WIRELESS NET NEUTRALITY REGULATION AND THE PROBLEM WITH PRICING: AN EMPIRICAL, CAUTIONARY TALE†

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> [F]our Internet principles that guide our case-by-case enforcement of the communications laws . . . can be summarized as: Network operators cannot prevent users from accessing the lawful Internet content, applications, and services of their choice, nor can they prohibit users from attaching non-harmful devices to the network. . . . The fifth principle [I propose] is one of non-discrimination—stating that broadband providers cannot discriminate against particular Internet content or applications. This means they cannot block or degrade lawful traffic over their networks, or pick winners by favoring some content or applications over others . . . .[1]

INTRODUCTION

The term "network neutrality" or "net neutrality" has been so bandied about of late that even a casual observer of Internet technology and policy likely has some familiarity with it. Roughly defined, net neutrality encompasses principles of commercial Internet access that include equal treatment and delivery of all Internet applications and content.[2] For some, net neutrality stands further for the proposition that Internet access operators should not be permitted to provide different qualities of service for application providers, even if those application providers can freely choose their desired quality of service.[3] What the casual observer may be

1. Julius Genachowski, Chairman, FCC, Preserving a Free and Open Internet: A Platform for Innovation, Opportunity, and Prosperity, Prepared Remarks at the Brookings Institution (Sep. 21, 2009), *available at* http://openinternet.gov/read-speech.html, [hereinafter Chairman's Statement]. A sixth principle proposed by Chairman Genachowski is "a transparency principle—stating that providers of broadband Internet access must be transparent about their network management practices." *See id.* The original four principles were officially adopted in an FCC policy statement for wireline broadband access facilities on August 5, 2005. Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, 20 F.C.C.R. 14,986 (Sep. 23, 2005) [hereinafter The Four Principles].

2. *See* The Four Principles, *supra* note 1, and *infra* Part II for a more in-depth discussion of net neutrality.

3. Most often referred to as the "non-discrimination principle," this is the fifth principle Chairman Genachowski proposed for FCC rulemaking. *See* Chairman's Statement, *supra* note 1. *See also* Bruce M. Owen, *Antecedents to Net Neutrality*, 30 REGULATION 14 (2007).

unaware of, however, is that net neutrality principles are, for the first time, being proposed for the wireless communications market.[4] Previous net neutrality regulation has been directed at traditional Internet services provided by telephone and cable companies. Although the focus of regulation has changed from wired access to include wireless access, the underlying rationales and assumed benefits from imposing such regulation have not changed. One of the "compelling reasons to be concerned about the future of openness . . . [is the] limited competition among service providers."[5] To be sure, there are well-established economic tenets that support such a concern.

One of the stated goals of most economic regulation is to support otherwise vulnerable consumers.[6] When consumers benefit from more of

As used in this Article, "application" signifies both applications (such as Google, Yahoo, and YouTube) and the content delivered by those applications.

4. "[E]ach form of Internet access has unique technical characteristics, they are all are [sic] different roads to the same place. It is essential that the Internet itself remain open, *however users reach it*." Chairman's Statement, *supra* note 1 (emphasis added). Acknowledging the unique technology of mobile communications, however, the Chairman added, "The rulemaking process will enable the Commission to analyze fully the implications of the [six network neutrality] principles for mobile network architectures and practices . . . . " *Id.* Network neutrality principles have already made inroads into mobile communications regulation in the formulation of the January 2008, 700-MHz spectrum auction, which includes "open platform" building requirements. Service Rules for the 698–746, 747–762 and 777–792 MHz Bands: Second Report and Order, FCC No. 07-132 ¶ 195 (August 10, 2007), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-07-132A1.pdf [hereinafter *FCC 700 MHz Band Auction*]; American Recovery and Reinvestment Act of Feb. 17, 2009, Pub. L. No. 111-5, 123 Stat. 115 [hereinafter Recovery Act] (allocating $7.2 billion for broadband deployment and incorporating by reference the four original network neutrality principles). Critics of open access interconnection requirements are battling the current Skype petition, which seeks to allow consumer premise equipment (CPE) to be attached at the discretion of end-users. SKYPE COMMUNICATIONS S.A.R.L., PETITION TO CONFIRM A CONSUMER'S RIGHT TO USE INTERNET COMMUNICATIONS SOFTWARE AND ATTACH DEVICES TO WIRELESS NETWORKS (Feb. 20, 2007), *available at* http://files.ctia.org/pdf/Skype_Wireless_Device_Petition_2-20-07.pdf [hereinafter SKYPE PETITION]. The House of Representatives is looking at one version of the zero-price rule as embedded in the Internet Freedom Preservation Act of 2009, H.R. 3458, 111th Cong. (2009). This bill calls for, among other things, regulation to "guard against discriminatory favoritism" by network providers and requires the FCC to assess if network providers add charges for quality of service to certain Internet applications and service providers. *Id.*

5. *See* Chairman's Statement, *supra* note 1; *see also* Jordan Golson, *Competition Breeds Lower Broadband Prices*, GIGAOM, June 17, 2009, http://gigaom.com/2009/06/17/competition-breeds-lower-broadband-prices/ (last visited Oct. 10, 2009)(citing the Pew Internet & American Life Project in its confirmation of a direct correlation between the number of competitive choices available and the benefit to consumers); NAT'L TELECOMM. INFO. ADMIN., DEP'T OF COMMERCE, *Networked Nation: Broadband in American 2007* (Jan. 2008), *available at* http://www.ntia.doc.gov/reports/2008/NetworkedNationBroadbandinAmerica2007.pdf (noting the connection between innovation and competition and the policies designed to create an environment to support both).

6. For example, a stated goal of establishing the National Broadband Plan is "advancing . . . consumer welfare" through the use of broadband infrastructure and services. A

what they desire in a product—lower prices, faster Internet access speeds, innovative applications and equipment—then consumer welfare increases. If a market is competitive, each operator will vie with the others to become as attractive, and fulfill as many consumer desires, as possible. Competition breeds the need for continued investment. No individual competitor can charge inordinately high prices, or fall too far behind in innovation, speed, or other desirable characteristics, or it will quickly find itself surpassed by more vigorous rivals.[7] In the past, the premise of the network neutrality regulation argument has been, however, that telephone and cable Internet service providers (ISPs) are not competitive but, rather, constitute a *de facto* duopoly.[8] The argument for net neutrality regulation of these "last-mile" operators is that the application and equipment providers, and their consumers, must be protected from the inordinate amount of anticompetitive market power such last-mile providers may exercise.[9]

Although much of the net neutrality regulation debate involves an examination of the economics of the traditional ISP market (DSL, cable and fiber—"wired" technologies), the arguments encouraging net neutrality regulation have migrated to the mobile telecommunications market with a noticeable lack of empirical evidence of systemic, anti-

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NATIONAL BROADBAND PLAN FOR OUR FUTURE, *Notice of Inquiry*, FCC No. 09-31, GN Docket No. 09-51 ¶ 9 (Apr. 8, 2009).

7. It is this competitive phenomenon to which President Obama referred as follows:

> If there were four or more competitive providers of broadband service to every home, then cable and telephone companies would not be able to create a bidding war for access to the high-speed lanes [on the Internet]. But here's the problem. More than 99 percent of households get broadband services from either cable or a telephone company.

Barack Obama, Then-U.S. Senator, Network Neutrality Podcast Transcript (June 8, 2006), *available at* http://obama.senate.gov/podcast/060608-network_neutral/print.php [hereinafter Obama].

8. *See, e.g.*, Tim Wu, *Why You Should Care About Network Neutrality*, SLATE, May 1, 2006, http://www.slate.com/id/2140850S (explaining that the "gatekeepers to the Internet [are] in most places a duopoly of the local phone and cable companies"); Karl Bode, *New FTC Boss: Tough on Broadband's Duopoly?*, DSLREPORTS.COM, May 12, 2009, http://www.dslreports.com/shownews/New-FTC-Boss-Tough-On-Broadbands-Duopoly-102398.

9. A "last-mile provider" is a provider that controls the hard-wire media or communications access into a given residence or commercial building. In other words, given a communications transport system, it is the "last-mile" in the delivery of content to the consumer. Such hard-wire access is relatively unique and, for various reasons, difficult to replicate. Many proponents of network neutrality argue that there is a broadband duopoly in the DSL cable access market. This bottleneck creates market power in the local access market that is viewed as problematic. *See, e.g.*, Cybertelecom, Federal Internet Law Policy: An Educational Project, Net Neutrality, http://www.cybertelecom.org/ci/neutral.htm (last visited Jan. 15, 2008). In contrast, mobile telecommunications are based on broadcast technology rather than hard-wire and therefore bypass the need for physical access to residential or commercial buildings.

competitive behavior in the latter.[10] Regulators and analysts alike have consistently found the present-day mobile communications market to be competitive.[11] If indeed this is the case, it calls into question the underlying rationale for network neutrality regulation with respect to mobile communications.[12]

Although lack of competition in the mobile industry may compel regulatory action, the FCC has demonstrated that a finding of competition in the market is not dispositive for regulatory forbearance.[13] Because the ultimate regulatory decision may not rest on competitive indicators, in this Article I seek to move the debate beyond a pure analysis of market competition to ask a more fundamental policy question—will the proposed network neutrality regulation improve the welfare of wireless Internet consumers? Arguably, even if the market is relatively competitive, there may be some blockades, or market failures, that prevent the market delivery of the most consumer beneficial mix of net neutral attributes. Proponents of regulation argue in part that Internet access providers are unable to internalize the long-term benefits of network neutrality and thus optimize their profits at socially suboptimal levels of neutrality.[14] Or, in the alternative, that in an effort to internalize externalities, network operators look to discriminate among end users and uses,

10. Most proponents of network neutrality regulation agree that competition is a means by which neutrality may be provided if consumers so demand. *Cf.* Obama, *supra* note 7, at 1 (asserting that (at least) four competitors are necessary to combat the theoretical problem of broadband service providers entering bidding wars for Internet access on standard cable and DSL networks).

11. *See, e.g.*, Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993: Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services ("Annual CMRS Competition Report"), *Thirteenth Report*, FCC No. DA 09-54 at ¶¶ 1–2 (Jan. 16, 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-09-54A1.pdf [hereinafter *Thirteenth Report*]; Annual CMRS Competition Report, *Twelfth Report*, FCC No. 08-28 at ¶¶ 1–2 (Feb. 8, 2008), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-28A1.pdf [hereinafter *Twelfth Report*]; Annual CMRS Competition Report, *Eleventh Report*, FCC No. 06-142, 21 F.C.C.R. 10947, 10950 ¶¶ 2–3 (Sept. 29, 2006) *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-142A1.pdf [hereinafter *Eleventh Report*]. Anywhere from three to six or more providers may operate in any given mobile telecommunications market. Of those operators, four are national facilities-based competitors. *See Thirteenth Report*, *supra*, ¶¶ 2, 14.

12. This Article does not examine the state of competition in the DSL or cable ISP markets.

13. For example, the FCC has stated that it looks to the marketplace to deliver the benefits of "choice, innovation and affordability" to consumers but will regulate if market forces "*alone* may not achieve broader social goals." 700 MHz Band Auction, *supra* note 4, ¶ 200 (explaining the decision to introduce open access requirements to the CMRS market in spite of finding the market "effectively competitive") (emphasis added).

14. *See* Tim Wu, *Network Neutrality, Broadband Discrimination*, 2 J. TELECOMM. & HIGH TECH. L. 141, 143 (2003); LAWRENCE LESSIG, THE FUTURE OF IDEAS: THE FATE OF THE COMMONS IN A CONNECTED WORLD (Random House 2001).

and that such discrimination will reduce application level innovation.[15] Assuming for the sake of argument that there exists some such welfare diminishing roadblock, to justify intervention the regulatory solution must be superior to the unregulated results otherwise the "cure will . . . be worse than the disease."[16]

Whether regulation can maximize consumer welfare above the status quo is an empirical question. Empirical analysis of new or yet to be enacted regulation necessitates the use of a proxy (existing) dataset. The more analogous the dataset is to the proposed regulation, the more informative the analysis. In this instance I examine two particular regulatory interpretations of network neutrality currently proposed. The first interpretation involves a general call to temper the network operator's ability to meter or impose consumption-based billing practices on end users or residential consumers (retail price control).[17] Under one such proposal, broadband service providers would be required to file their usage-based service plans with the FTC for FTC review of their "economic reasonableness and necessity" and to assure that no terms are "unjust, unreasonable, or unreasonably discriminatory."[18]

The second proposed regulation I examine is on the opposite side of the operator's two-sided demand equation and is often called the "zero-price" access rule (wholesale price control).[19] Roughly stated, a zero-price

15. This is largely a critique of unregulated network management that looks to solve congestion problems by, for example, targeting the most broadband-intensive applications or end users. *See, e.g.*, Wu, *supra* note 14, at 144 (noting that bandwidth management may result in overly-broad application layer controls or price discrimination).

16. *See generally* FTC, BROADBAND CONNECTIVITY COMPETITION POLICY 70 (2007) *available at* http://www.ftc.gov/reports/broadband/v070000report.pdf.

17. *See, e.g.*, Angele A. Gilroy, *Access to Broadband Networks: The Net Neutrality Debate*, CONG. RESEARCH SERV., June 1, 2009), http://assets.opencrs.com/rpts/R40616_20090601.pdf("Although most concede that networks have and will always need some management . . . the initiation of metered/consumption-based billing practices ha[s] further fueled the debate"); *see also*, Broadband Internet Fairness Act, H.R. 2092, 111th Congress (2009)(authorizing the FTC in consultation with the FCC to "review volume usage service plans of major broadband Internet service providers to ensure that such plans are fairly based on cost.").

18. Broadband Internet Fairness Act, *supra* note 15, at § 3(b)(3). It is not dispositive to this discussion that the bill may not succeed. The bill demonstrates a certain type of policy reaction in the face of metered consumer pricing. Arguably, the FCC could independently recategorize the provision of Internet access as common carrier (Title II) service. *See* Nat'l Cable & Telecomm. Ass'n v. Brand X Internet Serv., 545 U.S. 967, 1413–14 (2005). Under Title II of the Telecommunications Act, dominant and nondominant common carriers must file tariffs, and dominant carriers are subject to price-cap and rate-of-return regulation. 47 U.S.C. §§ 203(b), 204(a)(3); 47 C.F.R. §§ 61.38, 61.41, 61.58; *Implementation of Section 402(b)(1)(A) of the Telecommunications Act of 1996: Report and Order*, 12 F.C.C.R. 2170, 2182, 2188, 2191–92, 2202–03 ¶¶ 19, 31, 40, 67 (1997).

19. *See, e.g.*, C. Scott Hemphill, *Network Neutrality and the False Promise of Zero-Price Regulation*, 25 YALE J. ON REG. 135 (2008). The term "wholesale price control" is ap-

access rule prohibits the wireless Internet network operator from charging an application provider a fee to send information to that network operator's subscribers.[20] For example, in the parlance of net neutrality, the zero-price access rule prohibits access charges to applications by customer networks. The ultimate goal, or objective function, of the zero-price rule is to ensure access of application providers to consumers and thereby increase network effects and encourage innovation by application providers.[21] This is often referred to as encouraging innovation at "the edge" of the Internet where some believe all innovation should, and does, reside.[22] The zero-price rule, given the network principle that consumers have access to all legal applications, translates to mandated application access at a price equal to zero.[23] Although the goal of network neutrality is to insure innovation and openness, the regulatory mechanism is price control—regulated retail and wholesale pricing. There is an extensive history of price and access regulation in the mobile communications industry which is examined here to inform the current debate with concrete, empirical analysis.

