The Employment and Economic Impacts of Network Neutrality Regulation: An Empirical Analysis

Coleman Bazelon
The Brattle Group, Inc.

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About the Author

Dr. Coleman Bazelon is a principal in the Washington, DC office of The Brattle Group. He is an expert in regulation and strategy in the wireless, wireline, and video sectors. He has consulted and testified on behalf of clients in numerous telecommunications matters, ranging from wireless license auctions, spectrum management, and competition policy, to patent infringement, wireless reselling, and broadband deployment.

Dr. Bazelon frequently advises regulatory and legislative bodies, including the U.S. Federal Communications Commission and the U.S. Congress. He also has expertise in the federal government's use of discount rates for policy and regulatory analysis, intellectual property valuation, economic impact analysis, and antitrust and damages analysis.

Throughout his career, Dr. Bazelon has had extensive experience with spectrum license auctions. He advises on and evaluates numerous auction designs and regularly serves as an auction advisor for bidders in spectrum license auctions.

Prior to joining Brattle, Dr. Bazelon was a vice president with Analysis Group, an economic and strategy consulting firm. During that time, he expanded the firm's telecommunications practice area. He also served as a principal analyst in the Microeconomic and Financial Studies Division of the Congressional Budget Office where he researched reforms of radio spectrum management; estimated the budgetary and private sector impacts of spectrum-related legislative proposals; and advised on auction design and privatization issues for all research at the CBO.

Dr. Bazelon received his Ph.D. and M.S. in Agricultural and Resource Economics from the University of California at Berkeley. He also holds a Diploma in Economics from the London School of Economics and Political Science and a B.A. from Wesleyan University.

His CV is available at: www.brattle.com.

EXECUTIVE SUMMARY

As the Federal Communications Commission (FCC) continues its efforts to elaborate rules concerning net neutrality for Internet service in the U.S., it does so pursuant to Chairman Julius Genachowski's mandate for a fact- and data- driven approach to information.

One area of significant discussion has been the potential economic and employment impacts these rules may have. This paper seeks to provide policymakers at the FCC with an empirical analysis of such impacts.

Key Findings

New network neutrality regulations proposed by the FCC could slow the growth of the broadband sector, potentially affecting as many as 1.5 million jobs, both union and non-union, by the end of the decade.

If the network neutrality regulations being considered by the FCC were implemented:

- Revenue growth in the broadband sector could slow by about one-sixth over the next decade;
- Broadband sector jobs lost could be expected to total 14,217 in 2011, growing to 342,065 jobs by 2020;
- Economy-wide, 65,404 jobs could be put in jeopardy in 2011, with the total economy-wide impact growing to 1,452,943 jobs affected by 2020 due to reduced revenue growth in the broadband sector.

Mobile broadband is expected to be the source of most of the broadband growth over the next decade. Consequently, it would bear the largest share of the economic burden of network neutrality regulations. In 2008, mobile broadband lines accounted for only about one-quarter of all broadband lines, but would likely account for more than half of the economic losses over the coming decade if the proposed network neutrality regulations are put into place.

The possibility that such losses would be offset by gains in other parts of the Internet economy is remote. Notably, any dollar-for-dollar transfer of revenues from the broadband sector to the Internet content sector would be a net job loser because it takes significantly more spending on Internet content to create a U.S. job than it does to create one in the broadband sector.

I. INTRODUCTION

The Federal Communications Commission (FCC) recently sent to Congress the National Broadband Plan mandated by the American Recovery and Reinvestment Act of 2009.[1] That plan takes a multi-faceted approach to promoting broadband in America. At the same time, the FCC is engaged in a proceeding, "Preserving the Open Internet," that could result in the codification of network neutrality rules.[2] These policy developments are taking place against the backdrop of uncertainty about the FCC's authority to regulate broadband created by the recent ruling in *Comcast v. FCC*.[3] Clearly, such rules would shape how broadband providers interact with their customers and, consequently, would impact how broadband develops in America. This paper empirically examines the potential impacts of network neutrality regulations on revenue and employment in the broadband sector.

A proposal under consideration would have the FCC codify its existing four Internet principles and add two new ones: a nondiscrimination principle and an information disclosure (or transparency) principle.[4] The instant analysis does not turn on any one or two specific details of the proposed network neutrality regulations, but rather assumes that the rules will be strict, consistent with the FCC's proposal, such that they will change broadband providers' actions over the next decade—particularly in the nondiscrimination area. Such a constraining form of the network neutrality regulations would include strict nondiscrimination language that would severely limit broadband providers' ability to provide varying quality-of-service options and content prioritization.[5] The proposed rules would be much more limiting in what broadband providers could do—most dramatically in the expansion of the principles to mobile broadband providers—and would be a departure from the FCC's implementation to date of the first four Internet principles.

Broadband is an American success story. In little more than a decade, network deployment has progressed to the point where 95% of the U.S. population can now get fixed broadband at home, 98% can get 3G mobile broadband services, and nearly two-thirds have adopted broadband.[6] It facilitates the exchange of information—the lifeblood of our economy. As the FCC put it: "Like electricity a century ago, broadband is a foundation for economic growth, job creation, global competitiveness and a better way of life."[7] Any change in the rules affecting broadband should be well considered so as not to harm its future development. Particular care should be given not to derail growth of mobile broadband—the major source of broadband growth in the coming decade.

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1 Federal Communications Commission, "Connecting America: The National Broadband Plan," http://download.broadband.gov/plan/national-broadband-plan.pdf (accessed April 2, 2010).

2 Federal Communications Commission, 2009, "Notice of Proposed Rulemaking," GN Docket No. 09-191, WC Docket No. 07-52 (Released: October 22, 2009).

3 Comcast Corporation v. FCC & USA, No. 08-1291 (DC Cir) Decided April 6, 2010.

4 *Ibid.*

5 See, for example, Debbie Goldman, Gloria Tristani and Tillman Lay, "Comments of Communications Workers of America," GN Docket No. 09-191, WC Docket No. 07-52 (January 14, 2010): 14-21.

6 National Broadband Plan, *op. cit.*, 20, 22, 23.

7 National Broadband Plan, *op. cit.*, xi.

In the next section, the baseline broadband sector revenues are derived. The baseline revenues consist of revenue from expected fixed and mobile broadband connections plus sales of broadband connectivity to content and applications providers. The baseline sector growth starts at more than 20% per year and, absent the proposed regulations, is expected to continue to be at least 10% per year throughout the decade. If the proposed regulations are implemented, growth is expected to be about one-sixth less, leading to a decline in sector revenues compared to the baseline level. That decline in sector revenues is then used as the basis for estimating the employment and broader economic impacts associated with the proposed regulations. The employment losses associated with those reductions is found to be significant—14,217 direct broadband sector jobs lost in 2011 growing to 342,065 jobs lost by 2020; and economy-wide, affecting 65,404 jobs in 2011 growing to 1,452,943 by 2020. These additional jobs include both employment in sectors that feed into the broadband sector, such as equipment manufacturers, as well as employment created from the increased broadband sector income—everything from jobs in dry cleaners to retail and manufacturing. Following that analysis, an examination of wireline versus mobile broadband losses is provided and the relatively larger impact on the mobile sector is noted. The greater losses come about because the majority of broadband growth over the next decade will come from the mobile sector. Finally, the potential for offsetting gains from the Internet content sector is considered. It is unlikely that the Internet content sector could offset the job losses from the broadband sector because the employment deficit to overcome would be significant. Furthermore, the Internet content sector requires significantly more spending than the broadband sector to create a job. Thus, a dollar-for-dollar transfer from broadband infrastructure providers to Internet content providers would be expected to lead to a net decrease in employment.

