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Competition in Telecommunications and Economic Growth

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I. Executive Summary
This paper evaluates the impact that the sharp decline in CLEC prospects is likely to have on the U.S. economy if it is sustained. Our purpose is to explore the likely long run damage to the U.S. economy of the passage of the Tauzin-Dingell bill. While the direct impact of declining CLEC investment has likely been relatively small to date, we draw on numerous studies that have explored the impact of high-tech investment on output and find that declining CLEC investment will likely reduce aggregate output, *ceteris paribus,* by between 0.5 and 0.7 percentage points by 2006. This estimate translates approximately to a reduction in gross output of between $57 and $88 billion by 2006. In addition, the continued monopolization of local services by the Bell Operating Companies (BOCs) is likely to cost consumers over $108 billion in lost consumer surplus over the next five years.

II. Introduction
A companion paper[1] explains why the future of competition in telecommunications is in danger. Specifically, that paper demonstrated the negative impact on the competitive local exchange carrier (CLEC) industry of proposed legislation co-authored by Reps. Billy Tauzin (R-La.) and John Dingell (D-Mich.) that would prematurely relax line of business and other regulatory constraints imposed on incumbent local exchange carriers (ILECs).[2] The Tauzin-Dingell bill would effectively overturn the policy framework put in place by the Telecommunications Act of 1996 (TA96) that was intended to facilitate the emergence of sustainable and effective local competition. This framework was responsible for giving birth to the CLEC industry and for the extent of local competition, though limited, that we see today.[3]

This paper provides near-term and longer-term estimates of the potential impact on the U.S. economy and economic growth of diminished prospects for local telephone competition. Telecommunications are a basic infrastructure industry, providing services

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[1] See Glassman, J. and W. Lehr, "The Economics of the Tauzin-Dingell Bill: Theory and Evidence," mimeo, May 31, 2001 (see http://www.techcentralstation.com/NewsDesk.asp?FormMode=MainTerminalArticles&ID=69).

[2] HR-1542 is called the "Internet Freedom and Broadband Deployment Act." Its advocates promote it as a deregulatory proposal that would enhance consumer choice and the deployment of broadband access services. As we explain in Glassman & Lehr, *ibid*., it would do the exact opposite.

[3] As of December 31, 2000, ILECs own the facilities that provide 97.0% of all end-user lines, and ILECs

provide retail service to 91.5% of those lines. Most of the rest are provided by CLECs leasing facilities

that are regarded as necessities by consumers and virtually all businesses.[4] Local access facilities are an essential input to most communication services (*e.g.,* local and long distance telephone, Internet access, etcetera). Therefore, a negative shock to prospects for competition in local infrastructure services will be amplified as it reverberates first through related communication equipment and service markets and then through the rest of the economy that is dependent on our electronic communications infrastructure. Having an unregulated monopolist in control of essential bottleneck facilities is likely to hamper growth severely in this information age. But having a regulated monopolist is also not optimal since regulation distorts incentives and adversely affects market performance. As we explain further below, the costs to the economy of failing to realize effective local competition are large and likely growing.

The economic reverberations of the bill can be divided into two categories. First, the earlier paper demonstrated that consideration of the bill may have already caused tangible damage to the market value of and investment by CLECs. Evaluating the economic impact of these influences is a fairly straightforward accounting exercise. Second, if the bill were to pass and become law, then it would undoubtedly have a longrun

impact on the structure of the telecommunications industry. Evaluation of this is somewhat more speculative, but a large body of research can be drawn upon that provides some guidance to the likely magnitudes and directions.

from the ILECs under provisions mandated by the TA96. See *Local Telephone Competition: Status as of December 31, 2000*, Federal Communications Commission, Washington, DC, May 2001.

[4] Since 1970, over 90% of U.S. households have had a telephone (see Table 17.3 in *Trends in Telephone Service*, Federal Communications Commission, Washington, DC, December 2000).

In Section III, we contrast the benefits of competition to the costs of monopolization and review the empirical literature that attests to the improved performance to be expected from greater competition in telecommunication services. This discussion is followed in Section IV by a review of the empirical literature regarding the contribution of information technology to economic growth and our order-ofmagnitude

estimates of the negative impact on overall economic activity in the United States due to the deterioration in the CLEC industry and prospects for telecommunications competition.

Section V focuses on the direct cost to consumers due to above-cost pricing by the Bell Operating Companies (BOCs) that is sustained because of the lack of effective competition. The sustained monopoly power of the ILECs also contributes to a reduction in GDP output and growth, amplifying the impact associated with the reduction in CLEC investment that is addressed in Section IV, but an estimate of the quantitative impact of ILEC monopoly power on GDP is beyond the scope of the present paper. Section VI concludes.

III. Benefits of a Competitive Telecommunications Sector

A. Competition is superior to monopoly

Economists are generally agreed that, when feasible, competition offers the best way to organize economic activity. Competition promotes economic efficiency, assuring

that costs are minimized and resources are directed to their highest value uses. Firms are compelled to innovate to lower costs and to improve quality and product choice in a continuing quest to attract consumers and improve efficiency. Prices are driven toward

costs, thereby eliminating excess profits. In the absence of entry barriers (which includes the costs of adjusting capacity), dynamic performance is also efficient as aggregate industry capacity adjusts to accommodate fluctuations in consumer demand.

In contrast, monopoly markets are inefficient. The monopolist sets prices to maximize profits, which in the absence of competition, means that prices exceed economic costs. These higher prices result in a deadweight loss.[5] Capacity and investment are limited because prices are too high. Moreover, the absence of competition reduces pressure on the firm to improve quality or eliminate cost inefficiencies (Xefficiency[6]).

