TELRIC rules applied every year over the life of the asset in an ex post manner will ratchet down to a new, lower forward-looking cost, such that the ILEC will be denied an opportunity to recover its cost of capital.⁵⁸

To apply this lesson to ILEC investment in new technologies, we return to our earlier example. Recall our previous hypothetical investment opportunity, requiring an outlay of \$100 today (for example, for a line card for a DSLAM). Suppose that the price of that unit is expected to decline at a rate of two percent per year in real terms, owing to productivity improvements in manufacturing. Because TELRIC prescribes the use of the *current* forward-looking cost applied to past investment, the TELRIC cost basis for the investment calculated in 2002 would only be \$94 in constant real terms.⁵⁹ Modifying our previous example to include that reduced TELRIC cost basis, we see that the ILEC's ex ante expected return for the third year is as low as *negative* one percent—a loss of capital, let alone a denial of any opportunity to earn a competitive return on capital.⁶⁰ The ILEC would therefore be forced ex post to unbundle the

54 See source cited *supra* note 6.

55 See HARRY NEWTON, NEWTON'S TELECOM DICTIONARY 508 (15th ed. 1999) (Gordon Moore, the cofounder of Intel Corporation, predicted in 1965 that "computer chip complexity would double every twelve months for the next ten years. Ten years later his forecast proved true. He then forecasted that the doubling would occur every two years for the next ten years. Again history demonstrated his accuracy. The average of the two estimates is often stated as doubling every 18 months.")

56 See Jerry Hausman, *Cellular Telephone, New Products, and the CPI*, 17 J. BUS. ECON. & STAT. 188 (1999).

57 See ROBERT W. CRANDALL & LEONARD WAVERMAN, TALK IS CHEAP: THE PROMISE OF REGULATORY REFORM IN NORTH AMERICAN TELECOMMUNICATIONS 75-96 (1995); DAVID E.M. SAPPINGTON & DENNIS L. WEISMAN, DESIGNING INCENTIVE REGULATION FOR THE TELECOMMUNICATIONS INDUSTRY 80-88 (1996).

58 See Affidavit of Jerry Hausman on Behalf of the United States Telephone Association, Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, FCC 96-98 available in 1996 FCC Lexis 4312, at *10 (May 1996); KAHN, *supra* note 16, at 93-94; SIDAK & SPULBER, *supra* note 2, at 419-25; Sidak & Spulber, *supra* note 15, at 1139-45; Letter from Alfred E. Kahn to Hon. Reed E. Hundt, Chairman of the FCC (Jan. 14, 1997). This effect has been called "anticipatory retardation."

59 Projecting a 2% annual decline in cost in real terms over the three years between 1999 and 2002, we obtain a price in 2002 of \$94 (= \$100 ÷ 1.023).

60 The payoff to the "adverse" technology is unaffected (IP routers are the preferred technology, giving the ILEC a payoff of \$90 with 50% probability). The other half of the time, ATM switches are the better technology, but mandatory unbundling at forward-looking TELRIC prices reduces the ILEC's ex post payoff to \$108 (the projected cost basis of \$94 plus a return of 15%). The

element at a rate that makes the ILEC's investment unprofitable *ex ante*. No reasonable firm would choose to invest under those conditions. Consumers suffer as a result, because the mandatory unbundling deters efficiency-enhancing investments.

Therefore, the combination of TELRIC pricing and expected declines in forward-looking costs compounds the disincentive effect of mandatory unbundling on investment in new technologies. Although the FCC has recognized the possibility that it would be necessary to incorporate higher-than-customary rates of depreciation and return in its TELRIC calculations,⁶¹ it has yet to change historical depreciation in its actual implementation of its policy on mandatory unbundling. Thus, the disincentive effects of a properly computed forward-looking TELRIC are compounded by the improper use of historical depreciation schedules that often have been deliberately lengthened by state regulators to keep local rates low.⁶² Those considerations imply that the FCC should allow ILECs to make investments in advanced services in a regulatory environment in which the market will entirely determine the eventual rate of return. That conclusion holds with even greater force when one recognizes, as is documented by the earlier quotations from the SEC filings of the CAPs that were subsequently acquired by AT&T and MCI WorldCom,⁶³ that an ILEC cannot be said to be an "incumbent" with respect to any new technology or service.⁶⁴

The FCC itself has recognized how important incentives are to the innovation process, and it has already proposed a regulatory environment in which an ILEC may invest in advanced services without the threat of constant regulation, including mandatory unbundling at TELRIC prices:

We now explore the circumstances under which an advanced services affiliate would not qualify as an "incumbent LEC" under the definition set forth by Congress in section 251(h), and thus would not be subject to section 251(c) obligations. We also tentatively conclude that an advanced services affiliate, to the extent it provides interstate exchange access services, should, under existing Commission precedent, be presumed to be nondominant. Therefore, such affiliate would not be subject to price cap regulation or rate of return regulation for its provision of such services. We tentatively conclude that such an affiliate, as a non-incumbent, also should not be required to file tariffs for its provision of

ex ante expected return therefore falls even lower, to negative 1% ($50\% \times \$90 + 50\% \times \$108 = \$99$).

61 See Local Competition First Report and Order, *supra* note 6, ¶ 686, at 15,849.

62 See SIDAK & SPULBER, *supra* note 2, at 200.

63 See *supra* notes 33-36.

64 See *id.* at 80-81.

any interstate services that are exchange access.⁶⁵

Conditional on satisfying a number of criteria, an ILEC may create a separate affiliate that would be exempt from the requirements of § 251(c). The FCC recognized that by allowing ILECs to create separate subsidiaries that are exempt from the unbundling requirements in the Telecommunications Act, the agency could increase the likelihood that ILECs would continue to have an incentive to invest, innovate, and develop products.

Finally, we note that mandatory unbundling of a new technology is a disguised form of industrial policy.⁶⁶ Ironically, the FCC has attempted to distance itself from such blatant regulatory intervention. It stated two months before its issuance of the *Second Further Notice of Proposed Rulemaking*: "The role of the Commission is not to pick winners or losers, or select the 'best' technology to meet consumer demand, but rather to ensure that the marketplace is conducive to investment, innovation, and meeting the needs of consumers."⁶⁷ Rather than fund its program of developing broadband networks through a broad financing scheme, the FCC, assuming that it is acting with the authority of the U.S. government, has chosen to finance its version of industrial policy solely by taxing ILECs through TELRIC price regulation and compulsory access. If the government wants to subsidize the development of a new technology, there should be nondiscriminatory funding *ex ante* and nondiscriminatory access *ex post*. But if the funding is *not* competitively neutral, then neither should be access. The FCC cannot have it both ways. It is well established, under cases such as *Monsanto*⁶⁸ and *Kaiser Aetna*,⁶⁹ that the compelled sharing of the fruits of private investment can be a taking of property entitled to just compensation under the Fifth Amendment.