In short, I present here a unique empirical analysis of the consumer welfare benefits of prior regulation in the mobile telecommunications industry. In particular, I analyze the relative consumer benefits of state

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plied loosely here to emphasize that applications that demand access to the network are ultimately "inputs" to the end users' Internet experience.

20. This should not be confused with the price charged to an application provider by its own local ISP for initial access to the Internet. This zero-price rule is arguably an extreme version of the non-discrimination principle. Other alternatives may be to permit "tiered pricing" for different categories of like-applications. Because the analysis provided here is based on analogy, it can be applied against alternative proposals as appropriate.

21. *See, e.g.*, Hemphill, *supra* note 19, at 150 (noting concern that absent the rule operators may block competing applications or shift costs to application providers, thereby decreasing application investment and innovation in that market).

22. The transportation network built by Internet service providers is referred to as the "core." As Lawrence Lessig and Robert W. McChesney have commented, innovation is at the edge with producers and users, not connecting networks. Op-Ed., *No Tolls on the Internet*, WASH. POST, Jun. 8, 2006, at A23. Contrary to this belief which characterizes the core as just a "dumb pipe," the edge and the core of the Internet are arguably economic complements engaged in joint innovation. *See* Hemphill, *supra* note 19, at 165. The innovations of the core that have increased transport speeds and provided sufficient capacity, such as streaming video, have afforded the opportunity for greater innovation at the edge. The dichotomy of core versus edge innovation does not hold given the joint nature of the innovation path. This convergence of intelligence at the edge and in the core is problematic to many network neutrality regulation proponents because it threatens the "end-to-end" principle of the Internet, which would keep protocol, transport, and application levels separate as protection for the development of applications and content.

23. *See, e.g.*, Owen, *supra* note 3, at 14 ("Net neutrality policies could only be implemented through detailed price regulation . . . ."); Hemphill, *supra* note 19, at 137 (describing how net neutrality goes beyond common carrier condition as common carriers were permitted to engage in price discrimination not allowed under the price uniformity of the zero-price rule).

rate regulation and federal entry regulation. The institution of filing requirements and FTC review and approval of various consumer pricing regimes is highly analogous to the consumer price controls imposed by various state level public utility commissions in the past.[24] Furthermore, the imposition of a zero-price rule is analogous to past rate regulation; in particular it is similar to past wholesale regulation with its underlying principles of open access and interconnection rights to non-network competitors. Consumer welfare in this empirical analysis is defined in terms of consumer prices, not in express terms of innovation increases in the application and equipment markets.[25] A motivating rationale behind the zero-price rule, and network neutrality regulation in general, is that each application provider should enjoy nondiscriminatory access to the Internet for the equal opportunity to compete for the attention of end users.[26] Consumer prices offer a proxy for the size of the available network because as prices decrease subscribership typically increases.[27] As the size of the network increases, the benefit of network effects (e.g., profit, reputation, and notoriety) increases and, therefore, the incentive for innovation by application and equipment innovators increases.[28]

My analysis is set forth as follows. Part I presents a brief overview of a few key elements of the network neutrality debate that have led to various proposals for direct or indirect price regulation. Part II presents an introduction to the mobile communications industry and describes the unique dataset I use. Part III sets forth the empirical model to test for the efficacy of past regulation, including consumer price regulation and wholesale "open access" pricing regulation, and presents the results.

24. *See infra* Part III (describing various state regulatory regimes).

25. Innovation and consumer prices are arguably highly-correlated, as innovation depends on the exploitation of network economies of scale—the larger the network, the more profit is possible and so, the greater the incentive for investment in further innovation. Price also has the advantage of being highly quantifiable. In contrast, a quantifiable definition of innovation at the edge would be highly subjective and quite difficult to track. Moreover, consumer prices correlate to penetration rates, which has the added benefit of acting as a proxy for (the also unquantifiable) "spill-over" benefits associated with an individual's access to Internet content. *See generally*, Brett M. Frishman & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257 (2007) (discussing the societal importance of (unquantifiable) spillover effects).

26. The arguments relating to access and innovation are varied. One argument is that if applications were charged for access, some applications would never be developed, thus stifling innovation. *See* J. Gregory Sidak, *What Is the Network Neutrality Debate Really About?*, 1 INT'L J. OF COMMC'N 377, 383 (2007). Another argument is that incumbent providers of Internet content would pay to block new entrants. *Id.* Similarly, access providers with application businesses (such as Time Warner with streaming video) would vertically integrate and charge competing applications high access fees. *See* discussion *infra* Part II.B.2.

27. *See* discussion *infra* Part III.A.

28. *See* The Four Principles, *supra* note 1, at 14,988 (Principles 1–3); *see also* Chairman's Statement, *supra* note 1 (the Fifth Principle).

Specifically, *price* regulation, akin to proposed consumer price regulation and the zero-price rule, is shown to have had little or no benefit to consumers and may have harmed consumers in some instances. Moreover, even subjectively innocuous regulation is shown to have, at best, an ambiguous effect on consumer welfare. Comparable analysis of regulation increasing *market entry* suggests great consumer welfare benefits, indicating that regulation is best directed at encouraging increased competition rather than dictating specific network neutrality requirements to individual operators. Finally, the Conclusion sets forth the policy recommendations indicated by the empirical results.

I. THE NETWORK NEUTRALITY DEBATE AND THE PROBLEM WITH PRICE

For those unfamiliar with the network neutrality debate, a brief primer may be of use. In some regards, network neutrality is more a term of art than a precise goal or singular definition. However, some or all of the following general tenets are common. Under a network neutral regime, individuals can access anyone or any content available on the Internet, can use any application they may choose and can innovate devices without the network provider's approval.[29] For their part, network providers demonstrating network neutral principles do not discriminate with regard to application (even if the application is a competitive service offering, e.g., VoIP), and preferred services are offered on the same terms to all comers.[30]

At first glance, these tenets appear straightforward and easily accomplished. Behind each of these principles, however, lurks threats to a network provider's ability to manage congestion, to recoup the considerable investment costs of network building, and to engage in the many contractual arrangements involved in introducing new products and applications to consumers.[31] In the following discussion, it is important to

29. *See* The Four Principles, *supra* note 1, at 14,988 (Principles 1–3); *see also* Chairman's Statement, *supra* note 1.

30. John Eggerton, *Obama Makes Network-Neutrality Pledge*, BROAD. & CABLE, Oct. 29, 2007, http://www.broadcastincable.com/index.asp?layout=articlePrint (last visited Feb. 5, 2008).

31. *Network Neutrality: Hearing Before the S. Comm. on Commerce, Sci. & Transp.*, 109th Cong. 59-63 (2006) (testimony of J. Gregory Sidak), *available at* http://ssrn.com/abstract=942054 (noting the importance of the operator's ability to recoup sunk costs and manage congestion); *see generally*, P. Faratin et al., *Complexity of Internet Interconnections: Technology, Incentives and Implications for Policy,* 35th Annual Telecommunications Policy Research Conference, George Mason University (2007), *available at* http://people.csail.mit.edu/wlehr/Lehr-Papers_files/Clark%20Lehr%20Faratin%20Complexity%20Interconnection%20TPRC%202007.pdf.

keep in mind that similar to other telecommunications industries, the mobile Internet access market is characterized by a joint demand structure, or a two-sided market.[32] If the network is the center, the core, on one side of the core are competitors seeking interconnection rights, handset manufacturers vying for adoption and applications and content providers looking for transport. I term this loosely the "wholesale" demand for the network. On the other side of the core is consumer demand for access to the Internet. This is the "retail" demand for the network. Listed below are brief descriptions of various aspects of the Internet access industry (in particular mobile Internet access) which have been cited to justify network neutrality regulation. The list includes (A) restrictions on network interconnectivity and on the use of non-network equipment, (B) restrictions, blocked access and differential pricing on certain Internet applications, and (C) consumer tiered pricing regimes. Sections A and B correspond to certain issues raised on the wholesale side of demand, and Section C looks at the retail side.

A. *Control of Network Property—Network Interconnectivity, Consumer Premise Equipment and the Zero-Price Access Rule*

Interconnectivity and "open access" requirements are among the most complex and rapidly changing of the net neutrality tenets. Commercial Internet access in particular is characterized by a host of bi-lateral contractual obligations and agreements that result in the presentation of content and applications to the "eyeball" of the end user.[33] There are various levels in this transit process at which net neutrality advocates might call for mandatory interconnectivity rights, seeing such rights as a means by which application and content neutrality may be secured.[34] Critics in turn warn that given the complexity of the transit structure, regulators are unlikely to make the nuanced decisions necessary to enhance consumer welfare and are more likely to simply increase uncertainty in the market and discourage network investment.[35] As no brief discussion will do justice to this subject, no such discussion is attempted here. Instead, presented below is the case of mandated access of

32. Faratin, *supra* note 31.

33. *See generally*, P. Faratin et al., *The Growing Complexity of Internet Interconnection*, 72 COMMC'NS & STRATEGIES 51 (2008) *available at* http://ssrn.com/abstract=1374285.

34. *See* Wu, *supra* note 14, at 142 (noting, but rejecting, that structural remedies like open access might be potentially counterproductive in the promotion of network neutrality.)

35. *See* Broadband Deployment Plan Should Include Performance Goals and Measures to Guide Federal Investment, GAO-09-494 at 10 (Gov't Accountability Office May 2009) (citing the FCC's decision to release incumbent local telephone companies from its mandate permitting competitors to interconnect to the incumbents' networks with cost-based rates in order to expand incentives for incumbents to invest).

consumer premise equipment (e.g., handsets) at a regulated price of zero (or otherwise).

A prior example of the zero-price rule exists in the FCC decision *Carterfone* which concerned the attachment of wireline, consumer premise equipment.[36] The extension of the *Carterfone* principle of mandated access at a price has been proposed, and to some extent adopted, for consumer premise equipment in the mobile telecommunications market.[37] The third net neutrality principle is that consumers be able to attach any non-harmful device to a network, based on the premise that it is welfare enhancing to mandate that network owners allow "open access" to foreign (non-network) applications, software and equipment.[38] Net neutrality proponents argue that handsets and various other network attachments are not part of the network core but are rather part of the edge—locked into the core only by exclusive phone deals.[39] Therefore, they conclude, that these attachments should be protected from discriminatory network behavior in the same manner applications are protected by net neutrality regulation.[40] The proposal is that attachments be allowed on any given network at a price of zero after having met minimal technical requirements.[41] Currently, mobile network providers prohibit

36. *See, e.g.*, *In re Use of the Carterfone Device in Message Toll Telephone Service*, 13 F.C.C.2d 420 (1968) (decision) (finding Carterfone consumer premise equipment permissible and that it must be allowed by regulated monopoly AT&T). *See also* Hemphill, *supra* note 19, at 142.

37. The winning bidders of the 700 MHz C block auction are required to allow "open access" to their networks of equipment that meets minimal operator requirements. *See* FCC 700 MHz Band Auction, *supra* note 4, ¶ 202. It is interesting to note that although the FCC did not find that competition was "ensuring that consumers drive handset and application choices," it relied on its previous finding that the CMRS market "is effectively competitive." *See id.* ¶ 200. The structure of the auction itself speaks to the fact that the FCC did not base its open access requirements on an empirical determination of competition. Out of four scheduled 700 MHz auctions (A–D blocks), only two had open access requirements. If uncompetitive conditions existed, it is a logical presumption that all the auctions would have required open access. Moreover, the institution of a reserve price imbedded with the FCC promise to withdraw the open access requirements in the event that the reserve was not met also speaks to the experimental nature of the rules. Finally, the FCC itself speaks of the open access requirements as a "window of opportunity" rather than a regulatory necessity. *See id.* ¶ 201. That fact that the FCC considered the market competitive and yet instituted open access requirements with network neutrality principles, confirms that the state of competition in the market is not dispositive for regulatory decision makers and speaks to the importance of the policy question studied here.

38. *See* Chairman's Statement, *supra* note 1.

39. *See* Hiawatha Bray, *You're Your Handset Or a Network, Not Both*, BOSTON GLOBE, July 8, 2009, *available* at http://www.boston.com/business/technology/articles/2009/07/08/pick_your_handset_or_a_network_not_both/?page=full.

40. *Id.*

41. *See* FCC 700 MHz Band Auction, *supra* note 4, at ¶ 206 (mandating that licensees allow "customers, device manufacturers, third-party application developers, and others to use or develop the devices of their choosing in C Block networks"); SKYPE PETITION, *supra* note 4, at 5–6.

the use of some foreign attachments (e.g., non-network phones and some commercial lines) that do not meet their proprietary standards and contractual conditions.[42] These decisions are ostensibly based on various criteria of network protection, ability to meter consumer use and control quality, and to provide a unique or competitive device.[43]

Network neutrality proponents are concerned that such operator management practices are counter to product innovation.[44] Many recall the surge in technological advancement after attachments were allowed on telephones by the FCC's *Carterfone* decision. Prominent examples of telephone attachments that flourished include the fax and answering machines and, much later, the modem. The proposed objective of a "wireless *Carterfone*" decision is not to lower consumer prices *per se*, but to increase consumer premise equipment choices.[45] However, given the differences between the telephone industry of the *Carterfone* era and the mobile industry of today, a "wireless *Carterfone*" decision is unlikely to have analogous results to the original.[46]

Carterfone was imposed upon the pre-divestiture, monopoly AT&T. The current mobile telecommunications industry is not a monopoly but a competitive market.[47] Again, as between the ISP market and the mobile Internet access market, the state of relative competition affects the economic analysis of proposed regulation. In the case of AT&T, a franchise monopoly, the FCC had imposed rate-of-return regulation.[48] Under such regulation, the level of vertical integration (e.g., the firm's choice to manufacture its own attachment equipment or not) affects the costs of the firm and in turn the regulated prices it may ultimately charge consumers.[49] This regulatory process may distort vertical integration

42. *See, e.g.*, *Petition to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks* Opposition of CTIA—The Wireless Association, RM-11361 Appendix B at 1-5 (Apr. 30, 2007) (comment of Verizon Wireless); *see also* SKYPE PETITION, *supra* note 4, at 9.

43. *Petition to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks*, supra *note 42*.

44. *See* Tim Wu, *Wireless Carterfone*, 1 INT'L J. OF COMMC'N 389, 391 (2007).

45. *See* Wu, *supra* note 44, at 397, 420.

46. Not addressed in this section is the definition of the relevant market for handset equipment. The larger the relevant market the less likely equipment manufacturers may be adversely affected by the conduct of an individual operator. Arguably the relevant market is the United States (maybe the world) rather than the individual licensing regions of the mobile market. *See* Robert W. Hahn et al., *The Economics of "Wireless Net Neutrality"* 29–30 (AEI-Brookings Joint Center for Regulatory Studies, Working Paper No. RP07-10, 2007) *available at* http://ssrn.com/abstract=983111.

47. *See Thirteenth Report*, *supra* note 11.

48. Thomas W. Hazlett, *Wireless* Carterfone*: An Economic Analysis* 9 (Verizon Commc'ns, Working Paper, 2007) *available at* http://files.ctia.org/pdf/Comments_Verizon_SkypeOpposition_Hazlett_43007.pdf.

49. *Id.* at 10.

decisions as the firm invests in unregulated areas, not to bundle products in accordance with consumer demand, but to manipulate the permitted tariff.[50] Arguably, the FCC corrected its previous strategy of prohibiting attachments and removed this vertical integration distortion in *Carterfone*. In the mobile telecommunications industry of today, individual providers make extensive decisions as to the most profitable level of vertical integration of their products.[51] Motivated by consumer preferences, this decision process leads to extensive contractual and some exclusive licensing agreements of various attachments which may result in a competitive edge.[52]

It is also the case that exclusive arrangements and conditions on devices may be motivated by such valid competitive concerns as the protection of the physical network and the ability of a provider to meter use and charge for provided services. Mobile telecommunications operators have invested billions of dollars in the licenses and technological build-out required for a network.[53] To allow any device to be attached and either damage this network or bypass the company's ability to profit from its investment may ultimately damage competition and in turn hurt consumers.[54] On the other hand, if providers act arbitrarily in denying consumers access to desired features, the opportunity arises for a competitor to leverage a more open access strategy into greater market share.[55]

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50. Id.

