

The 700 MHz Spectrum Auction: An Opportunity to Protect Competition In a Consolidating Industry

Peter Cramton, Andrzej Skrzypacz and Robert Wilson ¹

13 November 2007

1 Summary

This paper is provided in connection with the 2007 Telecommunications Symposium – Voice, Video and Broadband: The Changing Competitive Landscape and Its Impact on Consumers, sponsored by the Antitrust Division of the U.S. Department of Justice (“the Division”). Our focus is on the state of competition in the wireless sector. Maintaining a competitive wireless sector is particularly critical if, as the Division’s agenda indicates, wireless services are to function as a competitive alternative to wireline technologies.

Strengthening competition is especially important now after recent mergers that consolidated the wireless industry into a few dominant firms (two to four depending on metric) with wide coverage and vertically integrated networks; moreover, the major firms’ leverage is magnified by their dominant positions in the markets for wireline telephony and broadband. These developments circumvent the Division’s (and the FCC’s) longstanding efforts to sustain competitive pressures in the market for wireless services.

We urge the Division to continue its proactive record of enforcement in the wireless sector and ensure that the significant amount of low frequency spectrum that will soon become available is not absorbed by the dominant wireless providers, thereby frustrating the opportunity for new entry.

¹ This paper was funded by Frontline Wireless, LLC.

Peter Cramton is Professor of Economics at the University of Maryland and Chairman of Market Design Inc. His research focuses on auctions and market exchange. Most of his recent work has addressed design and incentive questions in auctions. He has served as an auction expert for numerous companies in spectrum auctions and electricity auctions. He has advised the FCC and several foreign governments on the design and implementation of spectrum auctions. Cramton has designed electricity markets in New England, Colombia, France, and Belgium. He has published numerous articles on auction theory and auction practice in major journals. Cramton received his B.S. in Engineering from Cornell University and his Ph.D. in Business from Stanford University.

Andrzej (Andy) Skrzypacz is Associate Professor of Economics at the Stanford Graduate School of Business. His research is on microeconomic theory, especially information economics, market design, and dynamic games. His recent papers consider auction design, bargaining theory, repeated games, and collusion in markets. He received his PhD in Economics from the University of Rochester in 2000.

Robert Wilson is the Adams Distinguished Professor of Management, Emeritus, at the Stanford Business School, where he has been on the faculty since 1964. His research and teaching are on market design, pricing, negotiation, and related topics concerning industrial organization and information economics. He has been a major contributor to auction designs and competitive bidding strategies in several industries.

2 Introduction

The auction of 700 MHz spectrum is a critical event for the future of wireless services in America. This low-frequency spectrum is scarce and allows much better propagation than the less scarce higher-frequency spectrum. It enables better coverage at lower cost, especially outside metropolitan areas. These superior physical properties translate into economic considerations—this spectrum will play a crucial role in shaping the industry and its products and prices for decades to come. The spectrum is particularly important for the prospect of new entrants in the market for wireless broadband services.

Since the removal of the spectrum caps in 2003 the commercial mobile radio industry in the United States has steadily consolidated. Currently, two firms account for 53% of all industry revenue, and four firms account for 90%.² According to the Department of Justice's common measure of market concentration, the wireless market is highly concentrated. Additionally, the two leading firms, AT&T and Verizon, each have even greater wireless shares in their home wireline markets. Moreover, these two firms offer the broadest coverage for wireless, which allows them to earn much higher revenue per customer than other firms. Verizon and AT&T have the great advantage of owning spectrum derived from the original cellular grants in the early 80s, which like the 700 MHz spectrum, came from UHF channels. The long wavelengths, relative to PCS or AWS spectrum, lead to unique coverage advantages over their competition. That advantage can be reduced if entry of a new firm in the 700 MHz spectrum is allowed, but it will get reinforced otherwise. Finally, these two firms are in a unique position to offer triple-play and quad-play services (wireless service, broadband via DSL or fiber, wireline phone, and video). Since the wireless spectrum can be used to provide competition in the broadband market and in mobile video, the acquisition of the 700MHz spectrum by these two firms will prevent increased competition not only in the wireless telephone market but also in these two interrelated markets.

Coverage, or easy roaming, is an important feature of wireless service. In order to couple coverage/roaming with local service, any firm that wants to compete effectively with Verizon and AT&T either must build a nationwide network or acquire at wholesale the use of such a network. But this auction is the only major auction of low-frequency spectrum suitable for constructing coverage networks at low cost. AT&T and Verizon therefore have substantial incentives to acquire the 700 MHz spectrum, even if they have little intention to build on it for years to come, since winning the spectrum would deny this competitive advantage to rivals. These firms also have an incentive not to offer voice and data roaming service at competitive wholesale rates. Denying voice or data roaming or charging high prices for such roaming exploits Verizon and AT&T's competitive advantage, raising retail prices at the expense of consumers and efficiency.

