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**The Relationship between Technological and Regulatory Change  
in the Communications Industry**

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# The Relationship between Technological and Regulatory Change in the Communications Industry

Gregory L. Rosston\*

Abstract:

Major changes in technology and in regulation led to the proliferation of and willingness to pay for new communication services. The changes in technology enabled the changes in regulation, both through the ability to increase supply and quality, but because technological change opened the marketplace to new interest groups influencing regulators and regulation. At the same time, the regulatory system changed to allow and even promoting more competition. Part of the change to the regulatory system was in response to technological advances that changed the fundamental economics that provided the justification for monopoly regulation and concomitant theories of regulatory capture.

Keywords: Technological Change, Regulation, Competition, Antitrust, Telecommunications

JEL Codes: L51, L96, L98, O3

## I. Introduction

Communications has steadily become a larger part of Americans' lives and also a larger part of consumers' budgets. The vast majority of U.S. households now pay for wireless telephony, Internet, and even television. Thirty years ago, a small minority of people had or paid for any of these services; the communications services they used were less expensive, but also far inferior to what is available today. In fact, even by 2000, only 4 percent of households had broadband Internet (at slower than today's typical broadband speeds) and less than half of households (42 percent) had any home Internet access. Fifteen years ago, there was virtually no home broadband and less than one in five households had home Internet. Today, roughly 70 percent of households have broadband Internet access at home.<sup>1</sup> In 1980, less than 25 percent of households had pay television whereas today 85 percent of households pay for television service.<sup>2</sup> Finally, there is roughly one wireless phone per person in the U.S.<sup>3</sup>

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\* Deputy Director, Stanford Institute for Economic Policy Research, Stanford University. Thanks to Jonathan Cohen, Bruce Owen, Scott Wallsten and anonymous referees for help with this chapter. I have served as an advisor to government agencies and various telecommunications companies involved in some of the policy matters discussed in this chapter. None of the opinions expressed here are theirs.

<sup>1</sup> Statistics in this paragraph from U.S. Department of Commerce (2011).

<sup>2</sup> NCTA (2011) reports 18.1 million basic cable households in 1980 (there were essentially no satellite customers at that point in time). InfoPlease (2008) reports 80.8 million U.S. households in 1980. This leads to 22.4 percent of households with pay television in 1980. Seidman (2011) reports 85 percent of households with pay television in 2010.

<sup>3</sup> CTIA (2011)'s December 2011 Semi-Annual Wireless Industry Survey reports over 331 million wireless connections. Available at [http://files.ctia.org/pdf/CTIA\\_Survey\\_Year\\_End\\_2011\\_Graphics.pdf](http://files.ctia.org/pdf/CTIA_Survey_Year_End_2011_Graphics.pdf).

Major changes in technology and in regulation led to the proliferation of and willingness to pay for these new services. The changes in technology enabled the changes in regulation, both through the ability to increase supply and quality, but because technological change opened the marketplace to new interest groups influencing regulators and regulation.

The massive improvements in microprocessor technology following Moore's law enabled much more sophisticated end-user devices and better information transmission.<sup>4</sup> More sophisticated end-user devices have allowed substantially greater information to be delivered to consumers, whether it be to a big screen television in high definition or to a mobile smart-phone. In economic terms, these improvements have been shifts in the supply curve leading to a larger quantity (or higher quality) at the same price. At the same time, consumer learning about new capabilities for communications shifts the demand curve as well leading to a higher quantity.

The second major change has been to the regulatory system allowing and even promoting more competition. Part of the change to the regulatory system was in response to technological advances that changed the fundamental economics that provided the justification for monopoly regulation and concomitant theories of regulatory capture. Until the late 1960s, telephone service was thought to be a natural monopoly, and national over-the-air broadcast television service was limited to three major networks because of the spectrum allocation plan put in place at the advent of television to promote localism. With technology providing more choices and more providers and potential providers in the marketplace, the new and different forces competing for regulatory influence made capture by a single entity less likely. In addition, the wider deregulatory movement beginning in the 1970s that showed substantial consumer benefits in airlines, trucking, rail, and other industries was thought to have potential benefits for telecommunications as well and helped accelerate the deregulatory path in telecommunications.<sup>5</sup>

This chapter will look at the interaction of technological change with Federal Communications Commission ("FCC") regulation in two policy areas: spectrum and competition. While not continually increasing, technological advance has generally pushed the FCC, to reduce its restrictions and provide more flexibility for communications firms, leading to more choices for consumers. The combination of advances in technology and changed regulation led to the vast changes in communications witnessed over the past 30 years.<sup>6</sup>

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<sup>4</sup> See Intel (2005) for a short explanation of Moore's Law, which posits that the number of transistors on integrated circuits would double every two years and would continue to do so, increasing computing power and reducing cost.

<sup>5</sup> See Winston (1993).

<sup>6</sup> Social policy, including subsidies for rural and low income consumers that have substantial impacts on pricing, at the FCC is another area where technological change has affected regulation, but the programs are sufficiently different, complex, and separable that they will not be addressed directly in this chapter. Rosston and Wimmer (2001) and Akerberg et al (2009) provide some background on the impacts of these subsidy programs.