51. As pointed out by Thomas W. Hazlett, *supra* note 48, the FCC itself has recognized this important distinction between the case of AT&T and the mobile industry, and in 1992, rejected imposing bundling restrictions.

> [T]he lack of regulation based on rate-of-return principles, combined with the absence of monopoly status for cellular carriers, significantly reduces one important motive for carriers to bundle—to build unregulated CPE costs into the service rate base and cross-subsidize at the expense of the subscriber. As the DOJ notes, 'absent a guaranteed return on their cellular service investments, carriers cannot expect to recover CPE discounts by including it (the amount of the CPE discounts) in their rate base. We agree with this conclusion.

In re Bundling of Cellular Customer Premises Equipment and Cellular Service, 7 F.C.C.R. 4028 25 (1992).

52. One such recent example is the exclusive offering of the iPhone by AT&T. Such arrangements may violate network neutrality principles but arguably spur innovation by other competing firms. *See, e.g.*, Jessica Vascellero & Amol Sharma, *Google's Android Has Phone Debut Via T-Mobile*, WALL ST. J., Sept. 24, 2008, at B3.

53. The mobile industry's mid-year figure for annualized incremental capital investment in 2009 was $19.5 billion. CTIA Quick Facts, Mid-Year Figures, http://www.ctia.org/media/industry_info/index.cfm/AID/10323 (last visited Dec. 1, 2009).

54. Consumers may suffer if operators lose investors because they cannot attract and retain new customers.

55. This is a basic tenet of a competitive market and is exemplified in the analysis here. For example, see the aggressive pricing stance of the newest entrant at the time of the study:

In short, given the distinctions in the level of competition, and the differences in the technology at issue, economic theory does not predict that a "wireless *Carterfone*" decision would enhance consumer welfare in a manner analogous to the original *Carterfone*. The analysis in Part IV of prior wholesale (interconnection) price regulation, less onerous than that suggested by the zero-price rule regulation, lends empirical support to this theoretical conclusion.

B. *Network Management I*—Prioritization by *Application Restrictions and Differential Pricing*

1. Congestion Control

As discussed previously, one concern to which a regulated zero-price rule is a proposed solution is that an Internet consumer not be prohibited by her network operator from access to all available legal applications.[56] Although being able to access "any application" may resonate as a worthy, pro-consumer goal, the reality is that some applications utilize more of a network's limited resources (e.g., licensed spectrum) than others. The protocol of the Internet (TCP/IP) is not optimized for time-sensitive applications such as streaming video and VoIP. A network operator may manage such traffic by using means to control congestion that would violate the strict application of network neutrality principles.

Network management may take on several forms. To control congestion and maintain quality of service standards, operators have changed the timing of some application deliveries, charged end users premium prices for higher speeds and capacity and, in a few instances, disconnected high broadband end users by decreasing the revenue stream to application providers.[57]

Until 2008, Internet access pricing for end users has been based on an all-the-broadband-you-can-eat model.[58] Few limits have been placed on the amount of data an individual consumer may download. A problem has arisen with the rise of several file sharing programs where a few end users can utilize the majority of a network's capacity affecting the quality of service to all others who share the network.[59] An early response to

Sprint. Tim Wu also made note of this competitive phenomenon when he wrote, "The fourth and smallest competititor, T-Mobile, tends to be the least restrictive on consumers and application developers." Wu, *supra* note 44, at 390.

56. *See* Chairman's Statement and accompanying text, *supra* note 1.

57. *See, e.g.*, Time Warner's introduction of its high speed "RoadRunner" service.

58. All-you-can-eat pricing models are named for the infamous single-price, open buffet. In this instance the name refers to the fixed monthly price for broadband access regardless of usage.

59. It has been estimated that 5% of users may use up to 90% of available bandwidth due to peer-to-peer applications. *See* Formal Complaint of Free Press and Public Knowledge

this scenario has been to disconnect such users or to "slow" (throttle) the capacity taxing application.[60] The practice of slowing the application has met with public and FCC disapproval, but the problem of congestion remains. If slowing or otherwise deferring the externality imposed on the network's users by a particular application is not an option, two immediate solutions present themselves. The first is to begin charging end users tiered rates according to their capacity and speed demands.[61] This option is discussed further below in Section C. The second option is to charge the particular application (or application class) for using the network.

There is strong resistance among network neutrality proponents to charging application providers for use of a network.[62] Although this is not the current network operator practice, it is a logical possibility as a matter of economics. Network access is defined by a two-sided market structure. Both end users and application providers demand access to the network for their mutual benefit. Currently, network operators charge only end users for access and not application users.[63] It is conceivable that a network operator may charge higher prices to application operators in exchange for more reliable, premium delivery service.[64] It is unclear why such a practice would not be welfare enhancing. For example, if a medical provider desires that her streaming video of a surgical procedure be given preferential delivery service (above the "best efforts" standard of the current Internet TCP/IP), why should she be legislatively prohibited

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Against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications, Memorandum Opinion and Order, FCC No. 08-183 at 66 (Aug. 20, 2008) (Robert M. McDowell, dissenting).

60. *Id.*

61. *Id.*

62. Then-US Senator Obama characterized the creation of "high-speed" lanes at a premium cost as providers taking "control over Internet access." Eggerton, *supra* note 30. *See also* SKYPE PETITION, *supra* note 4.

63. *See* Gerald R. Faulhaber, *Network Neutrality: The Debate Evolves,* 1 INT'L J. OF COMMC'N 680, 686 (2007). Some network neutrality proponents would argue that application providers are simply end users as they too must pay their local ISP. *See, e.g.*, *Reconsidering our Communications Laws: Hearing Before the S. Comm. on the Judiciary*, 109th Cong. 7 (2004) (Statement of Vinton G. Cerf, Vice President, Google). This construct, while true, ignores the two-sided demand structure of networks. For example, farmers may rightfully be called "food consumers," but such a distinction in the context of the farmers' relationship with a grocery store chain in which their food is sold fails to capture the core of that economic relationship. In the Internet access market, application providers pay for their local servers but also transport their data to, and compete in, the local two-sided market of their consumers' ISPs.

64. Such preferential service arguably "favor[s] some content or applications over others," which goes against the fifth principle proposed by Chairman Genachowski. Chairman's Statement, *supra* note 1; *see, e.g.*, Hemphill, *supra* note 19, at 143–44, n.33 (citing Susan P. Crawford, *The Internet and the Project of Communications Law*, 55 UCLA L. REV. 359, 403–4 (2007) (noting that particular types of content should not be singled out for high-quality access, even if the access is provided for free)).

from procuring it and a network provider likewise prohibited from providing it? Although arguments have been made that such preferences will throttle new entrants incapable of paying premiums, there has been offered no empirical evidence that differentiation of application offerings will inhibit "innovation at the edge" of the Internet.[65] Indeed, differentiation by speed and quality of service has historically been the means by which new entrants compete in established product markets.[66]

As an example of the type of service which net neutrality regulation may forbid, a network operator may guarantee an application provider's speed and quality of delivery service by either prioritizing packet delivery or by caching data for that provider.[67] Large companies such as Google and Microsoft buy caching services, for example, from private companies to assure rapid delivery of their products.[68] These services are welcomed by network operators as it relieves pressure from the capacity constraints they face in satisfying end user demand.[69] Similarly, packet prioritization may improve the consumer experience by reducing various delivery problems associated with some applications.[70] By permitting network operators to compete in prioritizing or caching packets, competition in these services will increase and may help lower prices and increase the use of such services by smaller scaled organizations and new entrants. This scenario is the more likely in a market, such as the wireless market, that has been determined to be competitive.[71]

Regardless of contentions that net neutrality does not concern price control or rate regulation, as an economic matter, regulators will have

65. In fact, Gregory Sidak proposes just the opposite. *See* Sidak, *supra* note 26, at 383 (pointing out that a "market failure" argument is not the right argument to support the proposition that innovation on the edge of the market will be strangled by a tiering system of payment for priority delivery).

66. Faulhaber, *supra* note 63, at 694; *see* Sidak, *supra* note 26, at 377–88.

67. In the network neutrality debate, many proponents of net neutrality regulation consider the prioritization of packets to be distinct from the caching of data. The latter is not considered problematic by some commentators. The empirical analysis presented here does not consider the manner by which certain packets may be prioritized or advantaged.

68. Faulhaber, *supra* note 63.

69. *Id.*

70. Sidak, *supra* note 26, at 384.

71.

> [S]hareholders of tobacco companies benefited when Congress enacted a law commanding the tobacco companies to stop buying television ads. The new equilibrium was that no tobacco company would try to differentiate its product through television advertising. The same kind of equilibrium could emerge with respect to Internet commerce . . . [Internet companies] would prefer an equilibrium in which they did not need to compete against one another on the additional dimension of purchasing prioritized delivery.

Id. at 387.

simply entrenched the pricing status quo if unfettered network access of all applications is imposed by regulation. In other words, regulators will assure that network application access is set at a regulated price equal to zero.[72] This is the "zero-price" access rule. Although it is difficult to predict how pricing models may evolve in a two-sided demand system, it is plausible that as demand patterns continue to shift to higher broadband use, end user prices will likely increase.[73] Network neutrality regulation will prohibit a business model which spreads or shifts increased end user costs to application providers. If, in turn, regulated application access prices are combined with end user pricing controls, there will be increased danger of forgone investment in the network core and degradation of service.[74] As analyzed in Part IV, interconnection by price controls and regulatory oversight was utilized extensively by state regulatory agencies with no tangible benefit to consumers. This is no small result indeed, if the transaction costs that accompany industrial regulation and compliance are considered, the net result of regulation may be a social welfare loss.

2. Anticompetitive Prioritization

There is anecdotal evidence that networks may act anti-competitvely in relation to competing applications. The two examples most cited are (1) the cable modem provider, Comcast, slowing (or stopping) video downloads, and (2) the telephone company operator, Madison River, blocking VoIP services.[75] In both instances, the blocked, slowed or "censored" application was in direct competition with the core business of the operator. To apply the term censorship to these examples is rather confusing as these incidents more accurately reflect possible abuse of market power. While regulation may be called for, the distinction is material as to which type of regulation is most appropriate. Moreover, while

72. The SKYPE PETITION, *supra* note 4, recently tabled by former FCC Chairman Martin, has called for such application access. In addition, the strong action of the FCC against Comcast's "slowing" of access to BitTorrent, may indicate the FCC's preference for unfettered application access against network management principles—perhaps even against management by differential pricing.

73. This is particularly likely to occur in the short term as higher broadband use begins to push the limit of a given operator's equipment and spectrum capacity. Over the long term, prices may level or decrease if compensating improvements in network technology are developed and if additional spectrum licenses for mobile technologies are released—the latter development of course being outside the control of the network operator.

74. *Cf.* Sidak, *supra* note 26, at 387 (relating that a forced equilibrium on the side of the "service providers" would remove all competition from one sector of internet service, which would end competitive investment in prioritization).

75. *See In re* Madison River Commc'n LLC, FCC No. 05-543, 20 F.C.C.R. 4295 (Mar. 3, 2005) (Consent Decree), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-05-543A2.pdf.

these two incidents are explained by anti-competitive motivations, they may also be explained as legitimate attempts to control congestion by blocking certain high broadband applications. The question is best framed, not by how to prevent application and content censorship, but rather how to ensure proper competition.

Madison River has already received its judgment. Even though partially explained by controlling against high broadband use, the threat to new, rival competition inspired a narrow FCC decision which required Madison River to ensure VoIP services.[76]

The high profile case of Comcast has engendered vigorous cries for greater regulatory oversight.[77] And, while, anticompetitive motives may be ascribed to Comcast's conduct (e.g., to make a potential rival's product less desirable) there nonetheless remain arguments that there are legitimate network management principles at stake.[78] As shown by the empirical findings set forth in Part IV, to the extent that Comcast's activity has a serious impact on direct rivals, the FCC's case specific approach in Madison River, as opposed to sweeping legislative mandates, would be the least injurious to legitimate competitive practices. The risk of broad mandates is their possible adverse effect on competitors' ability to control network quality, and thus increase consumer welfare, by employing basic network management principles. Ironically, by disallowing network management of this type and by imposing a zero-price rule whereby application delivery cannot be tiered, consumers will be forced to internalize the full cost of negative externalities created by other customers on their chosen network. The likely result is decreased quality for all customers which may not be the most fruitful environment for innovators at either the edge or the core.

However, what may be equally disturbing about Comcast's particular practice was not simply that it focused on a rival's activity, but that consumers were not informed *ex ante* that such delay might occur, nor were they informed when it actually occurred. Presumably, if so informed, some consumers would have sought alternative access elsewhere that better fit their Internet use demands.[79] Although the company has now

76. *See id.* At 4297.

77. *See, e.g.*, Matthew Lasar, *Reactions to FCC's Comcast Decision Come Fast and Furious*, ARS TECHNICA, Aug. 1, 2008, http://arstechnica.com/old/content/2008/08/reactions-to-fccs-comcast-spanking-come-fast-and-furious.ars (noting strong reactions in support of the FCC decision against Comcast).

78. For example, Comcast was attempting to manage its traffic. *See* Gilroy, *supra* note 17, at 2.

79. Some network neutrality advocates claim that this is a specious argument because cable is a monopoly and, therefore, regulation is the consumer's only refuge. *See, e.g.*, Open Internet Coalition, Common Questions, http://www.openinternetcoalition.org/index.cfm?objectid=00175D28-F1F6-6035-BF6EA329CD5BD3F4 (last visited Dec. 1, 2009) ("Net

changed its initial contract to disclose the possibility of such a practice, it does not inform consumers when the delaying tactic is actively engaged.[80] Requiring such disclosure would be a reasonable and appropriate government response.[81]

C. *Network Management II—Consumer Tiered Pricing Regimes and the Broadband Internet Fairness Act*

On the consumer side of the operator's two-sided market, there has been some experimentation with metered or consumption-based pricing. The advantage of such differential pricing is that it allows the low broadband user to access the Internet without subsidizing the high broadband user.[82] Under differential pricing, the grandmother who sends occasional e-mails will pay less for Internet access than the individual who downloads 1,500 HD movies in one month.[83] Price is the most common means by which scarce resources may be most efficiently allocated. Users must internalize the externality their usage places on the network. Metered pricing is particularly common in the utilities industries where electricity, natural gas and water bills most likely contain a usage pricing element. The mobile industry has already begun to structure its pricing by capacity "buckets."[84] A flat rate is charged up to a certain number of megabytes with additional download capacity available at an incremental rate.[85]

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neutrality keeps the Internet as a free and open marketplace, so that a small number of . . . cable monopolies can't choke off competition and innovation."). Such logic is circular in that the only reason cable may be a monopoly is due to the archaic franchising requirements of local government (*i.e.*, it is regulation in the first instance that has allowed a sole cable operator to enter its market). Moreover, there are alternatives to cable Internet access (e.g., DSL, WiFi, WiMAX, and 3G) and, therefore, it is clear that a cable Internet provider is not a singular or "monopoly" provider of like services.

80. Peter Kaplan, *FCC Chief Again Critiques Comcast Net Tactics*, REUTERS, Apr. 22, 2008, http://www.reuters.com/article/internetNews/idUSN2232444820080422?sp=true.

