EXHIBIT A

DECLARATION OF MICHAEL D. TOPPER

Assessing the Competitiveness of Mobile Wireless: An Economic Analysis

Declaration of Michael D. Topper

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I. Introduction and Summary 1

II. The Commission's Current Analytical Framework 4

A. The Commission's current framework is consistent with other well-known approaches for assessing competition 5

1. The Commission's focus on consumer outcomes is consistent with modern antitrust law and economics 5

2. The Commission's analytical framework is well grounded in competition economics 6

3. The CMRS Competition Report approach follows the approach taken by the Commission in evaluating wireless transactions over the last decade and more 7

B. Competition analysis should be fact-driven and account for important economic characteristics of mobile wireless 8

1. Multi-dimension Competition 9

2. Significant Fixed Costs 10

3. Economies of Scope 11

4. Network Management 11

5. Investment Incentives 12

6. Vertical Relationships 13

7. Rapid Change 13

C. The Commission's current analytical framework is appropriately examining competition in mobile wireless 15

III. Indicia of Competition: Market Structure 15

A. Wireless Network Providers 16

1. Market Participants 16

2. Consumer Options 17

3. Changes in Market Shares 18

4. HHI Calculations 20

5. Costs and Profits 22

6. Rural Consumers 23

7. Access to Spectrum 24

8. Intermodal Competition 26

9. Joint Analysis of Mobile Voice and Broadband 28

B. Wireless Devices 29
C. Applications and Content 32
D. Summary of Market Structure Evidence 32
IV. Indicia of Competition: Provider Conduct 33
A. Technology Deployment 33
B. Network Quality 36
C. Wireless Devices 37
D. Applications and Content 40
E. Summary of Provider Conduct Evidence 43
V. Indicia of Competition: Consumer Behavior 43
A. Access to Information 43
B. Local Number Portability 44
C. Churn 45
D. Early Termination Fees 46
E. Summary of Consumer Behavior 47
VI. Indicia of Competition: Wireless Market Performance 47
A. Subscribers 47
B. Voice Telephony 48
C. Text and Multimedia Messaging 51
D. Mobile Data Services 52
E. Product Variety 54
F. International Comparisons 55
G. Summary of Market Performance 56

I. Introduction and Summary

In 1993, Congress created the statutory classification of "Commercial Mobile Services" ("CMRS") and established the promotion of competition as a public policy goal for commercial mobile services.[1] Since that time the Federal Communications Commission ("Commission") has issued a series of 13 annual CMRS Competition Reports on the state of competition in the wireless industry.[2] In those reports, the Commission has consistently come to the conclusion that the wireless marketplace is competitive. For example, in the First CMRS Competition Report, released on August 18, 1995, the Commission discussed the trends of emerging competition between previously discrete categories of CMRS services and spectrum allocations for PCS and stated "[t]he Commission believes that these trends all improve consumer benefits and should be encouraged."[3] And in the Thirteenth CMRS Competition Report, released on January 16, 2009, the Commission stated "U.S. consumers continue to benefit from effective competition in the CMRS marketplace."[4]

On May 14, 2009, the Commission released a Public Notice soliciting data and information on the state of competition among providers of CMRS for its Fourteenth Competition Report.[5] As it has in prior proceedings, the Commission asked for data and information regarding a variety of indicia of competition.

As a follow up, on August 27, 2009, the Commission released a Notice of Inquiry (NOI) related to competitive market conditions in mobile wireless.[6] In the NOI, the Commission asks "whether, and to what extent, we should modify or change the analytic framework used since the Ninth Report to analyze the competitiveness of the mobile

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[1] The Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66, Title VI, § 6002(b), amending the Communications Act of 1934 and codified at 47 U.S.C. § 332(c).
[2] Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services. ("CMRS Competition Report")
[3] First CMRS Competition Report, ¶ 8. ("First Report")
[4] Thirteenth CMRS Competition Report, ¶ 274. ("Thirteenth Report")
[5] Public Notice: Wireless Telecommunications Bureau Seeks Comment on Commercial Mobile Radio Services Market Competition, WT Docket No. 09-66, May 14, 2009. ("Fourteenth Report Public Notice")
[6] Notice of Inquiry: In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1992, Annual Report and Analysis of Competitive Market Conditions with Respect to Mobile Wireless Including Commercial Mobile Services, WT Docket No. 09-66, August 27, 2009. ("Mobile Wireless Competition NOI") The Commission released two other NOIs on August 27, 2009, one related to innovation and investment in wireless and one related to consumer behavior.

wireless market"[7] and announced that it will "expand the scope of our review to encompass the entire mobile 'value chain' from upstream markets for key inputs to downstream markets that depend on mobile wireless services."[8]

I have been asked by Verizon Wireless to assess, from the vantage point of economics, whether the current analytical framework being used by the Commission is appropriate for assessing competition in mobile wireless, and whether current wireless market quantitative and qualitative metrics are indicative of "effective competition." My qualifications are provided in Appendix A.

In summary, my findings are:

- The Commission's current structure-conduct-performance framework is appropriate for assessing competition in mobile wireless. The Commission's approach is based on the well-accepted consumer welfare standard of antitrust law and economics, is well grounded in academic research on the economics of competition, and is consistent with the approach taken by the Commission when it has evaluated wireless transactions under its public interest standard.
- The Commission's current analytical framework for assessing whether there is effective competition in the mobile wireless industry is a fact-driven approach and appropriately accounts for several important economic features of the wireless industry. These characteristics include competition along multiple dimensions, significant fixed costs, risky investments ahead of demand for services, common costs for many different services, reliance on shared network resources, rapidly changing technology and service offerings, and the important role of innovation as a contributor to consumer welfare gains. As a result, if the Commission continues to follow this approach and bases its analysis on the data, its findings will appropriately reflect the competitive conditions and outcomes in the wireless industry.
- The existing framework has successfully evolved over time to take account of changes in mobile wireless technology, new service offerings such as mobile

[7] Mobile Wireless Competition NOI, ¶ 7.
[8] Mobile Wireless Competition NOI, ¶ 9.

data, and new forms of competitive rivalry. Because the wireless industry is evolving rapidly, the Commission should continue to use the current, flexible framework and avoid a rigid approach that will soon be out of date. Moreover, the existing framework can, and should, take advantage of new data sources that shed light on the various dimensions of competition among firms participating in the mobile wireless industry.

- Market structure evidence shows that the vast majority of wireless consumers currently have substantial choice in where and how they purchase mobile voice and data services.
- The Commission should continue to treat market structure as only a first step in its competition analysis. It should follow a data-driven approach and resist the temptation to look for shortcuts that rely on artificial (and unreliable) structural bright lines.
- As in its prior competition reports, the Commission should seek to understand the different dimensions of competitive rivalry between providers and incorporate economic analysis that accounts for the unique features of the wireless industry. In its analysis, the Commission should continue to give primary importance to consumer welfare as measured by prices, output, quality, and the development of new and innovative services.
- A review of recent evidence from the wireless marketplace demonstrates that wireless consumers are benefitting from robust competition. The wireless market, while not perfectly competitive according to the textbook model, shows many signs of vigorous competition – low prices, numerous customer choices, new services and features, improved quality, and significant innovation. Most consumers have numerous choices when purchasing wireless service; switching between providers has gotten easier; service packages offering various bundles of services are available to consumers with different needs; there has been robust price competition for voice and data plans; wireless devices and mobile operating systems are evolving rapidly; and large numbers of new applications are available and in widespread use.

- Critiques of the Commission's current structure-conduct-performance framework are not justified by the underlying economics of the wireless industry.
- Policy should be directed to maintaining the investment incentives and market competition that have benefitted consumers. The Commission should not implement regulations that reduce incentives to innovate and invest or otherwise cause a diminution of competition, despite good intentions.

Support for these opinions is provided in the remainder of this paper. Section II reviews the methodological foundation for the Commission's current structure-conduct-performance framework. Sections III, IV, V and VI analyze current quantitative and qualitative indicia of competition in mobile wireless. Section VII provides a summary.

II. The Commission's Current Analytical Framework

In the Thirteenth Report, the Commission reviewed and analyzed data on competitive market conditions using a structure-conduct-performance framework, with its analysis organized into four categories: 1) market structure, 2) provider conduct, 3) consumer behavior, and 4) market performance. The Commission has been grouping its analysis explicitly into these four categories since the Ninth Report and looked at similar indicia of competition in earlier reports.

The Commission's structure-conduct-performance paradigm is based on several key economic building blocks:

- Market structure metrics such as concentration ratios, although a helpful starting point, are not a sufficient basis for assessing the effective of competition in mobile wireless. Assessing the competitiveness of the wireless market depends on a fact-driven analysis of the conduct of wireless providers and consumers.
- Anticompetitive effects do not necessarily follow from high market concentration. Rather, it is necessary to examine the competitive dynamics of price and non-price rivalry among wireless providers and assess how those actions promote competition or show signs of a lack of competition.

- Consumer behavior constrains market power when subscribers can easily switch providers to pursue better prices or more attractive service. Thus, it is important to examine consumer behavior and potential impediments to consumer switching.
- Effective competition brings tangible benefits to consumers in the form of lower prices, greater choice, new services, and high quality. It is these consumer outcomes that are the best indicator of effective competition.

After applying this framework, and assessing a wide range of quantitative and qualitative indicia of competition, the Commission found, consistent with earlier CMRS Competition Reports, that "[t]he metrics below indicate that there is effective competition in the CMRS market."[9]

A. The Commission's current framework is consistent with other well-known approaches for assessing competition

As shown below, the Commission's current analytical framework is consistent with the focus in antitrust law and economics on consumer welfare, is well grounded in economic research on competition, and is consistent with the approach the Commission uses in evaluating wireless transactions.

1. The Commission's focus on consumer outcomes is consistent with modern antitrust law and economics

The Commission's focus on consumer outcomes is consistent with modern antitrust law and economics. Courts, antitrust agencies, and economists all emphasize the importance of consumer welfare as the hallmark of competition policy.[10] For example, the Supreme Court stated in 1977 that "antitrust laws, however were enacted for 'the protection of competition, not competitors."[11] In other words, the best indicators of competition are measures of market performance that directly impact consumers – prices, quantities, quality, consumer experience, and new services – rather than measures of the

[9] Thirteenth Report, ¶ 1.
[10] See, e.g., Joseph Farrell and Michael Katz (2006), "The Economics of Welfare Standards in Antitrust," *Competition Policy International*, Vol. 2; Michael Katz and Howard Shelanski (2006), "Mergers and Innovation," *Antitrust Law Journal*.
[11] Brunswick Corp. v. Pueblo Bowl-O-Mat, Inc., 429 U.S. 477, p. 488, (1977), citing Brown Shoe Co. v. U.S., 370 U.S. 294, p. 320, (1962).

business success of particular competitors. For example, an increase in concentration can reflect vigorous competition as a more efficient or innovative firm takes market share away from rivals, and competition policy should reward, not penalize, such behavior as it redounds to the benefit of consumers.

Farrell and Katz (2006) state, "[a]s many have noted, the concept of harming competition is often hard to interpret and too naïve an interpretation would prohibit many beneficial agreements. Thus, the law has evolved toward prohibiting only acts that both (a) hurt competition in an ordinary (if sometimes vague) sense and (b) hurt efficiency and/or consumer surplus."[12] Katz and Shelanski (2006) also point out that the purpose of merger enforcement is to promote competition not for the sake of competition but in order to protect consumer welfare.[13]

The CMRS approach has consistently recognized the importance of competition in generating benefits to consumers. It is instructive to consider the First Report, which stated: "The Commission's implementation of PCS is an example of regulation that promotes the private marketplace over government mandates, the most efficient use of the nation's natural resources (in this case, spectrum), and competition (with the attendant benefits for consumers of lower prices, high quality, and innovation)."[14]

2. The Commission's analytical framework is well grounded in competition economics

The current analytical framework's reliance on an analysis of producer and consumer conduct is well grounded in competition economics, which recognizes that anticompetitive effects do not necessarily follow from high market concentration. Rather, it is necessary to examine the competitive dynamics of price and non-price rivalry among wireless providers and assess how those actions promote current and future competition or show signs of a lack of competition.

Market structure metrics, although helpful in identifying the contours of the industry, are not a sufficient basis for assessing the effectiveness of mobile wireless

[12] Farrell and Katz (2006).
[13] Katz and Shelanski (2006).
[14] First Report, ¶ 4.

competition. Even in highly concentrated markets, producer rivalry can lead to competitive outcomes. For example, an increase in concentration can reflect vigorous competition as a more efficient or innovative firm takes market share away from rivals. Similarly, economists recognize that the action of a single provider who chooses to expand its sales aggressively can thwart the potential for collusion even in concentrated markets.[15] Economists also recognize that in industries with highly differentiated products, coordination among suppliers can be difficult to sustain and collusive outcomes may be unlikely, even with a relatively small number of firms.[16] Thus, an assessment of effective competition must account for price and non-price rivalry between providers, the ability of consumers to switch providers in response to better prices or service, and the potential for innovation by firms inside and outside the industry to change the competitive landscape.

3. The CMRS Competition Report approach follows the approach taken by the Commission in evaluating wireless transactions over the last decade and more

The CMRS Competition Report approach is also broadly consistent with the analysis the Commission has taken in evaluating wireless transactions under its public interest standard. For example, almost a decade ago the Commission approved the Voicestream – Omnipoint and SBC – BellSouth wireless mergers. While recognizing that the mergers would result in consolidation, the Commission also considered the consumer benefits of the creation of nationwide footprints, and in the SBC – BellSouth transaction, the Commission also referred to the potential for new service plans and features.[17]

More recently, in the Sprint – Nextel transaction that was cleared in August 2005, the Commission ruled that the proposed merger served the "public interest, convenience, and necessity" through improved service quality and broader deployment of next

[15] Jonathan Baker (2002), "Mavericks, Mergers, and Exclusion: Proving Coordinated Competitive Effects under the Antitrust Laws," *New York University Law Review*, Vol. 77, p. 135.
[16] See, e.g., Louis Kaplow and Carl Shapiro (2007), "Antitrust," *Handbook of Law and Economics*, Vol. 2, p. 1117; Dennis Carlton and Jeffrey Perloff (2005), *Modern Industrial Organization*, 4th ed., pp. 127-136.
[17] Memorandum Opinion and Order in the Matter of Applications of SBC Communications, Inc. and BellSouth Corporation, Released September 29, 2000, ¶¶ 48-49 and Memorandum Opinion and Order in the Matter of Applications of Voicestream Wireless Corporation and Omnipoint Corporation, Released February 15, 2000, ¶ 46, ¶ 51.

generation technology, despite the fact that the merger increased concentration in many markets.[18] Similarly, the Verizon Wireless – Alltel transaction was cleared in November 2008 although divestitures were required in some markets.[19] Because Verizon Wireless and Alltel had complementary networks covering different geographic locations, the merger created a network with a more extensive national footprint. The benefits of the merger that were proposed by the applicants and considered by the Commission included expanded coverage of wireless broadband service in particular to rural customers, and better customer service.[20] In both transactions, the Commission undertook a market-by-market analysis that weighed the benefits to consumers and the public interest against the changes in industry concentration.