## II. Motivations for regulation and regulatory change

A long literature explores the role and goals of regulators.<sup>7</sup> Theories of regulation have evolved along with the world's experiences with regulation. Initially, regulation was viewed as acting in the public interest. As it became clear that regulation often benefited regulated firms and blocked entry, the predominant theory about public utility regulation became the "capture theory" whereby regulation was seen as a tool nominally to protect consumers, but for a variety of reasons ended up protecting and benefiting the regulated companies.<sup>8</sup> Capture theory formed the basis for more advanced political economy theories of government behavior through its ideas that the regulated firm had strong incentives and information about demand and costs, whereas consumers and their advocates were more diffuse and had less market information.<sup>9</sup> Posner (1971) discusses how regulation also serves a distributive purpose. Posner's theory helps explain many of the complex cross subsidies implicit in pricing of regulated services and the attempts to forestall entry to maintain the cross subsidies.

One of the key questions that led to the evolution of political economy theory from the original capture theory was the question of why regulation changed and why it changed at particular times. What were the forces that originally demanded regulation and what forces led to deregulation?<sup>10</sup> One of the main explanations for a change in regulation policy is that circumstances in the marketplace changed, leading to new and different pressures on regulators. The experience with the telecommunications industry illustrates how technological change in processing power provided some of the changed industry dynamics that in turn led to regulatory change.<sup>11</sup>

According to theory, regulatory change depends on the utility functions and budget constraints of the different parties involved in the decision process. FCC decisions affect consumers of communications services, current providers of services, and potential providers of services. FCC decisions are generally accomplished through Orders that arise from a Notice and Comment proceeding with a preliminary Notice of Proposed Rulemaking and public comment. The FCC ultimately issues a decision justified by the public record. The FCC's decisions are subject to court review when challenged, and while the FCC is granted deference to its decisions, courts not infrequently remand decisions to the Commission. In addition, while nominally an independent regulatory agency, the Chairman of the FCC is appointed by the President, the Commissioners are frequently invited to Capitol Hill to testify about their decisions, and Congress controls the FCC's budget. All portions of government in the process in turn have interest groups that attempt to influence their decisions. Advances in technology affect the pressures on regulators: new technology can increase demand and enhance or threaten market power. Depending on these impacts and expected impacts, parties' pressure regulators to maintain or change rules that in turn affect the market and to some extent the future direction of technology. As a result, arguments of

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<sup>7</sup> For a summary, see Noll (1989). *See also*, Ménard and Ghertman (2009).

<sup>8</sup> *See* Noll (1989).

<sup>9</sup> *See* Noll (1989).

<sup>10</sup> *See* Troesken (1994).

<sup>11</sup> *See* Noll and Owen (1983).

staff economists within the agencies advocating for more efficient regulations and competition can be given more or less weight by decision-makers.

Communications regulation illustrates the impact and interrelatedness of technology and regulation. While there are a wide variety of important examples, this chapter focuses on examples from two important areas of FCC jurisdiction: spectrum policy and competition policy. This chapter will not cover the gamut of FCC jurisdiction, nor even provide comprehensive coverage of technological change and regulatory decisions in these two areas; instead the examples are meant to highlight the impact that technological change has on the regulatory process.

Spectrum policy is one of the FCC's primary responsibilities, to manage the spectrum in the "public interest." In addition to protecting against interference between different transmitters, spectrum policy is complementary to competition policy. Competition policy has also been important in communications because of the historic view that parts of the communications network are natural monopolies and therefore need regulation to protect consumers from monopoly pricing and to allow competition for the provision of vertically-related communication services. The FCC also must approve license transfers for mergers and hence has authority over mergers in conjunction with either the Department of Justice or Federal Trade Commission.

### **III. Spectrum policy**

Electromagnetic spectrum is an input that providers use in combination with capital and technology to produce wireless communications. More spectrum enables either more communications capability or reduced need for capital and technological advance to produce the same degree of communications. For example, providers can increase capacity by constructing additional cell sites with a fixed amount of spectrum and technology, they can get access to more spectrum with the same cell sites and technology, or they can implement more advanced technology.

Over time, technological advances have enabled more intensive use of spectrum with the same number of cell sites (for example, the move from analog to digital transmission). In addition, technological advances have enabled the use of higher frequencies for more valuable uses like mobile telephony. With the increase in wireless communications capability, new wireless providers, equipment manufacturers and incumbents have pressured regulators to act in their interests, in some cases to release more spectrum, to change the rules applied to spectrum, or to reallocate spectrum from one use and users to others.<sup>12</sup>

#### **1. FCC historical spectrum allocation**

As evidenced by market transactions for spectrum use rights and FCC auctions, the rights to use spectrum can be valuable, but there are substantial differences in the value of spectrum and in the opportunity cost of using spectrum. The 700 MHz auction in 2008 raised nearly \$19 billion for 56 MHz

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<sup>12</sup> For a detailed history of spectrum regulation, see Hazlett (2001). Cave et al. (2007) provide a detailed background of the tools and considerations for government spectrum managers.

of spectrum while in 2003, the auction for the 1670 MHz band raised \$12.8 million for 5 MHz of spectrum, two orders of magnitude less per MHz. Spectrum varies in value because of its propagation characteristics. Some frequencies can be used for mobile devices because they do not require large antennas or line of sight transmission. Other frequencies are more suited to fixed, point-to-point transmissions. The value of the rights to transmit on a specific frequency not only depend on the technical characteristics of the specific frequency, but also on the demand for services that can be provided on that frequency and on the availability of complementary assets that can be used to transmit on those frequencies.