65 Advanced Capability Memorandum Opinion and Order, *supra* note 23, ¶¶ 95-100, at 24,055-59 (footnotes omitted).

66 Industrial policy largely has been discredited in the economics profession. For examples of industrial policy failures, see PAUL R. KRUGMAN & MAURICE OBSTFELD, *INTERNATIONAL ECONOMICS: THEORY AND POLICY* 285-92 (4th ed. 1997); SIDAK & SPULBER, *supra* note 2, at 495-97; and J. Gregory Sidak & Daniel F. Spulber, *Deregulation and Managed Competition in Network Industries*, 15 *YALE J. ON REG.* 117 (1998).

67 In re Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps To Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996 Report, 14 *F.C.C.R.* 2398, ¶ 5, at 2400 (1999) [hereinafter *Deployment of Advanced Telecommunications*].

66 *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1003-04 (1984).

69 *Kaiser Aetna v. United States*, 444 U.S. 164, 180 (1979).

B. *How Mandatory Unbundling Affects the Weighted-Average Cost of Capital*

In the examples presented above, we have assumed that the ILEC's cost of capital, which serves as the benchmark of comparison for all expected-return calculations, has remained constant.⁷⁰ Unfortunately, that assumption ignores the impact that mandatory unbundling has on the riskiness and cyclicity of the ILEC's economic performance and, hence, on the ILEC's weighted-average cost of capital. Mandatory unbundling raises both components of the weighted-average cost of capital for ILECs—equity and debt.

1. *Mandatory Unbundling Raises the Cost of Equity Capital*

The cost of equity capital depends on the systematic or “beta” risk of the firm. Beta risk is any risk whose source is related to economy-wide effects. An immediate implication of systematic risk is that it cannot be eliminated through diversification.⁷¹ Beta risk is measured by examining the sensitivity of a firm's stock price to the movements of a broad portfolio that contains the stocks of all firms in the economy. For example, one would expect to see higher betas for companies in industries that are highly cyclical.⁷² Investors demand a larger risk premium for stocks with large betas because such stocks contribute more to the volatility of an investor's overall portfolio.⁷³

How does mandatory unbundling affect an ILEC's beta and thus its cost of equity? The answer depends on how unbundling affects the cyclicity of an ILEC's returns. The effect of unbundling is to make an ILEC more sensitive to swings in the overall economy. In particular, a CLEC is more likely to lease the unbundled elements of the ILEC's network in times of weak demand for telecommunications services. Weak demand for a telecommunications service lowers its price and thus makes it harder for a CLEC to justify facilities-based entry, which not only may be more expensive in the short-term, but also may require investment that has a greater degree of sunk costs (as opposed to merely fixed costs) than does the leasing of UNEs at TELRIC prices over rather short lease terms. Alternatively, in times of high demand, a CLEC is more inclined to enter

70 For a clear exposition of cost-of-capital analysis, see EUGENE F. BRIGHAM & LOUIS C. GAPENSKI, *INTERMEDIATE FINANCIAL MANAGEMENT* 167-210 (5th ed. 1996).

71 See BREALEY & MYERS, *supra* note 26, at 156.

72 For a description of how cyclicity affects beta, see ROSS ET AL., *supra* note 26, at 300. Other factors that influence beta include operating leverage and financial leverage.

73 Of course, other factors such, as dividend yield, also affect the cost of equity capital. See, e.g., Mukesh Bajaj & Anand M. Vijh, *Dividend Clienteles and the Information Content of Dividend Changes*, 26 J. FIN. ECON. 193 (1990).

as a facilities-based competitor. Thus, the *timing* of the CLEC's request for unbundled network elements exaggerates the ILEC's risk of loss during times of weak demand. An ILEC's profits will fall in the face of CLEC entry through mandatory unbundling, because the CLEC will capture some customers from the ILEC. The ILEC's profit will fall even more if the access price for the unbundled network element is calculated by regulators in a manner that is not compensatory. The combination of lower returns during "weak demand" and unaffected returns during "high demand" intensifies the cyclicity of an ILEC's returns.

Because there has not been a recession since the passage of the Telecommunications Act of 1996, the conjecture about increased systematic risk is not falsifiable. There exist no data with which to test our conjecture empirically. What matters, however, is whether the capital markets understand the possibility of increased cyclicity and, therefore, penalize ILECs by requiring them to produce a higher (risk-adjusted) return on equity investment.

In summary, one would expect mandatory unbundling at TELRIC prices to increase beta for an ILEC by increasing the cyclicity of the company's financial performance. As a result, an ILEC's investors would demand a larger risk premium to hold the ILEC's stock, because that stock would contribute more to the volatility of the investor's overall portfolio. The larger risk premium would imply a higher cost of equity capital for an ILEC.

2. Mandatory Unbundling Raises the Cost of Debt Capital

Mandatory unbundling also raises the ILEC's cost of debt. It is well established in corporate finance that debt financing is a less expensive source of capital than equity financing.⁷⁴ For any given level of financial risk, debt financing is preferable to other forms of capitalization, because the interest that the firm pays is a tax-deductible expense.⁷⁵ A firm will continue to invest through debt offerings until the additional tax paid by lenders on an extra dollar of interest equals the corporate tax shield on an extra dollar of interest. Companies will issue less debt if they cannot be sure of taxable profits in the future.⁷⁶ Increased uncertainty limits a firm's ability to debt finance because the threat of financial distress trumps the corporate tax savings at an earlier stage of the capital allocation process.

Mandatory unbundling increases the cost of debt capital for an ILEC because it increases uncertainty for the firm. Under the FCC's current regime of mandatory unbundling, an ILEC is required to make the sunk

74 See BREALEY & MYERS, *supra* note 26, at 475.

75 See *id.*

76 See *id.*

investment to provide a particular UNE on the basis of expected orders submitted by requesting CLECs. The requesters, however, are not required to make firm commitments to take specified volumes of the UNE for a minimum contract duration. If the ILEC makes the UNE available but there are no CLEC orders that actually materialize for the UNE, as has occurred with unbundled switching, the ILEC is forced to bear that entire cost. This allocation of risk distorts competition: the ILEC is compelled to impute *to itself* this additional transition cost of mandatory unbundling when providing the network element in question to one of its affiliates. On the other hand, the CLECs do not need to incur that unbundling cost or impute it to themselves, to their affiliates, or to any other party with whom they choose to do business. Because an ILEC must bear all the risk of mandatory unbundling, the uncertainty of the ILEC's profits naturally rises. Moreover, because an ILEC will be limited in the *share* of total financing that it may structure as debt (a cheaper source than equity), the firm will experience an increase in its overall cost of capital. That effect, in addition to the increase in the cost of equity described above, will serve to undermine further an ILEC's investment prospects by "raising the bar" by which all expected returns are measured.