81. *See, e.g.*, Phil Weiser, *The Next Frontier for Network Neutrality*, 60 ADMIN.L.REV. 273 n.2 (2008) (explaining that the first best solution to assuring net neutrality may be a well-articulated consumer protection strategy set forth by the FTC and FCC); *see also* Chairman's Statement, *supra* note 1 (setting forth the Sixth Principle of transparency).

82. For a complete discussion of the advantages of congestion pricing, *see* Christopher S. Yoo, *Network Neutrality and the Economics of Congestion*, 94 GEO. L.J. 1847 (2006).

83. *See* Amy Schatz, Dionne Searcey & Vishesh Kumar, *Officials Step Up Net-Neutrality Efforts*, WALL ST. J., Feb. 13, 2008, at A4.

84. Babette Boliek, *Net Neutrality Regulations in the Mobile Telecommunications Market: A Cautionary Tale from the Era of Price Regulation*, 3rd Annual Conference on Empirical Legal Studies Papers 11 (2008), *available at* http://ssrn.com/abstract=1129517.

85. This is classic "two-tiered" pricing which has been utilized in the telecommunications industry and the mobile industry in particular for decades. *See infra* Part IV. Arguably, an alternative efficient pricing mechanism might be one in which an Internet provider may charge higher rates for access to, or more specifically, use of websites or webcasts that demand greater use of broadband (e.g., VoIP, streaming video, and file sharing sites). This may be a

Indeed, the move to two-tiered pricing for broadband consumption by the mobile industry would appear a natural development. The industry, by extensive trial and evolution, established a multi-tiered pricing structure, based primarily on usage for its core voice transmission business. It is understandable also in this industry that congestion on the network of tremendous concern due to the industry's technology constraints and the spectrum scarcity resulting from the FCC's limited release of licenses.[86]

Several trials of usage based pricing in the wired ISP industry have met with a deal of controversy. For example, a Time Warner Cable trial to establish several service tier options rolled out in Beaumont, Texas in 2008 led to an uproar of protest.[87] Opposition centers on concern that such billing practices will discourage the adoption of applications and services that, at least in their nascent incarnation, are more bandwidth-intensive then established programs.[88] Moreover, they note concern that established video delivery applications are often "bundled" by the network provider and have an unfair advantage against new rivals.[89] On the other side, operators claim that the growth in bandwidth usage has

simpler means of charging for broadband use than other metering methods but would arguably be forbidden under a zero-price rule regime. Pricing by "buckets," a capacity limitation, not only serves to internalize some of a consumer's external costs caused by high broadband demand, it does so in a manner that is content neutral—a strong net neutrality concern. Brett M. Frishmann & Barbara van Schewick, *Network Neutrality and the Economics of the Information Superhighway: A Reply to Professor Yoo*, 47 JURIMETRICS J. 383 (2007).

86. Chairman Genachowski has recognized these concerns in extending network neutrality to mobile operators. *See* Chairman's Statement, *supra* note 1 ("how the principles apply may differ depending on the access platform or technology"). The Chairman has stated that "the biggest threat to the future of mobile in America is the looming spectrum crises." *FCC Warns Of Mobile's Looming Spectrum Crisis Predicted Jump in Wireless Traffic Will Require More Bandwidth for Devices*, MSNBC, Oct. 7, 2009, http://www.msnbc.msn.com/id/33216878/ns/technology_and_science-wireless/. The "shortage of spectrum could hurt consumers and the country" as a "30-fold increase in traffic" is anticipated. Julius Genachowski, Chairman, Fed. Commc'n Comm'n, America's Mobile Broadband Future, Keynote Address at the International CTIA Wireless I.T. & Entertainment Conference (Oct. 7, 2009) (asking that the FTC consider all relevant distinctions in technology, etc., before applying the principles to the mobile industry).

87. See Free Press Organizes Nationwide Opposition to Time WarnerCable Metering, FREE PRESS, Apr. 10, 2009, http://www.freepress.net/node/56030.

88. *See* Gilroy, *supra* note 17, at 6–7. There is no explanation given for why new, inefficient technology should be subsidized by consumers either directly (by paying metered prices) or indirectly (by delayed service resulting from congestion). All other things being equal, it is unclear why the most efficient user of a scarce resource should not be the preferred choice.

89. *Id.* at 6. This later concern echoes rationales for a nondiscrimination principle. The concern against bundling seems to call for targeted FCC intervention (or at least attention) to determine if such a practice is harming competition. The imposition of a volume usage price regulation to all broadband providers—whether they bundle application offerings or not—seems to me to be an overly broad regulatory tool.

placed great financial pressure on networks to invest in mantainence and expansion.[90] A claim disregarded by opponents of such pricing practices who note that network equipment costs have been decreasing while profits have remained steady.[91]

Distaste for metered billing has inspired a bill sponsored by Representatives Massa Perriello and Hinkley entitled the Broadband Internet Fairness Act.[92] The bill if passed would cover all broadband Internet providers who provided broadband Internet service to two million or more subscribers directly or by affiliate.[93] As there is no carve out for mobile operators and a broad definition of "broadband Internet" this would likely cover a great many participants in the mobile industry who offer even limited Internet access.[94] Moreover, because the industry norm in mobile, unlike in traditional ISP, is to offer metered/usage based plans, this would have a major impact on the mobile industry.[95]

The Broadband Internet Fairness Act is worth examination as it is similar to the state regulatory regimes studied in Part IV. The Fairness Act would require that all usage based tariffs would be filed for review

90. *Id.*

91. *Id.* at 7.

92. Broadband Internet Fairness Act H.R. 2902, 111th Cong. (2009) (currently referred to the H. Comm. on Energy and Commerce).

93. *Id.* § 7(a)(3) ("The term 'broadband Internet service' means an Internet protocol-based transmission service that enables users to send and receive voice, video, data, graphics, or a combination thereof.").

94. *Id.* at 9 (defining "Broadband Internet Service Providers"). In accordance with the definitions, it would be necessary for mobile operators to give disaggregated data on voice-only versus voice and data and data-only users. It is likely that many mobile carriers would pass the threshold if subscribership is based on national levels. To put it in perspective, Sprint Wireless/Nextel with its affiliates counted over 39 million voice and data subscribers nationwide. SPRINT NEXTEL CORP., JUNE 2009 QUARTERLY REPORT 23 (2009), *available at* http://www.corporate-ir.net/seccapsule/seccapsule.asp?m=f&c=127149&fid=6443661&dc=. Verizon Wireless alone has 86 million subscribers, and Verizon Communications (most likely an affiliate of Verizon Wireless) has 2.8 million FiOS (Internet, phone, and TV operating over fiber optic communications networks) Internet subscribers alone. VERIZON COMMC'NS INC., CURRENT REPORT (Form 8-K), *available at* http://investor.verizon.com/sec/sec_frame.aspx?FilingID=6558177.

95. *See* Gilroy, *supra* note 17, at 6 (noting that this is not yet the industry norm). *See also*, e.g., Verizon Wireless, Mobile Broadband Plans for Wireless Internet Access, http://www.verizonwireless.com/b2c/mobilebroadband/?page=plans (last visited Dec. 1, 2009) (showing Verizon flat rate plans differentiated by tier (e.g. 5GB a month or 250MB a month) and type of connecting device with respective overage rates (e.g. $0.05/MB or $0.10/MB)); Sprint, Shop, http://nextelonline.nextel.com/NASApp/onlinestore/en/Action/DisplayPlans?filterString=Mobile_Broadband_Cards_Filter&id12=UHP_PlansTab_Link_DataPlans (last visited Dec. 1, 2009) (showing Sprint's two-tiered pricing plan for its 3G network and its monthly rate for unlimited capacity on its higher capacity 4G (limited) network); see also Broadband Internet Fairness Act, *supra* note 17, at 9 (defining "Broadband Internet Service" as "Internet protocol-based transmission service that enables users to send and receive voice, video, data, graphics, or a combination thereof.").

with the FTC.[96] Second, the network operator need provide information regarding the capital costs of the facilities used to provide the tariffed service based on an attribution of costs of the service.[97] In turn, those filings will be examined by the FTC, in consultation with the FCC, to determine if such plans are "just and reasonable" and do not unfairly "penalize" high volume users.[98] The plan is then subject to a public hearing by a Commissioner (or employee of the Commission) with an invitation for comments and testimony from the public.[99]

As set forth in Part IV, this degree of regulatory involvement (filing, approval and hearing) has been previously utilized by states in the regulation of mobile communications consumer prices.[100] The type of costs information requested and the calculations proposed are well known to telecommunications economists who have had extensive experience in such analyses in other regulated industries.[101] In the end, the empirical question is whether or not consumers benefit from such price intervention, the conclusions in Part IV question the success of such programs. In conclusion, critics of network neutrality regulation have often said that it is a solution in search of a problem.[102] Proponents argue that we are upon a slippery slope and propose a precautionary regulatory paradigm to preserve Internet neutrality.[103] I contend, however, that a key threshold question for network neutrality regulation is not rhetorical but rather empirical. That is, regardless of the degree of competitiveness in the market, will the proposed net neutrality regulation, particularly as translated into pricing regulations, lead to an outcome superior to the status quo. This question is considered in the context of price regulation and "terms and conditions" regulation. As mentioned previously with respect to proposed consumer volume usage price regulation and appli-

96. Broadband Internet Fairness Act, *supra* note 17, § 3(b).

97. *Id.* § 3(3).

98. *Id.* §§ 2(2), 4(c)(5).

99. *Id.* § 4 (d).

100. *See, e.g.*, In re State of Hawaii Pub. Util. Comm'n for Authority to Extend Rate Regulation of Commercial Mobile Radio Serv. in the State of Hawaii, 10 F.C.C.R. 7872 (1995) [hereinafter Hawaii Petition].

101. The call is usually for a form of Ramsey pricing in industries, such as mobile Internet access, which are characterized by marginal costs near zero and large infrastructure costs. The prices charged must permit the owner to recoup the fixed-cost investment plus marginal cost. *See, e.g.*, Jean-Jacques Laffont & Jean Tirole, *Access Pricing and Competition*, 38 EUR. ECON. REV. 1673 (1994).

102. *See, e.g.*, Amy Shatz, *U.S. as Traffic Cop in Web Fight*, WALL ST. J., Sept. 21, 2009, at A2, *available at* http://online.wsj.com/article/SB125329467451823485.html (stating Republicans are likely to argue that the FCC net neutrality plan is "trying to fix problems that don't exist"). *Cf.* Chairman's Statement, *supra* note 1 (declaring that net neutrality policies are "not about protecting the Internet against imaginary dangers").

103. *See* Chairman's Statement, *supra* note 1 ("If we wait too long to preserve a free and open Internet, it will be too late.").

cation access requirements, and as discussed below in Part III, price regulation is the tool by which many state regulators assured (and network neutrality regulators propose to assure) consumer price protection and interconnection compliance. Because state price regulation was preempted by federal statute, it is possible to construct an empirical comparison of the period with price regulation to the period without and measure the corresponding consumer effects.[104] This analysis is performed in Part IV and the conclusions are set forth in Part V. The final determination is that price regulation did not provide consumer benefits above the market result and that even low-level, non-price regulation may have negative consequences for consumers.

II. REGULATION OF THE UNITED STATES' MOBILE TELECOMMUNICATIONS INDUSTRY

A. *Overview*

As previously stated, the possible abuse of market power is a motivating concern for network neutrality regulation and understandably so. The history of the wireless industry, however, is replete with examples of growth, decreasing prices, and increasing competition over time. Indeed, the wireless industry has grown exponentially since its inception. In 1985, the United States' mobile telecommunications industry served roughly 340,000 subscribers and generated annual revenue of $480,000,000.[105] By the end of 2006, the industry served approximately 241.8 million subscribers and generated annual revenues of about $125.4 billion.[106] To put in perspective the impact of mobile telecommunications services on the average household, in 1985 the total number of subscribers was roughly equivalent to one subscriber per 260 households in the United States.[107] In 2006, the number of subscribers was slightly more than two subscribers in each and every household.[108]

As described in greater depth below, initially only two cellular mobile telecommunications licenses were issued per geographic market—creating

104. Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, 107 Stat. 312 (codified in relevant part at 47 U.S.C. 332(c)(3)(A) (2000)) ("no State or local government shall have any authority to regulate the entry of *or the rates charged* by any commercial mobile service or any private mobile service.") (emphasis added).

105. *See* Annual CMRS Competition Report, *Sixth Report*, FCC No. 01-192, app. C, tbl.1 (July 17, 2001), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-01-192A1.pdf [hereinafter *Sixth Report*].

106. *See Twelfth Report*, *supra* note 11, at 99, 126.

107. *See id.*; *see also* US Census Bureau, Historical Income Tables—Households, www.census.gov/hhes/www/income/histinc/h06ar.html (last visited Apr. 26, 2006).

108. *Twelfth Report*, *supra* note 11, at 88.

a duopoly in each region by government franchise.[109] The first cellular operations commenced in the mid-1980s.[110] Then, in 1995, the first licenses for personal communications services ("PCS") were distributed, thus providing an additional platform for mobile telecommunications operators to enter each geographic region.[111] Since 1995 the number of licensed mobile telecommunications operators (cellular and PCS) increased from two to as many as seven (or more) in some service areas.[112] In short, mobile telecommunications in the United States is a sizeable and fast-growing industry marked by a significant change in industry structure from duopoly to oligopoly.

Unsurprisingly, the gradual entry of additional operators has been accompanied by declines in mobile telecommunications prices. The direction of the change in consumer prices is clear (although the variety of price packages and bundles offered by different operators makes empirical comparisons challenging resulting in varying measurements of the magnitude of the price decline). For instance, the average cost of monthly mobile telecommunications service was approximately $61 in 1993 and declined to an average cost of $43.73 a month in 2006.[113] A casual analysis of the decrease in prices over time would seem to indicate that firms have engaged in some kind of price competition.[114]

109. *See* Annual CMRS Competition Report, *First Report*, 10 F.C.C.R. 8844 at 4 n.14 (Aug. 18, 1995) *available at* http://wireless.fcc.gov/auctions/data/papersAndStudies/fc95317.pdf [hereinafter *First Report*].

110. *Id.* at 2.

111. *See* Thomas W. Hazlett, *Is Federal Preemption Efficient In Cellular Phone Regulation?*, 56 FED. COMMC'N L.J. 155, 163–64 (2003).

112. *See* Annual CMRS Competition Report, *Ninth Report*, FCC No. 04-216 at 23 n.49 (Sept. 28, 2004), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-216A1.pdf [hereinafter *Ninth Report*].

113. The cost of monthly *digital* mobile telecommunications service ranged from $80 to $129.95 in 1998. Annual CMRS Competition Report, *Fourth Report*, FCC No. 99-136 at 9, n.33 (June 24, 1999) *available at* http://wireless.fcc.gov/auctions/data/papersAndStudies/fc99136.pdf [hereinafter *Fourth Report*]. The cost declined to a monthly average of $39.60 in 2000. *Sixth Report*, *supra* note 105, at 5; *Twelfth Report*, *supra* note 11, at 90 (excluding data revenues).

114. An assessment that prices are decreasing based on the decline of the average local monthly bill over time fails to account, however, for determinants that may counter this conclusion. For example, in the early years of operation, the average minutes of use ("MOU") declined so that the price per minute was actually higher than previous years even though the average local monthly bill was decreasing. If even a simple metric is used to determine the average price for a minute of use, it becomes clear that the market has not been as competitive in prices as the average monthly bill declines would imply.

