Net Neutrality Policies and Regulation in the United States

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1. Introduction

The US has engaged in an increasingly contentious policy debate about net neutrality for more than a decade. The debate was effectively launched by Wu (2003), who made the case for regulatory restrictions on how internet service providers (ISPs) might structure their service offerings. The idea was perhaps given legs by Yoo (2004) and Wu and Yoo (2007), where Yoo effectively took the opposite view of Wu and the visibility of the articles lent the issue legitimacy.

The nature of the conflict on net neutrality has been unusually partisan and combative for an information technology issue. It has included the usual scholarly articles, articles for the general public, regulatory proceedings, Congressional hearings, and social media postings. But there have been unusually intemperate statements, such as Investor's Business Daily referring to advocates of net neutrality regulations as snake oil salesmen[1] and Senator Ted Cruz referred to the regulations as "Obamacare for the internet."[2] And there are political exaggerations and confuscations, such as the Senate Democrats tweet on February 27, 2018, stating that absent net neutrality regulations, the internet will deliver content one word at a time, implying that the internet would slow down to a crawl.[3] Partly as a good-humored response to doomsday-like predictions of the Federal Communications Commission (FCC) voting to 2017 drop net neutrality regulations, the current FCC chairman's chief of staff, Matthew Berry, tweets

[1] "Net Neutrality Advocates Are Modern-Day Snake Oil Salesmen," *Investor's Business Daily*, November 22, 2017 https://www.investors.com/politics/editorials/fcc-ajit-pai-net-neutrality-repeal/ (accessed August 27, 2018).

[2] Chen, Angela. May 16, 2018. "Why is Net Neutrality a Political Issue? Democrats & Republicans Won't Settle For A Compromise," *Bustle* https://www.bustle.com/p/why-is-net-neutrality-a-political-issue-democrats-republicans-wont-settle-for-a-compromise-9099979 (accessed August 27, 2018).

[3] @SenateDems, February 27, 2018, https://twitter.com/SenateDems/status/968525820410122240 (accessed August 24, 2018). The internet delivers everything one bit at a time regardless of speed.

almost daily counting the days since the decision went into effect and noting the continued thriving of the internet.[4]

The back and forth has been quite uncivil. There have been numerous protests against the FCC[5] and two of its chairmen,[6] bomb threats against the agency,[7] and threats of violence against the current FCC chairman and his family.[8] Activism of this nature is unusual for a telecommunications issue, perhaps indicating that some of the oversized rhetoric has been taken literally by some people, that the activism is part of a larger political agenda, or both. Resolving the motives behind these aspects of the conflict is beyond the scope of this paper.

Something that is puzzling about the intensity of the conflict is it appears to be about means rather than goals. Jamison and Layton (2016) conclude that both proponents and opponents of net neutrality regulations have the same stated goal: Robust and open networks so that entrepreneurs can thrive and benefit consumers. If the stated goals are the actual goals, then where the regulatory proponents and opponents differ is the role of regulation. Some believe that ISPs should be regulated in ways similar to those of monopoly telephone companies. Others believe that the FCC should play a limited role as a resolver of disputes.

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[4] See, for example, @matthewberryfcc, August 22, 2018, https://twitter.com/matthewberryfcc/status/1032365032225497088 (accessed August 24, 2018). This particular tweet says, "Day 73 of the post-Title II era: The Internet is free and open, and 86 years ago today, the BBC aired its first experimental television program, featuring jiu-jitsu, a performing sea lion, and a painting demonstration. I don't believe that the sea lion performed jiu-jitsu . . ."

[5] Fung, Brian. May 9, 2018. "Why the Internet is suddenly protesting on net neutrality all over again," *The Washington Post* https://www.washingtonpost.com/news/the-switch/wp/2018/05/08/senate-democrats-have-been-pushing-a-big-vote-on-net-neutrality-all-year-its-here/?noredirect=on&utm_term=.d451194aefda (accessed August 27, 2018).

[6] Protestors were at then-Chairman Wheeler's house before the 2015 decision (Fung, Brian. November 10, 2014. "Protesters descend on FCC chairman's house over net neutrality," The Washington Post https://www.washingtonpost.com/news/the-switch/wp/2014/11/10/protesters-descend-on-fcc-chairmans-house-over-net-neutrality/?utm_term=.31ad2ee3b82d, accessed August 27, 2018) and at Chairman Pai's home ("In Net Neutrality Protests, US Regulator Ajit Pai Bombarded With Pizzas," NDTV https://www.ndtv.com/world-news/protest-outside-us-telecom-regulator-head-ajit-pais-home-over-net-neutrality-1780769, accessed August 27, 2018).