B. Competition analysis should be fact-driven and account for important economic characteristics of mobile wireless

In evaluating the competitive impact of a merger, courts and the antitrust agencies rely on the specific facts of each case setting. As described by the DOJ, the agencies "take into account pertinent characteristics of the market's competitive process using data, documents, and other information obtained from the parties, their competitors, their customers, databases of various sorts, and academic literature or private industry studies."[21]

Similarly, in addressing potentially anticompetitive business conduct, academic economists note the importance of fact-driven inquiries based on the specifics of each market setting. Baker (1999) notes that thirty years ago *per se* rules predominated which largely ignored the details of any specific case. However, these *per se* rules have been replaced more and more by economic analysis of the actual facts in each case, and this has been credited as helping to "reduce errors in determining the likely effects of business

[18] Memorandum Opinion and Order in the Matter of Applications of Nextel Communications, Inc. and Sprint Corporation, Released August 8, 2005, ¶ 3.
[19] Memorandum Opinion and Order in the Matter of Applications of Cellco Partnership d/b/a Verizon Wireless and Atlantis Holdings LLC, Released November 10, 2008, ¶ 3. ("Verizon Wireless – Atlantis Holdings Order")
[20] Verizon Wireless – Atlantis Holdings Order, ¶ 128.
[21] U.S. Department of Justice, 2006 Commentary on Horizontal Merger Guidelines, p. 3.

conduct."[22] In its 2007 report, the Antitrust Modernization Commission ("AMC"), a bipartisan commission established by Congress in 2002, noted "given the potential for either procompetitive or anticompetitive explanations for business conduct, antitrust analysis needed to move away from per se rules of automatic illegality."[23] Academic economists have generally urged courts to adopt more economic evidence and empirical methods for their antitrust analysis.[24]

As I discuss below, the Commission's current analytical framework for assessing whether there is effective competition in the mobile wireless industry is a fact-driven approach and appropriately accounts for several important economic features of the wireless industry. These characteristics of the wireless industry include competition along multiple dimensions, significant fixed costs, risky investments ahead of demand for services, common costs for many different services, reliance on shared network resources, rapidly changing technology and service offerings, and the important role of innovation as a contributor to consumer welfare gains.

1. Multi-dimension Competition

As in most real world markets, competition in mobile wireless takes place along many dimensions. Wireless providers use their network infrastructure to offer a variety of services, including voice telephony, text messaging, multimedia messaging, email, Internet access, music, video, and television. Providers offer differentiated products and services and compete on many dimensions, including the pricing of service packages and wireless devices, by offering different calling plans, applications and features, by allowing consumers to customize their user experience in various ways, and by improving network quality and coverage. In analyzing the effectiveness of competition, the Commission should account for the various dimensions of rivalry between providers.

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[22] Jonathan Baker (1999), "Developments in Antitrust Economics," *Journal of Economic Perspectives*, Vol. 13, p. 191.
[23] *Antitrust Modernization Commission Report and Recommendations*, April 2007, p. 35. ("AMC Report")
[24] See, e.g., Jonathan Baker and Timothy Bresnahan (forthcoming), "Economic Evidence in Antitrust: Defining Markets and Measuring Market Power," *Handbook of Antitrust Economics;* Jonathan Baker and Daniel Rubinfeld (2006), "Empirical Methods in Antitrust Litigation: Review and Critique," *American Law and Economics Review*, Vol. 1.

For example, carriers are increasingly competing by offering differentiated devices, operating systems, and applications.

2. Significant Fixed Costs

The costs of setting up, maintaining, and upgrading wireless networks are substantial. Carriers need to obtain spectrum licenses, build out their spectrum and upgrade their technologies. They need to invest in cell sites, backhaul, switching, and interconnection facilities. These investments have helped to deploy next generation technologies which improve the coverage, capacity, and capabilities of carrier networks, leading to service quality improvements for voice calls, faster mobile broadband, and other new mobile data services. Wireless carriers have continued to make substantial investments in their networks in 2009, and have plans to continue to do so in future years.

It is well recognized in economics that the number of competitors that can efficiently serve a market depends on the size of the market relative to the minimum efficient scale (MES) of production and distribution.[25] In industries like wireless with substantial fixed costs, it will be inefficient and not commercially viable for a very large number of facilities-based firms to operate in the same geographic area. Because of these technological constraints, the wireless marketplace is not a textbook perfectly competitive market – the fixed costs to set up a wireless telephone network are substantial and there are economies of scale and density.

In the presence of significant fixed costs and scale economies, average prices above marginal costs are not good indicators of a competitive problem. As described by the AMC, "[a]ntitrust analysis also must recognize that a price above marginal cost, by itself, does not necessarily suggest that a firm has market power that should be relevant in an antitrust matter or is operating anticompetitively in a relevant antitrust market."[26] Indeed, average prices must be above marginal cost to cover the fixed costs and earn a competitive return on the significant investments required to build out and upgrade wireless networks.[27] In this sense, a more long-term view of costs is appropriate.

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[25] See, e.g., Carlton and Perloff (2005), p. 76.
[26] AMC Report, p. 40.
[27] See, e.g., AMC Report, p. 41.

3. Economies of Scope

In addition to economies of scale, there are also economies of scope in the wireless industry, i.e., efficiencies in offering wireless services using shared network resources. Wireless providers use the same spectrum, network infrastructure, and equipment to offer a wide range of differentiated services. These different services share common costs. There are extra complexities associated with multiproduct firms and economies of scope in calculating average cost functions, primarily because of the extra difficulty in separating inputs and outputs. These complications spill into assessments of market structure and the interpretation of costs and margins.[28] In particular, with economies of scope price-cost margins for individual services are less likely to be informative about competitive conditions because of the arbitrary nature of common cost allocation.

4. Network Management

Wireless providers have hundreds of millions of customers on their networks. These customers are sharing a scarce resource – network bandwidth – and providers need to manage their networks to ensure that they can provide the range of services (and quality) for which their consumers wish to pay. Capacity of a wireless network is essentially a function of the amount of bandwidth, the amount invested in cell sites (both the number of sites and the number of radios, smart antennas, and other equipment at each site) and the backhaul capacity of the network.

In addition to realizing the efficiencies of economies of scope, network providers must manage network capacity. Because at any point in time, there is a limited amount of spectrum and the wireless network configuration has a fixed number of cell sites (and sectors), there is a bandwidth limit in each (small) geographic area that has to be shared among users in the same cell sector. For example, if one user is downloading video, she may be using a disproportionate share of the available bandwidth, which in turn can affect the experience for other users. Therefore, wireless providers must decide how much to invest and how much to charge customers for their usage.

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[28] See, e.g., Carlton and Perloff (2005), pp. 50-51; Robert Willig (1979), "Multiproduct Technology and Market Structure," *American Economic Rev*iew, Vol. 69.

One implication of these network management issues is that one type of user cannot be viewed in isolation from other types of users that are sharing network resources. Thus, provider practices, such as restrictions on certain bandwidth-intensive applications, should be analyzed in a manner that accounts for the externalities that certain users can impose on other users.

5. Investment Incentives

The need for substantial investment to deploy next generation technologies highlights the importance of investment incentives. Wireless service is an evolving technology and proper incentives must be in place to encourage research, development and the deployment of new and more efficient technology. Regulatory policy can affect the investment incentives of both new entrants and incumbents. For any investment to take place, firms have to believe they will be better off from having made the investment than not. If policy reduces the returns to investment, at the margin, firms are less likely to invest. The substantial investment in wireless networks, especially investment that is made well ahead of when demand becomes certain involves substantial risk. Hence any investment requires that there be an appropriate risk premium when evaluating a firm's investment decisions. For new entrants, more onerous regulation or uncertainty over future regulation can affect the scale and scope of entry, or make entry unviable. Similarly, uncertainty over future regulation may reduce the incentives for incumbents to innovate and invest.[29]

Economists recognize that in markets such as mobile wireless where investment and innovation are important, consumer welfare is very dependent on firms having incentives to continue to innovate and develop new and better products before corresponding demand becomes certain. For example, in his testimony to the Antitrust Modernization Committee, economist Richard Gilbert stated that, "dynamic competition to develop new products and to improve existing products can have much greater impacts on consumer welfare than static price competition."[30] Since mobile wireless innovation

[29] See Kaplow and Shapiro (2007), pp. 1088-1089.
[30] Richard Gilbert (2005), "New Antitrust Laws for the 'New Economy'?," Testimony before the AMC, November 18, 2005.

can have a large effect on consumer welfare, it is particularly important that proper market incentives for innovation and technology deployment be preserved.

6. Vertical Relationships

Vertical relationships between wireless providers and downstream suppliers—equipment manufacturers and applications providers—are already an important part of the wireless industry and are likely to grow as wireless consumers buy and use more wireless data devices and services. Consumers can already choose from a large variety of handsets from many independent manufacturers, and, increasingly, can add applications and content provided by a large number of third-party firms to customize their wireless experience. Thus, today's wireless market environment is very different from the regulated and vertically-integrated AT&T monopoly that existed at the time of the original Carterfone decision.

The relationship between downstream suppliers and wireless network providers requires that market dynamics be considered jointly, as competitive pressures in one market will shape the other. For example, exclusive distribution contracts for handsets should be analyzed by considering the incentives of handset manufacturers and wireless providers as they compete for current consumers and invest in future technologies.

7. Rapid Change

The wireless industry is evolving rapidly. As noted in the Mobile Wireless Competition NOI, "[t]he mobile wireless industry has continued to evolve since the writing of the Thirteenth Report, with mobile voice and mobile data/broadband services becoming increasingly intertwined and many mobile devices more closely resembling mobile computers instead of mobile telephones"[31] and "[w]e are now in the midst of a transition from reliance on mobile voice services to increasing use of and reliance on mobile broadband services, which promise to connect American citizens in new and deeper ways."[32]

[31] Mobile Wireless Competition NOI, ¶ 4.
[32] Mobile Wireless Competition NOI, ¶ 2.

In industries characterized by rapid change and innovation, measures of market concentration must be interpreted carefully. In these industries, it is possible for market boundaries to shift, for new forms of competition to emerge, and for entrants to quickly surpass incumbents because of technological developments, an attribute that the court recognized in the Microsoft antitrust litigation.[33] In these industries, incentives for innovation are of paramount importance and a careful analysis of competitive dynamics is warranted before undertaking regulatory interventions.

In its 2007 report, the Antitrust Modernization Commission addressed the issue of whether antitrust analysis can adapt to markets in which innovation, intellectual property and technological change are central features. It concluded that "antitrust analysis has sufficient grounding in sound economic analysis, openness to new economic learning, and flexibility to enable the courts and the antitrust agencies properly to assess competitive issues in new economy industries."[34] In particular, the AMC quoted Professor Carl Shapiro, noting that "basic economic principles do not become 'outdated' simply because industries become more dynamic."[35]

The current CMRS Competition Report framework has the flexibility to adapt to the many changes occurring in mobile wireless. While the Commission has consistently applied a broad based structure-conduct-performance framework, the quantitative and qualitative metrics reviewed by the Commission have appropriately changed to adapt to the changing wireless marketplace. For example, recent CMRS Competition Reports have given much more extensive coverage to SMS and MMS, prepaid plans, mobile data services, smartphones and other handsets, and third-party applications. As data usage has increased, recent CMRS Competition Reports have incorporated metrics such as price per text message and data ARPU.

The CMRS framework has also recognized the importance of continuing investment and innovation as a source of consumer benefits. As carriers have upgraded their networks and adopted new digital technologies, the report has focused on newly deployed and forthcoming technologies. Early CMRS Competition Reports monitored

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[33] U.S. Department of Justice, "*U.S. v. Microsoft: Court's Findings of Fact*," ¶ 59.
[34] AMC Report p. 31.
[35] AMC Report p. 31.

the ongoing conversion from analog to 2G. More recent reports have discussed plans for and deployment of 2.5G, 3G, and 4G technologies.

CMRS Competition Reports have evolved, becoming more rigorous and taking advantage of new data sources. For example, starting with the Twelfth Report, the Commission undertook a much more granular analysis than it has in the past and began measuring the number of different wireless operators offering mobile coverage in each of the 8 million census blocks. And in the forthcoming Fourteenth Report, the Commission intends to begin analyzing Form 477 data on the number of wireless operators offering mobile high speed Internet access, again at the census block level.[36]

C. The Commission's current analytical framework is appropriately examining competition in mobile wireless

The Commission, by following a structure-conduct-performance approach and undertaking a comprehensive competition analysis that looks at the particular economic characteristics of the wireless industry, is appropriately examining competition in the wireless industry. As a result, if the Commission continues to follow this approach and bases its analysis on the data, its findings will appropriately reflect the competitive conditions and outcomes in the wireless industry.

III. Indicia of Competition: Market Structure

In applying its structure-conduct-performance framework to the wireless industry, the Commission has consistently found that there is "effective competition." In the next four sections I follow a structure-conduct-performance paradigm to analyze current market metrics. As described more fully below, quantitative and qualitative indicia, together, suggest a market where consumers have many choices for obtaining wireless services, where providers are competing vigorously along many dimensions, and where consumers are using wireless more than ever. As such, consumers are realizing substantial benefits in terms of lower prices, improved quality, increased functionality, and new services and features.

[36] Fourteenth Report Public Notice, pp. 4-5.

In this section, I review evidence on the market structure of mobile wireless. In subsection III.A, I review the wireless network provider segment. Then, in subsections III.B and III.C, I review recent market structure evidence regarding wireless devices and applications.

Market structure evidence shows that the vast majority of wireless consumers currently have substantial choice in where and how they purchase mobile voice and data services. However, market structure indicators such as the number of competitors, market shares, or concentration ratios should only be the first step in a competition inquiry. The next step is to understand the conduct of providers and consumers in the market. The ultimate test is how well the market is serving consumers, as measured by prices, output, quality, product variety and the development of new services and devices that meet consumer needs. I cover current indicia of provider conduct, consumer conduct and market performance in sections IV, V and VI below.

A. Wireless Network Providers

1. Market Participants

There are currently four "nationwide" facilities-based carriers (AT&T, Verizon Wireless, Sprint, T-Mobile), three large regional facilities-based carriers (MetroPCS, Leap, U.S. Cellular), and many smaller regional carriers. The four nationwide carriers and the three large regional carriers all offer nationwide calling plans. Many regional carriers have also been able to offer nationwide pricing plans through roaming agreements with other carriers. Nationwide and regional carriers have built their current footprints through primary and secondary license acquisitions and build out.

Several recent acquisitions have enabled the nationwide carriers to continue to expand and fill in their footprints and increase the capacity of their existing networks.[37] These acquisitions continue a trend that began in the mid-1990s, with economic forces creating strong incentives for carriers to consolidate small and fragmented local footprints into national or large regional footprints that could better take advantage of economies of scale and more efficiently offer nationwide coverage, nationwide calling

[37] Recent acquisitions are summarized in the Thirteenth Report, ¶¶ 52-62.

plans, and advanced services. Coupled with the advantages of economies of scale, the efficiency gains of larger networks over localized markets have become apparent. Although new entrants can be viable, as evidenced by the recent success of Leap and MetroPCS, the transition from many small local providers to national carriers suggests some economic advantages to larger networks.

Expansion from regional to nationwide footprints and aggregation of spectrum have enabled providers to better achieve economies of scale and operating efficiencies that reduce costs and allow providers to compete more aggressively and expand the benefits of their services to consumers in the newly acquired areas. All these transactions were cleared by the Commission and Department of Justice, sometimes with requirements to divest overlapping licenses in specific geographic markets.

2. Consumer Options

One consequence of the build out of national and large regional footprints has been an increase in the number of mobile wireless provider choices available to most consumers. As of July 2008, the vast majority (95.5%) of Americans could choose from at least three facilities-based providers, and about 65% could choose from at least five facilities-based providers.[38] And data collected by the Commission indicates that consumer choice, as measured by the number of facilities-based provider options available to consumers, has increased since 2000, despite the transactions that occurred over this period of time. According to American Roamer data, the proportion of the U.S. population living in counties with three or more mobile providers grew from 87.8% in July 2000 to 98.0% in July 2007.[39] Starting in 2007, in response to concerns that its analysis was overstating the level of competition, the Commission began reporting mobile telephone rollouts by census block, a much smaller unit of geography than a county.[40] In July 2007, using this much more granular data, it still found that 95.5% of the U.S. population lived in census blocks with three or more mobile providers.[41] In July

[38] Based on American Roamer data at the census block level. Thirteenth Report, ¶ 41.
[39] Twelfth CMRS Competition Report, ¶¶ 42-6. ("Twelfth Report")
[40] There are approximately 8 million census blocks, 30,000 five digit zip codes and 3,200 counties in the U.S.
[41] Thirteenth Report, ¶ 41.

