Regulation in financial translation

The FCC’s Fifteenth Mobile Wireless Competition Report:

Innovation, investment, growth and competition

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The FCC has issued its Fifteenth Mobile Wireless Competition Report (Report) to Congress. Like last year’s report, this Report provides a tremendous amount of information from a broad range of sources about the mobile wireless industry, both traditional and broadband. Also like last year’s report, it does not reach a conclusion about effective competition: “The Fifteenth Report makes no formal finding as to whether there is, or is not, effective competition in the industry. Rather, given the complexity of the various inter-related segments and services within the mobile wireless ecosystem, the Report focuses on presenting the best data available on competition throughout this sector of the economy and highlighting several key trends in the mobile wireless industry.” Indeed, the Report is so encyclopedic, that it is only possible in this paper to focus on a few of its key points. [All citations in this paper are to the Report itself, unless otherwise noted; the quote is from ¶2 of the Executive Summary on page 5.]

Despite the lack of a conclusion about competition, the Report does present a very positive view of the mobile wireless industry, showing that it benefits both the U.S. economy and individual consumers. The Report shows that despite the maturity reflected in very high penetration rates, mobile wireless continues to grow because the industry continues to invest in and innovate at the network level. That core infrastructure, in turn, supports innovation in edge devices and applications that attract consumers. While the level of competition varies between urban and rural areas, almost all U.S. consumers have a choice among several network providers, among a variety of technologies and service-pricing plans, as well as among many devices and a huge range of applications. Indeed, it is obvious from an analysis of the data in the Report regarding competition, that competition is limited only in some of the lowest density areas, which is to be expected given the high cost and low revenue opportunities they offer.

The Report also discusses industry flaws and challenges. The FCC’s priority is ensuring that consumers are well-served, and the Report points out areas like bill shock and early termination fees (ETFs) that have caused concern but are being resolved as the FCC and industry work together. The most significant industry challenge on which the Report spends a great deal of time is the constraint on innovation and growth that is presented by the finite nature of spectrum, a limited resource that can only be stretched so far, despite a variety of expensive efforts to pack more traffic into less spectrum via compression, cell-splitting, distributed antenna systems (DAS), femtocells, and other means.
Summary and analysis of the Report:

Contribution to the economy:
The Report points out that the wireless industry is important to the economy, to jobs, and to innovation, concluding that: “Overall, mobile wireless broadband is fast becoming a key platform for innovation, especially innovations in areas key to the vitality of the United States.” [¶237]

In 2009, the mobile wireless ecosystem comprised 21.8% of the U.S. information and communications technology (ICT) industry, up from 19.9% in 2008. It grew 3.3% from 2008 to 2009 while the ICT industry as a whole declined 5.7%. It invested heavily in Research and Development (R&D), spending approximately 2% of revenues in 2008. Capital investment in recent years has ranged from 13% to 15% of revenues. The wireless industry helped sustain advertising revenues in 2009, with industry spending of $3.4 billion, rising from 6th to 5th place in Nielsen’s rankings. [pages 13 and 17, ¶237, chart 29, ¶130]

- **Jobs:** The wireless industry employed 249,247 workers directly as of the end of 2009, up from 184,449 at the end of 2000, for a job-growth rate of 4% per year. That figure grew again in 2010, to 250,393. Its indirect impact is even greater. The Report notes that according to CTIA, approximately 2.4 million workers overall were directly and indirectly dependent on the industry at the end of 2009. [¶235, CTIA Annualized Wireless Industry Survey Results – December 1985 to December 2010 (hereafter cited as CTIA 1985-2010)]

- **Growth:** The wireless industry grew revenues at an average annual rate of 21.2% from 2000 to 2009, growing from $52.5 billion to $152.6 billion in that timeframe. Revenues grew another 4.8% in 2010 to $159.9 billion. [¶235, CTIA 1985-2010]
  - Industry revenues grew from $65.3 billion in 2001 to $159.9 billion in 2010, up a total of 145% in the period. Growth slowed in 2008 to 2009 to 3%, but reaccelerated from 2009 to 2010 to 4.7%. [CTIA 1985-2010]
  - Average local revenue per month per user over that period was essentially flat, from $47.37 in 2001 to $47.21 in 2010, representing sharp decline in revenue per minute offset by a sharp increase in voice and data usage. Aggregate data revenues over that time frame grew from about $1 billion to $50.1 billion. Thus, revenue growth resulted from two factors: (1) subscriber growth, with subscribers over that period growing 136% from 128.4 million to 302.9 million and (2) growth of data traffic that created data revenues that helped offset sharply declining voice pricing. [CTIA 1985-2010, and CTIA Wireless Quick Facts]
  - Some of the fastest growth has been on the data side. Data-capable devices grew by 28.6 million, from the already high base of 228.4 million in 2008 to 257 million in 2009 [chart 7].