[7] Mak, Aaron. December 14, 2017. "The FCC Had to Pause Its Net-Neutrality Hearing Because of a Bomb Threat," *Slate* http://www.slate.com/blogs/future_tense/2017/12/14/fcc_vote_on_net_neutrality_was_interrupted_by_a_security_threat.html (accessed August 27, 2018).

[8] Kang, Cecilia. June 30, 2018. "Man arrested for 'threatening to kill' Ajit Pai's family over net neutrality," *Independent* https://www.independent.co.uk/news/world/americas/net-neutrality-threaten-to-kill-ajit-pai-family-fcc-us-justice-a8424256.html (accessed August 27, 2018).

Still others believe that market pressures will appropriately incentivize ISPs and that consumer harms should be address with *ex post* regulations.

The divide has led to wide swings in how regulators and policy makers have approached the issue and defined it. One extreme has been the effectively hands-off approach adopted first during the administration of President Clinton and now followed by the Trump administration. The other extreme was the Obama administration's adoption of what is called Title II regulation, which is the regulatory framework contained in the Communications Act of 1934 to regulate monopoly telephone companies. In between these are the light-handed policies attempted during the George W. Bush administration and early in the Obama administration.

This paper describes how the US has approached net neutrality, the scholarly research regarding the effects of such regulations, and the current situation. Section 2 describes the various regulatory approaches, including how regulation has defined internet services, the hands-off approach of the FCC under former-President Clinton, how the FCC under former-Chairman Michael Powell and former-Chairman Julius Genachowski attempted to address discrimination concerns while maintaining a light-handed approach, the turn to Title II regulation under former-Chairman Tom Wheeler, and the reversal of that policy under Chairman Ajit Pai. Section 3 explores the economic research on net neutrality, emphasizing articles published in leading economic journals. Section 4 is the conclusion.

2. Regulatory Approaches in the US

The FCC has been the locus of activity on how to properly address net neutrality issues in the US. But the agency has struggled to develop a consistent course of action that courts would accept as appropriate given the agency's authorizing statutes. This section reviews the regulatory framework that existed prior to the FCC's attempts to address net neutrality and then examines the attempts themselves.

a. The Development of the Regulatory Philosophy

The regulatory story underlying net neutrality began over 60 years ago. In 1956, the Department of Justice and AT&T entered into a consent decree[9] that prohibited AT&T from serving unregulated markets and confining it to common-

[9] *United States v. Western Electric Co.*, 13 Rad. Reg. (P&F) 2143, 1956 Trade Cas. (CCH) 71,134 (D.N.J. 1956).

carrier communication services and government projects. Also in 1956 the DC Circuit Court issued a decision in Hush-A-Phone,[10] which allowed customers to attach a plastic device to AT&T phones, which AT&T had attempted to prohibit. Following up in 1968 the FCC decided in Carterfone[11] that anyone could connect any privately-beneficial equipment to AT&T's telephone network as long as the equipment was not publically harmful. This triggered the development of technical standards for equipment so that customers could choose any equipment they wanted that met the standards. This became part of the paradigm for net neutrality regulations.

The principles underlying the 1956 Consent Decree, Hush-A-Phone, and Carterfone, combined with rapidly changing computing and telecommunications technologies, led the FCC into a series of decisions collectively known as the Computer Inquiries. These decisions created the regulatory framework that led the agency to define the internet as an information service, not a common carrier service. This designation determined the nature of the agency's jurisdiction over the internet.

The first of these inquiries, *Computer I*,[12] created a dichotomy between "basic" and "enhanced" telecommunications services.[13] In its *Second Computer Inquiry*, the FCC defined basic services as "pure transmission capability over a communications path that is virtually transparent in terms of its interaction with customer supplied information"[14] that were "regulated under Title II of the [Communications] Act."[15] Enhanced services were "any offering over the telecommunications network which is more than a basic transmission service. In an enhanced service, for example, computer processing applications are used to act on the content, code, protocol, and other aspects of the subscriber's information."[16] The FCC concluded that "enhanced services should not be regulated under the Act."[17]

This line between basic and enhanced found its way into the Modification of Final Judgment (MFJ) that broke up AT&T in 1984. The MFJ distinguished

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[10] Hush-A-Phone Corp. v. United States, 238 F.2d 266 (D.C. Cir. 1956).

[11] *Use of the Carterfone Device in Message Toll Tel. Serv.*, 31 F.C.C.2d 420 (1968).

[12] *Regulatory and Policy Problems Presented by the Interdependence of Computer and Communication Services*, Notice of Inquiry, 7 FCC 2d 11 (1966).