2008, a similar 95.5% of the U.S. population lived in census blocks with 3 or more mobile providers.

The Commission also estimated that as of May 2008, 92.5% of the population lived in census blocks with one or more provider of 3G mobile broadband and 72.5% of the population lived in census blocks with two or more providers of 3G mobile broadband.[42] In May 2007, 82.0% of the population lived in census blocks with one or more provider of 3G mobile broadband and 64.0% of the population lived in census blocks with two or more providers of 3G mobile broadband.[43] Ongoing deployment of 3G (and 4G) technology in 2008 and 2009 suggest that the percentage of consumers with two or more mobile broadband providers has increased since then.

In addition to facilities-based nationwide and regional providers, Mobile Virtual Network Operators ("MVNOs") use a reseller model in which they buy wholesale network capacity from facilities based providers, design service packages, and set their own retail prices. MVNOs purchase capacity from all the major nationwide wireless networks. MVNOs are low-price leaders and have been successful in gaining subscribers, often from offering low-priced prepaid plans.[44] Tracfone, the largest prepaid carrier in the U.S., had over 12 million subscribers as of June 2009.[45] Another leading MVNO, Virgin Mobile, claimed 5 million subscribers at the end of 2008.[46] In contrast to facilities-based providers, MVNOs can take advantage of wholesale capacity on different networks to target particular market segments.

3. Changes in Market Shares

The relative fortunes of different wireless providers have shifted over time. And in a competitive, rapidly changing market environment, there is no reason to expect market shares to stay constant. In fact, changes in share often signal vigorous competition, innovation and improved quality. For example, relatively new entrants

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[42] Based on American Roamer data at the census block level, with "mobile broadband" defined as WCDMA/HSPDA or EV-DO/EV-DO Rev. A technologies. Thirteenth Report, ¶ 146.
[43] Twelfth Report, ¶ 144.
[44] Bernstein Research, *U.S. Wireless: Pre-Paid Pricing… Fifty is the New One Hundred*, April 14, 2009; Bernstein Research, *Wireless Limbo… How Low Can You Go?*, July 2, 2009. ("Bernstein Research, *Wireless Limbo*"); Macquarie Research Equities, *Telecommunications Services*, August 4, 2009.
[45] Amèrica Mòvil, S.A.B. DE C.V., Form 6-K, filed July 21, 2009.
[46] Virgin Mobile USA, Inc., 2008 Form 10-K, filed February 28, 2009.

MetroPCS and Leap have made strong gains in subscribership in recent years. In the last few years, subscribership at these two providers have increased by about 30% per year in contrast to an overall industry annual growth rate of about 10%.[47]

Sprint, on the other hand, has experienced subscriber losses over two straight years.[48] Sprint attributes most of this loss to higher churn rates relative to competitors, already high penetration rates in most markets, and a move towards increasing the credit quality of its customers.[49] Sprint states that there may also be issues related to adverse perceptions about the quality of Sprint's services, networks, and handset offerings.[50] Sprint's subscriber losses also reflect vigorous competition by Sprint's nationwide, regional and MVNO competitors.

Some industry observers believe that Sprint's declining market position is leading it to develop new business models and compete more aggressively on price as it attempts to regain lost share and utilize its extensive investment in its network.[51] Sprint is very active in the wholesale market, and has been at the forefront of a number of new products and services. For example, the Amazon Kindle, which offers free wireless access to Kindle owners for downloading books, relies on the Sprint 3G network, [52] and Sprint was the first major wireless carrier to offer the Femtocell technology to resellers (MVNOs).[53]

These changes in market shares and firm strategies are an example of the competitive process at work. Firms are competing to offer attractive services to consumers and consumers are responding by shifting their demand to take advantage of different service offerings.

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[47] Bank of America – Merrill Lynch, *Global Wireless Matrix 2Q09 Voice and Data Divergence*, June 25, 2009, p. 187. ("Global Wireless Matrix 2Q09")
[48] Sprint Nextel, 2008 10-K, p. 30; Sprint Nextel, 2009Q1 10-Q, p. 30.
[49] Sprint Nextel, 2008 10-K, p. 34.
[50] Sprint Nextel, 2009 10-Q, p. 18.
[51] See, e.g., Rethink Wireless, *Sprint Boost Sparks Flat-Rate Price War*, January 19, 2009; Bernstein Research, *Quick Take - Wireless Pricing: In the Race to the Bottom, Sprint's in the Lead*, July 14, 2009.
[52] Bernstein Research, *U.S. Wireless: Boost-ed… Is the Pre-Paid Subscriber Boom for Real? (Hint: Maybe Not)*, May 11, 2009.
[53] "A femtocell functions like a mini cell tower. It provides improved wireless coverage up to 5,000 square feet by creating a CDMA network signal within the customer`s home or small office. The service works with any Sprint phone and requires an existing Internet broadband connection to carry the call back to the main Sprint network. When compared to unlicensed spectrum solutions (e.g., typical public WiFi network solutions), the femtocell offers more reliable performance and less interference." "Sprint is First Major U.S. Wireless Carrier to Offer Femtocell for Wholesale Partners," *Reuters*, June 10, 2009.

4. HHI Calculations

In the Thirteenth Report, the Commission calculated mobile wireless HHIs within each of the 176 Economic Areas.[54] It calculated an HHI of 2,674 as of December 2007. This compares to Commission calculations of an average HHI of 2,674 in 2006, 2,706 in 2005, 2,450 in 2004 and 2,151 in 2003.[55] In all of these years, the HHI is "Highly Concentrated" according to the Horizontal Merger Guidelines.[56]

Certain critics raised concerns about these concentration levels.[57] However, there are many well known limitations associated with drawing conclusions from simple HHI calculations. In fact, the Department of Justice ("DOJ") and Federal Trade Commission ("FTC") have been steadily deemphasizing the importance of concentration thresholds and the HHI.[58] Industrial organization economists and the antitrust agencies consistently caution against using HHIs as a shortcut for a more complete analysis of market competition.[59] The Horizontal Merger Guidelines make this logic explicit, using a framework that prescribes an economically motivated approach to defining a relevant market, and then going beyond market definition to consider competitive effects, entry, efficiency gains, and potential participant exit in the absence of the merger.[60]

HHI measures depend on defining the relevant product and geographic market, and it is well known in antitrust analysis that relevant market definition is difficult and requires a number of judgments about product substitution.[61] The approach taken in the Thirteenth Report relies on a "mechanical" approach to calculating HHIs. Economic Areas (EAs) are assumed to be the geographic unit for measuring concentration, mobile

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[54] HHIs ("Herfindhal-Hirschman Indices") are calculated by summing the squares of the individual market shares of the firms participating in a relevant market. A market with a monopoly provider has an HHI of 10,000. A market with five equally sized competitors has an HHI of 2000, calculated as 5 x (20 x 20). The Commission calculates the HHI based on the number of subscribers served by each carrier in 176 Economic Areas ("EAs"). HHIs for each EA are then weighted by the EA population to come up with a nationwide average. Thirteenth Report, ¶¶ 45-6.

[55] Ninth Report, Tenth Report, Eleventh Report and Twelfth Report.

[56] U.S. Department of Justice and the Federal Trade Commission, "Horizontal Merger Guidelines," Issued April 2, 1992 and Revised April 8, 1997. ("Horizontal Merger Guidelines")

[57] Comments of Consumer Federation of America et al., Fourteenth Report Public Notice, June 15, 2009, pp. 4-5. ("Comments of CFA, et al.")

[58] *Antitrust Modernization Commission Report and Recommendations*, April 2007, p. 52.

[59] See Kaplow and Shapiro (2007), pp. 1091-1092.

[60] Horizontal Merger Guidelines, p. 3.

[61] Jonathan Baker (2007), "Market Definition: An Analytical Overview," *Antitrust Law Journal*, Vol. 74, 2007, p. 131.

voice and data services combined are assumed to be the product market, subscribers are assumed to be the unit of measure, and facilities-based CMRS providers are assumed to be the industry participants. By assumption, MVNOs are excluded from the calculation, as are intermodal competitors such as wireline telephone and cable companies.

In addition, HHIs only measure the concentration of firms that are currently "in the market"; they provide no information as to the competitive influence of firms that are not "in the market" but nonetheless constrain the pricing power of the incumbents. A market definition that includes only a few firms would be considered very concentrated under the HHI. However, potential entry and competition from firms outside "the market" can lead to a market being effectively competitive, despite what a cursory HHI calculation would suggest.[62]

Compounding that, HHIs are static since they measure the concentration of a market at a specified point in time. The wireless industry is dynamic, with new services and technological developments leading to significant changes in the competitive landscape. For example, data services, smartphones, operating systems, and third-party applications have become an increasing part of the rivalry between providers. As call quality, data transfer rates, and network coverage have improved, consumers increasingly view wireless as an alternative to wireline voice and data service. And newer technologies, such as WiMax and VOIP are shifting the market boundaries that underlie any HHI calculation. The AMC has warned of the care necessary to assess market power in innovative markets,[63] and in a market as dynamic as wireless, HHI calculations need to be interpreted carefully.[64]

A snapshot HHI calculation also ignores churn. In the wireless industry, consumers frequently switch providers, and a number of recent market developments have made switching easier for consumers. An industry with four players where customers move (or can move) quickly and easily between the four players is very

[62] See, e.g., Kaplow and Shapiro (2007), p. 1093.
[63] AMC Report, p. 40.
[64] For complications associated with antitrust analysis in dynamic industries, see Carl Shapiro (2005), "Antitrust, Innovation, and Intellectual Property," Testimony Before the AMC," November 8, 2005.

different from an industry with four players where customers are loyal and rarely switch. However, the HHI is the same in both markets.

Finally, HHIs need to be interpreted within the cost structure and demand conditions of an industry. Because of significant economies of scale and scope in developing and deploying wireless networks, mobile wireless HHIs will inherently be greater than those in industries without significant economies of scale. However, economists recognize that HHIs in the 2500-3000 range calculated by the Commission for mobile wireless can be consistent with vigorous competition and consumer welfare benefits.

Because of these limitations in interpreting mobile wireless HHIs, the Commission is following well established regulatory and economic practice in treating HHIs as a starting point for evaluating a market, and complementing its analysis of market structure with an analysis of producer and consumer behavior and market outcomes.

5. Costs and Profits

In the Fourteenth Public Notice, the Commission proposed using accounting based profitability metrics (Lerner Index, return on equity, net profit ratio, operating profit ratio, return on assets, earnings per share, simple free cash flow margin) as a measure of market performance.[65] Certain commenters responded that the Commission has over relied on revenue and usage comparisons, and should also consider cost and profit metrics.[66]

Accounting based profitability metrics are likely to be uninformative indicators of the effectiveness of mobile wireless competition. Many of the profit ratios cited in the Fourteenth Public Notice depend on the accounting treatments of net income and net profit. As is well known, the concept of accounting profits differs significantly from an economic-based concept of profits. For example, opportunity cost is virtually ignored

[65] Fourteenth Report Public Notice, p. 12.
[66] Comments of CFA, et al., pp. 19-20.

under accounting profits, thereby neglecting the very important concept of risk and the returns to wireless providers for bearing the risk.[67]

Some of the profit metrics cited in the Fourteenth Public Notice like "return on assets" or "return on equity"[68] depend on the accounting treatment of assets, which can be quite divorced from their economic treatment especially with regards to intangible assets like goodwill, research and development, or intellectual property.[69]

Cost calculations are further complicated by economies of scope and the increasing variety of wireless services beyond voice that are provided like text messaging, Internet browsing, music downloading, etc. As the same network and investments can be used to deliver voice services along with these other services, obvious complementarities exist, and recovery of fixed costs needs to be shared across many services. In addition, use of shared network resources by one service can affect the quality and availability of network resources for other services. This makes proper estimates of marginal and average costs, and even average prices within different services complicated to estimate and interpret.[70]

These complexities make it very difficult to properly measure economic profits using accounting metrics. And any attempt to define a set of accounting rules to attempt to measure economic profits will impose considerable costs on providers and the Commission. A better approach is for the Commission to continue to rely on existing market structure metrics, supplemented by an analysis of provider conduct, consumer conduct, and market performance.

6. Rural Consumers

The availability of wireless services to rural consumers is a concern for the Commission. The Thirteenth Report looks specifically at rural markets, which it defines as a county with population density of 100 persons or fewer per square mile. Under this definition, 61 million people or about 21% of the U.S. population live in rural areas.

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[67] Kaplow and Shapiro (2007), pp. 1089-90.
[68] To the extent that equity is computed as the residual between assets minus liabilities.
[69] See, e.g., Franklin M. Fisher (1988), "Accounting Data and the Economic Performance of Firms," *Journal of Accounting and Public Policy*, Vol. 7, pp. 253-60.
[70] See Kaplow and Shapiro (2007), pp. 1087-8.

American Roamer data suggest that most rural consumers have choice among wireless providers. Using a census block designation, the Commission found that 94.2% of the population living in rural areas had two or more different providers, and 82.1% had three or more different providers.[71]

In addition, nationwide wireless providers advertise, market and price their services on a nationwide basis to take advantage of economies of scale. This creates a linkage between services and prices in different geographic areas, and suggests that consumers in rural markets realize some benefits from nationwide price competition.

Carriers have been expanding their 3G networks to include rural areas. Upgrades to Sprint's network have expanded its EV-DO footprint to cover more than 271 million people,[72] and the Verizon Wireless 3G network now covers more than 284 million people,[73] including many who live in rural areas.

However, it is impossible to ignore the economic reality that in a competitive wireless industry, less densely populated rural areas cannot support as much fixed investment as in more densely populated areas. In less densely populated geographic areas, there are simply fewer consumers over which to spread the fixed costs, and economic theory suggests that having fewer providers undertake the extensive fixed investment is actually efficient.

7. Access to Spectrum

Mobile wireless service requires access to spectrum. The U.S. has two categories of spectrum – licensed and unlicensed. Because it is shared, low-powered and unprotected from interference, unlicensed spectrum has been useful for short-distance, portable use such as WiFi, but not for mobile use. Mobile wireless service providers use licensed spectrum obtained at auction or in the secondary markets. The Commission recently auctioned additional spectrum through its Advanced Wireless Services (AWS)

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[71] Thirteenth Report, ¶¶ 102-104.

[72] "HTC Touch Pro2 from Sprint Pairs a Dynamic Must-Have Business Device with the Best Value in Wireless," *Sprint Press Release*, August 31, 2009. This figure is inclusive of data roaming.

[73] "Verizon Reports Revenue Growth and Continued Improvement in Cash Flow in 2Q," *Verizon Wireless Press Release*, July 27, 2009; Verizon Wireless website (http://aboutus.vzw.com/bestnetwork/network_facts.html).

auction (Auction 66 – increasing the spectrum available for next generation wireless services by 90 MHz and the 700 MHz auction (Auction 73 – increasing the amount of available spectrum available for next generation services by another 62 MHz.

In those auctions, established providers Verizon Wireless, AT&T and T-Mobile and smaller regional providers such as Leap and MetroPCS, as well as cable provider Cox Communications acquired spectrum. Leap and MetroPCS's spectrum acquisitions effectively allow them to expand their coverage areas to the entire country. Cox Communications also acquired spectrum, which it intends to use for mobile wireless service.[74] And technological developments have enabled wireless providers to utilize available spectrum more efficiently.