- **Investment:** Capital spending (capex) in 2009 by the wireless industry constituted 31% of the capex of the total telecommunications industry, 24% of the ICT sector’s, and 2% of total capex in the U.S. economy. According to CTIA, cumulative capex by the wireless industry was $310 billion from 1985 to 2010. [¶208, CTIA 1985-2010]
The annual amount varies somewhat, reflecting subscriber and traffic growth as well as upgrade cycles. In 2008 and 2009 capex was slightly over $20 billion, while in 2010 it climbed again to $24.9 billion, close to the previous peak in 2005. Capex as a percentage of revenues has declined as revenues have grown, and has been at 13-16% during 2007 to 2010, down from a peak of 20-22% in 2005. On a per average subscriber basis, capex in 2009 was $73.24, down slightly from 2008’s $76.73 and down sharply from the 2005 level of $129.38. [table 23, data from and calculations based on CTIA 1985-2010, chart 29, chart 28]

But the more meaningful measures are capex per incremental dollar of revenue and per incremental connection. Capex per incremental connections in 2010 was $1446, up from 2005’s $980. At the same time, revenue per incremental connection was down from $443 to $429 per year. As a result, capex per incremental dollar of revenue in 2010 was $3.37 up from 2005’s $2.21, i.e. up 53%. [data from and calculations based on CTIA 1985-2010]

Innovation: As we describe in more detail below, capital investment ensures both extensive coverage and continual upgrade of the infrastructure. The industry is currently in the process of upgrading to fourth-generation (4G) technologies that greatly expand capacity, to enable consumers to enjoy more bandwidth-hungry applications. As WiMAX, HSPA+, and LTE are rolling out, they create the potential for new devices and new applications. Those, in turn, will create demand for greater bandwidth, i.e. ever more and higher quality network capacity. [table 11]

Economic impact: The Report cites several studies that explain how the wireless industry contributes to the economy overall:

Pearce and Pagano’s 2009 study estimates that “a $17.4 billion investment in wireless broadband investments would generate a direct increase in GDP of 0.23%–0.30%, and an indirect increase in GDP of 0.65% - 0.98% over a two-year period.” [footnote 679 to ¶231]

“One study, which analyzes 21 OECD countries over the period 1970-1990, finds a positive causal relationship between telecommunications infrastructure and aggregate output. The authors find that the impact of increased investment in telecommunications infrastructure is a 0.6 percent increase in GDP, about a third of the average annual growth rate in industrialized nations.” The study talks about the impact of reduced transaction costs and increased efficiency throughout the economy, and the “significant direct effects on complementary industries such as input suppliers, handset manufacturers, operating system providers, and application developers.” [¶230 citing Roeller and Waverman]

Another cited study, by Entner, indicates that “the wireless telecommunications industry provided $100 billion in ‘value-added’ contributions to U.S.GDP in 2007, and going forward, productivity gains from wireless broadband services could generate as much as $860 billion over the period 2005-2016.” Entner’s study talks about various ways wireless can contribute to better industrial processes and increase efficiency. [¶236]

The Report discusses specific seemingly unaffiliated industries that benefit greatly from wireless connectivity: public safety, health care, energy and environmental applications, education, online entrepreneurial activities, mobile commerce. Mobile commerce is just emerging but is expected to grow quickly. While the impact on the other industries is not
quantified, that on mobile commerce is, with an estimate that a 2009 spending range from $500 million to $1.3 billion is expected to rise to $12 billion in 2013. One factor leading to rapid acceleration is the popularity of smartphones: “Data from comScore suggest that the increasing prevalence of smartphones may correspond to a growth in mobile shopping, as 10 percent of smartphones and 12 percent of iPhones have been used to access online retail sites, compared to only one percent of traditional handsets.” [¶231-234, ¶357, ¶359]

**Mobile wireless penetration, coverage, and choices:**

Mobile wireless is extremely popular, with 92% of adults subscribing. While there are still significant demographic variations in the uptake of mobile broadband and its various applications, mobile wireless voice has penetrated all age groups almost completely. Mobile wireless subscriptions continue to grow despite this high penetration of the U.S. population (POPs), because of the appeal of new services and devices.

- Different sources count connections somewhat differently, but by all counts growth is continuing despite a high penetration rate. Based on NRUF, connected devices rose from 128.5 million to 290.7 million from 2001 to 2009, while CTIA shows growth from 128.4 to 285.6 million subscriber connections in the same period. Based on the FCC’s Form 477 data, there were 274.3 million mobile telephone subscriptions in 2009. Growth has continued even through the recent tough economy, with NRUF showing 11.1 million new connected devices, CTIA showing 15.3 million new subscriber connections, and the FCC’s Form 477 showing an increase of 13 million in 2009. What makes the growth particularly remarkable is the already high penetration rate of 91% in 2008, which rose to 94% in 2009. CTIA data for year-end 2010 shows 302.9 million connections, a further increase of 17.2 million connections in 2010. [table 14, footnote 488, and chart 7, CTIA 1985-2010]

- Mobile wireless is penetrating all age groups, with an average penetration of 92%, a range of 90% to 96% among all groups under age 64 and 89% penetration among those over age 65. There is more variation among smartphone subscribers, however, with penetration peaking at 28% in the group aged 25-34, and lowest above age 55. Pew data on wireless Internet use by age confirms its popularity as well as the inverse correlation of usage to age. According to Pew Surveys, 84% of those aged 18-29 use wireless Internet, via a laptop or cell phone or both, 69% of those aged 30-49 do so, 49% of those aged 50-64 do so, and only 20% of those aged 65 or older do so [charts 13, 14, 15 and table 15].