II. BROADBAND BASELINE REVENUES

Broadband refers to various high-speed Internet access technologies.[8] The broadband sector consists of firms that provide broadband access, often called Internet Service Providers, such as network carriers and cable operators who deploy the broadband infrastructure and provide broadband services to businesses and consumers. To study the economic and employment impacts of network neutrality regulation, the broadband sector is divided into two broad sub-sectors based on the services sold: broadband services sold to end-users and broadband services sold to Internet content providers.

End-user service revenues are estimated first. At the end of 2008 there were approximately 102 million broadband lines in service, about one-quarter of which were wireless.[9] In 2008 there were approximately 16 million business lines, of which 9 million were wireless business lines.[10] The average price of a fixed home broadband connection is $41 per month.[11] The business

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8 The FCC notes six types of broadband technology: Digital Subscriber Line (DSL); Cable Modem; Fiber Optic Cable (Fiber); Wireless; Satellite; and Broadband over Power Lines (BPL), http://www.fcc.gov/cgb/consumerfacts/highspeedinternet.html (accessed April 2, 2010).

9 Federal Communications Commission, 2010, "High-Speed Services for Internet Access: Status as of December 31, 2008," (February 2010), Table 1, http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296239A1.pdf (accessed April 2, 2010).

10 *Ibid.*, Table 1 and Table 3, and The Brattle Group calculations.

11 John Horrigan, "Broadband Adoption and Use in America," OBI Working Paper Series 1 (February 2010): 15. $41 per month is very close to the results of a Pew Center study which found a $39 per month price.

connections seem to be largely of the SOHO[12] variety, which can sell for about one-and-a-half times a residential connection,[13] estimated to be $61 per month. Mobile broadband connections, consumer and business, are estimated to also sell for $41 per month.[14] End-user service revenues for 2008 were almost $52 billion. See Table 1.

Table 1
End-User Broadband Connections and Service Revenue (2008)

	Residential		Business		Total	
	Connections	$/Month	Connections	$/Month	Connections	$/Year
	1,000s		*1,000s*		*1,000s*	*$ 1,000s*
	[A]	[B]	[C]	[D]	[E]	[F]
[1] Fixed	70,148	$41.00	6,778	$61.00	76,926	$39,474,312
[2] Mobile	15,818	$41.00	9,299	$41.00	25,117	$12,357,564
[3] Total	85,966	$41.00	16,077	$49.43	102,043	$51,831,876

Source and Notes:
[A], [C]: Federal Communications Commission, 2010, "High-Speed Services for Internet Access: Status as of December 31, 2008," (February 2010), Table 1, http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296239A1.pdf (accessed April 2, 2010).
[B][1]: John Horrigan, "Broadband Adoption and Use in America." OBI Working Paper Series 1 (February 2010): 15.
[B][2]: Assumed to be the same as the price of a Residential Fixed line.
[B][3]: Calculated as the connections-weighted average of the fixed and mobile monthly prices.
[D][1]: Assumed to be ~1.5 times the price of a Residential Fixed line.
[D][2]: Assumed to be the same as the price of a Residential Mobile line.
[D][3]: Calculated as the connections-weighted average of the fixed and mobile monthly prices.
[E]: Calculated as [A] + [C].
[F]: Calculated as [A]*[B]*12 + [C]*[D]*12.

Revenues from services offered by broadband providers to content providers are estimated from the IMPLAN® model, a Social Accounting Matrix model that divides the U.S. economy into more than 400 sectors and estimates the web of interconnections between the sectors. (See Section III below for further discussion of IMPLAN®.) One sector of the IMPLAN® model is "352: Data Processing, Hosting, and Related Services" and includes such services as web and application hosting, and video and audio streaming services.[15] Because this category includes some services that are not part of the broadband sector as defined here, including cloud

[12] Small Office, Home Office.

[13] A multiple of 1.5 seems conservative. For pricing information of business connection, see, for example: http://business.comcast.com/internet/plans.aspx (accessed April 2, 2010), http://www.internode.on.net/business/internet/soho_adsl/all_plans/ (accessed April 2, 2010), and http://support.netyp.com/pricing_info/adsl_soho.htm (accessed April 2, 2010).

[14] An informal website survey of data pricing plans indicated that $41 per month was a reasonable estimate and unlike the SOHO market for fixed broadband connections, no significant differentiation existed between business and consumer pricing.

[15] All of the subsectors that make up each IMPLAN® sector used in this analysis are provided in Appendix A.

computing services and data processing, only a portion of this category is included under the broadband sector category. In 2008, that portion is set at 75%[16]which amounted to $59.1 billion.

The 2008 revenues are projected out to 2020.[17] The point of this projection is not to predict exactly where the broadband market will be in 10 years, but rather to estimate the economic impact of network neutrality regulations on that market development. Consequently, the baseline revenues for the broadband sector only need to be a reasonable forecast of market developments against which we can compare policy changes.[18]

Overall, broadband sector revenue is projected to have grown at a 23% annual rate in 2009, with that growth rate decreasing to 10% per year in 2016 and staying at that level through 2020. See Table 2, below. That growth can be split between the growth of broadband connections sold to end-users and services sold to content providers. Residential fixed lines continue to grow at 8% per year (the 2008 growth rate) until they reach 90% of households and thereafter grow at 2% per year. The business fixed lines grow at the same rate. The total mobile broadband lines are based on a combination of forecasts of smart phone adoption[19] and forecasts of the percentage of smart phones that use broadband capabilities.[20] The share of revenue from mobile broadband lines grows over the period, overtaking revenue from wireline broadband lines by 2013. The business versus residential split is fixed at its 2008 proportions of 37% business and 63% residential.[21] Prices are not forecasted to change.[22]

The mix of growth between end-user service revenues and revenues from sales to content providers is expected to change over the course of the next decade. The rapid growth in broadband lines will slow down in the next few years as the number of fixed lines becomes saturated. Robust growth of mobile broadband is expected to continue, but will represent smaller increases in overall broadband lines.

The broadband sector's sales to content providers are at the economic heart of the network neutrality debate. Proponents of network neutrality regulation are concerned that broadband providers will increase the share of revenue they extract from this sector by imposing variable

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16 IMPLAN® estimates the size of Sector 352: Data Processing, Hosting, and Related Services to be about $78.8 billion in 2008. World cloud computing spending in 2008, according to IDC (http://blogs.idc.com/ie/?p=224, accessed April 2, 2010), was about $16.2 billion. Sixty percent of that spending or about $10 billion is assumed to go to U.S. companies and is allocated to the content component of IMPLAN® Sector 352 (See Table 6). There are other segments included in Sector 352 that are not relevant to either the content or broadband component. Those were excluded leaving 75% of Sector 352 to be attributed to broadband in 2008.

17 All projections are done in 2010 dollars.

18 Because this analysis measures changes from the baseline, imprecision in the baseline only has second order effects on the analysis.

19 For the percentage of mobile phones that are smart phones, see, 2009-2014: "Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2009-2014," (February 9, 2010); 2014-2020: based on extrapolation of "S-curve" model.

20 FCC data indicates that smart phones that use broadband capability would be 50% in 2009. That percentage is increased until it reaches 100% in 2016.

21 Since prices for residential and business mobile broadband lines are assumed the same, the level of this split has no impact on the analysis.

