

# **Exhibit A**

**Hanging up on *Carterfone*:**  
**The Economic Case Against Access Regulation in Mobile Wireless**

By

**Marius Schwartz and Federico Mini\***

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**Abstract**

Recently, Professor Tim Wu recommended subjecting the U.S. mobile wireless industry to *Carterfone* type regulation governing attachment of devices to the network, and others have sought such “open” access regulation also for suppliers of software applications. *Carterfone* was applied to a regulated monopoly Bell system and its precedent simply does not fit today’s wireless industry. We document that the U.S. mobile wireless industry (a) is *not* highly concentrated, relative to industries typically subject to access regulation, and to the European mobile wireless industry, (b) displays competitive behavior, and (c) is continuing to deliver performance that compares favorably both over time, and with Europe. The industry, therefore, presumptively is *not* a candidate for intrusive access regulation. Professor Wu’s alleged examples of “restrictive” practices do not alter this presumption. Some of the allegations are factually wrong, and others describe practices of individual carriers that have not been adopted industry wide; moreover, the alleged practices plausibly serve beneficial purposes. Finally, *Carterfone* regulation succeeded largely because the technology of the public switched telephone network was relatively simple and stable, whereas mobile wireless technology is much more complex and rapidly changing. Thus, access regulation of this industry is unwarranted as a matter of economics: the costs are likely to be substantial, and the threshold case that “competition is not working” has not been made.

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\* Marius Schwartz: Professor of Economics, Georgetown University, Washington DC 20057, schwarm2@georgetown.edu; Federico Mini: Senior Consultant, Bates White LLC, Washington DC 20005, federico.mini@bateswhite.com. We thank Rob Lipstein and John Williams for helpful comments; Melinda Chan for excellent research assistance, and AT&T for financial support. The views expressed in this paper are our own.

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## I. INTRODUCTION

In a recent paper, Professor Tim Wu argues that various contractual and technological practices employed by wireless carriers stifle innovation in complementary markets for equipment and applications and inefficiently limit consumers' options.<sup>1</sup> To address these perceived ills he recommends, among other things, applying to the wireless industry *Carterfone*-type rules governing the attachment of devices to the network, as well as the "core network neutrality principles under which the cable and DSL industries currently operate." (Wu, pp. 2, 21-22.) Although Professor Wu disclaims that he is seeking comprehensive regulation, his paper can be read as supporting broad regulation to enforce "open" access to wireless networks for suppliers of devices or applications.<sup>2</sup>

Adopting such a course would be drastic and exceptional in a competitive industry like wireless that in recent years has been largely unregulated and has grown rapidly. Professor Wu himself has described the industry as having delivered wireless telephony at "competitive prices" (Wu, p. 1). Although he is now concerned that the observed past competition will not deliver adequate product variety or innovation, he fails to identify any significant changes in industry structure and performance to support these hypothetical concerns. Before addressing Professor Wu's specific claims — and showing that the *Carterfone* analogy simply does not fit — it is important to recall why, as a matter of good economic policy, a high threshold should be set for intrusive government intervention into firms' conduct. There are at least two compelling, common sense reasons.

First, there may not be any initial market failure, so intervention risks needlessly condemning good conduct. Even highly competitive markets will not entirely satisfy all constituents and will fall short of some utopian — and, therefore, irrelevant — benchmark. For example, product variety is limited by fixed costs; a seemingly undesirable restriction may be serving additional purposes that benefit those same consumers; an exclusive partnership with a supplier or distributor may restrict variety but enable lower prices. Given the risks of erroneously diagnosing "market failure," intervention should not be contemplated unless there is reasonable confidence that the target practices are, on balance, undesirable for consumers *and* that they reflect an enduring failure of competition.<sup>3</sup> The onus should not be shifted to the

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<sup>1</sup> Tim Wu, "Wireless Net Neutrality: Cellular *Carterfone* and Consumer Choice in Mobile Broadband," *New America Foundation*, Wireless Future Program Working Paper # 17, pp. 1-4, 23-25, February 17, 2007 ("Wu"). Professor Wu's paper was distributed at the FTC's Broadband Connectivity Competition Policy Workshop on February 13-14, 2007, in Washington, D.C. The paper can be downloaded at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=962027#PaperDownload](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=962027#PaperDownload).

<sup>2</sup> Skype, in its recent FCC petition, cites Wu, condemns the same practices, and stresses the risk to competition in markets for applications. Petition of Skype Communications S.A.R.L. to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks, RM-11361, filed February 20, 2007 ("Skype Petition"). The Skype Petition explicitly calls for access regulation, and urges the FCC to intervene in standard setting and to open a broad inquiry into the practices of the wireless industry. In so doing, the Skype Petition references Professor Wu's paper, characterizing it as a "comprehensive study" of "restrictive practices [by wireless carriers] that are not in the public interest." Skype Petition, p.13 n.22.

<sup>3</sup> This observation refers to regulation aimed at addressing concerns with market power, such as the open access rules proposed here. Issues such as false advertising or the adequacy of disclosures, which may arise even in

industry to justify non-regulation; as a threshold matter, proponents of regulation should provide compelling evidence of a serious competitive failure. The examples cited by Professor Wu fall well short of this necessary threshold.

Second, and at least as important, it is by now well appreciated that even well meaning regulation is a blunt instrument, which can impose its own considerable harm. That is, even if there is an initial competitive failure and regulation effectively curbs the harmful conduct, it can also impose unacceptable collateral damage.<sup>4</sup> This is particularly likely when, as here, the industry is technologically complex and rapidly changing.

Sound government policy towards market power therefore contemplates intrusive intervention only when there is both a demonstrable failure of the competitive process *and* the intervention is likely, on balance, to help rather than hurt. This paper argues that neither condition applies in today's wireless industry.

Section II evaluates the current and expected future state of competition in the industry. With four national providers, several regional ones, and scope for further entry, the market structure is very far from the monopoly or dominant firm settings in which *Carterfone* and similar access interventions have been imposed. Moreover, there are various behavioral indicators of competition, such as vigorous technological competition, aggressive attempts to divert customers, actual customer switching, and considerable diversity in firms' offerings. And, the industry demonstrates no "performance problem" as compared, for example, to Europe.

Section III addresses whether the practices alleged by Professor Wu offer a sufficient basis to overturn the presumption of an acceptably competitive market. We use "acceptably competitive" to stress that justifying heavy intervention requires finding not merely a departure from the theoretical benchmark of "perfect competition" but rather a serious failure of competition. Professor Wu asks why a carrier would restrict consumers' options of complementary devices or applications if this makes the carrier's service less attractive. He offers three explanations: (a) price discrimination, a motive he describes as "not uncontroversial" but "defensible"; (b) carriers may be protecting existing revenue streams; or (c) carriers may simply be making the wrong decisions. (Wu, pp. 3-4, 23-25.) Some of Professor Wu's allegations are factually wrong; this is an instructive reminder of one hurdle facing the government as referee — the basic facts will be contested. But even if the basic facts are resolved, the business justifications for the practices often will not be evident to outsiders. We will examine Professor Wu's three explanations and will argue that, even if applicable, they fail to offer a compelling basis for intervention. Moreover, and critically, all of the alleged practices can plausibly serve business purposes that clearly benefit consumers. These include managing scarce network capacity, addressing security and malicious software concerns, and ensuring interoperability between devices, the network, and applications to the quality level advertised by

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settings where firms lack market power, can be addressed through existing consumer protection laws, and would not, therefore, require any new forms of regulation

4 For a sobering recent reminder see Clifford Winston, *Government Failures versus Market Failure: Microeconomics Policy Research and Government Performance*, AEI-Brookings Joint Center for Regulatory Studies (2006).

the carrier. Collectively, the practices condemned by Professor Wu are neither clearly anti-consumer, nor do they demonstrate a failure of competition. And firms in presumptively competitive markets should be accorded broad latitude in product design, pricing terms, and choice of business partners.