Given the concentrated market structure, the participants in the auction for new spectrum have different economic incentives depending on whether they are new entrants or existing incumbents. An entrant that wins a license wants to operate so as to maximize the value of the license. In contrast, an incumbent bidding for a new license takes into account that new entrants can attract customers from its existing business and thereby jeopardize its profits and diminish the scarcity rents from its current licenses. As a result an incumbent is not neutral about how the

² This consolidation trend is continuing as seen by the recent acquisitions by AT&T and Verizon of Dobson and Rural Cellular, and the proposed acquisition of Aloha.

spectrum is allocated and used, even if it does not win a new license itself. This is a major difference from auctions where all players start on equal footing. We argue that the dominant low-frequency incumbents' incentives to protect current profits are large, and could undermine the efficiency of the auction outcome. In particular, this distortion leads incumbents to value the new licenses more than the true economic value to society and thus is likely to lead to a misallocation of the scarce spectrum.

Action now by the FCC and/or the Antitrust Division can break the current spectrum gridlock and begin a new phase of rapid innovation in the wireless industry as well as increased competition in the wireless, broadband, and video industries. The essential ingredient is sustaining market conditions favorable to new entry and intensified competition, which can most easily occur through ensuring that multiple national competitors have access to nationwide low frequency spectrum.

3 Auctions with incumbents bidding against entrants favor incumbents

Auctions are often assumed to be the most efficient way of distributing scarce inputs. Where market power is present, however, an open auction that treats incumbents and potential new entrants symmetrically, will often produce outcomes that are inefficient and have anti-competitive consequences for post-auction markets. Suppose that an incumbent monopolist already has one license, and now a second license is to be sold in an auction. Assume that a new entrant has greater economic value for the second license than the incumbent does. This is often the case, since an operator's value for additional spectrum typically falls with each additional increment. However, the incumbent enjoys monopoly rents that it wants to retain. Under nearly any economic model, entry would reduce monopoly rents and hence the monopolist's profit. The incumbent's license valuation is its economic value *plus* the foreclosure value (which is the loss of incumbent's monopoly rents were an entrant to win that license)—that is, the incumbent's valuation includes the value of deterring entry.

Under these assumptions, the incumbent monopolist will win the license (thereby blocking entry), even though the new entrant is more efficient, whenever the entrant's efficiency advantage is less than the incumbent's loss of monopoly rents were it to fail to deter entry. The greater are the monopoly rents, and hence the worse the monopoly problem is, the more likely it is that the incumbent wins.

The analysis above can be easily extended to more than one incumbent and the incumbents splitting the available licenses to deter entry. Indeed, in this more common case, we have seen many instances in spectrum auctions both in the US and elsewhere where the auction outcome is difficult to explain absent foreclosure incentives of incumbents. For example, in Auction 35, Verizon, Cingular and AT&T all bid for the three 10-MHz licenses that were for sale in January 2001. Verizon and AT&T already had spectrum in New York City, but Cingular had none. Verizon won two of the three licenses, and AT&T won the third, bidding over \$2 billion per license (\$11.40/MHz-pop), thereby excluding Cingular from New York City. The 1999 German spectrum auction provides another example.³

³ See for example, Grimm, Riedel and Wolfstetter (2003), "Low price equilibrium in multi-unit auctions: the GSM spectrum auction in Germany," *International Journal of Industrial Organization*, 21, 1557-1569.

A more recent example is AT&T's recent agreement to purchase 700 MHz spectrum from Aloha. This spectrum would have been valuable to new entrants, but AT&T was willing to pay more, possibly in an effort to frustrate the acquisition of such valuable spectrum by a new competitive force.

This is the great deficiency of an unrestricted auction when incumbents have rents to protect. Symmetric auctions among asymmetric bidders are prone to inefficient outcomes because the interests of consumers are not directly represented in the auction—the responsibility to promote consumers' interests resides with the FCC and the Division when they consider the rules of the auction and the awarding of licenses in the public interest. Both those decisions will inevitably shape the structure of the industry far into the future.

4 The wireless industry is vulnerable to inadequate competition

In this section, we outline the current market structure of the wireless industry and explain why, absent Division (or FCC) action, continuation of that structure will inhibit the development of new products and services and cause consumers to pay higher prices.

4.1 The market for wireless services is highly concentrated

Beginning in 1995, consumers enjoyed the remarkable benefits of competition in the wireless services market. Consumers benefited from both lower prices and improved services as a result of new entry into the wireless market. The new entry was a direct response to FCC policies that made spectrum available to entities other than the low-frequency incumbent providers. Demand expanded in terms of both subscribers and minutes.

However, changes in the market led to the demise of regional operators. Over time, customers have expressed strong preferences for nationwide service, absent exorbitant roaming charges. As a result, even large and formerly strong regional carriers such as US West and Bell South were forced into mergers that resulted in six nationwide carriers. Aside from some niche operators, nationwide service now appears to be an essential service in mobile telephony. In 2006, vertically-integrated, nationwide operators provided 90% of the retail wireless market, as shown in Table 1.

