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In the months leading up to his inauguration, President Barack Obama, like any modern lawyer, refused to give up his Blackberry (a.k.a., his “Barackberry”), much to the chagrin of aides who stressed that Presidential e-mails were a potential legal and security risk. The problem ultimately was resolved after President Obama was given a smart phone with enhanced security features.

More than any President of recent memory, technology was a key element to President Obama’s campaign promises. The new Administration has made numerous statements about how technology will make government more transparent, and how the country’s infrastructure requires innovation to move into the new century. This emphasis is echoed by commentators and interest groups such as the Business Software Alliance,¹ which has suggested that information technology and modern advances should be the cornerstone of some of the biggest projects in the coming years, namely, education, health care, the environment and economic stimulus.

¹ “The Business Software Alliance is the voice of the world’s commercial software industry and its hardware partners before governments and in the international marketplace.” See http://www.bsa.org/GlobalHome.aspx.
This article will discuss several of the major technology-related initiatives of the new Administration, and the legal issues inherent in such proposals.

I

ELECTRONIC HEALTH RECORDS

President Obama has proposed investing $50 billion over the next five years to expand the adoption of healthcare information technologies (IT), including the wide use of electronic medical records. Echoing this promise, The American Recovery and Reinvestment Act (ARRA), the $789 billion economic stimulus bill recently passed by both houses of Congress and signed into law by President Obama, contains appropriations for healthcare IT. Moving from paper-based record keeping to a healthcare IT system may, among other things, reduce medical errors and drive down health care costs resulting from inefficiency and duplicative care. Also, it will purportedly improve public health reporting and the coordination of care and information among hospitals, laboratories, and physician offices via an effective nationwide infrastructure for the secure and authorized exchange of patient information.

However, there are numerous barriers to expanding the use of electronic medical records. First, providers may be reticent to implement healthcare IT systems because upfront costs can run between $25,000 to $45,000 per physician, with cost savings often inuring to health insurers or other entities. Some commentators have suggested that doctors need financial incentives, akin to the higher reimbursement rates given to Medicare doctors to use e-prescriptions, or targeted subsidies to offset the initial investment, similar to an existing New York City Health Department program that encourages physicians to participate in a citywide electronic health project.

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Second, healthcare IT systems must be interoperable nationwide to facilitate the seamless sharing of medical records or lab results.\(^5\) In this regard, President Obama previously stated that he wished to make the Veterans Health Administration (VHA) a model in the use of healthcare IT, and, recently, one enhanced version of the VHA’s electronic medical records software, known as VistA, was released under the open source Eclipse Public License.\(^6\)

Third, doctors and technicians will require training on any new digitized system to prevent delays and errors. Last, there are outstanding privacy issues concerning electronic medical records, including minimum data security and breach notification standards, a statutory right to consumer privacy of electronic health information (which may or may not preempt certain state privacy laws), clarification of covered entities under the Health Insurance Portability and Accountability Act of 1996 (HIPAA)\(^7\) to include additional handlers of electronic medical records, and standards for the sharing of health data.\(^8\)


II

NET NEUTRALITY AND BROADBAND EXPANSION

Proponents of “net neutrality” remain committed to an Internet where all content is given equal access, as opposed to a system that offers preferential treatment for certain data and application transmissions. Opponents, however, contend that the heightened sophistication and size of the type of files being exchanged, particularly video files, have resulted in increased costs to Internet Service Providers (ISPs) for providing the necessary bandwidth. In addition, opponents urge a “hands off” approach, contending that there is no need for regulation mandating net neutrality and other Internet governance issues because market forces, in conjunction with existing antitrust regulations, are already sufficient.

President Obama supports net neutrality regulation to bolster the basic premise that ISPs should be prohibited from privileging certain website content over others, and that new competitors should have the same opportunities to reach wider audiences online.9 Indeed, Senator Dorgan, a sponsor of a previous net neutrality bill, plans to reintroduce a revised bill granting the Federal Communications Commission (FCC) authority to police net neutrality violations, given the Obama Administration’s favorable stance on the issue.

Some commentators predict that net neutrality legislation will wait for the outcome of the FCC/Comcast dispute. In August 2008, the FCC ruled that Comcast had unduly interfered with users’ rights to Internet content and applications of their choice when it monitored customers’ usage and selectively blocked certain BitTorrent peer-to-peer Internet traffic to allegedly ease network congestion.10 The FCC stated that it had authority to enforce a “national Internet policy” and “preserve and promote the open and interconnected nature of the public Internet.” Since the ruling, Comcast announced plans to limit residential Internet usage and has appealed the order to the D.C. Circuit Court of Appeals, arguing that the FCC lacks authority to

9 See generally Barack Obama: Technology, supra note 6.

enforce its net neutrality principles without specific Congressional authority.\(^{11}\) If the appeals court upholds the FCC’s authority to enforce its net neutrality principles, then Congress and the new Administration may hold off and allow the FCC to adjudicate any violations on a case-by-case basis; if the decision is overturned, interest in net neutrality legislation may be revitalized.

However, ARRA, which provides resources for broadband and wireless broadband deployment grants, contains net neutrality language.\(^{12}\) The Act obligates recipients of the federal broadband deployment grants to operate an “open access” network and adhere to the principles contained in the FCC’s broadband policy statement.\(^{13}\)

Indeed, the new Administration has stressed the importance of expanding broadband access to underserved rural areas and upgrading existing infrastructure to offer cutting-edge service at speeds equivalent to the top broadband nations (i.e., South Korea, Japan, Finland, the Netherlands, and France). It has been reported that the U.S. ranks fifteenth worldwide in broadband adoption and that according to an analysis by the Information Technology and Innovation Foundation (ITIF). The U.S. also trails numerous other countries in price, speed and broadband availability.\(^{14}\) The Obama Administration has stated that it wants to encourage more efficient use of the wireless spectrum and advance development by, among other things, refocusing the Universal Service Fund program from one that promotes telephone communication to one that promotes affordable broadband access. Ultimately, the Obama Administration and Congress will have to decide in what proportion financial incentives for broadband will go toward expanding service into rural areas or

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upgrading existing networks to allow such high-speed services as video teleconferencing, beyond those projects for which the telecom networks have already budgeted.¹⁵

III

FOCUS ON INTELLECTUAL PROPERTY

In late 2008, Congress passed the Prioritizing Resources and Organization for Intellectual Property Act (PRO-IP),¹⁶ which, among other things, enhanced the remedies for certain copyright infringement and counterfeit goods claims and created a new position within the Executive Office of the President, namely the Intellectual Property Enforcement Coordinator, or “IP Czar.” President Obama will appoint the first IP Czar who will be responsible for, among other duties, reporting to Congress and the President about the effectiveness of the government’s domestic and international intellectual property (IP) enforcement policies, chairing a committee to coordinate interagency anti-counterfeiting efforts, and reworking any regulatory weaknesses in IP enforcement.¹⁷ Similarly, President Obama also pledged to name the country’s first Chief Technology Officer (CTO). According to Obama’s campaign website, the CTO would be charged with several duties, including directing the modernization of agency IT infrastructures, ensuring the transparency and accessibility of government records by establishing centralized electronic depositories for lobbying and campaign finance reports, and posting transcripts of agency meetings and non-emergency bills online for public comment.¹⁸


During the last session of Congress, many unsuccessful patent reform proposals were launched that touched on issues such as the quality of issued patents, the calculation of damages in patent litigation, the definition of willful infringement, and streamlined processes for patent reexamination. On President Obama’s campaign website, patent reform is listed as one of the President’s IP-related goals. Among the list of proposals, he advocates increasing the United States Patent and Trademark Office’s budget for patent examinations and opening up the examination process to a so-called “public peer review” to help weed out weaker patents that might otherwise spur litigation and discourage future innovation.

**IV PRIVACY AND DATA SECURITY**

According to a recent survey, there has been almost a fifty percent increase in reported data security breaches at businesses, government agencies and educational institutions since 2007. Companies and other entities that handle sensitive consumer information are also faced with an increasingly complicated compliance task. At least forty-four states and the District of Columbia have enacted data security breach notification laws, which require, under varying standards, that companies suffering a qualifying breach of certain consumer personal information notify affected persons. Currently, there is no national data security breach notification law, but the new Administration has expressed support for passing such legislation. Several senators have expressed a desire to reintroduce data breach notification bills that died in the last Congress, yet the scope of such a new law remains uncertain. For example, would a federal law contain a “risk of harm” trigger - that is, a provision that excuses notification for technical breaches of a system that do not reasonably seem likely to subject affected customers to a risk of criminal activity? Another open

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20 *Id.*

question is to what extent, if any, a federal law would preempt existing state notification laws.

The Obama Administration has also pledged to strengthen privacy protections for the digital age, increase funding for Federal Trade Commission (FTC) enforcement efforts, and step up efforts to discourage cybercriminals by combating spyware, phishing schemes and other Internet-related privacy hazards. Federal spyware bills have died in the last three Congresses. The outlook for passage of a new comprehensive spyware bill with notice and consent provisions and a “Good Samaritan” provision that would limit remedies against anti-spyware software developers is mixed, particularly given Congress’s recent cybercrime amendments. The cybercrime amendments, among other things, increased the capabilities of the federal government to prosecute those behind malicious spyware, enabled identity theft victims to obtain restitution for the time and money expended in clearing up their credit, and criminalized the use of malicious spyware and keylogging software that caused computer damage.

V
BEHAVIORAL ADVERTISING

Another possible privacy initiative is online behavioral advertising, an issue addressed by the FTC and the last Congress. Generally speaking, behavioral advertising is the tracking of a consumer’s online activities (e.g., search engines queried and Web pages visited and content viewed) in order to deliver advertising targeted to the individual consumer’s interest. In theory, consumers would view ads that appeal to their interests, thereby allowing companies to better reach their target markets. For social networking sites, behavioral advertising can serve as an additional revenue source. Still, some advocates have claimed that such advertising threatens individual privacy and have called for the user opt-out protections. In late 2007,


the FTC staff issued a set of proposed principles to encourage development of self-regulation for online behavioral advertising, as well as address consumer privacy concerns over personal data collected by social networking and other websites. A full report is expected sometime this year.

Behavioral advertising on the ISP level has also become an emerging issue. In 2008, NebuAd, an online advertising company, began a behavioral advertising program in conjunction with several ISPs, allegedly without the consent or knowledge of the ISPs’ users. The program ended when Congress began to make inquiries. Subsequently, during a Senate committee hearing on behavioral targeting, many leading ISPs agreed in principle to stop the practice and only engage in behavioral targeted advertising with the affirmative consent of users. While the Obama Administration has not specifically professed a position on behavioral advertising, Congress will likely monitor this issue and determine whether the industry’s self-regulatory efforts offer sufficient consumer protections, or whether a data privacy bill authorizing stronger FTC regulation of the online advertising industry is required.

In the end, the new Administration has expressed a desire to tackle other, larger privacy issues that purportedly affect the national

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27 See Brennon Slattery, Big Brother ISPs are Watching, PC WORLD, Sept. 26, 2008, available at http://blogs.pcworld.com/staffblog/archives/007805.html. See also Valentine v. NebuAd, No. 08-5113 (N.D. Cal. Nov. 10, 2008) (Putative class action complaint filed against NebuAd and several ISPs, alleging, inter alia, claims under various federal and state computer privacy laws).
economy and homeland security. For example, President Obama’s website lists several initiatives in this regard, including protecting the IT infrastructure from cybercriminals and coordinating a national cyber policy that works to shield federal agencies and private entities from attacks and data theft. Moreover, the new Administration may look to update the federal electronic privacy, computer crime, and surveillance laws, as well as examine the growing concern over the security of electronic data and computer laptops during border searches in response to the Ninth Circuit’s ruling in *United States v. Arnold*. Regarding border searches of electronic devices, a bill, H.R. 239, has been introduced in the new Congress, which would, among other things, limit border searches of digital electronic devices to those under reasonable suspicion.

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ACCELERATED WIRELESS BROADBAND INFRASTRUCTURE DEPLOYMENT: THE IMPACT ON GDP AND EMPLOYMENT

by

Alan Pearce*
Michael S. Pagano**

I INTRODUCTION

Because of current economic conditions, President Barack Obama has demonstrated that one of his Administration’s major goals is a stimulus package targeting job growth.¹ Specifically, the President’s administrative team is looking for key sectors of the economy that can, with a relatively small amount of financial stimulus, yield significant and rapid increases in economic growth and employment. The wireless broadband sector of the Telecommunications-Information-Entertainment (T-I-E) Industry can deliver both of these economic benefits over the next two years.

This paper, undertaken with the cooperation of numerous wireless service providers and those deploying broadband infrastructure, estimates that new wireless broadband investments of $17.4 billion will, within twenty four months of making this additional investment, increase gross domestic product (GDP) by 0.9% to 1.3%, which translates in dollar terms to $126.3 billion to $184.1 billion, and will

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** Dr. Pagano is an Associate Professor of Finance at Villanova University School of Business in Villanova, PA. A Chartered Financial Analyst, he holds a B.S. in Finance from Fordham University and an M.B.A. and Ph.D. in Finance from Rutgers University.

¹ This goal has been achieved by President Obama signing into law the American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (Feb. 17, 2009).
result in an increase of between 4.5 million and 6.3 million jobs. The seven-to-tenfold increase in GDP due to new investment in wireless broadband networks is achievable because of both the direct and also the indirect effects these additional capital expenditures will have on the nation’s overall economic growth.

By investing in wireless broadband access infrastructure, both jobs and income are increased, not only by the direct investment in building new wireless towers and modifying existing towers, thereby expanding existing network capacity, speed, and reliability, but also by the indirect benefits of filling coverage holes and providing wireless broadband services to more of the United States. The resulting improved wireless broadband access can create new businesses based on the availability of faster Internet connections. In addition, existing organizations can not only reap gains in efficiency, but also identify new sources of revenue, enhance health and public safety services, and help consumers search online more effectively for goods, services, jobs, and educational opportunities.

The ability to deploy wireless systems and expand wireless broadband service depends on the availability of sites for the construction and placement of towers and transmitters. However, wireless carriers face a significant problem of many zoning authorities failing to resolve wireless tower site applications within a reasonable period of time. These delays or inaction substantially impede wireless build out. The Cellular Telecommunications Industry Association (CTIA) has compiled data on cell site backlogs from members who have more than 3300 applications pending before local jurisdictions. According to members interviewed for this report, this represents a “bottleneck” that, if removed, would result in a “flood” of “shovel-ready” new construction almost immediately. For this reason, in July 2008, CTIA filed a Petition for Declaratory Ruling with the Federal Communications Commission (FCC) seeking, inter alia, a reasonable “shot clock” for local zoning authorities to act on tower site applications.²

A grant of CTIA’s tower site Petition, along with more rapid approval by the FCC of related infrastructure permissions, would eliminate a significant barrier to wireless infrastructure investment and, as described further herein, enable the realization of additional wireless broadband investments of $17.4 billion as well as further direct and indirect economic benefits. In addition, action by the Chief of the Wireless Telecommunications Bureau on delegated authority removing the backlog of pending applications that have been referred to the Commission for review pursuant to the National Environmental Policy Act (NEPA) also would help expedite the construction or the augmentation of existing facilities.

II
OVERVIEW:
WIRELESS BROADBAND INDUSTRY, GDP, AND JOBS

Substantial economic benefits associated with greater investment in wireless broadband infrastructure can be generated not only by the direct economic effect of increased capital spending, but also from the indirect “follow-on” effects associated with the initial investment. This “indirect” effect is similar to building a roadway, which not only generates jobs and income for the builders of the road, but also provides opportunities for others to create new businesses and homes along the roadway.

Using conservative estimates, along with recently published empirical estimates of the positive impact of broadband access, this research describes the positive direct effects that will flow from facilitating immediate investment in wireless broadband infrastructure by expediting the approval process for towers and cell sites and outlines even stronger indirect effects caused by the types of benefits noted above. Table 1 provides highlights of the direct, indirect, and total effects on GDP and employment based on low and moderate levels of investment multipliers over the twenty four months following the beginning of construction.
Table 1: Economic Impact on GDP and Employment of Additional Wireless Capital Expenditures.