While the concept of cellular telephone service was first put forth in the 1940s by Motorola, the FCC did not authorize it until the 1970s and operators deployed the first systems in the 1980s.<sup>13</sup> Prior to cellular service, mobile telephony was extremely limited: there were a very small number of channels in any geographic area and the conversations were broadcast from a high power antenna to cover a wide area. That meant that few conversations could take place at any one point in time in any area. Despite being conceptually developed in the 1940s, effective cellular service required massive improvements in processor power to facilitate handoffs between cells.

In the 1970s, the FCC took back channels 70- 83 from the UHF television service and reallocated the spectrum to be used for mobile wireless service. Some of the spectrum went to “private” wireless service, allocated on a first-come, first-served basis for internal company transmissions and some went to public safety entities. Some, however, was allocated for the new cellular telephone service.

At first, the FCC decided that it would assign all of the spectrum it had allocated to cellular service to the incumbent wireline telephone provider because it argued those companies had the telephony expertise to run the new systems. Not surprisingly, AT&T, at the time the incumbent wireline company for most of the U.S., supported this decision and was the primary beneficiary. At the urging of the Department of Justice, the FCC changed its rule to split the spectrum into two blocks, reserving one for the wireline incumbent and making one available for a new entrant.<sup>14</sup>

The initial cellular licenses for the most populous areas were awarded on the basis of comparative hearings. The FCC accepted paper applications with sophisticated engineering designs about the buildout of the systems. The wireline providers, with at most a couple of applicants in each area, quickly agreed to divide the licenses and avoid the need for comparative hearings. Some of the non-wireline applicants were unable to agree and the FCC was forced to award licenses on the basis of comparative hearings to choose the “best” applications. The FCC comparative hearing process was wasteful and arbitrary. For example, the license for the Los Angeles market was awarded based on the winning applicant proposing one more cell site (24 as opposed to 23) to cover the entire LA area, and that cell

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<sup>13</sup> Rohlfs et al. (1991) and Hausman (1997) calculate large costs from the regulatory delay in introducing cellular service.

<sup>14</sup> See FCC (1981). Rosston (1994) provides an analysis of this decision.

site was on Catalina Island.<sup>15</sup> Even at the time, it was obvious that the FCC decisions were based out of date engineering plans and the plans were unrelated to the systems that were ultimately built.

Despite the inefficiency and arbitrariness, Congress would not give the FCC auction authority for the cellular licenses. Instead it allowed the FCC to use the same ping-pong ball lottery machine used for the Vietnam draft to determine winners of license applications.<sup>16</sup> In part, television broadcasters objected strongly to auctions for wireless licenses for fear that they too would have to pay for their valuable broadcasting rights.

With the lotteries, application aggregators tried to attract investors and bundled together large numbers of potential licensees into groups to increase the chance of at least one application being chosen as the winner. Most of the lottery winners made the prudent business (and socially beneficial) decision to sell their systems and reaped large rewards for having been chosen by the ping-pong ball machine.

Throughout the 1980s, cellular technology advanced rapidly. The first cellular phones in the early 1980s were car phones that relied on the car battery for power and an antenna on the roof to get a signal. Carphones gave way to transportable and “brick” cell phones. As battery and processor technology advanced, phones became smaller and lasted longer. These improvements led to large increases in demand and service prices fell at the same time.

However with only two firms in each geographic area, prices did not fall as rapidly as some had hoped. Some states regulated cell phone prices and tried to ensure a vibrant reseller market. Hausman (2002) argues that such state regulation actually increased prices because the resellers put pressure on regulators to maintain a high retail price to preserve their margins.

## **2. Spectrum allocation in the 1990s**

The FCC saw the tremendous increase in demand for mobile telephony and began a process to allocate additional spectrum for “Personal Communications Service” or PCS starting in the late 1980s that would compete with existing wireless service. During the cellular lotteries, the value the government was giving away became very clear. Kwerel and Rosston (2000) argue that the combination of this high value, a Democratic Congress, Democratic President, and budget rules requiring any expenditure to be offset by at least as great revenue provided the political foundation necessary to change to assignment of the new spectrum by auction. In 1993, Congress passed the Omnibus Budget Reconciliation Act that mandated the use of auctions for spectrum assignment in certain circumstances. With the new auction authority, the FCC relied on some of the early work done by economists in the Office of Plans and Policy (including chiefly Evan Kwerel) and brought in a number of economists and encouraged outside firms to hire their own auction economists. As a result, economists had a large role in designing the spectrum auctions.

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<sup>15</sup> See Murray (2002).

<sup>16</sup> Herzel (1951) and Coase (1959) both proposed that the FCC use auctions for spectrum licenses so the idea was not new by the time of the cellular allocations.

In 1994, the FCC set up a spectrum band plan with three new large 30 MHz blocks of spectrum and three smaller 10 MHz blocks of spectrum for a total of 120 MHz of new spectrum for mobile wireless service to complement the 50 MHz (two 25 MHz licenses) of original cellular spectrum. There were two key FCC auction decisions, and one subsequent FCC decision implementing the Telecommunications Act of 1996 (discussed in the next section) that set the stage for the increased proliferation of wireless communications.