In addition, Clearwire is using its significant, licensed, 2500-2690 MHz ("BRS/EBS band") spectrum holdings, acquired primarily on the secondary market, to deploy a 4G WiMax network that offers mobile wireless broadband service comparable to the speed of WiFi but with a longer range.[75] Clearwire has significant spectrum resources in most major markets,[76] and by September 2009 had launched CLEAR 4G WiMax mobile broadband service in 14 markets with 10 million people.[77] In addition to its retail service, Clearwire intends to provide wholesale services to other retail providers of mobile broadband. As it expands its network, Clearwire could become a fifth nationwide mobile broadband provider and has the potential to compete with wireline broadband providers.

Other recent purchases of spectrum by non-traditional wireless providers may impact the competitive landscape and lead to new services for consumers. There is speculation that Dish Network's spectrum purchase may be in preparation for mobile

[74] "Cox Plans to Launch a Cellular Network," *Wall Street Journal*, April 8, 2009.
[75] Sprint Nextel has a majority stake in Clearwire. Other investors in Clearwire include Intel, Google, Comcast, Time Warner Cable, and Bright House Networks.
[76] "Clearwire's Wolff Embraces 4G as a Whole but Touts Spectrum Position," *Telephony Online*, April 2, 2009.
[77] "Clearwire Introduces Clear™ 4G WiMAX Internet Service in 10 New Markets," *Clearwire Press Release*, September 1, 2009.

television.[78] Qualcomm has already announced a nationwide expansion of FLO TV, its mobile TV network.[79]

The Commission has also allocated spectrum for mobile satellite services ("MSS"), and a number of systems are currently operating or under development in these bands.[80] The Commission has also granted Ancillary Terrestrial Component (ATC) authority to several MSS operators, allowing them to combine satellite and terrestrial services using MSS spectrum. Current MSS offerings are primarily targeted at commercial, government, and maritime customers, but some providers also offer voice and data services for retail consumers. As MSS technology, including Ancillary Terrestrial Component (ATC) systems, continues to advance, it may begin to compete with terrestrial CMRS providers for certain customers.[81]

In addition, the Commission has taken actions to improve the efficiency of the secondary market for licensed spectrum.[82] Other Commission actions, such as making white spaces spectrum available for unlicensed use may lead to additional new entry and additional competitive pressures on wireless providers utilizing licensed spectrum.[83]

In principle, government control of spectrum allocation and assignment can create regulatory barriers to entry. In practice, as noted by the Commission, the "cumulative effect of these flexible, market-oriented spectrum policies has been to help reduce any entry barriers that may arise from government regulation of spectrum."[84]

8. Intermodal Competition

The capabilities of mobile wireless voice service make it a rival to voice services provided by traditional telephone carriers and by cable companies that provide voice telephony over their cable Internet lines. As technology deployment has improved the

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[78] "DISH May Plan Mobile TV with New Airwaves: Analysts," *Reuters*, March 20, 2008.
[79] "FLO TV Goes National – Expands Live Mobile TV Service as DTV Transition Frees Broadband Spectrum", *Qualcomm Press Release*, June 10, 2009.
[80] Comments of the MSS/ATC Coalition, Fourteenth Report Public Notice, June 15, 2009. ("MSS/ATC Comments")
[81] MSS/ATC Comments.
[82] John Mayo and Scott Wallsten, "Enabling Efficient Wireless Communications: The Role of Secondary Markets," *Georgetown Center for Business and Public Policy Working Paper*, June 2009.
[83] Second Report and Order and Memorandum Opinion and Order in the Matter of Unlicensed Operation in the TV Broadcast Bands, November 14, 2008.
[84] Thirteenth Report, ¶ 67.

coverage and call quality of mobile voice service, more consumers have dropped their traditional wireline service in favor of wireless.[85] In early 2005, approximately 7% of households were wireless only. Recent estimates of "wireless substitution" suggest that more than 20% of households are wireless only, eliminating the expense of wireline telephone service.[86] Other estimates of wireless substitution are of similar magnitude.[87] And analysts expect the wireless substitution trend to continue.[88]

The Nielsen Mobile study reports that the main reason that households "cut the cord" is to take advantage of better prices. For example, both Leap and MetroPCS offer local calling plans for about $30/month that are at a similar price point to calling plans offered by wireline telephone companies.[89] And, T-Mobile has developed a home phone service that allows consumers to keep their existing home phone, connect it to an in-home WiFi network, and use VOIP over the consumer's existing Internet service to make unlimited nationwide calls.[90] In addition to consumers "cutting the cord" and switching completely to wireless service, consumers also have the option of shifting minutes from wireline service to wireless service. For example, consumers can shift minutes to take advantage of mobile plans with unlimited minutes, free night and weekend minutes, or free minutes for calls to certain numbers.

Recent investments by wireless providers in upgrading to 3G and 4G technologies have greatly enhanced the mobile data capabilities of wireless networks. Consumers increasingly use mobile wireless devices for access to email, the Internet and other content previously available primarily from wireline providers. Wireless providers also offer mobile broadband, where subscribers use an aircard modem or netbook to connect to a wireless provider network. In addition, wireless providers have been augmenting

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[85] "Cutting the Cord," *The Economist*, August 13, 2009.
[86] Stephen J. Blumberg and Julian V. Luke (2009), "Wireless Substitution: Early Release of Estimates from the National Health Interview Survey," National Center for Health Statistics, May 2009.
[87] For example, estimates derived from the Commission's Trends in Telephone Report show that approximately 18% of households were wireless only (Thirteenth Report, ¶ 230), and a September 2008 study Nielsen Mobile found that approximately 17% of households were wireless only. See Nielsen Mobile, "Call My Cell: Wireless Substitution in the United States," September 2008.
[87] http://www.mycricket.com/cricketplans/details/30plan, accessed September 22, 2009.
[88] "Cutting the Cord," *The Economist*, August 13, 2009.
[89] http://www.mycricket.com/cricketplans/details/30plan, accessed September 22, 2009. http://www.metropcs.com/plans/default.aspx, accessed September 22, 2009.
[90] "T-Mobile to Launch $10 Home Phone Service," *T-Mobile Press Release*, June 25, 2008.

their data capabilities by offering Wi-Fi service. For example, AT&T maintains hotspot locations in many businesses like Starbucks where customers can access the Internet through AT&T's WiFi network. And, carriers now offer dual-mode handsets that operate on Wi-Fi as well as cellular networks.

Current consumers of wireline voice and data services represent a large potential market for wireless providers. The potential to attract additional wireline voice and data consumers serves as an important incentive for wireless providers to deploy next-generation technologies and to offer low prices, high quality, and innovative services.

9. Joint Analysis of Mobile Voice and Broadband

The Commission currently measures market concentration using a product market definition that includes mobile voice and data services. CFA argues that a better market definition would separate mobile voice from mobile broadband.[91] Given the economics of the wireless industry, such a proposal would be largely artificial and inappropriate. Mobile voice and mobile data are often received on the same consumer device, transmitted through the same wireless networks, and rely on much of the same infrastructure. Because of economies of scope, efficient provision of voice and data services relies on common network resources. On the demand side, consumers often choose to purchase bundles of mobile voice and data services. On the supply side, providers can respond to changes in consumer demand or take advantage of competitive opportunities by shifting network resources from voice to data, or vice versa. This is an example of what economists call supply substitution.[92]

In addition, new devices and applications are arising which blur the line between voice and data services. For example, the development of Google Voice, which organizes phone calls, text messages, and even provides transcripts of voice messages suggests that providers, handset manufacturers, and software developers are working towards a future of more voice and data integration. Similarly, mobile VOIP applications enable consumers to make voice calls using their wireless data plan.

[91] Comments of CFA, et al., pp. 5-7.
[92] See, e.g., Baker (2007), pp. 133-138.

Analyzing mobile voice and mobile data separately is inappropriate as a matter of economics, because it fails to account for consumer demand for bundled services, shared network resources that are used to provide both voice and data services, and innovation that is blurring the line between voice and data.

B. Wireless Devices

In the Mobile Wireless Competition NOI, the Commission expands the scope of its review to include the "entire mobile 'value chain', from upstream markets for key inputs to downstream markets that depend on mobile wireless services."[93] In this section, I review the structure of the market for wireless devices.

U.S. wireless providers do not manufacture their own wireless devices; nor do they own equity in any major equipment manufacturers. Instead, the handsets and other wireless devices used by consumers are sold by large electronics firms that are not affiliated with wireless providers. For example, none of the top selling brands (Motorola, Samsung, LG, Nokia, and BlackBerry) in a 2008 NPD study are affiliated with wireless providers.[94] Moreover, these top selling manufacturers provide handsets for all of the major U.S. wireless providers,[95] and most of the major regional providers and MVNOs are supplied by two or more of these major handset brands.[96] Many other manufacturers sell wireless devices in the U.S. including Alcatel, Apple, ASUS, Axxesstel, Bandrich, BenQ, Cal-Comp, Casio, Firefly, HP, HTC, Huawei, Jitterbug, Kyocera, Novatel, Option, Palm, Pantech & Curitel, Sanyo, Sharp, Siemens, Sierra Wireless, Sony Ericsson, Uniden, Waxess USA, and ZTE.[97]

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[93] Mobile Wireless Competition NOI, ¶ 9.

[94] Based on U.S. market shares in the first quarter of 2008. "The NPD Group: U.S. Consumer Mobile Phone Unit-Sales Declined 13 Percent Year-over-Year in Q2 2008," *NPD Group Press Release*, August 19, 2008.

[95] Verified by information contained in manufacturer websites (LG, Motorola, Nokia, Research in Motion's BlackBerry, and Samsung), as well as carrier websites. All manufacturers listed except for LG and Nokia listed phones for all of the 4 major carriers. LG did not list a phone for T-Mobile, whereas Sprint no longer carries Nokia phones.

[96] Verified by information contained in provider websites (AT&T, Sprint, T-Mobile, Verizon Wireless, Leap, Metro PCS, Net 10, Page Plus, Tracfone, Boost, and Virgin Mobile). Boost Mobile only carries Motorola, whereas the other regional and MVNO brands sell two or more of the major phone brands.

[97] Comments of CTIA, Fourteenth Report Public Notice, pp. 31-2. ("CTIA Comments")

Handset manufacturers sell in a global market and compete aggressively with each other for market share. Although the nationwide U.S. wireless providers are important handset customers, manufacturers also sell handsets to many other wireless providers around the world. There has been considerable entry into the device marketplace by new manufacturers, including the notable recent example of Apple, and manufacturer market shares have changed considerably over time.[98]

Consumers have considerable choice regarding handsets. According to recent CTIA analysis consumers in the U.S. have a choice of 630 unique wireless devices with a wide range of features.[99] And there has been a proliferation of new smartphones with added functionality. In Spring 2007, the Apple iPhone was launched on the AT&T network, followed by the launch of the 3G iPhone in July 2008 and the 3Gs iPhone in June 2009.[100] In Fall 2008, the BlackBerry Storm was introduced on the Verizon Wireless network.[101] In June 2009, the Palm Pre was launched on Sprint's network.[102] And other smartphones by manufacturers such as BlackBerry, Pantech, Nokia, and LG are available from many wireless providers. Based on recent visits to carrier websites, Verizon Wireless offered 14 different smartphones, AT&T offered 17, Sprint offered 16, and T-Mobile offered 15. See Table 1. According to CTIA, regional providers offered anywhere from 4 to 9 different smartphones as of May 2009.[103]

Handsets vary from basic phones providing voice calling capability to smartphones providing voice, data, and customized access to a variety of other features. Smartphones rely on a new generation of mobile operating systems that serve as a platform for third-party and proprietary software applications, and the functionality of these operating systems is an important dimension of competition.[104]

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[98] For an analysis of the change in manufacturer shares over time, see Robert Hahn and Hal Singer (2009), "Why the iPhone Won't Last Forever and What the Government Should Do to Promote its Successor," *Georgetown Center for Business and Public Policy Working Paper*, pp. 12-17.
[99] CTIA Comments, pp. 31-2.
[100] "Apple Introduces the New iPhone 3G," *Apple Press Release*, June 9, 2008; "Apple Announces the New iPhone 3GS - The Fastest, Most Powerful iPhone Yet," *Apple Press Release*, June 8, 2009.
[101] "BlackBerry Takes the World by Storm with Verizon Wireless and Vodafone," *BlackBerry Press Release*, October 8, 2008.
[102] "Sprint to Offer Palm Pre Nationwide on June 6," *Sprint Nextel Press Release*, May 19, 2009.
[103] CTIA Comments, p. 33.
[104] "The Battle for the Smart-phones Soul," *The Economist*, November 20, 2008.

Major operating systems include RIM (BlackBerry), Symbian, Windows Mobile, Apple, Android, and Palm.[105] In the past, most mobile operating systems were proprietary systems developed by manufacturers to run on their own phones, such as the BlackBerry OS for BlackBerrys and the Symbian OS for Nokia phones. Today, Microsoft's proprietary Windows Mobile is available for many phones. A recent news story about Microsoft indicates that "[m]ore than 30 smartphones running on Mobile Windows 6.5 from a total of over 15 handset vendors are to be launched [worldwide] before the end of 2009,"[106] including from all four nationwide providers AT&T, Verizon Wireless, Sprint Nextel, and T-Mobile. Another new development is the use of open source operating system software. Phones running Google's Android open source operating system have been introduced from HTC, Samsung, and Motorola. According to a May 2009 Google press release, there will be a total of 18 smartphones running on the Google Android platform by the end of 2009.[107]

The nationwide wireless providers and many regional providers also offer mobile broadband access to their networks using other wireless devices. Aircard devices can be inserted into a consumer's laptop or notebook computer to provide mobile broadband access. Providers also offer specialized "netbook" devices for mobile broadband access. Both aircards and netbooks are provided by third-party manufacturers. And, in a new wireless application, the Amazon Kindle utilizes Sprint's network to download books, newspapers and other media.

Coupled with increased openness of provider networks, such as Verizon Wireless's "Open Development Initiative" which opens its network to any manufacturer wishing to produce a compatible device,[108] the wireless device market is likely to expand. Moreover, there is no bright line between different wireless devices. The capabilities of devices are developing rapidly, and wireless devices are constantly incorporating new functionalities. I discuss the competitive dynamics of the wireless device segment in more detail below.

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[105] "The Battle for the Smart-phones Soul," *The Economist*, November 20, 2008.
[106] "Over 30 Windows Mobile 6.5 Smartphones to be Launched Before Year-End, Says Microsoft Executive," *Digitimes*, September 23, 2009.
[107] "Google: Expect 18 Android Phones by Year's End," *New York Times*, May 27, 2009.
[108] "Verizon Opens Network, Gets First Unsexy Device," *Verizon Wireless Press Release*, July 16, 2008.

C. Applications and Content

Improvements in mobile operating systems have facilitated another significant development in the mobile wireless value chain, the growing use of third-party applications from wireless provider, device manufacturer, and operating system associated stores. Just two years ago there were no application stores and users could not easily customize their phones. Wireless providers typically controlled which applications were available and offered content through service provider branded and controlled portals.

Today, smartphones can be customized using applications that combine input data from a GPS, compass, gyroscope, microphone, and the Internet. Thousands of third-party software developers have responded with a wide range of new services and features. These applications expand functionality and also allow users to customize their devices and service. Some applications are free to users while others require a fee. Applications include games, music-related programs, navigational aids, references sources, and news related resources. Smartphones can also access a wide range of content from the Internet, and many Internet sites have customized their content for mobile viewing. In addition, smartphones can be used to access music and video content. I discuss the competitive dynamics of the applications segment in more detail below.