<table>
<thead>
<tr>
<th></th>
<th>6 mos.</th>
<th>12 mos.</th>
<th>24 mos.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct Effects on GDP</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required Incremental Investment in Wireless Broadband Infrastructure</td>
<td>$4.4 bil.</td>
<td>$8.7 bil.</td>
<td>$17.4 bil.</td>
</tr>
<tr>
<td>Cumulative Change with Low Multiplier Effect</td>
<td>0.06%</td>
<td>0.11%</td>
<td>0.23%</td>
</tr>
<tr>
<td>Cumulative Change with Moderate Multiplier Effect</td>
<td>0.07%</td>
<td>0.15%</td>
<td>0.30%</td>
</tr>
<tr>
<td><strong>Indirect Effects on GDP</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Estimate of Cumulative Change</td>
<td>0.21%</td>
<td>0.43%</td>
<td>0.65%</td>
</tr>
<tr>
<td>Moderate Estimate of Cumulative Change</td>
<td>0.32%</td>
<td>0.65%</td>
<td>0.98%</td>
</tr>
<tr>
<td><strong>Total Effects on GDP</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Estimate of Cumulative Change</td>
<td>0.27%</td>
<td>0.54%</td>
<td>0.88%</td>
</tr>
<tr>
<td>Moderate Estimate of Cumulative Change</td>
<td>0.40%</td>
<td>0.80%</td>
<td>1.28%</td>
</tr>
<tr>
<td>Low Estimate of $ Change in GDP</td>
<td>$39.3 bil.</td>
<td>$78.6 bil.</td>
<td>$126.3 bil.</td>
</tr>
<tr>
<td>Moderate Estimate of $ Change in GDP</td>
<td>$57.6 bil.</td>
<td>$115.3 bil.</td>
<td>$184.1 bil.</td>
</tr>
<tr>
<td><strong>Effects on Total Employment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Estimate of Growth in Employment</td>
<td>0.83%</td>
<td>1.65%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Moderate Estimate of Growth in Employment</td>
<td>1.15%</td>
<td>2.3%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Low Estimate of Change in the Number of People Employed</td>
<td>1.1 mil.</td>
<td>2.3 mil.</td>
<td>4.5 mil.</td>
</tr>
<tr>
<td>Moderate Estimate of Change in the Number of People Employed</td>
<td>1.6 mil.</td>
<td>3.2 mil.</td>
<td>6.3 mil.</td>
</tr>
</tbody>
</table>
The seven-to-tenfold increase in GDP, compared to the initial incremental investment of $17.4 billion in wireless broadband networks, is created by the macro-economic “multiplier effect,” popularized by John Maynard Keynes. Income and employment generation are defined and explained in terms of how a $17.4 billion investment in infrastructure causes a substantially greater increase in an economy’s output through both “direct” and “indirect” effects on the economy. The direct effect on GDP is caused by the increased jobs and income associated with constructing new cell towers and expanding the capacity, reliability, and availability of existing wireless networks, giving even more Americans access to new applications and services to the nation as a whole. As noted in Table 1 above, the direct benefits are substantial and will increase GDP cumulatively between 0.23% and 0.3% over a two-year period.

In addition to the direct effects, Table 1 outlines even larger cumulative gains of 0.65% to 0.98% in GDP from indirect effects, such as increased revenues and lower costs for businesses, as well as greater online capabilities for consumers, for example, job searches, working from home, education via online distance learning services, healthcare and public safety, etc. These indirect benefits are the by-product of what economists call “positive externalities,” which indicate that society as a whole benefits from a nationwide wireless broadband network.

Recent research by Dr. Harold Furchtgott-Roth includes data from sources also used in this research and documents the many positive contributions made by the wireless services sector to society at large, concluding that “the wireless services industry is a large and growing segment of the American economy; and wireless services are the hub of the wheel of a much larger set of industries that contribute to American economic growth.” These findings are similar in spirit to those Pearce reported related to the potential positive impact that an

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nationwide emergency communications network can have in terms of greater public safety and homeland security.

Economists have studied the major benefits of network upgrades and the consequent positive externalities. Most recently, Yukihiro Kidokoro developed a theoretical model of how competing providers of Internet access can generate positive externalities by offering faster access speeds. In this model, the positive externalities of the network are derived from greater “information variety” that can be created due to faster Internet access. Thus, the model captures some of the key aspects of how wireless broadband Internet access can spawn new businesses, more effective shopping and delivery services, new work environments such as telecommuting, increased educational opportunities via distance learning, etc., that benefit all areas of society. In addition, the model demonstrates how competition between numerous Internet access providers can lead to faster access speeds relative to a situation where a monopolist controls the entire market.

A. Positive Externalities

A study for CTIA by Roger Entner provides data on annual capital expenditures of the wireless sector. The Entner report projects $860 billion in nationwide cost savings and additional revenue during the period from 2005 to 2016, the benefits of increased wireless broadband usage will have, and will continue to have, from productivity gains, primarily in the following areas:

- Improved management of inventory and other business resources
- Efficiency gains in delivering health care services
- Automating field service and fleet management

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6 Yukihiro Kidokoro, A Model of Internet Access When Internet Connection Speed is Upgradable, 19 INFO. ECON. & POL’Y 80 (2007).

7 Id.

• Reduced inventory losses due to more timely and accurate information
• Increased efficiency and automation of sales force activities
• Cost savings related to replacing office-based land lines with wireless communication devices

Using the Entner report,\(^{11}\) along with the Furchtgott-Roth data,\(^{12}\) as starting points, it is possible to see the value creation stemming from positive externalities when increased wireless broadband access is deployed. Some of these positive externalities are presented below:

• Increased opportunities for retailing and delivery services due to greater online shopping (particularly in rural areas where the quantity and variety of stores might be limited).
• More people may be likely to telecommute, thus alleviating traffic congestion, reducing pollution, and reducing gasoline consumption.
• Greater educational opportunities via increased enrollment in online distance-learning programs (via traditional colleges or adult-oriented schools, such as the University of Phoenix).
• Better matching of employee skills with employer needs via online job search services, such as Monster.com.
• Improved public safety through faster communication of emergencies to the public and via more effective monitoring of water pipes, natural gas pipelines, etc.
• Introduction of new telemetry-based business solutions such as point-of-sale applications, “white van” tracking services, remote monitoring of business processes and systems.
• More effective management of financial resources due to increased usage of electronic banking services such as online bill payment systems, online searches for low-cost loans and credit cards.
• In rural areas, online (and real-time) weather monitoring and farming information can provide timely and more in-depth information that can lead to increased crop yields and more efficient farms/ranches.

\(^{11}\) \textit{Id.}

\(^{12}\) Furchtgott-Roth, \textit{supra} note 4.
There are also numerous online business success stories related to how increased Internet usage spawned new businesses, for example, Amazon.com and online educational service companies such as The Apollo Group, which operates the University of Phoenix:

- Amazon.com (AMZN) has risen more than thirty-fold from May 1997 until December 2008. This translates into a Cumulative Average Growth Rate (CAGR) of 36.3%.
- Apollo Group (APOL) has risen more than sixty four-fold from January 1995 until December 2008. This translates into a CAGR of 34.7%.

### III PRIOR RESEARCH

While there have been numerous empirical studies of the economic impact of information technology (IT) and telecommunications spending, much less research has been conducted on broadband access to IT innovations such as the Internet. For example: Roller and Waverman\(^\text{13}\) and Waverman, Meschi, and Fuss\(^\text{14}\) find that greater investment in telecommunications infrastructure can yield a 0.59 percentage point increase in GDP growth across developed countries and also developing nations. In addition, Jorgenson\(^\text{15}\) examines how IT spending has enhanced economic growth and the overall quality of life, with a primary focus on how these investments have lowered the cost of capital and production costs, as well as increased productivity. Based on a survey of 2065 U.S. firms, Varian, Litan, Elder, and Shutter\(^\text{16}\) focus on the impact of investments in Internet business

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\(^{16}\) **HAL VARIAN, ROBERT E. LITAN, ANDREW ELDER & JAY SHUTTER, THE NET IMPACT STUDY: THE PROJECTED ECONOMIC BENEFITS OF THE INTERNET IN THE**
solutions and find that businesses expect to reap cost savings and increased revenue of over $450 billion during 2001-2010. This translates into an annual gain in productivity of 0.43 percentage points.

In sum, although these studies do not directly examine the effects of broadband access, they do confirm and support the hypothesis that increased IT and telecommunications spending has had a significant and positive impact on economies around the world.

In addition to the above studies, empirical research on the specific impact of broadband Internet access has begun to appear in the literature. An early paper by Crandall and Jackson\(^{17}\) estimated annual benefits of up to $500 billion (in terms of GDP) that would accrue to consumers and businesses because of increased access to broadband Internet services. More recently, the U.S. Department of Commerce\(^ {18}\) commissioned a study of the effect that broadband deployment will have on employment, salaries, new business formation, and other macroeconomic variables. Using data at the zip code level and regression analysis, the authors found a statistically and economically significant cumulative gain of 1.0 to 1.4 percent in the growth of jobs during 1998-2002. This translates into an annualized increase of 0.33 to 0.46 percentage points in employment due to greater broadband access.

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Crandall, Litan, and Lehr\textsuperscript{19} also use regression analysis to examine the effect that the proliferation of broadband has on the growth in employment and GDP at the state level (analyzed across forty eight states). They find that the marginal effect of wider broadband access on employment can result in a 0.22 to 0.30 percentage point increase in annual job growth. Thus, a three percentage point increase in the rate of broadband penetration could yield an additional 880,000 jobs. More recently, a study commissioned by the Sacramento Regional Research Institute (SRRI) studied the impact of broadband access at the county level by using data from thirty nine counties in California.\textsuperscript{20} The SRRI authors employ a methodology similar to the one used by the Department of Commerce\textsuperscript{21} and Crandall, Litan, and Lehr\textsuperscript{22} and find results that are consistent with these other studies. For example, the SRRI report indicates that there are annualized employment gains of 0.10 to 0.29 percentage points, which could translate into 1.8 million new jobs and $132 billion of additional payroll income in California during 2005-2015.\textsuperscript{23}

Overall, the studies have demonstrated that increased broadband access can lead to statistically significant and economically meaningful positive effects on economic activity. Although Internet access has been around since the 1990s, the benefits of the Internet have become much stronger during the current decade due to greater access to broadband-based Internet service. As Crandall, Litan, and Lehr observed:


\textsuperscript{21} Gillett, supra note 18.

\textsuperscript{22} Crandall et al., supra note 19.

\textsuperscript{23} Van Gaasbeck et al., supra note 20, at 30.
Broadband services offering at least an order of magnitude improvement over dial-up data rates and always-on connectivity were needed for the Internet to realize its true potential and to make it feasible to better realize the potential of embedded ICT [information communications technology] investments. The emergence of ICT-powered enhanced healthcare, telecommuting, and realization of economic growth benefits in communities in rural areas (the “death of distance”) depend on the widespread deployment of broadband services.\(^{24}\)

To date, the research not only provides a better understanding of the economic impact of broadband access, it also enables us to quantify a forward-looking economic growth estimate which combines the direct “multiplier” effects of additional wireless capital expenditures with the indirect “externality” effects based on all the benefits noted above that follow from an expansion of wireless broadband services.

IV
EMPIRICAL METHODS USED

In order to compute the direct and indirect effects of wireless broadband investment on economic activity, we used multiple empirical methods. Although alternative methods are used to estimate the investment multiplier, as well as the benefits of the positive externalities derived from wireless broadband, and the related impact on job growth, all of these empirical techniques provide a consistent picture of how broadband access can help stimulate economic output and employment.

A. Estimating the Direct Effect of Wireless Broadband Capital Expenditures on GDP

To estimate the “direct” effect of wireless broadband spending on GDP, two important inputs are needed: 1) a forecast of increased wireless broadband capital expenditures; and 2) an appropriate investment multiplier.

\(^{24}\) Crandall et al., supra note 19, at 6.
The first step is to forecast capital expenditures. To do this, we obtained the Personal Communications Industry Association’s (PCIA) current forecasts of increased spending on cell towers, existing sites, and other wireless facilities, if tower siting approval mechanisms and time periods were given greater regulatory clarity and certainty. Item 1 in Table 2 provides details of the PCIA forecasts of $11.5 billion in new wireless investments, if regulatory relief is provided by the FCC as requested in CTIA’s Petition for Declaratory Ruling.

Due in large part to current economic conditions, wireless service providers are cutting back, as opposed to increasing, capital expenditures. According to UBS, publicly traded national wireless carriers are expected to decrease their collective capital spending in 2009 by twenty one percent from 2006 levels. In addition, the U.S. Census Bureau’s data on Annual Capital Expenditures (which covers both public and private wireless companies) has shown large cyclical swings that coincide with overall macroeconomic conditions. However, wireless broadband infrastructure spending could be accelerated under the Administration’s broadband stimulus program.

Figure 1 illustrates the historical trends in the U.S. Census and the UBS research capital expenditure data. During the last economic downturn, wireless investments dropped nearly eighteen percent from 2000 to 2003 and, as noted, UBS is projecting a twenty one percent decline in wireless capital expenditures by the publicly traded


26 Petition for Declaratory Ruling, supra note 2.


29 Id.

30 UBS, supra note 27.
nationwide wireless providers from 2006 to 2009. This information can help quantify the magnitude of “countercyclical stimulus” that would be needed to offset the wireless companies’ projected cutbacks in investment spending during 2009. For example, we estimate that a total of $5.88 billion is required to completely offset these cutbacks in capital spending. This figure is obtained by multiplying the expected twenty one percent drop in spending by the 2006 industry-wide capital expenditures of $28 billion (see Item 2 of Table 2 for more details on this calculation).

Given the PCIA figures and our internal forecasts of wireless broadband spending, we simply sum these two forecasts to obtain an estimate of $17.4 billion for the total incremental wireless broadband capital expenditures. As can be seen in Item 3 of Table 2, this figure is the sum of lines (A) and (B), which represent the PCIA’s and our internal spending forecasts, respectively. These capital investments are then assumed to be spent evenly over the next two years.

To assess the full impact of this $17.4 billion of wireless broadband investment, a Keynesian multiplier is needed to quantify the ripple effects of greater investment on the spending behavior of other firms that provide goods and services to the wireless broadband sector. Thus, we use two different multipliers in order to provide a range of possible values for the direct effect of additional wireless capital expenditures. For example, the “Low” multiplier of 1.91 is based on the Bureau of Economic Analysis (BEA) investment multiplier for the Communication, Transportation, and Utilities Industries.\(^\text{31}\) In addition, a “Moderate” multiplier of 2.49 is based on the BEA’s investment multiplier for regional construction. This alternative multiplier was employed because one can view the direct investment in building wireless cell towers and other infrastructure as a set of regional construction projects.

Once forecasts of wireless capital expenditures and appropriate investment multipliers have been obtained, an estimate can be made regarding how GDP will be affected by this increased direct

investment by multiplying the total incremental wireless broadband capital expenditures by the investment multipliers. Item 4 in Table 2 provides the details for these calculations, and shows that the total direct effect of wireless broadband spending is expected to be between $33.2 and $43.2 billion.

**B. Estimating the Indirect Effect on GDP of Wireless Broadband Capital Expenditures**

To estimate the “indirect” effects associated with all the other economic benefits derived from greater productivity, increased revenue opportunities, a wider variety and easier accessibility of goods and services, improved information, etc., we rely upon previous studies of Internet and broadband usage. In particular, we use the annual productivity gains of 0.43% of GDP estimated in Varian, et al., and the 0.65% annual productivity enhancements found in Entner to provide “Low” and “Moderate” estimates of the indirect effects of additional wireless broadband spending on GDP.

These annual figures are then compounded over the six through twenty four month forecast period to come up with cumulative gains in GDP that would be attributable to indirect benefits of the additional $17.4 billion in wireless broadband investments. Item 5 in Table 2 explains the calculations of these indirect benefits.

**C. Estimating the Total Effect on GDP of Wireless Broadband Capital Expenditures**

As shown in Item 6 of Table 2, the “total” effect of the projected increase in wireless broadband spending is a simple sum of the direct and indirect effects on GDP (and employment).

**D. Estimating the Impact of Additional Wireless Broadband Capital Expenditures on Total Employment**

In order to examine the wireless impact of broadband spending on employment, we rely upon the multivariate regression approach that

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32 **VARIAN, supra** note 16.