Section IV refutes the *Carterfone* analogy as a basis for regulating the mobile wireless industry. Consistent with an appreciation of the risks from intervention, detailed access regulation — as in *Carterfone* or in antitrust cases involving monopolization — has typically been reserved for exceptional cases: a bottleneck monopoly that poses a serious threat of monopolization in adjacent markets. In such circumstances, even far-reaching intervention can plausibly be deemed worthwhile. Today’s wireless landscape is radically different: no single U.S. carrier can hope to monopolize adjacent markets for equipment or applications. Mandating open access regulation of *non-dominant firms*, especially in a market that even proponents of regulation characterize as “an unquestioned success,” (Skype Petition, p. 3) would constitute a sharp departure from past norms. Second, access regulation in mobile wireless would be unusually far-reaching and intrusive, in an industry whose conditions are especially inhospitable to successful regulation. Professor Wu is correct that not all access regulation is doomed — its efficacy depends on the technology environment. He notes (Wu, p. 27) that the “line-sharing rules were a failure, while *Carterfone* was a smashing success.” Successfully regulating access in the complex and rapidly changing wireless broadband industry, however, is a far tougher challenge than was faced by the FCC in *Carterfone*, which involved regulating the connection to a mature, stable, and voice-centric PSTN.

Section V concludes that the case for considering scrutiny of the industry, let alone imposing heavy regulation, simply has not been made.

## II. COMPETITION AND PERFORMANCE IN THE U.S. WIRELESS INDUSTRY

Professor Wu’s position that the mobile wireless industry deserves scrutiny hinges largely on his claim of insufficient competition. He does not provide any systematic evidence to substantiate this claim. Rather, he asserts that the industry is a concentrated “oligopoly” and that carriers engage in a “pattern of parallel behavior.” (Wu, p. 3. *See also* pp. 25-26.) This position is flawed on two counts.

First, while concentration in mobile wireless may be higher than in “blue jeans or vodka” (Wu, p. 3), it is *not high* by the standards of industries where access intervention has been sought, nor compared, for example, to mobile wireless concentration in most European countries.

Second, concentration is only a starting point for a competitive analysis. All else equal, a less concentrated industry might be expected to behave more competitively. However, all else is rarely the same, and firms’ conduct even in highly concentrated markets — much more concentrated than U.S. mobile wireless — can range from monopolistic to fiercely competitive. A broad look at the mobile industry’s conduct and performance as measured by various indicators demonstrates that, far from reflecting collusive “parallel behavior,” the wireless

industry is so distanced from monopolistic conduct and poor performance that it is presumptively not a candidate for regulation.

### A. Concentration and Entry

**Number of Providers.** The U.S. mobile voice industry includes four nationwide facilities-based carriers: AT&T Mobility (the former Cingular), Sprint Nextel, T-Mobile, and Verizon Wireless.<sup>5</sup> There are also large regional providers, such as Alltel and U.S. Cellular.<sup>6</sup> The vast majority of U.S. wireless consumers can therefore choose from at least four, and in many cases more, facilities-based providers. The FCC tracks data on the number of mobile wireless license holders (cellular, PCS, and/or digital SMR) at a fairly disaggregated county level (there are about 3,200 counties in the U.S. (*See* FCC Eleventh Report, ¶ 14.) The FCC estimates that in 2005, 98% of the U.S. population lived in counties served by at least three such providers and 94% lived in counties served by at least four providers. (*Id.*, ¶ 41.) In addition, there are resellers, known as Mobile Virtual Network Operators (MVNOs), that lease wholesale capacity from facilities-based carriers, but set their own retail prices and compete for subscribers. (*Id.*, ¶¶ 27-28.)

**3G Networks.** All four national carriers, as well as large regional ones, are actively deploying 3G networks.<sup>7</sup> While T-Mobile has lagged behind in 3G development, it was a major winner in the latest Advanced Wireless Spectrum auction.<sup>8</sup> Perhaps as important, another major winner was SpectrumCo., a joint venture of four major cable companies: Comcast, Time Warner, Cox, and Advance/Newhouse.<sup>9</sup> Thus, industry concentration is not at risk of significantly increasing with the shift to 3G; indeed, concentration may well drop.

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<sup>5</sup> Each of these carriers operates networks in the western, midwestern, and eastern parts of the country, and each has networks covering at least 230 million people. Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, Eleventh Report, FCC 06-142, ¶ 25. (Sept. 2006) (“FCC Eleventh Report”).

<sup>6</sup> Alltel’s geographic footprint covers about 80 million people, and U.S. Cellular’s covers 55.5 million. *See*, Alltel Corporation Form 10-K for the fiscal year ended December 31, 2006, p. 2; United States Cellular Corporation Form 10-Q for the quarter ending September 30, 2006; filed February 23, 2007, p. 39.

<sup>7</sup> FCC Eleventh Report, ¶¶ 110-114.

<sup>8</sup> The auction results can be found at <http://wireless.fcc.gov/auctions/default.htm?job=release&id=72&y=2006> (visited April 24, 2007).

<sup>9</sup> *Id.* Sprint Nextel also participated in SectrumCo. but was a small shareholder (5%) and only a silent partner. Tiernan Ray, *Why is Cable Bidding Big for Wireless*, SmartMoney.com (Sept. 1, 2006). Comcast’s web site also describes SpectrumCo. as a “Cable Consortium” and notes that of the \$2.37 billion it spent in the auction, \$2.17 came from Comcast, TW and Cox. Comcast Press Release, *Cable Consortium Acquires Spectrum Licenses Covering National Footprint* (Oct. 5, 2006), available at <http://www.cmcsk.com/phoenix.zhtml?c=118591&p=irol-newsArticle&ID=912578&highlight=>. Cable companies have vigorously marketed their “triple play” of voice, wired broadband and video, but as Verizon and AT&T roll out their own “quadruple play” adding wireless to the triple play bundle, the cable companies can be expected to enhance their own offerings by adding mobile services.

**Comparisons with Europe.** Professor Wu offers up Europe as a competitive paradigm, from which the U.S. wireless industry has strayed.<sup>10</sup> It is instructive to compare wireless industry concentration in the U.S. and Europe. Figure 1 in Appendix A performs such a comparison between the U.S. and 15 EU member countries in 2006<sup>11</sup> using two measures: the number of national facilities-based operators, and the Herfindahl-Hirschman Index (HHI) of concentration. Regarding the number of carriers, three countries have 5 carriers, eight have 4 carriers, and four countries have 3 carriers. As noted, the U.S. has 4 nationwide carriers but also several large regional ones, while European countries do not have regional carriers (all spectrum licenses are allocated on a national basis). Thus, the U.S. compares favorably in terms of the number of facilities-based providers in a “typical” geographic area.

Moreover, the degree of *inequality* among carriers is generally greater in Europe, as measured by a higher HHI.<sup>12</sup> The FCC reports the number of subscribers for individual carriers at the fairly disaggregated geographic level of Economic Areas (EAs), of which there are 172 in the U.S.<sup>13</sup> In 2005, over half the U.S. population (53%) lived in EAs with an HHI below 2,660.<sup>14</sup> Figure 1 (in Appendix A) shows that the HHI is higher in all 15 EU countries except the UK and Denmark. The other thirteen countries each have HHIs above 3,000, with the population-weighted average for the 15 countries at 3,085.

Moreover, these figures understate concentration in Europe as compared to the U.S. First, in European countries subscriber data are only reported for the top two carriers individually plus “all others” as a single number, and the HHI figures reported in Figure 1 are computed by conservatively assuming that all other carriers have equal shares (unequal shares would raise the HHI). Second, both the U.S. and EU data attribute MVNO subscribers to the facilities-based carrier that serves that MVNO; since MVNO penetration is generally greater in the U.S. (see

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<sup>10</sup> Wu, p. 3, citing Eli Noam, *The Next Frontier for Openness: Wireless Communications*, Telecommunications Policy Research Conference, 2001 (Noam 2001). Professor Noam (pp. 3-4) asks why the U.S. is not dominant in mobile wireless, as compared to Europe and Japan.

<sup>11</sup> We focus on western European EU-15 countries because in the remaining 10 EU member countries (who joined the EU on May 1<sup>st</sup>, 2004) mobile markets are relatively less mature and more concentrated: in three of them (Cyprus, Malta, and Slovakia) there are only two mobile operators; in four of the remaining seven (Czech Republic, Estonia, Hungary, and Slovenia) the two largest operators hold approximately 80% or more of the market (by number of subscribers). Source: European Electronic Communications Regulation and Markets 2006 (“EU Twelfth Report”), European Commission, [COM(2007) 155], Brussels, 29 March 2007, Annex II, at 44.

<sup>12</sup> The HHI is an index of concentration obtained by squaring the market shares of each of the firms, adding these terms and, by convention in antitrust, multiplying the result by 10,000. For example, an industry with four equal-share firms would have an HHI of 2,500 ( $= 4 \times (1/4)^2 \times 10,000$ ). The HHI is higher if there are fewer firms or, for a given number of firms, their shares are less equal.