First, contrary to the FCC of the 1970s that had to be goaded by the Department of Justice to create competitive wireless carriers, Reed Hundt, the FCC Chairman from 1994 – 1997, was committed to ensuring that the wireless marketplace would be as competitive as possible. Chairman Hundt developed a saying, “Read the Law. Study the Economics. Do the Right Thing”<sup>17</sup> and relied on economists to push for efficiency-enhancing rules in spectrum policy, auctions and the implementation of the Telecommunications Act of 1996. His commitment to competition was to at least some extent contrary to the perception of many who viewed his main goal as maximizing auction revenues. The FCC set spectrum cap rules to prevent the two incumbent cellular providers in any geographic area from buying any of the three large licenses. (The incumbents each had a 25 MHz cellular licenses and the FCC set a 45 MHz cap so they could buy two of the 10 MHz licenses, but could not buy any of the 30 MHz licenses in their geographic area.) Because there were only two providers of service, the additional competition threatened by the introduction of new licenses would have made the incumbents willing to pay high prices for the licenses: incumbents could use the additional spectrum to serve demand, but also could acquire the licenses to prevent new entrants from cutting prices and stealing customers.<sup>18</sup> MCI, the second largest long distance provider at the time, with no local wireline or wireless presence, was among those pushing to promote competitive entry, possible for its own business plan, or to ensure that there would be more competition at the local level which served as a complement to its long distance service. While MCI did not ultimately bid for the new wireless licenses, Sprint, another independent long-distance provider with no wireless presence was the biggest purchaser of PCS licenses.

Second, the FCC provided flexible service and technical rules for the new PCS providers. Previously, the FCC mandated specific technologies and services for wireless licensees. Over time, the FCC rules have become more flexible in many instances. For example, when it first granted cellular telephone licenses, the FCC required licensees to transmit using the original Analog Mobile Phone Standard (AMPS), but when it allocated spectrum for PCS, the FCC rebuffed Motorola’s attempts to have the FCC choose a standard and instead let licensees choose their own transmission protocols.<sup>19</sup>

One of the factors influencing the FCC at the time was the new wireless technology, CDMA (Code Division Multiple Access) being developed by Qualcomm. While Europe had moved earlier and picked Groupe Special Mobile (“GSM”), at the time that Europe picked its wireless standard the development of

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<sup>17</sup> Hundt (2000), p-69.

<sup>18</sup> See Gilbert and Newbery (1982) and Cramton et al (2011).

<sup>19</sup> See Motorola (1994), FCC (1994). Consumers generally care about the quality of service, not the frequency nor the technology used to provide it and are generally unaware that most handsets today embody multiple frequencies and multiple technologies.



CDMA was less far along. It was still a risky, unproven technology when the FCC decided not to pick a standard, but the FCC's decision gave CDMA technology a chance to prove itself in the marketplace rather than being shut out by regulators. Without the potential new technology, the FCC likely would have adopted a standard and locked the U.S. (and likely the world) into a technological path determined by GSM.

In addition, PCS licensees were able to provide any wireless service: voice, video, data, with two minor exceptions – they could not “broadcast” and could not provide point-to-point microwave service as that was the service being displaced from the spectrum.<sup>20</sup> In concert with the service flexibility, the FCC also gave operators technical flexibility. Rather than following Europe and imposing a technical standard, the FCC trusted the marketplace to decide on technical solutions for a number of reasons. First, there would be a number of wireless providers so they would compete on many different aspects, potentially including technology.<sup>21</sup> Second, allowing providers to choose their technology would avoid delay. The FCC process for deciding upon and approving a specific standard was expected to take a substantial amount of time. Third, establishing a standard would have cemented in a specific technology without giving flexibility to change without FCC action. Ultimately, most of the rest of the world chose GSM for their mobile networks, usually mandated by the government regulators. In the U.S. some providers chose GSM, some chose Time Division Multiple Access (TDMA) and later converted to GSM, and others chose CDMA. CDMA technology was the precursor to much of the technology embodied in today's more advanced “4G” Long-Term Evolution or “LTE.”

The auctions were a success in many ways. New operators got licenses rapidly and were able to aggregate sufficient blocks of spectrum to launch competitive cellular services. And the auctions raised more than \$40 billion by 2001 and got licenses into the hands of those who valued them highly while minimizing transactions costs.<sup>22</sup> The initial spectrum auctions in the U.S. did not completely allocate spectrum efficiently, in large part due to efforts to pursue social goals at the same time as spectrum allocation.<sup>23</sup>

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<sup>20</sup> The new PCS licensees paid the relocation costs of the incumbent microwave licensees. See Cramton et al (1998).

<sup>21</sup> There was some concern that firms with market power might find it in their interest to adopt incompatible technology in part to increase switching costs for customers. To date, that has not been a major issue, but some firms have complained of incompatible standards in the 700 MHz band that is being used for new LTE networks and the FCC has started a proceeding on the issue, FCC (2012).