33 **ENTNER, supra** note 6.
has been used by the U.S. Department of Commerce, along with authors Crandall, et al., and the SRRI authors. All three of these studies use regression analysis in order to estimate the impact of broadband usage on various economic factors, including employment, personal income, business formation, GDP, etc.

To demonstrate how this regression approach works, we present below a brief description of the model used in the SRRI report to identify the effects of broadband usage on employment, wages and salaries, and business formation. The estimate of the parameter in the following ordinary least squares (OLS) regression equation is equal to the average growth rate for each individual county in California during 2001-2006.

$$g_{i,t} = \alpha_i + \delta_t + X_{i,t} \beta + \gamma BB_{i,t} + e_{i,t}$$

This regression model indicates that the quarterly growth rate of employment in a particular county and during a specific quarter, ($g_{i,t}$), is a function of the county’s average growth rate, ($\alpha_i$), a “dummy” variable to control for trends over time ($\delta_t$), other “control” variables such as personal income levels ($X_{i,t}$), and the effect of broadband “penetration” ($BB_{i,t}$), (as measured by the parameter labeled, $\gamma$, or “gamma”). This gamma ($\gamma$) parameter measures the marginal effect of the penetration of broadband on job growth (holding constant all other factors in the model). Thus the main area of interest in the Department of Commerce, Crandall et al., and SRRI studies is the statistical and economic significance of gamma ($\gamma$). All three studies report significant positive estimates for gamma, ranging from 0.1% to 0.5% on an annualized basis. They also suggest that a ten percent increase

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34 GILLET ET AL., supra note 18.
35 Crandall et al., supra note 19.
36 VAN GAASBECK ET AL., supra note 20.
37 GILLET ET AL., supra note 18.
38 Crandall et al., supra note 19.
39 VAN GAASBECK ET AL., supra note 20.
in nationwide broadband access can lead to a 1 to 5 percent increase in employment.

In sum, these empirical analyses provide strong evidence that greater broadband access leads faster job growth.

To obtain “Low” and “Moderate” estimates of the impact of broadband access on employment, we used the Commerce Department’s annualized estimates for gamma of 0.33% and 0.46%. The Commerce Department’s parameters were chosen because they were based on an extensive database that segmented the nation’s level of broadband access at the zip code level, thus yielding over 22,000 data points. These gamma estimates are then multiplied by Entner’s forecast of increased broadband access of five percentage points per year during 2009-2010 to produce the expected impact on job growth during this two-year period. We assume that this increased penetration rate of broadband access will occur evenly over the forecast period. Item 7 of Table 3 provides the details on these estimates.

V

EMPIRICAL RESULTS

Table 3 provides the estimated effects on GDP and employment due to increased spending on wireless broadband infrastructure. As described in the previous section’s discussion of Table 2, the information displayed in Table 3 begins with estimates of the direct effects on GDP of increased wireless spending over a twenty-four month period and then reports the indirect and total effects in subsequent rows. The final section of Table 3 provides estimates of the impact on employment due to increased wireless capital expenditures.

As noted in the Introduction, and summarized in Table 1, a $17.4 billion investment in increased wireless broadband infrastructure can have a large and relatively rapid positive influence on the nation’s levels of GDP and employment. For example, additional wireless broadband investments can increase GDP by 0.88% to 1.28% (a gain of $126.3 billion to $184.1 billion in dollar terms) within two years of the additional investment. In turn, this investment will also create 4.5

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40 Entner, supra note 6.
million and 6.3 million additional jobs over the two-year forecast period 2009-2010. The data thus add to the overview of the wireless sector concisely outlined in the Furchtgott-Roth report.41

This seven-to-tenfold increase in GDP (when compared to the initial incremental investment of $17.4 billion in wireless broadband networks) is achievable because of the direct and indirect effects of these additional capital expenditures. Table 3 shows that the direct effects of increased wireless spending can raise GDP between 0.23 and 0.30 percentage points over a two-year period. In addition, Table 3 reports an even bigger gain in GDP of between 0.65 and 0.98 percentage points because of all the positive indirect effects associated with making wireless broadband service more widely available.

Overall, the results suggest that additional investment in wireless broadband infrastructure can yield significant and economically meaningful gains in GDP and employment.

VI
CONCLUSIONS

Broadband wireless brings both bandwidth and speed, which translate into value, economic growth, and job opportunities. An economic goal of the Obama Administration should be to bring high speed wireless broadband services to all Americans using as a model the deployment of the public switched telecommunications network (PSTN), which provided ubiquitous, low cost services to all, and the Interstate Highway System, both of which brought enormous economic and employment benefits to the U.S. In order to accelerate the much-needed economic stimulus, the new Administration should remove economic and regulatory bottlenecks in order to simulate investment in “shovel-ready” new infrastructure. A first step in relieving a critical regulatory bottleneck would be FCC action granting the CTIA Petition for Declaratory Ruling42 that requests a reasonable “shot clock” for local zoning authorities to act on wireless industry tower siting applications. Action on pending applications that have

41 Furchtgott-Roth, supra note 4.

42 Petition for Declaratory Ruling, supra note 2.
been referred to the FCC because of NEPA review would also help expedite the construction and/or augmentation of existing facilities.

The broadband stimulus grants 43 naturally will have a major impact on growth. Additionally, the Administration can assist in the construction of infrastructure and the more rapid deployment of broadband services throughout the nation by encouraging the FCC to take action with respect to the bottleneck in cell site approvals. Rapid deployment of wireless broadband services will provide an immediate economic stimulus to a wide array of business, governmental, educational, social and entertainment, healthcare, and law enforcement and public safety activities. This build-out will also contribute to growth in jobs and incomes while also assisting in the country’s much needed economic recovery during the next two years. Additional wireless broadband investment in infrastructure will contribute to the creation of between 4.5 million and 6.3 million jobs over the next two years. Jobs and income benefits will accrue to the U.S. economy as a whole because improved wireless broadband will stimulate new business activity due to the availability of faster and more robust Internet connections. Existing business and other organizations will reap gains in efficiency, and will identify new sources of revenue; public safety and health care can be enhanced and brought to more Americans; educational opportunities will be more easily available; work from home will be enabled thus aiding energy conservation; and vital infrastructures will be protected by broadband wireless-dependent early warning and sensing equipment.

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43 American Recovery and Reinvestment Act, supra note 1 § 6001.
Table 2: Key Assumptions Related to the Economic Impact Estimates

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New Cell Tower Construction</td>
<td>0.488</td>
</tr>
<tr>
<td>New Investment in Collocated / Existing Towers</td>
<td>5.250</td>
</tr>
<tr>
<td>Capital Investments in Wireless Facilities</td>
<td>5.738</td>
</tr>
<tr>
<td><strong>Line (A): Total New Wireless Broadband Investments</strong></td>
<td><strong>11.476</strong></td>
</tr>
<tr>
<td><strong>This amount is then divided evenly over the 24 mos.</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Capex for Nationwide Wireless Companies (2006-2009)</td>
<td>-21.0%</td>
</tr>
<tr>
<td><strong>Line (B): Capex Decline due to UBS' Projected Cutbacks ($ bil.)</strong></td>
<td><strong>5.880</strong></td>
</tr>
<tr>
<td><strong>This amount is then divided evenly over the 24 mos.</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Total Incremental Wireless Broadband Capital Expenditures:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Line (C): equals the Sum of Lines (A) and (B) ($ bil.)</strong></td>
<td><strong>17.356</strong></td>
</tr>
<tr>
<td><strong>This amount is then divided evenly over the 24 mos.</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Investment Multiplier for Direct Effects of Wireless Capex on GDP:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BEA (1999) Multiplier for Communication, Transportation, &amp; Utilities</td>
<td>1.91</td>
</tr>
<tr>
<td><strong>Total Direct Effect on GDP of Capex based on Low Multiplier</strong></td>
<td><strong>33.150</strong></td>
</tr>
<tr>
<td><strong>This amount is then divided evenly over the 24 mos.</strong></td>
<td></td>
</tr>
<tr>
<td>BEA (2003) Multiplier for Regional Construction</td>
<td>2.49</td>
</tr>
<tr>
<td><strong>Total Direct Effect on GDP of Capex based on Moderate Multiplier</strong></td>
<td><strong>43.216</strong></td>
</tr>
<tr>
<td><strong>This amount is then divided evenly over the 24 mos.</strong></td>
<td></td>
</tr>
<tr>
<td>Sensitivity of Employment Growth to Broadband Penetration Rate</td>
<td>0.0033</td>
</tr>
<tr>
<td>Est. Annual Increase in Broadband Penetration Rate (Ovum, 2008)</td>
<td>5.0%</td>
</tr>
<tr>
<td><strong>6 mos.</strong></td>
<td><strong>12 mos.</strong></td>
</tr>
<tr>
<td><strong>24 mos.</strong></td>
<td></td>
</tr>
<tr>
<td>Low Estimate of Effect on % Growth in Total Employment</td>
<td>0.83%</td>
</tr>
<tr>
<td><strong>1.65%</strong></td>
<td><strong>3.30%</strong></td>
</tr>
</tbody>
</table>
**Sensitivity of Employment Growth to Broadband Penetration Rate** 0.0046

<table>
<thead>
<tr>
<th>Est. Annual Increase in Broadband Penetration Rate (Ovum, 2008)</th>
<th>5.0%</th>
<th>6 mos.</th>
<th>12 mos.</th>
<th>24 mos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate Estimate of Effect on % Growth in Total Employment</td>
<td>1.15%</td>
<td>2.30%</td>
<td>4.60%</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The Estimated Growth in the Number of People Employed for the above estimates are computed by multiplying the above percentages by the 2008 Q3 Labor Force of 137.331 mil. workers.

### 5. Indirect Effects of Wireless Capex on GDP caused by Positive Externalities:

<table>
<thead>
<tr>
<th>Sensitivity of Employment Growth to Broadband Penetration Rate</th>
<th>0.0046</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Estimate of Annualized % Chg. in GDP (Varian et al. est.)</td>
<td>0.43%</td>
</tr>
<tr>
<td>Moderate Estimate of Annualized % Chg. in GDP (Ovum estimate)</td>
<td>0.65%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6 mos.</th>
<th>12 mos.</th>
<th>24 mos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.21%</td>
<td>0.43%</td>
<td>0.65%</td>
</tr>
<tr>
<td>0.32%</td>
<td>0.65%</td>
<td>0.98%</td>
</tr>
</tbody>
</table>

**Note:** The Estimated Dollar Chg. In GDP for the above estimates are computed by multiplying the above percentages by 2008 Q3 GDP of $14,420.5 bil.
## Table 3: Estimated Effects on Nominal GDP and Total Employment due to Increased Wireless Broadband Investment*

<table>
<thead>
<tr>
<th>Direct Effects on GDP of Wireless Capex (in $ bil. or %)</th>
<th>Source</th>
<th>6 mos.</th>
<th>12 mos.</th>
<th>24 mos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative Additional Wireless Broadband Capital Expenditures</td>
<td>PCIA (2008)</td>
<td>$2,869</td>
<td>$5,738</td>
<td>$11,476</td>
</tr>
<tr>
<td>Wireless Capex to offset Business Cycle downturn</td>
<td>UBS (2008), IAE</td>
<td>$1,470</td>
<td>$2,940</td>
<td>$5,880</td>
</tr>
<tr>
<td>Total Incremental Wireless Broadband Capital Expenditures</td>
<td></td>
<td>$4,339</td>
<td>$8,678</td>
<td>$17,356</td>
</tr>
<tr>
<td>Cumulative $ Chg. In GDP with Low Multiplier Effect (1.91x)</td>
<td>BEA (1999)</td>
<td>$8,287</td>
<td>$16,575</td>
<td>$33,150</td>
</tr>
<tr>
<td>Cumulative $ Chg. In GDP with Moderate Multiplier Effect (2.49x)</td>
<td>BEA (2003)</td>
<td>$10,804</td>
<td>$21,608</td>
<td>$43,216</td>
</tr>
<tr>
<td>Cum. % Chg. In GDP with Low Multiplier Effect</td>
<td></td>
<td>0.06%</td>
<td>0.11%</td>
<td>0.23%</td>
</tr>
<tr>
<td>Cum. % Chg. In GDP with Moderate Multiplier Effect</td>
<td></td>
<td>0.07%</td>
<td>0.15%</td>
<td>0.30%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indirect Effects on GDP of Increased Broadband Usage due to Additional Wireless Capex</th>
<th>Source</th>
<th>6 mos.</th>
<th>12 mos.</th>
<th>24 mos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Estimate of $ Impact on nominal GDP (0.43% per year)</td>
<td>Varian et al. (2002)</td>
<td>$30,971</td>
<td>$62,008</td>
<td>$93,112</td>
</tr>
<tr>
<td>Moderate Estimate of $ Impact on nominal GDP (0.65% per year)</td>
<td>Ovum (2008)</td>
<td>$46,791</td>
<td>$93,733</td>
<td>$140,828</td>
</tr>
<tr>
<td>Low Estimate of Cum. % Chg. in nominal GDP</td>
<td></td>
<td>0.21%</td>
<td>0.43%</td>
<td>0.65%</td>
</tr>
<tr>
<td>Moderate Estimate of Cum. % Chg. in nominal GDP</td>
<td></td>
<td>0.32%</td>
<td>0.65%</td>
<td>0.98%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Effects on GDP of Increased Broadband Usage due to Additional Wireless Capex</th>
<th>6 mos.</th>
<th>12 mos.</th>
<th>24 mos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Estimate of $ Impact on nominal GDP</td>
<td></td>
<td>$39,258</td>
<td>$78,583</td>
</tr>
<tr>
<td>Moderate Estimate of $ Impact on nominal GDP</td>
<td></td>
<td>$57,595</td>
<td>$115,341</td>
</tr>
<tr>
<td>Low Estimate of Cum. % Chg. in nominal GDP</td>
<td></td>
<td>0.27%</td>
<td>0.54%</td>
</tr>
<tr>
<td>Moderate Estimate of Cum. % Chg. in nominal GDP</td>
<td>0.40%</td>
<td>0.80%</td>
<td>1.28%</td>
</tr>
<tr>
<td>---</td>
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</tr>
</tbody>
</table>

**Impact of Additional Wireless Capex on Total U.S. Employment (in mil. of jobs or %)**

<table>
<thead>
<tr>
<th>Source</th>
<th>6 mos.</th>
<th>12 mos.</th>
<th>24 mos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Estimate of Effect on % Growth in Total Employment</td>
<td>U.S. Commerce (2006)</td>
<td>0.83%</td>
<td>1.65%</td>
</tr>
<tr>
<td>Moderate Estimate of Effect on % Growth in Total Employment</td>
<td>U.S. Commerce (2006)</td>
<td>1.15%</td>
<td>2.30%</td>
</tr>
<tr>
<td>Low Estimate of Change in the Number of People Employed</td>
<td></td>
<td>1.133</td>
<td>2.266</td>
</tr>
<tr>
<td>Moderate Estimate of Change in the Number of People Employed</td>
<td></td>
<td>1.579</td>
<td>3.159</td>
</tr>
</tbody>
</table>

* Changes in GDP and Employment are based on 2008 Q3 data: $14,420.5 bil. and 137.331 mil., respectively.
Figure 1: Annual Capital Expenditures by Wireless Service Providers.

Sources: UBS Wireless Industry report (supra note 27), U.S. Census data (supra note 28).
TELECOMMUNICATIONS IN A DEARTH OF CAPITAL:
A CHANGED PARADIGM THAT REQUIRES A NEW WAY OF THINKING

by

Jennifer A. Manner*

Just a few years ago capital for the construction and operation of telecommunications facilities was readily available to new and long-established entities for both traditional services and expansion into new and innovative telecommunications services offered to consumers. While investments in new infrastructure were not always successful or profitable in their ventures, entities were generally able to raise sufficient capital in the markets to adequately fund their efforts when they had sound business cases. This meant that regulators and policy makers in the telecommunications area had greater confidence that a hands-off approach or an approach of service and facilities enablement would result in their policy goals generally being reached.1 Of course, not being naïve, policymakers also had a keen recognition that the market would not always fund everything that policy makers wanted to achieve. In those cases, these regulators and market-based policymakers would swerve from their traditional hands-off course of conduct and establish mandates, such as providing emergency communications services or other public interest services.2

* Ms. Manner is Vice President of Regulatory Affairs, Skyterra Communications, L.P.; Adjunct Professor, Georgetown University Law Center and American University’s Washington College of Law. Ms. Manner holds a B.A. from SUNY Albany, J.D. from New York Law School, cum laude, and LL.M. in International Law, from Georgetown University Law Center. The views expressed in this article are solely those of the author and do not reflect any of her employers.