<sup>13</sup> FCC Eleventh Report, ¶¶ 13, 43-45, and Appendix A, Table 3.

<sup>14</sup> In computing these figures, we have left out the Aberdeen (SD) Economic Area (which accounts for less than 0.03% of the U.S. population) since the FCC withheld the HHI figure to maintain firm confidentiality. The FCC reports the median HHI, *i.e.*, the HHI for the median EA not adjusting for population, as higher, at 2,785, and the average value of the HHIs weighted by EA population as 2,706. FCC Eleventh Report, ¶ 45. Instead of EAs, if one computes a “national” HHI for a universe that includes only subscribers to the four nationwide providers, the HHI in 2005 is 2,719. (The subscriber data needed for this calculation appear in the FCC Eleventh Report, Appendix A, Table 4.) This universe is likely to be economically less informative, because it ignores regional providers, but we use it in Table 1 of Appendix A as a conservative measure for the U.S.

section II.B below), comparing subscriber HHIs for facilities-based carriers will overstate retail level concentration in the U.S. relative to Europe.

Based on standard measures of concentration, therefore, the U.S. compares quite favorably to the EU. Concentration indicators alone, of course, do not directly reveal the degree of competition in an industry. Nevertheless, they are helpful for guiding presumptions. Professor Wu repeatedly uses the term “oligopoly” to suggest that competition among wireless carriers cannot be counted upon to deliver good performance. In reality, the concentration level in wireless — with at least four significant, national level competitors, and additional regional competitors in many local markets and scope for further entry — would not strike mainstream industrial organization economists as high enough to presume a serious lack of competition, let alone to justify heavy conduct regulation.

## **B. Behavioral Indicators of Competition**

Professor Wu ridicules the notion that the wireless industry is “fiercely competitive” by retorting that a cell phone company is not as easy to start as a hot dog stand. (Wu, p. 25.) This argument confounds conduct with structure: even industries with far higher concentration than wireless can exhibit vigorous rivalry. Professor Wu’s repeated references to “oligopoly” do not address this central issue of conduct. Instead, he asserts that carriers engage in a “pattern of parallel behavior” (Wu, p. 3) and that the practices he highlights somehow prove lack of competition. The actual facts belie such a portrayal. By various indicators, the wireless industry exhibits considerable rivalry, as the following examples illustrate.

### **1. Technological Competition and Accelerated Deployment**

The FCC has documented carriers’ initiatives in deploying advanced technologies beyond 2G.<sup>15</sup> Outside sources bring out vividly the competitive dynamics. In late 2003, Verizon Wireless broadly launched EV-DO technology. (*Id.*, ¶ 110.) Sprint, which had planned to wait for a more advanced CDMA technology to become available (EV-DV), altered its plans in 2004 and adopted EV-DO, a decision that industry observers interpret as follows:

The day that Verizon announced it was doing [EV-]DO, the rest of the industry knew it was doing DO, ... Sprint needed to come up with a competitive response to Verizon. DO was the only technology available. It was a forgone conclusion.<sup>16</sup>

Sprint confirmed that its capital investment in deploying EV-DO constituted “an acceleration from Sprint’s earlier plan to balance spending evenly between 2005 and 2006.”<sup>17</sup>

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<sup>15</sup> FCC Eleventh Report, ¶¶ 107-113.

<sup>16</sup> Kevin Fitchard, *Is EV-DV dead?*, Telephony Online (Mar. 14, 2005), quoting Steve Searles, Nortel Networks VP of marketing for CDMA technology. Searles is also cited as saying that Verizon’s decision set off a chain of events that caused all North American carriers to reevaluate their technology plans.

<sup>17</sup> Sprint Press Release (June 22, 2004).

Cingular Wireless/AT&T took note of these initiatives in describing its competitive response:

Verizon and Sprint are deploying 3G data-only network technology using ... EV-DO. ... We intend to be the pre-eminent wireless communications company in the U.S. Our business strategies to achieve that goal are to: ... accelerate the build out of the network to improve coverage ... [and to] deploy UMTS/HSDPA in major markets across the country. This technology will increase the capacity of our network to carry voice traffic and provide data speeds that exceed those of the commercial offerings provided by other competitive carriers today and will allow us to offer a host of new broadband data applications.<sup>18</sup>

Subsequently, Verizon committed to a faster 3G version of EVDO (Rev. A), and Sprint brought forward its own deployment.<sup>19</sup> Commenting on Sprint's announcement that by the end of 2006 it will offer 3G EV-DO coverage to 190 million POPs and will begin EV-DO Rev. A deployment in Q1 2007, industry analysts wrote: "Given the tight race in EV-DO deployment ... Verizon Wireless should counter this announcement ... to clarify its own EV-DO Rev. A deployment schedule."<sup>20</sup> In February 2007, Verizon Wireless did just that.<sup>21</sup>

These examples of ongoing competitive jockeying to provide superior networks for advanced broadband wireless services demonstrate that the mobile wireless industry, far from being "mature" and cozy, exhibits classic, strong rivalry in competing for new services. Economic logic implies that if competition among rivals were weak — either because the market were highly mature and each carrier had a "lock" on its existing customers or because carriers were acting collusively — then carriers would not feel pressured to accelerate the deployment of new technologies in response to pressure from rivals. The fact that they do testifies to the force of competition.

## 2. Comparative Advertising, Subscriber Churn, and Price Cutting

**Comparative Advertising.** In addition to technological competition to improve their service offerings, wireless carriers compete by advertising heavily their network qualities.<sup>22</sup> Importantly, such advertising is aimed not only, or even primarily, at drawing new customers, but also at persuading rivals' customers to switch or dissuading one's own customers from switching. The distinctive feature is that the advertising is often comparative in nature — a carrier will compare its quality or other features to that of another, often by name. Again, this is

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<sup>18</sup> Cingular Wireless 10-K for fiscal year ended December 31, 2005, p. 14.

<sup>19</sup> Cell Data News (Aug. 3, 2006).

<sup>20</sup> *Competitive Response* newsletter, *Current Analysis* Competitive Intelligence Reports, Apr. 11, 2006.

<sup>21</sup> *Competitive Response* newsletter, *Current Analysis* Competitive Intelligence Reports, Feb. 14, 2007.

<sup>22</sup> The FCC Eleventh Report identified Cingular and Verizon Wireless as two of the top three brands, as measured by advertising spend, in 2005, with the top four carriers spending \$3.5 billion on advertising on 2005. *Id.* ¶ 129.

telling evidence of competition. If carriers' advertising were aimed at attracting brand new customers, we would not expect to see calls for customers to "switch" or the naming of particular carriers in one's advertising. Yet we do see such advertising, signifying attempts to *divert* customers from competitors or prevent such diversion of one's own customers, the hallmark of competitive behavior.

Examples of such comparative advertising targeted at competitors abound:

- Verizon has registered a service mark describing itself as "America's most reliable network."
- Cingular/AT&T urges customers to "switch to the network with "the fewest dropped calls."
- T-Mobile directly compares its Dash phone to Verizon's Verizon Q.
- Sprint Nextel ran an advertising campaign for mobile broadband targeted at AT&T, claiming both broader coverage and faster speeds.<sup>23</sup>
- And in the recent NCAA "March Madness" basketball tournament, AT&T aired high-profile TV ads proclaiming that it offers "more coverage in more cities than Sprint."

**Subscriber Churn.** Profit-maximizing carriers would not invest heavily on comparative advertising if they were insulated from competition. The fact that they do invest is powerful evidence that they perceive significant competitive threats and opportunities. And, indeed, the industry displays considerable switching by subscribers. For example, CTIA reports that the industry as a whole has a six-month churn rate (% of subscribers disconnecting) of 10.3% in the first half of 2006, or over 20% per annum.<sup>24</sup> Such significant churn indicates a competitively fluid landscape in mobile wireless with considerable scope for competition.<sup>25</sup>

**Pricing of Music Downloads.** In October 2005, Sprint introduced the first OTA (Over-The-Air) downloads of full-music tracks through the Sprint music store, with over 250,000 songs.<sup>26</sup> The fee of \$2.50 per download included two copies of the song — one for the cellphone and one for download on to a PC.<sup>27</sup> In response, Verizon began offering OTA downloads in January of 2006 through its V-Cast music service at \$1.99 per song.<sup>28</sup> ATT/Cingular began offering iTunes downloads in September 2005; in November 2006, ATT/Cingular introduced side-loading at \$9.99 for 40 tracks.<sup>29</sup> Starting April 2007, Sprint Nextel Corp. plans to cut its

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<sup>23</sup> Sprint News Release, Sprint Launches Aggressive New Advertising to Give Wireless Customers the Facts (Sept. 16, 2006), available at [http://www2.sprint.com/mr/news\\_dtl.do?id=13260](http://www2.sprint.com/mr/news_dtl.do?id=13260).