- Mobile wireless Internet access subscriptions in 2009 rose to 115.7 million from 86 million in 2008, and devices capable of 200 kbps or more rose to 55.8 million in 2009 from 26.5 million in 2008 [charts 6 and 7].

- At the end of 2009, smartphones numbered 49.8 million and wireless laptops, aircards, and modems numbered 11.9 million [chart 7].
• A different cut was provided by a series of surveys of early adopters, which shows that smartphone adoption by early adopters has increased from 15% in October 2006 to 42% in December 2009 [chart 8].
  
  o According to Pew surveys, the most popular mobile data application is taking a picture, with 76% of cell phone users doing so as of May 2010. Texting was second, with 72% doing as of May 2010. Other data apps used as of May 2010 are: Instant messaging at 30%, play music at 33%, playing a game at 34%, email at 34%, record a video at 34%, and Web access at 38%. [table 38, chart 9]

• Coverage is extensive. Choices among competing providers are available to subscribers almost everywhere, for both traditional mobile wireless and for mobile broadband wireless:
  
  o Mobile wireless covers 99.8% of the U.S. population and 99.2% of Americans have access to at least two wireless providers, 94.3% have access to at least four, while 89.6% have access to five or more and 76.4% have access to six or more. [table 5]

  o Competition exists in most cellular market areas (CMAs). 97.2% of the population in 91.1% of CMAs can choose among three or more providers. [tables 5, 8]

  o Mobile wireless has also become a substitute for wireline telephony, with 24.9% of adults and 29% of children living in households that have cut the cord. [chart 47]

  o Mobile broadband covers 98.5% of the U.S. population, again with multiple competing providers available to most consumers: 91.9% have two or more, 81.7% have three or more, and 67.8% have four or more. [table 7]

  ▪ The definition of broadband in this Report is 3G and 4G technologies, running at least 200 kbps in one direction, rather than the 4 mbps down/1 mbps up (4/1) definition used in the FCC’s recent Seventh Broadband Progress Report and Order (706 Report) and its Rural Broadband Report. However, actual speeds are between the two.

  ▪ As of June 10th, PC Magazine’s test showed a range of speeds from .94/.34 mbps to 2.11/.4 mbps. A PC World test showed a range of speeds from 1.4/.77 to .877/.43 on laptops and 1.26/.22 to .72/.13 on smartphones. With HSPA+ and LTE rollouts in 2011 to 2013, speeds should become much higher.

• Consumers can choose among providers, technologies and payment plans:
  
  o Consumers have a choice of providers essentially regardless of income. There are 6.1 mobile wireless providers at median household income under $50,000 and 6.4 providers at all levels of income above $50,000. There are 3.3 mobile broadband providers at median household income under $50,000 and 3.7 at all levels above. [chart 5]
- As of mid-2010, consumers also have a choice of technologies, with 99.2% of POPs covered by CDMA, 99% covered by GSM/TDMA, and 90.7% covered by iDEN, for a total digital 2.5 G coverage of 99.8%. EV-DO/EV-DO rev A coverage is 98.3% and WCDMA/HSPA is 79.8%, and mobile WiMAX is 17.7% for an overall 98.5% coverage by 3G/4G [tables 12, 13].

- Consumers have a choice of payment plans:
  - As of the end of 2009, 223.5 million subscribed to post-paid plans, 39 million subscribed to traditional prepaid plans, and 15.9 million subscribed to unlimited prepaid plans [chart 11].
  - Family plan penetration grew to 67% of all mobile subscribers by the end of 2009 [chart 12, citing Credit Suisse].

- Cellular pricing has been a good deal for U.S. consumers, both relative to CPI and in comparison to pricing in other countries:
  - U.S. wireless pricing has declined steadily over the years. From 1997 to 2009, U.S. CPI has risen 33.7%, all-telephone CPI has risen 2.4%, while cellular-CPI has declined by -35.8%. 2009 itself, however, was something of an anomaly. U.S. CPI fell for the first time in this period, by -0.4% while all-telephone CPI rose 1.9% and cellular-CPI was flat at 0.0% after declining in every previous year. [table 19]

  - A more granular look shows that even in 2009, per-unit prices were falling. The average local bill per month fell from $50.07 to $48.16, which essentially brought it back to the level from which it had undergone slight annual gyrations since 2002. What is more significant, however, is that in that period from 2002, average blended (voice and data) revenue per minute had fallen from $0.11 to $0.07, as usage increased by 63% from 427 to 696 MOUs. Average local-bill voice revenues (i.e. ex. data) fell to $34.34 in 2009, below $38.40 in 2008 and well below $47.82 in 2002. Average revenue per voice minute fell 56% from $0.112 in 2002 to $0.049 in 2009, and 9% from 2008’s $0.054. In other words, providers’ average revenues per user per month remained fairly stable, but their customers received far more minutes and messages in return, with data becoming an increasingly important component of revenues. [table 20]