With the recent severe economic down-turn and the arrival of a new Administration in Washington, D.C., many telecommunications industry observers and participants are becoming aware that the hands-off, market-based policies that have governed telecommunications may need to be re-evaluated – for example through the broadband stimulus grant program.\(^3\) This article examines why market-based regulation still is relevant, even in today’s capital-starved telecommunications markets. what actions policymakers are taking to ensure continued funding for critical communications services and associated job creation, and what these policy makers should do to ensure that such actions do not result in a distortion of the competitive telecommunications market, which in the past has resulted in substantial consumer benefits.

I

WHY MARKET-BASED REGULATION STILL MAKES SENSE

Any long-term participant in the telecommunications industry will remember the days of heavy-handed regulation in the telecommunications sector. In hindsight, such regulation spurred innovation, as well as reduced rates, and where regulation fell short, competition has stepped in to cure many of the ills that regulation was aimed at correcting. However, it is important to remember the old days of a heavily regulated telecommunications marketplace where there was limited customer choice, expensive rates and where innovation was limited, especially since that type of market continues to exist in certain countries around the world and certain policy choices that are being made in the United States today may require revisiting the imposition of some of these type of regulations.

In the early years of telecommunications, many markets were dominated by a single telecommunications provider.\(^4\) While in many

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\(^4\) See generally JENNIFER A. MANNER, INTERNATIONAL TELECOMMUNICATIONS MARKET ACCESS, at Chapters 1-4 (Artech House 2002).
countries this dominant provider was government owned, in some, like the United States, a virtual monopoly was given to a commercial entity, in this case, AT&T Communications, Inc. While certain important policy goals could often be achieved via a monopoly provider, many others, such as reasonable prices for services, universal service (though not such a problem in the United States, because of other policies), and innovation were often negatively impacted. Because of these hindrances, and because of the development of technology and increasingly open global markets, many countries starting in the 1980s faced pressure to open their telecommunications markets to competition and became market-openers. Governments taking the path towards a liberalized telecommunications market faced at least one daunting problem: how to ensure that a dominant, in many cases monopoly, provider, did not abuse its market-position in such a way that resulted in competition being stalled and new entrants being unable to successfully enter a market.

To remedy this, among other ills, regulators enacted regulations that curbed this potential anti-competitive conduct, to ensure that the new entrants would be able to enter into what can be termed a “level-playing field.” While this type of regulation, which continues today in many markets, was not market-based, it was necessary to ensure that new entrants could enter markets that had previously been denied to them or that they were blocked from entering. In countries where such regulations were effectively enacted and enforced, consumers have been able to gain access to advanced telecommunications

5 Id.


8 See, e.g., Id.; Manner, supra note 5.
services at reduced prices. Further, the teledensity of the availability of telecommunications services has increased dramatically.

However, savvy regulators and policymakers recognized that as established markets became competitive, and as new markets such as the Internet with no dominant service provider emerged, it was not necessary to retain or enact such regulatory schemes, since there was no real potential for market abuses based on a dominant position. Instead, regulators and policy makers in these areas have focused on a more hands-off approach to regulation, e.g., stepping in to regulate where it makes the most sense, such as generic technology standards to ensure that services can interoperate, and to fulfill public interest goals that might not otherwise be met, such as the availability of emergency communications.

A noticeable success of pro-competitive telecommunications policies is the terrestrial wireless market, where cell phones and other mobile devices have widely proliferated. At least 60 percent of the world’s population has a cell phone. Compare this to a figure from less then ten years ago when it was estimated that over fifty percent of the world’s population had not even made a voice phone call.

What is equally interesting is how the market has responded to the needs of consumers in offering such services. While there continues to be a wide proliferation of billing in arrears for cellular-type services, other options have become increasingly popular for consumer

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9 KENNARD, supra note 8, at 2.

10 MANNER, supra note 5.

11 See Abernathy, supra note 1, at 2.


segments where a pay-as-you-go or prepay approach makes more sense.\footnote{14}

Accordingly, one very successful scheme for policymakers and regulators has been to create a regulatory structure that enables new technologies and services, and to impose few regulatory requirements that are overly burdensome or add significant costs on the provider, except where there are overwhelming public interest requirements that must be met.\footnote{15}

Despite these and other successes, even the most advanced thinking regulators and policymakers recognize the need to impose non-market based regulations in some cases. An example of this was the FCC’s triennial review proceeding.\footnote{16} In this proceeding, the FCC, by majority, turned over to the States the determination of whether to allow unbundled switching. This decision, while ultimately overturned by the courts, left a chill in the air for regulatory certainty and pro-market regulation.\footnote{17}

One noticeable attribute of market-based regulation, however, has been the availability of capital for large-scale deployments of telecommunications infrastructure and access to scarce resources, such as spectrum.\footnote{18} Unfortunately, with the economic downturn in the United States, this availability of ready capital is in question. Without access to capital, the competitive telecommunications market, without some form of government enablement may not be able to achieve what current and incoming policy makers see as important policy goals. The broadband stimulus legislation thus is timely and important.

\footnote{14}{For example, companies such as Virgin Mobile, have made substantial in-roads into the pre-pay cellular market place. \textit{See} Roger Cheng, \textit{Virgin Mobile Is Set to Ride Budget-Minded Trend}, \textit{WALL ST. J.}, Feb. 3, 2009, http://online.wsj.com/article/SB123370253990245341.html.}

\footnote{15}{\textit{MANNER}, supra note 5.}


\footnote{17}{\textit{Id.} at 585.}

II
WHY MARKET-BASED POLICIES SHOULD
NOT BE ABANDONED

Based on the actions of the new President and the Congress, it appears that at least for the foreseeable future increased broadband deployment at high speeds to all Americans will continue to be a key goal.\textsuperscript{19}

In today’s policy debate, there are different ways to achieve this goal, with very different outcomes likely. However, the most interesting part of the current policy debate is a belief that a market-based approach to regulation will not achieve these goals on their own; that is, that the market may not provide the types of broadband access to unserved and underserved portions of the United States without government funding sources. While this may be a fair assessment, and more may need to be done, it is important for regulators and policymakers to be careful where they step in and recognize that providing government funding and taking other similar actions without ensuring that competition is protected may result in substantial future harm to the telecommunications market in ways that are not currently appreciated.

A starting point is to analyze the universal broadband deployment policy goal and the best possible approach to achieving it, recognizing the shortage of capital. In the past twenty years, U.S. policy makers would have created a regulatory scheme that was an “enabler” in enticing the provision of nationwide broadband communications.\textsuperscript{20} This approach has been pursued over the past few years with some success. However, even if a regulatory scheme enables the provision of these services, it is questionable whether in today’s economic climate such ambitious facilities building projects, which will be necessary to fulfill this goal, can be met unless the government creates financial incentives. Hence, going forward we are likely to see the current and continued efforts to provide funding mechanisms to ensure the deployment of this broadband infrastructure for all Americans,


\textsuperscript{20} See Abernathy, \textit{supra} note 1, at 1.
which is a very expensive endeavor. This includes the most recently adopted stimulus legislation, where grants and loans for broadband service are being awarded especially in unserved and underserved areas.\textsuperscript{21}

The first problem with such an approach is the right speed (assuming there is only one speed) for the provision of broadband communications in all areas of the country,\textsuperscript{22} and how the cost of this build-out will be funded, especially in a capital-starved telecommunications industry.\textsuperscript{23}

In terms of required speed for broadband, this is a very tricky question. As most people are aware, the speeds available for data connections keep increasing as technology continues to evolve. Only two to three years ago, many in the United States believed that it would be a tremendous goal if Americans could receive access to one Mbps of capacity each. Today, that number does not even come close to the speeds that are being proposed by policymakers throughout the country; speeds as fast as 100 times this rate are now being considered.\textsuperscript{24} These are the sorts of speeds that are being advanced by the high-technology industry players, such as chipset manufacturers, as necessary to carry the data that they believe will be associated with networks in the near future. However, the access to such speeds comes at a cost. For example, many rural areas of the United States today do not even have access to the lower speeds that were envisioned a few years ago. These consumers would likely be happy to have what is now seen as basic service to as compared to


broadband, such as wireless or satellite communications, that generally offer lower speed services.

Accordingly, U.S. policy makers must not limit their incentives to a chosen one or two technologies, but look across all platforms to ensure that whatever platform makes the most sense in a geographic area is able to be utilized and can receive financial incentives for infrastructure and deployment. Accordingly, the recent stimulus legislation, which did not mandate speeds, but encouraged high speeds, is right on the mark.25 However, the legislation still leaves some discretion as to speed requirements with the National Telecommunication and Information Administration of the Department of Commerce, which will administer the broadband grants. The Department of Commerce needs to refrain from imposing speeds in a vacuum without taking into consideration deployment costs in its analysis.

Another possible negative effect of such financial incentives is the potential reduction of competition. By relying on government funding of these systems, how does competition take hold? Are we once again creating a government-funded monster (or perhaps lots of monsters) that future new entrants, who are not beneficiaries of this funding, will not be able to compete with? This could negatively impact the deployment of next-generation technologies that could bring unanticipated consumer benefits to Americans.

It is imperative that the United States government recognize what they are potentially doing if they allow for funding of broadband without appropriate regulatory safeguards in place. In essence, what can be created in order to give juice to additional infrastructure builds is an industry where certain competitors will be allowed to build out their systems with government funding. This will make it extremely hard for new entrants to enter the market place. The only way to prevent such a perversion is to recognize the need for competitive safeguards.

Accordingly, while Congress and other U.S. policymakers are crafting such financial schemes, it is imperative that they also consider imposing certain safeguards to guard against the anti-competitive

effects of funding. While the stimulus legislation recognizes the possibility of such safeguards, they are narrowly and ill defined. While they recognize the possibility of non-discrimination and network interconnection restrictions, they do not provide safeguards that will ensure that the use of such financial incentives does not inure to other business lines of the receiving company. Cross-subsidization of other areas could negatively affect competition in competing businesses by providing the funded entities with means to their lower their prices to the detriment of their competitors who are not benefiting from the same financial incentives. Further, if there is no ability for new entrants to effectively compete in certain markets, this may result in a monopoly situation, hence allowing the subsidized entities to charge monopoly rates and further harm consumers.

This was similar to what was done early in the telecommunications industry when cross-subsidization of services was permitted in order to achieve important policy goals (in this case, universal service for basic telephony). However, there were no competitive providers of telecommunications services in that era. In fact, when competition was introduced, policy makers were careful to ensure that incumbents did not use the money they earned for monopoly services to fund competitive services. It would seem that as policy makers look at mechanisms to ensure that market distortion does not flow from the introduction of financial incentives to deploy broadband infrastructure, restrictions on cross-subsidization should be revisited and possibly imposed as a condition to funding.

Other problems involve restrictions on reasonable terms and conditions being set on special access to broadband wireline communications. Special access circuits are essential inputs (dedicated telecommunications facilities) that all telecommunications carriers, both wireline and wireless use to reach their customers and connect their networks. Financial incentives are likely to be provided as part of the upcoming stimulus package for broadband special access. To date, even without financial incentives, many parties have alleged that the providers of special access have been engaging in


anti-competitive conduct through inflated prices and the imposition of anti-competitive terms and conditions. The addition of financial incentives could cause more allegations of anti-competitive conduct, possibly to the detriment of competition. Specifically, artificially inflated special access prices bring increased costs to competitors, and therefore reduce the capital those competitors have available to build new infrastructure, thus harming consumers. Accordingly, before any financial incentives are provided to providers of special access, appropriate anti-competitive safeguards must be in place and well defined.

These examples demonstrate that policymakers must carefully evaluate how to balance the very important goals of increased deployment of broadband service and ensuring that competition continues to be vibrant in the telecommunications market. Failure to ensure that anti-competitive behavior will not be the result of any stimulus legislation could result in a market place that denies consumers the lower prices and innovative services that have been the direct result of a competitive telecommunications marketplace ultimately harming U.S. consumers.

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BROADBAND STIMULUS POLICY IN EUROPE AND THE US: 
A COMPARATIVE REVIEW

by

Dariusz Adamski∗

I

OVERVIEW

The American Recovery and Reinvestment Act of 20091 (herein after “Stimulus Act”), signed by President Barack Obama into law on February 17th, allotted about 0.92% of its overall $787 billion budget – $7.2 billion – to broadband related programs. The sum consists of two parts, separately allocated in Title I and II of the Act’s Division A. The first broadband program, amounting to $2.5 billion and managed by the US Department of Agriculture’s Rural Utilities Service (RUS), is devised for grants, loans and loan guarantees for broadband infrastructure in rural areas, seventy five percent of which are “without sufficient access to high speed broadband service.” The other share of the broadband-related investments within the stimulus package is to be disposed by the Broadband Technology Opportunities Program (BTOP), a program managed by the National Telecommunications and Information Administration (NTIA). BTOP has five main objectives:

1. Providing access for consumers in unserved areas;2

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2 See generally, John. M. Peha, Bringing Broadband to Unserved Communities, BROOKINGS (July 2007), http://www.brookings.edu/papers/2008/07_broadband_peha.aspx (Estimating that in July 2008 about eight percent of US homes (10.4 million) did not have access to cable broadband, while eighteen percent homes were not served by any DSL service provider.)
2. Improving access for consumers in underserved areas;
3. Providing support for public interest schemes facilitating access to broadband;
4. Improving broadband uptake by public safety agencies;
5. Stimulating demand for broadband, economic growth, and job creation.\(^3\)

Within the overall sum of $4.7 billion allocated to the BTOP, at least $200 million is earmarked “for competitive grants for expanding public computer center capacity, including at community colleges and public libraries”; at least $250 million “for competitive grants for innovative programs to encourage sustainable adoption of broadband service”; and up to $350 million for developing and maintaining a broadband inventory map.\(^4\) The Secretary of Commerce may also allocate to the FCC “amounts deemed necessary and appropriate… for the purposes of developing a national broadband plan or for carrying out any other FCC responsibilities.”\(^5\)

At the same time, in the European Union (EU) the European Commission (Commission) has earmarked, as part of the Community stimulus actions, €1 billion for actions aimed at overcoming the "broadband gap" between urban and rural areas. More specifically, the resources are to provide access to thirty percent of the EU’s rural population lacking broadband, mainly in Eastern and Southern parts of the EU.\(^6\)

While the broadband stimulus constitutes a clear departure from the market driven approach to broadband in the US,\(^7\) the European

\(^3\) American Recovery and Reinvestment Act § 6001(b)(1) 
Supra note 1 at Sec. 6001(b).

\(^4\) Id., at § 6001(l).


actions are an incremental development of telecommunications policy interweaving elements of industrial intervention with comprehensive regulation. It is therefore worth a look at the debate surrounding the U.S. Congress’ actions from the perspective of experiences in stimulating broadband deployment in Europe. To this end this article will contextualize the stimulus comparatively, and then discuss already announced details of the US recovery package from the perspective of comparable practices pursued in Europe.

II
CONTEXT

While cable broadband has never been subject to policy intervention in the EU, the access part of telecommunications infrastructure has fallen into the ambit of a two-tiered policy. It comprises a comprehensive regulatory system, on the one hand, and a redistributive industrial policy, on the other. The first one aims at enhancing competition on telecommunications markets deemed structurally uncompetitive, while the latter subscribes to a broader public policy towards innovation and “inclusive Information Society.”

Broadband stimulus contributes to the latter in the first place. Before discussing it, however, it is worth to explain the relationship between the EU broadband stimulus, as part of its innovation policy, and the European telecommunications regulatory framework.

In stark contrast with the current approach of the FCC, regulation still plays a decisive role in enhancing efficiency of


8 Except for rare instances of horizontal telecom-cable integration. For the sake of efficient intervention on telecommunications markets, regulation has been extended to cable networks in these instances. See, e.g., Press Release Telecoms: Commission endorses new Danish rules to open wholesale access to cable broadband (Mar. 12, 2009) http://europa.eu/.