Table 1. Wireless market share by year

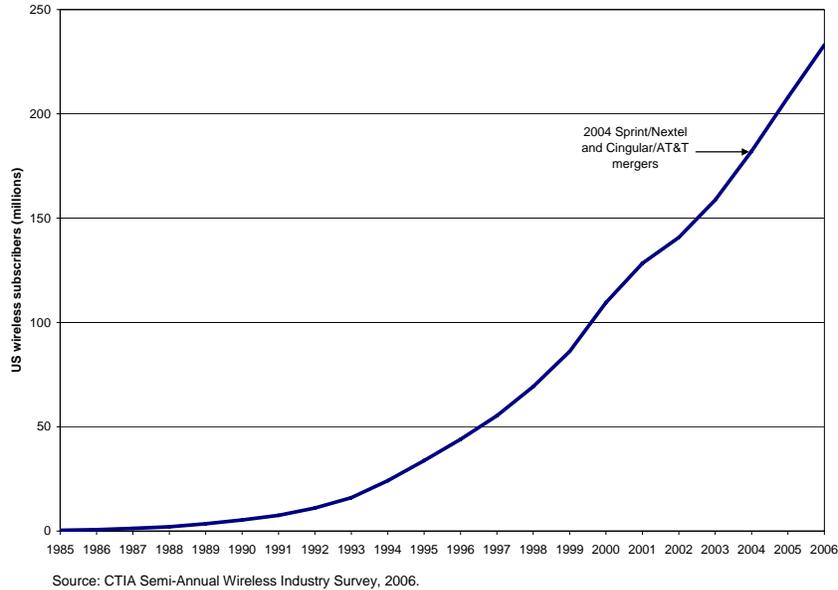
Carrier	Market share by year (%)				
	2002	2003	2004	2005	2006
Verizon	23	23	28	25	26
Cingular	18	16	29	27	27
AT&T	19	18			
Sprint	14	13	13	25	25
Nextel	11	11	7		
T-Mobile	6	8	10	12	12
Others	8	10	15	11	10
Total	100	100	100	100	100

Note: Totals do not sum due to rounding.

Source: Merrill Lynch "Global Wireless Matrix 4Q06," pg. 178.

The initial consolidation of local and regional licensees into nationwide providers was followed by a second wave of mergers among the larger providers. First, Cingular merged with AT&T Wireless in October 2004, and then Nextel merged with Sprint in December 2004. The industry now has only four nationwide operators: AT&T, Verizon, Sprint, and T-Mobile. Consolidation often occurs in industries, but typically in *declining* industries where there are not enough customers for existing firms to maintain efficient scale. Shakeouts also do occur in new industries in which demand is growing. Nonetheless, we are concerned that this consolidation occurred at a time of tremendous growth, as shown in Figure 1.

Figure 1. Consolidation at a time of rapid growth

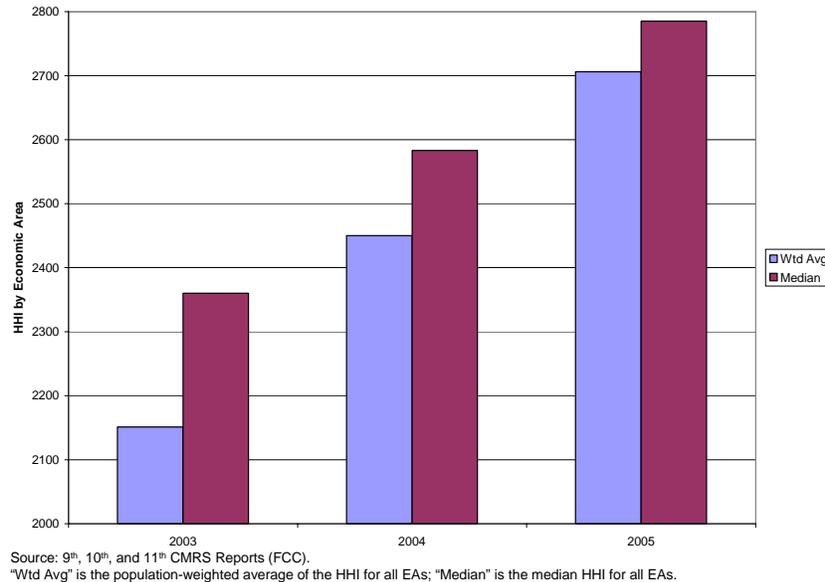


The most widely used measure of market concentration is the Herfindahl-Hirschman Index, HHI.⁴ HHI in the wireless services industry at the end of 2005 was over 2,700.⁵ By this measure, the wireless services market is highly concentrated. Figure 2 shows how market concentration has increased steadily in the last three years.

⁴ The U.S. Department of Justice, for example, uses the HHI for evaluating mergers. A market with an HHI less than 1,000 is considered to be competitive, one with an HHI between 1,000 and 1,800 is considered to be moderately concentrated, and one with an HHI of 1,800 or greater is considered to be highly concentrated. To compute the HHI, one sums the squares of the sellers' market shares. The HHI can range from a minimum of close to 0 to a maximum of 10,000. An HHI approaching zero would indicate near-perfect competition, with many thousands of sellers with negligible market shares. An HHI of 10,000 indicates the existence of a single firm with 100% market share.

⁵ HHI is from the FCC's 11th CMRS Report, September 2006.

Figure 2. The wireless market has become more concentrated



Together, Verizon and AT&T have:⁶

- 52% of the subscribers and 53% of the revenues as of December 2006,
- two-thirds of the net subscriber additions in the fourth-quarter of 2006, and
- a unique ability to directly offer a “quad-play” bundle (wireline, wireless, TV, and broadband), creating threats to competition in these related industries

An important element of their dominance is the competitive advantage derived from being the only nationwide carriers whose primary networks use low-frequency spectrum. We expect Verizon and AT&T to compete vigorously in the auction for at least part of the 700 MHz spectrum in order to preserve and strengthen this competitive advantage, even if consumers would benefit much more from a new entry.