  - Average per user U.S. voice minutes of use (MOUs) peaked in the second half of 2007, at 769 per month, declining by the second half of 2009 to 696 per month. The FCC attributes the decline to substitution of mobile messaging and other data services for voice. Average text messages per month rose from 144 to 488 in the same period and average MMS message per month rose from 2.3 to 14.4. A CTIA chart showing minutes and messages as a measure of wireless usage supports that view, showing that industry-aggregate MOUs grew 24% from 2006 to 2010, while text messages grew 1190% in the same time, so that by the end of 2010 there were nearly as many text messages as there were voice minutes, i.e. 2.2 trillion MOUs
plus 2.1 trillion text messages. [chart 19 and Table 18, ¶180, CTIA’s Wireless Industry Indices: 1985-2010, CTIA Wireless Quick Facts]

- Average roaming rate per minute, which is paid by carriers for using each other’s networks fell 72% from $0.09 in 2002 to $0.025 in 2009, and fell 17% from $0.03 to $0.025 from 2008 to 2009. [Table 22]

- It is worth comparing U.S. usage and pricing to that in other countries, and the Report provides data via a Merrill Lynch 2009 report. Almost all the other countries have higher penetration of POPs than the U.S. at 93%, and roughly half also have a higher percentage of prepaid subs than does the U.S. On the other hand, average U.S. usage is much higher than that in any other country, at 824 MOUs per month vs. 426 for Canada, the next highest. Voice revenue per MOU is by far the lowest in the U.S. at $0.04, with Singapore’s $0.06 next and the range as high as $0.25 in Japan (where usage is only 137 MOU per month). The outcome of this combination is an ARPU of $49.91, in the third quartile of a range from $22.08 for Germany to $58.06 for Japan. [Table 44]

- The FCC has had some concerns about switching costs as well as unexpected charges. As the Report points out, bill shock is an issue that has concerned the FCC, as did early-termination fees. The industry and FCC are working together to find solutions to these issues.[¶244-253]

**Innovation:**

- The wireless industry has continually updated its networks for better capacity and performance, but the innovation cycle has accelerated in recent years, with the moves to WiMAX and LTE following rapidly upon upgrades to EV-DO and HSPA.

- As of July/August 2010, a combination of several digital wireless technologies covered 99.8% of U.S. POPs. CDMA 1xRTT reached 99.2% of U.S. POPs, GPRS/EDGE reached 98.9%, WCDMA/HSPA reached 79.8%, EV-DO Rev A reached 98.3%, and Mobile WiMAX reached 17.7%. As detailed below by company, further upgrades are underway, with WiMAX and LTE expected to be deployed throughout most of the U.S. during 2011-2013. [tables 12 and 13, chart 4]

- As of August 2010, EV-DO Rev A covered 239 million Sprint POPs. Sprint has announced its Network Vision upgrade, a process that will take 3-5 years to consolidate its various technologies. Sprint is now reselling Clearwire’s WiMAX service, which covered approximately 120 million POPs as of year-end 2010. [Table 11, ¶112]

- Clearwire had a WiMAX network that covered 120 million POPs as of year-end 2010. Clearwire’s company website indicates as of 7/8/11 that its network covers 130 million POPs in 70 markets. The network is resold by Sprint, Comcast, Best Buy and others as well as operating under the CLEAR brand. Clearwire claims speeds of 3-6 mbps down with bursts up

7
to 10 mbps. Clearwire has also tested LTE in Phoenix and claimed a download speed of 20-70 mbps in that test. [Table 11, ¶113 and Clearwire website visited 7/8/11]

- As of September 2010, EV-DO Rev A covered 289 million Verizon Wireless POPs. Verizon Wireless launched LTE in December 2010 in 38 cities covering 110 million POPs. Verizon Wireless plans to cover its entire footprint of 289 million POPs by the end of 2013 with LTE, with most of the build completed in 2012. Advertised speeds for EV-DO Rev A are 600 kbps to 1.4 mbps down and 500-800 kbps up, while LTE provides 5-12 mbps down and 2-5 mbps up. Other advantages of LTE are global roaming and lower latency. [Table 11, ¶109, and Verizon IR website, transcript of Barclays Capital presentation 5/24/11]

- As of early 2010, HSPA covered 230 million AT&T POPs. As of January 2011, the entire HSPA footprint was upgraded to HSPA+. AT&T’s HSPA+ has a theoretical speed of 14.4 mbps and can reach actual speed of 6 mbps down in cell sites with enhanced backhaul. It also addresses a variety of other network issues such as dropped calls, consistency, and slowdowns during peak periods. AT&T is launching LTE in mid-2011 in markets covering 75 million people and plans to complete its upgrade of its HSPA+ footprint to LTE by year-end 2013. However, AT&T has announced that it would extend LTE beyond that previous plan to cover 97% of the U.S. population if its merger with T-Mobile USA is approved. [Table 11, ¶110-111, and AT&T reply to opposition, FCC docket 11-65, June 30, 2011]

- As of mid-2010, HSPA covered 212 million T-Mobile POPs. T-Mobile upgraded the network by year-end 2010 to HSPA+, covering 200 million POPs in 100 cities. Speed is claimed to be comparable to that experienced by others offering WiMAX and LTE, with a theoretical maximum of 21 mbps. T-Mobile has not announced plans to upgrade to LTE. [Table 11]

- As of January 2011, MetroPCS has launched LTE in 13 cities. A MetroPCS press release dated 4/1/11 indicates that LTE service was also added in Tampa, bringing LTE to all 14 cities served by the company. [Table 11, ¶115, and press release on MetroPCS website, visited 7/8/11]

- LightSquared plans to build an integrated satellite/terrestrial LTE network that should cover 100 million POPs by the end of 2012 and 260 million POPs by the end of 2015. [¶116]

- The Report shows that there is both extensive competition and innovation in devices, operating systems and applications: there is a large number of both traditional handsets and smartphones available in various air-interfaces, there are many service providers distributing most of the devices, and post-discount average prices are falling rapidly.