<sup>24</sup> CTIA's *Wireless Industry Indices: Mid-Year 2006 Results*, CTIA, Nov. 2006 ("CTIA Indices 2006").

<sup>25</sup> Note that a low churn rate, however, need not reflect lack of competition, e.g., if customers' demands are well matched with their existing providers.

<sup>26</sup> Sprint Press Release, Sprint launches the first instant, over the air music download service in the U.S. (Oct. 31, 2005). Another source we used for the chronological sequence of OTA music downloading offerings and their pricing we report below is: *Can you hear me now?: Audio is the untapped opportunity in mobile*, Yankee Group, Trend Analysis, Feb. 21, 2007 ("Yankee Group").

<sup>27</sup> Marguerite Reardon, *Cingular to jump onto mobile-music bandwagon*, CNET News.com, Nov. 2, 2006.

<sup>28</sup> John Borland, *Verizon plans to offer mobile music downloads*, CNET News.com, May 24, 2006.

<sup>29</sup> Yankee Group, p. 3.

digital music download fee to 99 cents per song, matching prices at iTunes, the leading Internet music service run by Apple Inc., in anticipation of AT&T's roll out of the Apple iPhone.<sup>30</sup> This sequence of price undercutting is a further illustration of competitive forces at work.

### 3. Diverse Approaches

Professor Wu asserts that carriers engage in “parallel behavior” and suggests this is indicative of “limited competition.” (Wu, p. 3.) Two remarks are in order. First, even very similar conduct is consistent with vigorous competition if the conduct in question reflects efficient business behavior. For example, if consumers place a high value on network quality and reliability and if this requires carriers to exercise fairly tight end-to-end control, one would not be surprised to find carriers — large and small — behaving in a broadly similar such manner. Secondly, at the level of specific practices, there is considerable diversity in the behavior of the major carriers in both pricing and non-price terms.

**Pricing.** AT&T, for example, is the only major wireless carrier that allows unused minutes to rollover from month to month. Sprint Nextel, Alltel and U.S. Cellular allow for free incoming call minutes, while Alltel and T-Mobile, among others, have introduced unlimited calling to “favorite” telephone numbers (which can include wireline numbers).<sup>31</sup> The FCC aptly characterized pricing as “independent” and reflecting “continued experimentation.”<sup>32</sup>

**Non-Price Terms: Bluetooth Restrictions.** Carriers differ considerably also in their conduct regarding product and service offerings. Bluetooth restrictions provide an instructive example. Professor Wu states that the “disabling of Bluetooth functionality has been a major sticking point for many consumers” citing especially Verizon Wireless, but adding that “Sprint and AT&T have also, at various times, disabled various Bluetooth capabilities—particularly on smartphones like the *Treo* line.” (Wu, p. 11). He adds that “the treatment of Bluetooth features by carriers is inconsistent and mixed,” (*id.*), and complains that the resulting uncertainty causes difficulties for developers. Several points are worth noting.

First, “inconsistent and mixed” suggests diversity in carriers’ approaches, undercutting Professor Wu’s claim that carriers engage in “a pattern of parallel behavior.” Whereas Verizon was alleged to have restricted “side-loading” — data transfers between a handset and a PC that bypasses the carrier’s network and instead uses a device such as Bluetooth or a USB cable — AT&T allows such transfers. Moreover, Verizon now is also citing its sideloading option.<sup>33</sup>

Second, Bluetooth, if implemented incorrectly, exposes the phone to intrusion by pranksters sending unauthorized messages to that phone (a phenomenon known as Bluejacking), that some consumers, such as parents seeking a safe cell phone for their children, may find

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<sup>30</sup> *Sprint challenges iPhone with 99 cent over-the-air music downloads*, Apple Insider, Mar. 26, 2007.

<sup>31</sup> Alltel’s plan is called “My Circle,” at <http://www.alltelcircle.com/>; T-Mobile’s plan is called “My Faves,” at <http://www.t-mobile.com/shop/plans/default.aspx?plancategory=24>). See also FCC Eleventh Report, ¶ 91.

<sup>32</sup> FCC Eleventh Report, ¶ 90.

<sup>33</sup> <http://www.anywhereyougo.com/2006/01/verizon-wireless-launches-vcast-music.html>. See also <http://www.fiercewireless.com/story/verizon-wireless-touts-sideloading-music/2006-11-21>

disturbing. This, too, could explain why carriers may choose to omit Bluetooth capabilities from certain phones.

Thus, one of Professor Wu's main examples purporting to demonstrate a problem in the industry fails to do so. As we argue in Section III, the same holds for other of his examples.

#### 4. MVNOs

In a market where facility ownership is highly concentrated, each facility provider may be reluctant to sell wholesale capacity to resellers, for fear they may compete with it for retail sales and thereby reduce its overall profit. The emergence of a wholesale market in capacity can be a signal that the market is reasonably competitive, reflecting a belief by facility owners that they may as well sell to resellers because the alternative is for a competitor to make the sale — causing similar pressure at retail but depriving the first carrier of the wholesale revenue.<sup>34</sup> The European Commission, for example, commenting on why retail markets where there are MVNO access agreements tends to be more competitive, noted that one possible interpretation is that “competitive markets deliver voluntary wholesale access as a natural outcome.”<sup>35</sup>

Based on this reasoning, the growth of MVNOs in the U.S. mobile wireless market — reflecting the willingness by facilities-based carriers to supply them — can be taken as a further signal of competition. MVNO presence in the U.S. is significant and growing. The FCC cites estimates that from 4.7 million at the end of 2003, the number of MVNO subscribers grew to 13.4 million in 2005, about 6% of the total 213 million wireless subscribers in the U.S.<sup>36</sup> This MVNO presence is greater than in most European countries. For example, while MVNO accounted for 10% of all subscribers in the UK, in other major European countries such as France, Germany, Italy, and Spain their share was negligible.<sup>37</sup>

In sum, the behavior of wireless carriers does not reveal any failure of competition, and is far from what one would normally associate with an industry in need of regulation.

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<sup>34</sup> Nuecheterlein and Weiser observe: “But based on experience in the long distance and wireless markets, it seems likely that, as competitive pressure from rival platforms increases, at least some companies will take the economically rational step of offering attractively priced wholesale services to resellers ... lest they otherwise lose that traffic and all associated revenues to rival facilities-based providers.” Jonathan E. Nuecheterlein and Philip J. Weiser, *Digital Crossroads: American Telecommunications Policy in the Internet Age*, MIT Press, 2005, at 99. The authors quote Jesse Drucker, *Sprint's Role as Wholesaler: 'Arms Dealer' to the Industry*, Wall Street Journal, May 21, 2004, at B1, as stating that Sprint has aggressively resold to other companies which then ended up “competing against Sprint.” (Nuecheterlein and Weiser, fn. 62.)

<sup>35</sup> “Public Consultation On A Draft Commission Recommendation: On Relevant Product and Service Markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communication networks and services (Second edition), *Commission Staff Working Document*, Brussels, 28 June 2006, SEC(2006) 837, at 40.

<sup>36</sup> FCC Eleventh Report, ¶ 27, citing the Yankee Group.

<sup>37</sup> Office of Communications, *The Communications Market: Interim report* (Feb. 2006).