II. The Effect of Mandatory Unbundling on the CLEC's Investment Decision

A. *Optimal Entry Delay*

The uncertain success of any technology gives imitators an advantage over innovators when regulators mandate unbundling at TELRIC prices. By requesting unbundled elements, the CLEC can always "keep its powder dry" and unbundle the ILEC's successful technology choice. In that manner, mandatory unbundling confers a second-mover advantage and substantially decreases a CLEC's incentives to make a sunk investment, an effect that has been investigated in the recent academic literature on innovation and real-option theory. As Avinash Dixit and Robert Pindyck note, the cost to a firm of delaying investment "must be weighed against the benefits of waiting for new information."⁷⁷ Applying this insight to the CLEC's option to purchase unbundled network elements at TELRIC rates, Jerry Hausman has noted that "[g]iven the fundamental uncertainty and the sunk nature of the investment, a 'reward for waiting' occurs because over time some uncertainty is resolved."⁷⁸ One CLEC, Intermedia,

77 DIXIT & PINDYCK, *supra* note 19, at 9.

78 Hausman, *Valuing the Effect*, *supra* note 16, at 33.

acknowledged that fact in its 1999 SEC filings:

Utilizing leased facilities enables Intermedia to (i) meet customers' needs more rapidly; (ii) improve the utilization of Intermedia's existing network; (iii) add revenue producing customers before building out its network, thereby *reducing the risks associated with speculative network construction or emerging technologies*; and (iv) subsequently focus its capital expenditures in geographic areas where network construction or acquisition will provide a competitive advantage and clear economic benefit.⁷⁹

Simply put, CLECs have the freedom to choose between investing today in sunk equipment embodying uncertain technology or delaying that investment until more information becomes available and reduces that uncertainty.

In telecommunications—with leapfrogging innovations and fundamentally different competing technologies—the decision to invest today (rather than to delay investment) is particularly risky, as it often commits the CLEC to a particular technology that may reveal itself later to be inferior. Investments in telecommunications technology also face uncertainties about market demand, competition, and the associated costs. The history of telecommunications offers many examples of firms that squandered substantial market opportunities by investing either too early or too late.⁸⁰

Without mandatory unbundling, a CLEC would have to balance delay against the potential loss of a first-mover advantage. Through early investment, a CLEC could serve markets before other CLECs or ILECs in complementary markets could deploy networks. With mandatory unbundling, however, the payoff to swift action diminishes, as such outlays can only confer transitory rewards. A compulsory-sharing regime tips the balance of the CLEC's calculus in favor of waiting. The value of the first-mover advantage erodes, and the value to the CLEC of keeping its options open increases. If hindsight confirms that the ILEC chose to invest in the correct technology, then the CLEC can simply demand to unbundle the ILEC's facilities at TELRIC prices.

The option value of mandatory unbundling at TELRIC prices can lead the CLEC to prefer unbundling to building facilities, even if building facilities has a higher net present value. One CLEC, Focal Communications, admits in its SEC filings that it can shift risk onto the

79 INTERMEDIA COMMUNICATIONS INC., 1999 SEC FORM 10-K, at 7 (1999) (emphasis added).

80 For example, AT&T introduced Picturephone too soon. See, e.g., AT&T CORP., AT&T PICTUREPHONE BROCHURE (visited Dec. 1, 1999) <www.djvu.att.com/djvu/att/archives>.

ILEC by exploiting the option to unbundle:

The Company's strategy of leasing rather than building its own fiber transport facilities results in the Company's cost of service being a significant component of total costs. The Company has to date been successful in negotiating lease agreements which match the duration of its customer contracts, thereby allowing the Company to avoid the risk of continuing expenses associated with transmission facilities that are not being used by revenue generating customers.⁸¹

Moreover, if each CLEC expects other CLECs to reason in the same manner, the incentive to delay investment is amplified. Stated another way, as soon as a particular CLEC commits to an investment in a particular technology, that CLEC is no longer protected by its second-mover status. Other CLECs may benefit by waiting for a superior technology to emerge.

B. *The Possibility of Regulatory Gaming*

Mandatory unbundling of network elements at TELRIC prices creates incentives for a CLEC to game the regulatory system. One plausible strategy that CLECs (and their IXC parents or strategic partners) could employ is to demand a perfect, "bug-free" version of the ILEC's back-office systems and operations support systems (OSS) before considering entry. Because most CLECs and IXCs have new OSS and back-office computer systems, requests for UNEs by those firms can place heavy burdens on the ILEC's older computer systems and databases. ILECs have invested large amounts in upgrading their legacy systems and training employees.⁸² Nonetheless, some IXCs claim that the current system is still plagued by errors.⁸³ Three years after the enactment of the Telecommunications Act, not a single regional bell operating company (RBOC) has received permission to begin offering consumers in-region interLATA service. It would be naïve to ignore that such delay can be increased through regulatory gaming by CLECs—whose owners and strategic partners, the IXCs, have a strong incentive under the competitive checklist process of § 271⁸⁴ to characterize any problem in the ILEC's

81 FOCAL COMMUNICATIONS CORP., 1999 SEC FORM 10-K, at 11 (1999).

82 See, e.g., Raymond W. Smith, *Smoke Detection: Clearing the Air on Local Competition*, in *IS THE TELECOMMUNICATIONS ACT OF 1996 BROKEN? IF SO, HOW CAN WE FIX IT?* 25 (J. Gregory Sidak ed., 1999) (describing OSS compliance at Bell Atlantic).

83 See, e.g., John Zeglis, *Out of the Courts and into the Market: Wouldn't It Be Great?*, in *IS THE TELECOMMUNICATIONS ACT OF 1996 BROKEN? IF SO, HOW CAN WE FIX IT?*, *supra* note 82, at 100 (describing AT&T's complaints about RBOC provision of OSS).