<sup>22</sup> Cramton (2002)

<sup>23</sup> The legislation authorizing the use of auctions for spectrum licenses contained a to “ensure the participation of designated entities [small businesses, businesses owned by women and minorities, and rural telephone companies] in the provision of service.” OBRA 93 1993, sec. 309(j). Ultimately, because of the Supreme Court *Adarand* decision, the FCC narrowed its designated entity preferences to be for all small businesses. The FCC implemented extremely generous installment payment options in the auction and several large bidders declared bankruptcy soon after the C block auction and the spectrum was tied up in bankruptcy courts for several years. See Kwerel and Rosston (2001).

Subsequently, the FCC has allocated or reallocated more of spectrum in a series of auctions raising more than \$30 billion since 2001.<sup>24</sup> The changes in the wireless marketplace have been dramatic. Prices have dropped substantially, new services have emerged rapidly, and operators have adopted new wireless access technologies such as High-Speed Packet Access (HSPA) and Long-Term Evolution (LTE) without the need for government mandates or involvement.<sup>25</sup>

### 3. Future spectrum allocations

Advances in wireless transmission and handset technology have allowed firms to offer new and more advanced services to consumers. Firms have pushed the FCC to make additional spectrum available to the marketplace because spectrum is a substitute for additional capital or technology. The resistance to making additional flexible spectrum available to the marketplace has primarily come from television broadcasters and government agencies that use spectrum. Both of these groups have a vested interest in maintaining their spectrum and neither group faces the full opportunity cost of using spectrum.

As technology advanced to make cable and satellite technology more attractive alternatives for terrestrial over-the-air television, and demand for mobile wireless increased, the television broadcasters ability to prevent transfer of their spectrum decreased. Broadcasters resisted the first reallocation of channels 70 -83 in the 1970s, the more recent transition of channels 50-69 in the FCC's 700 MHz auctions, and recently fought against the push for incentive auctions to allow the transition of even more broadcast spectrum. However, because of the change in technology to cable and satellite for television and the rise of wireless communications, the relative value of spectrum for broadcast television has diminished.

In addition to broadcasters, the government currently uses a large amount of valuable spectrum. There have been some reallocations of government spectrum, for example the Advanced Wireless Service (1710 to 1755 MHz and 2110 to 2155 MHz) band in 2007. But such reallocations have been contentious and taken time, and the current discussions about the transition of government spectrum point to the likelihood of a long transition period.<sup>26</sup> One issue is that current government users do not see the upside of giving up spectrum because they do not realize the opportunity cost of their spectrum use.

At the same time, mobile wireless companies see spectrum as an input to their production function of wireless communications and are pushing to have more spectrum made available to them. The advancing technology that reduced the value of spectrum for television and increased the value for mobile communications has pushed mobile wireless companies to lobby the FCC and the federal government to increase the amount of spectrum flexibly available to the market.

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<sup>24</sup> Data available on the FCC Auctions web page at [http://wireless.fcc.gov/auctions/default.htm?job=auctions\\_home](http://wireless.fcc.gov/auctions/default.htm?job=auctions_home) (visited 12/27/2011).

<sup>25</sup> See Rosston and Topper (2010).

<sup>26</sup> For example, U.S. Department of Commerce (2012) addresses the reallocation of the 1755 – 1850 MHz band with costs of costs of \$18 billion over ten years and some federal systems remaining in the band indefinitely.

## IV. Competition policy

Technology has also had a substantial impact on competition policy in communications, both at the FCC and antitrust agencies. Historically, the telephone system was seen as a natural monopoly at the local level. The large economies of scale, scope and density made a wire-based alternative to the copper telephone network prohibitively expensive for a second provider in any area. As a result, government regulated the rates that could be charged for local telephone service. At the same time, and in part because of the price regulation, there has been concern about vertical competition issues. Technological advances in wireless and wireline have changed the nature of and need for regulation in both circumstances over time.

### A. Horizontal Competition Concerns

Local telephone service was thought to be a natural monopoly and, like electricity, was regulated on a rate of return basis.<sup>27</sup> However, local telephone service was not one homogeneous product. For example, local telephone service can be to residence or business in low cost or high cost areas. Regulation of local telephone prices incorporated both the economic justification of ensuring that the local provider did not exploit its market power to charge rates that were too high, and also incorporated a pricing system to keep certain prices low regardless of cost.<sup>28</sup>

Regulation of local exchange prices began to change in the late 1980s when an economist, Gerald (“Jerry”) Brock, became head of the Common Carrier Bureau.<sup>29</sup> He pushed the move from rate of return regulation toward price cap regulation for local exchange service. While the FCC only had jurisdiction over a part of local service (due to the common costs of providing interstate services and intrastate services), the FCC’s move to price caps for interstate service move set the stage for state regulators to move away from traditional rate of return regulation and toward price cap regulation.<sup>30</sup>

While this change in regulation was not driven by a change in technology, price cap regulation interacted with the change in technology to provide substantial future flexibility for new telecommunications services. Technology has changed the need for local telephone service regulation. Over the past few years, advances in Voice over Internet Protocol (VoIP) combined with cable companies building more robust high-speed data networks to a large majority of homes, and the proliferation of wireless phones have changed the view that local telephone service is a natural monopoly. For the vast majority of households, there are four or more networks that can provide voice service (wireline telephone, cable, and multiple wireless providers). As a result, over 30 percent of homes have no traditional wired telephone.<sup>31</sup> The introduction of these alternative services has likely changed the elasticity of demand for traditional telephone service (while the demand for communication may still be inelastic, the demand faced by any one provider is likely more elastic and the elasticity of different forms of communications, eg. voice calls, email, text, is likely higher than the

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<sup>27</sup> Brock (1998) discusses the rate of return system.