D. Summary of Market Structure Evidence

Although the wireless market is not perfectly competitive according to the textbook model, there are many signs of effective competition at work. Most significantly, the vast majority of Americans have multiple choices where to purchase wireless services. Four nationwide facilities-based wireless providers, several significant regional facilities-based wireless providers, smaller local facilities-based providers, and MVNOs compete to provide wireless services. Consumers continue to substitute from wireline to wireless voice and data services. Commission actions have made more spectrum available to incumbents and new entrants such as Clearwire. New services are being developed as providers deploy next-generation networks. The wireless device and applications segments are vigorously competitive with many manufacturers, operating systems, and applications developers competing for consumers and expanding the

wireless experience. Thus, the market structure evidence suggests few competitive problems in the mobile wireless industry.

IV. Indicia of Competition: Provider Conduct

Although market structure evidence is useful, market structures by themselves do not dictate how providers will act. Economists generally consider two basic theories of potential anticompetitive behavior arising after a change in market structure due to a merger – "coordinated effects" and "unilateral effects."[109] Market shares or other measures of market structure do not dictate actual provider conduct in either theory. The Commission reflects current economic thinking when it states "neither coordinated interaction nor unilateral action to lessen competition is a necessary consequence of market concentration and entry barriers."[110]

Instead, a detailed, fact-driven inquiry of the market setting is required. In particular, mobile wireless is undergoing dramatic change as carriers, device manufacturers, and operating systems and applications developers deploy new technologies that improve existing services and enable new services and features. An understanding of these provider practices is critical for assessing the effectiveness of wireless competition. In this section, I review several important dimensions of competition between providers, including those related to technology deployment and improvements to network quality. I discuss other important dimensions of competition from the perspective of consumer behavior and market performance in Section V and Section VI.

A. Technology Deployment

Deployment of next-generation technologies is an important dimension of mobile wireless competition. Next-generation network upgrades have allowed carriers to improve the coverage, capacity, and capabilities of their networks, leading to improvements in service quality improvements for voice calls,[111] and the development of

[109] Horizontal Merger Guidelines, Sections 2.1-2.2.
[110] Thirteenth Report, ¶ 110.
[111] "J.D. Power and Associates Reports: The Gap in Call Quality Performance among Carriers Narrows as Competition Intensifies across the Wireless Service Industry," *J.D. Power and Associates Press Release*, August 27, 2009.

new and much improved mobile data services. These improvements give carriers new opportunities to differentiate themselves from their competitors and compete for wireless customers.

3G technologies for GSM include EDGE, WCDMA, and WCDMA with HSDPA.[112] 3G technologies for CDMA include EV-DO, EV-DO Revision 0 and EV-DO Rev. A.[113] 4G technologies include LTE and WiMAX.[114] Each of these generational advances increase data transfer speeds and in some cases voice capacity and spectrum efficiency.[115] The four nationwide wireless providers and the significant regional providers have been deploying these next generation technologies, leading to much greater availability of mobile broadband, which is now generally available to most consumers.

CTIA estimates that prior to the economic downturn the wireless industry made capital expenditures of more than $24 billion in 2006 and $25 billion in 2005.[116] During the 2005-2006 time period, CDMA providers were in the process of making significant investment to upgrade networks to EV-DO technology, and some of the GSM providers were upgrading to WCDMA with HSDPA technology.[117]

CTIA estimates that even during the current economic downturn wireless carriers spent more than $20 billion in capital expenditures in 2008 and about $21 billion in 2007.[118] In the first quarter of 2009, despite the economic downturn, one analyst estimated that spending continued with $4.7 billion in additional capital expenditures by the four major carriers as they continue to deploy advanced technologies.[119]

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[112] EDGE: Enhanced Data Rates for GSM Evolution; WCDMA: Wideband CDMA; HSDPA: High Speed Data Packet Access.
[113] EV-DO: Evolution-data optimized. Subsequent revisions are upgrades.
[114] LTE: Long Term Evolution; WIMAX: Worldwide Operability for Microwave Access.
[115] Thirteenth report ¶¶ 131-133.
[116] *CTIA's Wireless Industry Indices: Year-End 2008 Results*, May 2009, Table 50. ("CTIA Year End 2008 Wireless Indices") CTIA's semi-annual surveys are voluntary, meaning the companies that respond to particular questions may differ from year to year and not all companies respond to every question each year. CTIA reports the raw results from the survey and does not attempt to adjust the figures for the non-respondents or to make the results exactly comparable year-to-year. Thus, the figures from the CTIA surveys indicate trends, but cannot be presumed to show the precise level of changes.
[117] Eleventh Report, ¶¶ 110-114 and Tenth Report, ¶¶ 113-116.
[118] *CTIA's Wireless Industry Indices: Year-End 2008 Results*, May 2009, Table 50.
[119] Global Wireless Matrix 2Q09, p. 187.

During 2008, Verizon Wireless upgraded and expanded its EV-DO Rev. A network footprint, at that point covering more than 240 million people. In 2009, as a result of investments made after the Alltel merger, its 3G network footprint now covers 281 million people.[120] In addition, Verizon Wireless has plans to develop a 4G LTE network by 2010 and is currently testing LTE technology in select cities.[121]

Sprint has also expanded its 3G network to cover more than 271 million people.[122] Through Clearwire, Sprint offers the first 4G data services in select US cities and is planning on expanding to 80 markets by 2010.[123] AT&T has continues to expand and upgrade its 3G WCDMA network,[124] and now provides coverage in about 350 metropolitan areas.[125] AT&T also has plans to develop a 4G network by 2012.[126] T-Mobile's 3G network will cover approximately 200 million people by the end of the year.[127] Regional providers have also been upgrading to 3G and plan upgrades to 4G.[128]

It is instructive to compare the situation today to a decade ago, when much of the cellular infrastructure was still analog. Transmitting data over cellular networks was slow and limited to select devices. Paging devices were still popular and SMS services were still in their infancy. Full Internet access was not available over cellular networks without a computer and specialized equipment.

New technology has dramatically improved voice capacity and data transfer speeds, and allowed mobile access to a range of multimedia content and applications not available a decade ago. Current 3G networks are capable of much increased voice capacity and data transfer. For example, in the evolution from 2G to 3G GSM

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[120] "Verizon Reports Revenue Growth and Continued Improvement in Cash Flow in 2Q," *Verizon Wireless Press Release*, July 27, 2009; Verizon Wireless website (http://aboutus.vzw.com/bestnetwork/network_facts.html).
[121] "Verizon Tests LTE Network in Boston & Seattle," *Gigaom*, August 14, 2009.
[122] "HTC Touch Pro2 from Sprint Pairs a Dynamic Must-Have Business Device with the Best Value in Wireless," *Sprint Press Release*, August 31, 2009. This figure is inclusive of data roaming.
[123] "Clearwire and Cisco Form Alliance to Deliver 4G Mobile Internet Services for Consumers and Businesses," *Clearwire Press Release*, May 13, 2009.
[124] For instance, see "AT&T Boosts 3G Network in D.C. Area," *Washington Business Journal*, September 10, 2009, "AT&T Improves 3G Mobile Broadband Coverage in New York & New Jersey," *AT&T Press Release*, September 1, 2009.
[125] AT&T Comments, Fourteenth Report Public Notice, p. 25.
[126] "AT&T's 700 MHz Strategy: LTE," *Gigaom*, April 3, 2008.
[127] "T-Mobile USA to Offer New 3G-Enabled Phone," *T-Mobile Press Release*, June 17, 2009.
[128] See, e.g., "Unlimited Wireless Carrier MetroPCS Announces Vendors for 2010 4G LTE Launch," *MetroPCS Press Release*, September 15, 2009.

technology, average data speeds have increased from below 100-130 kbps to 400-700 kbps.[129] CDMA providers using EV-DO Rev. A can achieve maximum data throughput speeds of 3 Mbps, and GSM providers using WCDMA/HSDPA can achieve burst rates up to several Mbps.[130] The deployment of 4G networks will mean data downloads that are even faster, peaking at 63 Mbps.[131]

Wireless coverage has also improved substantially in the last decade. Ten years ago there were 81,698 cell sites and five years ago there were 175,725 cell sites. By the end of 2008 there were 242,130 cell sites.[132]

B. Network Quality

Technology deployment has allowed carriers to improve the quality of voice and data services, and this is an important dimension of competitive rivalry between providers. As wireless networks have moved from 2G to 3G and, now, 4G technology, the speed and quality of service has improved. In addition, the number of cell sites per subscriber, one proxy for service quality, has grown 9.0% in 2007 and 13.5% in 2008.[133]

Third-party studies indicate that the quality of mobile wireless service is improving. In January 2009 Consumer Reports concluded that "cell-phone service has become significantly better" as providers have reduced connectivity problems, static and dropped calls.[134] A study conducted by J.D. Power and Associates in the first six months of 2009 found that wireless carriers improved quality by reducing dropped calls and static.[135] And the American Consumer Satisfaction Index found a continuing three year trend of improving satisfaction rates for wireless users in 2009.[136]

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[129] Twelfth Report, ¶ 130.
[130] Thirteenth Report, ¶¶ 131-132.
[131] Thirteenth Report, ¶ 133.
[132] *CTIA's Wireless Industry Indices: Year-End 2008 Results*, May 2009, Table 2.
[133] Goldman Sachs (2009), *U.S. Wireless Industry Model*, May 20, 2009.
[134] "Best Cell-Phone Service", *Consumer Reports*, January 2009.
[135] J.D. Power and Associates (2009), *2009 Wireless Call Quality Performance Study*, Vol. 2, referenced at http://www.jdpower.com/telecom/articles/2009-Wireless-Call-Quality-Volume-2. See also "J.D. Power and Associates Reports: Overall Wireless Carriers Reduce Dropped Calls, Failed Connections and Static, Driving an Improvement in Call Quality Performance," *J.D. Power and Associates Press Release*, August 27, 2009. ("J.D. Power Press Release")
[136] "Customer Satisfaction Rises Again, Now Joined by Other Economic Indicators," *ACSI Press Release*, May 19, 2009, available at http://www.theacsi.org/images/stories/images/ news/0901q_Press_Release.pdf.

C. Wireless Devices

Improvements in wireless network technology have spawned considerable innovation in wireless devices and mobile operating systems. For example, the functionality in the current generation of handsets greatly exceeds that of just a few years ago. Five years ago smartphones were relatively large devices with small, generally monochromatic screens. Battery life was shorter, and many common features of today's smartphones, such as the ability to take photos, were much less well developed. Today, smartphones have sophisticated operating systems and many more features. Smartphones show vivid colors and can come with touchscreens like on the Apple iPhone, the BlackBerry Storm, and the Palm Pre. The first BlackBerrys were made for email and could not make calls. Now, smartphones can make voice calls, access the Internet, play music and video, be used for games, be converted into GPS devices, and be customized with an increasing variety of applications.

Some handset manufacturers have entered into time-limited exclusive distribution arrangements with a wireless network provider for specific smartphones. For example, the iPhone is currently available exclusively on the AT&T network,[137] the Palm Pre on the Sprint Network,[138] and the BlackBerry Storm on the Verizon Wireless network.[139]

There are several procompetitive economic motivations for handset manufacturers and wireless providers to use these exclusivity arrangements.[140] Designing and launching a new handset involves considerable risk and expense, and an exclusive contract is a mechanism for a wireless provider and handset manufacturer to share that risk. Launching an innovative new handset like the iPhone required significant investment both by Apple and by AT&T. For example, the substantial network investment that AT&T made to accommodate the iPhone and its added traffic burden were important to

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[137] "AT&T Chief Presses to Keep iPhone, Deepen Wireless Push," *The Wall Street Journal*, April 15, 2009.
[138] "Verizon to Offer Palm Pre in Early 2010", *Wireless – CNET News*, July 27, 2009; "Web-Centric Platform and New Palm Pre Phone to Debut Exclusively on Sprint's Mobile Broadband Network in First Half of 2009," *Palm Press Release*, January 8, 2009.
[139] "BlackBerry Takes the World by Storm with Verizon Wireless and Vodafone," *BlackBerry Press Release*, October 8, 2008.
[140] For further discussion, see Michael Katz (2009), "An Economic Analysis of The Rural Cellular Association's Petition for Rulemaking Regarding Exclusivity Arrangements Between Commercial Wireless Carriers and Handset Manufacturers," exhibit to Comments of AT&T, In the Matter of Petition for Rulemaking Regarding Exclusivity Arrangements Between Commercial Wireless Carriers and Handset Manufacturers, RM-11497, February 2, 2009; Hahn and Singer (2009).

the success of the service. And while in hindsight the iPhone has been very successful, it represented a risky investment by AT&T and Apple. Without such an agreement, AT&T may not have been willing to make such a significant commitment upfront. Exclusivity can also help to assure product quality. For example, the quality of an iPhone user's experience depends not just on the iPhone device, but also on the quality of the underlying wireless network. By aligning the incentives of Apple and AT&T, an exclusive distribution arrangement helped to bring a high quality product to market. Similarly, launching a new handset requires an extensive marketing effort. In the case of the iPhone, AT&T could invest in marketing activities to promote the iPhone without concern about free riding by other carriers. In the absence of an exclusive contract, there would have been less incentive for AT&T to undertake marketing expenditures because rival carriers could free ride off of those efforts.

By promoting innovation, exclusive distribution arrangements for certain handsets have benefitted consumers. The success of the iPhone has spawned competition from other manufacturer-wireless provider pairs, and new smartphones have become an important dimension of competition in the wireless industry. For example, Verizon Wireless has competed vigorously with the AT&T/Apple combination through providing BlackBerry and other smartphone devices. As shown above, smartphones, some offered under exclusive arrangements and some offered without exclusivity, are increasingly available from national and regional wireless providers.

There have been concerns expressed by certain parties that exclusive distribution arrangements for smartphones are harming the competitive process and consumers. For example, CFA argues that exclusive distribution arrangements limit consumer choice, restrict innovation, and lead to higher prices.[141] While it is possible in certain circumstances for vertical restraints, such as exclusive distribution arrangements, to harm consumers, those circumstances do not hold in today's wireless industry.

Economists recognize that in certain scenarios, firms with market power at one level in a vertically related chain necessary to produce a service to consumers can exploit that market power and influence competition in related segments to the detriment of

[141] Comments of CFA, et al., pp. 15-18.

consumers.[142] The typical situation leading to consumer harm is when a firm can foreclose rivals from a key input and prevent them from serving customers. It is important to note that virtually all of the scenarios where vertical restrictions harm consumers arise when there is significant market power at one level. Even then, a large economics literature details efficiency rationales for vertical restrictions on suppliers or distributors, which usually involve an attempt to align incentives of upstream and downstream firms. For example, firms may want to ensure that downstream distributors do not exercise market power and mark up prices too much (avoiding double marginalization), provide sufficient customer support and product promotion (solving free rider problems), and maintain quality (avoiding misplaced blame for product problems).[143] Similarly, firms may want to ensure that upstream suppliers conduct the optimal amount of investment (avoid the hold-up problem), produce compatible, complementary products, and maintain quality (avoiding misplaced blame for product problems). In these cases, vertical restrictions can align the incentives of the upstream and downstream player in a way that can increase economic efficiency and lead to the development of new and/or improved products and services.

In the wireless industry, there is vigorous competition between wireless operators. In such a situation, there is little competitive concern about exclusive handset distribution arrangements. Competing providers have a strong incentive to provide the most attractive service offerings to consumers, and will enter into agreements with device manufacturers for obtaining the handsets that enable them to better compete for consumers. In addition, handsets are available from many manufacturers, and neither Apple nor any other manufacturer dominates the handset industry. Although the Apple iPhone is currently popular, there are competing smartphones that share many of the features of the iPhone, and providers can compete with AT&T without having access to the iPhone. Thus, the economics of the wireless industry are not consistent with

[142] Joseph Farrell and Philip Weiser (2003), "Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age," *Harvard Journal of Law & Technology*, Vol. 17, No. 1.
[143] For a summary, see Patrick Rey and Jean Tirole (2007), "A Primer on Foreclosure," *Handbook of International Organization*, Vol. III.

economic theories of anticompetitive foreclosure.[144] Indeed, handsets are an important part of competitive rivalry between carriers that is leading to substantial benefits for consumers.