- The number of manufacturers offering handsets in the U.S. grew from 8 in 2006 to 21 in 2010, and the number of handset models offered grew from 124 to 302, of which 207 were offered by the top 5 manufacturers. [table 29, 30, 31]
There were a total of 96 smartphone models offered by the top 5 manufacturers—not including Apple—as of June 2010, out of a total of 152. That 152 was up from 56 in June 2009. The top eight service providers offered between 2 and 25 smartphones (MetroPCS and AT&T, respectively). [tables 30 and 34, chart 42]

- Of the 152 smartphone models offered in June 2010, 67 used CDMA/1xRTT/EV-DO air interface, 80 used GSM/WCDMA, 2 used iDEN, 2 used GSM/CDMA, and 1 used CDMA/WCDMA. It is reasonable to expect the LTE network upgrade cycle will also drive device upgrades. [table 34]

- 220 service providers offered at least one handset model in December 2009. HTC had the largest number of service providers—128—distributing its devices, RIM had 116, Pantech and Samsung 66, Palm 55, Nokia 44, LG 40, HP 27, Motorola 14, Apple 5, Garmin 4, Sony Ericsson 3, Acer and Sharp 1 each. [table 36]

- Distribution of both service and devices is also available via various channels including mass market electronic retailers and websites.

- Smartphone operating systems offer a glimpse into the potential for competition in the market, with Google’s Android moving from 5.2% share in December 2009 to 19.6% share in August of 2010. That share was gained at the expense of major established players Microsoft -7.2%, RIM -4%, Palm -1.5%, and Apple -1.1%. [table 35]

- Average price for all handsets fell from $85 to $50 from 2006 to 2009. Average prices for smartphones fell from $220 to $120 in the same timeframe. [chart 43]

- As of Q3’2010, 28% of all cell phones owned by U.S. subscribers were smartphones, and 41% of new purchases were smartphones. [chart 44]

- Both application stores and applications have developed very quickly. There were about 360,000 applications available to consumers via the top 6 application stores. The first of these stores, the Apple App Store was launched in July 2008 and has the greatest number at 250,000 as of September 2010. Android Market was launched in October 2008 and is second with 80,000. [table 37]

- By January 2011, Apple App Store had about 400,000 applications, and had enjoyed more than 9 billion downloads, up from 6.5 billion in September 2010. As of September 2010, developers of Apple apps had earned over $1 billion from their applications. [table 37, chart 45, ¶ 345]

- As of June 2010, the most popular applications were games, music, social networking, news/weather, maps/navigation/search, entertainment/food, sports, video/movies, banking/finance, shopping/retail, productivity, communication, lifestyle. [table 39]
As of June 2010, the most popular application for Android OS users was Google Maps, while for Blackberry OS and iPhone OS users it was Facebook. [chart 46]

**Competitive analysis: Density, HHI, competitor metrics**

Analysis of the statistics provided in the Report makes it obvious that the issue of competition is closely linked to the issue of population density. The vast majority of the U.S. population is non-rural, lives in a miniscule portion of the country’s landmass, and can choose among numerous competitors offering mobile wireless and even mobile broadband wireless. A small portion of the population is rural and served and lives in a very large portion of the land mass that has both coverage and a more limited level of choice. Finally, there is a minute portion of the population that has no coverage at all—unserved rural—that is living in a landmass twice the size occupied by the majority.

- Competition and density: competition is everywhere except in the most rural areas:
  - Of the total U.S. population (POPs) of 285,230,516 people, 21.3% or 60,836,650 people live in rural areas, rural being defined in this Report as a county whose population density is 100 people or fewer per square mile. These rural areas constitute 4,169,790 census blocks out of a U.S. total of 8,262,363 census blocks, and cover 3,367,687 square miles out of a U.S. total of 3,799,408 square miles, i.e. 88.6% of total U.S. square miles. Conversely, 224,393,866 people live in 431,721 square miles, i.e., 78.7% of the U.S. population lives in 11.4% of the land mass. [tables 40, 5]
  - The U.S. population as a whole (rural and non-rural combined) enjoys extensive coverage by and competition among mobile wireless service providers. For the US overall, 99.8% of POPs are covered by 1 or more providers, 99.2% by 2 or more, 97.2% by 3 or more, 94.3% by 4 or more, 89.6% by 5 or more, 76.4% by 6 or more. [table 5]
  - Rural areas also have extensive mobile wireless coverage and enjoy considerable competition, with 99.2% of rural POPs covered by 1 or more provider, 96.6% covered by 2 or more, 88.4% covered by 3 or more, 77.4% covered by 4 or more, 62.2% covered by 5 or more, and 42% covered by 6 or more. [table 40]
  - It is worth noting that population density per square mile in areas that have at least 1 mobile wireless provider for rural areas is 25.1, for the U.S. overall is 98.2, and for non-rural areas is 458.4. For areas with at least 6 providers, the corresponding figures are 87.6, 419.1, and 841.6 [calculations based on tables 5, 40, chart 48].
  - Rural mobile broadband coverage is also remarkably extensive, with 93.7% of rural POPs covered by at least 1 provider, 69.1% covered by at least 2, 38.1% rural at least 3, and 17.3% covered by at least 4. The comparable figures for the U.S. as a whole are 98.5%, 91.9%, 81.7%, and 67.8% [table 41 and 7, chart 49].
Conversely, it is worth noting that population density per square mile in areas that have at least 1 mobile broadband wireless provider for rural areas is 31.9, for the U.S. overall is 124.5, and for non-rural areas is 478.0. For areas with at least 4 providers, the corresponding figures are 200.9, 912.7, and 1145.9 [calculations based on tables 7, 41].