Consumers have less choice to purchase a more limited range of lower quality goods and services.

While the static deadweight costs of monopoly may be substantial, its dynamic implications are likely to be far worse, especially in the presence of technological progress and changing market conditions. The monopolist has a natural incentive to seek to maintain its market power and this distorts its investment incentives. Indeed, a monopolist is willing to engage in strategies that would otherwise be uneconomic if by so doing it can preserve its excess profits. This inspires the monopolist to invest in entry barriers and to bias its technology choices to reduce the threat of potential competition.

[5] The deadweight loss arises because the monopolist sets prices above cost which suppresses demand from marginal consumers who would be willing to purchase the good if it were priced competitively. This reduction in demand represents a loss in economic efficiency.

[6] X-efficiency or managerial slack, is the general term for cost-inefficiencies that occur in organizations because decision-makers are partially isolated from market forces and their private interests deviate from the firm's owners (profit-maximization). This is more likely to arise in the context of monopoly firms (see, Leibenstein, H., "Allocative Efficiency vs. X-efficiency," *American Economic Review*, vol. 56 (June 1966) 392-415).

The impact of such strategies can be to slow the adoption of more efficient technologies, the expansion of consumer choice, and the emergence of effective competition.

Finally, monopoly markets are inequitable, capturing too large a share of total surplus for the firm's owners and leaving too little for consumers.[7] Competitive markets maximize consumer surplus by driving prices toward economic costs. Firms recover their costs, including earning a fair return on invested capital, which is all that is necessary to assure sustainable and efficient industry supply.

B. Telecommunications legacy of regulated monopoly

Few, if any, real world markets match the ideal of perfect competition. This is certainly the case with telecommunications, where the presence of substantial economic barriers to entry limit the extent of free entry and exit. Telecommunications infrastructure requires substantial investments in long-lived capital assets that must be made in relatively large increments (lumpy investment) and may be substantially irreversible (sunk). Capacity costs are largely fixed, driven by the requirements of peak demand. The same capacity can be used to support multiple services so there are large shared and common costs (*e.g.,* the same switches and wires are used to handle data and voice, local and long distance traffic). Rapid technological progress, industry convergence,

globalization, and regulatory liberalization have all increased market uncertainty, which
7 Total surplus is the difference between the aggregate willingness-to-pay for goods (market demand) and the costs of supplying that demand.

further increases the effective hurdle rate for new investment.[8] Finally, the positive demand externalities inherent in communication networks make large networks more attractive than small.[9]

These characteristics of telecommunications costs and demand give rise to scale and scope economies that limit the number of viable firms in the marketplace and greatly favor an entrenched incumbent who already has an ubiquitous network in place. In recognition of these features and because of the desire to promote universal access to telephone service, policy-makers historically regulated telephone service as an end-to-end monopoly. Whether policymakers were correct in their original assessment that telecommunications was a natural monopoly (*i.e.,* a single firm can most efficiently supply industry demand) is irrelevant at this point. The fact remains that we currently have a *de facto* incumbent monopolist with control over essential bottleneck facilities. When coupled to the underlying cost/demand characteristics of telecommunications, it is not feasible for effective competition to establish itself in the face of an entrenched incumbent without a proactive regulatory framework. Simply eliminating the existing regulatory apparatus without addressing the current state of the market and infrastructure investment will merely substitute an unregulated monopolist for a regulated one. While the latter is a problem, the former is likely to be far worse.

8 See our companion paper (note *1, supra)* for further discussion of how increased uncertainty in the face of irreversible investments increases the cost of capital.

9 Positive network externalities arise in communication networks in a number of ways. First, the value of telephone service increases with the number of people one can potentially call (the subscribership externality). Second, most communications are beneficial to both the caller and recipient (the calling externality). Third, their may be additional positive benefits because of the increased presence of

It is simply not a viable option to consider unregulated monopoly control of our information infrastructure. Telecommunications is too important to our overall economy, as we explain further in the following section. Therefore, as long as local access infrastructure remains a *de facto* monopoly, it will be subject to some regulation to assure that the incumbent does not overly abuse its ability to set prices above costs to earn excess profits. Because the regulator has inferior information relative to the incumbent firm, enforcement is always imperfect. The cat-and-mouse game of regulation requires a complex apparatus that imposes deadweight costs and distorts the incentives of the firm. The regulatory bureaucracy can further reduce incentives to innovate because the regulatory process imposes additional costs and delays that limit the ability of the incumbent to adopt new technologies or offer new services.[10]

At the moment, some constraints are necessary. The incumbent firm has an incentive to seek to preserve its market power and may engage in strategic investment or product/marketing behavior that is designed to deter competition.[11] For example, an incumbent firm may invest in surplus capacity to deter entry[12] or may engage in tying arrangements (*e.g.,* requiring customers to purchase local and long distance services as a

complementary goods and services. For example, the success of the Windows operating system is due in part to the greater selection of software applications which are compatible with it.

10 For example, Hahn (1999) argues that regulatory intervention will reduce incentives to innovate in the

computer industry (see Hahn, Robert, "Costs of Regulating Microsoft," Article, AEI-Brookings Joint Center for Regulatory Studies, January 1998).

11 See Krattenmaker, T. and Salop, S., "Anticompetitive Exclusion: Raising Rivals' Costs to Achieve Power over Price", Yale Law Journal, vol. 96, no. 2 (December 1986) 209-293; Salop, Steven C. and David T. Scheffman, "Raising Rivals' Costs," American Economic Review, Vol. 73 (May 1983), pp. 267-271; or, Economides, N., "The Incentive for Non-Price Discrimination by an Input Monopolist," Mimeograph, Stern
School of Business, New York University, January 1997.