D. Applications and Content

Improvements in mobile operating systems and handset technology have led to the recent rapid development of applications and content. Applications developers can now write software for a variety of operating systems, including BlackBerry, Symbian, Windows Mobile, Apple, Android, and Palm. The downloading of applications exploded with the opening of the Apple App Store in Summer 2008. Total downloads from Apple's App Store reached 1.5 billion in July 2009 and the store currently has a selection of 65,000 applications.[145] The popularity of applications has expanded to other smartphones. The end of 2008 and beginning of 2009 saw the rollout of application stores for other handsets, including the Android App Market with 10,200 applications,[146] BlackBerry App World with 2,000 applications,[147] Nokia Ovi Store with 1550 applications,[148] and Palm App Catalog with 41 applications.[149] Increasingly, providers and manufacturers see software as a big differentiating factor among cell phones, and some industry analysts believe that applications could become a determining factor in what devices and operating systems consumers and providers choose.[150]

CFA argues that limitation of certain services and applications on handsets and wireless networks reflect insufficient competition.[151] CFA specifically discusses restrictions on the use of the Skype VOIP application on the Apple iPhone on AT&T's 3G network. CFA also mentions restrictions on Sling Media's SlingPlayer Mobile application on AT&T's 3G network, and the lack of certain features on the Apple iPhone

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[144] For further discussion, see Gregory Rosston and Michael Topper (2009), "An Antitrust Analysis of the Case for Wireless Network Neutrality," *Stanford Institute for Economic Policy Research Discussion Paper*, 08-040, July 2009.
[145] "Apple's App Store Downloads Top 1.5 Billion in First Year," *Apple Press Release*, July 14, 2009.
[146] "Android Market Statistics," Androlib.com, September 9, 2009.
[147] "BlackBerry App World Now Home to 2,000 Applications, RIM Pretty Stoked," *Engadget*, July 8, 2009.
[148] Ovi Online Store, accessed September 14, 2009.
[149] "Official Palm Pre App List Growing — Word Ace Rocks!" *jkOnTheRun*, August 24, 2009.
[150] Yankee Group, "*An Operating System's Ecosystem and Profitability Determine Its Success*," July 2009.
[151] Comments of CFA, et al., pp. 12-13.

3G-S. Recently, there has also been some controversy and a Commission inquiry about the blockage of the Google Voice application for the iPhone.[152] Google Voice is a voice and data messaging application that can link all of a user's phone numbers to one number. In addition it can improve and simplify voicemail access.[153]

The Google Voice issue is related to the decision by Apple, the handset provider, as opposed to AT&T, the wireless provider. Apple, as the designer of the iPhone and its underlying operating system, needs to manage the user interface that consumers experience. In the case of Google Voice, it appears that Apple is potentially concerned with quality and compatibility, as the application replaces Apple's core user interface, and the security of its users' information.[154]

As a matter of economics, wireless providers also have to manage their networks to serve a large number of heterogeneous customers, which can mean denying some groups certain features and rights to increase the experience for other groups. These restrictions may also be temporary as the provider spends time assessing the impact of the features on its own network and the experience of all users. If specific applications compromise security, reliability or performance and individual customers do not have the requisite knowledge or skill to reject such applications on their own, or if their use would benefit individual users, but cause substantial negative externalities such as excessive use of network resources, then network operators benefit consumers by rejecting such applications.[155]

Notably, Google Voice is currently available on Android and BlackBerry phones, which can be used on AT&T and other networks.[156] Thus, for AT&T service, consumers are able to choose between an iPhone without Google Voice and smartphones like the BlackBerry with Google Voice. This is an example where handsets and services are differentiated by the applications available, and in direct contrast to CFA's claims of

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[152] Commission's Letter to AT&T and Google, "Apple's Rejection of the Google Voice for iPhone Application," July 31, 2009.
[153] http://www.google.com/mobile/products/voice.html#p=default, accessed September 15, 2009.
[154] Apple's Response to the Wireless Telecommunications Bureau's Questions of July 31, 2009, August 21, 2009.
[155] For further discussion, see Rosston and Topper (2009).
[156] http://www.google.com/mobile/products/voice.html#p=default, accessed September 15, 2009. See also "The Best Phones for Google Voice," *PCMag.com*, August 4, 2009. http://www.pcmag.com/article2/0,1895,2351127,00.asp, accessed September 22, 2009.

"clone competition."[157] Similarly, the Skype application, while not available on the Apple iPhone, is available on Windows mobile handsets that run on AT&T's 3G network and the networks of other carriers.[158]

Although this discussion highlights the restrictions of Google Voice and Skype on the Apple iPhone, the iPhone in many ways exemplifies the trend of increasing openness to third-party applications. When the iPhone was first introduced in July 2007, Apple did not use AT&T's own web browsing and entertainment service to access the Internet, but kept significant control over applications and services. Then in fall 2007, Apple announced a software development kit allowing software developers to develop third-party applications for the iPhone. Apple launched its App Store, a platform for third-party developers to market applications in July 2008. Although new applications are subject to Apple's review, these developments represent improvements in "openness" over the years before and many third-party applications are now available.

In addition to openness at the application level, there is also openness at the device level. This includes Verizon Wireless's recent "Open Development Initiative" which opens Verizon Wireless's network to any manufacturer wishing to produce a compatible device.[159] In addition, consumers can purchase third-party aircards from all the major wireless providers which then allow wireless-equipped laptops from any manufacturer to have mobile access, greatly expanding the universe of network compatible devices.

Recent developments suggest that wireless providers are responding to consumer demands for more "openness" to third-party applications, devices, and content, and that "openness" is becoming another dimension in which carriers are competing for consumers. Fundamentally, providers profit by offering attractive packages to consumers, and need to balance network management and quality control concerns against consumer demand for applications and content. A network provider that restricts

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[157] Comments of CFA, et al., p. 21.
[158] See: http://www.skype.com/download/skype/windowsmobile/, accessed September 22, 2009; http://www.microsoft.com/windowsmobile/en-us/devices/smartphones.mspx, accessed September 22, 2009; Michael Katz (2009), "Measuring Effective CMRS Competition," Exhibit A to Reply Comments of AT&T, Fourteenth Report Public Notice, July 13, 2009, pp. 29-30.
[159] "Verizon Opens Network, Gets First Unsexy Device," *Verizon Wireless Press Release*, July 16, 2008.

access to desirable third-party applications or content will lose business to rivals that are open to similar applications or content.

E. Summary of Provider Conduct Evidence

As the Antitrust Modernization Commission has stated, "[i]nnovation provides a significant share of the consumer benefits associated with competition, particularly in the most dynamic industries. New and improved products and services, as well as new business methods and production processes, are created through innovation."[160] The last few years have witnessed substantial innovation and technology deployment by wireless network providers, equipment manufacturers, mobile operating systems developers and mobile applications developers. Providers are continuing to build out and enhance their 3G networks, the deployment of 4G networks is in the works, new business models have been implemented, many new multi-featured smartphones have been introduced and handset technology is advancing rapidly, and many applications are being designed for use with mobile devices. As I describe more fully below, these developments are benefitting consumers through new and innovative services, better quality, and lower prices.

V. Indicia of Competition: Consumer Behavior

The ability of consumers to switch wireless providers in response to new service offerings, attractive calling plans and prices, or improvements in network quality is an important part of the competitive dynamic in wireless, and serves as an important check on the potential market power of wireless providers. In this section, I review recent evidence on consumer access to information and potential barriers to switching wireless providers.

A. Access to Information

Given the large variety of service providers, plans, handsets, handset applications, data services, and network quality, as discussed above, consumers potentially face a dizzying array of options. However, as noted in the Thirteenth Report, there is a large amount of high quality information available to consumers. Third-party publications like

[160] AMC Report, p. 39-40.

Consumer Reports and J.D. Power and Associates provide overviews and comparisons. J.D. Power and Associates posts a semiannual wireless user survey which rates providers by region.[161]

Carriers themselves provide detailed information on network coverage and typically offer satisfaction guarantee plans which allowed customers approximately a month to exchange equipment or break the service agreement without an early termination fee. In addition, carriers engage in extensive advertising to inform consumers about their services, prices and network quality.

In any market, asymmetric information has the potential to change and limit levels of competition. However, given the prevalent use of cell phones, the ready availability of high-quality third-party information, and information and advertising by providers, the risk of asymmetric information harming consumers seems low. A market of well informed consumers quickly determines the best product, provide prompt market signals, and impose competitive forces to reward the best products. Despite the complexity of options, as long as wireless consumers continue to have access to good information, they serve as an effective competitive force.

B. Local Number Portability

Local number portability ("LNP") refers to the ability of customers, at the same location, to keep phone numbers when switching from one service provider to another. LNP was established by the Commission's rules and orders and fully implemented by 2004. Many consumers have taken advantage of number portability. According to NRUF data, between December 2003 and September 2008 approximately 54 million consumers had ported their numbers between wireless carriers and another 3.2 million consumers had ported their numbers from wireline to wireless.[162] In 2008, monthly average rates of wireless to wireless number LNP averaged 947,000 subscribers. Moreover, analysts have noted that LNP causes providers to exert more effort and increase resources aimed at retaining existing subscribers.[163]

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[161] J.D. Power Press Release, August 27, 2009.
[162] Stroup, Craig and John Vu, *Numbering Resource Utilization in the United States*, FCC, March 2009.
[163] Ninth Report, ¶ 165.

C. Churn

Monthly churn statistics provide a measure of consumer switching between carriers. Most carriers have been reporting churn rates in the range of 1.5% to 3.0% per month, with an average churn rate of 1.9% in first quarter 2008, implying annual churn of more than 22%, which means that approximately 60 million subscribers leave their providers each year, evidence that it is not that difficult to switch carriers. Churn rates for prepaid plans are typically much higher.[164]

Despite implementation of wireless LNP in 2003-2004, churn rates have been declining in recent years. This decline is likely related to increased customer satisfaction due to the improvement of call quality as carriers have deployed next-generation technologies and increased the number of cell sites. Although concerns about network quality are still raised, recent survey evidence indicates that call quality is improving. Because poor call quality is highly correlated with customers' desire to switch carriers, it is not surprising that as call quality has improved there has been a decrease in churn.[165]

Verizon Wireless, AT&T, T-Mobile, Sprint, MetroPCS, and Leap all provide prospective customers with detailed coverage information to encourage customers to enroll in their plans.[166] Analysts believe that these efforts coupled with improved customer care, better deals on handsets, and bigger incentives for longer contracts have helped to reduce the level of churn.[167] Thus, decreasing churn rates probably do not reflect a decrease in consumer choice but rather an increase in the quality of customer experience and, over time, the ability of continuing wireless customers to sort to their preferred provider.

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[164] See Figure 6 of MacQuarie Research (2009), *Prepaid Wireless Services: Slumdog Millionaires*, May 1, 2009.

[165] Even without increasing call quality, customer sorting as customers gain experience with different wireless networks would decrease churn. For example, if new customers are more likely to churn than existing customers, a decreasing proportion of new customers as the installed base grows would naturally lead to a smaller churn. Experienced customers would be less likely to churn because they have already had the chance to try one or more networks at home and at work so are more likely to have found the most appropriate carrier for their individual calling patterns.

[166] Coverage information from carrier websites: AT&T (www.wireless.att.com/coverageviewer), Sprint (coverage.sprint.com), T-Mobile (t-mobile.com/coverage), and Verizon Wireless (www.verizonwireless.com.b2c/coveragelocater controller), as of September 21, 2009.

[167] Eleventh Report ¶ 148.

D. Early Termination Fees

ETFs are a traditional part of postpaid contractual rate plans, and CFA argues that ETFs limit customer switching and competition.[168] In general, these plans provide handset discounts to consumers in exchange for a longer term commitment to a service plan, and charge a fee if consumers cancel service before the end of their contract. It is a considered choice made by the consumer, who has the option of choosing an alternative service agreement with no handset discount and no term commitment.

As a matter of economics, ETFs can be an efficient form of contracting between wireless providers and consumers, leading to vigorous competition between providers to attract postpaid customers. For example, ETFs can encourage providers to invest in the upfront costs needed to provide a new customer with a handset.[169]

Recent developments have given consumers considerably more contractual options. First, consumers can avoid ETFs by signing up on a prepaid basis (and many of them choose that option as indicated by the strong growth of prepaid plans). Second, consumers who enter into postpaid contracts with ETFs can typically cancel service within a grace period of approximately one month. Third, in 2006 Verizon Wireless became the first carrier to pro-rate its ETF such that the fee is reduced each month the customer stays with the plan. In 2007, AT&T, Sprint, and T-Mobile followed suit with similar policies.[170] Fourth, carriers have recently introduced month-to-month postpaid plans that do not have ETFs.[171] Fifth, the major wireless providers have put in place policies that allow consumers to change contract options without triggering a contract extension. Finally, the Commission cites some evidence that secondary markets for unexpired wireless contracts have developed, in which consumers who want to cancel unexpired contracts can transfer their contracts to other consumers.[172]

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[168] Comments of CFA, et al., pp. 14-15.
[169] For further discussion, see Greg Houston and Hayden Green (2007), "Assessing the Merits of Early Termination Fees," in *Economics of Antitrust: Complex Issues in a Dynamic Economy*, 2007. See also Charles Davidson (2009), "Losing the Forest for the Trees: Properly Contextualizing the Use of Early Termination Fees in the Current Wireless Marketplace," ALCP Scholarship Series, June 2009.
[170] Twelfth Report, ¶ 115.
[171] Thirteenth Report, ¶ 113.
[172] Thirteenth Report, ¶ 186.

E. Summary of Consumer Behavior

Developments over the last few years have made it easier for consumers to obtain information about their options for obtaining wireless service, and to switch providers in response to those options. For example, carriers provide detailed information about local network coverage to prospective customers, local number portability allows consumers to retain their phone number when they switch providers, and there are now many contractual options available to consumers for obtaining service. These are good signs of the competitive process at work; consumer behavior serves as an important check on market power when subscribers can and do switch providers to pursue better prices or more attractive service.

VI. Indicia of Competition: Wireless Market Performance

The market structure, provider conduct, and consumer behavior evidence discussed in the prior three sections all indicate that there is effective competition in the mobile wireless industry. The ultimate test of effective competition is whether it is bringing tangible benefits to consumers in the form of lower prices, greater choice, new and innovative services, and high quality. In this section, I review recent evidence on wireless market performance, as measured by the prices, services and quality available to consumers, including the many new services and features that have been enabled by more advanced wireless technologies. This focus on consumer outcomes is consistent with the consumer welfare focus of competition policy.

A. Subscribers

Wireless use has increased significantly, whether measured by subscribers, minutes of use or data usage. CTIA estimates that there were 270.3 million subscribers at the end of 2008 implying a penetration rate of 87.8% and a 30% increase in subscribers between December 2005 and December 2008.[173] Table 2 shows the growth in subscribers and the penetration rate over time.

[173] CTIA Year End 2008 Wireless Indices, Table 13.

B. Voice Telephony

Mobile voice services are offered through a wide variety of calling plans. Many plans offer nationwide coverage without additional roaming or long distance charges, free night and weekend minutes, and free calls to specified numbers. Other features such as rollover minutes and direct connect (walkie-talkie) options are available on certain plans. Many of these plan features, such as free roaming and long distance, were much less prevalent five or ten years ago. Carriers continue to experiment with different plans, and consumers typically have considerable choice among plans within and across carriers. The wide variety of plans give consumers considerable ability in finding a plan that meets their specific needs, and recent carrier practices have made it easier for consumers to change plans.