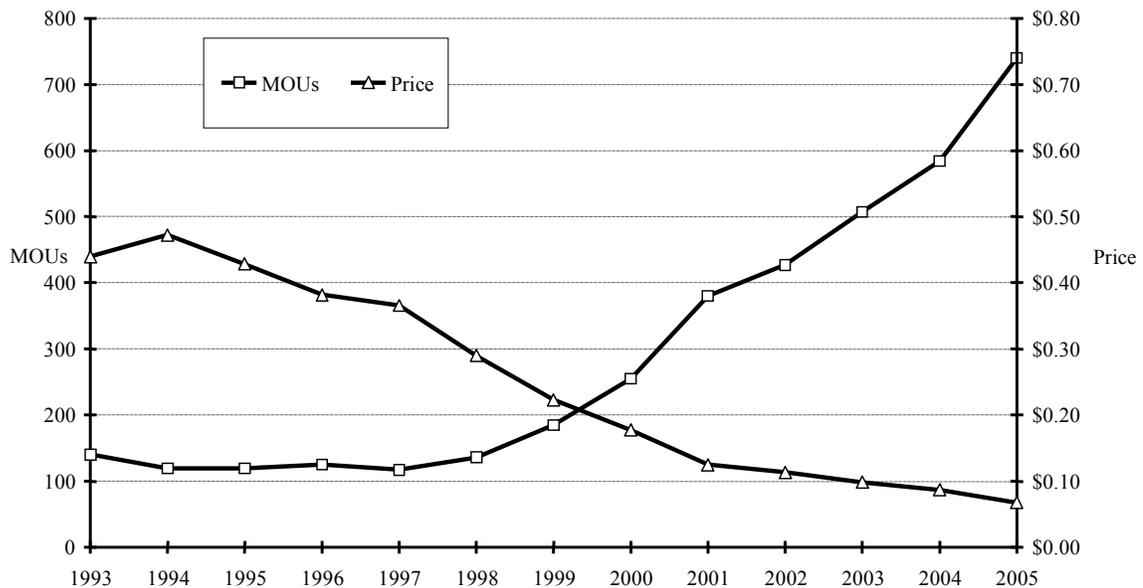
## C. No Evidence of “Poor Performance” to Invite Regulation

We now show that the U.S. wireless industry also displays no signs of poor performance that would call for scrutiny, whether based on trends in usage and prices within the U.S., or based on comparing these measures, as well as 3G deployment, with those in Europe.

### 1. Trends in Minutes of Use and Average Revenue Per Minute

Figure 2 shows average Minutes of Use (MOUs) per subscriber per month and the average price paid per MOU. The data come from CTIA information cited in the FCC’s Eleventh Report. Appendix B to this paper explains the data and methodology, and shows that the trends exhibited in Figure 2 remain virtually unchanged under an alternative, arguably more conservative, way to estimate MOUs and average price.

**Figure 2: Wireless Monthly MOUs and Price Per Minute in the U.S., 1993-2005**



Source: FCC Eleventh Report.

Based on a simple “eyeball test,” the trends in industry performance have remained very positive. Since 2001, average MOUs have almost doubled, while price has fallen from about 12 cents to about 8 cents. Next, we compare these series against their counterpart in Europe.

### 2. Comparisons With Europe

Professor Wu cites Professor Noam (2001, pp. 3-4) as arguing that, unlike other areas of communications, the U.S. lags Europe (and Japan) in mobile wireless, and that the “one different variable is policy.” The policy referenced by Noam in this context is actually spectrum allocation — not *Carterfone* rules; nevertheless, it is instructive to consider Europe — which standardized on the GSM technology — as a benchmark for assessing U.S. performance.

**Average MOUs.** One informative measure of cellular usage is the average monthly MOUs per active subscriber. I compare this measure, as well as prices per minute, in the U.S. against five major European countries: France, Germany, Italy, Spain and the United Kingdom. To compare usage, one must recognize that the number of minutes are tracked differently in Europe, because the pricing systems used by carriers are different. In Europe, wireless subscribers pay incremental charges only for calls they originate (*Calling Party Pays*, or *CPP*). In the U.S., subscribers pay for both calls originated and calls received (*Receiving Party Pays*, or *RPP*). Thus, a minute of on-net conversation between two U.S. mobile subscribers is recorded in each party's monthly MOUs, while in Europe the same minute is recorded only in the calling party monthly MOUs.<sup>38</sup> Since per minute prices are computed as the ratio between the average subscriber's monthly bill and its MOUs, "single counting" of on-net MOUs in Europe makes direct comparison of prices between the U.S. and Europe inappropriate as well.<sup>39</sup>

Appendix C provides details on the methodology we used to "convert" European usage and price statistics to comparable U.S. figures.<sup>40</sup> Whenever there was not enough information to perform an exact conversion, we applied the most conservative approach, that is, the method that leads to European usage being higher and /or prices being lower when expressed in U.S. terms. Throughout, we considered active rather than total subscribers when computing MOUs, to avoid understating usage per person in Europe (where the proportion of subscribers that are active is considerably lower due to the greater use of prepaid plans and, with them, dormant accounts).<sup>41</sup>

Figure 3 compares monthly MOUs in the U.S. (from Figure 2) to their European counterparts. The figures are striking. While MOUs in Europe have been rather flat between 2001 and 2005, they have almost doubled in the U.S., and in 2005 were more nearly three times as large as in the highest European country (France).

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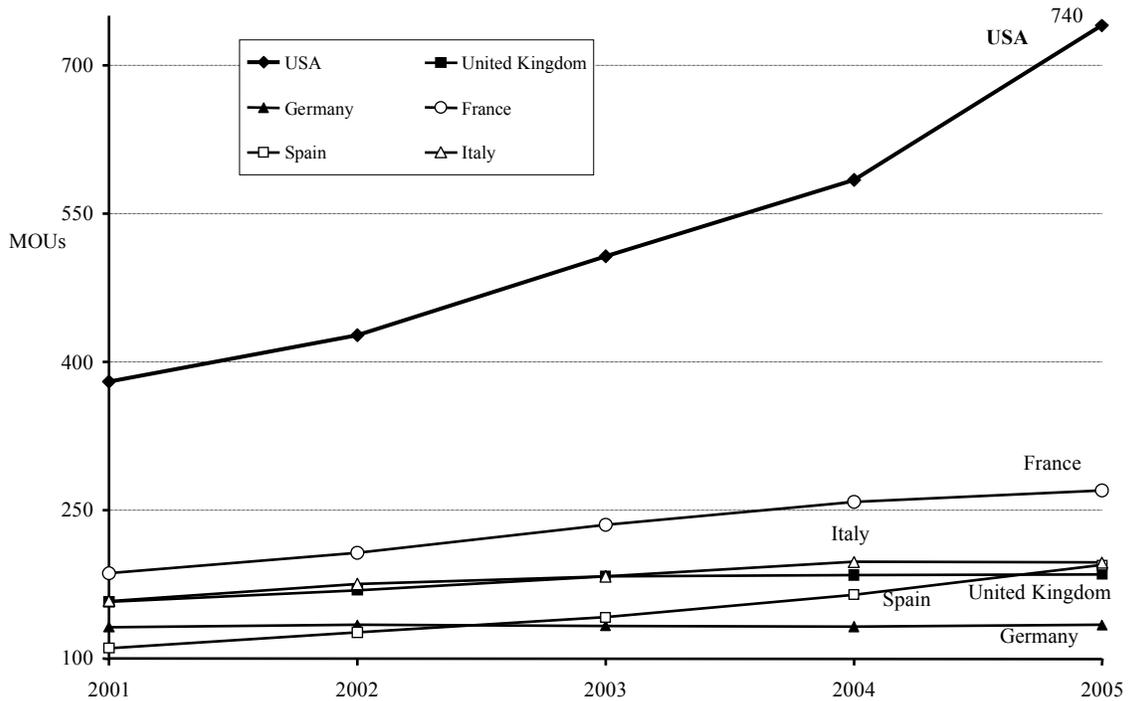
<sup>38</sup> Note however that one minute of conversation for an inter-network call minute gets recorded exactly the same way on both sides of the Atlantic.

<sup>39</sup> Indeed, the FCC Eleventh Report acknowledges that the figure it uses for its international comparison "somewhat" understate MOUs (hence overstate prices) reported for foreign countries, see ¶193.

<sup>40</sup> We converted prices expressed in European currencies (Euros and British pounds) to U.S. dollars using OECD Purchasing Power Parities for GDP, at <http://www.oecd.org/dataoecd/61/56/1876133.xls> (last visited Apr. 20, 2007).

<sup>41</sup> Appendix C also discusses "penetration rates," which are higher in Europe than in the U.S., and why they are a problematic measure for comparing cellular performance across these regions.