12 See Dixit, A., "The Role of Investment in Entry Deterrence," *Economic Journal*, 90 (1980) 95-106.

bundle) to preclude competition from non-vertically integrated competitors.13 The incumbent may also engage in inefficient strategies to circumvent regulations. This can include over-investing in capital if the allowed return is set too high14 or crosssubsidization
to avoid regulatory controls.15 Regulatory oversight – which is perforce costly to implement – is needed to protect consumers and adjacent markets from the abuse of such strategies.

C. Benefits of establishing effective local telecommunications competition

If effective competition can be established, however, then market forces can substitute for direct regulatory oversight to discipline industry behavior. Of course, you cannot have competition without competitors—which means there has to be successful and sustainable market entry. The incumbent will naturally oppose such entry and so asymmetric regulation is required if a transition to competition is to be realized.16

13 See Whinston, M., "Tying, Foreclosure, and Exclusion," *American Economic Review,* vol 80 (1990) 837; or, Carlton, D. and M. Waldman, "The Strategic Use of Tying to Preserve and Create Market Power in Evolving Industries," mimeo, Graduate School of Business, University of Chicago, March 2000.

14 See Averch, H. and L. Johnson, "Behavior of the Firm under Regulatory Constraint," *American Economic Review* (Dec 1962) 1052-69.

15 For example, the regulated firm may seek to misallocate costs from deregulated services to regulated services to raise prices for regulated services or to subsidize entry into competitive markets (see Bernheim, Douglas B., and Robert D. Willig, "*The Scope of Competition in Telecommunications*," Working Paper, American Enterprise Institute Studies in Telecommunications Deregulation, Washington, DC, October 1996.)

16 Of course, if one believes that local telephone access services are a natural monopoly then it is not feasible or desirable for competition to succeed. We do not believe this is the case, and hence, focus on the potential welfare benefits from moving to a competitive regime. However, if local services are a natural monopoly, then we will have to retain public utility regulation of the essential facilities indefinitely and may need to implement further structural separation to minimize the adverse effects of this regulation or the risk of monopoly leveraging in adjacent or downstream markets such as long distance, Internet access, or other advanced data services. Assuming the existence of a natural monopoly would strengthen our arguments from the earlier paper (note 1 *supra*) as to why it would be inappropriate to relax regulatory oversight of the ILECs prematurely.

Competition will deliver benefits to consumers through lower prices, increased consumer choice and service quality, and improved incentives to invest and innovate. Prices will be lower because competition will eliminate monopoly profits and because the "survival of the fittest" law of competitive markets will force firms to minimize costs. In addition, liberalization will eliminate the deadweight costs of regulation.

Consumer choice will expand because customers will be able to purchase service from multiple providers, and providers will be driven to improve quality and to offer new bundles of services to differentiate themselves. Most importantly, competition will help

fuel innovation that provides the impetus for continued growth and still larger benefits in the future.

Competition will lower prices, resulting in increased demand, which will induce additional investments in aggregate industry capacity. Competition also fuels incentives to innovate as firms seek to lower costs and to differentiate their products in order to improve margins. Competition, therefore, encourages faster network modernization.[17]

There is ample evidence that regulatory liberalization and increased competition encourage more rapid telecommunications infrastructure modernization. For example,

[17] The theoretical literature is mixed with regard to its assessment of the impact of industry structure on incentives to adopt innovations. Arrow (1964) and Reinganum (1983) both argue that a monopolist is less likely to innovate because of the "replacement effect" that arises because the monopolist takes into account the impact on pre-innovation monopoly profits of the innovation (see Arrow, K. "Economic Welfare and the Allocation of Resources for Inventions," in *The Rate and Direction of Inventive Activity*, edited by Richard Nelson, Princeton University Press: Princeton, NJ, 1962; or, Reinganum, J., "Uncertain Innovation and the Persistence of Monopoly," *American Economic Review*, vol 73 (1983) 741-748). Gilbert and Newberry (1983) argue that an opposite result may obtain if a monopolist is threatened with competitive entry (see Gilbert, R. and D. Newberry, "Preemptive Patenting and the Persistence of Monopoly," *American Economic Review*, vol 74 (1982) 514-526).

Taylor *et al* (1992)[18] examined the behavior of Regional Bell Operating Companies (RBOCs) from 1980 through 1990 and found that RBOCs subject to alternative forms of regulation (*e.g.,* price cap or other forms of incentive-based regulation instead of rate of return) were more likely to invest in network modernization. Greenstein *et al* (1995)[19] found a similar result.[20] Since the move to alternative regulation is often accompanied by liberalization, these studies provide indirect support for the positive impact of competition on telecommunications infrastructure investment. Direct evidence of the positive effect is provided by a recent study by Sappington and Ai (2001),[21] who found that competition accentuates the positive effect of incentive-based regulation on network modernization investments.

Additional empirical evidence that liberalization and competition lower prices, improve productivity, increase teledensity,[22] and improve service quality is provided by

[18] Taylor, W., C. Zarkadas, and J. Zona, "Incentive Regulation and the Diffusion of New Technology in Telecommunications," National Economic Research Associates, paper presented to the Ninth Biennial Conference of the International Telecommunications Society, Sophia-Antipolis, France, 1992.

[19] Greenstein, S., S. McMaster, and P. Spiller, "The Effect of Incentive Regulation on Infrastructure Modernization: Local Companies' Deployment of Digital Technology," *Journal of Economics and Management Strategy*, Vol 4, No. 2 (1995) 187-236.