<sup>28</sup> See, for example, Posner (1971) and Rosston and Wimmer (2001).

<sup>29</sup> See Brock (1998) and Brock (2003) for fuller discussions. John Haring, an economist who was head of the FCC’s Office of Plans and Policy at the time also influenced the Commission’s change to price cap regulation.

<sup>30</sup> See Sappington and Weisman (2010) for a discussion of the impact of price cap regulation.

<sup>31</sup> Blumberg and Luke (2011).

overall elasticity). However, the success of these new technology-driven competitive alternatives would not have been as pervasive or rapid without a change in regulation from the implementation of the Telecommunications Act of 1996.

### 1. The Telecommunications Act of 1996

Prior to the Telecommunications Act of 1996, local interconnection between competing and complementary networks was generally controlled by state regulators who saw interconnection fees as a way to keep monthly local telephone rates low. Because it was necessary to connect with the local provider for most calls, termination charges by the local exchange company tended to be above cost and much higher than the rates that the local company paid to others for terminating its calls. For example, it was typical for a cellular company to pay three cents per minute to terminate a call on the wireline network.<sup>32</sup> When calls went from the wireline network and were terminated on the wireless network, a typical payment might be on the order of one cent per minute, but often the payment also went to the wireline company. With a typical local calling volume of around 1,000 minutes per month for a household, and most of those calls going to wireline phones, a three cent per minute expense would put the cost of wireless phones at \$30 before any of its own network costs were incurred. As a result, wireless calling plans had relatively high per minute charges and were not considered landline replacement because of the high prices and also because of the relatively low quality and coverage. In addition, at the time, about 80% of wireless calls originated on the wireless network and only about 20% went from a landline to a wireless phone.

The headline features of the 1996 Telecom Act were the fights between the long distance providers and the local telephone companies: the long distance providers fought for low cost access to the pieces of the local networks so they could provide service to customers without building their own local networks; in exchange, the local telephone companies wanted to be able to provide long distance service, which they had been prevented from providing by the Consent Decree in the 1984 AT&T antitrust case. However, ultimately more important than these highly contentious provisions, the 1996 Telecom Act made a much more important change to the rules about interconnection. It required that transport and termination of traffic be “reciprocal.” Telephone companies made the argument that three cents one way and one cent the other way was reciprocal so that there was no need for them to change behavior. Because of this view and the notion that the incumbent phone companies had the best idea about their costs and had the highest volume of calls, the FCC changed the word “reciprocal” that was in the legislation to “symmetric” so that if the Incumbent Local Exchange Carrier (“ILEC”) charged a high price for its termination, it would also have to pay a high price for its outgoing calls.<sup>33</sup>

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<sup>32</sup> See FCC (1996), para. 1082.

<sup>33</sup> FCC (1996), para.s 1069 – 1096. I served as the Deputy Chief Economist at the FCC and was heavily involved in the FCC’s proceedings to implement the Telecommunications Act of 1996.

The ILECs apparently did not foresee the change in demand due to the Internet.<sup>34</sup> They focused their attention on the rules for the pricing of unbundled network elements and ignored this subtle change in the rules, although this change made much more of a difference in competition for facilities-based providers. Once the ILECs, with the view that interconnection would be between wireline and wireless networks, set a high termination price, innovative Competitive Local Exchange Carriers (“CLECs”) signed dial-up ISPs like AOL that received incoming calls and made no outgoing calls as customers. As a result, the above-cost termination payments went to the CLECs and the ILECs found themselves paying out much larger amounts than they had anticipated. ILECs subsequently reduced significantly the rates for symmetric termination.

The subsequent reduction in termination payments, from 3 cents per minute to a fraction of a penny a minute has made a huge difference in the ability of facilities-based local competitors like wireless companies and cable companies to compete with the ILECs, and this change would not have occurred had the ILECs been able to pay out one rate and charge a much higher rate for incoming traffic. Wireless carriers were able to take advantage of the much lower termination payments for their calls to the wireline network and begin to offer new services like “free nights and weekends” in addition to the mobile-to-mobile calling that avoided the wireline termination payments altogether. Ultimately, the reduction in termination payments contributed to AT&T’s ability to offer the Digital One Rate in 1999 that started the move to big packages of minutes usable anywhere in the country, and also to VoIP services that compete with the ILEC.

The technological advances in wireless, broadband, and VOIP led to different parties with different interests vying for influence in Congress and at the FCC. Some of these newly interested parties pushed for low-cost interconnection and the resulting changes in regulation that promoted the interests of these new competitors led to an increased diversity of competition that in turn has lessened the need for traditional monopoly regulation through its reduction of horizontal monopoly power.<sup>35</sup>

## **B. Vertical competition issues**

The FCC is also concerned with vertical competition issues where market power at one level of the communications infrastructure could impede competition at another. In most cases, antitrust practice has adopted the view that most vertical agreements are efficiency-enhancing unless there is a substantial degree of market power at one level. However, perceived market power at one level has been the reason that vertical issues have historically played a large role in communications competition policy.