[13] *Amendment of Section 64.702 of the Commission's Rules and Regulations* (*Second Computer Inquiry*), Docket No. 20828, Final Decision, 77 FCC 2d 384, 420, para. 97 (1980) (*Computer II Final Decision*).

[14] *Id*. at 420, para. 96.

[15] *Id*. at 428, para. 114.

[16] *Id*. at 420, para. 97.

[17] *Id*. at 428, para. 114.

between "telecommunications services" that were "actually regulated by tariff,"[18] and "information services," which included "data processing and other computer-related services,"[19] and "electronic publishing services."[20] The Telecommunications Act of 1996 (the 1996 Act) picked up this terminology, defining "information service" the same as in the MFJ.[21]

With the 1996 Act, Congress intended to "promote competition and reduce regulation."[22] In doing so it distinguished between the lightly regulated "information services" and "telecommunications services,"[23] which were regulated as common carrier services. Congress also found that the "Internet and other interactive computer services have flourished, to the benefit of all Americans, with a minimum of government regulation"[24] and made it the policy of the United States to "promote the continued development of the Internet and other interactive computer services and other interactive media" and "to preserve the vibrant and competitive free market that presently exists for the Internet and other interactive computer services, unfettered by Federal or State regulation."[25]

The FCC followed this basic-information dichotomy and also kept to the 1996 Act's preference for an internet unfettered by Federal or State regulation throughout most of its work on net neutrality, with the exception being the 2015 Open Internet Order.[26] For example, in the Commission's review the 1996 Act's definitions as they applied to the internet, it concluded that internet access services were properly classified as an information service.[27] It also concluded that subjecting ISPs to "the broad range of Title II constraints," would "seriously curtail the regulatory freedom that the Commission concluded in *Computer II* was

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[18] *U.S. v. Am. Tel. & Tel. Co.*, 552 F. Supp. 131, 228-29 (D.D.C. 1982) (*MFJ Initial Decision*), *aff'd sub nom. Maryland v. U.S.*, 460 U.S. 1001 (1983).

[19] *Id*. at 179.

[20] *Id*. at 180.

[21] *Implementation of the Non-Accounting Safeguards of Section 271 and 272 of the Communications Act of 1934, as amended*, CC Docket No. 96-149, First Report and Order and Further Notice of Proposed Rulemaking, 11 FCC Rcd 21905, 21954, para. 99 (1996) (*Non-Accounting Safeguards Order*); *see also, e.g.*, H.R. Conf. Rep. No. 104-458 at 126 (Jan. 31, 1996) ("'Information service' and 'telecommunications' are defined based on the definition used in the Modification of Final Judgment."); *see also Federal-State Joint Board on Universal Service*, CC Docket No. 96-45, Report to Congress, 13 FCC Rcd 11501, 11514, para. 28 (1998) (*Stevens Report*) (citing *MFJ Initial Decision*, 552 F. Supp. at 226-32).

[22] Preamble, Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996).

[23] 47 U.S.C. § 153(24), (53).

[24] 47 U.S.C. § 230(a)(4).

[25] 47 U.S.C. § 230(b)(1), (2).

[26] FCC, *In the Matter of Protecting and Promoting the Open Internet, Report and Order*.

[27] *Federal-State Joint Board on Universal Service*, CC Docket No. 96-45, Report to Congress, 13 FCC Rcd 11501, 11536, para. 73 (1998) (*Stevens Report*).

important to the healthy and competitive development of the enhanced-services industry."[28]

b. Decisions on Net Neutrality and their Aftermaths

The FCC's first attempt to address net neutrality was in 2005 – three years after Wu's article -- when the Commission adopted an Internet Policy Statement intended "to ensure that broadband networks are widely deployed, open, affordable, and accessible to all consumers".[29] The statement provided four consumer-centric guiding principles, also referred to as "Four Freedoms." (Powell 2004)

- Consumers are entitled to access the lawful Internet content of their choice.
- Consumers are entitled to run applications and use services of their choice, subject to law enforcement's needs.
- Consumers are entitled to connect their choice of legal devices that do not harm the network.
- Consumers are entitled to competition among network providers, application and service providers, and content providers.

The last principle should probably be read as a statement that regulators should not create barriers to competition: While it is meaningful to say that customers have a right to choose, it is another thing to say that they are entitled to multiple choices because the latter implies that someone has an obligation to create additional providers in otherwise monopoly markets. That is not something the FCC has taken upon itself to do.

The first three principles would be consistent with common carrier obligations if they had been imposed on ISPs. But the principles were framed like consumer protection. If the FCC had stopped there and simply (1) pressured ISPs to always offer a broadband service package that included access to all lawful content and apps, and allowed customers use of any device of their choosing, while (2) not prohibiting ISPs from offering other services packages, the net neutrality debate might have ended there in the US because ISPs rarely violated the three principles and most ISPs never violated them. But that isn't what the FCC did.