[20] Greenstein *et al* (1995) also provided some evidence that competition further enhances incentives to modernize, although the results were ambiguous. The principal focus of the study was on alternative modes of regulation, not on the impact of competition. They found that relaxing restraints against local bypass encouraged ILEC fiber deployment but the result was only weakly significant, and seemingly paradoxically, allowing intraLATA competition depressed fiber deployment.

[21] Sappington, David, and Chunrong Ai, "The Impact of State Incentive Regulation On the U. S. Telecommunications Industry," working paper, Department of Economics, University of Florida, March 2001.

[22] Historically, the potential threat of competition for universal service goals has been a major policy concern. The studies cited here demonstrate that liberalization enhances teledensity and service coverage.

cross-national studies from Boyland and Nicoletti (2000),[23] Ros (1999),[24] and Walsten (1999).[25]

Because of the limited availability of data on CLECs and because aggregate

industry investment is dominated by the ILECs, most of the empirical studies to date have focused on the behavior of the ILECs in response to competition. A few, however, have looked explicitly at the impact of CLEC competition. Woroch (2000)[26] found that CLEC investments in fiber rings prompted competitive investment by the ILECs, and vice versa, demonstrating the virtuous cycle of investment we should expect in the face of competition. Tomlinson (1995)[27] found that CLEC competition (in the form of Competitive Access Providers) induced ILECs to improve service quality and network reliability.

As the empirical literature demonstrates, liberalization and increased telecommunications competition can be expected to have a positive impact on overall

[23] Boyland and Nicoletti (2000) present cross-national analysis of 23 OECD countries between 1991 and 1997 and find that prospective and actual competition both bring about productivity and quality improvements in telecommunication services, with lower prices (see Boyland, O. and G. Nicoletti, "Regulation, Market Structure and Performance in Telecommunications," Economics Department Working Paper No. 237, Organization for Economic Cooperation and Development, Paris, 2000).

[24] Ros (1999) in cross-national study of 110 countries using ITU data over the period from 1986-1995 found that liberalization and competition enhance penetration and efficiency (see Ros, A., "Does Ownership or Competition Matter? The Effects of Telecommunications Reform on Network Expansion and Efficiency," *Journal of Regulatory Economics*, 15 (1999) 65-92.)

[25] Walsten (1999) studied regulatory reform in panel of African and Latin American countries and found that competition significantly increased access and lowered costs. (See Walsten, S., "An Empirical Analysis of Competition, Privatization, and Regulation in Africa and Latin America," World Bank Working Paper #2136, June 1999.)

[26] Woroch, G., "Competition's Effect on Investment in Digital Infrastructure," mimeo, Department of Economics, University of California – Berkeley, May 2000.

industry performance. And, since there obviously cannot be any competition without competitors, an effective CLEC industry is necessary if the benefits of competition are to be delivered. In the next section, we consider the important role that information technology and telecommunications have in the overall economy and its implications for economic growth, before introducing our framework and estimates for quantifying the impact of the deterioration in the CLEC industry on the overall economy.

IV. Assessing the Near-term and Longer Term Impact of Tauzin-Dingell on the U.S. Economy.[28]

A. Information Technology's Contribution to Economic Output

There is increasing agreement in scholarly circles that the information technology (IT) revolution has lead to a dramatic increase in U.S. productivity growth. For example, according to Jorgenson (2001), information technology added 1.18 percentage points to GDP growth and accounted for 2/3rds of the growth in total factor productivity during the second half of the 1990's.[29] This is doubly impressive when one recognizes that IT assets account for less than 5 percent of total capital stocks.[30] A Department of Commerce study estimated that IT industries which account for less than 10 percent of total output contributed nearly a third of real GDP growth from 1995 to 1999, and lower prices for IT

[27] Tomlinson, R., "The Impact of Local Competition on Network Quality," in *Quality and Reliability of Telecommunications Infrastructure*, edited by William Lehr, Lawrence Erlbaum Associates: Mahwah, NJ, 1995.

[28] The authors are indebted to Kevin Hassett of the American Enterprise Institute for helpful comments and suggestions in the preparation of this section.

[29] See Jorgenson, Dale, "Information Technology and the U.S. Economy," *American Economic Review*, vol 91, no 1 (March 2001) 1-32.

equipment and services helped lower inflation during the period by 0.5 percent per year.[31] Oliner and Sichel (2000) estimated that IT accounted for 56 percent of the growth in labor productivity from 1996 to 1999.[32]

In the past, technological change, from the steam engine to the automobile, has often led to a rapid transformation of the economy, accompanied by rapid economic growth, followed by a return to a period of slower growth, as diminishing returns set in. Economist Edward Leamer described the process in a recent paper for the National Bureau of Economic Research as follows – [33] think of the economy as an orchard. Early in an expansion, there are many low-hanging pieces of fruit, and workers can simply wander from tree to tree and generate enormous output. After a while, the low-hanging fruit has been picked, and the orchard owners invest in ladders to take workers to the higher branches. After the ladder technology is exhausted, perhaps they invest in cherry pickers, that lift workers to the highest branches. Then, when all of the accessible fruit are harvested, the orchard owner has two options, either wait a year for the fruit to grow back (a period of very slow growth), or break out into the frontier and try to find a new orchard.

[30] In 1999, IT assets accounted for 4.35 percent of U.S. domestic tangible capital stock (see Jorgenson (2001), note 29, *supra*, page 12).

[31] See *Digital Economy 2000*, Economics and Statistics Administration, U.S. Department of Commerce, Washington, DC, June 2000, page 6-7.

[32] See Oliner S. and D. Sichel, "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?" Washington, DC: Federal Reserve Board, May 2000.