**Figure 3: Wireless Monthly MOUs, U.S. and Major European Countries, 2001-2005**



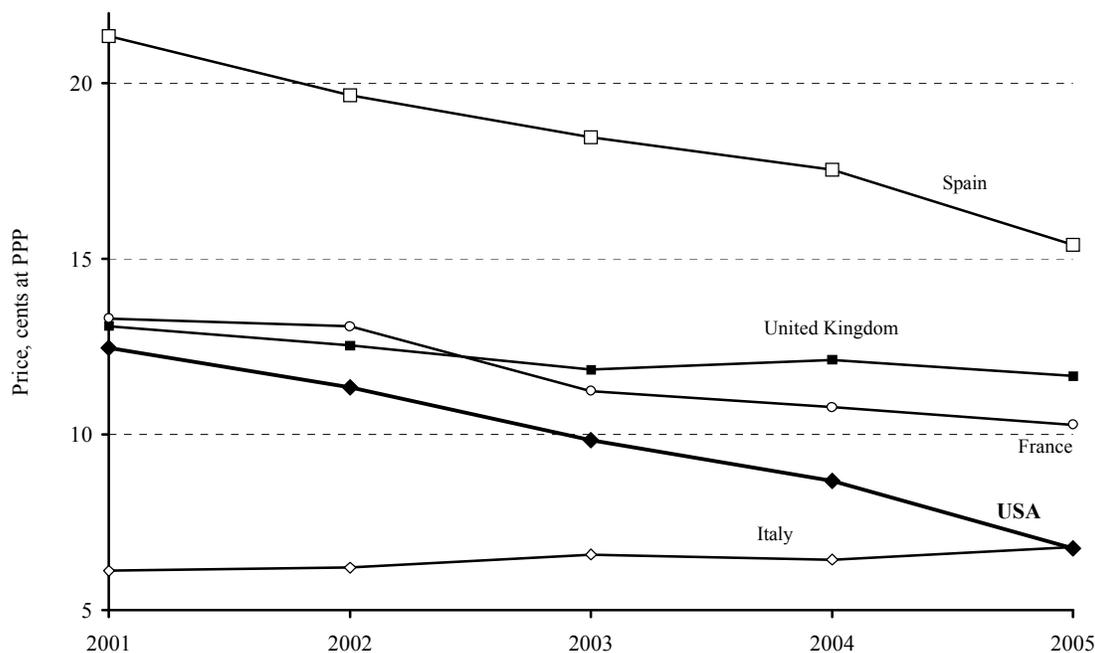
Source: Figure 2, above (U.S. data) and Appendix C (European Data).

Note: U.S. data is based on the last six months of the year; European data refers to the whole year.

**Prices.** Figure 4 compares average price per MOU in the U.S. (again from Figure 2) to that in France, Italy, Spain, and the UK (data for Germany was not available). The only country that experienced a comparable decline is Spain. But it, as well as the UK and France continued to show considerably higher prices than the U.S., about 50% higher in France, and higher still in the UK and Spain.<sup>42</sup>

<sup>42</sup> The sole exception, Italy, likely arises because information was not available on the split between mobile-to-mobile calls and fixed-to-mobile, so to be conservative we doubled *all* the mobile minutes, which overstates the minutes in Italy relative to the U.S. and therefore understates the price. The striking feature about Italy, however, is the flat trend in pricing, as opposed to the decline in the U.S.

**Figure 4: Wireless Average Price Per Minute, U.S. and Major European Countries, 2001-2005**



*Source:* Figure 2 above (U.S. data); Appendix C of this paper (European Data), and OECD (exchange rates at Purchasing Power Parity, <http://www.oecd.org/dataoecd/61/56/1876133.xls>).

*Note:* U.S. data is based on the last six months of the year; European data refers to the whole year. Data to compute price trend in Germany was not available.

The data in Figures 3 and 4 portray a very positive picture of performance in the U.S. wireless industry from the standpoint of consumers. From 2001 to 2005, the average minutes of use — a measure of wireless “consumption” by the average subscriber — has grown much more rapidly in the U.S. than in any European country, ending up almost three times larger than in the top major European country. And the price per minute paid by consumers has fallen faster in the U.S. (in percentage terms), to a level considerably lower than in the major European countries.

**3G Deployment.** As for the roll-out of next-generation wireless networks capable of supporting mobile broadband services, in the U.S., all of the top five carriers are currently deploying 3G and more than 99% of the population already has access to at least one 3G provider; while 93% has access to at least two. In contrast, EU statistics show that only the UK has at least five active 3G operators; Austria, Germany, Italy and Sweden have four, while other countries have fewer active competitors.<sup>43</sup> As for coverage, the OECD reports that in Europe, half of the population currently lives in areas where no wireless broadband services are

<sup>43</sup> EU Twelfth Report, Annex, Volume 2, p. 41-42, and GSM Association website ([www.gsmworld.com](http://www.gsmworld.com)).

available.<sup>44</sup> Thus, the U.S. compares favorably in 3G deployment, despite the fact that Europe made available more spectrum that could be used for 3G and did so earlier than the U.S.<sup>45</sup>

Based on these data, the U.S. certainly does not trail the EU in wireless performance, if anything, the reverse holds. Nor is there evidence that the “application stall” which concerns Professor Wu is putting the brakes on industry growth. If there were serious concerns about the prospects for developing wireless broadband data services, we would not be seeing aggressive network deployment by U.S. carriers, nor adoption by consumers. Yet a recent consulting report states that sales of smart mobile devices in North America grew by 54% between 2005 and 2006 (compared to 42% in the rest of the world).<sup>46</sup>

The evidence of Section II as a whole dispels the notion that the wireless industry is non-competitive, stagnant, or otherwise exhibits some obvious performance problem to warrant intervention. It is noteworthy that the European Commission (EC) has chosen to forbear from regulating wireless broadband markets. Wireless broadband deployment in Europe is, if anything, lagging the U.S., and the EC in general is more predisposed to intervention in telecom markets than are U.S. regulatory agencies. Yet the EC has sensibly elected not to regulate wireless broadband markets. Specifically, the EC identifies a list of markets that are candidates for *ex ante* regulation by national regulatory authorities based on satisfying three criteria: high entry barriers, the absence of mitigating factors that yield effective competition despite such barriers, and the insufficiency of competition law as an alternative to *ex ante* regulation.<sup>47</sup> The

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<sup>44</sup> *Mobile multiple play: new service pricing and policy implications*, Working Party on Telecommunication and Information Services Policies, OECD, 15 January 2007 [DSTI/ICCP/TISP(2006)1/FINAL], p.40.

<sup>45</sup> European Union countries set aside spectrum in the 2100 MHz band and auctioned it off between 2000 and 2001: by March 2001, the eleven Member States that had already issued 3G licenses covered nearly 90% of the European 2G mobile subscribers. “The Introduction of Third Generation Mobile Communications in the European Union: State of Play and the Way Forward,” European Commission, COM(2001)141 final, Brussels, 20 March 2001. The process was completed in 2002 when France and Finland finalized their licensing of 3G spectrum (“Towards the Full Roll-Out of Third Generation Mobile Communications,” European Commission, COM(2002) 301 final, Brussels, 11 June 2002). In the U.S., the FCC is currently allocating and licensing additional spectrum suitable for advanced wireless services (AWS) (FCC Eleventh Report, ¶ 73.) The first AWS auction took place in September 2006, [http://wireless.fcc.gov/auctions/default.htm?job=auction\\_summary&id=66](http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=66); in the meantime, U.S. wireless operators offer high-speed mobile data services using their existing Commercial Mobile Radio Service (CMRS) spectrum.

<sup>46</sup> Based on data reported in Canals' press releases, <http://www.canals.com> (last visited Apr. 22, 2007). Canals defines “smart mobile devices” as all hand-held devices capable of handling voice and data applications with the exception of “feature phones”, which are defined as “pocket-sized device positioned primarily for voice, offers full, configurable two-way data synchronisation, but OS-based applications cannot be added without restriction.” Sources: Canals: “Global smart phone shipments treble in Q3,” (Oct. 27, 2004) (definition of “feature phone”); “Smart mobile device market remains steady at 55%,” (July 25, 2006) (definition of “smart mobile device”).

<sup>47</sup> See Directive of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services (*Framework Directive*), Official Journal of the European Union, L Series, 108, Apr. 24, 2002, p.33; and Commission Recommendation on relevant product and service markets within the electronic communications sector susceptible to *ex ante* regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communication networks and services, 2003/311/EC, Feb. 11, 2003 (*Commission Recommendation 2003*, describing the three criteria). National authorities may impose *ex ante* regulation on markets excluded from the list only after obtaining approval from the EC, a step that has very rarely been sought.

EC excluded wireless data markets from this list in 2003; the proposed updated list, planned for the fall of 2007, again excludes them from such regulation.<sup>48</sup>

### **III. THE PRACTICES ALLEGED BY PROFESSOR WU CAN BENEFIT CONSUMERS AND DO NOT SHOW LACK OF COMPETITION**

Professor Wu argues that carriers exert excessive control over the identity and features of devices and applications that can be used on their networks. He has identified examples (which do not seem to be industry-wide practices) that he claims demonstrate this excessive control. His main claims are as follows.