In response to a complaint that Comcast was degrading peer-to-peer internet traffic, the FCC chose to impose its principles as obligations.[30] Comcast

[28] *Id*. at 11524, para. 46.

[29] Preserving the Open Internet, 20 FCC Rcd 14986.

[30] *In re Formal Compl. of Free Press & Public Knowledge Against Comcast Corp. for Secretly Degrading Peer-to-Peer Applications*, 23 F.C.C.R. 13,028 (2008).

appealed and the DC Circuit Court rejected the FCC's decision, stating that the FCC had failed to provide statutory authority for imposing obligations.[31]

With the ball back in its court, the FCC launched a second light-handed attempt to address net neutrality in 2010 when the agency tried to write administrative rules regarding net neutrality.[32] This was early in President Obama's first term. In this decision, the FCC adopted three basic rules:

1. Transparency. Fixed and mobile broadband providers must disclose the network management practices, performance characteristics, and terms and conditions of their broadband services;
2. No blocking. Fixed broadband providers may not block lawful content, applications, services, or non-harmful devices; mobile broadband providers may not block lawful websites, or block applications that compete with their voice or video telephony services; and
3. No unreasonable discrimination. Fixed broadband providers may not unreasonably discriminate in transmitting lawful network traffic.

As part of this 2010 attempt to define rules for ISPs, the FCC adopted a light-handed, multistakeholder approach for resolving net neutrality issues. This approach was short-lived, as the FCC never utilized the multistakeholder group. (Jamison and Layton, 2016)

The agency failed to implement its multistakeholder approach in part because, in 2014, the DC Circuit Court again reversed the FCC on jurisdictional grounds, finding that the 2010 rules were effectively common carrier obligations. This was a problem because the FCC had determined that ISPs were not common carriers and so not subject to common carrier requirements.[33]

In its ruling, the DC Circuit Court effectively provided the FCC with a roadmap for how to classify ISPs as common carriers and then impose net neutrality rules. The FCC followed the court's advice in its 2015 Open Internet Order,[34] in which the agency took the heavy-handed approach of applying its 1930s-era rules for regulating monopoly telephone companies. More specifically, the Commission, under the prompting of then-President Obama,[35] classified consumer broadband service as common carrier services under Title II of its

[31] Comcast Corp. v. FCC, 600 F.3d 642 (DC Cir. 2010)

[32] *Preserving the Open Internet, Report and Order*, 25 FCC Rcd 17905.

[33] Verizon v. FCC, 740 F.3d 623 (DC Cir. 2014).

[34] Federal Communications Commission, *In the Matter of Protecting and Promoting the Open Internet, Report and Order*, FCC 15-24, March 12, 2015.

[35] President Obama, Statement on Net Neutrality (Nov. 10, 2014), https://obamawhitehouse.archives.gov/the-press-office/2014/11/10/statement-president-net-neutrality.

enabling statutes and reclassified mobile broadband Internet access service as a commercial mobile service. The Commission also adopted three bright-line rules that had the effect of prohibiting blocking, throttling, and paid-prioritization. It also adopted a general Internet conduct standard,[36] as well as "enhancements" to the transparency rule developed in the 2010 decision.

The FCC's stated rationale for adopting the Title II approach included a belief that the country needed more and better broadband; that the rules adopted in 2010 appeared to not hinder internet development, so rules under Title II should not either; indeed regulatory rules might even stimulate investment; it needed to use its authority under Title II in order to impose net neutrality rules; and that "broadband providers hold all the tools necessary to deceive consumers, degrade content, or disfavor the content that they don't like." The DC Circuit Court upheld the decision, although Judge Williams issued a strongly worded dissent.[37]

Members of Congress and former FCC chief economists criticized the agency's 2015 decision and the process used to reach it. The FCC's chief economist at the time of the decision called the rulemaking process and subsequent order an "economics free zone" because the agency excluded input from its own economists when developing the decision, thus getting its economic analysis wrong. (Brennan 2016) Another former chief economist was critical of the decision's lack of economic rationale, stating that while he appreciated the agency citing his work in the order, but that the substance of his articles were the opposite of what the order claims.[38]

Two important dissenters from the FCC's 2015 decision were the two Republican commissioners, then-Commissioner Adjit Pai and Commissioner Michael O'Rielly. The Commission's 2015 split over net neutrality – the three Democrat commissioners voted for the 2015 decision and the two Republican commissioners voted against it – reflected not just a disagreement on regulation, but a partisan divide that had emerged under then-Chairman Tom Wheeler. (Wallsten 2016) So it was no surprise that when Republicans gained a majority at the Commission in 2017 that they voted to effectively vacate the 2015 decision, stating, "We reverse the Commission's abrupt shift two years ago to heavy-handed utility-style regulation of broadband Internet access service and return to

[36] General conduct standards can take many forms. The standard adopted by the FCC in 2015 appears sufficiently vague to provide little guidance on what the agency might have done applying the rule.