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<sup>34</sup> The Telecom Act of 1996 was also hailed as a grand bargain between rival long-distance and local telephone companies. By providing the carrot of long-distance entry to the local carriers, Congress forced the local carriers to open their local networks to competition. Removal of these barriers also tore down the artificial distinction between local and long distance telephone calls that had evaporated due to dramatic decreases in the cost of transmitting calls over long distance.

<sup>35</sup> Harris et al. (1995) argue that with advances in local telephone competition, ultimately the only regulation would possibly be to ensure competitive interconnection charges.

The theory of the AT&T antitrust case in the late 1970s and early 1980s was that the local exchange was a natural monopoly while other related communications services such as long distance could be provided competitively because they did not have the same economies of scale, scope and density. The theory of the Consent Decree in *US v. AT&T* was a concern that AT&T was using its bottleneck local exchange monopoly to prevent entry and competition in long distance and information services businesses.<sup>36</sup> The FCC had instituted safeguards to try to prevent the behavior that the Justice Department claimed was occurring. Hence, the Consent Decree provided clearer structural remedies that did not rely on internal accounting and separations, but instead on line of business restrictions that prevented the newly created Regional Bell Operating Companies (RBOCs) from entering into specific lines of business without Court approval. While this prevented some of the problems at issue, such restrictions also possibly prevented efficiency-enhancing services from appearing or appearing as rapidly.<sup>37</sup>

The 1982 Consent Decree separated the local exchange from the provision of long distance service because of the potentially competitive provision of long distance service.<sup>38</sup> Long distance service became competitive because of the use of microwave towers to provide long-haul carriage of telephone calls. However, there were no large economies of scale in microwaves due to the limited number of calls per radio and radios per tower. As a result, MCI, Sprint and others were able to provide service and compete with AT&T's prices.<sup>39</sup> On the local end, viable competition did not exist for telephone calls and dial-up Internet access was just beginning.

## 1. Network neutrality

One of the most publically controversial FCC policy debates over the past 15 years has been the concept of "open access" or "network neutrality."<sup>40</sup> The debate is essentially about the ability of a network provider to use control of its facilities to access customers to disadvantage companies at another vertical level of service provision. The concern for home internet service developed when dial-up Internet access began to give way to cable and DSL high-speed Internet access. In the dial-up world, the telephone company provided a voice-grade connection and the Internet Service Providers (ISPs) provided modem banks that would answer the call from a customer's computer and connect that computer to the Internet. Different ISPs competed on the availability of numbers in different areas, on customer service and on additional information services for the customer.<sup>41</sup> With the advent of high-speed cable and DSL, there was no need or value added from the equipment provided by ISPs and much of their value-added was subsumed into the basic service.

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<sup>36</sup> See Noll and Owen (1989) and Brennan (1987).

<sup>37</sup> Hausman (1997) estimates that the delay in the introduction of voice messaging services reduced consumer welfare by over \$1billion.

<sup>38</sup> While cellular service was also a competitive service and could have been separated from the local exchange, in 1982 its importance and competitive significance were not well understood and negotiators thought it would be important to provide additional revenue opportunities to the local exchange companies. (Private conversation with William Baxter who was the Assistant Attorney General for Antitrust who negotiated the Consent Decree with AT&T) and Cauley (2005).

<sup>39</sup> Subsequently, long distance transport companies began to use fiber optic cables.

<sup>40</sup> Schuett (2010) provides a background of some of the economic articles relating to network neutrality.

<sup>41</sup> See Downes and Greenstein (2002).

With the demise of their value-added, independent ISPs pushed for “open access” where the facilities-based providers would be required to provide wholesale service to the ISPs so they could sell a bundled package to consumers. The FCC never acted on open access in a general proceeding, but did mandate nondiscrimination provisions as a condition of the Time Warner-AOL merger. The FCC worked with the FTC to evaluate the merger and both were concerned about the vertical merger leading to exclusionary effects. Time Warner had cable systems served 18 percent of cable households and AOL was at the time the leading ISP with 40 percent of U.S. online households.<sup>42</sup> To prevent vertical foreclosure, the FTC required TimeWarner cable to enter into agreements with two (pre-approved) independent ISPs and the FCC mandated non-discrimination provisions on top of the FTC’s remedy.

Since then, ISPs have not had much of an impact on the development of competition in high-speed access. However, there has remained a concern that high-speed access providers might have the ability and incentive to discriminate against some content and in favor of other content. The most famous example of actions like this was Madison River Telephone Company’s blocking the port used by Voice over Internet Protocol (VoIP) provider Vonage.<sup>43</sup> There have been only a small number of other instances where high-speed access providers have restricted access to specific content, but most of the argument on both sides has been speculative: “access providers might in the future restrict access so we need a prophylactic rule against any such behavior;” on one side, and “we have never done anything bad and would not so why put in a rule” on the other.

In economic terms, one would want to investigate what are the real incentives and ability of high-speed access providers to discriminate and what efficiency gains would be prevented through a rule. The FCC followed this analytical framework in its recently completed investigation of the Comcast – NBC Universal joint venture.