84 See 47 U.S.C. § 271(c)(2)(B) (Supp. II 1996) (For example, one of the checklist items is

network as evidence that its local exchange markets are closed to competition. The likely result of the FCC's ordering of mandatory unbundling of OSS and other information-based assets at TELRIC prices would be to slow the § 271 approval process even more.

C. *Diminished Provision of "Traditional" Services Using Innovative Means*

In the face of mandatory unbundling at TELRIC prices, CLECs will be less inclined to develop innovative ways to provide service. For example, innovations are being developed to permit the provision of POTS over DSL lines without the use of any circuit-switching apparatus.⁸⁵ CLECs will have less incentive to pursue those technologies if they can require the ILEC, through "spectrum unbundling," to provide the POTS service, especially if the ILEC is compelled to provide that service below cost because of rate regulation and social-pricing concerns.

Without spectrum unbundling, CLECs have an incentive to add voice service to DSL—either by investing in voice switching or by developing voice-over-DSL protocols. Innovation and investment would therefore be higher in the absence of spectrum unbundling. In early 1999, Commissioner Powell warned that mandatory unbundling may diminish the CLEC's incentive to offer "traditional" service using new means: "While mandating access can bring about short-term improvements in retail competition, it also may undermine incentives for developing new methods to circumvent the influence of incumbents over distribution."⁸⁶

Also, as noted by Commissioner Powell in the *Second Further Notice of Proposed Rulemaking*⁸⁷ and by Justice Breyer in *Iowa Utilities Board*,⁸⁸ the incentives for a CLEC in such a regulatory framework encourage its overdependence on unbundling and its underinvestment in facilities-based competition. Commissioner Powell observed that "unconstrained access would eviscerate incentives for entrants to install their own facilities and thereby inhibit the type of competition most likely to spur innovation,

reciprocal compensation arrangements. Because the requirement is absolute and the definition of "reciprocal compensation" is unclear, CLECs could cause delays by challenging whether or not the ILEC does indeed provide reciprocal compensation arrangements. The section contains 13 general categories of checklists).

85 See *Jetstream Offers CLECs Affordable Entry into Small Business*, COMM. TODAY, Dec. 8, 1998, at 27; 3COM, *End-to-End ADSL: Solutions for Deployable ADSL Services* (Jan. 1988) <www.teledotcom.com/strategies/xdsl3com.html>; PARADYNE CORP., *supra* note 47.

86 Deployment of Advanced Telecommunications, *supra* note 67 (statement of Commissioner Powell).

87 SFNPRM, *supra* note 12 (statement of Commissioner Powell).

88 *AT&T Corp. v. Iowa Utils. Bd.*, 119 S. Ct. 721, 754 (1999) (Breyer, J., concurring in part and dissenting in part).

provide price discipline and otherwise benefit consumers.”⁸⁹ The FCC should scrutinize the CLECs’ strategic incentives when designing the optimal policy of mandatory unbundling pursuant to § 251(d)(2).

III. Further Distortions of the Investment Decision Caused by the FCC’s Mandatory Unbundling Rules

In the following sections, we show how the possibility of mispriced UNEs aggravates the disincentives to invest in innovation efforts. We also demonstrate how mandatory unbundling will eliminate or greatly reduce procompetitive bundling opportunities for ILECs that would redound to the direct benefit of consumers. Finally, we argue that the FCC should endeavor to solve the commitment problem associated with its discretion to mandate the unbundling of additional network elements in the future at TELRIC prices.

A. *The Relation Between Retail Rates and Costs Affects the CLEC’s Entry Decision*

The possibility of mispriced UNEs further reduces the incentives to invest in innovation efforts. A conflict arises if UNEs are available at TELRIC prices while resale rates are calculated on the basis of avoided-cost discounts applied to retail rates.⁹⁰ In cases where retail rates are below costs, especially in rural and low-density service areas, CLECs rationally will choose to use resale rather than lease unbundled network elements at TELRIC prices, thus obtaining wholesale service considerably below cost. That effect drastically reduces the ILEC’s incentive to engage in innovation and the CLEC’s incentive to enter a particular geographic market as a facilities-based competitor. By contrast, the CLEC’s ability to bypass wholesale rates in areas where retail prices exceed costs reduces the CLEC’s incentives to invest in facilities.⁹¹ That is particularly important in locales where particular artificially high rates (often for business service) are maintained by regulatory fiat.

89 SFNPRM, *supra* note 12 (statement of Commissioner Powell).

90 See SIDAK & SPULBER, *supra* note 2, at 308, 335-37.

91 As Justice Scalia, writing for the Court in *Iowa Utilities Board*, noted:

Because this universal-service subsidy is built into retail rates, it is passed on to carriers who enter the market through the resale provision. Carriers who purchase network elements at cost, however, avoid the subsidy altogether and can lure business customers away from incumbents by offering rates closer to cost. This, of course, would leave the incumbents holding the bag for universal service.

Iowa Utils. Bd., 119 S. Ct. at 737.

B. *Input Unbundling Eliminates Procompetitive Output-Bundling Opportunities That Would Benefit Consumers*

Mandatory unbundling will eliminate or greatly reduce procompetitive bundling opportunities for ILECs that would redound to the direct benefit of consumers.⁹² Bundling of outputs is attractive if a new service is most cost-effectively marketed and most convenient to the end-user when combined with an existing service. For example, many ILECs currently offer POTS bundled with DSL service at an attractive price and include an Internet Service Provider (ISP) for a nominal charge. Thus, some customers are able to purchase all three of those services from an ILEC for a single price. This bundling advantage is being threatened by AT&T, which announced plans in 1998 to bundle POTS, long-distance service, cable television service, cable modem, and ISP offerings all for one price:

AT&T intends to pursue local entry by transforming the cable footprint of one-way cable plant into a two-way, broadband network capable of meeting the full spectrum of communication needs of the residential customer. AT&T intends to deploy a variety of services over the upgraded cable plant, including a richly featured "all-distance" (i.e., local, long distance, international) voice telephony offering. AT&T plans to use existing circuit-switched technology to pilot telephony service offers over the cable plant beginning in 1999. However, AT&T expects to begin to transition to an integrated Internet protocol (IP) packet data architecture by the end of 2000 that affords cost and feature benefits over the older circuit-switched technology.⁹³

Mandatory spectrum unbundling would eliminate the ILEC's opportunity to offer bundled one flat-rate residential service and DSL service. Such regulatory intervention would make it harder for ILECs to match the bundled services that sophisticated rivals like AT&T likely will offer in the marketplace. Despite this perverse consequence for competition and consumer welfare, the FCC is pursuing mandatory spectrum unbundling in the *Advanced Services Further Notice of Proposed Rulemaking*.⁹⁴

Mandatory spectrum unbundling would decrease the ILEC's incentive

92 It has long been noted that bundling can have procompetitive or efficiency-enhancing effects in markets subject to rapid technological innovation. See, e.g., Joseph Gregory Sidak, *Debunking Predatory Innovation*, 83 COLUM. L. REV. 1121 (1983).