[37] *United States Telecom Ass'n v. FCC*, 825 F.3d 674 (D.C. Cir. 2016)

[38] See comments of Michael Katz in "The Future of the Internet Ecosystem in a Post-Open Internet Order World: Part 1," Technology Policy Institute symposium January 12, 2016 https://www.youtube.com/watch?v=Gz4W0sDxkfs&t=834s, at 13:40 (accessed August 27, 2018).

the light-touch framework under which a free and open Internet underwent rapid and unprecedented growth for almost two decades."[39] More specifically, the FCC:

- Ended "utility-style regulation of the Internet in favor of the market-based policies";
- Reclassified consumer broadband services as an information service and not as a common carrier service; and
- Reinstated the private mobile service classification of mobile broadband Internet access service.

In reversing the 2015 decision, the FCC also restored the authority of the "Federal Trade Commission to police the privacy practices of Internet Service Providers (ISPs)." By statute, the Federal Trade Commission (FTC) does not have authority over common carriers, so the 2015 decision caused the FTC to lose jurisdiction over privacy with respect to ISPs.

The FCC's rationale for its 2017 decision included beliefs that laws other than Title II were better suited for protecting consumers and competition, that Title II regulations suppressed infrastructure investment, that classifying internet as a common carrier service was unsound as a legal matter, and that the costs of the 2015 decision outweighed the benefits. In its 2015 decision, the FCC deliberately chose to not conduct a cost-benefit analysis.

c. Responses to the 2017 Decision

The supporters of imposing common carrier regulations on ISPs reacted in opposition to the new FCC decision. In May 2018 the US Senate voted to overrule the FCC's 2017 decision, but the US House of Representatives failed to go along. Under the Congressional Review Act, Congress can cancel an agency decision within 60 days after the rule is reported to Congress.[40] With a divided Congress effectively siding with the FCC in the 2017 decision, the decision went into effect on June 11, 2018.

Some state governments sprang into action. Governors in Hawaii, New Jersey, Montana and New York issued executive orders stating that their governments would not do business with broadband providers that did not follow net neutrality regulations. State legislatures in California, Oregon, and Massachusetts took up legislation to impose net neutrality requirements on broadband providers. And over 20 state attorneys general, plus the District of Columbia, sued the FCC, arguing that the 2017 decision was arbitrary, capricious, an abuse of procedure, and a violation of applicable laws. (Layton 2018) These

[39] FCC, *Restoring Internet Freedom, Declaratory Ruling, Order, Report and Order*. 33 FCC Rcd 311 (1).

[40] 5 U.S. Code § 802.

state actions map to the partisan divide that has come to be part of net neutrality in the U.S. as all of the governor offices, states attorney general offices, and state legislators that have acted are controlled by Democrats.

As of the time of this writing, these state responses have not been resolved. They all have legal problems. The governors' actions might violate the Supreme Court's marketplace-participant doctrine, which holds that a state cannot use procurement practices that are tantamount to regulating an industry. (Cooper 2018) Actions by state legislatures might be viewed as regulating interstate commerce, which states do not have authority to do. In order to avoid this problem, states would likely have to separate internet traffic that has its beginning and end points within the state from interstate and international traffic, something that might be impossible to do in any practical way. The legal appeals of the FCC's 2017 decision face the problem of judicial deference: Courts in the US largely accept regulatory agencies' claims regarding jurisdiction based on interpretation of their statutes, and the FCC in 2017 appeared to map its decision both to the evidence it had and to its enabling statute. So while it may seem strange that an agency would make a decision and then reverse itself within a span of two years, courts in the past have upheld their authority to do so. (Hurwitz 2017)

3. Economic Research on Net Neutrality

Most of the substantive arguments offered in the net neutrality debate are about the economic effects of *ex ante* regulation versus those of *ex post* regulation. These issues have been researched in the scholarly economics literature, so this section reviews that literature. With one exception, the focus here is on what has been demonstrated in articles that use explicit economic models and that appear in higher-level, peer-reviewed economics journals.[41] The exception is a law review article. It is included because it is the only US empirical study of net neutrality in an academic journal. There have been other empirical analyses, but they are unpublished white papers or blogs. Including them would require extensive review of their academic merits, which is beyond the scope of this paper.