Although our discussion focuses on the decrease in competition for the final consumer, it is important to notice a related lack of competition in the voice and data roaming services. The four nationwide operators all provide similar vertically integrated wireless services, combining both wholesale and retail. AT&T and T-Mobile use the GSM standard; Verizon and Sprint use the CDMA standard. Often there are only two providers in a given area that are true head-to-head competitors for services such as voice and data roaming, and in some areas roaming is available only from a single party. Customer demand for nationwide coverage combined with the weak competition in the roaming market puts firms without a nationwide footprint at a great disadvantage vis a vis the incumbents. For this reason the C and D Blocks are especially crucial for increasing competition in the wireless market.

Our fear, which is grounded in both economic theory and empirical analysis, is that this pattern of consolidation will lead to higher prices, poorer service, and reduced innovation.⁷ Our

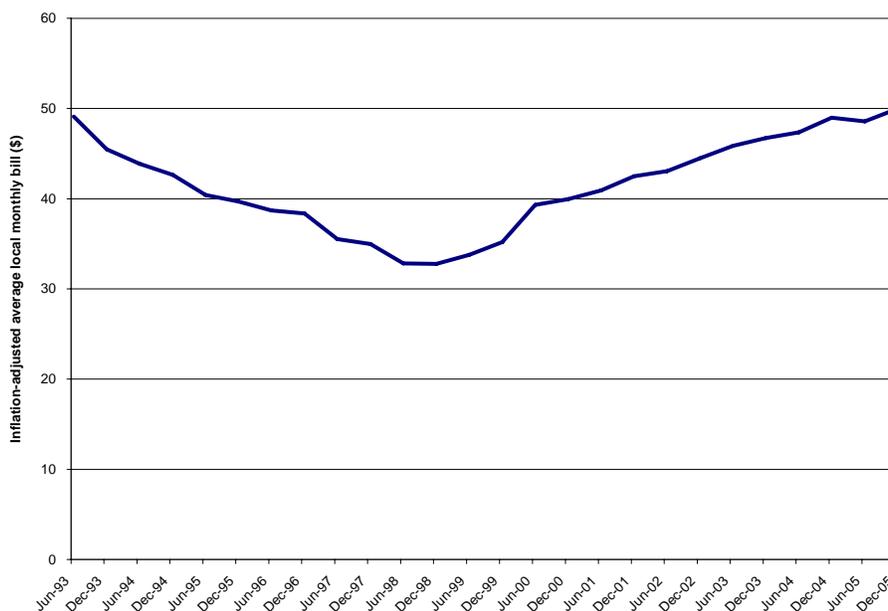
⁶ Data from Merrill Lynch, “Global Wireless Matrix 4Q06,” 28 March 2007 at 177-178.

⁷ See for example, William J. Baumol, *The Free-Market Innovation Machine: Analyzing the Growth Miracle of Capitalism*, Princeton University Press, 2002.

apprehension is well-founded. Dominant operators, such as Verizon, have taken actions such as disabling valuable phone features on their phones. Such behavior is a common problem in monopolistic or oligopolistic markets, but can be driven out by competition. Other carriers have also disabled phone features that consumers value. The motive is to sell “value added” services to the consumers who are less price-sensitive. If they were not disabled, these features could enable customers to avoid paying extra for certain “value added services.” For example, a customer could directly download songs to her phone over Bluetooth, rather than downloading it over the Verizon network. Verizon apparently finds it profitable to engage in such practices despite the fact that disabling features annoys some customers and outrages others.

Consumer monthly bills for wireless services also suggest weak competition. As shown in Figure 3, the inflation-adjusted monthly bill initially fell, but since 1999, consumers’ monthly bills have been increasing. Even though the cost per minute continued to decline, we argue that these average monthly bills are a better price-based measure of competition, since the costs of providing wireless service to a customer are mostly fixed.

Figure 3. Wireless monthly bills initially fell but now are rising



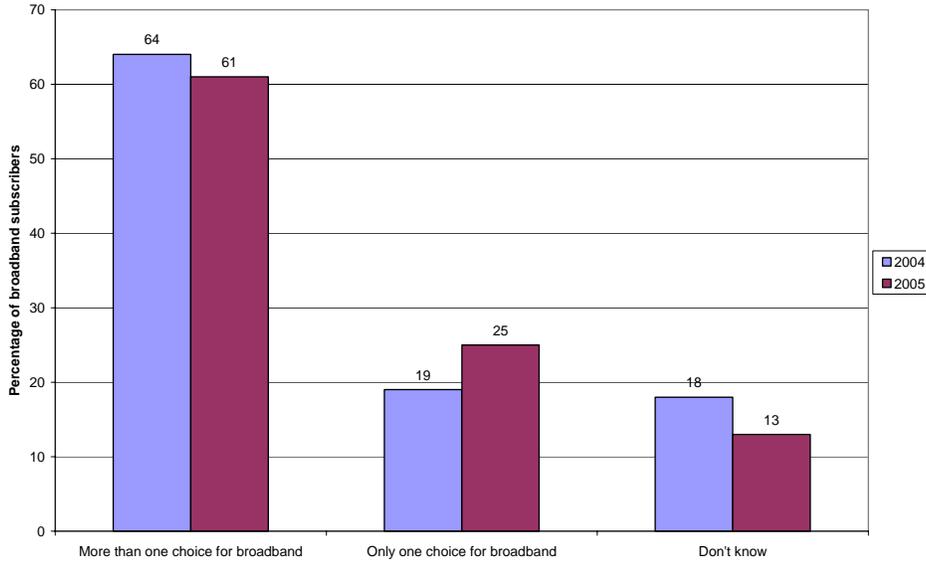
Source: CTIA report, pg 200 (table 105). CPI data from BLS, Dec 2005 dollars.