[33] See Leamer, E., "Lifecycle of US Economic Expansions," National Bureau of Economic Research Working Paper #8192, March 2001.

"New Growth" theorists such as Paul Romer of Stanford University have argued that the information technology revolution may be different from earlier periods of dramatic economic transformation because information technology itself makes the exploration process cheaper and more productive.[34] Computer technology allows aircraft manufacturers to better test new plane designs without endangering the lives of test pilots. The Internet has removed barriers to information flow, and connected scientific collaborators from all corners of the earth. In 1998, the IT industries accounted for nearly one-third of all company-funded R&D.[35] If the ability to find new things is permanently improved by such factors, then higher economic growth may be sustainable.

Until recently, there was little evidence that the IT revolution had provided a solid economic return. Famous were the words of Robert Solow, who in 1987 declared that "we can see the computer age everywhere but in the productivity statistics."[36] Such observations were backed up by careful scholarly research. For example, Oliner and Sichel (1994) found that computers contributed almost nothing to productivity growth through the early 1990s.[37]

[34] See Romer, Paul M. "Endogenous Technological Change," *Journal of Political Economy*, vol 98 (1990) S71-S102; or, "Untangling e-conomics," *Economist.com*, September 21, 2000.

[35] See *Digital Economy 2000*, note 31 *supra*, page 32.

[36] New York Times, May 20th, 1987, p. A1.

[37] These results based on an analysis of aggregate data were also supported by a number of studies using disaggregated industry data. See, for example, Loveman, G., "An Assessment of the Productivity Impact of Information Technologies", mimeo, Massachusetts Institute of Technology, September 1990; Morrison, C., and E. Berndt, "Assessing the Productivity of Information Technology Equipment in U.S. Manufacturing

Industries," NBER Working Paper No. 3582, January 1991; Roach, S., "America's Technology Dilemma: a Profile of the Information Economy", *Morgan Stanley Special Economic Study*, New York, April 1987; or, Bailey, M. and R. Gordon, "The Productivity Slowdown, Measurement Issues, and the Explosion of Computer Power", *Brookings Papers on Economic Activity,* vol 2 (1988) 347-432.

Recently, these results changed in a dramatic way. For example, Oliner and Sichel updated their earlier study to include data for the late 1990s and found that IT investments started to exhibit tremendous returns starting in about 1995. Up until 1995, Oliner and Sichel estimated that the contribution of the IT sector to U.S. real output growth was about 0.5 percent per year. Between 1996 and 1999, it soared to 1.1 percent per year.[38] Other authors have found a similar story, but it is especially noteworthy that past skeptics such as Oliner and Sichel have been converted by the evidence.[39] While these numbers are striking, Brynjolfsson and Hitt (2000) argue convincingly that they likely provide conservative estimates of the true economic gains from IT.[40] In particular, firm-level studies such as that by Lichtenberg (1995) and Lehr and Lichtenberg (1999) often find that IT investments are tremendously productive.[41] Brynjolfsson and Hitt discuss why measurement problems in the National Income and Product Accounts miss many of the firm-level gains.

This economic literature demonstrates that the IT revolution is having a profound impact on how our economy works. It is contributing to a transformation in the way firms

[38] See Oliner, S. and Daniel S., "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?" *Journal of Economic Perspectives*, vol 14, no 4 (Fall 2000) 3-22.

[39] For example, see Jorgenson (2000), note 29, *supra*; Whelan, Karl, "Computers, Obsolescence, and Productivity," Federal Reserve Board, Finance and Economics Discussion Series Paper 2000-6, February 2000; and, Gordon, R., "Does the 'New Economy' Measure Up To The Great Inventions of the Past," National Bureau of Economic Research Working Paper #7833, Cambridge, MA, August 2000.

[40] See Brynjolfsson, E. and L. Hitt, "Beyond Computation: Information Technology, Organizational Transformation, and Business Performance," *Journal of Economic Perspectives*, vol. 14, no. 4 (Fall 2000) 23-48.

[41] See Lichtenberg, F., "The Output Contributions of Computer and Equipment and Personal: A Firm-level Analysis," *Economics of Innovation and New Technology*, vol. 3 (1995) 201-217; and, Lehr, W., and F. Lichtenberg, "Information Technology and Its Impact on Productivity: Firm-level Evidence from Government
and Private Data Sources, 1977-1993," *Canadian Journal of Economics*, vol 32, no 2 (April 1999) 335-362.

organize, communicate, distribute, and produce their goods and services. IT is fundamentally altering business processes, affecting the ways in which firms innovate, manage production, and communicate with customers. The growth in communication services, especially the Internet, has proved a critical component in the IT revolution. It has helped accelerate the diffusion of computers and IT throughout our economy to the extent that today over 169 million persons, or 60 percent of the population, have Internet access.[42] Most of these users, however, still access the Internet over slow speed dial-up connections. To realize the Internet's full potential, users need broadband, "always on" connections.[43] The availability and penetration of broadband services had been growing quite rapidly – reaching 12 percent of the home Internet access population by December 2000.[44] However, Telecommunications International reported that the Internet population actually fell slightly in the first quarter of 2001, due in part to the failure of a number of Internet service providers.[45]

The health and continued growth of communication services, and broadband

Internet access in particular, is important if we are to continue to realize the benefits of

[42] See "Internet Penetration Reaches 60 Percent in the U.S.," Nielsen//NetRatings Press Release, February 28, 2001.