In general, economic research on net neutrality has found that the impacts of regulations depend on the conditions in the marketplace. Under various conditions such regulations can be harmful to consumers, harmful to network

[41] The search for articles was limited to those appearing in economics journals ranked in the top 300 in IDEAS/RePEc Aggregate Rankings for Journals (https://ideas.repec.org/top/top.journals.all.html). The search was not exhaustive of these journals, so it is possible that articles were omitted that are relevant to the topic.

providers, harmful to content providers, or hinder investment. But there are also conditions under which opposite effects might occur. Most but not all of the articles conclude that regulatory restrictions on ISPs offering advanced features can lower economic efficiency. A notable exception is blocking customer access to content that customers find valuable. Such blocking is generally found to be harmful, based on the assumption that consumers do not want blocking.

What should readers make of studies with conflicting findings? Each study relies on specific assumptions about technologies and markets. The assumptions drive the findings. The challenge for readers who want to apply these studies is to determine which conditions are most applicable in their situations. Because of this, the review below highlights studies' basic assumptions.

The remainder of this section is organized into sub-questions: (1) How regulations restricting ISPs from offering enhanced network features might affect (a) total welfare, (b) network investment, and (c) the variety of content on the internet and content provider investment; (2) How prohibitions on network termination fees affect total welfare; and (3) How prohibiting ISPs from blocking content affects total welfare.

a. Effects of *ex ante* restrictions prohibiting features such as fast lanes on welfare[42]

The literature finds that the welfare effects of prohibitions on features such as fast lanes depend on market conditions, such as whether ISPs are monopolies, how charges might be implemented, network engineering, customer valuation of content, and the types and variety of content provided on the internet. Most articles find that the *ex ante* regulations decrease welfare.

One of the earliest papers, Hermalin and Katz (2007) addresses the situation of a monopoly ISP that does not provide its own content, but provides network services to competing content providers and to consumers. (In contrast to most other papers, this paper analyzes transmission differences as quality differences as opposed to explicit fast lanes or paid prioritization.) The paper finds that *ex ante* regulations can either increase or decrease total welfare, but are most likely to reduce it: The restrictions lower total welfare when content providers who would prefer low-quality connections are excluded from the market because ISPs are not allowed to offer lower quality services, or when

[42] Total welfare is generally defined as the sum of consumer surplus and producer surplus. Sometimes the surpluses are weighted, for example, by giving a certain amount of preference to consumers. Consumer surplus is the net value that consumers receive from consuming a product or products over and above what the consumers pay. Producer surplus is the revenue producers receive over and above their production costs. Some papers reviewed in this section use different definitions of welfare. Those instances are noted in the text.

content providers who would prefer high-quality service have to settle for lesser quality service. The paper finds similar conclusions for a duopoly ISP market.

Choi and Kim (2010) examines a situation where there is a monopoly ISP and two content providers that differ in the quality of their content. It allows only one content provider to purchase a fast lane. The research finds that *ex ante* regulation lowers welfare when content providers vary greatly in what they provide.

Njoroge et al. (2014) examines a situation where there are two ISPs and neither provides its own content. There is a large number of competing content providers that vary in the quality of their individual services and that receive money only from advertising. The paper assumes a content provider might connect directly to one ISP and then reach consumers that are connected to a second ISP, and that the second ISP might charge the content providers for reaching its consumers. The paper finds that if an ISP imposes fees on content providers that connect through another ISP, *ex ante* regulations lower total welfare. It also finds that such regulations can increase welfare if content providers vary greatly in the types of content that they provide.

Njoroge et al. (2014) finds that *ex ante* regulations lower total welfare, but can increase welfare if content providers vary greatly in the types of content that they provide. These results are different from those of Choi and Kim (2010) regarding the effects of content differentiation in part because Choi and Kim allows only one content provider to purchase the fast lane. Choi and Kim also assumes a monopoly ISP and that the ISP offers fast lanes by offering paid prioritization. Njoroge et al. assumes that the ISP offers separate fast and slow lanes. This is an example where technology choice matters to model results.

Most economic analyses assume that ISPs can vary the amount of bandwidth that they provide, which appears to align with actual ISP practice to choose network capacity based in part on the amount of traffic. In contrast, Economides and Hermalin (2012) examines a situation where there is a single ISP whose total bandwidth is fixed, the ISP does not provide its own content, and there is a large number of content providers, but each is a monopoly.[43] The paper states that *ex ante* regulations improve total welfare in monopoly situations, but appears to omit industry profits from the welfare calculation.