9 Throughout the article the American term “regulation” will be used interchangeably with its European equivalent of “ex-ante regulation.” The difference stems from the fact that the term “antitrust” (U.S. nomenclature) most often functions in the EU as “ex-post regulation.”
telecommunications markets in the EU.\textsuperscript{10} This ongoing dependence on regulation stems from several factors: a general approach (which, if anything, will be strengthened by the current economic downturn) that the ultimate aim of consumer welfare can and should be pursued through governmental action; the fact that intra-modal competition\textsuperscript{11} is much less of an option in Europe than in the US due to much more moderate reach of the cable technology;\textsuperscript{12} and relatively late liberalization of the telecommunications sector.\textsuperscript{13}

Among provisions relevant to broadband, the regulatory framework authorizes national regulatory authorities (NRAs) to verify periodically the significant market power (SMP) of incumbent operators\textsuperscript{14} on markets susceptible to \textit{ex-ante} (forestalling) regulation,\textsuperscript{15} and to trigger regulatory measures if the SMP occurs. The

\begin{itemize}
  \item [10] Regulation has been generally lifted from markets based on the backbone and middle-mile infrastructure. Conversely, it has stiffened on data and voice international roaming markets and (particularly important for the present discussion) markets of physical access infrastructure.
  
  \item [11] Also called infrastructure competition, facilities-based competition, or intra-platform competition.
  
  
  \item [13] The liberalization was completed in the EU-15 in late 1990s, and in the new accessions states—in the beginning of 2000s.
  
  \item [14] Market analysis is undertaken pursuant to Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services (2002/C 165/03), O.J. 2002, C 165/6. The methodology used is congruent with that used by competition (antitrust) authorities.
  
    \begin{enumerate}
      \item Presence of high and non-transitory barriers to entry;
    \end{enumerate}
\end{itemize}
regulatory toolset is potent, reaching as far as tariff-setting and (implicit, so far) functional separation.\textsuperscript{16} All behavioral obligations (transparency, non-discrimination, accounting separation, access to network facilities, cost orientation) are used by the NRAs\textsuperscript{17} on two wholesale broadband markets covering the least replicable asset in the value chain of broadband, and therefore susceptible to \textit{ex-ante} regulation: (1) of access to physical infrastructure, including shared or fully unbundled access and (2) of broadband access.\textsuperscript{18} SMP incumbents\textsuperscript{19} are therefore generally obliged to offer both LLU and Bitstream products (along with resale and ancillary services like collocation or access to ducts) to other providers on terms and conditions determined by the NRAs.

The situation is somewhat more piecemeal when it comes to the Next Generation Access Networks (NGAs), both VDSL and FTTx, as these are not necessarily substitutable with the DSL markets subject to regulation. Some countries, however, have extended access obligations onto these markets, sometimes in a symmetric fashion (embracing all

(b) Market structure not tending towards effective competition within the relevant time horizon;
(c) The insufficiency of competition law alone to adequately address the market failure.)


\textsuperscript{17} Only the Maltese NRA has removed all the regulatory obligations from the wholesale broadband access market. The UK and Portuguese NRAs are in the process of withdrawing or targeting access regulation on certain geographic areas. For a broader account of the market situation see \textit{supra} note 12 at 51-52.

\textsuperscript{18} See Directive 2002/19/EC, \textit{supra} note 15 (designating eight markets (one retail and seven wholesale) as susceptible to \textit{ex-ante} regulation).

\textsuperscript{19} 14\textsuperscript{th} Progress Report, \textit{supra} note 12 at 37. (The incumbent (DSL) broadband providers had 45.6\% of the (retail) market share in January 2009 (i.e. 54.4\% of the market was occupied by entrants), comparing to 46.0\% in January 2008 and 46.8\% in January 2007.)
operators on a given market).\textsuperscript{20} In response to expansion of the NGAs,\textsuperscript{21} the Commission is currently working on a recommendation introducing an aligned regulatory approach on regulated access to Next Generation Access Networks (NGA).\textsuperscript{22} Most importantly for the current discussion, regulation of the NGAs should be lighter in comparison with the DSL access networks, in order to take into account “the initial investment by the facility owner, bearing in mind the risks involved in making the investment.”\textsuperscript{23} On the other hand, though, technological upgrades do not justify \textit{per se} lifting regulatory remedies from operators providing NGAs.\textsuperscript{24}

In consequence, the pace and scope of broadband deployment depends in Europe, regardless of the standard interplay of market forces, on the ability of NRAs to strike the right balance between static (short term) efficiencies, which suggest resolute intervention into wholesale tariffs, and dynamic (long-term) efficiencies, advocating more moderate policy in order to stimulate investments in the technologically dynamic, and thus hardly predictable, environment. In essence, therefore, and contrary to the regulatory choices of the FCC, broadband policy in the EU relies in the first place on broadening markets (stimulating price reductions oriented towards static efficiencies) and deepening them (stimulating investment, i.e. enhancing dynamic efficiency)\textsuperscript{25} with regulatory measures.\textsuperscript{26}

\textsuperscript{20} See \textit{id.} at 52-53.

\textsuperscript{21} To point at two most ambitious plans: in 2008 Deutsche Telekom announced €3 billion investments in NGAs and BT in the UK GBP1.5 billion.


\textsuperscript{24} German attempts to legislatively exempt Deutsche Telekom from third party regulatory access to its VDSL network caused a clash with the Commission in 2007: press release of Feb. 26, 2007 Commission launches “fast track” infringement proceedings against Germany for “regulatory holidays” for Deutsche Telekom, IP/07/237, \textit{available at} http://europa.eu/. The plans were later abandoned.

\textsuperscript{25} On relationship between regulation and investment in the UE see J. Huigen, M. Cave, \textit{Regulation and the promotion of investment in next generation networks—A European dilemma}, 32 Telecomm. Policy 713 (2008) and A. de Streel, \textit{Current and
Regulatory intervention has been supported in Europe by proactive industrial policies on national and community level. Therefore, the current EU broadband stimulus, contrary to the general approach on the other side of Atlantic, does not stand in Europe as an isolated and transient set of public expenditures aimed predominantly at boosting employment and recovering the staggering domestic production. It is rather another stage of industrial policy stemming from overarching, and mainly redistributive, strategies: “eEurope Action Plan 2005”\(^{27}\) (strategy for years 2002-2005) and the “i2010 – A European Information Society”\(^{28}\) (strategy for years 2005-2010). More precisely, the broadband stimulus plan, currently being developed at the EU level and already named the “EU broadband strategy,” aims at complementing and reinforcing the i2010 strategy.\(^{29}\)

Quite paradoxically, the extant elements of industrial policy intervention, often associated with arbitrariness and inefficiencies, set a more stable ground for the stimulus actions than the approach prevailing in the US so far. Fiscal stimulation is more logical (and based on more reliable information) when the broadband sector is

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\(^{26}\) Ideally, the (DSL access) regulation should invite platform entry based on limited investments from entrants in the short term, and use “stepping stones” (“rungs in a ladder of investment”) in transition towards loop entry (and enhanced infrastructure investments), in the longer term. See M. Cave, Encouraging infrastructure competition via the ladder of investment, 30 Telecomm. Policy 223 (2006) (perspective of the European regulatory practice). The concept has been successful in the EU. In Jan. 2009 69.3% (27.4 million) of all incumbent lines were either fully or partially unbundled compared to 60.1% a year earlier and 49.2% in January 2007. See 14\(^{th}\) Progress Report, supra note 12 at 43. For a skeptical assessment of whether the previous US regulatory system was in a position to achieve the same regulatory goals see T. Quast, Did federal regulation discourage facilities-based entry into US local telecommunications markets?, 32 Telecomm. Policy 572 (2008).


\(^{28}\) COM(2005)229 final,

\(^{29}\) The Internet portal created for the strategy is available at http://www.broadband-europe.eu.
structurally non-competitive and therefore non-efficient without government intervention in low-density/low-income areas. By the same token, the necessity of stimulating broadband deployment with fiscal mechanisms is more questionable in markets perceived as structurally competitive, generally more efficient, and capable of incurring higher investments in the long term.\textsuperscript{30} This poses the question whether any broadband-related redistribution is indeed necessary in the US. One dilemma is whether its aggregate benefits would exceed costs, considering oversight problems discussed later. And, if so, then the other is whether the financial stimulus should not be more appropriately channeled towards actions where market forces are less promising in addressing negative externalities\textsuperscript{31} of non-action.\textsuperscript{32}

III

STIMULUS IN MORE DETAIL

Broadband is often referred to as “the highway of the 21\textsuperscript{st} century.”\textsuperscript{33} The telecommunications infrastructure, however, is far less

\textsuperscript{30} John Horrigan, \textit{Home Broadband Adoption 2008}, Pew Internet & American Life Project, (July 2008), available at http://www.pewinternet.org/~/media//Files/Reports/2008/PIP_Broadband_2008.pdf (The Report demonstrates that in 2008 62\% of American dial-up users were not interested in shifting into broadband, and only one in five among about 27\% adults in the “digital gap” indicated no access or too high a price as prime reasons for not using the internet. Roughly every second in this group pointed at “I’m not interested”, “the internet is difficult or frustrating”, “it is a waste of time” as the main reason for not being connected. No corresponding EU data are known to the author. Yet an assumption that the picture is similar in Europe would make economic rationality of broadband deployment and upgrade with a “push” method paid through taxes correspondingly suspicious.)

\textsuperscript{31} Negative externalities are defined as divergence between private and social costs.

\textsuperscript{32} See generally, Michael Katz, \textit{Broadband’s Role in the Economy and the Stimulus}, AEI Center for Regulatory and Market Studies (Feb. 10, 2009), available at http://www.aei.org/events/eventID.1881/event_detail.asp. (arguing that, assuming that the cost of preventing one infant death is $250 thousand, opportunity costs of the broadband stimulus at the level of $6 billion (conservative calculation of the initial House bill) amount to 24 thousand saved infants foregone). http://www.aei.org/events/eventID.1881/event_detail.asp.

\textsuperscript{33} See, e.g., B. Lennett, S. Meinrath, \textit{Building a 21st Century Broadband Superhighway: A Concrete Build-out Plan to Bring High-Speed Fiber to Every}
transparent and more sophisticated than the motorway. Thus the preparatory work related to ascertaining the most desirable network architecture and technologies in a given location takes more time. To be efficient, broadband build-out and/or upgrade is therefore rather poorly predestined for immediate actions. Yet indeed immediate actions are required by the Stimulus Act. According to the “shovel ready” philosophy of the stimulus package, the Act makes it clear that “priority for awarding … funds shall be given to activities that can commence promptly following approval.” In more specific terms, the BTOP is to dispose its stimulus funding before the end of fiscal year 2010 (Sec. 6001(d)(2)) and projects are to be completed within two years following an award (Sec. 6001(d)(3)).

How can the government assure “the biggest bang for the buck” in such short deadlines, considering that the federal government does not possess good quality information on the current status of the broadband reach-out? Competition between tenderers may play an important role, yet naturally only in the areas where it would occur. Potentially, an inventory map, which is contemplated by the stimulus legislation, could also be useful. It is worth quoting the relevant provision (Sec. 6001(d)(2)) in extension, though, paying attention to the timeframe:

The Assistant Secretary [of Commerce] shall develop and maintain a comprehensive nationwide inventory map of existing broadband service capability and availability in the United States that depicts the geographic extent to which broadband service

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34 To use the language of the Stimulus Bill: “Priority for awarding funds made available under this paragraph shall be given to projects that provide service to the highest proportion of rural residents that do not have access to broadband service.” http://thomas.loc.gov/cgi-bin/query/F?c111:1:./temp/~c111l4Z4eN:e48350.

35 Legislation seeking better information on broadband connection—Broadband Data Improvement Act, 47 U.S.C. § 1301 (2008), was enacted in Oct. 2008. Only a few months earlier, in June 2008, the FCC released details of its March order on collection of broadband availability data at any meaningful (census tract) level. Legislation seeking better information on broadband connection—Broadband Data Improvement Act.
capability is deployed and available from a commercial provider or public provider throughout each State. Not later than two years after the date of the enactment of this Act, the Assistant Secretary shall make the broadband inventory map developed and maintained pursuant to this section accessible by the public on a World Wide Web site of the National Telecommunications and Information Administration in a form that is interactive and searchable.36

To be sure, the map will be produced soon after the BTOP completes the awarding procedure, and thus it will not help in prioritizing the support. The inventory part of the stimulus is even more interesting from the broader perspective, though. To recapitulate: First, the stimulus package is a temporary scheme aimed at recovery from the current economic downturn. Second, intra-modal competition renders the US broadband markets sufficiently competitive, according to the FCC’s position. Why, then, spend $350 million on an inventory map? It is rather pointless, unless the incoming administration is taking into consideration departure from either of the paradigms, and, in consequence,37 shifting towards permanent government intervention.

Another provision suggests this even more strongly. Namely, in early 2010 the FCC is to submit to the Congress a national broadband plan,38 which “shall seek to ensure that all people of the United States have access to broadband capability and shall establish benchmarks for meeting that goal.”39 This language closely resembles the European

36 The inventory map occurred already in Sec. 3 of Broadband Census of America Act, H.R. 3919, 110th Cong. § 3 (2007). Appropriations authorized for the inventory map amounted, according to H.R. 3919, 110th Cong. § 10(a) (2007), to $60 million (for three years)—almost six times less than $350 million (supra, Overview) authorized by the Stimulus Bill for the same purpose.

37 Except for the fact that no Communitywide inventory map has been either produced or even planned in the EU.

38 American Recovery and Reinvestment Act, supra note 1 at Sec. 6001(k)(1).

39 The plan should include: “(A) an analysis of the most effective and efficient mechanisms for ensuring broadband access by all people of the United States; (B) a detailed strategy for achieving affordability of such service and maximum utilization
rhetoric of the “inclusive Information Society” and of the corresponding strategies aimed at implementing the idea.

Central planning sounds odd enough in the American context. More disturbingly, however, the awarding procedure, the development of the plan, and the nationwide inventory map are to be pursued simultaneously, by three different agencies, in a very short timeframe, and in a government institutional framework unaccustomed to far-reaching market intervention.

Haste in spending naturally favors telecom giants like Verizon or AT&T. Under the existing time constraints these companies are best placed to propose “shovel ready” actions by replacing corporate capital (now either much more costly or unavailable), in projects they have already planned, with tax-dollars. When it comes to the BTOP, the measures alleviating ensuing potential problems are set by the Stimulus Act. Eligibility criteria are the first of them. Accordingly, award proposals may be submitted only by public authorities, nonprofits, or another entities “that the Assistant Secretary finds by rule to be in the public interest.”40 Second, the Act favors socially and economically disadvantaged small businesses,41 and, third, the applications, among others, are to demonstrate “that the project would not have been implemented during the grant period without Federal grant assistance.”42 One cannot predict at this point the extent to which these valves will stand up to their task. At least the efficacy of the last one is doubtful, however, considering that the federal agencies do not possess information requisite to verify assertions of tenderers. And certainly the above provisions will not do the trick when it comes to

of broadband infrastructure and service by the public; (C) an evaluation of the status of deployment of broadband service, including progress of projects supported by the grants made pursuant to this section; and (D) a plan for use of broadband infrastructure and services in advancing consumer welfare, civic participation, public safety and homeland security, community development, health care delivery, energy independence and efficiency, education, worker training, private sector investment, entrepreneurial activity, job creation and economic growth, and other national purposes.” Id. at § 6001(k)(2).

40 Id. at § 6001(e)(1)(C).

41 Id at § 6001(h)(3).

42 Id. at § 6001(h)(3). Id. at § 6001(e)(3).
the appropriations disposed through the RUS, as it is not covered by comparable requirements.

The stimulus legislation does not give a full overview of interconnection obligations imposed by the awarding agencies on benefiting operators. The Department of Agriculture and the NTIA will define them in the awarding process. Some details can be already assessed, though. To start with the most significant one, the Stimulus Act, when determining appropriations managed by the RUS, provides that priority is given to open access projects, a clear retraction from the unconditional openness requirement set by the House version of the bill. Returning to the comparative character of this article, in the EU, quite predictably, the requirement of open wholesale access has always been adhered to strictly in broadband projects subsidized from public resources, whether of the Community or member states. In state aid decisions the wholesale access

43 The Assistant Secretary of Commerce, in coordination with the FCC, is explicitly authorized to set the basic interconnection provisions for BTOP projects. Id. at § 6001(j). The Assistant Secretary of Commerce, in coordination with the FCC, is explicitly authorized to set the basic interconnection provisions for BTOP projects. Id. at (Sec. 6001(j)).