Moreover, the decrease in prices may not reflect the corresponding decrease in marginal costs. In fact, there is some evidence that this has not been the case. For instance, in a study of California prices from 1989 to 1993, the California PUC determined that while consumer prices had declined an average of 14.9%, operating expenses per consumer had dropped by 47%, and capital investment per subscriber had declined 46%. *See* Petition of the People of the State of California and the Public Utilities Commission of the State of California to Retain

This downward pressure on prices is of great interest to policymakers whose goal is to insulate consumers from suffering the ill effects of imperfect markets (such as a market with few competitors) yielding higher than competitive rates. The potential abuse of price is also a point of central concern to the network neutrality debate. An imperfect market is one that is marked by operators with market power. Price regulation is the regulators' response to the fear that such market power might be used to charge end users higher, non-competitive rates. Network neutrality is in large part a response to the fear that operators will exercise their market power to increase access prices or to block competing Internet technologies (e.g., VoIP), content or non-network innovation.

Contrary to the regulatory goal of reducing prices, however, there has been empirical evidence that regulation in this industry may itself contribute to higher prices.[115] This is a result of note for the type of extensive regulation—from regulating the physical structure of the network, access charges and proprietary innovation—proposed to accomplish network neutrality. The notion that regulatory policies aimed at the relatively simple, easily verifiable goal of decreasing prices may themselves be the source of higher consumer rates runs counter to the very justification for regulatory intervention—to maximize social welfare in the presence of market failure.[116] Presented below is a description of the dataset derived from regulatory decisions made during the development of the mobile industry.

B. *Dataset*

To examine the welfare effects of previous regulatory choices in the wireless industry, I am able to exploit two unique characteristics of the industry's regulatory history. First, I am able to separate the effects of entry regulation from price regulation because of the division of federal and state regulatory power in the United States. Because of federal licensing requirements, from the inception of the mobile telecommunications industry the FCC has been the sole arbiter of entry into the market. As a matter of regulatory choice, however, and as described in greater depth below, the FCC refrained from regulating interstate prices in wireless.

Regulatory Authority over Intrastate Cellular Service Rates, 10 F.C.C.R. 7486, 7520 (1995) [hereinafter California Petition]; *see also* Gautam Naik, *Cellular Phone Rates Spark Static from User*, WALL ST. J., May 5, 1994, at B1 (reporting that national price trends for cellular service do not track declining costs).

115. *Id.*

116. *See, e.g.*, WILLIAM SHEW, REGULATION, COMPETITION, AND PRICES IN THE U.S. CELLULAR TELEPHONE INDUSTRY, ENSAE-CREST CONFERENCE ON THE ECONOMICS OF RADIO-BASED COMMUNICATIONS 41 (June 23–24, 1994) (mimeo.); Jerry Hausman, *Mobile Telephone*, *in* 1 HANDBOOK OF TELECOMMUNICATIONS ECONOMICS 602–03 (Martin E. Cave et al. eds., Elsevier 2002).

States, on the other hand, due to the distinction between interstate and intrastate regulation memorialized in the 1934 Communications Act, were free to exercise full control over intrastate prices.[117] The fifty States (and D.C.) chose a wide-range of regulatory programs providing an interesting array of cross-sectional data. The second unique aspect of the dataset came by way of legislative intervention with the Omnibus Budget Reconciliation Act of 1993 (the "1993 OBRA").[118] Under the 1993 OBRA, the state price regulation programs were preempted. The analysis presented here spans the period before and after federal preemption capturing this intriguing change in the time series data. Presented below is an in depth description of the development of both federal entry and state price regulation.

1. Federal Entry Regulation

As stated above, because of federal licensing requirements, from the inception of the mobile telecommunications industry the FCC was the sole arbiter of entry.[119] The Commission proposed a novel regulatory compromise with hopes of preventing monopoly pricing, while simultaneously not overloading the market with competitors which could destroy possible economies of scale.[120] Rather than directly regulate operations or prices, the FCC chose to grant two, rather than one, operating licenses in each market to introduce market forces to prevent providers from exercising noncompetitive behavior. One license (the "B" license) would be awarded to the local exchange carrier (the wireline licensee) and the other license (the "A" license) to an FCC-designated operator not affiliated with phone companies (the non-wireline licensee).

By July 1992, the FCC-established duopoly market was acknowledged to provide "only limited competition in cellular markets."[121] Specifically, consumer welfare (the consumer side of the social welfare equation) was decreased by the failure of the duopoly market to con-

117. 47 U.S.C. § 151 (1934).

118. Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, 107 Stat. 312.

119. *See First Report*, *supra* note 109, at 1.

120. *Id.*

121. U.S. GEN. ACCOUNTING OFFICE, CONCERNS ABOUT COMPETITION IN THE CELLULAR TELEPHONE SERVICE INDUSTRY 19 (1992) [hereinafter GAO Report]; *see also* Cellular Communications Systems, 86 F.C.C.2d 469, 474 (1981), *modified*, 89 F.C.C.2d 71–74 (1982), *further modified*, 90 F.C.C.2d 571 (1982) (noting that the duopoly market structure provided "less than optimal competitive opportunities"); *Reply Comments of the US Dep't of Justice*, CC Docket No. 91-34 at 4–5 (June 19, 1991) (stating "there is insufficient evidence to warrant the conclusion that the cellular service market is in fact workably competitive. In each service area there is still a duopoly[.]"); *Comment of the Staff of the Bureau of Economics of the Federal Trade Commission,* CC Docket No. 91-34 at 7 (July 31, 1991) (asserting that "the staff [of the Bureau of Economics of the FTC] disagrees with the tentative conclusion that cellular service is produced in a competitively structured market.").

strain consumer service prices. In 1993, a full ten years after the FCC issued the first cellular licenses, an auction system for distributing PCS licenses was authorized under the 1993 OBRA.[122] A year later, PCS licenses were first auctioned and the cellular industry had several new rivals. The final blocks of the PCS licenses were sold in Auction 58 in 2005.[123] The number of licensed and operational mobile telecommunications firms changed dramatically after 1993. In the top twenty-six markets, for example, in 1993 all twenty-six had two operational firms.[124] In 1997, twenty-one of the top twenty-six Metropolitan Statistical Areas ("MSA") had five or more operational firms.[125]

2. State Price, Non-Price Regulation

While the FCC held control of entry, the States' authority over intrastate price regulation, was unabridged until such power was expressly preempted by Congress in the 1993 OBRA.[126] The 1993 OBRA was landmark legislation redefining state regulatory power over mobile telecommunications operators. The 1993 OBRA was passed to amend the Communications Act of 1934 to promote continued growth in the mobile telecommunications industry. Significantly, Congress removed the States' authority to regulate intrastate service prices. (47 U.S.C. § 332©(3). The change in the federal-state regulatory divide caused by the passage of the 1993 OBRA was so profound that it divides the dataset into two main time frames: (1) prior to the passage of the 1993 OBRA, and (2) the period following full enactment and enforcement of the Act.[127]

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122. Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, 107 Stat. 312 (codified in relevant part at 47 U.S.C. 332 (Supp. V 1993)).

123. *See* FCC Auctions: Factsheet: Auction 58, http://wireless.fcc.gov/auctions/default.htm?job=auction_factsheet&id=58 (last visited June 5, 2007). Auction 58 was a "reauction" of licenses necessitated by the ultimate return to the FCC of licenses previously auctioned under a set aside program for "designated entities." For a more complete history of the designated entity program, *see* Thomas W. Hazlett & Babette E.L. Boliek, *Use of Designated Entity Preferences in Assigning Wireless Licenses*, 51 FED. COMMC'NS L.J. 639 (1999).

124. PAUL KAGAN ASSOCS., INC., CELLULAR RATES VOLUME ONE—MSAS 47 (1994).

125. PAUL KAGAN ASSOCS., INC., COMPETITIVE RATES IN CELLULAR TELECOM 13–20 (1998).

126. Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, 107 Stat. 312.

127. It should be noted that even in the absence of federal statutory law such as the 1993 OBRA, the States' authority to regulate would be far from plenary. The federal Constitution also places limits on the exercise of state regulatory power. Specifically the "dormant" commerce clause restrains state economic protectionism and protects the national market for interstate commerce. *See, e.g.*, Quill Corp. v. North Dakota, 504 U.S. 298, 312 (1992) ("[W]e have ruled that the [dormant Commerce] Clause prohibits discrimination against interstate commerce and bars state regulations that unduly burden interstate commerce. . . .")(citations omitted).

As a result, service providers working across several States often would face a patchwork of regulations. The analysis in Part IV not only exploits the regulatory variance between the time periods before and after the 1993 OBRA, but also the variance in regulatory choices across States prior to preemption. In so doing, the results not only speak to whether price regulation is *per se* superior (inferior) to market outcomes but what *form* of price regulation may be superior (inferior).

By 1992, twelve States had memorialized their decisions not to regulate cellular service prices by passing legislation banning such regulation.[128] In another three States, the public utility commissions enacted *de facto* bans on price regulation by formally declaring that they would not regulate service prices.[129] In an additional twelve States and the District of Columbia, the public utility commission generally chose not to exert jurisdiction over mobile telecommunications operations or tariffs.[130] Four of those twelve States regulated operators and service prices in monopoly markets only.[131]

In States that chose to exert regulatory jurisdiction over the cellular industry, the chosen form of regulation was either at the wholesale level, the retail level, or both. A State could control several aspects of commercial activity aside from prices. For instance, the public utility commissions could require a certificate of public convenience and necessity ("CPCN") whenever the operator started service or expanded its system.[132] Regulators required firms to use standard accounting procedures such as the Uniform System of Accounting.[133]

In the mid-1980s, twenty-nine States had not banned regulation, either by law or by *de facto* bans on regulation promulgated by their public utility commissions.[134] Of those twenty-nine, twenty-one required that

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Nine States decided to petition the FCC for the right to retain their rate regulation authority. *See* 47 U.S.C. § 332(c)(3)(A–B). Seven of the petitions before the FCC were rejected. In essence the FCC itself found each petitioning State's mobile industry sufficiently competitive to negate the justification for price regulation. In order to prevail, the States had to satisfy a high burden of proof as the Commission had adopted a strong preference for encouraging market forces over command-and-control regulation. The Commission determined that, although States had an interest in protecting in-state consumers, competition itself was a strong protector of the interests of telecommunications users and "state regulation . . . could inadvertently become as [*sic*] a burden to the development of . . . competition." *Id.*

128. NAT'L ASS'N OF REGULATORY UTIL. COMM'RS, REPORT ON THE STATUS OF COMPETITION IN INTRASTATE TELECOMMUNICATIONS, 130–31 (1992) [hereinafter NARUC 1992].

129. *See* Shew, *supra* note 116, at 21 tbl.4-2.

130. *See* NARUC 1992, *supra* note 128, at 130–31 tbl.10; Shew, *supra* note 116, at 14.

131. NARUC 1992, *supra* note 128, at 30, 91, 95, 105.

132. NARUC 1992, *supra* note 128, at 130–31 tbl.10.

133. *Id.*

134. Regulation in Maine and Missouri was banned by statute in 1988 and 1986, respectively. Four States—Illinois, Tennessee, Utah, and Wisconsin—regulate operators in monopoly markets only.

wholesale and/or retail tariffs be submitted for commission approval.[135] In addition to tariff filing and approval requirements, five States (besides Maine) had instituted price cap regulation and three States engaged in profit regulation.[136]

Of those States that required commission approval of tariffs, Hawaii, California, and North Carolina[137] had the most formal procedures. For example, the Hawaii Public Utilities Commission (the "HPUC") required tariffs to include exchange area, base rate areas, the "conditions and circumstances" under which service would be furnished, and a definition of the classes and grades of service available.[138] Operators complained that the HPUC's regulatory practice "substantially delayed new service offerings and alternative rate plans."[139]

Less stringent price regulation was instituted by Arizona, Connecticut, Nevada, New York, Ohio, and South Carolina. These States allowed operators to vary their prices within a range specified by either the operators themselves or the public utility commission.[140] New York provided a good example of this "lightly regulated" approach to tariffs.[141] Under New York's system, operators established a range of rates for each element of their service—e.g., access charge, peak minute price, roaming charges, etc.[142] Once the tariff schedule became effective, operators were free to make rate changes within the range upon one day's notice to customers and the New York State Public Service Commission (the "NYPSC").[143] The NYPSC would review the rate ranges proposed only upon complaint.[144] A formal evidentiary hearing was required before any operator was permitted to increase its rates above the maximum set forth in its tariff.[145]

The remaining States, Illinois, Kentucky, Massachusetts, New Mexico, Virginia, and Wyoming, engaged in a more informal style of price

135. NARUC 1992, *supra* note 128, at 130–31 tbl.10.

136. *See* Shew, *supra* note 116, at tbl.4-2; *see also*, Hawaii Petition, *supra* note 100; California Petition, *supra* note 114; *Petition of New York State Public Service Commission To Extend Rate Regulation,* FCC No. 94-108, 10 F.C.C.R. 8187 (1995) [hereinafter New York Petition].

137. Arguably formal procedures flow naturally from the type of regulation, profit regulation, selected by these three States. *See* Shew, *supra* note 116, at 15 tbl.4-1. North Carolina deregulated cellular services in 1991. *See* State ex rel. Utilities Com'n v. North Carolina Cellular Ass'n, Inc., 433 S.E.2d 785 (N.C. Ct. App. 1993).

138. *See* Hawaii Petition, *supra* note 100.

139. *See id.* at 20.

140. These States engaged in "rate cap" regulation. *See* Shew, *supra* note 116, at 16.

141. *See* New York Petition, *supra* note 136.

142. *Id.*

143. *Id.*

144. *See id.* at 22.

145. *Id.*

regulation.[146] Cellular operators were required to file tariffs with the public utility commission ostensibly for approval, but the criteria for approval were unarticulated and little formal documentation from the operator was required.[147]

Six States did not require commission approval of tariffs or place a price cap on the possible range of tariffs.[148] Only one of those six States required the filing of tariffs for "informational purposes" only.[149] The objective of a filing requirement ostensibly was to provide a monitoring device so that the commission could assert authority over prices if it was warranted. The remaining five States instituted some form of "terms and conditions" regulation mandating certification and/or accounting or financial reporting requirements.[150]

TABLE 1
STATE REGULATION

A. Price Regulation Prior to the Enactment of the 1993 OBRA

State	Wholesale Reg. Only	Tariff Filing/ Approval	Price Cap/ Profit Reg.	Other Reg.[1]
AK, AR[2], IL[3 4], MA, ME[5], MI[6], MO[7], MS[8], UT[3], WV		•		Certification
AZ, CT, HI, OH, SC	•	•	•	Certification
CA, NC, NY		•	•	Certification
KY, NM, TN[3], VA, WI[3], WY	•	•		Certification

Sources: NARUC 1992, *supra* note 128, at 30, 91, 95, 105, 130–31; NARUC, REPORT ON THE STATUS OF COMPETITION IN INTRASTATE TELECOMMUNICATIONS 182–83 (1993); Shew, *supra* note 116, at tbl.4-2.
1. Other regulation not listed includes an accounting requirement that firms in CT, IL, MS, OH and SC use the Uniform System of Accounting in all financial reports. 2. Price regulation banned by statute in 1991. 3. Regulation in monopoly markets only. 4. Regulation of retail prices only. 5. Regulation banned by statute in 1988. 6. Regulation banned by statute in 1992. 7. Regulation banned by statute in 1986. 8. Tariff approval required for retail prices only.

B. Non-Price, Terms and Conditions Regulation Prior to the Enactment of the 1993 OBRA

State	Tariff Filing[1]	Certification	Accounting Requirements
AR, IN		•	
LA	•		
NV, ND[2]		•	•

Source: NARUC 1992, *supra* note 128, at 75, 130–31.
1. Tariff filing for informational purposes only. 2. North Dakota required "registration" of operators.

146. These States generally required board "approval" of the state commission. *See* Shew, *supra* note 116, at 17; NARUC 1992, *supra* note 128, at 130–31.

147. *See* Shew, *supra* note 116, at 16–17. All operators were required to file their wholesale prices for approval. Only in Illinois and Massachusetts, were firms also required to file their retail prices.