Phone plans have progressively gotten cheaper. In February 2008, Verizon Wireless introduced an unlimited nationwide flat-rate calling plan for $100 a month. AT&T and T-Mobile quickly announced plans with similar pricing,[174] and Sprint launched the "Simply Everything Plan" which included unlimited voice and data for the same $100 price.[175] In September 2009 Sprint introduced a new $70 monthly plan with unlimited calls to any U.S. cell phone.[176] This came one day after AT&T announced a plan giving customers free calls to five numbers of their choosing for customers not on the unlimited plans, an option already offered by T-Mobile and Verizon Wireless.[177] Regional and prepaid providers are also offering competing unlimited voice and data plans. In March 2009, MetroPCS launched a BlackBerry with unlimited data and voice for $50 a month.[178] Other regional and MVNO providers now offer similar plans, with Boost Mobile charging $50 a month and Leap charging $45 a month for unlimited voice and data service.[179]

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[174] "For Big Talkers, Wireless Firms Offer Flat Rates," *The Wall Street Journal*, February 20, 2008.
[175] "Sprint Launches Revolutionary $99.99 'Simply Everything (SM)' Plan," *Sprint Press Release*, February 28, 2008.
[176] "Sprint Plan Ups Ante in Wireless Market," *The Wall Street Journal*, September 11, 2009.
[177] "AT&T's Free-Calling Offer Preserves Revenue," *The New York Times Bits Blog*, September 9, 2009. Plan information from AT&T website (www.att.com/alist).
[178] CTIA Comments, p. 27.
[179] Boost Mobile Website (http://plans.boostmobile.com/monthlyunlimited.aspx), accessed September 15, 2009 and Leap Wireless Website (www.mycricket.com/cricketplans/), accessed September 15, 2009.

Carriers also offer voice plans with smaller buckets of minutes, some representative plans for the nationwide carriers are shown in Table 3. In addition, most plans no longer include roaming and long distance charges that were commonplace a few years ago. And many plans no longer charge for features such as voice mail, call waiting, call forwarding, caller ID, and three way conference calling.[180]

A notable 2009 development has been dramatically reduced prices of prepaid calling plans where customers can forgo a long-term contract and prepay the provider for service. In recent months, the price for prepaid plans with unlimited calling minutes (which can also include unlimited data) has fallen from about $100 per month to $50 per month. In January 2009, Sprint's prepaid brand, Boost, dropped the price of its unlimited plan from $100 to $50 (a 50% decrease) to better match the approximately $50 price of competitors Leap and MetroPCS. Virgin Mobile followed suit in April 2009 lowering its price from $80 to $50 (a 37.5% decrease). In July 2009, Tracfone, a prepaid wireless reseller, introduced an unlimited plan which was co-branded as running on the Verizon Wireless network at $45.[181] Two weeks after Tracfone's offer, Sprint responded by improving the services on its own unlimited plan,[182] and within one month both MetroPCS and Leap effectively cut their own prepaid unlimited prices by 10%.[183]

Prepaid service is increasingly competing with postpaid plans.[184] One metric of the increasing importance of prepaid is its share in new subscriber additions. In the first quarter of 2009, prepaid users composed 75% of all new retail subscribers for the top 10 U.S. carriers,[185] and prepaid subscribers comprised almost 17% of all wireless

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[180] For example, see "Free Services and Features Make Verizon Wireless a Great Value," *Verizon Wireless Press Release*, August 26, 2009.
[181] Bernstein Research, *Quick Take – U.S. Telecommunications: Another LEAP into the Abyss (of Pre-Paid Pricing)*, August 4, 2009. ("Bernstein Research, *LEAP into the Abyss*"); Bernstein Research, *Wireless Limbo*.
[182] Originally, the Sprint $50 unlimited deal was only available on its iDEN network. Sprint expanded the $50 offer to also include unlimited voice and data on its CDMA network. Previously, the CDMA unlimited talk and data plan was priced at $70 (an effective 28.6% decrease). Bernstein Research, *Wireless Limbo*; Bernstein Research, *Race to the Bottom*.
[183] See Bernstein Research, *Wireless Limbo*; Bernstein Research, *LEAP into the Abyss*.
[184] Bernstein Research, *LEAP into the Abyss*; Bernstein Research; CTIA Comments, p. 28.
[185] "Prepaid and Gross Subscribers in the United States Keep the Wireless Market Growing in 1Q09, According to IDC," *IDC Press Release*, June 2 2009.

subscribers.[186] In comparison, prepaid comprised only 8.6% of all wireless subscribers in 2002.[187]

Given that new features and pricing options are constantly being added and the quality of service is improving, it is difficult to track the price of comparable plans over time. The U.S. Bureau of Labor Statistics' Cellular CPI attempts to control for these changes. As shown in Table 4, mobile plan prices for urban areas have decreased every year for the past 10 years and are now 36% lower than they were in 1997. According to the BLS, the cellular CPI attempts to control for all changes in plan quality, however this is not always possible given the rapid change in features and pricing options.[188]

Another indicator of price trends is average revenue per voice minute (ARPM), which can be calculated from CTIA's semi-annual surveys, and is reported in the Commission's CMRS Competition Reports. As shown in Table 5, ARPM has declined from $0.35/minute in 1998 to $0.07/minute in 2008. However, ARPM has become increasingly inaccurate as a price metric in a wireless environment with increasing mobile data use. This inaccuracy arises because ARPM is calculated using total service revenues (include revenue from data services) in the numerator and voice minutes (but not measures of data usage) in the denominator.

An alternative measure of the trend in voice prices is average voice revenue per minute (AVRPM), which can be calculating by subtracting wireless data revenues from CTIA estimates of the average local monthly bill, then dividing by the number of voice minutes. The Commission has begun reporting AVRPM in its CMRS Competition Reports.[189] Because AVRPM excludes revenue from data services, it is a more accurate measure of price trends for voice services. As shown in Table 5, AVRPM has declined from $0.35/minute in 1998 to $0.05/minute in 2008.

These price declines have been accompanied by increases in usage. As shown in Table 6, CTIA survey data indicate that average monthly voice minutes of use per

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[186] Global Wireless Matrix 2Q09, p. 2.
[187] Strategy Analytics (2009) *Worldwide Cellular User Forecasts 2009-2014*, May 2009.
[188] U.S. Bureau of Labor Statistics (2008), "How BLS Measures Price Change for Cellular Telephone Service in the Consumer Price Index," March 6, 2008 (http://www.bls.gov/cpi/cpifactc.htm), accessed September 23, 2009.
[189] Thirteenth Report, ¶ 193.

subscriber were 769 at the end of 2007, an increase of 80% relative to five years earlier.[190] After increasing from 1997 through 2007, the most recent CTIA survey data indicate that average monthly voice minutes of use declined to 708 minutes at the end of 2008. . This decline may be due to an increase in prepaid subscribers who tend to use fewer minutes per month, or an increase in text messaging and e-mail as a substitute for voice calls. Postpaid minutes of use remained fairly flat in 2008, decreasing from 799 to 795.

C. Text and Multimedia Messaging

Text ("SMS") messaging and multimedia ("MMS") messaging have become an increasing part of the wireless experience. As shown in Table 7, CTIA data indicate that SMS volume in the last six months of 2008 was 620 billion, an increase of 188% over the last six months of 2007 and 561% over the last six months of 2006.[191] CTIA data also indicates that MMS volume (e.g., photo messaging) in the last six months of 2008 was 9.30 billion, an increase of 166% over the last six months of 2007.

Carriers now offer a variety of calling plans that include bundles of SMS and MMS messages, and the majority of SMS/MMS transmissions are covered by messaging plans. Indeed, more than 99% of the text messages that Verizon Wireless and AT&T were providing in 2009 were offered under monthly text messaging plans.[192]

The price of text messaging has been declining in the last few years. The vast majority of text messages are covered by monthly plans, and these plans have declined in price. Thus, although post-paid pay-as-you-go text messaging prices have increased, the average price per text message has declined considerably. According to CTIA data, the average revenue per text message declined from $0.036 per text message in 2005 to $0.022 in 2007, and by the end of 2008, average revenue per text message fell to

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[190] All data in this paragraph from CTIA Year End 2008 Wireless Indices, pp. 192-197.
[191] All data in this paragraph from CTIA Year End 2008 Wireless Indices, Appendix B, p. 30.
[192] For Verizon Wireless see Randal Milch (2009), Testimony before the Subcommittee on Antitrust, Competition Policy, and Consumer Rights, Committee on the Judiciary, United States Senate regarding Cell Phone Text Messaging Rates Increase and the State of Competition in the Wireless Market, June 16, 2009, p. 5. For AT&T see Wayne Watts (2009), Testimony before the Subcommittee on Antitrust, Competition Policy, and Consumer Rights, Committee on the Judiciary, United States Senate regarding Cell Phone Text Messaging Rates Increase and the State of Competition in the Wireless Market, June 16, 2009, p. 4.

$0.0101.[193] This represents a reduction of 71% from 2005 levels, and 53% from the level at the end of 2007.

D. Mobile Data Services

As with voice calling plans, consumers typically have considerable choice among data plans. Most plans offer SMS, MMS, and Internet access. In addition, plans can include music playing services, mobile TV, downloadable ringtones/ringback tones, wallpaper, maps, and applications.[194] There are many variants of these plans, including stand-alone "mobile broadband" plans for use with an "aircard" modem and a laptop, netbook, or similar device, and plans providing email and/or Internet access from BlackBerrys, PDAs and other smartphone devices. Some available plans are bundled with voice service, others offer data as an add-on to voice service, and other plans are offered on a standalone basis. Some plans offer unlimited data, while other plans offer

Current prices for mobile broadband plans used with an aircard are shown in Table 8. For example, Verizon Wireless currently offers a 5GB monthly plan at $59.99 and a 250MB monthly plan at $39.99 for access to the Verizon Wireless 3G network.[195] AT&T offers a 5GB monthly plan at $60 and a 200MB monthly plan at $40 for access to AT&T's 3G network.[196] Other providers offer similar 3G plans, and Sprint also offers a monthly plan offering unlimited 4G usage where available and 5GB of 3G usage at $69.99.[197]

Wireless providers also offer a variety of data plans for use with smartphones. Current prices for smartphone data plans are shown in Table 9. For example, Verizon

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[193] Calculated using data from the CTIA Year End 2008 Wireless Indices report. Six month text revenues are divided by six month text traffic.

[194] For examples, see Verizon Wireless Website (http://products.vzw.com/index.aspx?id=fnd&lid=//global//features+and+downloads), accessed September 15, 2009 and AT&T Website (http://www.wireless.att.com/cell-phone-service/ringtones_media/index.jsp), accessed September 15, 2009.

[195] http://www.verizonwireless.com/b2c/mobilebroadband/?page=plans&lid=//global//plans//mobile+broadband+plan, accessed September 11, 2009.

[196] http://www.wireless.att.com/businesscenter/popup/dataconnect-comp-=table.jsp, accessed September 28, 2009.

[197] http://nextelonline.nextel.com/NASApp/onlinestore/en/Action/SubmitRegionAction?isUpgradePathForCoverage=false&currZipCode=&upgradeOption=&nextPage=DisplayPlans&equipmentSKUurlPart=%3FcurrentPage%3DratePlanPage&filterStringParamName=filterString%3DMobile_Broadband_Cards_Filter&newZipCode=10001, accessed September 28, 2009.

Wireless currently offers an unlimited monthly data plan for smartphones for $49.99 and AT&T offers an unlimited monthly data plan for smartphones for $35.00. Carriers also offer a variety of bundled voice/data plans.

Comparisons of current data prices with comparable prices from earlier periods are not readily available and even if they were, may be somewhat misleading. Consumers have benefitted from considerable improvements in data speeds and coverage as 3G technology has been deployed. Thus, an "unlimited" data plan from five years ago is much less functional than an unlimited data plan today on a quality adjusted basis. Table 10 shows prices from a 2005 study that compiled mobile broadband prices as of mid-2004.[198] Most providers offered a "pay per use" plan where subscribers paid a monthly fee of $10-$40 that included 2-20MB of data, and then an overage charge. Providers also offered unlimited usage plans that ranged in price from $29.99 - $80 per month.[199]

In 2004, Verizon Wireless offered an unlimited plan using 2.5G technology for $79.99 and it now offers a 5GB mobile broadband plan for $59.99 and an unlimited data plan for smartphones for $49.99. 5GB of data throughput would have been very heavy data use in 2004. In 2004, Sprint offered an "unlimited" monthly plan, with a 300MB data throughput cap, for $80. Today Sprint offers a monthly mobile broadband plan for $69.99 that includes unlimited 4G and 5MB of 3G data throughput and an unlimited data and messaging plan for smartphones for $69.99.[200]

Mobile data usage has increased significantly in recent years. According to CTIA, data revenues accounted for 23.2% of total wireless service revenues in the last half of 2008, up from 13.5% in the last half of 2006.[201] Several sources indicate that the percentage of subscribers using their wireless phones for data services continues to increase:

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[198] Gerard Brosnan (2005), "Trends in the Mobile Data Services Market," The Telecommunications Review 2005, Table 2, available at http://www.noblis.org/NewsPublications/Publications/TechnicalPublications/TelecommunicationsReview/Documents/04-Brosnan-TR2005.pdf.

[199] Information not available on any restrictions pertaining to the 2004 "unlimited usage" plans.

[200] As mentioned above, it is difficult to compare plans given the significant improvement in data transfer speeds that have occurred.

[201] CTIA Year End 2008 Wireless Indices, p. 112.

- For example, a recent Pew Internet Survey indicated that in 2007 11% of Americans reported accessing the Internet "yesterday" from their mobile device. In 2009 this same figure is 19%.[202]
- Nielsen Mobile indicates that 37% of subscribers paid for access to the mobile Internet in the first quarter of 2008.[203]
- Between January 2008 and January 2009, comScore found a 107% increase in the number of unique users accessing mobile information (excluding social networking sites or blogs) on a daily basis. The number of unique users accessing social networking sites or blogs on a daily basis increased even more rapidly, at 427%.[204]
- In 2009, comScore estimated that a total of 63.2 million people accessed information on their mobile device in the month of January.[205]
- According to comScore, the number of games downloaded by smartphones increased by 291% from November 2007 to November 2008, while decreasing for non-smartphones.[206]

E. Product Variety

The wide variety of voice, messaging, mobile broadband and smartphone plans give consumers considerable choice in finding a plan, or switching to new plan, that meets their mobile communications needs. Nevertheless, CFA argues that parallel pricing across the national wireless providers indicate the absence of meaningful competition.[207] CFA's claims are not well supported by the economics of the wireless industry. Although parallel pricing can be a symptom of limited competition, this activity, by itself, does not prove the lack of competition. Economists and the courts have long recognized that parallel pricing can be consistent with vigorous competition. For example, since wireless providers face similar costs for deploying and operating their

[202] *Wireless Internet Use*, Pew Internet & American Life Project, July 2009.
[203] "Critical Mass: The Worldwide State of the Mobile Web," Nielsen Mobile, July 8, 2008.
[204] "Mobile Internet Becoming a Daily Activity for Many," *comScore Press Release*, March 16, 2009.
[205] "Mobile Internet Becoming a Daily Activity for Many," *comScore Press Release*, March 16, 2009.
[206] "Smartphones Provide Extra Mana for Mobile Games Industry as Audience for Downloaded Games Grows 17 Percent," *comScore Press Release*, January 30, 2009.
[207] Comments of CFA, et al., pp. 8-11.

networks and largely compete for the same demand, vigorous competition would tend to result in market equilibrium prices that are similar for similar products and services.