22 The model is calibrated in 2010 dollars.

pricing and other discriminatory practices on content providers. Although revenues from sales to content providers would be expected to increase in any event with the growth of the content sector,[23] the sustained high growth rates compared to end-user service revenues reflected in the baseline incorporates the assumption that the broadband providers will likely find new ways to charge content providers.[24] The projections presented below reflect the assumption that as revenue growth from broadband end-user connections slows, it will be offset, at least in part, by increased revenues from content providers. See Table 2.

Table 2
Broadband Sector Baseline ($ Billions)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
[1] End-User Service Revenue	$52	$64	$76	$90	$106	$123	$140	$154	$160	$165	$170	$175	$179
[2] Services to Content	$59	$73	$87	$102	$121	$141	$163	$195	$224	$257	$295	$336	$384
[3] Broadband Total	$111	$137	$162	$192	$226	$264	$304	$349	$384	$422	$465	$511	$562
[4] Broadband Growth Rate		23.3%	18.7%	18.2%	17.8%	16.7%	15.0%	15.0%	10.0%	10.0%	10.0%	10.0%	10.0%

Source and Notes:
[1]: Based on FCC Form 477 data, Tables 1 and 3, available at http://www.fcc.gov/wcb/iatd/comp.html, and The Brattle Group calculations.
[2]: Calculated as 75% of Sector 352: Data processing, hosting, ISP, web search portals and related services as estimated by IMPLAN® in 2008. For 2009 - 2020, [3] - [1]
[3]: Previous year * (1 + [4]).
[4]: Based on broadband growth for 2009, tapering off to 15% in 2014 and to 10% from 2016 - 2020.

III. THE IMPLAN® MODEL

IMPLAN® is a widely used standard Social Accounting Matrix model (a form of input-output models) that estimates the relationships between economic expenditures, incomes and employment, both within sectors of the economy and between them.[25] It tracks the effect of demand for goods and services (expenditures) on inputs, including labor, needed to meet those demands. It estimates both the direct effects of expenditures and the indirect effects as firm revenue and labor income are then spent on other sectors of the economy. (These are referred to as indirect and induced effects, respectively.) Although the model is capable of sophisticated local and regional analysis, it is used here to estimate national employment and output impacts only.

[23] Sales to content providers have experienced higher growth rates in recent years compared with sales to end-users.

[24] Although it is possible that the growth in broadband provider revenues estimated here could be sustained by increasing revenues from current sources, the baseline projections are consistent with broadband providers imposing new charges on content providers.

[25] For more information on IMPLAN see the USDA Natural Resource Conservation service web page at: http://www.economics.nrcs.usda.gov/technical/implan/implanmodel.html. According to this web page: "The USDA Forest Service in the mid-70s developed IMPLAN for community impact analysis. The current IMPLAN input-output database and model is maintained and sold by MIG, Inc. (Minnesota IMPLAN Group). Over 1,500 clients across the country use the IMPLAN model, making the results acceptable in inter-agency analysis."

The model works by dividing the U.S. economy into more than 400 sectors. Although fairly detailed for a model of the entire economy, each IMPLAN® sector is itself an aggregation of many more detailed lines of business. For example, IMPLAN® sector "351: Telecommunications" includes both the wireline and wireless video, voice and broadband sectors. Consequently, broadband sector end-user service revenues are captured within the 'Telecommunications' sector. Likewise, revenues from broadband sector sales to content providers are captured in IMPLAN® sector '352: Data Processing, Hosting, and Related Services.' The details of the subsectors that make up each IMPLAN® sector used are provided in Appendix A.

This model reports the economic activity and employment associated with the broadband sector. The simulations estimate the changes in economic activity and employment associated with a strict network neutrality policy regime of the type proposed by the FCC. Whether or not these employment estimates represent net impacts on employment depends on whether these resources would be employed elsewhere or not. On the one hand, to the extent that the Internet sector uses resources that would otherwise be idle, the gross output and employment effects reported represent net effects. On the other hand, to the extent that these resources would be employed elsewhere in the economy, the net effects on spending and employment would be smaller than the gross effect reported here.

IV. NETWORK NEUTRALITY IMPACT ON THE BROADBAND SECTOR

The academic literature on possible effects of network neutrality regulation does not provide a consensus view on whether such regulations should be expected to help or harm the broadband sector, although several economists have concluded that such regulation would be harmful.[26] Furthermore, experience with analogous regulatory episodes suggests that price and/or access regulation imposed on privately owned infrastructure can be expected to impede investment and sector development. Relevant examples include:

- The 700 MHz C Block. In early 2008, the FCC auctioned most of the so-called 'digital dividend'—radio spectrum freed for new uses at the conclusion of the transition to digital

[26] Those expressing concern with net neutrality regulations include, Gerald R. Faulhaber, "Network Neutrality: The Debate Evolves," International Journal of Communication 1 (2007): 684-685; Bruce Owen and Gregory Rosston, "Local Broadband Access: Primum Non Nocere or Primum Processi? A Property Rights Approach," Stanford Institute for Economic Policy Research (SIEPR) Discussion Paper No. 02-37 (2003); Robert Hahn, and Scott Wallsten, "The Economics of Net Neutrality," Economists' Voice (2006), www.bepress.com/ev.; Martin Cave and Pietro Crocioni, "Does Europe Need Network Neutrality Rules?," International Journal of Communication 1 (2007). Prominent proponents of net neutrality include Professor Lawrence Lessig (see, for example, U.S. Senate, Committee on Commerce, Science and Transportation, *Testimony of Lawrence Lessig Hearing On "Network Neutrality"* (February 7, 2006), and Vinton Cerf (see, for example, U.S. Senate Committee on the Judiciary Hearing on Reconsidering our Communications Laws *Prepared Statement of Vinton G. Cerf, Vice President and Chief Internet Evangelist, Google Inc.* (June 14, 2006). Inimai Chettiar and J. Scott Holladay support net neutrality regulations but agree that "it is impossible *a priori* to determine how the market surplus [of the broadband and content sectors] would shift." Inimai M. Chettiar and J. Scott Holladay, "Free to Invest The Economic Benefits of Preserving Net Neutrality," Institute for Policy Integrity, New York University School of Law (January 2010): 44.

television broadcasting. In a significant policy experiment, the FCC imposed "requirements for open platforms for devices and applications."[27] As with all open access regulations, concerns were expressed about the negative impacts on the value of the band from decreased investment incentives associated with such regulations.[28] The 700 MHz auction had numerous design flaws that make it difficult to draw definitive conclusions about the impact of the open access requirements on the value of the C Block.[29] Nevertheless, the C Block did sell at a significant discount to the average price paid for spectrum in the 700 MHz auction[30] and the lower price was attributed by some bidders to the open access regulations.[31]

- E.U. Broadband Unbundling. In Europe, several studies have attempted to examine the impact of open access regulation on investment in broadband. Typically such studies focus on service penetration, assessing the impact of open access regulations on measures such as broadband subscribers per 100 inhabitants. These studies find that facilities-based competition based on competing networks, as opposed to access-based competition based on regulatory opening of private networks, drives broadband penetration.[32]

- UK Rail. Open access policies are widely perceived to have performed very poorly in the British rail industry. Prior to the 1993 Railway Act, the British rail industry was a state-owned vertically integrated monopoly. The Railway Act privatized the industry, dividing it into separate companies. The initial experience with privatization was positive, with rapid growth in both passenger and freight traffic.[33] Costs and subsidies declined, following an initial substantial increase in subsidies as a result of privatization of infrastructure and rolling stock and the introduction of commercially based charges for their use.[34] However, following a serious accident attributed to poor infrastructure

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27 Federal Communications Commission, 2007, "Second Report and Order," WT Docket No. 06-150 (Released: August 10, 2007): ¶ 195.