93 AT&T CORP., 1998 SEC FORM 10-K, at 15 (1999).

94 See *Advanced Services FNPRM*, *supra* note 49. The California legislature similarly is considering such a policy. See *supra* note 48.

to develop innovative technical solutions that facilitate bundling, such as splitterless DSL. It would also decrease incentives for CLECs to compete in residential telephony. Instead of unbundling the entire loop, CLECs simply would pursue the most profitable advanced-services portion of the customer's demand. That digital cream-skimming would not necessarily increase competition in residential voice telephony; rather, it would more likely siphon off to CLECs the most lucrative opportunities among the most attractive customers of the residential market. Moreover, in the process, the CLECs would not be developing the customer service and other intangible assets that are required to be successful local exchange carriers. In short, mandatory spectrum unbundling would preclude (at least in the short-term) the possibility of ILECs competing for the advanced-services market.

C. *The FCC Should Solve the Commitment Problem Associated with Its Discretion To Unbundle Additional Network Elements in the Future*

Economic theory recognizes that commitments made in bargaining situations influence the behavior of other actors only to the extent that the person making such commitments is credibly bound (by himself or others) to honor them.⁹⁵ The notion of enforceable agreements plays a role in regulated industries similar to its role in competitive markets. As Pablo T. Spiller and others have shown, both theoretically and empirically, the level of investment in long-lived infrastructure undertaken by a regulated (or recently privatized) public utility depends critically on regulatory institutions having been designed to ensure the credibility of the regulator's commitments that it will not act opportunistically once the utility has placed those nonsalvageable assets into service.⁹⁶

The FCC's interpretation of the "necessary" and "impair" standards ultimately leads to a choice of which network elements shall be unbundled. For any well-defined geographic market, the FCC's framework will result in one of four classifications for each network element:

- (1) the element will be unequivocally within the set of

95 See, e.g., PAUL MILGROM & JOHN ROBERTS, *ECONOMICS, ORGANIZATION AND MANAGEMENT* 131 (1992); THOMAS C. SCHELLING, *THE STRATEGY OF CONFLICT* (1960); OLIVER E. WILLIAMSON, *THE ECONOMIC INSTITUTIONS OF CAPITALISM: FIRMS, MARKETS, RELATIONAL CONTRACTING* 167 (1985); OLIVER E. WILLIAMSON, *THE MECHANISMS OF GOVERNANCE* 120-44 (1996).

96 See Brian Levy & Pablo T. Spiller, *The Institutional Foundations of Regulatory Commitment: A Comparative Analysis of Five Country Studies of Telecommunications Regulation*, 10 J.L. ECON. & ORG. 201 (1994); Pablo T. Spiller, *Institutions and Regulatory Commitment in Utilities' Privatizations*, 2 INDUS. & CORP. CHANGE 387 (1993); see also Shane Greenstein et al., *The Effect of Incentive Regulation on Infrastructure Modernization: Local Exchange Companies' Deployment of Digital Technology*, 4 J. ECON. & MGMT. STRATEGY 187 (1995).

- elements to be unbundled;
- (2) the element will be unequivocally outside the set of elements to be unbundled;
 - (3) the element will be just within the set of elements to be unbundled; or
 - (4) the element will be just outside the set of elements to be unbundled.

The first two classifications may be regarded as *inframarginal* cases, and the latter two classifications may be regarded as *marginal* cases. Economics teaches, of course, that consumers and firms make decisions at the margin.⁹⁷ An ILEC considering whether to invest in a technology that relies on a network element in the fourth category would rationally forgo that investment if there were a significant risk that regulators would later reclassify the element as one subject to mandatory unbundling at regulated, cost-based rates. To the extent that the risk of regulatory reclassification is significant, the incentive problem extends not only to network elements that the FCC currently subjects to mandatory unbundling, but also to any network element for which it might be technically feasible for the FCC *in the future* to order mandatory unbundling at a TELRIC price.

There are several ways in which a network element that “just passed the test” might eventually be reclassified as being subject to mandatory unbundling at a TELRIC price. First, any standard adopted by the FCC will incorporate several exogenous characteristics that will likely change over time. For example, suppose the FCC embraced an efficient-competitor standard for mandatory unbundling that incorporated the extent of competition in the supply of the requested element. Suppose further that the number of distinct suppliers of the requested element in a well-defined geographic market decreased as the result of a consolidation or a decision to exit the industry. When applied at a later date, the efficient-competitor standard might reclassify the requested element such that the ILEC would then be ordered to unbundle that element at a TELRIC price.

Second, the application of any regulatory standard that relies on empirical data is subject to measurement error. To continue the earlier example, suppose that the FCC’s standard required the level of competition for the supply of the network element to meet some threshold, t^* . Suppose that the FCC (or the state public utility commission (PUC))

⁹⁷ See, e.g., PAUL A. SAMUELSON & WILLIAM D. NORDHAUS, *ECONOMICS* 161 (15th ed. 1995).

must measure the actual level of competition for the supply of that element, t , which is randomly distributed from 0 to 100.⁹⁸ Suppose further that the FCC (or the state PUC) measures the actual level of competition with error, such that the FCC's estimate of competition is $t + e$, where e is a random error term that ranges from -10 to 10. Assume that the FCC declares that the network element should *not* be unbundled at the present time (that is, the actual level of competition surpasses the target level, t^* .) The ILEC can only infer from such a decision that the actual level of competition, t , ranges from $t^* - 10$ (if the error term was -10) to 100. Assuming the FCC's subsequent measurement of competition is just as accurate as its first attempt, the probability that the FCC will reclassify the network element in the subsequent round of examination is substantial.⁹⁹

Given the significant likelihood that a network element that the FCC originally considered off-limits eventually may be unbundled, either through measurement error or through a change in exogenous variables underlying the test, the FCC should adopt an appropriate commitment mechanism to encourage investments in network elements subject to this risk of regulatory reclassification. The FCC should outline its position regarding network elements *conditional on the first application of its impairment test* in the present remand proceeding. To all elements that are originally unbundled at TELRIC prices, the FCC should apply a sunset provision that would (1) remove the element from the set of network elements subject to mandatory unbundling, and (2) place the burden on the CLEC to prove that an absence of competitive conditions for end-user telecommunications services requires regulators to continue to mandate unbundling of the element at a TELRIC price. The mandatory unbundling of obligations for the ILEC's elements should sunset after the passage of two years or upon the entry of a facilities-based competitor of the stature of AT&T, MCI WorldCom, or Sprint, whichever occurs first.