Economides and Tåg (2012) also makes an unusual assumption, namely that content providers may not necessarily benefit from advanced network features such as fast lanes. The paper considers both monopoly ISP and duopoly ISP situations where there are many content providers that obtain revenue from advertising and that differ in their costs of setting up their services. The model omits considering how ISPs might alter their investment and requires that all

[43] The assumption of monopoly content providers is unusual.

consumers purchase ISP service. The paper finds that the effects of *ex ante* regulations on total welfare depend on a variety of market conditions, but the paper restricts its welfare calculation to only the value of content. Economides and Tåg also finds that consumers are always worse off with *ex ante* regulations. In a related article, Caves (2012) uses the Economides and Tåg model and finds that such regulation decreases total welfare under the most common market conditions.

In a more generally applicable paper, Bourreau, Kourandi, and Valletti (2015) finds that *ex ante* regulations lower welfare. They assume there are two competing ISPs, which aligns with the situation in many US markets, and content providers vary in their preferences for fast lanes, which also seems appropriate.

Choi, Jeon and Kim (2015) find that the effects of *ex ante* regulations on welfare are sensitive to the degree to which content providers receive revenue from advertising versus payments from consumers for accessing content. This paper is more general in that it allows that content providers are heterogeneous in the value of their content and vary in how much they value fast lanes. Also, content providers receive revenue from advertising and may charge customers for accessing content. It examines monopoly and duopoly ISP markets and finds that it makes no difference as long as the ISPs determine interconnection charges and subscribers pay a single subscription price.

Reggiani and Valletti (2016) examines a situation where there is a single ISP and multiple content providers. Unusually, there is only one large content provider, which is defined as one that sells multiple applications. All other content providers are small and provide only a single application. An important feature of this paper is that the ISP charges a fixed price for prioritization and that prioritization is not a substitute for any other input that a content provider might use. These mean that buying prioritization is more profitable for the large content provider than for the small content providers. Therefore the effects of fast lanes are driven by the response of the large content provider. The finding is that *ex ante* regulations lower welfare if they lower content innovation, which the paper defines as the amount of content provided.

Greenstein, Peitz and Valletti (2016) offers a summary of the economics literature with respect to net neutrality and provides basic analyses to address the core issues. The paper shows that general *ex ante* restrictions on ISPs charging content providers (that depend on advertising for revenue) for access to consumers may increase or decrease total welfare, but the restrictions do result in higher consumer prices for ISP services. The paper also explains that if content providers charge customers for services, such as in the cases of Netflix and Amazon Prime, then the regulations decrease market efficiency if ISPs are able to charge different service fees to lower-value content providers than to higher-value content providers. The regulations can increase efficiency if ISPs are unable to

discriminate between content providers. Finally, the paper finds that recent theoretical contributions generally support the idea that *ex ante* net neutrality regulation on competing platforms is welfare decreasing, but states that this is an under-researched area.

b. Effects of *ex ante* restrictions prohibiting features such as fast lanes on investment

The literature gives mixed results, showing that the investment incentive is sensitive to how content providers and consumers respond to prices and to how consumers value content. Choi and Kim (2010) find that ISPs' incentives to invest depend on the value that customers place on network services relative to the value that some content providers might place on faster delivery speeds, so the effects of *ex ante* regulation is ambiguous.

Several models find that *ex ante* regulations lower ISP investment. These include Economides and Hermalin (2012), Njoroge et al. (2014), and Bourreau, Kourandi, and Valletti (2015). Reggiani and Valletti (2016) find that the regulations lower network investment if fast lanes stimulate content provision by a large content provider enough to overcome any decline in the number of small content providers, which the *ex ante* regulations would cause.

c. Effects of *ex ante* restrictions prohibiting features such as fast lanes on the variety of content on the internet and content provider investment

The literature gives mixed results. Most articles find that *ex ante* regulations lower content value when some content providers value the features that ISPs would offer absent the regulations.

Hermalin and Katz (2007) finds that *ex ante* regulations reduce the number and variety of content providers because regulations eliminate content providers that would prefer a lower quality service. It also finds that the regulations induce some content providers to buy a higher quality service than they would prefer, and others to purchase lower quality service than they would prefer. This lowers economic efficiency for those content providers.

Bourreau, Kourandi, and Valletti (2015) finds that *ex ante* regulations result in lower content innovations. Reggiani and Valletti (2016) finds that *ex ante* regulations lower the amount of content provided by a large content provider if its advertising fees are low relative to its content production costs and high relative to the smaller content providers' production costs. Greenstein, Peitz and Valletti (2016) describes how an ISP might price the enhanced service in such a way as to

exclude some lower-end content providers if lower-end and higher-end content providers would both pay for terminating their content.