[43] Traditional consumer Internet access relies on dial-up modem connections. These are limited to access speeds of 56Kbps or less and the need to explicitly initiate a connection substantially reduces the usability of Internet access. In contrast, currently available broadband access services such as cable modems and digital subscriber line (DSL) services offer an order of magnitude faster connection speeds, and typically, support "always on" connections. This latter is especially important because it eliminates the delay and added effort required to initiate an access session each time a user wishes to access the Web or check email. See Gillett, S. and W. Lehr, "Availability of Broadband Internet Access: Empirical Evidence," paper presented to the Twenty-Seventh Annual Telecommunications Policy Research Conference, September 25-27, 1999, Alexandria, VA.

[44] See "Broadband Access Soars Nearly 150 Percent At Home," Nielsen//NetRatings Press Release, February 8, 2001.

[45] See "U.S. Subscribers to Online Services Fall in Q1," Internet.com, May 1, 2001.

the IT revolution in terms of continued innovation, GDP and productivity growth, and further improvements in consumer welfare. In light of the empirical evidence cited above, which attests to the important role IT and communication services play in our overall economy, it is worthwhile trying to estimate the potential impact that harm to the CLEC industry may have on the economic performance of the US economy.

B. Estimating the Economic Impact of CLEC decline

There have likely been many negative repercussions of the CLEC decline. Large equipment manufacturers such as Cisco Systems and Nortel have posted large losses, and also paired back activity significantly. Certainly, the large drop off in CLEC activity has contributed to these developments, but identifying the exact share is difficult at best. Isolation of the direct impact of the CLEC troubles is far less speculative. In our companion paper, we demonstrated that the market capitalization of publicly traded CLECs declined significantly on a few Tauzin–Dingell event days. Our analysis showed that the market value of CLECs declined 84 percent from March 2000 to May 2001. A decline of this magnitude is likely to reduce substantially CLEC investment in telecommunications infrastructure, including investment in advanced data services. This, in turn, will reduce economic growth and output -- both because of the reduced aggregate investment in IT capital and because of reduced prospects for efficiency-enhancing competition in communication services.

Hassett and Hubbard (1998) analyzed the relationship between the market capitalization of firms and their investment behavior and found strong evidence that a reduction in market capitalization will result in a reduction in future investment.[46] A decline in market capitalization as large as that experienced by the CLECs is too great to apply directly the estimates from the Hassett and Hubbard study. Indeed, almost all firms in the industry have seen their market capitalization drop so much that they would be expected to disinvest rapidly. However, in order to be conservative, we consider the impact of a reduction in investment proportionate to the decline in market capitalization, using the coefficients from the Hassett and Hubbard review as a guide. Taking a broad brush, this suggests that the reduction in CLEC market values may reduce their investment by between 42 percent and 84 percent.[47]

In 2000, CLECs invested almost $25 billion, and investment had been growing substantially every year since 1997.[48] Originally, plans called for investment in 2001 to

rise relative to 2000, but the events of the last year have caused many of those plans to be cancelled. While there is no complete data available for 2001, a survey of anecdotal reports we conducted in our previous paper highlights the many sharp drops in spending

[46] See Hassett, K. and G. Hubbard, "Tax Policy and Investment," National Bureau of Economic Research Working Paper #5683, February 1998.

[47] This is likely to be conservative because the analysis by Hassett and Hubbard focused on marginal changes in market capitalization. Changes of the magnitude experienced by the CLECs are likely to be associated with much more substantial disruptions in operating plans with a magnified impact on investment, including bankruptcies. Indeed, the reduction in CLEC market capitalization does not account for the full extent of these because we were only able to include CLECs in the market capitalization index that were actively traded during the full time period.

[48] The ALTS report states that CLECs invested $24.9 billion in 2000, up from $16.8 billion in 1999 (48% increase) and $5.0 billion in 1997 (71% annualized increase) (see "State of Local Competition 2001," Association for Local Telecommunications Services (ALTS), Washington, DC, February 2001).

already under way this year. Even if investment were to drop to zero, however, the immediate and direct impact would be small relative to GDP, which will likely be above $10 trillion for 2001.

Investment is conducted by firms because they are attempting to accumulate a desired level of capital with which to provide output to customers. The key question is, how much will the declining investment reverberate in future years into lower permanent capital stocks? Clearly, the answer to this question depends on the future of telecommunications law, and the enforcement of laws that enable CLECs to compete. Assuming that but for the loss of market capitalization, investment would have continued to grow at 10 percent,[49] the IT capital stock would have increased by $167 billion over the next five years (ignoring depreciation). In contrast, if the current anticompetitive environment is allowed to continue, or even to become worse as a consequence of the Tauzin-Dingell bill, then investment will stay permanently lower. Using the loss in CLEC value as an indicator of how much lower, we could expect IT capital stocks to be lower by between $95 to $147 billion over the next five years.[50]

We can translate this reduction in investment and IT capital into an estimate of the impact on GDP using estimates from the empirical literature cited earlier on the productivity impact of IT investment. The firm-level studies find that an extra dollar of

[49] This is quite conservative in light of the fact that CLEC investment had been growing 70 percent per year since 1997, including 48 percent alone between 1999 and 2000. Jorgenson (2000) estimates that from 1995 to 1999, the capital stock for communications equipment grew 11 percent annually (see Jorgenson (2000), note 29, *supra*, page 13.

[50] That is, depending on whether the loss in market capitalization resulted in a 50 percent or 100 percent reduction in future investment based on CLEC investment of $24.9 billion in 2000.

IT capital will increase total output by at least 60 cents.[51] Thus, we would expect GDP to be lower by between $57 and $88 billion in 2006 because of the reduction in IT capital associated with the loss in CLEC market capitalization identified earlier.