For those elements for which the FCC (or the relevant state public utilities commission) does *not* initially mandate unbundling at TELRIC prices, the FCC should announce a "rising competitive benchmark" by which those elements would be tested in the future. Suppose, for example, that the FCC adopted a consumer-welfare standard that asked whether the ILEC could exercise market power in the end-user services market by restricting access to a given network element. Upon the first application of the test, the FCC (or state PUC) would assess whether, in a particular

98 For example, the FCC may attempt to measure the Herfindahl-Hirschman Index (HHI) of concentration in the switching market by calculating shares as a function of switches sold. In that case, the range of the competitive index would be from zero to ten thousand.

99 The probability that the UNE would be reclassified can be calculated by summing the probabilities that $t + e$ is less than t^* given that t ranges from $t^* - 10$ to 100. Assuming (1) both variables are uniformly distributed, (2) e is independent of t , and (3) $t^* = 75$, the probability would be 28%.

geographic market, the ILEC's restriction of CLEC access to the element at a TELRIC price would allow the ILEC to raise prices in the end-user services market by *five* percent. Conditional upon the element not being unbundled at a TELRIC price in the first regulatory iteration, the FCC (or state PUC) would assess, in its second iteration, whether denying CLECs unbundled access to that network element at a TELRIC price would allow the ILEC to raise prices in the end-user services market by *ten* percent. Because it is less likely that an ILEC could sustain a ten percent price increase (relative to a five percent increase), the probability would greatly diminish that regulators would reclassify the element as being subject to mandatory unbundling at a TELRIC price.

Suppose, alternatively, that the FCC embraced a competitor-welfare standard that asked whether a CLEC profitably could produce the service given the ILEC's restriction of unbundled access to the network element in question.¹⁰⁰ In its first application of the test, the FCC (or state PUC) could assess whether a CLEC could earn a *fifteen* percent rate of return without having access to the requested element at TELRIC prices.¹⁰¹ Again, conditional upon the regulator not ordering the ILEC to unbundle the element at a TELRIC price, in its second application, the FCC (or state PUC) would assess whether a CLEC could earn a *ten* percent rate of return without having access to the requested element at a TELRIC price. An increasing competitive benchmark would credibly commit the regulator to a policy of not reclassifying one of the ILEC's network elements after the regulator initially has determined that the element in question should not be subject to mandatory unbundling at a TELRIC price. Such a credible commitment by the FCC would maintain the proper incentives for the ILEC to continue making investments in the development and improvement of that element.

IV. The Effect of Mandatory Unbundling on Innovation in Particular Network Elements

In this Part, we describe recent innovations in switching, loops, DSLAMs, and transmission facilities. Mandatory unbundling at TELRIC prices would jeopardize continued innovation with respect to each of these developments.

100 We emphasize that the FCC should adopt a consumer-welfare standard rather than a competitor-welfare standard for interpreting § 251(d)(2).

101 One such profitable business plan might entail leasing the element from the ILEC at a voluntary rate in excess of TELRIC.

A. *Switching*

A number of voice-switching innovations, including more efficient routing tables and vertical features, should not be unbundled. Whether or not these innovations ultimately are deemed to be “proprietary,” they represent a substantial investment by the ILEC in embedded intellectual property for the creation of service enhancements. Similar concerns and negative implications arise with respect to the mandatory unbundling of data switching (such as ATM and DSLAMs).

First, these advanced switching services have not been deployed as extensively as competing technologies. For example, industry commentators observe that cable modems outnumber DSL modems. After AT&T’s acquisition of TCI, the CLEC that will provide the majority of cable modem service throughout the United States will be AT&T.¹⁰² AT&T’s proposed acquisition of MediaOne would increase that dominance.¹⁰³

Second, the provision of business switched-data services is currently dominated by IXC’s, and ILECs have only a miniscule share of this market segment. Frost & Sullivan reports that in 1997, the three largest IXC’s (AT&T, MCI, and Sprint) accounted for 73.5% of such traffic.¹⁰⁴ Frost & Sullivan also reports that IXC’s control over 90% of the market in certain advanced segments, such as ATM and frame relay.¹⁰⁵ That evidence suggests that IXC’s, not ILECs, are the dominant providers of services in this segment of the industry.

The FCC’s suggestion that mandatory unbundling extend to packet switches raises troubling issues with respect to the Telecommunications Act’s goals of fostering innovation and extending advanced telecommunications services: “It is the policy of the United States . . . to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by Federal or State regulation.”¹⁰⁶ Packet switches are the legitimate object of these expressions of legislative concern, for they are expected to be the

102 See Carol Wilson, *Broadband: Get Ready for the Gale*, ZDNET NEWS (June 26, 1999) <<http://www.zdnet.com/zdnn/stories/news/0,4586,2281301,00.html>>.

103 See Kathy Chen et al., *AT&T-MediaOne Deal Is Likely: Complaints Involve Control over Cable-TV Business and Pipelines to Internet*, WALL ST. J., May 6, 1999, at B11.

104 See FROST & SULLIVAN, U.S. MARKETS FOR ATM, FRAME RELAY, SMDS AND X.25 PUBLIC DATA SERVICES 1-13 (1998). Business switched data services include switched multimegabit data service (SMDS), ATM, and frame relay, as well as lower-speed X.25 service. See *id.* at 1-13.

105 See *id.* at 2-3.

106 47 U.S.C. § 230(b)(2) (Supp. II 1996). The stated congressional purpose prefacing the Telecommunications Act is “[t]o promote competition and reduce regulation in order to secure lower prices and higher quality services for American telecommunications consumers and encourage the rapid deployment of new telecommunications technologies.” Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56, 56.

foundation for delivering advanced telecommunications services. By definition, advanced services currently are services not widely deployed, and for which the critical technology is advancing rapidly. The supply of these services, therefore, is fraught with technological risk. In many cases, the supply is yet to be created, as the assets still need to be deployed. Therefore, we conclude that mandatory unbundling of switches at TELRIC prices likely would impose large social costs in the form of reduced investments. Such mandatory unbundling would not “reduce regulation,” nor would it “encourage the rapid deployment of new telecommunications technologies,”¹⁰⁷ as Congress intended through its enactment of the Telecommunications Act.