28 Coleman Bazelon, "Too Many Goals: Problems with the 700 MHz Auction," Information Economics and Policy 21 (2009): 120.

29 See, for example, *ibid.* Also see, Babette Boliek, "Net Neutrality Regulation in the Mobile Telecommunications Market: A Cautionary Tale from the Era of Price Regulation," George Mason University School of Law (2008).

30 "The price discount in the 700 MHz auction for the C Block was 48% in total value and 72% on a $/MHz-Pop basis." Bazelon, *op. cit.*, 124.

31 From an interview with Ralph de la Vega, President and CEO of AT&T Mobility on CSPAN on December 14, 2009, http://www.youtube.com/watch?v=lqVwbGE763A (accessed April 2, 2010).

32 Perhaps the most careful recent analyses of this question are Walter Distaso, Paolo Lupi, and Fabio M. Manenti, "Platform Competition and Broadband Uptake: Theory and Empirical Evidence from the European Union" (paper presented at the 2004 EARIE and ITS Conferences, January 2005); Scott Wallsten, "Whence Competition in Network Industries? Broadband and Unbundling Regulations in OECD Countries," Technology Policy Institute (December 2007); Leonard Waverman, Meloria Meschi, Benoit Reillier, and Kalyan Dasgupta, "Access Regulation and Infrastructure Investment in the Telecommunications Sector: An Empirical Investigation," LECG (September 2007).

33 Luisa Affuso, Alvaro Angeriz, and Michael Pollitt, "The Impact of Privatisation on the Efficiency of Train Operation in Britain," Centre for Globalization Research Working Paper 28, Queen Mary University of London (2009). Also see, Rico Merkert, "The Restructuring and Future of the British Rail System," Institute of Transport Studies, University of Leeds, Working Paper 586 (February 2005).

34 *Ibid*.

maintenance and resulting in severe speed restrictions and disruptions to service, the private infrastructure company, Railtrack, was placed in the hands of receivers and a new not-for-profit company, Network Rail, took its place.[35] The lesson from the UK rail experience is that structural separation (an extreme form of open access) can lead to underinvestment in infrastructure. Although privatization was hoped to lead to increased investments, the separation of the infrastructure owner and operating companies meant that some of the costs created by underinvestment in rail infrastructure (disruptions to service and safety concerns) were not fully felt by the firm responsible for the investment decisions.

Perhaps the most analogous regulatory episode was the U.S. broadband open access regulations in the first half of the last decade. Broadband open access and net neutrality regulations are both regulatory interventions aimed at restricting a broadband network owner's ability to exercise market power.[36] The first acts at a structural level to eliminate any potential market power in the provision of the good; the second acts at a behavioral level restricting the broadband provider's ability to benefit from any such market power. Since both sets of regulations aim to tie infrastructure owners' hands in the same way—prevent them from acting anti-competitively—the rules are expected to have similar impacts on their behavior. Consequently, the experience with broadband open access provides a natural experiment to examine the potential effects of net neutrality regulation.

A study by Thomas Hazlett and Anil Caliskan of George Mason University estimates the effect of deregulation on DSL service.[37] At the end of 2002, unregulated cable modem subscriptions outnumbered regulated DSL subscriptions by two-to-one. By 2006, 4 years after deregulation began, DSL lagged behind cable modem service by less than 15%.[38] Using various statistical specifications, they found that the quarterly rate of DSL growth increased by about 18% with deregulation.[39] An increase of 18% translates into roughly 15% when measured as a decline in the growth rate.

A one-sixth decline in the broadband sector growth rate seems reasonable. The DSL experience should not be taken as determinative of what will happen under the proposed network neutrality regulations. Rather, it is suggestive of the general size of the impact such regulations can have. Apart from the DSL experience, a 15% reduction in the growth rate of the broadband sector is a modest benchmark to use in the current analysis. It allows for sector growth near the

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35 Chris Nash, "Regulatory Reform in Rail Transport - the UK experience," Swedish Economic Policy Review 9, no. 2 (2002) cited in Chris Nash and Cesar Rivera-Trujillo, "Rail regulatory reform in Europe – principles and practice," Institute for Transport Studies, University of Leeds (September 2004).

36 In this analysis, I am not taking a position on whether or not or to what degree broadband providers have market power. These regulations—broadband open access and net neutrality—would not be proposed absent a concern about market power.

37 Thomas W. Hazlett and Anil Caliskan, "Natural Experiments in U.S. Broadband Regulation," George Mason University Law and Economics Research Paper Series, 08-04 (February 2008).

38 *Ibid,* Table 5 reports year-end 2006 cable modem subscribers of 29.33 million and DSL subscribers of 25.14 million.

39 *Ibid,* Table 4 and page 14, show an increased DSL growth rate of 6.3% when DSL was deregulated by being declared an information service in addition to the approximately 12% increase observed following the elimination of line sharing. This accounts for a total effect of 18.3%.

levels anticipated under the status quo (the sector continues to grow at five-sixths of the baseline growth rates). Of course, should the effects of network neutrality regulation be greater or smaller than the benchmark used here, the economic and employment impacts measured here would be greater or smaller as well.

Reducing the growth rate of the broadband sector by around 15% per year would have a significant negative impact on employment and economic activity. Table 3 reports the decreased revenues in the broadband sector beginning in 2011. The loss—$5 billion in 2011, growing to $100 billion by 2020—increases over time and represents a 2.5% smaller sector in 2011 and a 17.7% smaller sector by 2020. See Table 3.

Table 3
Alternative Broadband Sector Revenue ($ Billions)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
[1] Baseline Broadband Sector	$111	$137	$162	$192	$226	$264	$304	$349	$384	$422	$465	$511	$562
[2] Baseline Broadband Growth Rate		23.3%	18.7%	18.2%	17.8%	16.7%	15.0%	15.0%	10.0%	10.0%	10.0%	10.0%	10.0%
[3] Reduced Broadband	$111	$137	$162	$187	$215	$245	$276	$311	$337	$365	$395	$427	$462
[4] Reduce Broadband Growth Rate		23.3%	18.7%	15.3%	14.9%	14.0%	12.6%	12.6%	8.4%	8.3%	8.3%	8.3%	8.2%
[5] Decrease in Broadband Spending	$0	$0	$0	$5	$11	$19	$28	$38	$47	$58	$70	$84	$100
[6] Reduced Broadband Sector Size	0.0%	0.0%	0.0%	2.5%	4.9%	7.1%	9.1%	11.0%	12.3%	13.7%	15.0%	16.4%	17.7%

Source and Notes:
[1]: See Table 2, line 3.
[2]: See Table 2, line 4.
[3]: (1 + [4] Current Year) * [3] Previous Year.
[4]: Hazlett & Caliskan find an increase of 18.3% in the quarterly growth of DLSs as a result of FCC deregulation reversing open access rules.
The 18.3% increase due to deregulation translates to approximately 15.5% decrease.
This reduction in quarterly growth was translated to reductions in the baseline annual growth rate of Broadband revenues.
Thomas W. Hazlett and Anil Caliskan, "Natural Experiments in U.S. Broadband Regulation," George Mason University Law and Economics Research Paper Series, 08-04 (February 2008).
[5]: [1] - [3].
[6]: [5] / [1].