44 In the statutory language: “priority for awarding such funds shall be given to project applications for broadband systems that will deliver end users a choice of more than one service provider.” Id. at § 5(b), Div. A, Title I.

45 The bill, H. R. 1, explicitly provided that: “[t]his amount is available for grants, loans and loan guarantees for open access broadband infrastructure.” Id.

46 Some of the other standard terms used in the EU inevitably will also be employed in the US Stimulus. This regards particularly requirements of open tendering process, technological neutrality, limited project duration, or monitoring and clawback mechanisms. On the other hand, subsidy matching, required by Sec. 6001(f) of the Stimulus Bill is rarely requested in European projects.

47 Any aid from resources of a member state must be notified to the Commission. The latter determines its impact on interstate competition. The subsidy is illegal when it “distorts or threatens to distort competition by favoring certain undertakings.” (EC Treaty, Art. 87(1). This is generally the case of broadband deployment subsidized from national resources and exploited commercially. The Commission may, however, consider these as compatible with the common market if, among others, they “facilitate the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest.” Id. at (Art. 87(3)(c). This provision is almost always applied by the Commission to clear broadband subsidies. For a remote
requirement ensues that “the selected operators will have to provide access to the subsidized networks to other operators on equal and non-discriminatory terms that will enable the latter to replicate their formers’ offers.” The requirement stabilizes prices and quality of retail services, and on efficiency of the subsidized scheme in general, through market mechanisms. Yet, by the same token, it may raise problems of setting wholesale prices and wholesale service quality, and the costs of regulation/adjudication in case commercial negotiations between the subsidized network provider and other ISPs fail. Naturally these costs somewhat offset benefits of enhanced efficiency caused by service competition, and may lead to regulatory perpetuation. The problem is clearly exacerbated by distortions that the subsidy causes for the price setting mechanism of market interplay between supply and demand.

The open access generates a revenue stream for the subsidized operator from the wholesale market. It may, however, be seriously counterbalanced by falling retail prices. After all, this is exactly the idea behind inter-modal competition. Unless the gap can be covered by broadening the market (the consumer base in the first place), which is not certain under the requirements of minimizing price distortions, enhancing service competition may encourage subsidies. The choice between requiring wholesale openness (as in the EU) and giving only a lip-service to it (as in the US) essentially, therefore, comes down to choosing between inefficiencies stemming from regulatory supervision (in the case of imposing open access) or from monopoly control over the infrastructure (in the case of foregoing this requirement). Both may be significant, and both are extremely difficult to measure and predict.

exemption of a situation when the Commission issued a negative decision see Decision of July 19, 2006, C(2008)3226 final, N 35/2005 – the Netherlands; Broadband infrastructure in Appingedam. Restrictions now discussed (like open access) are devised by member states to demonstrate that the aid is proportional, i.e. that the same improvement cannot be achieved with less of the aid. *Commission decisions on State aid to broadband* (2003-2009), European Commission Competition Directorate (Feb. 24, 2009), is available at http://ec.europa.eu/competition/sectors/telecommunications/broadband_decisions.pdf


49 Inter-modal competition is also called “service competition” or “inter-platform competition.”
in a sector experiencing tremendous technological development. Assuming efficient regulatory oversight, the European model should be preferred. One may be somewhat wary about this option, however, considering the long track of inefficient and incumbent protective regulation in the US. Subsidized monopolies, nevertheless, require regulation of some sort in either scenario. Absent open wholesale access, the task of maintaining high quality retail services and reasonably low prices must be assumed by a monitoring agency, in essence merely shifting regulation from the wholesale to the retail level.

While open access aims at keeping retail prices reasonably low, another requirement almost universally provided in European subsidy schemes is intended to hold them from falling unreasonably. Most often referred to as “elimination of price distortions,” this essentially means “that the selected operators will have to offer retail services at prices that are comparable to the average prices in areas where the service already exists.” Without such a condition, the stimulus can easily turn into an excessive subsidy of end-users in rural and remote areas, by providing access to services at prices lower than in areas in which broadband is provided on fully commercial terms. According to the European approach, therefore, properly designed broadband subsidies should cover only what German authorities call a “profitability gap.” It is yet to be seen if a similar requirement will be introduced by the US stimulus agencies. The Stimulus Act, however, leaves this question unaddressed. One of its provisions suggests even that price distortions (as understood in the EU) may be justified: namely, the projects supported should “increase the affordability of, and subscribership to, service to the greatest population of users.” On the other hand, the Act requires that the projects “provide the greatest broadband speed possible to the greatest population of users in the


51 “The difference in investment costs and profitability threshold for providing similar broadband services in rural areas compared to urban areas.” Decision of 2 July 2008, C(2008)3157 final, N 115/2008 – Germany; Broadband in rural areas of Germany.

52 American Recovery and Reinvestment Act, supra note 1 at § 6001(h)(2)(A).
area.” Efficiency enhancing mechanisms aimed at eliminating price distortions are arguably in a much better position to achieve this latter goal.

The Stimulus Act requires that the projects subsidized through the BTOP be compliant with four network neutrality principles set by the FCC. The principles provide that: (1) consumers are entitled to access the lawful Internet content of their choice; (2) consumers are entitled to run applications and services of their choice, subject to the needs of law enforcement; (3) consumers are entitled to connect their choice of legal devices that do not harm the network; and (4) consumers are entitled to competition among network providers, application and service providers, and content providers. Interestingly, no comparable requirements of network neutrality have been introduced into the European broadband projects. This seems to stem predominantly from the fact that the network neutrality, understood as the principle of end-to-end connectivity, is protected through general regulatory means. Particularly, Art. 5(1)(a) of Directive 2002/19/EC provides that the NRAs are authorized to impose “to the extent that is necessary to ensure end-to-end connectivity, obligations on undertakings that control access to end-users, including in justified cases the obligation to interconnect their networks where this is not already the case.” The European practice shows, moreover, that this authorization does not play a particularly important regulatory role.

53 The final version of the bill therefore does not establish a minimal threshold of passive infrastructure costs stemming from speed requirements. The original House bill required transmission speeds of at least 45 Mbits downstream and at least 15 Mbits upstream. \textit{Id.} at § 6001(h)(2)(B). The final version of the bill therefore does not establish a minimal threshold of passive infrastructure costs stemming from speed requirements. The original House bill required transmission speeds of at least 45 Mbits downstream and at least 15 Mbits upstream. \textit{Id.} at (Sec. 6002(j)(1)).

54 \textit{Id.} at § 6001(j).


56 Only the Polish NRA has attempted to apply the rule, which it has twice attempted, in context of Internet traffic since the regulatory framework was implemented into national laws of the EU member states in about 2004. The European Commission, however, suggested using more standard regulatory tools (letters of Feb. 27, 2007—notification PL/2006/0656, and of Feb. 4, 2008—
IV
CONCLUSIONS

Two days after the Senate embarked on its version of the Stimulus Act, then President-Elect Obama announced that “to build an economy that can lead this future, we will begin to rebuild America … It means expanding broadband lines across America, so that a small business in a rural town can connect and compete with their counterparts anywhere in the world.”

Along such positive externalities of enhanced business productivity, supporters of the broadband stimulus point also that some international statistics rank the US as the 15th worldwide in terms of broadband penetration. More important, notification PL/2008/0745). On the deregulated, but also much more competitive, U.S. market the FCC has also intervened only twice in similar cases within the last five years. Madison River Communications L.L.C., Consent Decree, 20 FCC Rcd. 4295 (2005), Comcast, Memorandum Opinion and Order, FCC 08-183 (Aug. 1, 2008). Overall, this highlights the role of negative publicity as the main bulwark against similar practices, rendering regulatory intervention relatively less important.


59 See OECD Broadband Statistics, http://www.oecd.org/dataoecd/21/35/39574709.xls. In fact the comparison is not as worrisome when the US is compared to the UE as a whole (27 member states). From this perspective, broadband penetration rate in June 2008 was 3.4% higher in the US than in the EU (25% and 21.6%, respectively), with annual increase in penetration only slightly higher in the EU than in the US (3.4% and 3.1%, respectively). See also supra note 12 at 35. Data as of June 2008, available from the OECD Broadband Portal: http://www.oecd.org/sti/ict/broadband. In fact the comparison is not as worrisome when the US is compared to the UE as a whole (27 member states). From this perspective, broadband penetration rate in June 2008 was 3.4% higher in the US than in the EU (25% and 21.6%, respectively), with annual increase in penetration
some estimations predict that the broadband stimulus will have a significant positive impact on workforce. Accordingly, $5 billion stimulus would create almost 100,000 new jobs directly in short-term and almost 2.5 million jobs as network effects. Others announce almost 500,000 jobs retained or created directly under a broadband subsidy of $10 billion. And, after all, the proportion of the broadband appropriations in the overall stimulus package may be deemed moderate, much lower than sometimes advocated.

On the other hand, however, except for expenditures aimed at improving infrastructure in the public domain, educational, medical or used for public safety purposes, the stimulus boils down to transferring money from (future) taxpayers to (current) telecom companies in the name of subsidizing broadband. More importantly, the transfer is to take place in an already developed business environment, with Verizon very successfully pursuing its FTTH “FIOS Program” (and AT&T its somewhat less successful “U-verse Program”), with new and cheap cable modem technologies (Docsis 3) soon allowing US cable operators for much higher speeds than currently available, and with current operators setting up ventures (like Clearwire) to extend wireless broadband networks. Most of the European markets are much less amenable to this sort of advanced intra-modal competition and only slightly higher in the EU than in the US (3.4% and 3.1%, respectively). Cf., 14th Progress Report, supra note 12 at 35.


63 Version 3 three of Data Over Cable Service Interface Specification enables transfer of 200 Mbps (downstream; four channels). In Europe, upgrades in these technologies have been started in 2008 in Belgium and Sweden, and are planned in Spain (2009) and Portugal (2010). See supra note 12 - 14th Progress Report, p. at 45.
cost-effectiveness it brings about. The mixture of regulatory intervention and industrial policy applied there is therefore more justifiable. It is also entrenched in already functioning, and traditionally accepted, institutional arrangements. In the US, on the other hand, the retreat from the Schumpeterian attitude towards broadband markets has been both rapid and quite radical, reaching as far as elements of central planning, traditionally rejected on this side of Atlantic for its, euphemistically speaking, suspicious efficiency. It is also worth to bear in mind the comment of Judge Greene, uttered in the AT&T divestiture case, on the FCC’s regulatory (in)capabilities: “the Commission is not and never has been capable of effective enforcement of the laws governing AT&T’s behavior.”

It is still to be seen whether the two agencies responsible for broadband subsidies are competent enough to avoid similar charges. For many reasons, from regulatory vacuum to information asymmetries to quite exotic core policy expertise of one of the agencies (RUS), the task will be very difficult. And most fundamentally, the positive externality arguments are dubious, considering that broadband is used in overwhelming proportions for entertainment purposes. It may be argued that the same resources


66 The EU framework attempts to remedy the information asymmetries problem with an obligation put on telecoms to provide “all the information, including financial information … necessary for national regulatory authorities to ensure conformity with the provisions of, or decisions made in accordance with” the regulatory framework: Art. 5(1) of Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive), O.J. 2002, L 108/33. Even with such a strong legal basis the regulatory process is seriously hounded by information asymmetries.

could boost real innovation and entrepreneurship if spent on research advancing human abilities to harness information technologies for the benefit of the whole society (e.g. wireless technologies or health IT, to name just two among many). These opportunities and resulting positive externalities are significantly forgone under the broadband stimulus.

responsible for over two-thirds of all Internet traffic, surpassing web browsing by a factor of almost 3. Over 71% of all this P2P traffic consists of video.”) See also MATTHEW HINDMAN, THE MYTH OF DIGITAL DEMOCRACY at 60-61 (Princeton Univ. Press 2009) (revealing that “[o]verall, about 10.5 percent of Web traffic goes to adult or pornographic Web sites. A slightly smaller portion (9.6 percent) goes to Web-mail services such as Yahoo! Mail or Hotmail, 7.2 percent of traffic goes to search engines, while only 2.9 percent of Web traffic goes to news and media sites.”)
THE ECONOMIC BENEFITS OF BROADBAND AND INFORMATION TECHNOLOGY

by

Patrick S. Brogan*

I
INTRODUCTION

Developments over the last half-decade have provided critical mass for the phenomenon of “convergence” – the coming together of the information, communications, and technology (ICT) industries technologically, economically, and competitively. In this dynamic and growing ecosystem, providers of broadband communications networks, digital devices, and a limitless array of content and applications all rely on each other to generate new value for consumers and multiple benefits for the U.S. economy. At the same time, ICT industries are competing across traditional industry boundaries. See Figure 1.

Figure 1: The Dynamic ICT Ecosystem

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The purpose of this analysis is to illuminate the interdependence and competitiveness of the ICT industries, the growing impact of ICT on the broader economy, and the benefits of continued investment in this young, flourishing ecosystem.

The U.S. economy depends on the continued health of the ICT sector. Given the interdependence of ICT industries, the analysis that follows takes a holistic approach. It describes the economic impact of the full ICT sector, in relation to other sectors and in relation to the economy as a whole. The analysis begins with the contribution of ICT to economic output, or Gross Domestic Product (GDP). It then looks at growing investment in ICT and the use of ICT inputs across the economy. The analysis then explores the broader economic benefits of ICT, including the impact on consumer value and choice, jobs, and productivity. See Figure 2.

**Figure 2: Framework for Analysis of ICT Economic Impact**

| **GDP and Growth:** ICT is among the premier contributors to GDP and is the greatest driver of real GDP growth in the economy |
| **Capital Investment:** ICT generates a disproportionately large amount of the capital investment in the U.S. economy |
| **ICT Usage Across Sectors:** Critical sectors of the economy depend on ICT inputs to facilitate their advancement in the global information economy |
| **Consumer Value & Choice:** ICT offers consumers expanding value with new and innovative services for a small portion of income |
| **Employment:** ICT generates millions of high-wage, high-growth jobs within the sector and across the entire economy |
| **Productivity:** ICT drives a large share of productivity, enhancing long-term economic growth and U.S. global competitiveness |

ICT investment and adoption yields economic benefits.

Projecting the sector’s successful growth into the future must be the key goal of relevant policymakers. Doing so will require careful attention by policymakers to the entire ICT ecosystem and the checks and balances that exist within it. Any change to current policies bears a heavy burden to demonstrate how that change could improve sector performance and to carefully account for the affects on jobs, growth and innovation as that change ripples through the ICT ecosystem. The risks involved in upsetting the balance that has produced the ICT record of economic success and innovation over the last several years should give pause to any policymaker considering changing course.
Rather, policy should maintain a positive climate of ICT industry and consumer-driven investment, innovation and growth.

II

HOW CONVERGENCE HAS ALTERED
THE ICT INDUSTRY DYNAMIC

As a result of convergence, the information, communications, and technology (ICT) industries are at the same time interdependent and competitive. Industry players rely on each other to generate new value while competing across traditional industry boundaries to provide integrated services. The result is a relatively unfettered process of dynamic and flexible interaction among ICT players and consumers that has generated massive innovation. Consumers today can access a growing menu of content and applications anywhere, anytime using a growing choice of devices. New products and services are driven by collaboration, personalization, and user-defined experiences.

As this dynamic ecosystem grows, new broadband-enabled business models arise, creating new value and disrupting traditional relationships within industries. Perhaps less noticed, but of great importance, is the shifting of value between and among the ICT industries and consumers. See Figure 3.

1 For this analysis, “ICT” industries consist of information (digital or digitize-able content and entertainment), communications (broadband networks), and technology (information technology such as hardware, software, communications equipment). These industries are found in the following categories of the North American Industry Classification System (NAICS): Computer and Electronic Product Manufacturing, Computer Systems Design and Related Services, and the “Information” Industries, which consist of Telecommunications and Broadcasting, Publishing Industries including Software, Motion Picture and Sound Recording Industries, Information and Data Processing Services. The Computer and Electronic Product Manufacturing industry is part of the Durable Goods Manufacturing sector and the Computer Systems Design and Related Services industry is part of the Professional, Scientific, and Technical Services Sector. The analysis at times refers to the ICT sector, which consists of the collective ICT industries. See U.S. Census Bureau: North American Industry Classification System (NAICS), http://www.census.gov/eos/www/naics/. See Appendix, infra at 89, for discussion of GDP measurement as used throughout this paper.
Figure 3: Illustrative Examples of ICT Value Shifts

• **iTunes**: Apple, a technology company, has become the leading U.S. music retailer\(^2\) using the broadband Internet and computers, disrupting the traditional music distribution chain. Value shifts away from the music industry (information) toward technology and consumers.