Peitz and Schuett (2016) examines a situation where a monopoly ISP serves two types of content providers: Some that offer content whose quality suffers if delivery is delayed, while others whose quality is not sensitive to delay. The paper assumes that content providers can make investments to improve traffic management. The paper finds that *ex ante* regulations cause content providers to underinvest in technology that could efficiently manage the amount of traffic they put on the network. As a result, strict *ex ante* net neutrality restrictions often lead to socially inefficient allocation of traffic and traffic inflation in this paper.[44] *Ex ante* net neutrality regulations that would allow some differences in traffic treatment by ISPs do not necessarily improve the situation.

d. The effects on total welfare of regulations prohibiting ISPs from charging content providers for terminating traffic

This question has received little attention in the literature. Papers find that the effect depends upon how ISPs charge consumers and the value that customers obtain from content.

Musacchio et al. (2009) examines a situation with multiple ISPs of equal size, but each is a monopoly for its customer base. There are multiple content providers. It finds that *ex ante* regulations against such charging for terminating traffic lower total welfare in situations where consumers' price sensitivity to prices for clicks is low or high (as opposed to nearly the same) relative to content providers' charges for advertising. It also finds that the regulations can improve total welfare in situations where consumers' price sensitivity is nearly the same as content providers' charges for advertising.

Njoroge et al. (2014) finds the *ex ante* regulations lower total welfare in situations where an ISP imposes fees on content providers that connect through another ISP. Greenstein, Peitz and Valletti (2016) finds that restricting ISPs from charging termination fees reduces total welfare.

Boliek (2009) provides the only academic empirical study of the effects of net neutrality. The research addresses two questions. The first issue is whether wireless ISPs should be allowed to use consumption-based billing for residential consumers. This restriction is rarely included in net neutrality, but is sometimes mentioned. The second issue is whether ISPs can charge content providers for accessing customers, such as by charging termination fees. The paper found that regulation of prices was often associated with higher retail and wholesale prices,

[44] "Traffic inflation" means that the content providers underinvest in technologies that lower the amount of traffic that is needed to deliver their content.

and not with lower prices. This implies that *ex ante* regulation of terminating traffic prices could result in higher prices for consumers.

e. The welfare effects of regulations prohibiting ISPs from blocking content

Few economists have investigated this issue. In general the papers find that blocking content providers that customers want to access decreases welfare. *Ex ante* prohibitions on blocking improve total welfare in Economides and Hermalin (2012). Greenstein, Peitz and Valletti (2016) confirm this result.

Broos and Gautier (2017) examines a situation where there are up to two ISPs that compete for customers. The ISPs offer traditional phone service and internet service, and the phone service competes with an app that offers voice services over the internet (VoIP). It finds that the ISPs have incentives to exclude VoIP competes with the ISPs' own services. A monopoly ISP may want to exclude a competing internet app if the app is of inferior quality relative to the ISP's own service and if the ISP cannot ask for a surcharge for its use. However, this is not always profitable. In both the monopoly and duopoly situations, prohibiting the exclusion of the app and surcharges for its use has ambiguous effects on welfare.

4. Conclusion

The US debate about net neutrality has been unusually contentious for a telecommunications regulatory issue, especially given that all sides appear to have the same stated objective. The substantive difference appears to be over whether to apply *ex ante* or *ex post* regulations. On this, the economics literature gives varying answers regarding how *ex ante* and *ex post* regulations differ in their effects on welfare and investment. The assumptions of the models are key. But when the answer to the question of the effects of *ex ante* regulation is "it depends," and the scenarios that give different answers are realistic, it would seem that the policy decision should be in favor of addressing problems when they occur because *ex ante* regulations would clearly do some harm and *ex post* regulations, properly conducted, would do little harm. That appears to be an unacceptable answer for regulatory advocates.

Perhaps the persistence of contention arises from the way the issue entered the regulatory landscape. The US has a long history of dealing with the anticompetitive conduct of AT&T's regulated monopoly. The company took what could be viewed as extreme measures to protect that monopoly, including denying customers the opportunity to place even a plastic Hush-A-Phone cup on their

telephone receivers to block noise. The body of regulatory activity against AT&T provided the intellectual foundation for that Wu (2003) and others built upon for net neutrality, including device connection standards, drawing bright lines between telecommunications and enhanced services, and regulating wholesale pricing.

The advocates for an *ex post* approach, beginning with Yoo (2004), appear to adopt a post-monopoly mindset, emphasizing the dynamics of rapidly changing technologies, the value of customer choice, and diversity of situations.

Given the partisan nature of the issue, what happens next is likely to depend more on elections than on analysis.

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