As reported in Table 4, the reduced direct broadband spending of $5 billion in 2011 would flow through the economy by way of indirect effects on business spending (business purchasing inputs from other sectors) and induced effects on labor income (employees spending their income across the economy) to reduce economic activity by $14 billion in 2011. The total economic activity supported by the lost broadband spending would grow to $292 billion by 2020—almost 3 times the direct loss in the broadband sector of $100 billion.

Table 4
Broadband Sector Loss of Economic Activity and Associated Jobs (2011- 2020)

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Output ($ billion)										
[1]	Direct Effect	5	11	19	28	38	47	58	70	84	100
[2]	Total Effect	14	32	54	79	111	137	168	203	244	292
	Employment										
[3]	Direct Effect	14,217	32,777	55,425	81,871	117,716	149,154	186,980	231,001	281,981	342,065
[4]	Total Effect	65,404	150,791	254,980	375,121	530,495	662,363	818,445	999,548	1,208,731	1,452,943

Source and Notes:
[1]: See Table 3, line 5.
[2] - [4]: The Brattle Group calculations based on IMPLAN®.

The economic activity lost in the broadband sector would support significant employment in that sector and economy-wide. In 2011, the lost broadband sector output of $5 billion would have generated 14,217 jobs in the broadband sector, and the $14 billion in economy-wide economic activity would have supported a total of 65,404 jobs. The cumulative effect of the reduced growth rate of the broadband sector would grow substantially by 2020. In that year, the $100 billion in reduced broadband sector revenues would have generated 342,065 broadband sector jobs and the $292 billion economy-wide impact would have supported 1,452,943 jobs.

V. WIRELESS VERSUS WIRELINE IMPACTS

Currently, broadband deployments are dominated by wireline connections. As Table 1 indicates, in 2008 roughly three-quarters of all broadband lines were wired. Within a few years, however, wireline broadband connections will begin to reach a saturation level.[40] In contrast, mobile connections are only starting to grow in earnest. Furthermore, saturation of mobile broadband is limited by population, whereas fixed broadband connections are limited by the much smaller number of households. As reported in Table 5, the consequence of this is that although direct employment losses in the near-term are higher for wireline broadband (56% wireline versus 44% mobile in 2011), the losses in the mobile sector exceed those in the wireline sector by 2013 and continue to increase over the next decade (42% wireline versus 58% mobile in 2020).

[40] In 2008, fixed broadband connections were adopted by about 60% of total households. In the baseline represented in Table 2 (above), those connections continue to grow at 8% per year until they reach 90% of U.S. households (the assumed saturation rate) in 2015 and then are projected to grow at about 2% per year—in line with household growth—through the end of the decade. Even if the saturation level of fixed broadband lines was higher than 90%, it is unlikely to exceed 100%. Consequently, fixed broadband connections are likely to reach a saturation point before the end of the decade.

Table 5
Broadband Sector Loss by Wireline vs. Mobile ($ Billions)

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Employment Loss										
[1]	Wireline	7,911	16,737	26,226	36,782	52,221	64,775	80,404	98,367	118,918	144,257
[2]	Percent of Total	56%	51%	47%	45%	44%	43%	43%	43%	42%	42%
[3]	Mobile	6,305	16,040	29,199	45,090	65,495	84,379	106,576	132,634	163,063	197,808
[4]	Percent of Total	44%	49%	53%	55%	56%	57%	57%	57%	58%	58%
[5]	Direct Jobs Lost	14,217	32,777	55,425	81,871	117,716	149,154	186,980	231,001	281,981	342,065

Source and Notes:
[1]: [2]*[5].
[2]: Based on FCC Form 477 data, Tables 1 and 3 (http://www.fcc.gov/wcb/iatd/comp.html) and The Brattle Group calculations.
[3]: [4]*[5].
[4]: Based on FCC Form 477 data, Tables 1 and 3 (http://www.fcc.gov/wcb/iatd/comp.html) and The Brattle Group calculations.
[5]: See Table 4, line [3].

VI. THE CONTENT SECTOR

Some proponents of more comprehensive network neutrality regulation proposals have suggested that job losses in the broadband sector might be offset by increased employment in the Internet content sector.[41] This conclusion seems highly unlikely for at least three reasons. First, there is no *a priori* expectation of any *net* increase in jobs in the Internet content sector. Second, the potential losses in the broadband sector are large, thus creating a significant employment benchmark that would need to be exceeded by new employment in the Internet content sector for there to be a net increase in jobs. Third, jobs in the Internet content sector are more expensive than jobs in the broadband sector in that it takes more spending on Internet content to create a U.S. job than it does in the broadband sector.

A. EXPECTED IMPACT OF NETWORK NEUTRALITY REGULATION ON THE INTERNET CONTENT SECTOR

The Internet content sector comprises all of the websites and Internet based services that broadband end-users access over broadband connections. For the content sector, the effect of potential discrimination in pricing and services is ambiguous. Simply put, a regime of network neutrality regulation will likely have different content winners than a regime without network neutrality regulation, but there is no *a priori* reason to believe there will be more content with or without such regulations.

Under a regime absent of network neutrality regulations, some Internet content will thrive. For example, services and applications that will benefit from being able to have guaranteed

[41] See, for example, Ben Scott, "Comments of Free Press," GN Docket No. 09-191, WC Docket No. 07-52 (January 14, 2010): 69.

quality-of-service will do better in an environment where broadband providers can offer enhanced quality-of-service. Streaming video, voice and video conferencing, health monitoring, and gaming applications are just some of the existing applications that may benefit from being able to purchase guaranteed levels of quality-of-service. Services and applications with strong network effects may also benefit from being able to pay for priority treatment. Furthermore, many of the large commercial Internet sites that are commercially viable today should continue to do well. But of course, as with all things Internet, it is the yet to be developed services and applications that may benefit the most.

Under the strict network neutrality regime being considered by the FCC, different Internet content might flourish. In particular, some Internet content is less commercial and generates very little revenue.[42] Content that does not generate much economic value may be advantaged by a network neutrality regime.[43] It is worth noting, however, that such content, by not primarily being engaged in the economy, does not significantly impact employment. Larger commercial sites have the potential of doing better or worse under network neutrality regulations. On the one hand, potentially lower costs of access should benefit them; on the other hand, potentially less developed broadband infrastructure could harm their businesses. With some content winning and some content losing, there is no reason to believe that the total amount of content will be more or less (or more or less valued by Internet users) under one regime or the other. Some business models will do well under one regime, others under the other regime.

B. THE EMPLOYMENT DEFICIT THE INTERNET CONTENT SECTOR WOULD HAVE TO OVERCOME IS LARGE

Even though there is no expectation of more Internet content under a regime of strict network neutrality regulation, the estimates here suggest that the Internet content sector would have to be almost one-half larger than its expected size in 2020 (already expected to be 4 times larger than in 2009) to offset the potential losses from the broadband sector. See Tables 6 and 7, below. This offsetting growth would require more than simply the content sector capturing the broadband sector's losses—it would take almost $300 billion in content sector revenues to offset the employment impacts of a $100 billion loss in the broadband sector—because each dollar spent on content supports less employment than a dollar spent on broadband.