Moreover, wireless providers offer a wide variety of bundled voice and data services with many features and pricing variables (free calling minutes, free off-peak minutes, rollover minutes, etc.) that change over time. Product differentiation makes it very difficult for carriers to coordinate pricing and monitor cheating from any agreement. These market conditions make it very unlikely that carriers are coordinating their prices.

F. International Comparisons

International comparisons are another source of data for analyzing the effectiveness of competition in the U.S. mobile wireless industry. Data suggest that the U.S. fares well along many important dimensions of wireless performance when compared to other developed countries: average monthly minutes of use are much higher and average revenue per minute much lower in the U.S. than in other developed countries.[208] Although there are regulatory differences between the U.S. and other countries which contribute to these differences,[209] robust competition in the U.S. has also contributed to keeping prices low and usage high.

While international comparisons are interesting, differences in the market and regulatory environment across countries need to be accounted for in interpreting various metrics. For example, mobile penetration rates tend to be slightly lower in the U.S. (90%) than in most of the developed European countries (over 100% in many countries) and developed Asia (although Japan's rate is at 86.7%).[210] The slightly lower U.S. penetration rate can be attributed to several factors, including: 1) differences in demographics; the U.S. has a significantly younger population than most other developed countries, and penetration rates are calculated as the number of subscribers relative to the total population; 2) greater use of prepaid plans in Europe; 3) more frequent use of multiple devices and/or multiple SIM cards in Europe, in part because of high roaming rates in Europe and the ability to use a single device across the U.S. with low or no

[208] Global Wireless Matrix 2Q09.
[209] For example, in Western Europe and Japan the calling party typically pays ("Calling Party Pays" or "CPP") rather than the mobile party paying as in the United States.
[210] Global Wireless Matrix 2Q09.

roaming charges and 4) differences across carriers in accounting for inactive subscribers. For these reasons, the lower penetration rate in the US says little about the relative competitiveness of the US.

As another example, a recent article by economist George Ford criticizes a 2009 OECD comparison of mobile telephone prices across countries for failing to take account of important differences between the U.S. and Europe in usage.[211] The OECD study compares prices across countries by defining three "usage baskets". In his paper, Ford points out that the OECD's analysis is highly dependent on the particular usage baskets selected by the OECD, which are not representative of the usage patterns of American consumers.

The more general point is that when interpreting international comparisons of wireless service metrics, it is important that the Commission accounts for differences in consumer behavior, market conditions, and the regulatory environment.

G. Summary of Market Performance

My review of the evidence demonstrates that wireless consumers are benefitting from robust competition. Wireless, while not perfectly competitive according to the textbook model, shows many signs of vigorous competition – low prices, significant product variety, new services and features, improved quality, and significant innovation. Nearly all consumers have numerous choices when purchasing wireless service, switching between providers has gotten easier, voice, data and bundled service packages are declining in price, and there has been a burst of innovation in wireless devices and applications.

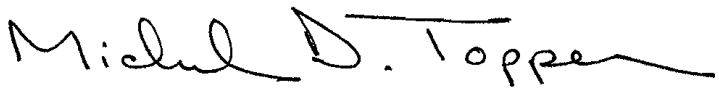
Some commenters suggest a need for greater regulatory intervention in mobile wireless.[212] In assessing any proposed interventions, it is important to remember that policy proposals for wireless networks should have as their primary focus increasing consumer welfare. In general consumer welfare is enhanced by removing obstacles to competition by private firms, and not by favoring any one particular firm. The

[211] George Ford, "Be Careful What You Ask For: A Comment on the OECD's Mobile Price Metrics," *Phoenix Center for Advanced Legal & Economic Public Policy Studies*, September 16, 2009. The original OECD study is: *OECD Communications Outlook 2009*.
[212] Comments of CFA, et al., p. 31.

Commission's current analytical framework is well suited to address this consumer welfare standard. More generally, Commission policy should be directed to maintaining the incentives that have led to the current competitive environment in wireless and encourage continued competition to benefit consumers.

The Commission should be very careful about implementing regulations that reduce incentives to innovate and invest or otherwise cause a diminution of competition despite good intentions. Regulation is difficult in a dynamic industry like wireless, where innovation and investment are critical to competition among incumbent firms and potential entrants. Preventing a firm from reaping the rewards of its investments and ingenuity or the threat of taking away such rewards can change a firm's actions. Regulation that is preemptive and overly broad will prevent pro-competitive carrier practices. The Commission should introduce new regulation only after a careful evaluation of the wireless market shows that particular carrier practices are on balance anticompetitive and that consumers are better served by regulation than market forces.

I declare under penalty of perjury that the foregoing is true and correct.



Michael D. Topper
Executed September 29, 2009

Appendix A: Qualifications

I am Vice President and Head of the Antitrust & Competition Practice at Cornerstone Research. I have been a faculty member in the Department of Economics at the College of William & Mary, and a lecturer in the Department of Economics at Stanford University. While at William & Mary and Stanford, I taught courses in microeconomics, econometrics, and antitrust economics. I have a Ph.D. and M.A. in Economics from Stanford University. I also received a B.S. in Systems Engineering from the University of Virginia and an M.S. in Engineering Economic Systems from Stanford University.

Prior to getting my doctorate in economics, I worked as an engineering economist at Bell Laboratories and Bell Communications Research. In my fifteen years at Cornerstone Research, my consulting work has focused on the application of microeconomics, econometrics, and quantitative analysis to litigation and regulatory matters. I have worked on numerous consulting projects in the telecommunications industry, including antitrust, merger review, spectrum policy, intellectual property, breach of contract, and securities issues.

Table 1
Smartphones by Carrier
September, 2009

Source: Carrier Websites as of September 16, 2009

	AT&T	Sprint	T-Mobile	Verizon	Leap	MetroPCS
Apple						
iPhone 3G	X					
iPhone 3GS 16 GB	X					
iPhone 3GS 32 GB	X					
Blackberry						
Pearl 8110	X					
Pearl 8120			X			
Pearl 8130		X				
Pearl Flip 8230				X		
Curve			X			
Curve 8310	X					
Curve 8330		X		X		X
Curve 8320	X					
Curve 8350i		X				
Curve 8520			X			
Curve 8900	X		X			
Storm 9530				X		
Tour 9630		X		X		
8700g			X			
8703e			X			
8820	X		X			
8830		X		X		
Bold	X					
HTC						
Fuze	X					
Ozone				X		
Ozone with TALKS				X		
Snap		X				
Touch Diamond		X		X		
Touch Pro		X		X		
Touch Pro2		X	X	X		
LG						
Incite	X					
Motorola						
Evoke					X	
Hint					X	
i920		X				

Smartphones by Carrier (continued)
September, 2009

Source: Carrier Websites as of September 16, 2009

	AT&T	Sprint	T-Mobile	Verizon	Leap	MetroPCS
Nokia						
Surge	X					
E71x	X					
Palm						
Centro		X				
Pre		X				
Treo 755p		X				
Treo Pro		X				
Pantech						
Matrix Pro	X					
Samsung						
Ace		X				
Behold		X				
BlackJack II	X					
Finesse						X
Highlight			X			
Jack	X					
Memoir			X			
Messager						X
Omnia				X		
Propel	X					
r450						X
Saga				X		
T-Mobile						
Dash 3G			X			
G1			X			
myTouch 3G			X			
Shadow			X			
Sidekick LX			X			
Verizon						
XV6900				X		
SMT5800				X		
Number of Smartphones	17	16	15	14	2	4

Note:
Smartphones are defined by the carrier where available.

Table 2
Wireless Subscribers and Penetration Rate
2001 – 2008

Source: CTIA's Wireless Industry Indices YE 2008, Tables 11 & 13

Year	Estimated Wireless Subscribers (Millions)	Wireless Penetration Rate
2001	128.4	44.2%
2002	140.8	48.0%
2003	158.7	53.6%
2004	182.1	61.0%
2005	207.9	69.0%
2006	233.0	76.6%
2007	255.4	83.2%
2008	270.3	87.8%

Table 3
Voice Pricing Plans

Source: Carrier Websites, September 2009

	Minutes	Price
AT&T	450	$39.99
	900	$59.99
	1350	$79.99
	Unlimited	$99.99
Sprint	200	$29.90
	450	$39.99
	900	$59.99
	Unlimited	$99.99
T-Mobile	300	$29.99
	600	$39.99
	1000	$49.99
	1500	$59.99
	Unlimited	$99.99
Verizon	450	$39.99
	900	$59.99
	1350	$79.99
	Unlimited	$99.99

Table 4
Cellular Consumer Price Index
1997 – 2008

Source: Bureau of Labor Statistics

Year	Consumer Price Index
1997	100.0
1998	95.1
1999	84.9
2000	76.0
2001	68.1
2002	67.4
2003	66.8
2004	66.2
2005	65.0
2006	64.6
2007	64.4
2008	64.2

Note:
The above figures represent the prices paid by urban consumers. The Bureau of Labor Statistics began including wireless services in the CPI in 1997. This data is from Series ID CUUR0000SEED03.

Table 5
Wireless Service Revenue
1993 – 2008

Source: CTIA Wireless Industry Indices YE2008, Table 46, 72, 74, and Chart 25

Year[1]	Average Revenue per Minute (ARPM)[2]	Average Voice Revenue per Minute (AVRPM)[3]
1993	$0.55	-
1994	$0.53	-
1995	$0.50	-
1996	$0.44	-
1997	$0.42	-
1998	$0.35	$0.35
1999	$0.25	$0.25
2000	$0.19	$0.19
2001	$0.13	$0.13
2002	$0.12	$0.12
2003	$0.10	$0.10
2004	$0.09	$0.09
2005	$0.07	$0.06
2006	$0.07	$0.06
2007	$0.06	$0.05
2008	$0.07	$0.05

Notes:
[1] All figures are for the second half of the year.
[2] Calculated by dividing total service revenue by local and roaming MOUs.
[3] Calculated by dividing total service revenue minus data revenue by local and roaming MOUs.
[4] These numbers differ slightly from those reported by the Thirteenth CMRS Report.

Table 6
Average Monthly Minutes of Use
1993 – 2008

Source: CTIA Wireless Industry Indices YE2008, Table 79

Year[1]	Average Monthly Minutes of Use[2]
1993	140
1994	119
1995	119
1996	125
1997	117
1998	136
1999	185
2000	255
2001	380
2002	427
2003	507
2004	584
2005	708
2006	714
2007	769
2008	708

Notes:
[1] All figures are for the second half of the year.
[2] Based on all CTIA responses, some of which were incomplete. See table 79 and 80 in the CTIA report for more information.

Table 7
Reported Six-Month SMS and MMS Traffic Volume
2004 – 2008

Source: CTIA's Wireless Industry Indices Year End 2008, Charts 54 & 55

Date	Text/SMS Volume (billions)	MMS Volume (billions)
Dec 2004	24.71	
Jun 2005	32.54	0.28
Dec 2005	48.66	0.85
Jun 2006	64.82	1.14
Dec 2006	93.83	1.59
Jun 2007	146.99	2.61
Dec 2007	215.56	3.49
Jun 2008	384.97	5.63
Dec 2008	620.18	9.30

Notes: Figures are for the 6 months ending in the period given.

Table 8
Aircard Data Prices
September 2009

Source: Carrier Websites, accessed September 2009

Carrier	Plan	Technology	Max Monthly Traffic	Price
Verizon Wireless	Daypass	EV-DO	Unlimited for 24 Hours	$15.00
Verizon Wireless	Mobile Broadband 250MB	EV-DO	250 MB	$39.99
Verizon Wireless	Mobile Broadband 5GB	EV-DO	5 GB	$59.99
AT&T Wireless	DataConnect 200 MB	UMTS/HSDPA	200 MB	$40.00
AT&T Wireless	DataConnect 5 GB	UMTS/HSDPA	5 GB	$60.00
Sprint	Mobile Broadband Connection Plan – 3G	EV-DO	5 GB	$59.99
Sprint	Mobile Broadband Connection Plan – 4G[1]/3G	EV-DO / WiMax	4G: Unlimited; 3G: 5GB	$69.99
T-Mobile	WebConnect	EDGE / HSDPA[3]	5 GB	$59.99
Leap Wireless / Cricket	Cricket Broadband	EV-DO	Unlimited[2]	$40.00
US Cellular	Wireless Modem Plan	EV-DO	5 GB	$49.95

Notes:
[1] Average 4G download speeds are 3-6x faster than typical 3G download speeds
[2] Download speed may be throttled if total downloads exceed 5GB in a single month.
[3] HSDPA available in select markets.

Table 9
Smartphone Data Prices
September 2009

Source: Carrier Websites, accessed September 2009

Data-Only Plans for Smartphones

Carrier	Plan	Max Monthly Traffic	Price	Notes
Verizon Wireless	PDA/Smartphone/ BlackBerry Solution - Unlimited Data Usage	Unlimited	$49.99	
AT&T	PDA/Blackberry Personal	Unlimited	$35.00	$30 with a voice plan
AT&T	PDA /BlackBerry Personal w/ Tethering	5GB / Mo	$65.00	$60 with a voice plan
T-Mobile	BlackBerry Unlimited	Unlimited	$39.99	Voice calls .20/minute
T-Mobile	Sidekick Unlimited Web + 300 Texts	Unlimited	$44.99	Voice calls .20/minute
T-Mobile	Sidekick Unlimited + Unlimited Texts	Unlimited	$54.99	Voice calls .20/minute
Sprint	Only offers Combo plans			
Cricket	Only offers Combo plans			
MetroPCS	Only offers Combo plans			
US Cellular	BlackBerry / Windows Mobile Email & Web Personal Service		$29.95	$24.95 with a voice plan
US Cellular	BlackBerry Email & Webservice (Corporate enterprise)		$44.95	$39.95 with a voice plan

Combination Plans for Smartphones

Carrier	Plan	Max Monthly Traffic	Price	Notes
Verizon Wireless	PDA/Smartphone Nationwide Email (450 voice minutes)	5GB	$79.99	Price is $129.99 for unlimited voice minutes
Verizon Wireless	Mobile Broadband Connect (5GB) Tethering	5GB	$15 to $50	Price is $50 when added to voice plans, $15 when added to any Nationwide email plan.
AT&T	See chart above for price reduction in combos.			
T-Mobile	Blackberry Enterprise (includes 300 texts)	Unlimited	$39.98	
Sprint	Simply everything	Unlimited	$99.99	unlimited voice, data, messaging
Sprint	Everything Data - with Any Mobile, Anytime (450 voice minutes)	Unlimited	$69.99	unlimited data and messaging
Cricket	All smartphones require $15 for mobile web browsing at 3G speeds		$15.00	
MetroPCS	Both available smartphones have $50 plans		$50.00	Includes unlimited nationwide long distance

Table 10
Data Prices
July 2004

Source: Gerard A. Brosnan (2005), "Trends in the Mobile Data Services Market", *The Telecommunications Review*

Carrier	Wireless Technology	Pay Per Use	Max Monthly Traffic	Price
AT&T Wireless	GPRS/EDGE	$19.99 monthly; subscription includes first 8 MB $6.144 per MB (after exceeding 8 MB)	100MB[1]	$49.99
Cingular	GPRS/EDGE	$9.99 monthly; subscription includes first 2 MB $10.24 per MB (after exceeding 2 MB)	Unlimited	$54.99
Nextel	iDEN	$19.99 monthly; subscription includes first 5 MB $9.22 per MB (after exceeding 2 MB)	Unlimited	$59.99
Sprint PCS	1xRTT/1xEV-DO	$40.00 monthly; subscription includes first 20 MB $2.05 per MB (after exceeding 2 MB)	300MB	$80.00
T-Mobile USA	GPRS	N/A	Unlimited	$29.99
Verizon Wireless	1xEV-DO	N/A	Unlimited	$79.99

Note:
[1] If users use more than 100MB in two consecutive months they are forced to upgrade plans.