*First*, carriers allow only certain approved phones on their network. (Wu, p. 8.) In addition, the GSM carriers (AT&T and T-Mobile) lock the phones they sell to prevent them from being used on another GSM carrier's network. (*Id.*, pp. 8-9.)

*Second*, equipment developers are said to complain about "being forced to disable services or features that might be useful to consumers." (Wu, p. 9.)<sup>49</sup> He cites the disabling or impeding of (a) call timers, (b) photo sharing, (c) Bluetooth capabilities, (d) Wi-Fi capabilities, and (e) the initial selection of the Wireless Application Protocol (WAP) approach to web access that, unlike Palm's "Blazer," permitted access to only a subset of all web sites. (*Id.*, pp. 9-12.)

*Third*, carriers contractually ban consumers on certain "unlimited" use pricing plans from using certain applications, such as with server devices or with host computer applications, streaming of video, music or games, and VoIP. (Wu, pp. 13-14.)

*Fourth*, carriers create difficulties for application developers by imposing onerous qualification requirements before granting access to phone capabilities and by maintaining a variety of standards instead of adopting a uniform environment. (Wu, pp. 15-16.)

Professor Wu recognizes that a carrier faces a downside by restricting the number of phones consumers can choose, their functionalities, and the applications they can access, but he advances three explanations for why carriers may nevertheless employ the above practices: *price discrimination* among different consumers, *protecting revenue sources*, or simply *mistakes*. (Wu, pp. 3-4, 23-25.) Section A below scrutinizes these explanations and argues that, even if applicable, they would not provide a compelling basis for policy intervention. Moreover, all of these practices can plausibly serve other purposes that are clearly pro-consumer. Section B

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<sup>48</sup> *Commission Recommendation* 2003. Commission Staff Working Document Public Consultation On A Draft Commission Recommendation On Relevant Product and Service Markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communication networks and services (Second edition), SEC(2006) 837, Brussels, 28 June 2006, p. 16.

<sup>49</sup> In the second part of the same sentence, Professor Wu also cites developers as complaining about "being forced to add elements to telephones that the designers do not think are what consumers want." However, we could find no examples in the paper of such practices.

illustrates this for some of Professor Wu’s examples. Overall, the alleged practices neither justify regulatory scrutiny nor overturn the competitive presumptions established in Section II.

## A. Economic Analysis: Professor Wu’s Explanations and Alternative Reasons

### 1. Price Discrimination, Protecting Revenue Sources, and Mistakes

**Price Discrimination.** Offering a menu of products that vary in their range of features can be a form of price discrimination. Such behavior can be profitable because it allows the firm indirectly to price discriminate among consumers: those who value the added features more will choose higher versions and pay more, while others will opt for the versions with fewer features and pay less. The beneficial aspect — for both overall welfare and consumers — is that a seller’s ability to segment customers and engage in price discrimination allows the seller to serve a broader range of consumers than if restricted to a single version and price. Thus, segmentation tends to increase overall output. Professor Wu recognizes that such price discrimination is common in many industries, and he states that the practice “while not uncontroversial, is defensible.” (Wu, p. 3.)

**Protecting Revenue Sources.** Professor Wu argues that price discrimination cannot explain all the examples of what he terms product “crippling” because the carriers “do not also make available a fully-capable product for a higher price.” (Wu, p. 3.) His alternative explanation, other than mistakes, is that “carriers may be acting to protect existing revenue streams. If a feature like Wi-Fi might endanger 3G or voice revenue, the carrier may block it to protect its income, ...” (*Id.*, p. 4.) As a second example, he asserts that “many carriers cripple Bluetooth’s media transfer capabilities. Bluetooth makes it easy to communicate between a computer and cell phone, so blocking helps preserve an existing revenue source—the prices the companies can charge for songs, ringtones, wallpapers, and other content.” (*Id.*, p. 24.) In a similar vein, he claims that carriers disable photo sharing between phones and email so as to steer customers to paid photo-sharing sites from which the carriers derive revenue. (*Id.*, p. 10.) Let me assume for now that the facts are as he portrays them (although they sometimes are not), and discuss in broad terms the economics of “revenue protection” and the policy implications.

The Bluetooth and photo sharing examples involve a carrier seeking to derive revenue from value added services that are *complementary* to its core “airtime” offering. The carrier’s goal is to share in the revenue from such services, whether by running its own site or partnering with one or more independent providers. The likely motive, actually, is again a form of *price discrimination*, which Professor Wu finds defensible, and which indeed can be welfare enhancing. If consumers were identical, the carrier could maximize profit by pricing usage at marginal cost and charging a fixed fee that reflects the consumer surplus from using the phone in an entirely unrestricted manner. Consumers, however, are quite heterogeneous: some use their phones mainly for basic voice services while others use numerous other services. By limiting access to sites whose revenue it shares, the carrier can obtain additional revenue selectively from these consumers while keeping the price of its basic service (airtime and monthly fee) lower. Restricting access by selling phones with limited functionality is an imperfect mechanism to sustain such price discrimination. A carrier will prefer — and will look for ways — to charge directly for access to enhanced services, and would offer handsets with artificially limited

features (*i.e.*, limits that are not cost justified) only if the former were not possible. In the latter case, preventing “crippling” would limit the carrier’s ability to price discriminate, and would have the same negative aspect that Professor Wu noted earlier: the carrier would likely raise the per-unit price and/or fixed fee of its basic service to *all* consumers, causing a reduction in usage and/or some consumers to drop out altogether.

Professor Wu’s Wi-Fi example has a somewhat different flavor. Wi-Fi is a *substitute* for the carrier’s voice service (if Wi-Fi is used for VoIP) or data services, and the carrier purportedly disables Wi-Fi in order to increase use of its own network. However, economic analysis shows that if the alternative technology provides a valuable option to consumers, then a carrier would earn greater profit by allowing a consumer to use it along with the carrier’s service, and collect revenue by charging a higher fixed fee. That is, for purposes of raising revenue, excluding the alternative technology is an inferior option. And, indeed, some carriers offer devices with both CMRS and Wi-Fi capabilities (see Section III.B.2 below.)

Overall, attempting to prevent carriers from “protecting revenue sources” through offering devices with limited functionality is a very problematic theory on which to justify policy intervention in the wireless industry for several reasons.

*First*, revenue protection by itself should not be seen as undesirable; as explained, it often amounts to price discrimination, a practice that tends to increase overall output and is not presumptively harmful.

*Second*, insofar as the concern is not with revenue protection as the goal but with “crippling products” as the means, firms have strong incentives to find ways of sustaining price discrimination while minimizing the extent of inefficiency from limiting consumers’ options. And indeed, many of alleged “crippling” practices are either incorrect or are justified by other business reasons, as discussed shortly.

*Third*, intervention would be a sharp departure from standard U.S. antitrust practice, which allows even a firm with substantial market power considerable latitude in pricing, product design, and dealings with suppliers of inputs or complements, provided the market position was legitimately acquired and the practices pose no significant threat to competition in adjacent markets. While this antitrust standard does not bind regulatory agencies or other policy makers, it enjoys strong justifications: the need to preserve incentives for firms to invest in creating new products and, at least as important, the difficulty of distinguishing whether a seemingly “restrictive” practice is motivated solely by revenue protection or by a host of other reasons that can benefit consumers. As demonstrated shortly, in the wireless industry this concern with convicting-the-innocent is well grounded.

*Finally*, if the antitrust logic for limiting intervention even against a dominant firm does not provide sufficient comfort, it is important to remember that the wireless industry is not characterized by a dominant firm, but by considerable competition among several strong rivals. If one firm proves overly restrictive in a true (rather than superficial) sense, this creates an opening and strong incentives for competitors to offer less restrictive alternatives. And, indeed, the wireless industry exhibits such heterogeneity and rivalry in firms’ behavior.

**Mistakes.** Besides price discrimination and revenue protection, Professor Wu’s only explanation for the above practices is that carriers are simply making a mistake — they excessively control their networks even if this sacrifices profit.<sup>50</sup> We offer two observations. First, firms investing their private funds are entitled to make mistakes even if this is costly not only for them but also to consumers and participants in adjacent markets. Second, and critically, it is difficult for outsiders to know what is a “mistake” versus a legitimate business decision based on superior information. As discussed next, Professor Wu ignores numerous plausible and beneficial purposes of the contested practices.