In the IMPLAN® framework, two IMPLAN® sectors are used to estimate the economic effects of spending on Internet content. The first is "350: Internet Publishing & Broadcasting," which includes web publishing and broadcasting as well as Internet search portals. This sector is

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[42] "Some websites (such as Yahoo, Facebook, and YouTube) derive a great deal of benefit from accessing Internet users. The price these websites pay ISPs to upload information onto the Internet is far below their willingness-to-pay for access to Internet users, meaning they extract a great deal of benefit (i.e., "surplus") from the transaction, and they would pay more if needed. Other websites generate very little revenue (such as personal blogs, academic sites, and niche message boards), and those content providers may not be willing to pay much more than their current upload fees to access Internet users." Chettiar and Holladay, *op. cit.*, 21.

[43] Although even under a non-network neutrality regime, noncommercial content should not be disadvantaged because there is little incentive for broadband providers to discriminate against content that their subscribers value, assuming the content does not put undue demands on the broadband network.

assumed to grow at historical annual rates of 20.5%[44] through 2009, then fall to 15% per year in 2012 through 2015 and then to 10% per year through 2020. The second IMPLAN® sector is "352: Data Processing, Hosting, and Related Services," which includes cloud computing and other application service providers. This sector is assumed to grow at 27% per year through 2009[45] and then fall to 15% per year in 2012 through 2015 and then to 10% per year through 2020. The baseline for the Internet content sector is provided in Table 6.

Table 6
Internet Content Sector Baseline ($ Billions)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
[1] Internet Publishing & Broadcasting	$120	$144	$171	$202	$232	$267	$307	$353	$388	$427	$470	$516	$568
[2] Data processing, hosting, and related services	$10	$12	$15	$19	$22	$25	$29	$34	$37	$41	$45	$49	$54
[3] Total Internet Content Sector	$130	$157	$186	$221	$254	$292	$336	$386	$425	$467	$514	$566	$622
[4] Overal Sector Growth Rate		21.0%	18.7%	18.7%	15.0%	15.0%	15.0%	15.0%	10.0%	10.0%	10.0%	10.0%	10.0%

Source and Notes:
[1]: 2008 Output for IMPLAN® sector 350: Internet Publishing & Broadcasting as estimated by IMPLAN®. 2008 - 2009 growth of 20.5% from Service Annual Survey available at http://www2.census.gov/services/sas/data/Historical/sas-08.pdf. 2012 - 2015 growth is assumed at 15% per year, thereafter growth rate is assumed at 10% through 2020.
[2]: The International Data Corporation (IDC) estimates that world cloud computing spending for 2008 is $16,235 million. It is assumed that 60% of the amount is spent in the U.S. Spending is projected to reach $42,270 million in 2012. This implies an annual growth rate of about 27% which is used for 2008 - 2009, 2009 - 2011 growth rate is adjusted for inflation, 2012 - 2015 growth is assumed at 15% per year, thereafter growth rate is assumed at 10% through 2020.
[3]: [1] + [2]
[4]: Growth rate of [3].

The Internet content sector would have to grow significantly for the jobs supported by that growth to be equal to (much less exceed) the jobs associated with the expected losses in the broadband sector. See Table 7. In 2011, content sector output would have to be about $12 billion higher than the baseline projection of $221 billion, more than a 5% increase. That required increase in the content sector size grows to 48% by 2020.

[44] The 20.5% growth rate is obtained by comparing the 2006 and 2007 revenues of sub-sectors: Internet publishing and broadcasting, web search portals, online newspapers, books, periodicals, directories, databases, and other collections of information from the 2007 Service Annual Survey (SAS). The SAS is published by the U.S. Census Bureau and is conducted to provide national estimates of annual revenues and expenses of select service sectors. http://www2.census.gov/services/sas/data/Historical/sas-08.pdf (accessed April 2, 2010).

[45] IDC estimates that world cloud computing spending for 2008 is $16,235 million. It is assumed that 60% of the amount is spent in the U.S. Spending is projected to reach $42,270 million in 2012. This implies an annual growth rate of about 27%. http://blogs.idc.com/ie/?p=224 (accessed April 2, 2010).

Table 7
Required Increase in Content Sector Economic Activity to Offset Losses in the Broadband Sector (2011 – 2020)

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
[1] Direct Jobs	*Employment*	14,217	32,777	55,425	81,871	117,716	149,154	186,980	231,001	281,981	342,065
[2] Economic Activity	*$ Billions*	$12	$29	$48	$71	$103	$130	$163	$202	$246	$298

Source and Notes:
[1]: See Table 4, line [3].
[2]: The Brattle Group calculations based on IMPLAN®.

The differences in output required to support a given number of jobs are illustrated by Tables 4 and 7. The 14,217 jobs lost in 2011 are associated with a $5 billion decrease in broadband output; the same 14,217 jobs in the Internet content sector are associated with a $12 billion increase in output. Likewise, by 2020, the 342,065 jobs in the broadband sector associated with lost broadband spending of $100 billion are associated with $298 billion in direct Internet content sector revenues.

C. RELATIVE 'COST' OF JOBS IN THE BROADBAND AND INTERNET CONTENT SECTORS

Some proponents of strict network neutrality regulations argue that by taking additional revenues from the content sector through variable or tiered pricing, there will inevitably be less 'wealth' in the sector and, presumably, less content in the future.[46] This argument ignores an important off-setting consideration—namely, that so-called non-neutral pricing in the context of the Internet need not be a zero sum transfer of wealth from the content sector to broadband sector, but very easily could grow the pie. Nevertheless, to the extent that the absence of network neutrality regulations leads to a transfer of 'wealth' (or sector revenues) from the Internet content sector to the broadband sector, such a transfer would be expected to have a positive impact on employment. Dollar for dollar transfers between the broadband and the Internet content sectors do not have neutral effects on employment. As Table 8 indicates, in 2011, each dollar of spending in the broadband sector supports about twice as many direct jobs as in the content sector (2.95 v 1.32 jobs per million dollars of spending in 2011). Taking the indirect and induced effects into account to examine economy-wide impacts, each dollar of spending in the broadband sector still supports significantly more employment (4.72 v 3.52 jobs per million dollars of spending in 2011). Consequently, any transfers of wealth induced by network neutrality regulations—of a flow of revenue from broadband providers to content providers—would be expected to have a negative impact on employment.

[46] See, for example, Chettiar and Holladay, *op. cit.*, 20-23.

Table 8
Jobs per One Million
Dollars of Sector Revenues

	Sector	2011 *Direct* Jobs / $1 MM	2011 *Total* Jobs / $1 MM
[1]	Broadband Sector	2.95	4.72
[2]	Content Sector	1.32	3.52

Source and Notes:
[1] - [2]: The Brattle Group calculations based on IMPLAN®.

This overall disparity can be seen in individual company data. See Table 9. The largest representatives of the Internet content sector generated more than twice the revenue per U.S. employee in their Internet business segments than the largest broadband providers. This relative difference in revenue per employee is not explained by higher wages in the Internet content sector alone.[47] Absent higher wages, the additional revenue per employee in the content sector must be accounted for in some other way. The possibilities are higher non-labor costs (unlikely when comparing content to infrastructure), more off-shore (or outsourced) employment, and/or higher profitability of the sector.[48]

[47] IMPLAN® calculates 2011 labor income per worker of $89,496 for the Internet content sector and $78,697 for the broadband sector, a difference of less than 14%—only a fraction of the difference in Internet revenue per U.S. employee.