When we call the extent of coverage in rural areas remarkable, it is because of the extraordinarily low population density of the areas that are not covered at all. Covering the rural areas that currently have no mobile wireless provider at all would require building out 959,622 square miles to serve a total population of 515,396 people, or a population density of 0.53 people per square mile. By contrast, the 224,393,866 people who live in non-rural areas of the U.S. occupy 431,721 square miles, i.e. roughly half the area occupied by the people who are still unserved in rural areas. Population density for non-rural POPS who are covered by wireless is 520 people per square mile [calculations based on tables 5, 40, 7, 41].

covering the rural areas that have no mobile broadband coverage would require building out 1,579,550 square miles to cover 3,845,562 people, or a population density of 2.4 people per square mile [calculations based on tables 5, 40, 7, 41].

HHI, the standard measure of competition supports the non-rural v. rural approach to the issue of competition. Below are several cuts at the analysis as well as an explanation of HHI and the methodology used to derive it in the U.S. and abroad. The discussion is based on Table C-3 which provides population, HHI, and density by Economic Area (EA).

In 2009, average POP-weighted HHI was 2802 for the total population of the U.S. and average POP-weighted density was 287.

- Note: The 2802 is slightly lower than the 2811 cited in the Report because Table C-3 did not provide HHI for the Huntsville AL-TN EA to maintain the confidentiality of that information, but presumably the FCC did use that info in its own calculation of total HHI. Excluding an EA from the POP-weighted total lowers total. In this case, it lowered it by 0.3%.

In 2009, average POP-weighted HHI was at 2450 for roughly 60% of the population and at 3313 for the other 40%. Average POP-weighted density for the 60% of the population was 370 and for the other 40% was 166. [calculation based on table C-3]

In 2009, average POP-weighted HHI was at 2530 for roughly 76% of the population and at 3676 for the other 24%. Average POP-weighted density for the 76% of the population was 335 and for the other 24% was 132. [calculation based on table C-3]

- Note: As the Report indicated, 76% of the U.S. population is served by 6 or more mobile wireless providers. Since table C-3 does not show the number of providers per EA, there is no way to be certain from the data provided in the Report that the
EAs that collectively represent the 76% of the population with the lowest HHIs are the same EAs that have 6 or more providers.

- In 2009, HHI was at 2644 for roughly 90% of the population and at 4246 for the other 10%. Average POP-weighted density for the 90% of the population was 304 and for the other 10% was 129. [calculation based on table C-3]

- Another way to approach this issue is to look at Charts 2 and 3, which condense the information provided in C-3 by density zones. The Report notes that the national HHI measured on a population weighted basis by Economic Areas in 2009 was 2811, with a range among EAs from 1903 to 6572. Even just a glance at charts 2 and 3 is enough to indicate that the average is badly skewed by the low-density areas of the country, particularly the band below 100 people per square mile. It makes sense that there would be fewer providers in areas where long distances between subscribers raise cost, and the scarcity of potential subscribers lowers revenue potential, as we explain in our discussion of rural areas above. But not even all low-density areas have super-high HHIs, probably because of the impact of USF in drawing multiple mobile wireless providers to areas in which their presence would not otherwise be economically sustainable. [charts 2 and 3, C-3, ¶52]

- HHI is the standard antitrust measure of market concentration—the Herfindahl-Hirschman Index. Table C-3 is a table of HHIs for all Economic Areas (EAs) in the U.S. According to the FCC’s Report, national HHI measured on population-weighted basis by Economic Areas (EAs) in 2009 is 2811 on average, with range among EAs from 1903 to 6572. That is down from the 2008 average of 2842, and the 2008 range of 2123 to 6801 However, ¶52 indicates that in June 2010, average was back to 2848, with a range of 2077 to 6538, reflecting the closing of the AT&T/Verizon-Alltel and ATN/Verizon-Alltel transactions. [tables C-3 and 9, ¶52]

- HHI is calculated by adding the squares of the market shares of competitors in a market. A market with a single provider would have an HHI of 10,000, i.e., 100*100. A market with four equal providers would have an HHI of 2500, i.e. 4*(25*25)=4*625. However, it is also possible to arrive at an HHI of 2500 with six providers whose market shares are 35, 30, 15, 10, 5, 5% or with eight providers whose market shares are 44, 16, 12, 8 ,5, 5, 5% or with ten providers whose market shares are 45, 14, 11, 9, 5, 4, 3 ,3 ,3 ,3%, or with various other combinations of numbers of providers and market shares. Each of these markets would have different competitive characteristics and would offer consumers different choices, despite the identical HHI value. Thus, HHI provides a measure of concentration, but one that has to be interpreted carefully.