148. *See* NARUC 1992, *supra* note 128, at 130–31, tbl.10.

149. *Id.*

150. *Id.*

C. No Regulation Prior to the Enactment of the 1993 OBRA

State	State Law or PUC Ban
AL, CO, DC, FL, GA, ID, IL[1], IA, KS, MD, MN, MT, NE, OK, OR, RI, TX, UT[1], VT, WA, WI[1]	
AR, ME	Since 1991
DE, MO	Since 1986
MI, NC	Since 1992
SD	Since 1988
Source: NARUC 1992, *supra* note 128, at 30, 95, 105, 130–31. 1. No regulation exercised in markets with two or more operators.	

Table 2 below summarizes the various types of regulation in place for those States that continued to have some form of regulation after the 1993 OBRA and final consideration of all state petitions to the FCC.

TABLE 2
STATE REGULATION 1994–2000
STATES WITH CHANGES IN PRICE REGULATION AFTER 1993
OBRA AND FINAL JUDGMENT ON STATE PETITIONS

State	Federal Entry & Rate Reg. Preemption[1]	Tariff Filing	Other Reg.[2]
AK, AR, KY, MA, ME, WI[3]	•		Certification[4]
AZ, CA, CT, HI, NC, OH, VA, WY	Since 1995		
MS, NM, WV	•	•	Certification
NY	Since 1995	•	Certification
Sources: NARUC, REPORT ON THE STATUS OF COMPETITION IN INTRASTATE TELECOMMUNICATIONS 184–85 tbl.15 (1994); NARUC, TELECOMMUNICATIONS COMPETITION 294–99 tbl.21 (1997). 1. Federal entry and rate regulation preemption became effective on August 10, 1994, pursuant to FCC Decision GN Docket 93-252. According to statute, on August 10, 1994 all States had to either (i) desist from rate regulation of CRMS or (ii) file a petition with the FCC to seek permission to continue such regulation. For purposes of this table, those States that show rate regulation continuing until 1995 had petitioned the FCC for permission to continue rate regulation after August 10, 1994. Those petitions were denied in May of 1995 and reconsideration of those petitions were generally denied in August 1995. 2. States are not preempted from "quality" regulations or the regulation of general terms and conditions of intrastate mobile telecommunications operations. 3. No regulation exercised in markets with two or more operators. 4. No certification required in AK, MA or ME. KY requires USoA.			

III. REGULATION, COMPETITION, AND PRICING IN THE UNITED STATES' MOBILE TELECOMMUNICATIONS INDUSTRY

A. *Hypotheses to Test*

The proposed consumer price (retail price) regulation and the zero-price access rule (wholesale price regulation) of network neutrality are analyzed in context of state regulatory choices before and after federal preemption. In addition, the relative value of different types of regulation

is examined. The specific hypotheses to test are set forth below under headings (i(b)) and (ii).

Although not the central focus of my analysis, the state of competition in the industry is highly relevant to ultimate policy decisions. Arguably, the greater the degree of competition in a market, the greater is the burden to justify regulatory intervention.[151] In particular, in a fast-paced innovative industry such as mobile Internet access, the risk is increased that suboptimal regulation will hinder development.[152] A thorough examination of competition in this industry is beyond the scope of this Article, but I expressly consider here how regulation, specifically federal entry regulation, has led to the decrease in consumer prices commonly associated with competitive markets. *See* heading (i(a)) below. Moreover, as set forth under headings (iii) and (iv), I examine how service and market characteristics may allow a given firm to exert anti-competitive market power.

i. How does regulation affect consumer prices? Specifically: (a) To what extent, if at all, does federal entry regulation affect consumer prices, and (b) to what extent, if at all, does state regulation affect consumer prices?

ii. How do specific types of regulation affect consumer prices? Specifically: (a) To what extent, if at all, does "high" versus "low" levels of regulation affect consumer prices, and (b) to what extent, if at all, does wholesale price (interconnection) regulation affect consumer prices?

iii. Does multimarket interaction influence consumer prices? Are prices higher or lower for operators that compete against each other in several markets?

151. It is a general welfare theorem in economics that a competitive equilibrium, under certain assumptions, is Pareto optimal. That is, the equilibrium cannot be changed to another that would increase the welfare of some consumers without decreasing the welfare of others. In an ideal competitive market, government intervention would not be necessary to increase efficiency although some may argue for income distribution policies unrelated to efficient resource allocation. *See, e.g.*, W. KIP VISCUSI ET AL., ECONOMICS OF REGULATION AND ANTITRUST 77–79 (4th ed. 2005).

152. *See, e.g.*, FTC, A National Broadband Plan for Our Future, *Comments*, GN Docket No. 09-51 ¶ 2 (Comm. Print 2009) ("Policies that promote competition and consumer protection can foster new and innovative offerings. . . . This insight applies forcefully to the broadband access and Internet content and applications market."); FCC, Fostering Innovation and Investment in the Wireless Communications Market: A National Broadband Plan for Our Future, *Notice of Inquiry*, GN Docket No. 09-157 ¶ 5 (Comm. Print 2009) ("[W]hile we recognize the success of certain regulatory policies in promoting innovation, we are aware that Commission policies and processes can also hinder the progress of innovation and investment.").

iv. Does brand recognition affect consumer prices? In particular, may the mobile telecommunications operator affiliated with the local landline telephone company charge a premium because it may be better known than the competing operators? Alternatively, does incumbency affect consumer behavior?

B. *Description of the Variables*[153]

The analysis here examines data for each wireless operator in a particular MSA at a particular point in time (1985, 1993, 1997, 1998 or 2000). For ease of comparison with prior works in this area, I adopt many of the variable names and variable choices utilized by Shew (1994).[154] The endogenous variable for this study is the log of the consumer prices for a minimum of 100–160 "any time" minutes offered by a given firm at a particular time in one of the top twenty-six MSAs. Below is set forth a list of the key variables. A complete description of all variables and the source of the corresponding data are set forth in Appendix 1.

Dependent Variable:

Price

Operators offer nonlinear prices with multiple price plans among which consumers may self-select their preferred plan. The plans may be broken down into 6 basic components: (1) a one-time activation fee, (2) a recurring access fee, (3) a roaming fee, (4) a long-distance fee, (5) a peak per minute fee, and (6) a non-peak per minute fee.[155] To simplify further, the plans may be described as a multi-tiered pricing plan where (1) the activation and access fee entitle the subscriber to a

153. *See infra* Appendix 1 for a summary of variable names, descriptions, and sources.

154. For a more thorough comparison of the variables utilized in this analysis and those used by Shew, *see* Shew, *supra* note 116, at 22–31.

155. An additional price of service is the purchase price of the customer handset. Often this price has been heavily subsidized by operators, usually in exchange for a long-term service agreement with the consumer. Typically, however, authors have chosen not to expressly include the price of handsets in the calculation of the service price variable. *See, e.g.*, Shew, *supra* note 116; L. Keta Ruiz, *Pricing Strategies and Regulatory Effects in the U.S. Cellular Telecommunications Duopolies*, *in* TOWARDS A COMPETITIVE TELECOMMUNICATIONS INDUSTRY: SELECTED PAPERS FROM THE 1994 TELECOMMUNICATIONS POLICY RESEARCH CONFERENCE, 13–46 (Gerald Brock ed. Lawrence Erlbaum Assocs. 1995); Hausman, *supra* note 116, at 563–604; Hugh S. Fullerton, *Duopoly and Competition: The Case of American Cellular Telephone*, 22 TELECOMMS. POLICY 593–607 (1998); Philip M. Parker & Lars-Hendrik Röller, *Collusive Conduct in Duopolies: Multimarket Contact and Cross-Ownership in the Mobile Telephone Industry*, 28 RAND J. ECON. 304–322 (1997). For purposes of the analysis here, the cost of handsets is not included in the calculation of service price. However, future research that redefines the price variable to account for differences in long-term and short-term contract prices may capture some of the effect of handset subsidies and would be an interesting point for comparison. *See, e.g.*, Ruiz, *supra*, at 37 (finding that during the cellular duopoly the price of service under a contract was 2.96% less than without a contract).

certain number of minutes of usage, and (2) additional fees may or may not be assessed on those minutes if they are made outside of the area or network (roaming), are to a phone number outside of the area (long-distance), or are made during a peak period.

For this study, the dependent variable is the log of PRICE, log(P), where P is defined as the monthly bill paid by a single subscriber for a given level of usage. I examine the least expensive plan to provide the subscriber with 100 to 160 "any time" minutes of use per month. The use of "any time" minutes bypasses the need to set a somewhat arbitrary ratio of peak to off-peak minutes of use.[156] The choice of 100 to 160 minutes of use was selected primarily for three reasons. The first reason is theoretical. The least cost plan is arguably the plan chosen by the "marginal" consumer. The marginal consumer is the one who is most likely to have just been lured into the market by an attractive low price and will also be the first customer to leave if prices are increased. The marginal consumer is a "representative" consumer for purposes of this analysis. The second reason this particular number of minutes of use is of interest is because it is a fair approximation of the average number of minutes of use for the time period between 1993 and 1999, the duopoly/oligopoly period of the study.[157]

The average "minutes of use" from 1993 to 1999 was 134.[158] In the early years of mobile telecommunications, the average consumer's minutes of use actually declined as non-business users entered the market.[159] As consumer prices decreased, the average consumer's minutes of use began to increase to the levels listed here.[160] Therefore, the average minutes of use for the period of this analysis should be skewed slightly downward to compensate for the missing data from 1985–1992. Finally,

156. When creating a "best price" index that includes peak and off-peak minutes, many studies adopt a 20%:80% ratio. *See, e.g.*, California Petition, *supra* note 114, at 7536.

157. *See* Thomas J. Sugrue, Comments Presented to FCC for the Sixth Annual CMRS Competition Report tbl.5 ("*Average Minutes-of-Use per Month 1993 to 2000*") (June 20, 2001), *available at* http://wireless.fcc.gov/statements/010620cmrsSugrue_slides.ppt (citing CTIA, Semi-Annual Mobile Telephone Industry Survey 168–69 (June 2001)).

158. *Id.*

159. *See id.*; CTIA, *Midyear Survey Report* (2009), *available at* http://files.ctia.org/pdf/CTIA_Survey_Midyear_2009_Graphics.pdf (for graphs of subscriber data and minutes of use). The survey shows numbers and usage from 1985 to 2009 (average monthly bill, number of subscribers, total minutes used, etc.); however, what is not shown is the average number of minutes used by individual wireless customers. See also, FCC 6th Annual Report 22, FCC 01-192, July 2001, http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-01-192A1.pdf.

160. *See* Sugrue, *supra* note 157.

100 to 160 minute plans are of interest insofar as low-usage plans seem to have greater price variance than do high-usage plans.[161]

In addition to the pricing components that make up a service plan, service plans may be further distinguished as "basic" plans or "discount" or "promotional" plans. Basic plans are those plans which are usually available on a long-term basis. Discount or promotional plans are usually available on a short-term basis, often during a three to six month window, to a customer who is initiating service or renewing a contract during that time. Discount plans are a common tool of operators to encourage subscription when a new competitor enters the market or in anticipation of a high activation period such as the holiday season of December. Discount plans are also a way for many operators to offer lower prices while circumventing arduous state filing requirements for basic plan offerings.[162] For this study, the lowest priced plan available for the given quarter was used whether that plan was a "basic" or "promotional" plan. The limitation of using discount rates without consideration of other restrictive terms of the contract may overstate the savings experienced by consumers. However, the choice to use the "best price" available irrespective of whether the best price is given by a discount plan is based on evidence that the vast majority of subscribers migrate to lower priced promotional plans when available.[163] Some studies note that by 1994 less than 20 percent of cellular subscribers were on basic plans.[164] Subscribers themselves, therefore, exhibit a preference for the lowest price plan even when such plans may be accompanied by more restrictive or punitive conditions than other available plans.

An example of a widely used restrictive condition on service plans is that the plan may require a consumer to lock into a given price for a one or two year time period. Such contractual obligations force a consumer to choose between a low price and increased flexibility. Moreover, such long-term contracts are enforced by high termination fees, typically $150 dollars or more.[165] This may equate to as much as six months or more of a very low priced service plan making a switch during the contract term

161. Based on comparative standard deviations of three distinct plan categories in the dataset tested here.

162. *See, e.g.*, California Petition, *supra* note 114, at 37 (citing L.A. Cellular Supplemental Comments, in which advocates for L.A. Cellular argued that "new rate plans [basic plans] still require significant advance notice and that [California] PUC procedures require characterization of rate reductions as 'promotional' if they are to be implemented with minimal delay.").

163. *See id.*

164. California Petition, supra note 114, at 7536.

165. *See*, Judge: Early termination fee on cell phone contract illegal, caller.com, July 29, 2008, http://www.caller.com/news/2008/jul/29/judge-early-termination-fee-cell-phone-contract-il/.

highly unattractive. As a preliminary calculation, the lowest price plan was selected without regard to the term length of the contract. Alternative calculations of the PRICE variable to differentiate between the lowest prices for plans of one year or less and plans of one year or more are reserved for future research.[166]

Regulatory Variables:

State Regulation

The following dummy variables are employed to test the effect of state regulation. Three regulatory regimes can be identified for the period of this study: (1) "low regulation" in States where operators faced terms and conditions regulation, including possible tariff filing requirements, but were not required to submit tariffs for commission approval, (2) "high regulation," where operators were required to file proposed prices for commission approval and/or faced price cap or profit cap regulation, and (3) "no regulation," in States which by legislation or regulatory decision enforced no price or terms and condition regulation. Accordingly, three dummy variables are defined corresponding to low regulation, REGL, high regulation, REGH, and no regulation, REGN. The excluded variable is REGN. The Broadband Internet Freedom Act corresponds at least to "low regulation" as it calls for tariff filing. It also has similarities to "high regulation" as it calls for tariff approval but the approval process may fall short of stringent profit cap or price cap regulation.[167]

Federal Entry Regulation[168]

In the absence of collusion, direct competition makes the demand for an operator's service more elastic, since any increase in its service price may cause it to lose business to its rival. Increases in the number of operators decrease competitors' ability to coordinate prices and to collude. Thus, other factors being equal, a market with many operators should produce lower service prices than duopoly or monopoly markets.

More specifically, each additional operator in the market may have a greater or smaller impact on consumer prices than the previous entrant. In accordance with economic theory, it is anticipated that the move from two or fewer operators to three or more operators would have led to a decrease in prices.[169] In other words price asymptotically approaches

166. *See supra* note 155.

167. H.R. 2902 111th Cong. §§ 3(b), 4(d) (2009).

168. For this analysis, federal regulation is modeled solely as entry regulation. Accordingly, the effect that the number of operators in a market has on prices is considered a proxy for the effects of federal entry regulation.

169. This follows naturally from one of the basic tenets of economics: as competition increases, prices will decrease. *See, e.g.*, FTC, BROADBAND CONNECTIVITY COMPETITION

marginal cost as the number of competitors approach infinity. I model entry with two dummy variables DTWO for markets with one or two operators and DMORE for markets with three or more operators. The excluded variable is DMORE.

Service Variable:

Wireline

A market structure variable of interest is the competitive effect of being the "wireline" (i.e. the local exchange carrier) versus the "non-wireline" licensee in the market. WIRELINE is a dummy variable taking the value of 1 if the operator is the local wireline operator and 0 otherwise. Because the FCC decided to license the local wireline operator and one non-wireline operator in each market, it arguably created an immediate advantage for the local wireline operator as one who had already established its name and quality in the minds of the local consumers.[170] Whether incumbents retain market power is of continued importance in the network neutrality regulation debate as incumbents are rendered ineligible for participation in certain programs due to the presumption that they have a competitive advantage in the market.