[48] "For network companies, 64% of cash flow is reinvested into the network (as capital expenditures) and 14% of it is taken as net income (profits). In contrast, non-network companies invest only 28% of cash flow generated by operations back into the economy, while retaining 49% of the cash as profits. In summary, network companies create more jobs and return more cash back into the economy than non-network companies." Larry F. Darby, Joseph P. Fuhr, Jr. and Stephen B. Pociask, "The Internet Ecosystem: Employment Impacts of National Broadband Policy," The American Consumer Institute Center for Citizen Research (January 28, 2010): 24.

Table 9
Internet Revenue per U.S. Internet Employee

	2007 Internet Revenue	US Internet Employees	Revenue / Employee
	$ Billions		*$ Thousands*
Google	$17	15,124	$1,097
Yahoo	$7	10,725	$617
Microsoft	$3	3,855	$757
AT&T	$6	15,092	$384
Verizon	$3	8,397	$398
Comcast	$5	17,416	$309

Source and Notes:
Hamilton Consulting, "Economic Value of the Advertising-Supported Internet Ecosystem," (June 10, 2009): 29, 38.

VII. CONCLUSION

As the FCC undertakes the next steps in its important review of proposed rules to preserve an open Internet in the U.S., it should carefully avoid implementing policies that will hinder its attempts to promote universal access to high-speed broadband in America. Nor should it adopt policies that would negatively impact the U.S. economy or the jobs outlook. As this analysis suggests, strict network neutrality rules of the type proposed by the FCC would be one such counterproductive policy. If implemented, network neutrality rules could lead to a broadband sector that is almost 18% smaller than it would otherwise be by the end of the decade. That decrease would disproportionately impact the wireless sector and would unlikely to be offset by any potential increased growth in the Internet content sector. An 18% reduction in the broadband sector would lead to a loss of almost 350,000 broadband sector jobs, both union and non-union jobs, and impact about 1.5 million jobs economy-wide. Consequently, network neutrality regulations would be counterproductive to reaching the FCC's goals of increased broadband connectivity and the associated economic benefits that connectivity would bring.

Appendix A
IMPLAN ® Sector Components

Internet Service Providers

IMPLAN Code: 351, IMPLAN Category: Telecommunications

NAICS code and description:

517110	Telecommunications networks, wired
5172	Wireless Telecommunications Carriers (except Satellite)
517410	Resellers, satellite telecommunication
517410	Satellite telecommunication carriers
517410	Satellite telecommunication resellers
517911	Long-distance telecommunication resellers (except satellite)
517911	Resellers, telecommunication (except satellite)
517911	Wireless telecommunication resellers (except satellite)
517919	Earth stations (except satellite telecommunication carriers)
517	Telecommunications
517110	Facilities-based telecommunication carriers (except wireless)
517110	Telecommunications carriers, wired
517110	Telephone installation by telecommunications carriers, wired
517110	Wired Telecommunications Carriers
517210	Telecommunications carriers, cellular telephone
517911	Microwave telecommunication resellers
517911	Pre-paid calling cards, telecommunications resellers
517911	Telecommunications resellers
517911	Wired telecommunication resellers
517919	Other Telecommunications
517110	Cable TV providers (except networks)
517110	Direct broadcast satellite (DBS)
517110	Direct-to-home satellite systems
517110	Music program distribution, cable or satellite
517110	Satellite master antenna television service (SMATV)
517110	Satellite television distribution systems
517210	Ship-to-shore broadcasting communication carriers (except satellite)
517210	Telephone communications carriers, wireless (except satellite)
517210	Wireless data communication carriers (except satellite)
517210	Wireless telephone communications carriers (except satellite)
517410	Earth stations for satellite communication carriers
517410	Long-distance telephone satellite communication carriers
517210	Two-way paging communication carriers
517919	Radar station operations
517919	Telemetry and tracking system operations on a contract or fee basis
517919	Information access services via client supplied telcommunications connection
517919	Internet access providers via client supplied telcommunications connection
517919	Internet service providers (ISP) via client supplied telcommunications connection
517919	ISP (internet service providers) via client supplied telcommunications connection
517919	On-line access service providers via client supplied telcommunications connection
517110	Cable television distribution services
517110	Closed circuit television (CCTV) services
517110	Direct broadcast satellite (DBS) services
517110	Direct-to-home satellite system (DTH) services
517110	Local telephone carriers, wired
517110	Long-distance telephone carriers, wired
517110	Multichannel multipoint distribution services (MMDS)
517210	Mobile telephone communication carriers, except satellite
517210	Paging services, except satellite
517210	Radio paging services communications carriers
517210	Ship-to-shore broadcasting communication carriers, except satellite
517210	Two-way paging communication carriers, except satellite
517210	Wireless data communication carriers, except satellite
517210	Wireless Internet service providers, except satellite
517210	Wireless video services, except satellite
517210	Mobile telephone communication carriers, except satellite
517210	Paging services, except satellite
517210	Radio paging services communications carriers
517210	Ship-to-shore broadcasting communication carriers, except satellite
517210	Two-way paging communication carriers, except satellite
517210	Wireless data communication carriers, except satellite
517210	Wireless Internet service providers, except satellite
517210	Wireless video services, except satellite
517210	Mobile telephone communication carriers, except satellite

Internet Service Providers

IMPLAN Code: 351, IMPLAN Category: Telecommunications

NAICS code and description:

517410	Telephone communications carriers, satellite
517911	Telephone communications resellers (except satellite)
517919	Satellite telemetry operations on a contract or fee basis
517919	Satellite tracking stations on a contract or fee basis
517110	Cable program distribution operators
517110	Closed circuit television (CCTV)
517110	Local telephone carriers (except wireless)
517110	Long-distance telephone carriers (except wireless)
517110	Telegram services (except wireless)
517110	Telephone carriers, facilities-based (except wireless)
517110	Television operations multichannel multipoint distribution services (MMDS)
517110	Television operations, closed circuit
517110	Television operations, multipoint distribution system
517110	Broadband Information access services (eg. Cable, DSL)
517110	Broadband Internet access providers (eg. Cable, DSL)
517110	Broadband Internet service providers (ISP) (eg. Cable, DSL)
517110	Broadband ISP (internet service providers) (eg. Cable, DSL)
517110	Broadband On-line access service providers (eg. Cable, DSL)
517210	Beeper (i.e., radio pager) communication carriers
517210	Cellular telephone communication carriers
517210	Cellular telephone services
517210	Mobile telephone communication carriers
517210	Paging services
517210	Personal communication services (PCS) (i.e., communication carriers)
517210	Radio paging services communication carriers
517210	Paging services, except satellite
517210	Radio paging services communications carriers
517210	Ship-to-shore broadcasting communication carriers, except satellite
517210	Two-way paging communication carriers, except satellite
517210	Wireless data communication carriers, except satellite
517210	Wireless Internet service providers, except satellite
517210	Wireless video services, except satellite
517110	Cable television distribution services
517110	Closed circuit television (CCTV) services
517110	Direct broadcast satellite (DBS) services
517110	Direct-to-home satellite system (DTH) services
517110	Local telephone carriers, wired
517110	Long-distance telephone carriers, wired
517110	Multichannel multipoint distribution services (MMDS)
517919	Satellite tracking stations
517919	Satellite tracking stations
517110	Cable television distribution services
517110	Closed circuit television (CCTV) services
517110	Direct broadcast satellite (DBS) services
517110	Direct-to-home satellite system (DTH) services
517110	Local telephone carriers, wired
517110	Long-distance telephone carriers, wired
517110	Multichannel multipoint distribution services (MMDS)
517919	Satellite tracking stations
517110	Internet service providers, using own operated wired telecommunications infrastructure (e.g., cable, DSL)
517110	On-line access service providers, using own operated wired telecommunications infrastructure
517110	VoIP service providers, using own operated wired telecommunications infrastructure
517110	Internet service providers, using own operated wired telecommunications infrastructure (e.g., cable, DSL)
517110	On-line access service providers, using own operated wired telecommunications infrastructure
517110	VoIP service providers, using own operated wired telecommunications infrastructure
517919	Dial-up Internet service providers, using client-supplied telecommunications connections
517919	Internet service providers, using client-supplied telecommunications (e.g., dial-up ISPs)
517919	On-line access service providers, using client-supplied telecommunications (e.g., dial-up ISPs)
517919	VoIP service providers, using client-supplied telecommunications connections
517919	Dial-up Internet service providers, using client-supplied telecommunications connections
517919	Internet service providers, using client-supplied telecommunications (e.g., dial-up ISPs)
517919	On-line access service providers, using client-supplied telecommunications (e.g., dial-up ISPs)
517919	VoIP service providers, using client-supplied telecommunications connections
517110	Internet service providers, using own operated wired telecommunications infrastructure (e.g., cable, DSL)
517110	On-line access service providers, using own operated wired telecommunications infrastructure
517110	VoIP service providers, using own operated wired telecommunications infrastructure
517919	Dial-up Internet service providers, using client-supplied telecommunications connections
517919	Internet service providers, using client-supplied telecommunications (e.g., dial-up ISPs)
517919	On-line access service providers, using client-supplied telecommunications (e.g., dial-up ISPs)
517919	VoIP service providers, using client-supplied telecommunications connections