- The Report points out that HHI in the U.S., unlike in other countries, is calculated by summing the squares of the market shares of the four nationwide players and then adding the square of the total shares of all the rest. As the Report points out, this raises the HHI above what it
would be if the smaller players’ shares were squared individually and then added in. [footnote 1165]

- Justice Department and Federal Trade Commission guidelines consider HHI between 1500 and 2500 to be moderately concentrated and HHI between 2500 to 10,000 highly concentrated. The national average HHIs of 2842, 2811, and 2848 for December 2008, December 2009, and June 2010 are at the low end of the highly-concentrated range. However, as we indicated above, for 60% of the U.S. population HHI in 2009 was at 2450, i.e. in the moderately concentrated range. For 76% it was at 2530, i.e. barely over the line into the highly concentrated range. [Chart 1, calculations based on table C-3]

- The Report also includes Merrill Lynch’s calculation of nationwide HHI for the U.S. and 9 other countries as of Q4’2009. In their estimation, the U.S. HHI of 2350 is second lowest behind the U.K.’s 2220, with Germany third lowest at 2840 and the rest ranging up to Japan’s 3570. One reason for the difference between the FCC and Merrill HHI’s may be the way the smaller players are included, since all players are counted individually outside the U.S. [table 45, footnote 1165]

- The Report also approaches the issue of competition by sketching out the positions of some of the key players, providing some metrics about their performance.

- Wireless subscribers (subs) and net additions:
  
  - During the period from 2006 to 2010, the smallest and largest companies added subscribers steadily—AT&T, Verizon, MetroPCS, and Leap have all made substantial gains, and those of MetroPCS and Leap were spectacular. MetroPCS ended 2010 with 8.2 million subs, having quadrupled its 2005 subscriber base. Leap ended 2010 with 5.5 million subs, having nearly tripled its 2005 subscriber base. AT&T increased its base by roughly two thirds and Verizon by roughly a half. [chart 18, company IR bulletins Q4’2009 and Q4’2010 and Q1’2011, table 3]

  - Sprint, T-Mobile, and U.S. Cellular had much more erratic performance. Sprint ended the period with a subscriber base that was barely up from 2005. T-Mobile added roughly half. And U.S. Cellular added about a quarter to the 2005 base. Their patterns, however, were very different. Sprint slowed sharply in 2007, had a disastrous 2008, but was in solid recovery in 2010. T-Mobile, on the other hand, did well through 2008, but slowed sharply in 2009 and lost subscribers in 2010. U.S. Cellular’s slide has been more gradual but there is no recovery yet. [chart 18, company IR bulletins Q4’2009 and Q4’2010 and Q1’2011, table 3]

  - Bottom line, the small players that focused on urban markets did very well. Both MetroPCS and Leap gained steadily during 2006-2009. MetroPCS gained a total of 6.1 million subscribers during 2006-2010, while Leap gained 3.5 million in the same
timeframe. By the end of 2010, MetroPCS had 7.9% penetration of its covered POPs and Leap had 5.6% despite having respectively quadrupled and tripled their covered POPs from the end of 2005. [calculations based on company 10Ks and IR bulletins for the relevant periods]

- The Report also tracks some financial measures. EBITDA (earnings before interest, taxes, depreciation and amortization) margins are the only ones shown for all 7 companies, so we focus on that.

- Chart 34 uses fourth quarter results of each year from 2005 through 2009, which is not ideal, since there are quarterly variations and the fourth quarter is particularly volatile because it includes the Christmas selling season. Having said that, Verizon’s margins over the period range between 43.2% and 47.5%. AT&T’s range between 31.1% and 40.7%, with the high in 2009. Sprint’s ranged between 35.4% and 18.2%. T-Mobile’s range from 29.1% to 33.1% over the period, with the low in 2009. Leap’s range from 17.1% to 31.6% over 2005 to 2009, ending at 21.9% in 2009. MetroPCS’ range is from 28.9% to 30.5%, ending at 30.5%. U.S. Cellular’s range is from 18.4% to 28.8%, with the low in 2009. [chart 34]

- It is noteworthy that MetroPCS, which had about 3% share of U.S. retail subscribers in 2009 had EBITDA margins in the same range as T-Mobile which had about 12% share and much higher than Sprint which had about 17% share. In fact, MetroPCS’ EBITDA margin was close to T-Mobile’s throughout 2005 to 2009, and was higher than Sprint’s from 2007 to 2009. Even Leap and U.S. Cellular, each of which had roughly 2% share in 2009, had EBITDA margins close to, and occasionally higher than, Sprint in 2008-2009. Of course, their share in the markets they actually serve is higher than their national share. MetroPCS, for example, had 7.2% share of covered POPs in 2009, and Leap had 5.1%, while U.S. Cellular had about 13%. [chart 34 on p. 137, Credit Suisse 1Q11 Wireless Trends Review p. 32, 2009 PCS and Leap and U.S. Cellular 10Ks and IR reports]