The interpretation of this variable is complex in that it encompasses both reputational effects and cost advantages. Some of these incumbency advantages will be controlled for by the age of market variable described below, but to the extent they are not they may affect the WIRELINE variable.

Market Variables:

Multimarket Contacts

Many of the firms in this study have extensive mobile telecommunications holdings. Indeed, several firms' holdings are so extensive that their licenses constitute a national network.[171] As a result, several firms confront each other in each of a number of geographic markets. Such confrontation has the theoretical potential of diminishing the degree of competition as repeated interaction in various markets increases the opportunity for reprisal against a firm which competitors view as pricing too aggressively in a market. In addition, repeated interaction also presents greater opportunities for the coordination of prices among competitors. Thus, when firms in a particular market confront each other in a number of other markets as well, there may be a tendency for prices

POLICY, *supra* note 16, (stating that increased competition leads to lower consumer prices in the wireless market).

170. *See, e.g.*, Ruiz, *supra* note 155, at 31.

171. In particular, SBC, AT&T, and Bell Atlantic had subscribers and extensive license holdings across the nation. Sprint had extensive licenses but, at the time of this study, had not yet built out its network.

in that particular market to be higher. To the extent providers are acting in concert, this variable may also inform the general "bottleneck" concerns emphasized in the net neutrality debate.

To model interaction, a dummy variable is created for multimarket contacts with four specific firms: AT&T, Bell Atlantic, SBC, and Sprint.[172] The first three firms have been in the mobile telecommunications marketplace since 1985. Bell Atlantic and SBC are both original wireline operators in seven of the top twenty-six MSAs.[173] In 1997 and 1998 (midway through the oligopoly period studied here) AT&T, Bell Atlantic, and SBC were first, second, and third in total number of subscribers in the national market.[174] In reverse order (SBC, Bell Atlantic, and AT&T) these firms were first, second, and third in penetration rates of the respective total population covered by its licenses (also known as total, licensed "POPs").[175] Because of all these factors, it would be unsurprising to find that the presence of one of these operators might have a strong impact on the pricing behavior of rivals in a particular market. An aggressive competitive strategy by one or all might lead to lower prices in markets in which they compete. If these firms tend to collude with rivals, prices may actually be higher in markets where these firms compete. Alternatively, a non-cooperative equilibrium with higher than competitive prices could arise if it were more costly for a firm with multimarket contacts to cut prices against a rival who might in turn cut prices in other markets in response.

Sprint is a relative newcomer in the market, licensed as one of the original PCS operators in 1995 and starting operations in 1996.[176] Although in 1997 and 1998 Sprint was too new to have the penetration and subscriber rates that AT&T, Bell Atlantic, and SBC had, Sprint had purchased a large amount of licenses that made it number one in total POPs.[177] Sprint is included in the study to look at the impact on prices of a nationwide "third entrant" in the marketplace.[178]

The multimarket contact dummies are MMATT, MMBA, MMSBC, and MMSPRINT. Each dummy takes the value of 0 if a particular operator in a given market at a particular time does not meet the specified

172. During the time period of this study, AT&T and SBC were separate entities. In 2005, SBC merged its Cingular wireless brand with AT&T wireless and, in most markets, rebranded Cingular as the "new AT&T."

173. *See* PAUL KAGAN ASSOCS., INC., KAGAN CELLULAR TELEPHONE ATLAS (1998).

174. *Id.*

175. *Id.*

176. *Id.*

177. *Id.*

178. In other words Sprint was often the third licensee in any given, previously duopolistic, MSA.

contact firm in any other market, 1 if they meet in one other market, 2 if they meet in two other markets, and so forth.

Other Market Variables

Other explanatory market variables include DENSITY, LAND, AVGINC, TTI and AGEMKT. In order, DENSITY is a measure of population in units of 100,000 per one thousand acres of land. The denser an area, the more efficiently it may be serviced by a given cell site. In addition, the total area covered by a given operator may affect its ability to provide service efficiently. Therefore the variable LAND is included where LAND is the number of acres in units of one thousand in each covered MSA. The variable AVGINC is the average annual income in the given MSA. It would be expected that in markets with higher personal income levels, the demand for mobile telecommunications services will be higher as well. The travel time index, TTI, is an index of the commute time for each geographic market study. This variable is in part a proxy for business density in the market. The variable AGEMKT is defined as the number of months the market has been serviced. Barring the exit of the oldest firm from the market, the number of months the market has been serviced is equivalent to the number of months that the first entrant in the market has been in operation.

Indicator Variables:[179]

Regional Dummies

To control for the fixed-effects that may be associated with each region within the study, four regional dummies are utilized: Northeast, REGION1; Midwest, REGION2; South, REGION3; and West, REGION4. Many of the firms in this study were regional operators (the regional Bell operating companies or RBOCs, for example).[180] Therefore, the regional dummy is used to control for the centralized costs associated with each firm's production function. Moreover, this dummy acts as a proxy for the local cost price index, it would be expected that operators in regions with higher consumer price indexes, would charge higher consumer prices. The excluded variable is REGION1.

Time Period Dummies

The study covers five time periods: monopoly, duopoly, and three points of time in the oligopoly period. As the industry has aged, and as the number of competitors in the market has increased, observed consumer

179. The term "indicator" variable is used here as short-hand to designate the use of binary variables.

180. Firms in distinct regions may have unique operational characteristics that this variable will help isolate. It will not, however, differentiate between operational distinctions between two operators in the same region.

prices have decreased. This is exactly what is predicted from economic theory. In accordance, the five time period dummies should register the progressive decrease in consumer prices over time. The excluded period is PERIOD5, the last period in the study.

C. *Regression Analysis*

A reduced-form price equation is used to explain an operator's consumer prices in a given market at a particular point in time in terms of state regulation ("R"), a service variable ("S"), market-specific variables ("M"), as well as the regional and time indicators ("I"): Log(P*) = *f*(R, S, M, I). The reduced-form price model is estimated using a generalized least squares method.

D. *Estimations and Results*

1. The Full Model

The key results of the full random-effects generalized least squares reduced-form price model are presented in Table 4.[181]

TABLE 4
ESTIMATES OF THE REDUCED-FORM PRICE MODEL FOR MOBILE TELECOMMUNICATIONS SERVICES

Variable	Random-Effects Model	
	Coefficient	Standard Error
Regulatory Variables		
REGL	0.0563**	0.0255
REGH	0.0382	0.0436
DTWO	0.0475**	0.0239
Service Variable		
WIRELINE	0.0325	0.0242
Market Variables		
MMATT	0.0086*	0.002
Market Variables (Continued)		
MMSBC	-0.0244*	0.0065
MMBA	0.0106	0.0071
MMSPRINT	0.0144*	0.0017

181. For complete regression results, *see* Appendix 2. A fixed-effects least squares model was also performed for comparison. A Hausman specification test was performed to test the assumption in the random-effects model that there is no correlation between the included explanatory variables and the cross-sectional random effect. The results indicate that the random-effects model is both fully-efficient and consistent at a 99% confidence level. In accordance with that determination, the random-effects model results are presented for discussion and analysis.

Variable	Random-Effects Model	
	Coefficient	Standard Error
R^2	0.7873	
1. The dependent variable is the log of consumer prices for 100 to 160 "any-time" minutes offered by each operator in each time period. 2. The GLS random-effects regression results are shown. Using Hausman's specification test, the random-effects model was found to be fully efficient and consistent at a confidence level of 99%. 3. *N* = 440. 4. (a) * significant at the 99% confidence level, (b) ** significant at the 95% confidence level, and (c) *** significant at the 90% confidence level.		

Regulatory Variables:

The results of the model provide no evidence that customers benefited from state price regulation.[182] In those States in which regulation is considered high (where tariffs are required to be filed with the PUC for approval), the result of such efforts is shown to increase prices by 4% over the prices found in States that have no regulation at all. This result, however, is statistically insignificant. This is similar to the finding of Ruiz who also found a positive, but statistically insignificant, effect to her comparable definition of high regulation.[183] It is also similar to the overall findings of Shew's differentiated regulatory model. In that model Shew found that the majority of the state price regulatory schemes tended to raise prices (had a positive effect), but were statistically insignificant.[184] However, in contrast to Ruiz, in Shew's simple modeling of regulation, he found that "high" regulation had a negative, but still statistically insignificant, effect.[185]

Hausman also found the effect of high regulation was to increase consumer prices and to a much larger degree than that found by other authors, 15% as opposed to the 4% found here and the 1% found by Ruiz.[186] In fact Hausman directly critiqued Ruiz's finding on regulation for being inconsistent with his observation that the highest average consumer prices were found in regulated states.[187] In addition, Hausman apparently surmised that because the decline in prices in 1996 came after the elimination of state price regulation, then the preemption of state

182. Not addressed here are the costs to consumers in their role as taxpayers, who must pay for the cost of designing, maintaining, and enforcing regulatory procedures. Adding these costs to the consumer bill might encourage legislators to ban some or all regulatory activity in this arena in a preemptive move to avoid such costs. This is especially persuasive in the context considered here, where the regulator is enacting consumer protection policies aimed at countering anticompetitive pricing rather than trying to protect consumers' health and safety.

183. Ruiz, *supra* note 155, at 37.

184. Shew, *supra* note 116, at 35–37.

185. *Id.* at 36 tbl.5-1 (results for the Price Caps and Profit Reg. coefficients).

186. Ruiz, *supra* note 155, at 37; *see also* Hausman, *supra* note 116, at 593.

187. Hausman, *supra* note 116, at 593.

price regulation was the cause of declining prices and, therefore, state price regulation prior to 1996 must have increased prices artificially.[188]

Returning to discussion of the results presented in this study, perhaps most interesting is that a low level of non-price regulation, for example, certification processes and accounting requirements, has a positive and statistically significant effect on consumer prices. In other words, States that exercise low levels of regulation exhibit higher consumer prices in mobile communications than those States where regulation is legislatively banned or in which the PUC formally forgoes regulation. For example, all other things being equal, a consumer in an MSA within a State with low regulation (REGL) would spend 5.6% more for her service than a consumer in an unregulated state, or an additional $1.12 on a $20 monthly bill. It is exactly these "low level" (i.e., non-price) types of regulation that are allowed under current law and which States have shown an interest in expanding.[189]

Looking to the federal entry regulation variable, the change from two or fewer operators to three or more operators had the effect of lowering consumer prices. The positive result of the DTWO coefficient implies that mobile telecommunications customers paid higher prices, approximately 4.7% higher, when only two or fewer operators were in

188. An alternative specification to the full model is tested in which, similar to Hausman, the time period and regional indicator variables are dropped. Also the "entry" variable is simplified to a discrete, "Number of Operators" variable. The most significant distinction between the full-model and the alternative specification is that the coefficient for the state regulatory variable for high regulation, REGH, is larger and highly significant. This result is unconvincing, however, as the variations in the two specifications represent real distinctions. For instance, the time indicators used in this study may be interpreted as controlling for such changes in input costs over time. The time indicators are decreasing in magnitude and statistically significant, showing that consumer prices did indeed decrease overtime. For these and other reasons, the more conservative results of the more comprehensive full model are presented for discussion.

189. The results of the random-effects model are distinct from those of the fixed-effects model. Although in the random-effects model the coefficient of low regulation is positive and significant, the same coefficient in the fixed-effects model, although positive also, is not significant. Moreover, the sign for the high-regulation coefficient in the random-effects model is positive, but it is negative in the fixed-effects model, although in both models these results are not significant. The discrepancy between the two models casts some doubt on the dependability of the results of both. However, there is some evidence that the random-effects model is more descriptive than the fixed-effects model.

The nature of the fixed-effects model limits it to the identification of variables that change over time. That is, the impact of variables which are constant over time—such as regional distinctions—are absorbed into the fixed effect and are not separately estimable. There is no dispute that many state regulatory regimes changed as a result of the 1993 OBRA. However, as a statistical matter, it is not immediately evident that the regime changes were sufficiently numerous to be identified in the fixed-effects model. A structural change test indicated that the change in regulatory regimes was indeed not statistically significant. This finding supports the conclusion that the random-effects model results are superior to those of the fixed-effects model.

the market as opposed to when more than three operators were competing. The result is statistically significant and is consistent with the results predicted by economic theory.

Service Variable:

The variable of WIRELINE may have several different meanings that make it difficult to interpret. It may be a proxy for "brand" and/or service quality. Due to the nature of the FCC entry program, the wireline operator is also the incumbent operator who may have additional advantages not fully controlled by the AGE variable. It was expected that all of these advantages would more likely than not allow the wireline operator to charge a premium for services. Although the WIRELINE coefficient is indeed positive, it is not significant and therefore not a major contributor to the makeup of consumer prices.

Market Variables:

The multimarket dummy variables provide mixed results. Only one of the three dummies, MMBA is not significant. Two of the four, MMATT and MMSPRINT are highly significant with positive coefficients. This translates to higher prices for consumers when rival firms meet these two providers in multiple markets. A possible interpretation of this result relates to a key similarity between the two operators—Sprint and AT&T are numbers one and two in the total number of licensed POPs. For both Sprint and AT&T, this large number of POPs is due to the great number of licenses they hold and the wide coverage they enjoy. In turn, this greater coverage area translates into more multimarket contacts with competing firms. The results tend to suggest that the higher the absolute number of multimarket contacts the firm has, the greater is its ability to influence increases in consumer prices.[190]

An intriguing result is that multimarket contact with SBC has a negative impact on the prices of its competitors. For each additional market in which rivals also compete against SBC, prices are lower. A possible explanation may be associated with the fact that SBC is the competitor that had the highest penetration rates in its licensed POPs of the three other firms modeled. Its deep penetration rates suggest that SBC's competitive strategy may be explained by a theory set forth by Bernheim and Whinston (1990).[191] Bernheim and Whinston point out that a firm facing interaction with competitors across many markets may decide to fight vigorously and simultaneously in all markets so that its short-term gains are not just in one market, but in all its markets.[192]

190. PAUL KAGAN ASSOCS., INC., *supra* note 173.

191. Douglas Bernheim & Michael Whinston, *Multimarket Contact and Collusive Behavior*, 21 RAND J. ECON. 1 (1990).

192. *Id.* at 2.

Of the remaining market variables (DENSITY, LAND, AVGINC, TTI and AGEMKT) only LAND and DENSITY are statistically significant. The LAND variable coefficient is positive and highly significant. If the LAND area of the MSA is greater than in other studied MSAs, the prices charged by firms are also slightly higher. This corresponds with the interpretation that, controlling for population density, the size of the area contributes to the costs of operation and consequently leads to higher consumer prices. The coefficient of the variable of population density, DENSITY, is also significant and is negative. The negative sign of this coefficient supports the interpretation that higher levels of density in an area provide an operator the opportunity to efficiently provide service to more subscribers at a given price than is possible in more sparsely populated areas. If population is not dense, operators must create more cells to cover the area which necessitates a greater degree of capital investment than in highly populated areas.

Indicator Variables:

As expected, the time period indicators may be interpreted to show decreasing consumer prices over time. The excluded indicator is that of the last oligopoly period studied, the year 2000. Each prior time period has a positive and significant coefficient indicating that each time period prior to the last had higher consumer prices. Moreover, the coefficients of each succeeding time period are decreasing such that the coefficient for PERIOD1 > PERIOD2 > PERIOD3 > PERIOD4. Again, this is the expected result that demonstrates that consumer prices were decreasing over time.

The only significant regional indicator was that of REGION2, the Midwest. The excluded regional indicator was the Northeast and, therefore, the negative coefficient on REGION2 indicates that consumer prices in the Midwest were lower than those in the Northeast. Given the comparative consumer price indices of these two regions, this is as would be expected.