While this decline may seem speculative, there is strong evidence that investment has dropped significantly in recent months. This decline is beginning to show up in the best aggregate indicator of overall telecommunications investment activity, the Commerce Department's advance durables (M3) release. Year-over-year, orders for telecommunications equipment were down a striking 38 percentage points.[52]

Thus, our calculations suggest that the devastation of the CLEC industry will, if

allowed to proceed unchecked, likely lower GDP by the end of 5 years by between 0.5 percent and 0.7 percent relative to a baseline with healthy CLECs.[53] Of course, the demise of the CLECs may cause the BOCs to enter with more investment, which would partially offset this. However, as discussed earlier, BOC incentives to invest may be fairly low if they are able to permanently stake out a solid monopoly position. As noted above, these estimates are conservative, because if the CLECs continue to suffer further, reductions in market capitalization may be expected, including additional bankruptcies. This will further reduce projected CLEC investment, with the result that IT capital stocks and GDP will be even lower than what we have estimated here.

[51] See Brynjolfsson and Hitt (2000), note 40 *supra*, page 31.

[52] New orders for non-defense communications equipment for May 2001 were down 37.6% relative to May 2000 according to recent data from the Commerce Department (see Table 2, Commerce Department's Advance Durables Release, May 2001, http://www.census.gov/indicator/www/m3/prel/).

An alternative estimate of the negative impact of the reduction in CLEC investment may be obtained by applying the aggregate-growth accounting approach used by Oliner and Sichel (2000).[54] Ignoring depreciation, the reduction in CLEC investment over the next five years of between $95 to $147 billion estimated above translates into a 12 percent to 19 percent reduction in the capital stock of communications equipment.[55] Since Oliner and Sichel estimate that the income share of communications equipment was 2 percent, their approach would suggest that the reduction in CLEC investment would lower GDP growth by between 0.2 to 0.4 percent in 2006.[56]

C. Assessing the impact of failed telecommunications sector competition

The above estimates focus solely on the reduction in projected IT capital stock associated with the loss in market capitalization for the CLEC industry. The estimates do not include the loss in GDP, consumer welfare, and economic efficiency because of the lack of effective competition in telecommunications, a key infrastructure industry. The methods used above do not allow one to estimate the potential drag on the overall economy because local telecommunications services remain a *de facto* monopoly. In addition to distorting investment decisions in telecommunications and industries

[53] GDP in 2000 was $9.96 trillion and GDP growth averaged 3.46 percent from 1948 to 2000. Assuming this growth continues, expected GDP in 2006 would be $12.2 trillion. Therefore the reduction in GDP would represent a reduction of between 0.5 to 0.7 percent.

[54] See Oliner and Sichel, note 38, *supra*.

[55] In 1999, the net capital stock of Communications Equipment was $449 billion (see Table 3KCU.--Current-Cost Net Stock of Private Fixed Assets; Equipment, Software, and Structures; by Type, 1925-99, Bureau of Economic Advisors, http://www.bea.doc.gov/bea/dn2/ns2000.exe). Assuming a conservative growth rate of 10%, this would suggest capital stock would be $796 billion in 2005. If the collapse in CLEC market capitalization reduces investment between $95 to $147 billion as discussed above, then this would represent a reduction in the communications capital stock of 12 percent to 19 percent, respectively.

dependent on telecommunication services, the higher prices and operating costs that are characteristic of monopoly markets depress demand and capital investment, as we earlier explained. With increased competition, prices for local services (and for services that require local access as an essential input) which would fall, stimulating additional employment and demand growth for telecommunication services, thereby contributing to output growth within telecommunications and the rest of the economy.

Today, it appears that the Bell Operating Companies (BOCs) are earning more than $28 billion per year in excess profits for switched services (see Exhibit 1). This

estimate is computed by comparing BOC revenues for switched services (provided in reports filed with the FCC) with estimates of the forward-looking economic costs of providing service (as estimated using the model developed by the FCC for estimating the cost of providing local services as part of its universal service proceedings). Regulatory price caps that are based on historical embedded cost estimates fail to restrain BOC pricing adequately and allow BOCs to earn substantial monopoly profits, and most likely, to operate at inflated cost levels. According to the analysis in Exhibit 1, the BOCs are realizing a 70 percent margin on switched service revenues.[57] The net present value of these excess profits over the next five years is worth $106 billion to the BOCs, which

[56] See Oliner and Sichel, note 38, *supra*, Table 1.

[57] This is not inconsistent with certain services being restricted to below-cost levels by overly restrictive price regulations. For example, because of geographic rate averaging and systematic discrepancies between business line and residential service pricing, flat rate residential service is provided below cost in some high cost areas. However, when assessing whether a service is underwater, one must properly match revenues and costs so that incremental revenues from ancillary services such as vertical features or toll calling are not neglected.

provides a potent incentive to act aggressively to deter the emergence of competition that would threaten those monopoly profits.

With the emergence of effective competition, prices would be driven towards costs—a process that could result in price declines of up to 41 percent. This would stimulate increased demand, investment, and output in the sector. To be conservative, we assume an overall demand elasticity of 0.1.[58] With this assumption, we estimate that the deadweight loss from this above-cost pricing is reducing consumer and total surplus by $588 million per year.[59] The net present value of this stream over five years (to make it comparable with the earlier estimates) is $2.2 billion.[60] Therefore, the excess pricing by the BOCs is costing consumers over $108 billion in lost consumer surplus over the next five years (in present value terms).

Moreover, the expansion in consumer and total surplus associated with the elimination in monopoly profits is conservative because it excludes any adjustment to account for increased productivity, lower costs, or improved service quality—which are likely to contribute to increased telecommunications sector and GDP growth.