B. *Loops*

There is also a high potential for innovation in the area of loops, especially in the development of advanced broadband technologies such as DSL. Those areas include loop plant upgrades and conditioning (for example, bridge tap, dry join, and load coil removal), the implementation of DSLAMs at digital loop carrier (DLC) huts,¹⁰⁸ and the development of new and faster DSL protocols. Although interfaces are not *per se* proprietary to ILECs, they do reflect substantial development in trade secrets, such as engineering, installation, and troubleshooting techniques and methodologies.

In the presence of mandatory unbundling of the traditional loop, mandatory spectrum unbundling exacerbates the disincentive for investment. It is currently both cost-effective and feasible for CLECs to provide their own DSLAMs and switching equipment to provide DSL and POTS over an ILEC's unbundled “traditional” loops. For example, Paradyne has developed a DSL “starter kit” for extending service to as few as twenty subscribers over loops exceeding 20,000 feet.¹⁰⁹ Given the feasibility of unbundling the entire loop for use by the CLEC and the desirability of increasing competition in the local telephone market, the consumer benefits of mandatory spectrum unbundling are nonexistent. The only “benefit” of such a policy is captured by the CLEC and its shareholders, because the CLEC most likely would unbundle the entire loop if mandatory spectrum unbundling were not an option. In that sense, spectrum unbundling would be a classic case of asymmetric regulation: the

107 *Id.*

108 DLC is “network transmission equipment used to provide pair gain on a local loop. The digital loop carrier system derives multiple channels, typically 64 Kbps voice-grade, from a single four-wire distribution cable running from the central office to a remote site.” NEWTON, *supra* note 55, at 252.

109 See Bob Metcalfe, *More from Maine's Rural MVL DSL Front: Pick Your Speed and Pay Your Toll*, INFOWORLD, July 13, 1998, at 4.

CLEC would pursue the more profitable, unregulated service, while the ILEC would be left providing basic local service (in many cases, below cost). Innovation would be eroded by regulations that arbitrarily favored CLECs, without regard to the adverse effect of such asymmetric regulation on the welfare of consumers.

The FCC should reject mandatory spectrum unbundling outright because of its obviously deleterious effects on innovation. Such regulatory intervention would certainly reduce, and possibly eliminate, the current innovation occurring in loop technology, as well as reduce the market for small, entrepreneurial companies like Paradyne that are creating CLEC-tailored solutions to the provision of DSL and POTS over an unbundled loop. Indeed, once one accounts for the harmful effects that such an unbundling rule would have on the currently dynamic and competitive market for advanced services, the only reason to implement mandatory unbundling would be to enrich CLECs at the expense of ILECs and their ratepayers. Nothing in the Telecommunications Act authorizes the FCC to engage in such redistribution of income.

C. *Digital Subscriber Line Access Multiplexers*

The *Second Further Notice of Proposed Rulemaking* raises the prospect of mandatory unbundling of DSLAMs.¹¹⁰ Such a policy would harm the public interest. To understand why, it is instructive to review the recent developments in DSLAM technology. Some RBOCs are now experimenting with versions of DSL service that rely on high-frequency, high-power transmission over ordinary copper loops using asymmetrical data rates—such as ADSL, where the end-user's download rate is much faster than the upload rate. In particular, some firms are experimenting with ADSL technology that does not require a splitter at the customer's premises.¹¹¹ This technology is known as G.Lite, or "splitterless ADSL."¹¹² Some analysts have criticized G.Lite as the "wrong" technology,¹¹³ which appears to be inferior to alternative symmetric DSL solutions relying on other standards, such as Paradyne's Hotwire multiple virtual lines (MVL)

110 See SFNPRM, *supra* note 12, ¶ 35, at 8707.

111 A splitter "resides at both the [central office] and service user locations, allowing the copper loop to be used for simultaneous high-speed DSL data transmission and single line telephone service. POTS splitters usually come in two configurations—a single splitter version designed for mounting at the residence and a multiple splitter version designed for mass termination at the [central office]." PARADYNE CORP., *supra* note 47, at 29.

112 For a general description of G.Lite technology, see Tim Greene, *Key DSL Flavor Faces Big Compatibility Test; but G.Lite Modem Makers Hope To Achieve Interoperability by June*, NETWORK WORLD, Apr. 19, 1999, at 1.

113 See, e.g., Bob Metcalfe, *Universal ADSL Working Group Is Speeding G.Lite Down a Road to Nowhere*, INFO WORLD, Sept. 7, 1998.

system.¹¹⁴ Although G.Lite is a public, nonproprietary standard, the consortium members are devoting considerable effort to the implementation of G.Lite in their networks. Such efforts include the deployment of G.Lite-compatible DSLAMs in central offices, development of loop selection and testing procedures, testing for interoperability, and OSS support.¹¹⁵

If the FCC were to mandate the unbundling of DSLAMs, the attractiveness of G.Lite deployment would plummet. First, the ILEC would have to sell wholesale access to DSLAMs, which would dampen investment incentives in central office facilities. Second, the ILEC would be forced to share with other DSL operators the considerable investment in personnel training, installation procedures, and OSS support. Finally, the product differentiation that the ILEC is seeking through its ability to offer "splitterless" DSL service would be nullified. The provision of the splitter would entail an additional cost that the ILEC would have to charge to the customer. Consequently, the price-adjusted quality of the ILEC's DSL service would diminish relative to the CLEC's DSL service.

D. *Transmission Facilities*

1. Fixed-Link Innovations

Often CLECs provide competing loop services without using any regulated input from the traditional ILEC. For example, AT&T claims that half of its traffic from business customers terminates on its own network, a figure that is certainly higher after the company's purchase of Teleport Communications Group in 1998.¹¹⁶ Competing carriers encourage the use of their facilities through discounts or rebates for traffic either originating or terminating on proprietary networks, or through the use of special "on-net" tariffs. Any mandatory unbundling rule that facilitates a CLEC's ability to share the ILEC's innovations in fixed-link transmission would reduce the CLEC's incentive to invest in those types of proprietary networks. Government-induced disincentives to investment do not enhance consumer welfare and should not be regarded as advancing the public interest.

114 See PARADYNE CORP., *supra* note 47, at 73.

115 See Carol Wilson, *ITU Approves G.Lite*, INTERACTIVE WEEK ONLINE, (June 23, 1999) <<http://www.zdnet.com/intweek/stories/news/0,4164,2281396,00.html>>; Carol Wilson, *Shedding Light on G.Lite Standard*, INTERACTIVE WEEK ONLINE, (June 16, 1999) <<http://www.zdnet.com/intweek/stories/news/0,4164,407169,00.html>>.