4.2 The market for broadband is highly concentrated

The related broadband market is even more highly concentrated than the market for wireless services. Most customers have only two choices for residential broadband access: the phone company or the cable company. Thus, it is not surprising that more than 93% of Americans buy broadband from either the phone or cable company.⁸ In 2005, one quarter had only a single choice, as shown in Figure 4. And some have no choice at all—broadband is simply not available.

⁸ Federal Communications Commission, “High-Speed Services for Internet Access: Status as of December 31, 2006,” Table 6. Released, October 2007.

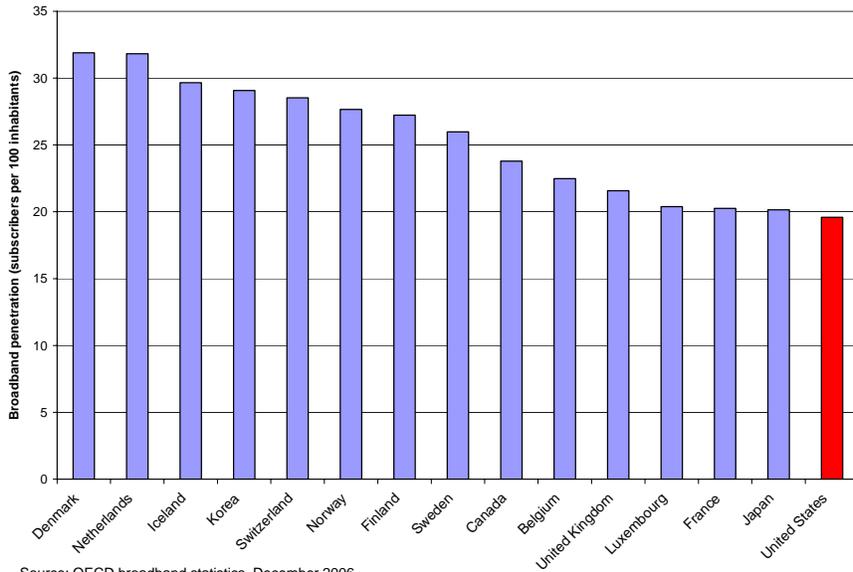
Figure 4. One quarter of broadband subscribers have only one choice



Source: "Home Broadband Adoption 2006," Pew Internet and the American Life Project, pgs. 7-8.

Like wireless service, broadband service has experienced rapid growth that is sure to continue. Despite the growth, broadband penetration in the U.S. lags behind many other countries as shown in Figure 5. Some of the wireless carriers have responded to this growth with broadband wireless services. However, the coverage is often quite limited, especially for true broadband speeds.

Figure 5. Many countries have greater broadband penetration than the U.S.



Source: OECD broadband statistics, December 2006.

The FCC recognizes the importance of having a *third pipe for broadband*. For example, Chairman Kevin J. Martin states:

“In much of the country, however, consumers have a choice of only two broadband services: cable or DSL. And in some parts of the country, consumers don’t even have that choice. The

most important step we can take to provide affordable broadband to all Americans is to facilitate the deployment of a third ‘pipe’ into the home. We need a real third broadband competitor. And we need a technology that is cost-effective to deploy not just in the big cities, but in the rural areas, as well. All Americans should enjoy the benefits of broadband competition—availability, high speeds, and low prices.”⁹

Because the two largest vertically-integrated wireless providers (AT&T and Verizon) are also wireline telephone companies that have made huge investments in DSL service, the current industry structure is not conducive to wireless becoming a third, independent competitive option for broadband access. Preventing the dominant players from buying both C and D Block licenses in the 700 MHz spectrum auction would, by creating an additional nationwide wireless network, offer an opportunity for increased competition in the broadband services market.¹⁰