• **Net Video**: Online video services (e.g., Hulu, NBC.com, and ESPN360) are bypassing traditional content distribution, i.e., subscription video, using the broadband Internet. Value shifts away from subscription video toward content providers and consumers.

• **Broadband Bundled Netbooks**: ISPs have started to offer customers cheap, portable computers at a subsidized rate in exchange for a term contract, like cell phones.\(^3\)

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acceptance of this approach could bring more people online and shift value from and within the technology sector.

Whether well established (iTunes) or more experimental (online video, netbooks), these examples demonstrate how value can shift among ICT industries. Consumers capture value through cheaper, more powerful products and services. Industry value-capture is driven by flexible negotiation and interaction among ICT players. In this dynamic environment, shifting value and interdependence provide the checks and balances needed to ensure that consumers will benefit from sustained investment and innovation.

III

ICT IMPACT ON THE U.S. ECONOMY

A. ICT Impact on GDP and Economic Growth

The analysis begins with an examination of the ICT sector’s contribution to GDP. To compare ICT to other sectors, we use GDP-by-Industry data from the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). The data are based on the value-added approach to measuring GDP, as described in the Appendix Part A. The GDP-by-Industry data are provided at various levels of granularity, which allowed us to develop sector groupings appropriate for analysis.4

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4 The ICT sector was formed by combining the Computer and Electronic Products Manufacturing industry from the Durable Goods sector and the Computer Systems Design and Related Services industry from the Professional, Scientific, and Technical Services sector and combining them with the Information Sector (consisting of the Telecom and Broadcasting, Information and Data Processing Services, Publishing Industries including Software, and Motion Picture and Sound Recording industries). We shifted Pharmaceuticals from Nondurable Goods Manufacturing to Health Care. Pharmaceuticals were estimated as 44.3% of chemicals product manufacturing, or $110 billion out of $249 billion for 2007, based on the Pharmaceutical portion of Chemical Manufacturing Value Added in the BEA 2002 Benchmark Input-Output Accounts. We also shifted $17 billion from Mining (Gas and Oil Extraction) and $70 billion from Nondurables (Petroleum and Coal Products) and combined with Utilities to form an Energy category. See U.S. Department of Commerce: Bureau of Economic Analysis (BEA), http://www.bea.gov/ (last visited Apr. 10, 2009).
The ICT sector contributed over $900 billion to GDP in 2007. ICT was among the top sectors in the economy at about 6.5% of the total GDP. Only the Real Estate, Finance, and Health Care sectors contributed more. See Figure 4.

**Figure 4: Industry Contributions to GDP**

Moreover, ICT was by far the greatest contributor to real U.S. GDP growth. Due to data limitations, we discuss real GDP in terms

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5 BEA, GDP-By-Industry Data 1998-2007, available at http://www.bea.gov/industry/gdpbyind_data.htm (Figures are in nominal dollars, i.e., not adjusted for inflation or deflation).

6 Real GDP accounts for the fact that consumers and businesses get more “real” output for the dollar from ICT due to declining prices and the increasing power of ICT products and services, such as computers and broadband. Real GDP presents several measurement issues that prevent us from looking at the real GDP of a combined ICT sector. Unlike the nominal GDP data, real GDP figures cannot be combined across industries, as we did with the nominal data to form a combined “ICT sector.” This is because the “chaining” process that BEA uses to convert nominal to real dollars for each sector and industry yields real GDP figures that are not additive (i.e., the economy-wide total does not equal the sum of the sectors and the sector totals do no equal the sum of the industries). Therefore, we are limited to looking at growth for the sectors and industries for which BEA provides real GDP data. A note of caution on interpreting the chart: two sectors include ICT industries. These are the Durables and Professional Services sectors, which include Computer and Electronics Manufacturing and Computer System Design and Related Services, respectively. Therefore these sectors’ growth rates are overstated compared to rates that would result if the ICT component industry had not been included.
of the categories and subcategories provided in the government data, rather than our composite “ICT sector. Real GDP for the Information sector—the category that comprises most of our composite ICT sector—grew 8.1% in 2007, greater than any other sector and four times the 2% rate of the economy as a whole. In fact, all of the subcategories comprising our ICT sector outgrew the overall economy: Information and Data Processing Services 25.5%; Computer and Electronic Product Manufacturing 19.9%; Computer System Design and Related services 10.1%; Telecom and Broadcasting 7.1%; Motion Picture and Sound Recording Industries 4.9%; and Publishing Industries (including Software) 3.7%. See Figure 5.

Figure 5: Industry Contributions to Real Economic Growth

![Graph showing annual growth in real GDP by industry]  

B. ICT Investment

We turn next to investment\(^8\) because ICT investment has a disproportionate impact on GDP and is the source of many other economic benefits, such as consumer value and choice, employment, and productivity. We address investment from two perspectives.

\(^7\) See GDP-By-Industry Data, supra note 5 at tab 97NAICS_VA, GO, II, series code VACHN.

\(^8\) “Investment” as used herein refers to private investment in fixed assets. Governments also invest in ICT, but ICT investment is not broken out of government investment spending.
First, firms across the economy, including firms in ICT and non-ICT industries, invested $455 billion in ICT equipment, software, and structures in 2008. Second, firms from the ICT industries invest in all types of assets, mostly but not exclusively ICT equipment, software, and communications structures. We look at the specific case of broadband service providers, who invested at least $64 billion in 2008, depending on the source and the methodology of estimation.⁹

1. **Economy-Wide Investment in ICT**

ICT investment contributes a disproportionately large share of U.S. private fixed investment. Private fixed investment across the U.S. economy in 2008 was $2.041 trillion, about fourteen percent of GDP. This investment consisted of $488 billion in residential investment, $555 billion in non-residential structures, and $999 billion in non-residential equipment and software.¹⁰ Total 2008 investment in ICT equipment, software, and structures was $455 billion, consisting of $241 billion in software, $90 billion in computers and peripherals, plus $103 billion in communications equipment and $21 billion in communications structures. See Figure 6. The $455 billion of ICT investment represented twenty two percent of all private fixed investment and the $434 billion invested in ICT equipment and software accounted for forty three percent of non-structural investment.

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⁹ Different sources for tracking capital expenditures are discussed in Part III.B.2, *infra at 73.*

ICT investment has grown substantially in the last half-decade. Since bottoming after the technology and telecommunications bubble of the late 1990s and early 2000s, annual ICT investment has grown by thirty three percent, from $343 billion in 2003 to $455 billion in 2008. Fueled by broadband, annual communications equipment and structures investment grew thirty two percent from $94 billion to $124 billion during the same period. Real annual communications equipment investment, which accounts for the effects of declining prices and the increased power of the equipment, was forty percent greater in 2008 than 2003 and surpassed the peak levels achieved in 2000 during the technology and telecommunications bubble. See Figure 16.

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12 BEA, NIPA Table 5.5.6U Real Private Fixed Investment in Equipment and Software by Type, available at http://www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N. BEA derives
2. *Broadband Provider Investment*

Broadband providers invested at least $64 billion in 2008. Market research firm the Yankee Group estimates that broadband providers invested $64.2 billion in 2008, up from $62.5 billion in 2007. See Figure 7. The U.S. Census Bureau publishes broader capital expenditure estimates in the $80 billion range. Further, the Census Bureau publishes historical data showing that, like economy-wide investment in ICT, broadband provider investment has grown significantly over the last half-decade. Census estimates indicate annual carrier investment was thirty percent greater in 2007 than 2003.

Figure 7: *Carrier Capital Expenditures and Projections*[^14]

<table>
<thead>
<tr>
<th>U.S. Carrier Capital Expenditures ($ billions)</th>
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<tbody>
<tr>
<td>Cable</td>
</tr>
<tr>
<td>Telecom</td>
</tr>
<tr>
<td>Includes hundreds of wireline and wireless carriers, including four wireless carriers with national broadband footprints</td>
</tr>
<tr>
<td>2007: 49.1</td>
</tr>
</tbody>
</table>

“real” dollar measures by using a method called “chaining” that states current dollars in terms of the purchasing power of dollars in a base year, here 2000.


[^14]: Graphic created by US Telecom using source data from Yankee Group. © Copyright 1997-2009. Yankee Group Research, Inc. All rights reserved. Data are in nominal dollars. Includes wired and wireless telecommunications carriers and cable providers. Wireless spectrum license payments are not included.
Broadband era investment is based on a solid foundation of facilities-based last mile competition. The tech and telecom bubble era of the late 1990s to early 2000s was marked by strong ICT investment. Some investment yielded lasting value, such as the build out of corporate data networks, carrier fiber networks, national wireless networks, and the overall growth of the Internet. But much was driven by speculative investment. The broadband era, starting in roughly 2003, provides an instructive contrast. Investment is being driven in significant part by sustainable facilities-based competition for the last mile and continued integration of broadband ICT into the fabric of the economy. Examples of last mile broadband investment include deployment of fiber networks, such as FiOS and U-verse, upgrades to cable networks with DOCSIS 3.0, and implementation of wireless broadband technologies such as EV-DO Revision A, GPRS/HDSPA, WiMAX, and LTE. As noted above, we have surpassed bubble era investment levels.

C. Intermediate Use of ICT

The U.S. economy depends on ICT inputs to thrive in the global information economy. Inputs are not directly measured in GDP. Nonetheless, the growing use of ICT inputs indicates that ICT is becoming increasingly ingrained in the way U.S. firms conduct business. Non-ICT sectors spent $617 billion on ICT inputs in 2007 up from $338 billion in 1998. Yet, despite the growing power of the technology, spending on ICT consumed a relatively flat share of total output. See Figure 8. Including ICT sector use, ICT inputs were just

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15 ICT intermediate inputs, or “inputs” for short, are similar to investment, but different in important respects. Inputs are similar to investments in that they reflect adoption and use of ICT technologies and services. But ICT inputs are different from investment in that they are not reflected in GDP—at least not directly. The key difference between an investment and an input is the investment contributes to future production and has a useful life of more than a year, whereas an input is used in production with a year. As shown in Appendix Part A, inputs are used to produce other products and services. Therefore inputs are reflected in GDP only indirectly through the sale of some other final good or service. Otherwise the value of the input would be double counted. For example, a manufacturer builds computer inputs into an automobile, but only the value of the automobile is reflected in GDP. A personal financial advisor utilizes voice and data networking inputs to monitor investments and communicate with clients, but its monthly networking bill is not reflected in GDP except through its fees, which recover its operational costs.
over $1 trillion in 2007. Critical sectors, including Professional Services, Health Care, Finance, and Government (which includes Public Education) are heavy users of ICT inputs. See Figure 9.

**Figure 8: ICT Input Growth Over Time**


Figure 9: Non-ICT Industry Spending on ICT Inputs in 2007

<table>
<thead>
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<tbody>
<tr>
<td>Total ICT ($617b)</td>
<td>68</td>
<td>76</td>
</tr>
<tr>
<td>Telecom ($230b)</td>
<td>55</td>
<td>53</td>
</tr>
<tr>
<td>Other Than Telecom ($387b)</td>
<td>13</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 10: Communications Consumption and Share of National Income

U.S. Personal Communications Expenditures on Communications Services ($ billions) and % of National Disposable Income

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18 *Id.*

19 *Id.*
D. Consumer Value and Choice

ICT has provided consumers exponentially better value for a stable share of national income. Since 1990, consumer spending on ICT has grown from $197 billion to $545 billion, 5.1% of national disposable income in 1990, peaking at 5.9% in 2000, and falling to 5.4% last year. Spending on communications services, a subset of ICT, has tripled over the same period, from $77 billion to $243 billion, and at 2.3% of national disposable income, up from 1.8% in 1990 but below its peak of 2.5% in 2001. See Figure 10. Yet consumer value has grown exponentially in the intervening years.

For example, in communications, consumers have exponentially more and better choices today. Figure 11 shows that the mix of spending has shifted over time from traditional voice services to broadband, entertainment, and mobile services. Yet, while U.S. communications expenditures as a share of national disposable income have been flat since 1997, we have added over 100 million broadband and video connections, hundreds of new video programming choices, and over 100 million wireless connections.

- In 1990, the Internet was unknown to most of the U.S., yet by mid 2008, 55% of U.S. households subscribed to home broadband. As broadband penetration has grown, new technologies such as fiber and mobile broadband have taken a growing share of new subscriptions. See Figure 12. Prices for basic wireline broadband services have dropped by half since the beginning of the decade. By 2007, consumers could get 10-20 times the speed they could get for the same price as they paid at the start of the decade.

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20 BEA, NIPA Table 2.4.5U Personal Consumption Expenditures by Type of Product, available at http://www.bea.gov/national/hipaweb/nipa_underlying/Index.asp; NIPA Table 2.1 Personal Income and its Disposition, available at http://www.bea.gov/national/hipaweb/SelectTable.asp?Selected=N#S2.

21 Id.

• In 1990, there were approximately 52 million multi-channel video subscribers, compared to 99 million in 2008.\textsuperscript{23} In 1994 there were 106 national cable programming networks\textsuperscript{24} compared to 565 in 2006.\textsuperscript{25}

• In 1990 there were 5 million wireless subscribers compared to 270 million in 2008.\textsuperscript{26} Wireless consumers used an average of 140 minutes per month in 1993 compared to 769 in 2007.\textsuperscript{27} Wireless data accounted for 18% of wireless service revenue in 2007.\textsuperscript{28}


\textsuperscript{27} In the Matter of Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, FCC-DA 09-54, Table 12 at 93 (Jan. 16, 2009).

\textsuperscript{28} Id.
Figure 11: The Changing Mix of Communications Service

![Graph showing personal consumption expenditures (PCE) for communications services, 1990-2008. The $ billions are represented on the y-axis, with years 1990 to 2008 indicated on the x-axis. The graph shows the percentage of Internet, Cable TV, and Wireless subscribers increasing over time.]

Figure 12: The Changing Mix of Broadband Technology

![Graph showing the percentage of residential subscribers added per period (annual % change) from 2005 to 2007. The graph includes data for Mobile Wireless, Satellite & Fixed Wireless, Cable, WiMAX (Fiber), and WiMAX (DSL).]

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29 Id.

Figure 13: Weighted Average Monthly Price for Top 5 ILEC Wireline Broadband

<table>
<thead>
<tr>
<th>Year</th>
<th>Maximum Advertised Price by Downstream Speed Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Up to 768 kbps</td>
</tr>
<tr>
<td>2001</td>
<td>$16</td>
</tr>
<tr>
<td>2002</td>
<td>$32</td>
</tr>
<tr>
<td>2003</td>
<td>$30</td>
</tr>
<tr>
<td>2004</td>
<td>$30</td>
</tr>
<tr>
<td>2005</td>
<td>$30</td>
</tr>
<tr>
<td>2006</td>
<td>$28</td>
</tr>
<tr>
<td>2007</td>
<td>$18</td>
</tr>
</tbody>
</table>

E. Employment

ICT sustained at least 10 million jobs across the economy. Using the most current occupational employment data (2007), we are able to see how broadband and ICT contribute to the job market both within and outside of the broadband/ICT industries. In 2007, ICT industries sustained more than 5.7 million jobs, including 3.3 million jobs that were not ICT-centric and 2.4 million ICT-centric jobs. Non-ICT industries also employed 4.4 million in ICT-centric jobs. See Figure 14.

ICT jobs are among highest-earning and fastest growing jobs in the U.S. the economy. The ICT industry average wage of $29.43 is 50% greater than the national average hourly wage of $19.56 and ICT occupations pay, on average $27.05, about 38% more than the national average. Based on Labor Department projections for 2006-16, ICT occupations are among the fastest growing in the economy. In fact, network and data communications analysts are the fastest growing occupation in the economy at 53.4% growth over the ten-year period.