[58] There is a wide range of estimates in the empirical literature on the elasticity of different telecommunication services. Generally, local services, and especially basic subscriber line service is thought to have a low price elasticity of demand – on the order of 0.1 or less, whereas usage-sensitive toll services are estimated to be much more elastic – on the order of 0.7 or higher. Demand for value-added services such as vertical calling features (call waiting, voice mail, or three-way calling) are thought to be elastic. For further discussion, see Taylor, L., *Telecommunications Demand in Theory and Practice*, Kluwer Academic Publishers: Boston, 1994.

[59] Assuming linear demand, initial switched revenue of $70 billion (=PQ), and an elasticity (ε) of 0.1, the deadweight loss from excess pricing is approximately $(1/2)\varepsilon(\Delta P/P)^2(PQ)=(1/2)(0.1)(0.41)^2(70)=\$0.588$ billion.

[60] This is computed as the present value of a five-year annuity paying $588 million per year with an interest rate of 11.25 percent, the approved rate of return for the BOCs, to maintain consistency with earlier estimates.

Unfortunately, there is no easy way to estimate these additional benefits that could be expected to be foregone if effective CLEC competition is eliminated.

V. Conclusions

A competitive telecommunications sector is critical to the health and continued

growth of the U.S. economy. There cannot be a competitive industry without competitors to challenge the *de facto* monopoly power of the ILECs, incumbent local exchange carriers, namely the BOCs. The Telecommunications Act of 1996 created a regulatory framework to promote effective local competition and gave birth to the CLEC industry. Now, that industry is in severe trouble, jeopardy that has been exacerbated by the Tauzin-Dingell bill, which would prematurely relax regulatory constraints on the ILECs. In an earlier paper, we estimated that the market capitalization of CLECs fell from March 2000 to May 2001 by 84 percent with almost half of this decline occurring on days associated with positive news about the pro-ILEC legislation.

This paper provides an estimate of the negative impact on the U.S. economy and consumers because of the harm to the CLEC industry and the continued monopolization of local telecommunications markets by the ILECs. While the decline in CLEC activity has likely had a fairly small direct effect on the economy in the short term, the reduction in investment relative to a baseline with healthy CLECs is profound. We estimate conservatively that the impact of lower cumulative investment harm will be to lower GDP by $57 to $88 billion in 2006 -- put another way, GDP growth may be lower by between 0.3 to 0.7 percent in that year alone. This effect would be mitigated somewhat if the BOCs increase their investment to offset the lack of CLEC expansion. In addition, the

continued monopolization by the BOCs is likely to cost consumers over $106 billion in net present-value terms over the next five years.

Exhibit 1

Computation of Excess BOC Profits

The BOCs are currently earning $29 billion per year in excess profits, which over the next five years is worth $106 billion in present value terms

Total Switched Revenues ($ Billions)[61]	$ 70.1
Total BOC Access Lines (Millions)[62]	140.4
Switched Rev per line per month	$ 41.61
Total Platform Cost (including return)[63]	$ 17.71
Total Retail-level Costs[64]	$ 6.82
Total BOC Economic Costs	$ 24.53
Total Excess Profits per line per month	$ 17.08
Total Excess Profits per year ($ Billions)	$ 28.8
Present Value ($ Billions)[65]	$ 106

[61] Switched Revenues are for 2000 and are from FCC ARMIS 43-03 Reports, Table I, and are the sum of lines 5001, 5002, 5060, 5069, 5081, 5082, 5084, and 5100 (see http://gullfoss2.fcc.gov/cgibin/websql/prod/ccb/armis1/forms/armis.hts for source data). SNET and GTE are excluded in computations of excess profits here, so these estimates are conservative.

[62] Switched access lines are for 2000 and are from FCC ARMIS 43-08 reports, Table III, column dj.

[63] Cost of network platform is derived from the FCC's Synthesis Model for universal service, adjusted to yield total switched local network costs. This model estimates the TELRIC for providing local telephone and access services. It includes a return for invested capital and an allowance for general overhead costs (see *Fifth Report and*

Order, In
the Matter of Federal-Joint Board on Universal Service (CC-Docket No. 96-45) and Forward Looking Mechanism
for High Cost Support for Non-Rural LECs (CC-Docket No. 97-160), Before the Federal Communications Commission, October 28, 1998. The model may be obtained from the FCC's website at http://www.fcc.gov/ccb/apd/hcpm/). The adjustments to the model to include costs for providing intraLATA toll and
access services are explained in *Ex Parte Presentation by AT&T to Federal Communications Commission*, In the
Matter of Application by Verizon New England, Inc. Bell Atlantic Communications, NYNEX Long Distance
Company, and Vefizon Global Networks to Provide In-Region InterLATA Services in Massachusetts, CC Docket
No. 01-9, February 1, 2001.

64 Retail expenses are collected from RBOC year 2000 ARMIS 43-03 Reports, Table I, column i, for direct retail
accounts (6610, Marketing, and 6620, Service Support) plus retail share of overhead accounts (6120, General
Support, 6710, Executive and Planning, and 6720, General and Administrative). Latter is computed as direct retail
share of operating expenses, excluding overhead accounts, depreciation, and access expenses.

65 Present value of excess profits are calculated as a five year annuity using an annual discount of 11.25%, the
RBOCs' FCC-authorized rate of return. (See *Tenth Report and Order*, In the Matter of Federal-Joint Board on
Universal Service (CC-Docket No. 96-45) and Forward Looking Mechanism for High Cost Support for Non-Rural
LECs (CC-Docket No. 97-160), Before the Federal Communications Commission, November 2, 1999)