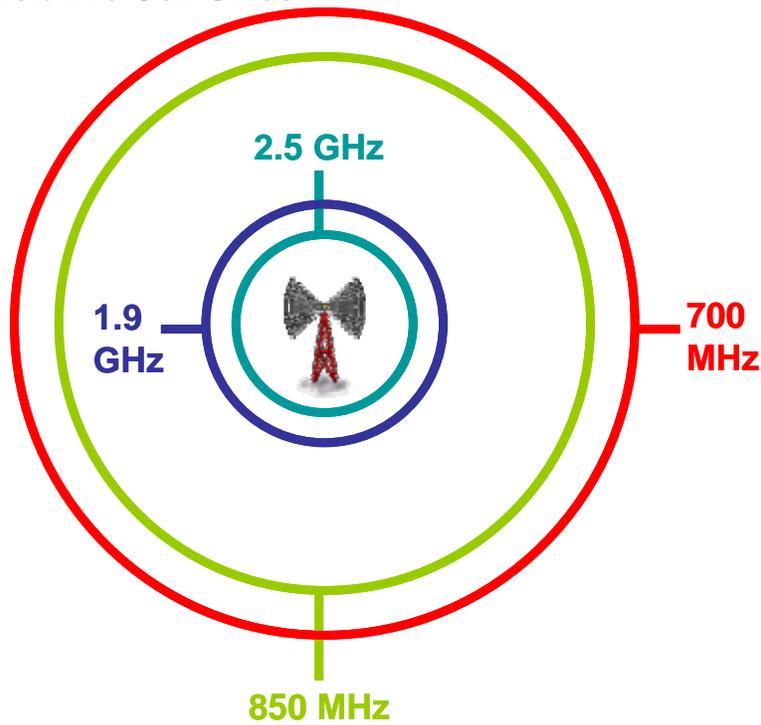
5 The 700 MHz auction provides the best opportunity to promote additional competition

The 700 MHz auction is the last big auction on the horizon and is the only auction ever of large blocks of prized low-frequency spectrum. This spectrum has propagation characteristics that would enable new entrants to compete in network coverage and quality with the cellular incumbents. Figure 6 shows the relative cell sizes of the various bands: BRS/EBS (2.5 GHz), PCS (1.9 GHz), cellular (850 MHz), and the 700 MHz band. BRS/EBS is well-suited to provide enormous capacity in urban markets where small cell-sizes are required. However, for the vast majority of the U.S., the 700 MHz band has a clear advantage in providing economic coverage, requiring approximately one-tenth the number of cell sites for the same coverage as a network built at 2.5 GHz.

⁹ Statement of Chairman Kevin Martin, Report and Order and Further Notice of Proposed Rule Making, FCC 07-72, 27 April 2007.

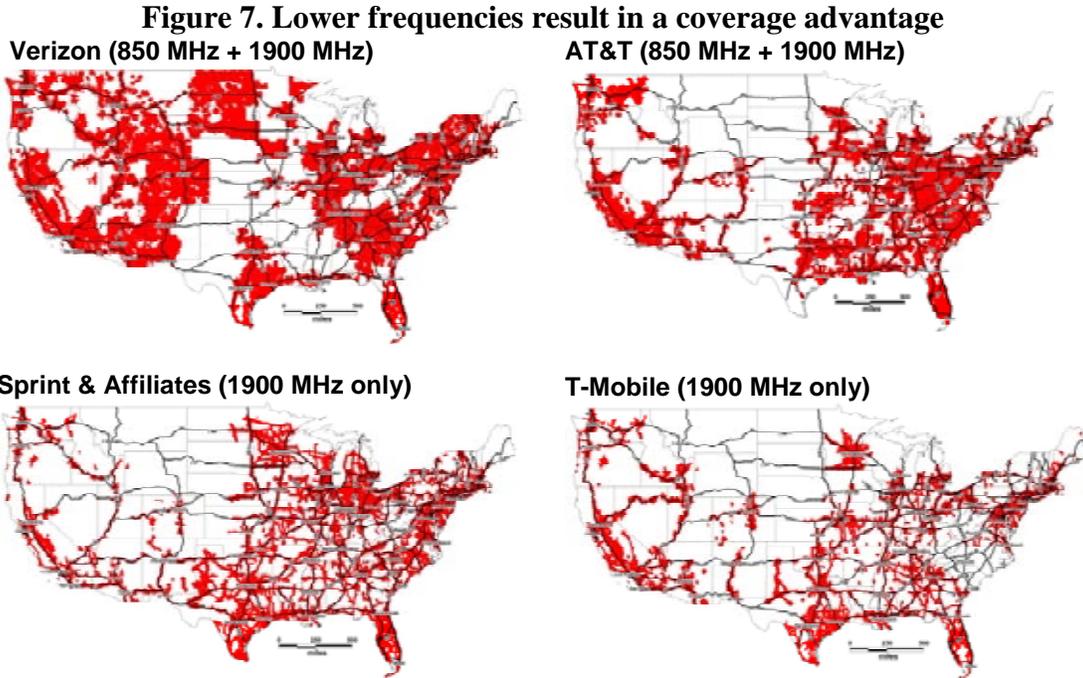
¹⁰ One possible use for the open-access spectrum would be as a complement to other facilities-based networks that would be able to deliver higher speed fixed access and combine with the wireless network to provide ubiquitous coverage. In this way, the C and D Blocks would not necessarily be the third “pipe” but would enable a provider of broadband services to compete effectively as a third pipe against the existing dominant providers, especially for “cord cutting” customers who value mobility.