Internet Service Providers

IMPLAN Code: 352, IMPLAN Category: Data processing, hosting, and related services

NAICS code and description:

5181	Internet Service Providers and Web Search Portals
518	Internet service providers, web search portals, and data processing services - specify service
518210	Application hosting
518210	Application service providers (ASPs)
518210	ASPs (Application Service Providers)
518210	Automated data processing services
518210	Computer input preparation services
518210	Computer time leasing
518210	Computer time rental
518210	Computer time sharing services
518210	Data capture imaging services
518210	Data entry services
518210	Data processing computer services
518210	Data processing services (except payroll services, financial transaction processing services)
518210	Disk and diskette conversion services
518210	Disk and diskette recertification services
518210	Electronic data processing services
518210	Media streaming services
518210	Microfiche recording and imaging services
518210	Microfilm recording and imaging services
518210	Optical scanning services
518210	Scanning services, optical
518210	Web hosting
518210	Computer data storage services
518210	Video and audio streaming services

Content Providers

IMPLAN Code: 350, IMPLAN Category: Internet Publishing & Broadcasting

NAICS code and description:

519130	Advertising periodical publishers, exclusively on Internet
519130	Agricultural magazine and periodical publishers, exclusively on Internet
519130	Almanac publishers, exclusively on Internet
519130	Art publishers, exclusively on Internet
519130	Atlas publishers, exclusively on Internet
519130	Book publishers, exclusively on Internet
519130	Broadcasting exclusively on Internet, audio
519130	Broadcasting exclusively on Internet, video
519130	Business directory publishers, exclusively on Internet
519130	Calendar publishers, exclusively on Internet
519130	Catalog of collections publishers, exclusively on Internet
519130	Children's coloring book publishers, exclusively on Internet
519130	Comic book publishers, exclusively on Internet
519130	Diary and time scheduler publishers, exclusively on Internet
519130	Dictionary publishers, exclusively on Internet
519130	Directory publishers, exclusively on Internet
519130	Discount coupon book publishers, exclusively on Internet
519130	Electronic directory publishers, exclusively on Internet
519130	Encyclopedia publishers, exclusively on Internet
519130	Entertainment sites, Internet
519130	Fiction book publishers, exclusively on Internet
519130	Financial magazine and periodical publishers, exclusively on Internet
519130	Game sites, Internet
519130	Pattern and plan (e.g., clothing patterns) publishers, exclusively on Internet
519130	Periodical publishers, exclusively on Internet
519130	Portals, web search
519130	Postcard publishers, exclusively on Internet
519130	Poster publishers, exclusively on Internet
519130	Professional book publishers, exclusively on Internet
519130	Professional magazine and periodical publishers, exclusively on Internet
519130	Publishers, Internet greeting card
519130	Publishers, Internet map
519130	Publishers, Internet racing form
519130	Racetrack program publishers, exclusively on Internet
519130	Racing form publishers, exclusively on Internet
519130	Radio guide publishers, exclusively on Internet
519130	Radio schedule publishers, exclusively on Internet
519130	Religious book publishers, exclusively on Internet
519130	Religious magazine and periodical publishers, exclusively on Internet
519130	Scholarly journal publishers, exclusively on Internet
519130	Scholastic magazine and periodical publishers, exclusively on Internet
519130	School book publishers, exclusively on Internet
519130	School textbook publishers, exclusively on Internet
519130	Scientific journal and periodical publishers, exclusively on Internet
519130	Search portals, Internet
519130	Special interest portals (e.g., parents sharing information about child rearing, etc.), internet

Content Providers

IMPLAN Code: 350, IMPLAN Category: Internet Publishing & Broadcasting

NAICS code and description:

519130	Greeting card publishers, exclusively on Internet
519130	Guide, street map, publishers, exclusively on Internet
519130	Internet book publishers
519130	Internet broadcasting
519130	Internet comic book publishing
519130	Internet entertainment sites
519130	Internet game sites
519130	Internet magazine publishing
519130	Internet news publishers
519130	Internet newsletter publishing
519130	Internet newspaper publishing
519130	Internet periodical publishers
519130	Internet radio stations
519130	Internet search web sites
519130	Internet sports sites
519130	Internet video broadcast sites
519130	Juvenile magazine and periodical publishers, exclusively on Internet
519130	Magazine publishers, exclusively on Internet
519130	Map publishers, exclusively on Internet
519130	Medical journal and periodical publishers, exclusively on Internet
519130	Newsletter publishers, exclusively on Internet
519130	Newspaper publishing, exclusively on Internet
519130	Nonfiction book publishers, exclusively on Internet
519130	Pamphlet publishers, exclusively on Internet
519130	Street map and guide publishers, exclusively on Internet
519130	Technical magazine and periodical publishers, exclusively on Internet
519130	Technical manual publishers, exclusively on Internet
519130	Telephone directory publishers, exclusively on Internet
519130	Television guide publishers, exclusively on Internet
519130	Trade journal publishers, exclusively on Internet
519130	Trade magazine and periodical publishers, exclusively on Internet
519130	Travel guide book publishers, exclusively on Internet
519130	University press publishers, exclusively on Internet
519130	Video broadcasting, exclusively on Internet
519130	Web broadcasting
519130	Web communities (except web search portals)
519130	Web search portals
519130	Yearbook (e.g., high school, college, university) publishers, exclusively on Internet
519190	Clipping services, news
519190	Press clipping services
519190	Stock photo agencies
519190	Telephone-based recorded information services
519190	Title search services (except real estate)
519130	Internet search portals
519130	Web communities
519130	Internet search portals
519130	Web communities
519190	News clipping services

Content Providers

IMPLAN Code: 352, IMPLAN Category: Data processing, hosting, and related services

NAICS code and description

Please refer to IMPLAN code 352 in Internet Service Providers section.