## 2. Comcast-NBCU

Comcast formed a joint venture with NBCU in 2010.<sup>44</sup> Comcast is the leading cable television company with 23 million households subscribing to video service and also the leading cable high-speed access provider with 16 million cable broadband subscribers.<sup>45</sup> The FCC and DOJ examined its bid to take control of NBCU, a content provider to see if Comcast would have the ability and incentive to exclude other access providers from NBCU content, and also whether Comcast would have the ability and incentive to discriminate against other content providers to favor its newly-owned content. Analysis of the transaction looked at the impact on Comcast of withholding its programming from other Multi-channel Video Program Distributors (“MVPDs”) such as DirecTV and Dish Network. The tradeoff for Comcast was whether by withholding such content from its rivals, enough subscribers would transfer to Comcast service to outweigh the costs that Comcast would incur by not selling its content to its rivals for their remaining customers. For example, if Comcast were to refuse to provide USA Network to DirecTV (or to charge a very high price for it), Comcast would lose the affiliate fees paid by DirecTV for its remaining subscribers. At the same time, some DirecTV subscribers would value USA Network

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<sup>42</sup> Faulhaber (2004)

<sup>43</sup> FCC (2005)

<sup>44</sup> I submitted economics analysis to the FCC and DOJ on behalf of Comcast in relation to this transaction.

<sup>45</sup> DOJ (2011).

sufficiently highly that they would drop their DirecTV subscription and subscribe to Comcast. Comcast would profit from this customer's cable subscription and possibly also be better able to sell a bundle of cable, Internet and telephone.<sup>46</sup>

The FCC's concern stems from its designation of certain programming as "must have." With only 12% of programming revenue, if all programming were substitutable, there would be no concerns about withholding programming. However, must have programming, according to the FCC is sufficiently highly demanded that any MVPD who wants to compete would be at a severe disadvantage if it did not have the programming and other MVPDs did. Generally, the FCC considers the major broadcast networks as well as marquee cable channels and regional sports networks (RSNs) as "must have" content. Comcast already had interests in some of the regional sports networks, and did not make Comcast Sports Net Philadelphia available to DirecTV or Dish Network. The FCC found that Comcast's refusal accounted for its substantially higher MVPD share in Philadelphia than in other areas and raised the concern that with access to substantially higher quality and quantity of content through the NBCU transaction, Comcast would have the ability and incentive to exclude its rivals in other areas.<sup>47</sup>

The FCC proceeding included evidence about the possible impacts, centering on the required diversion rates: how many customers would have to switch to Comcast to make such a strategy profitable.<sup>48</sup> First, the new content was national so that unlike the RSN refusal, which occurred in a single local area, blocking networks would cause Comcast to forgo affiliate fees across the country, while it only covered 24% of the households. This fact alone makes an exclusionary strategy less likely. A second mitigating factor was the extent of long-term contracts. Comcast would be unable to exclude all MVPDs at the same time. Hence disgruntled customers of the excluded MVPD would also have the option to switch to another provider. All of these considerations were factored into the estimations of the potential competitive harm.

The parties and the FCC incorporated a similar cost-benefit analysis for vertical harm for the nascent "online video distribution" business. Apple, Netflix, Hulu and others offered different versions of video over the Internet to subscribers. The FCC was concerned that Comcast might have the incentive and ability to foreclose these new businesses because it feared that they would provide significant competition for Comcast's subscription video business. The increase in Internet access speeds allowed these businesses to provide their service to customers. The FCC was worried not only that Comcast would deny programming to protect its subscription video business, but also because Comcast is the largest provider of Internet access in its territories, the FCC was also concerned that Comcast would diminish the quality or access to online video providers' sites.

To protect against these concerns, the FCC and Department of Justice approved the transaction with conditions to ensure that competing MVPDs and new online video distributors had access to NBCU programming at reasonable prices and that video programmers would have access to Comcast's cable distribution systems.

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<sup>46</sup> See Baker (2011).

<sup>47</sup> FCC (2011), para 37.

<sup>48</sup> The Department of Justice also investigated the transaction and its analysis followed similar lines as the FCC.



The concept of “must have” programming is particularly relevant with the technological change enabling Internet packagers and more direct distribution to consumers. For example, program providers who have “must have” content should be able to extract some or all of the surplus they create for MVPDs. For example, major league baseball have developed its own product, MLB.com to circumvent MVPDs, while there are news reports that Dish Network might offer a package without ESPN, the most expensive cable channel.

The FCC conditions on the merger reflect a concern about potential harmful vertical effects when there is market power in at least one layer, and were set to ensure that the new technology for viewing video was not precluded by anticompetitive actions. These conditions were influenced by the new platform providers such as Netflix and Apple, and more traditional competitors such as DirecTV wanting to ensure that regulations provided them with access to programming at a low price.

## V. Conclusions

Economists have influenced communications regulation, but more importantly, advances in technology created the forces pushing decision makers to be more sympathetic to market opening regulatory changes. The microprocessor revolution increased the ability for competitive firms to develop alternatives to the traditional communications firms that offered telephone and video service. As a result, these new firms pushed for changes to regulation to enable them to compete in the marketplace. Their influence led to multiple wireless carriers, cable television, satellite television and set the stage for new providers being able to implement new business plans without needing explicit regulatory approval.

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