Figure 6. 700 MHz spectrum has a ten-fold coverage advantage over 2.5 GHz spectrum
Relative Cell Sizes



The coverage advantage of the lower frequency spectrum is seen in the coverage maps of the four nationwide incumbents shown in Figure 7. Given this coverage advantage, it is not surprising that the original two cellular incumbents, Verizon and AT&T, have a dominant position in the wireless market.¹¹

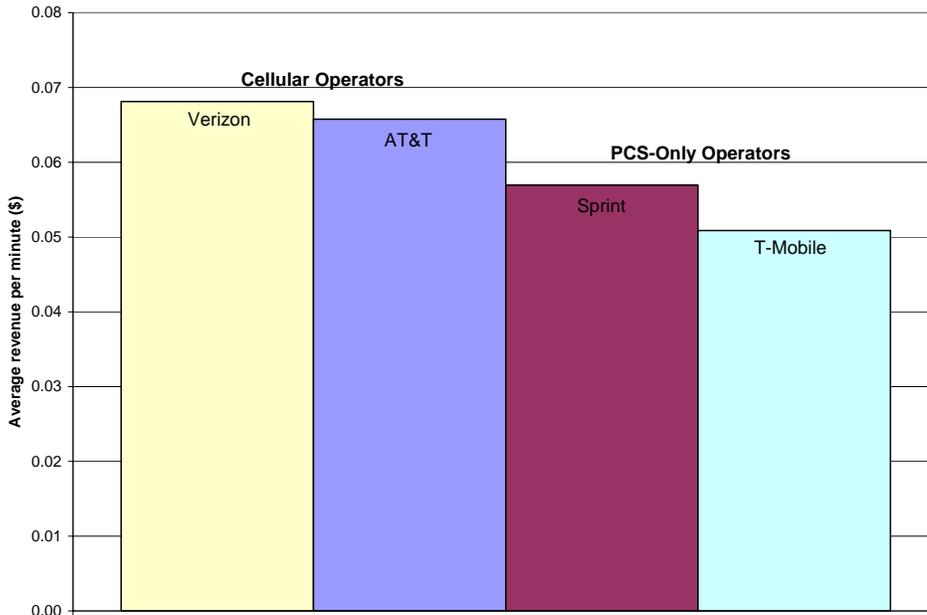
¹¹ Both the Verizon and AT&T networks of today resulted from numerous mergers and acquisitions beginning in the 1980s. Initially, there were two cellular incumbents in each region; today there are virtually two cellular incumbents nationwide.



Source: CoverageRight.

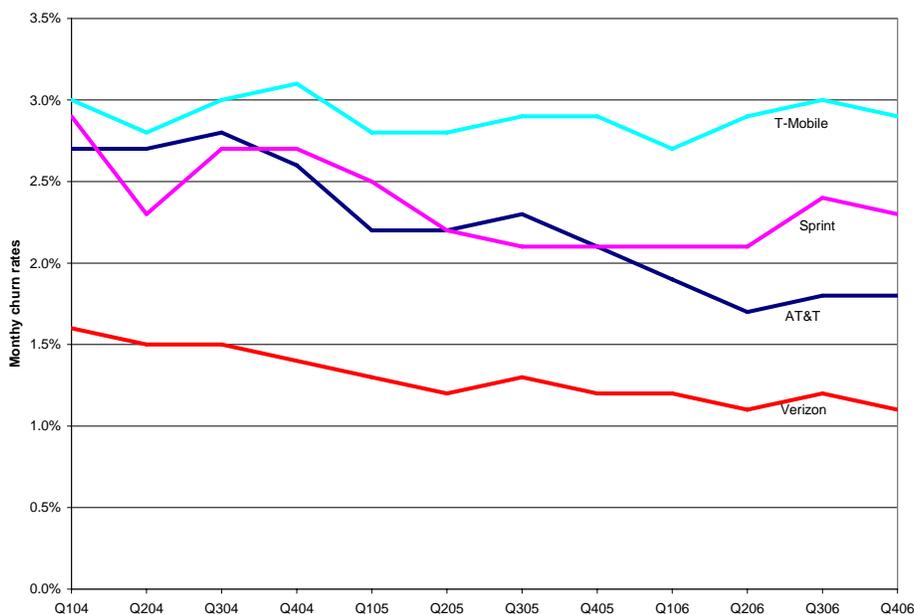
The coverage advantage that Verizon and AT&T enjoy appears to enable them to earn higher per customer revenue than their PCS-only competitors, as shown in Figure 8. It also leads to lower churn, as shown in Figure 9.

Figure 8. 850 MHz Cellular operators charge more than 1900 MHz PCS-only operators



Source: Merrill Lynch US Wireless Matrix, 4th Quarter 2006. pg. 31.

Figure 9. 850 MHz Cellular operators have lower churn rates



Source: Merrill Lynch US Wireless Matrix, 4th Quarter 2006, pg. 31.

6 Antitrust policy should preclude acquisition of additional nationwide low-frequency spectrum by the current operators of nationwide cellular networks

In this section we argue that consumer welfare will be well-served by enhanced competition in the wireless and broadband markets, which can only occur if the existing dominant wireless providers are not allowed to acquire the assets that are necessary for such enhanced competition. Antitrust intervention is only appropriate where market conditions indicate that competitive harm is likely. The markets for wireless and broadband services exhibit those characteristics.

6.1 There are large barriers to entry in the wireless service market

The main barriers to entry in the market for wireless services are currently the limited amount of usable spectrum and the large fixed costs/capital requirements necessary to acquire that spectrum and to deploy the physical infrastructure for wireless transmission.