2. The Full Model with Differentiation of State Regulatory Programs

To test the effects of a specific type of regulation, the regulatory variables of the full reduced-form price model are redefined in two variations. First, the regulatory variable REGH is more specifically defined to distinguish between two types of "high" regulation: (1) tariff approval requirements combined with price cap or profit regulation, REGPCPR,[193]

193. Price cap and profit regulation regimes are separate and distinct forms of industrial regulation and, ideally, should be tested as separate explanatory variables. In this study, however, four States practiced price cap regulation and only two States practiced profit regulation.

and (2) tariff approval requirements alone, REGOH. The results are set forth below in Table 5.

The second formulation of regulation redefines the regulatory variable to pinpoint those states which engaged in wholesale price controls. This construction is particularly informative to the network neutrality debate as this choice of regulation is most akin to that proposed under the network neutrality rubric encapsulated by the zero price rule. To isolate the effect of wholesale price regulation REGH is disaggregated to two variables, "high" regulation of wholesale and consumer prices, REGHWC, and "high" regulation of wholesale prices only. REGL is similarly disaggregated to the two variables REGLWC and REGLW. The results are set forth below in Table 6.

TABLE 5
EFFECTS OF PRICE CAP AND PROFIT REGULATION

Variable	(i) Full Reduced-Form Model		(ii) Full Reduced-Form Model with Regulatory Differentiation	
	Coefficient	Standard error	Coefficient	Standard error
Regulatory Variables Equation (i)				
REGL	0.0563**	0.0255		
REGH	0.0382	0.0436		
Regulatory Variables Equation (ii)				
REGL			0.0585**	0.0256
REGOH			-0.0859	0.0846
REGPCPR			0.06841	0.0450

1. Coefficient for REGPCPR significant at the 87% level. 2. The dependent variable for both models is the log of consumer prices for 100 to 160 "any-time" minutes offered by each operator in each time period. 3. $N = 440$. 4. (a) * significant at the 99% confidence level, (b) ** significant at the 95% confidence level, and (c) *** significant at the 90% confidence level.

In Table 5, Column (ii), regulation is modeled with three different variables.[194] Similar to the full-model results presented in Column (i), the coefficient for low regulation is positive and statistically significant. The coefficient of the second regulatory variable, REGOH, is negative, indicating that tariff approval requirements lead to lower consumer prices; however, it is not statistically significant. Therefore, it is

To overcome the small sample size of these two regimes, I combined them as, arguably, each raises corporate responsibility to a similar and greater degree than other regulatory regimes (such as regulatory approval of tariff filings). A subsequent analysis with the price cap and profit regulation regimes estimated separately resulted in similar coefficients to the combined estimation. As expected, the separately estimated coefficients were less significant than the jointly estimated variable.

194. For complete regression results, *see* Appendix 3.

not possible to conclude that requiring tariff approval lowers consumer prices.

The third regulatory variable is REGPCPR. Arguably the price cap and profit regulation mechanisms, although separate and distinct programs, are the most onerous forms of price regulation practiced. To comply with these regimes, firms often must submit information on their costs, subscriber numbers, and profit margins. Such information is closely guarded by most firms, as it reveals a great deal of strategic information to rivals. Interestingly, the coefficient of this variable is positive indicating that this costly (to both firm and regulator) and intrusive regulatory scheme might actually raise prices rather than lower them. Such a result frustrates the goal of consumer protection and advocacy which is a primary justification for the regulation of private enterprises. However, the coefficient on REGPCPR is slightly below the 90% confidence level. This low level of significance may be due to the small sample size of States in this study that practiced price cap and profit regulation—only five States and only in the monopoly and duopoly periods. Nonetheless, the result is intriguing and would be an interesting factor to test in future research.

TABLE 6
EFFECTS OF WHOLESALE PRICE REGULATION

Variable	(i) Full Reduced-Form Model		(ii) Full Reduced-Form Model with Regulatory Differentiation of Wholesale Prices	
	Coefficient	Standard error	Coefficient	Standard error
Regulatory Variables Equation (i)				
REGL	0.0563**	0.0255		
REGH	0.0382	0.0436		
Regulatory Variables Equation (ii)				
REGLWC			0.0534**	0.0258
REGLW			(dropped)	
REGHWC			0.0318	0.0535
REGHW			0.0531	0.0617

1. Coefficient for REGPCPR significant at the 87% level. 2. The dependent variable for both models is the log of consumer prices for 100 to 160 "any-time" minutes offered by each operator in each time period. 3. $N = 440$. 4. (a) * significant at the 99% confidence level, (b) ** significant at the 95% confidence level, and (c) *** significant at the 90% confidence level. 5. The "Mutual Variables" of Table 14(ii) are of similar sign and magnitude to those set forth in Table 13(i) and are omitted for reasons of brevity.

In Table 6, Column (ii), regulation is modeled with four different variables. The four variables introduce, and specifically test, the effect of regulation in the wholesale market. States made one of five choices in

this arena, (1) applied "low regulation" to both the retail and wholesale markets for mobile services (REGLWC); (2) applied "low regulation" to the wholesale market only (REGLW); (3) applied "high regulation" to the wholesale and retail markets (REGHWC); (4) applied "high regulation" to the wholesale market only (REGHW) or (5) applied no regulation at all. Similar to the full-model results presented in Column (i), the resulting three estimates for the various coefficient formulations are positive. In particular, the coefficient for low regulation of both consumer and welfare prices is positive and statistically significant. This indicates that even relatively low, or presumably innocuous, regulation of wholesale and consumer prices may lead to higher consumer prices.

Interestingly the other two results for REGHWC and REGHW are positive, indicating once again that intrusive regulatory schemes might actually raise prices rather than lower them. However, the coefficients on these variables are not statistically significant and, therefore, definitive conclusions as to their impact on consumer prices cannot be made.

CONCLUSIONS AND POLICY IMPLICATIONS

The empirical results presented here have some interesting implications for the debate on network neutrality regulation of wireless Internet access providers. The presumed objective of industrial regulation is that consumer welfare will increase in the regulated market to a level over and above that attained in the unregulated market. The risk of suboptimal regulation, however, is that not only may it fail to increase consumer welfare, but it may actually lead to a net loss in consumer welfare. Suboptimal regulation can, therefore, be less preferable than the total absence of regulation even in imperfect or noncompetitive markets.

In this analysis, there is no evidence that regulation lowered consumer prices. If consumer prices are not lowered, penetration rates may not increase and the incentive to innovate created by increased network size is less likely realized. Moreover, there is no evidence to show that the result of price regulation such as that proposed for volume usage plans would have greater consumer benefit than the consumer rate regulation regimes studied here. Nor is there evidence that the zero-price rule, mandated access with a price control set to zero, would have greater consumer benefit than did previous interconnection mandates and wholesale price regulation. To the contrary, as demonstrated some state regulation—even relatively innocuous forms of regulation, such as certification processes and accounting requirements—actually lead to increased consumer prices. Such results again belie any presumption that regulation is consumer welfare enhancing *per se*. These results should

also counsel regulators to use caution in evaluating the benefits of even subjectively minor regulation as it appears to add real costs to consumers. The past regulatory experience in the industry provides a cautionary warning that such intrusion may be counter to the desired outcome of enhancing consumer welfare.

On the other hand, there is evidence that increased market entry lowered consumer prices. A corollary to this conclusion is that the FCC's past delay in licensing a fifth, sixth, and seventh operator may have led to the maintenance of higher prices and, thus, to consumer welfare losses. Such losses directly caused by regulatory policy, coupled with the success of direct competition, suggest that the FCC should liberalize its licensing of spectrum rather than hamper its rapid and efficient allocation with "open access" and other network neutrality requirements. In other words, the most consumer welfare enhancing regulation is synonymous with regulation that enhances competition. Network neutrality demands arguably tie the hands of operators to control their own networks, to provide acceptable quality of service levels and to differentiate their service by price, innovation, exclusive content, equipment partnerships or flexible usage rules.

Competition in wireless Internet access has the added benefit of perhaps reducing the concerns of network neutrality proponents in the parallel market of DSL and cable Internet provision. The entry of four facilities-based providers and several mobile resellers into the "last-mile" provision of at-home Internet services will place increasing competitive pressure for the market to move towards a zero-price rule if that is indeed the socially optimal outcome. Therefore, increasing competition, rather than stifling price experimentation in the consumer market and mandating application access prices in the application market, appears to be the more welfare-enhancing regulatory objective.

APPENDIX 1
TABLE OF DATA DESCRITPIONS AND SOURCE

Variable Name	Description	Source of Data
AGEMKT	Length of time market has been serviced in months.	Various publications of Paul Kagan Associates and FCC licensing records.
AVGINC	Average annual income.	State of the Cities Data Systems ("SOCDS") census data.
DENSITY	A measure of population in units of 100,000 per one thousand acres of land.	SOCDS census data.
DTWO, DMORE	Dummy variables to control for the presence of two or fewer or more than two operators in the market.	Various publications by Paul Kagan Associates and quarterly reports by Econ One.
LAND	Area in 1,000s of acres.	United States Census Department.
MMATT; MMBA; MMSBC; MMSPRINT	If given operator in a given MSA has contact with ATT (or BA, SBC, or SPRINT) in no other markets MMATT = 0; 1 if one other market contact with ATT, 2 if two other market contacts, etc.	Various publications by Paul Kagan Associates and quarterly price data reports by Econ One.
PERIOD1, 2, 3, 4, 5	Indicator variables of the respective years of the dataset.	Determined by PRICE data sources.
POP	The average population in 100,000s as of the end of year.	SOCDS census data.
PRICE	Average, least cost plan for 100–160 "any time" minutes per month.	Various publications by Paul Kagan Associates, quarterly price data reports by Econ One and FCC report.
REGION1, 2, 3, 4	Indicator variables of Northeastern, Midwestern, Southern and Western regions of the United States.	U.S. Census Bureau.
REGL	If operator is required to meet non-price regulation standards only REGL = 1; 0 otherwise.	Reports on the status of competition in intrastate telecommunications by the National Association of Regulatory Utility Commissioners ("NARUC").
REGH	If operator is required to file tariffs for commission approval REGH = 1; 0 otherwise.	Reports on the status of competition in intrastate telecommunications by NARUC.
REGOH	If operator is required to file tariffs for commission approval only REGOH=1; 0 otherwise.	Reports on the status of competition in intrastate telecommunications by NARUC.
REGPCPR	If operator is required to file tariffs for commission approval and is subject also to price cap or profit regulation REGPCPR=1; 0 otherwise.	Reports on the status of competition in intrastate telecommunications by NARUC.
REGLWC, REGHWC	If operator is subject to "low" or "high" wholesale and consumer price regulation REGLWC, REGHWC = 1, 0 otherwise.	Reports on the status of competition in intrastate telecommunications by NARUC.

Variable Name	Description	Source of Data
REGLW, REGHW	If operator is subject to "low" or "high" wholesale price regulation only REGLW, REGHW = 1, 0 otherwise.	Reports on the status of competition in intrastate telecommunications by NARUC.
TTI	The Travel Time Index (TTI) where TTI is an index of the commute time.	2004 Urban Mobility Study published by the Texas Transportation Institute.
WIRELINE	A dummy variable equal to 1 to indicate the local exchange operator granted an FCC "wireline" license and 0 otherwise.	Various publications by Paul Kagan Associates.

APPENDIX 2
ESTIMATES OF THE REDUCED-FORM PRICE MODEL FOR MOBILE TELECOMMUNICATIONS SERVICES

Variable	(i) Random-Effects Model		(ii) Fixed-Effects Model	
	Coefficient	**Standard error**	**Coefficient**	**Standard error**
Regulatory Variables				
REGL	0.0563**	0.0255	0.0160	0.0532
REGH	0.0382	0.0436	-0.0150	0.0617
DTWO	0.0475**	0.0239	0.0444***	0.0272
Service Variable				
WIRELINE	0.0325	0.0242	0.0318	0.0239
Market Variables				
MMATT	0.0087*	0.0020	0.0086*	0.0020
MMSBC	-0.0248*	0.0065	-0.0255*	0.0064
MMBA	0.0106	0.0071	0.0116	0.0072
MMSPRINT	0.0144*	0.0017	0.0147*	0.0017
DENSITY (Log)	-0.0719*	0.0293	0.0994	0.1099
LAND (Log)	0.0786*	0.0281	-0.2646	0.1499
AVGINC (Log)	0.008	0.0617	>-0.0001	> 0.0001
TTI (Log)	0.0664	0.1857	0.2862	0.3579
AGEMKT	-0.0001	0.0004	-0.0072*	0.0006
Indicator Variables				
REGION2	-0.0448***	0.0322	(dropped)	
REGION3	-0.0114	0.0322	(dropped)	
REGION4	0.0154	0.0440	(dropped)	
PERIOD1	1.2220*	0.0836	(dropped)	
PERIOD2	0.9008*	0.0512	0.3101*	0.0394
PERIOD3	0.4104*	0.0288	0.2164*	0.0265
PERIOD4	0.2756*	0.6561	0.1047	0.0730
CONSTANT	2.86*	0.6658	5.7657*	1.7486
R^2	0.7873		0.4189	

1. The dependent variable for both models is the log of consumer prices for 100 to 160 "any-time" minutes offered by each operator in each time period. 2. Column (i) shows GLS random-effects regression results. Column (ii) shows GLS fixed-effects regression results. Using Hausman's specification test, the random-effects model was found to be fully efficient and consistent at a confidence level of 99%. 3. N = 440 for both regressions. 4. (a) * significant at the 99% confidence level, (b) ** significant at the 95% confidence level, and (c) *** significant at the 90% confidence level.

APPENDIX 3
ESTIMATES OF PRICE CAP AND PROFIT REGULATION

Variable	(i) Full Reduced-Form Model		(ii) Full Reduced-Form Model with Regulatory Differentiation	
	Coefficient	**Standard error**	**Coefficient**	**Standard error**
Regulatory Variables Equation (i)				
REGL	0.0563**	0.0255		
REGH	0.0382	0.0436		
Regulatory Variables Equation (ii)				
REGL			0.0585**	0.0256
REGOH			-0.0859	0.0846
REGPCPR			0.06841	0.0450
Mutual Variables				
DTWO	0.0475**	0.0239	0.0495**	0.0239
WIRELINE	0.0325	0.0242	0.0324	0.0241
MMATT	0.0087*	0.0020	0.0087*	0.0020
MMSBC	-0.0248*	0.0065	0.0244*	0.0065
MMBA	0.0106	0.0071	0.0105	0.0071
MMSPRINT	0.0144*	0.0017	0.0144*	0.0017
LAND (Log)	0.0786*	0.0281	0.0803*	0.0284
AVGINC (Log)	0.0127	0.0608	> 0.0001	> 0.0001
DENSITY (Log)	-0.0719*	0.0293	-0.0683*	0.0295
TTI (Log)	0.0579	0.1851	0.0966	0.1863
AGEMKT	-0.0001	0.0004	-0.0007	0.0004
REGION2	-0.0448***	0.0317	-0.0528***	0.0328
REGION3	-0.0114	0.0322	-0.0215	0.0322
REGION4	0.0154	0.044	-0.0017	0.0452
PERIOD1	1.2220*	0.0836	1.2235*	0.0835
PERIOD2	0.9008*	0.0512	0.8948*	0.0511
PERIOD3	0.4104*	0.0288	0.4096*	0.0288
PERIOD4	0.2756*	0.0368	0.2778*	0.0386
CONSTANT	2.81*	0.6561	2.849*	0.6645
R2	0.7873		0.79	

1. Coefficient for REGPCPR significant at the 87% level. 2. The dependent variable for both models is the log of consumer prices for 100 to 160 "any-time" minutes offered by each operator in each time period. 3. N = 440. 4. (a) * significant at the 99% confidence level, (b) ** significant at the 95% confidence level, and (c) *** significant at the 90% confidence level.