- One measure the Report only tracks for the four largest players is churn. Chart 36 on page 155 depicts the churn rates of the four national players from 2005 to 2009, with Verizon’s churn consistently below 1.5%, AT&T’s falling gradually from over 2% to about 1.5%, Sprint’s rising from 2.5% to 3% and T-Mobile’s rising from just under 3% to just over 3%. MetroPCS’ churn in 2009 was 5.6% and Leap’s was 4.6%. The Report discusses low churn as undesirable, as a potential indicator of lack of competition. Investors as well as the companies view it quite differently. Whatever its cause—and service quality is clearly a major factor—its impact on the company is negative. Because of the high cost of advertising, marketing, and device-subsidy, churn is extremely costly and high churn is a significant contributor to low EBITDA margins. Low churn is also arguably helpful to consumers by making lower service prices
and/or greater device subsidies possible. [chart 36, MetroPCS and Leap 2009 10Ks and IR reports]

- We raise the point about the regional players’ EBITDA margins being near or even well above those of much larger national players because of what it says about market entry and about the importance of the actual markets served. It is clearly possible to enter the wireless industry and to grow. That’s not to say that there isn’t some minimum level of scale that matters. But careful targeting and good execution are critical, as MetroPCS and Leap’s successes demonstrate, and as Sprint and T-Mobile’s stumbles despite their larger scale show in a more unfortunate way. New entrants can succeed, especially if they pick their niche carefully and then execute their strategy well—for example, focusing as MetroPCS and Leap do on urban markets that offer a large potential subscriber base and thus a large potential revenue pool and relatively low cost per subscriber.

- The Report discusses various companies’ spectrum holdings. [charts 39 and 38, tables 27 and 28]

- As the Report points out, various spectrum bands have different characteristics that mean that they are not completely fungible. For example, the ability of signals to penetrate buildings or the distances they are able to travel vary by band. There is no simple way to equate spectrum held in one band to spectrum held in another. It also matters how companies’ holdings are aggregated—a national block like the 20 MHz C-block in the 700 MHz band is easier to use than the equivalent amount of spectrum that is stitched together from a patchwork of different pieces at different frequencies across the country. Having said that, the Report does discuss holdings by each company in various bands.

- As chart 39 shows, the largest absolute amount of spectrum is held by Clearwire, which holds 125 POP-weighted average megahertz (avg MHz), all of it above 2GHz. That amounts to 26.7% of all the spectrum accounted for in chart 39.

- Sprint’s own holdings place it 4th, with 50 avg MHz, or 10.7% of the total, split between spectrum below 1 GHz and between 1 GHZ and 2GHz. But, as the Report points out, Sprint and Clearwire are affiliated. Their combined holdings of 175 MHz amount to 37.4% of the total, spread across all three band groups.

- Verizon holds the 2d largest position, well behind Clearwire with 84 avg MHz, spread between the two band groups below 2 GHz but more weighted below 1 GHz. That amounts to 17.9% of the total.

- AT&T holds the 3d largest position with 77 avg MHz, spread evenly between the two band groups below 2 GHZ. That amounts to 16.5% of the total.
- T-Mobile is 5th, with 48 avg MHz, all in the 1 GHz to 2 GHz band. That amounts to 10.3% of the total.
- Were AT&T and T-Mobile to combine, the new entity would hold 125 avg MHz, or 26.7% of the total, mostly between 1 GHz and 2 GHz (before any divestitures). That would still place them behind the Sprint-Clearwire total of 175 avg MHz.
- The regional players, MetroPCS, Leap, and U.S. Cellular each hold about 2% of the total spectrum, all of it below 2 GHz.
- Another 55 avg MHZ is simply charted as being held by others.

- The Report has an extensive discussion of spectrum that is beyond the scope of this paper, beyond pointing out that it provides a very useful tutorial for anyone new to wireless investment. There is extensive discussion of ways to stretch spectrum, via cell-splitting, fiber backhaul, distributed antenna systems, Wi-Fi and femtocells, but the Report’s bottom line remains a need for more spectrum in the face of the explosive demand for bandwidth that is anticipated. Put another way, unless spectrum is freed up for the core, it will become more difficult to innovate at the edge. [¶264-305]

**Investment perspectives:**

The Report does not reach a conclusion about effective competition, but it does provide the data to show that most consumers in the U.S. have access to multiple competitors, even in areas so lightly populated that entry, much less multiple entry, is surprising. While the Report focuses attention on a national population-weighted average HHI of 2811 in 2009, it provides the detailed data that makes it possible to calculate that for about 60% of the population HHI is at 2450, within the moderately concentrated range and for about 76% it is 2530, barely into the range of high concentration which runs from 2500 to 10,000. For the other 24% the average is 3676, still reflecting several competitors, but not the abundance that is enjoyed in densely-populated areas.

The Report takes a positive view of the mobile wireless industry, both traditional and broadband, recognizing that it is important to the economy—to jobs, to growth, to investment and to innovation. That the Report is constructive matters to investors because it indicates that the FCC remains committed to helping this industry grow and evolve, particularly by helping make more spectrum available and by making the spectrum that is available more accessible and usable.

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