By making more spectrum available, the FCC reduces the first barrier to entry. Initially, the FCC made two cellular licenses available in each geographic area. In 1995, the FCC added the broadband PCS spectrum, making it possible for up to seven new large competitors to enter each market. In order to ensure that the incumbent cellular providers would not act on their incentives to frustrate new entry and forestall competition, the FCC set out “spectrum caps” for the auction. The caps were designed specifically to promote new entry by multiple providers in every single geographic area in the country while ensuring that they had sufficient spectrum to pursue efficient business plans.

One may perceive that a lot of spectrum has been sold already and hence the availability of spectrum is not an important impediment to entry. That is wrong. First, as shown in Section 5, the costs of developing a network on the less-scarce high-frequency spectrum are much higher than on the scarce low-frequency spectrum. Second, the prices of spectrum in recent auctions

show that even the high-frequency spectrum is highly valuable because of its scarcity—the high auction prices in the AWS auction reflect in part the weakness of competition in the wireless market.

Barriers to entry have become more daunting as wireless has become a nationwide service. Unfortunately, if the same rules previously used to sell spectrum are used in the upcoming auction, the nationwide nature of the product will make it especially easy for the dominant low-frequency incumbents to prevent entry.

Without voice or data roaming, a new entrant must aggregate the footprint of a nationwide license and it must amass capital to build a nationwide network; otherwise, it must contract with a nationwide incumbent for expensive roaming or accept affiliation, or be limited to a local niche product. The fundamental fact is that, without acquiring low-frequency spectrum, entry into provision of retail services is blocked by the proprietary networks held by the nationwide incumbents in a concentrated industry.

6.2 New entry will lower prices through competition and increase innovation

In addition to a concentrated market and high barriers to entry, antitrust policy should only be invoked where consumers will benefit as a result. The introduction of one or more additional nationwide wireless networks would almost certainly result in significant competitive benefits. In fact, retail consumers will be the ultimate beneficiaries of new entry. First, intensified competition lowers prices. Indeed, this price pressure is the main reason for the incumbents' incentives to prevent the development of an open-access network. Second, increased price competition provides additional incentives to find cost-saving solutions both in network operation and in provision of network services, leading to additional price decreases at the retail level. As experience has shown in many industries, the threat of losing customers to competitors provides strong incentives to innovate, and it encourages firms to reduce costs, develop higher quality products, and introduce a wider variety of products and services.¹²

6.3 New entry creates additional competition for broadband

Finally, intensified competition in wireless services will impact the related market for broadband services, leading to similar benefits in that market, which is an area of concern for both the Antitrust Division and the FCC. Voice transmission has already shifted substantially to mobile devices. Broadband will likely follow this path too—mobile wireless broadband is likely to grow. Hence the proposal to promote new entry must be considered also in terms of its benefits for the broadband market and the services it provides.

Although a mobile broadband connection may not have as high capacity as a fixed-line connection, the advantage of mobility may make it a viable substitute for fixed-line broadband usage, just as mobile voice has substituted for fixed-line voice usage. Even if a wireless connection is slower than a fixed-line connection, mobility may offer enough value for users to be interested in using it together with, or instead of, the wired connection. Many customers are switching to mobile voice service (to complement or substitute fixed-line service) despite the

¹² See for example, N. Economides, K. Seim, and B. Viard, “Quantifying the Benefits of Entry into Local Phone Service.” Working Paper, Stanford University, August 2006.

superior quality of fixed-line voice service.¹³ One expects the same to happen in part of the mobile IP data market. That is, even though slower than fixed-line broadband, the wireless product can provide substantial value to some customers.

As we noted above, competition in broadband is quite limited. Competition will be improved if the FCC creates multiple “pipes” into homes, as well as portable ones. Moreover, the 700 MHz spectrum allows for better coverage, creating for some customers their first broadband connection. By providing another alternative to fixed-line broadband, we anticipate that mobile offerings will introduce more price competition to the market for broadband services.

7 Conclusion

Since 1994 two factors have thwarted the efforts to sustain competition in the wireless industry. One is the unanticipated importance of roaming, and more generally, the value to customers of nationwide coverage. The second is the consolidation of the bulk of the original cellular licenses into just two nationwide networks (Verizon and AT&T) operating over the favorable lower-frequency spectrum. Moreover, Verizon and AT&T combine these wireless networks with nearly complete telecom packages that include wireline and broadband. The basic ingredients for a permanent oligopoly are now in place. Unfavorable consequences for consumers are developing: increasing prices, weak competition, and lagging innovation.

Now is the crucial moment for the Division to reassert its commitment to a competitive wireless industry. If the two dominant wireless providers are able to monopolize the last low-frequency spectrum potentially available for many years then their entrenched positions will be impregnable.

The 700 MHz auction is the last chance for many years to sustain competitive pressure in the wireless industry. The next phase could be a continuing struggle to rein in the predictable excesses of an entrenched oligopoly.

¹³ See CTIA, *Semi-Annual Wireless Industry Survey*, p. 10. At the end of 2006, there were 1.8 trillion wireless minutes with annual growth of over 20%.