116 See Stephanie N. Mehta & John J. Keller, *Sprint Plans To Integrate Voice, Data*, WALL ST. J., June 3, 1998, at A3 (quoting Frank Ianna, AT&T's network chief).

2. Wireless Innovations

Wireless carriers are experimenting with a wide range of wireless data services.¹¹⁷ For example, Teligent has integrated point-to-point and point-to-multipoint wireless technologies with traditional broadband wireline technology. Teligent serves its customers by placing a small digital microwave antenna on the roof of a customer's building. It currently offers service in 24 markets that comprise more than 405 cities and towns with a combined population of more than 75 million.¹¹⁸ The company views changing consumer preferences and a favorable regulatory climate as key ingredients to its success:

We believe we are well positioned to capture revenues in the estimated \$128 billion business communications market. Our focus is on the estimated \$51 billion local exchange market, which is currently one of the most profitable segments in the communications industry. Local exchange services have historically been provided by regional monopolies known as incumbent local exchange carriers or "ILECs." ILECs have typically used older, existing copper wire-based networks. The ILECs' networks, faced with increasing demand from businesses for new services, such as Internet access, at reasonable costs, have created a "last mile bottleneck" between the customer location and the ILEC network switch. Our market research indicates that the ILECs have been unable to satisfy customer demands for cost-effective, flexible and responsive service and that a significant portion of Teligent's target customer base—small and medium-sized businesses—is currently dissatisfied with its ILEC service. The potential revenue opportunity in this market, coupled with changes in the regulatory environment designed to enhance competition, have created opportunities for competitive local exchange carriers, or "CLECs," such as Teligent. We intend to reduce or eliminate this last mile local bottleneck and gain market share primarily through the use of our SmartWave(TM) local networks while providing quality customer service and competitive pricing.¹¹⁹

117 Traditional commercial mobile radio operators (including cellular, PCS, and specialized mobile radio) are increasing their deployment of next-generation wireless data services. See, e.g., Eoin Licken, *New Data Age: Now, Portable Phones Aren't Just for Talking*, INT'L HERALD TRIB., Jan. 21, 1999, at 10. Other wireless carriers are also entering the fray. For example, Metricom is offering a mobile wireless low-speed data service. See METRICOM INC., 1999 SEC FORM 10-K, at 3 (1999). Other carriers, such as Teligent and Winstar, are offering fixed high-speed (DS-1 and above) services using land-based or satellite-based technologies. See TELIGENT INC., 1999 SEC FORM 10-K, at 3 (1999); WINSTAR INC., 1999 SEC FORM 10-K, at 8 (1999).

118 See TELIGENT INC., 1999 SEC FORM 10-K, at 3 (1999).

119 *Id.* at 4.

Teligent's strategy is suggestive of what other CLECs can do. Again, such investments in alternative technologies for access to the local network, which are already taking place *without* mandatory unbundling of the ILEC's advanced services, would surely diminish in the face of more expansive mandatory unbundling rules.

Conclusion

Mandatory unbundling at TELRIC prices distorts the investment decisions of ILECs. With respect to investments that decrease the marginal cost of an existing service, an invasive policy of mandatory unbundling undermines the ILEC's incentives to maintain and upgrade its existing facilities. Mandatory unbundling of new services supported by new technologies is even more harmful to consumer welfare because it confers a valuable option on CLECs that can be exercised against the ILEC whenever the service and technology prove successful. It is disturbing that the FCC's *Second Further Notice of Proposed Rulemaking* refers to "investment" or "innovation" only *once*.¹²⁰ Investment, innovation, and product development are too central to consumer welfare in a high-technology industry such as telecommunications to be treated as an afterthought by the FCC.

Mandatory unbundling also raises the ILEC's cost of capital, which serves as a benchmark of comparison for all expected returns. First, mandatory unbundling at TELRIC prices increases the cyclical nature of an ILEC's profits and hence raises the ILEC's systematic or beta-risk. As a result, an ILEC's investors would demand a larger risk premium because the firm's stock would contribute more to the volatility of an investor's overall portfolio. The larger risk premium would imply a higher cost of equity capital for an ILEC. Second, mandatory unbundling raises the uncertainty of an ILEC's profits and increases the probability of its financial distress, diminishing the ILEC's ability to use debt financing. Because debt is a cheaper source of finance, the ILEC's weighted-average cost of capital will rise.

Mandatory unbundling at TELRIC prices also adversely affects the CLEC's investment decision. First, a compulsory-sharing regime tips the balance of the CLEC's calculus in favor of waiting. The value of the first-mover advantage erodes, while the value to the CLEC of keeping its options open increases. Second, mandatory unbundling of network elements at TELRIC prices creates incentives for a CLEC to game the regulatory system. Third, in the face of mandatory unbundling at TELRIC prices, CLECs will be less inclined to develop innovative ways to provide

120 See SFNPRM, *supra* note 12, ¶ 3, at 8696.

service.

Other FCC policies exacerbate the perverse incentives that stem from mandatory unbundling at TELRIC prices. In cases where retail rates are below costs, especially in rural and low-density service areas, CLECs rationally will choose to use resale rather than lease unbundled network elements at TELRIC prices, thus obtaining wholesale service considerably below cost. Mandatory unbundling also will eliminate or greatly reduce procompetitive bundling opportunities for ILECs that would redound to the direct benefit of consumers. Finally, the FCC should commit itself credibly to maintaining the proper incentives for the ILEC to continue making investments in elements that would be at risk of being unbundled at TELRIC prices in the future.

In assessing whether a particular interpretation of § 251(d)(2) would enhance consumer welfare and thus serve the public interest, the FCC should recognize that any regulation that mandates the unbundling of network elements at regulated prices can severely distort investment, product development, and innovation in the telecommunications marketplace. If some mandatory unbundling is good for purposes of serving the public interest, it does not at all follow that more is better. Mandatory unbundling has costs as well as benefits, and the *Second Further Notice of Proposed Rulemaking*, by ignoring that tradeoff, fails to give investment and innovation the solicitude that the public interest standard requires. Congress directed the FCC in § 251(d)(2) to consider, “at a minimum,” the “necessary” and “impair” standards when deciding whether to mandate unbundling of particular network elements at regulated prices. The “something more” that the FCC should consider, beyond the statute’s minimum concerns, is the harm that mandatory unbundling at TELRIC prices would impose on consumer welfare by discouraging investment, innovation, and product development.