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33 Id. Averages are means. Industry and occupational wages are weighted by number of employees.
Altogether, data network analysts, computer programmers and analysts, and database administrators were projected to add 625,000 jobs over ten years.\(^\text{34}\)

**Figure 14: ICT Employment**\(^\text{35}\)


<table>
<thead>
<tr>
<th>U.S. ICT Occupations within Non-Farm Employment 2007 (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-ICT Industries</strong></td>
</tr>
<tr>
<td>4.4 million occupations outside of the ICT industries that utilize, implement, produce, distribute, or enable ICT, e.g.,</td>
</tr>
<tr>
<td>- Network and IT administrators / analysts</td>
</tr>
<tr>
<td>- Computer system design and support</td>
</tr>
<tr>
<td>- Computer and software programming</td>
</tr>
<tr>
<td>- Content and advertising occupations</td>
</tr>
<tr>
<td><strong>ICT Industries</strong></td>
</tr>
<tr>
<td>10.1 +</td>
</tr>
<tr>
<td>5.7 ICT industry jobs</td>
</tr>
<tr>
<td>2.4 million ICT-centric occupations employed within ICT industries, e.g.,</td>
</tr>
<tr>
<td>- Network engineers</td>
</tr>
<tr>
<td>- Semiconductor manufacturers</td>
</tr>
<tr>
<td>3.3 million non-ICT-centric occupations employed within the ICT industries, e.g.,</td>
</tr>
<tr>
<td>- General managers</td>
</tr>
<tr>
<td>- Accountants and lawyers</td>
</tr>
<tr>
<td>- Administrative staff</td>
</tr>
</tbody>
</table>

F. **Productivity**

Productivity is among the most significant economic benefit of ICT adoption because productivity is a critical determinant of the long-


\(^{35}\) Occupational Employment Statistics 2007, *supra* note 32. The occupational employment data allow us to look at a cross section of occupations employed by industry. We looked at data for 295 industry subgroups and 800 occupations, classifying industries as ICT or non-ICT and classifying certain occupations as ICT-centric or not. ICT-centric occupations are those that exist to utilize, implement, produce, distribute, or otherwise enable ICT. Examples include network administrators or computer programmers. Jobs not specifically dedicated to ICT functions, but employed by ICT industries, might include accountants, lawyers, and office staff. Data do not capture agricultural or self-employed (9.7 million in May 2007) workers or the “multiplier effect” of jobs created outside of the ICT sectors to support ICT firms and employees (e.g., lawyers, property managers, general management consultants, and others). ICT occupations reported at subgroup level were 2.3 million, adjusted upward to 2.4 million to estimate industry total. See Appendix Part B for list of ICT-centric occupations.
term economic growth and the living standards of our nation. Starting in the mid 1990s, economists began to find evidence that ICT is a significant driver of productivity growth. Productivity will remain critical to future economic growth because, when broken down into its components, GDP growth equals the sum of the growth rates of hours worked and productivity.

To understand how ICT affects productivity, consider that three factors drive growth in productivity, defined as output per unit of labor:

- Labor quality: improved education and skills yield greater output per unit labor.
- Capital deepening: investment in productive capital assets increases output per unit of labor; these assets include both ICT and non-ICT capital.
- Total factor productivity: a catch all to explain what is not otherwise explained, essentially it encapsulates innovation in business organization and production processes; total factor productivity includes both ICT and non-ICT firms.

ICT has no effect on productivity through labor quality or non-ICT capital deepening. ICT has a direct effect on productivity through ICT capital deepening and through total factor productivity within ICT firms. ICT may also have an indirect, or partial, effect on productivity through the total factor productivity of non-ICT firms.

Economists began to investigate the impact of ICT when productivity growth jumped from an average of about 1.5% during the period from 1973 to 1995 to an average at or above 2.5% from 1995 to 2000. Some economists have recently found that the direct impact of ICT from both ICT capital deepening and total factor productivity within ICT firms contributed between half and three-quarters of the productivity growth during the period.  

\[\text{See Dale W. Jorgenson, Mun S. Ho, & Kevin Stiroh, A Retrospective Look at the U.S. Productivity Growth Resurgence, Federal Reserve Bank of New York, Staff Report No. 277 (Feb. 2007) (finding an average annual growth rate of 2.7\% during 1995-2000, of which 1.01\% was attributable to ICT capital deepening and 0.48\% was attributable to total factor productivity of ICT firms, for a total direct ICT impact of 1.59\% (59\% of the total impact)). See also Stephen D. Oliner, Daniel E. Sichel, & Kevin J. Stiroh, Explaining a Productive Decade, Federal Reserve Board,}\]

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significant from 2000 through the middle of the decade, but was more muted: between 0.33% and 0.4%.

Recently, economists have begun to look beyond the direct impact of ICT capital deepening and total factor productivity in ICT firms to determine whether ICT has an indirect or partial impact on the total factor productivity of non-ICT firms. The theory is that ICT is a “general purpose technology” that positively affects productivity in non-ICT firms, usually in combination with complementary investments in intangible capital such as training and organizational knowledge needed to utilize the ICT capital. Under this theory, the total factor productivity benefit lags the investment in ICT, possibly by many years. In fact the theory posits a negative concurrent correlation between ICT investment and total factor productivity because an organization’s focus is on acquiring and installing technology rather than building the organizational knowledge needed to use it. Some preliminary studies have found some evidence in favor of this general purpose technology theory, though the issue is the subject of ongoing inquiry.

Estimating the current dollar impact of ICT-generated productivity is an imprecise endeavor. We calculated a purely hypothetical “back of envelope” scenario, based on actual real GDP growth for the non-farm business sector of 0.8% and annual...
productivity growth of 2.8% from 2007 to 2008.\textsuperscript{39} We estimated that out of roughly $300 billion in productivity-driven GDP growth in the non-farm business sector, ICT could account for about $100 billion, possibly as much as $150 billion or more. Again, this estimate must be taken with a grain of salt. See Figure 15 below and discussion in Appendix Part D.

Figure 15: Illustrative Estimate ICT Productivity Contribution to 2008 GDP

Figure 15: Illustrative Estimate ICT Productivity Contribution to 2008 GDP

<table>
<thead>
<tr>
<th>Factors Driving Productivity Growth</th>
<th>Non-ICT 50%-67%</th>
<th>ICT Indirect Up to 17%</th>
<th>ICT Direct 33%</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Labor Quality (Skills, Education)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Non-ICT Capital Investment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Non-ICT-Driven Efficiencies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside of ICT Industries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• ICT-Driven Efficiencies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside of ICT Industries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• ICT Capital Investment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Efficiencies in ICT Industries</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Ballpark Estimate:**
ICT contributed up to 50% or $100 - $150 billion out of $300 billion in productivity driven GDP growth in 2008

IV
CONTINUED ICT GROWTH IS THE KEY POLICY OBJECTIVE

New policy approaches, rooted in the interdependent and competitive nature of the ICT ecosystem, have helped to spur the progress of convergence. Facilitating the continued growth of ICT remains a critical policy objective. The question will be how to encourage continued investment, adoption, and flexible interaction among industry players and consumers so that the ICT ecosystem continues to flourish and innovate. Doing so will require careful attention by policymakers to the entire ICT ecosystem and the checks and balances that exist within it.

Broadband supports the entire ICT sector and recent broadband policy decisions have helped spur healthy broadband investment. Policies have encouraged competing facilities-based providers to deploy broadband with private capital by moving to greater parity among broadband providers and choosing a monitoring and enforcement approach to protecting consumers rather than prescriptive mandates. In addition, policymakers have begun to break down barriers, encouraging entry into nontraditional markets. Where necessary, policy has turned to public-private partnerships or public investment, such as the recent broadband mapping and stimulus programs. Figure 16 shows that real growth in broadband and communications equipment investment in the last half decade coincided with a series of pro-competition and pro-investment policy decisions.

Any proposed change to current policies bears a heavy burden to demonstrate how that change could improve sector performance and to carefully account for the affects on jobs, growth and innovation as that change ripples through the ICT ecosystem. The risks involved in upsetting the balance that has produced the ICT record of economic success over the last several years should give pause to any policymaker considering changing course. Rather, policy should maintain a positive climate of ICT industry and consumer-driven investment, innovation and growth.
V CONCLUSIONS

ICT is a rapidly integrating, innovative sector requiring broad economic and policy perspectives. ICT industry players increasingly rely on each other to generate new value for consumers. At the same time, ICT industries are competing across traditional industry boundaries, bringing competitive discipline to the innovative process.

The sector has become a major engine of economic output and growth. ICT contributed $902 billion in GDP in 2007 – among the top contributing sectors in the U.S. economy and the primary driver of real, inflation-adjusted growth.

The U.S. depends on ICT to facilitate participation in the global information economy. U.S. industries invested $455 billion in ICT investment in 2008, representing 22% of total investment. Broadband providers alone invested over $64 billion in 2008. Annual network infrastructure investment is up over 30% since 2003. In addition to

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Figure 16: Real Investment Growth for Communications Equipment

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40 BEA, NIPA Table 5.5.6U Real Private Fixed Investment in Equipment and Software by Type, available at http://www.bea.gov/national/nipaweb/nipa_underlying/SelectTable.asp. FCC decisions are available at www.fcc.gov.
investment non-ICT sectors used $617 billion in ICT inputs to their production in 2007.

ICT investment and usage yields substantial economic benefits. Consumer ICT spending of $545 billion has been shifting to an increasing volume of innovative technologies and communications services, for a stable-to-declining share of income. ICT provides at least ten million jobs in ICT industries and across the economy (based on 2007 data). Economists have estimated that at least one-third, and likely more of ongoing productivity growth is attributable to ICT. The impact of productivity is to raise incomes, generate economic growth, and enhance U.S. global competitiveness.

The pro-competition and pro-investment environment of recent years has, bolstered the U.S. economy and generated hundreds of billions in investment, innovation, and consumer benefits. Any change to current policies bears a heavy burden to demonstrate how that change could improve sector performance and to carefully account for the affects on jobs, growth and innovation as that change ripples through the ICT ecosystem. Policy should maintain a positive climate of ICT industry and consumer-driven investment, innovation, and growth.
A. Measuring Economic Output

For the purposes of the analysis, we used the most common measure of economic output, Gross Domestic Product (GDP), as our foundation. Economists measure GDP as economic output for a period, such as a year, in three ways:

- **Value Added**: The value of gross output, i.e., the sum of total sales receipts across the economy, less the value of intermediate goods and services used as inputs to production.

- **Income**: The sum of employee compensation, taxes on production and imports less subsidies, and gross operating surplus, which is a measure of corporate profitability.

- **Expenditures**: The sum of the value of “final” expenditures by consumers, businesses, and governments.

Figure 17 is a simple depiction of the key terms and relationships between these three measures.\(^\text{41}\)

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The latter two approaches listed are expressed in the familiar macroeconomic equation, which states that GDP equals income (Y) which equals final expenditures, consisting of personal consumption (C), private investment (I), government spending (G), and the net of exports less imports (NX). We can extend the equation to value added (VA), expressing the relationship as \( GDP = Y = C + G + I + NX = VA \).

When measuring GDP, economists exclude intermediate goods and services purchased as inputs to production since their value is already included in the sale of the final product. Investment, on the other hand, is considered a final purchase and is included as part of GDP. This is because investment consists of fixed assets that have useful lives of more than a year and contribute to future production.

We use U.S. Department of Commerce, Bureau of Economic Analysis (BEA) data. Specifically, we use the Annual Industry Accounts for value added measures of GDP, which are appropriate for comparing ICT and other industries. We use the National Income and Product Accounts for expenditure and income measures of GDP, which offer a useful context for ICT consumption and investment. The Annual Industry Accounts are current through 2007 and the National Income and Product Accounts are current through 2008.
To put GDP numbers in context, using the value-added approach, gross output for 2007 was $25.809 trillion. After subtracting intermediate inputs of $12.001 trillion, value added, or GDP, for 2007 was $13.806 trillion. At the time of the writing of this paper, 2008 data for the value added approach were not available. However, using the expenditures approach, we know U.S. GDP in 2008 was $14.265 trillion, consisting of the following components:  

- $10.057 trillion in personal consumption expenditures (PCE).  
- $1.995 trillion in gross private investment, consisting of $2.041 in fixed private investment, offset by a $46 billion decline in private inventories.  
- $2.883 trillion in government spending, consumption plus investment.  
- An offset of $671 billion for the net of exports ($1.861 trillion) minus imports ($2.532 trillion).

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42 See NIPA Table 1.1.5, supra note 10.
B. **ICT-Centric Occupation List**

The employment analysis is based on U.S. Bureau of Labor Statistics, Occupations Employment Statistics 2007. In our analysis, the following occupations were classified as ICT-centric.

- Advertising and promotions managers
- Advertising sales agents
- Archivists
- Audio-visual equipment technicians
- Audio-visual collection specialists
- Broadcast news analysts
- Broadcast technicians
- Camera and photographic equipment repairers
- Camera operators, television, video, and motion picture
- Communications equipment operators, all other
- Communications teachers, postsecondary
- Computer and information scientists, research
- Computer and information systems managers
- Computer hardware engineers
- Computer operators
- Computer programmers
- Computer science teachers, postsecondary
- Computer software engineers, applications
- Computer software engineers, systems software
- Computer support specialists
- Computer systems analysts
- Computer specialists, all other
- Computer, automated teller, and office machine repairers
- Data entry keyers
- Database administrators
- Desktop publishers
- Electrical and electronic equipment assemblers
- Electronic equipment installers and repairers, motor vehicles
- Electronic home entertainment equipment installers and repairers
- Film and video editors
- Graphic designers
- Job Printers
- Librarians
- Library assistants, clerical
- Library science teachers, postsecondary
- Library technicians
- Media and communication equipment workers, all other
- Media and communication workers, all other
- Motion picture projectionists
- Network and computer systems administrators
- Network systems and data communications analysts
- Radio and television announcers
- Radio mechanics
- Radio operators
- Retail sales for ICT-associated products and services (electronics and communications equipment, content)
- Security and fire alarm systems installers
- Semiconductor processors
- Sound engineering technicians
- Switchboard operators, including answering service
- Telecommunications equipment installers and repairers, except line installers
- Telecommunications line installers and repairers
- Telemarketers
- Telephone operators
- Word processors

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43 Occupational Employment Statistics (4-digit NAICS), *supra* note 32.
C. Productivity Impact Estimate

We conservatively look only at the non-farm business sector, ignoring farms (a small portion of output) and housing (mostly imputed rents). Real GDP for the non-farm business sector grew 0.8% from $9.128 trillion in 2007 to $9.199 trillion in 2008.\textsuperscript{44} Productivity for the non-farm business sector grew 2.8%, meaning real GDP would have fallen 2% without the productivity growth.\textsuperscript{45} It follows that without productivity, real GDP for the non-farm business sector would have been $8.943 trillion. To get the nominal productivity impact, we need to convert to nominal dollars and compare to nominal GDP for the period. To convert to nominal dollars, for the sake of simplicity, we assume that the ratio of nominal to real GDP is the same before and after the productivity adjustment. Nominal non-farm business GDP was 10.917 billion in 2008, and real non-farm business GDP was 84.3% of that. Dividing $8.943 trillion by 84.3%, we get a nominal non-farm business GDP of $10.614 trillion without the productivity impact. Subtracting from actual non-farm business GDP of $10.917 trillion, we get a productivity impact of roughly $300 billion. We now attribute some portion of this productivity impact to ICT. Based on economic studies that allocated productivity growth to ICT in the 2000 to 2005/6 period\textsuperscript{46} we could speculate by extrapolating from the past that a third of the 2008 productivity impact was attributable to ICT capital deepening and total factor productivity of ICT firms. We could further speculate that about one-third of the impact was from labor improvement and non-ICT capital deepening, i.e., not affected by ICT, and the final third was affected attributable to total factor productivity of non-ICT firms. If the ICT impact on total factor productivity of non-ICT firms were zero, the total impact of ICT would be about one-third, or $100 billion dollars. If the ICT impact on total factor productivity of non-ICT firms were half, then the total ICT impact would be about fifty percent, or $150 billion. So a range of $100 billion to $150 billion seems to be a reasonable range for our estimate.

\textsuperscript{44} BEA, NIPA Table 1.3.6, available at http://www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N (last visited Apr. 16, 2009)

\textsuperscript{45} See Productivity and Costs: Fourth Quarter and Annual Averages, supra note 39.

\textsuperscript{46} See Jorgenson et al., supra note 36.