## 2. Alternative Reasons for the Alleged Practices

To appreciate why wireless operators today exercise substantial control over their networks it is helpful to note both the historical context and some distinguishing features of the wireless environment. Until fairly recently, cellular telephones were used almost exclusively for voice services, and voice service still accounts for the lion’s share of revenue. The traditional wireline telephone industry takes end-to-end responsibility for the quality of service very seriously, as reflected in its extremely high reliability, and it is natural that wireless providers would be quite concerned about meeting high consumer expectations also in mobile voice service. In their promotional efforts, wireless providers today continue to stress heavily their comparative performance in dropped calls and other aspects of network quality.

Addressing this high concern with quality poses several unique challenges in wireless. First, because of the multiple technologies and standards, ensuring compatibility between devices and networks is more difficult. Second, because signal transmission is not isolated in a “pipe” connecting each user but uses the airwaves as a shared resource, a carrier must exercise some control over the handset and its features to prevent degradation of service to other users arising from those who excessively consume radio system resources. Third, the mobility aspect creates the need for the network to communicate with the device not only for the obvious purpose of coordinating call handoffs, but also, for example, to update the handset SIM to choose the carrier’s preferred roaming partners in various localities (which reduces roaming costs).

The preceding discussion pertains largely to a carrier’s need to control the radio frequency interface of handsets. Turn now to application programming interfaces. Handset capabilities are rapidly evolving to support, beyond voice, a host of new services, and their operating systems must accordingly interact with numerous and complex applications. In seeking to “open” their traditionally more sheltered systems and enable more applications, wireless carriers naturally would seek to contain the well-known security and privacy problems that have been encountered with the public wireline Internet. The goal is to tap the creativity of the more free-wheeling Internet while maintaining the high quality of service that wireless users have come to expect. In this regard, the security issues are potentially even more severe for

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<sup>50</sup> He offers a “cultural” reason for such conduct: “We can call this the Bell model, after the same patterns of behavior exhibited by the pre-breakup Bell Company.” (Wu, p. 25.) As we explain in Section IV, the analogy is inapt: the Bell system was a regulated monopoly with very different economic incentives than those of unregulated firms. As for a “cultural” (rather than economic) explanation, there is little reason to think that today’s rivalrous and unregulated wireless carriers have the same mindset as the old Bell system.

wireless than for wireline networks, due to the added issues raised by multiple technologies, mobility, and power considerations (*e.g.*, there is a form of attack that can drain a handset's battery by repeatedly sending spurious service requests).<sup>51</sup>

As carriers adapt to the rapid technological change in both equipment and applications, it is unsurprising that they may proceed at a more deliberate pace than some adventurous Internet users or application developers may prefer. Carriers are catering to the majority of consumer and must give serious weight to considerations that might strike some as mundane. The cost of adding new features and the inconvenience caused by viruses or other malicious software may seem a minor price to pay for “progress” to savvy advanced users, but can have major detrimental effects on a carrier's costs and the satisfaction of the majority of consumers. The quality of service point should not be discounted. Consumers in the wireless world are accustomed to carriers exerting tight end-to-end responsibility for service performance, which involves managing various aspects of interoperability and security to ensure that service quality and various features perform to the level advertised by the carrier. It is too quick to dismiss such concerns by arguing *caveat emptor*, because if certain features do not work properly—even if the consumer was warned against using wrong equipment or applications—other consumers can be adversely affected, and the carrier can still suffer direct costs or harm to its reputation.

None of this is to argue that all carriers should or will maintain their current business models indefinitely. There are inherent tradeoffs between the higher quality of service, broadly defined, from an approach concerned with optimizing devices and applications to ensure a better end to end experience on average, and Professor Wu's suggested approach, which might afford individual users more latitude to experiment with devices and applications but can sacrifice quality and impose costs on the network as a whole. These tradeoffs will be evaluated differently by heterogeneous consumers, and will change over time as consumers' experience evolves and the capabilities of wireless networks, devices and applications continue to multiply. Accordingly, economics predicts adaptation by carriers, and some diversity in the approaches taken by rivalrous carriers reflecting differences in their business judgments and the customer groups they seek to target.

Finally, like wireline carriers, wireless carriers must ensure that subscribers who pay for defined levels of use of the network do not consume disproportionate resources well in excess of what is envisioned in their pricing plans. Some practices that superficially appear as “discrimination against applications” in fact seem motivated by bandwidth management.

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<sup>51</sup> Narus Whitepaper: NarusInsight Secure Site Wireless Module, accessible at [http://www.narus.com/\\_pdf/products/NSS\\_Wireless\\_Security.pdf](http://www.narus.com/_pdf/products/NSS_Wireless_Security.pdf).

## **B. A Closer Look at Some of Professor Wu's Examples**

We now illustrate the above themes by analyzing a few of Professor Wu's specific examples.

### **1. Device Testing and Certification**

Professor Wu notes that while Sprint discourages the use of non-Sprint phones on its network, Verizon is more restrictive and allows approved phones only. AT&T has a similar policy, so it is worth fleshing out some of the legitimate reasons for such restrictions.

One set of reasons involves optimizing how handsets and network equipment interact to improve the quality of service. For example, AT&T indicates that currently available devices that have undergone Cingular's extensive testing and certifications result in lower dropped call rates compared with the total base of devices in use on its network today. In addition, a subscriber with a handset not certified by AT&T cannot be guaranteed the same ability to use instant messaging, push-to-talk, and other useful features that AT&T may widely advertise. Such concerns with compatibility and customer perceptions of the network's service can be very important. Because a customer calls the cellular carrier and not the handset manufacturer when something does not work properly, carriers have a strong incentive to ensure reliable and consistent operation of handset capabilities and features.

Other reasons for certification of handsets pertain to efficient use of shared network resources. For example, AT&T requires devices to include an Adaptive MultiRate (AMR) Voice Coder for improved call quality and increased capacity. Devices can tolerate a higher level of interference without compromising voice quality if they are using the AMR vocoder. This permits radio channels to be reused more often, allowing the network to service more customers using a given amount of bandwidth.

In addition, Over The Air (OTA) control from the base station allows updating of the roaming profiles on the handset's Subscriber Identification Module (SIM). This enables AT&T to reduce the roaming charges it pays, enabling lower prices to its customers. The roaming feature is especially ironic for Professor Wu's analysis. He cites Professor Noam as the first academic to have called for *Carterfone* type rules. In that paper, a central problem addressed by Professor Noam was how to reduce "high" roaming rates.<sup>52</sup> OTA programming can serve precisely this function, by directing subscribers to lower-priced networks and thereby also inducing competing host networks to cut their roaming rates.<sup>53</sup> The EU has noted that a key reason for persisting high roaming rates in Europe is the limited ability of carriers to steer roaming traffic towards lower-priced networks, and in 2003 it added international wholesale roaming to the list of markets that national authorities are allowed to regulate.<sup>54</sup>

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<sup>52</sup> Noam (2001), at 10. Interestingly, market forces in the U.S. have reduced roaming rates considerably (see Section IV.B.1 below).

<sup>53</sup> Ulrich Stumpf, "Prospects for Improving Competition in Mobile Roaming," paper prepared for the 29<sup>th</sup> TPRC, Alexandria, VA, pp. 17-20 (Oct. 27-29, 2001).

<sup>54</sup> See "Working Document On The Initial Findings of the Sector Inquiry into Mobile Roaming Charges," European Commission, Directorate General Competition, Brussels, 13 December 2000, p. 17; Explanatory Memorandum to

## 2. The e61 and Wi-Fi

Professor Wu states that “American wireless carriers have strongly resisted and blocked the installation of Wi-Fi capabilities in cellular phones.” He cites AT&T’s decision not to sell in the U.S. Nokia’s e61 phone and instead market the e62 version, which he calls “a crippled version of the e61 that has Wi-Fi and other features removed.” He quotes MSN columnist Gary Krakow as to carriers’ supposed motive: “What some carriers fear most is the e61’s ability to handle VoIP calls ... That’s why we won’t see Wi-Fi on the e62.” Professor Wu adds that in the U.S., “with a few notable exceptions, it is difficult today to find a Wi-Fi capable cell phone.”

Regarding the e62, it appears that the alleged facts are wrong. AT&T’s decision to forego the e61 in favor of the e62 seems to have been driven by cost and demand considerations, not fear of Wi-Fi. First, the e61 did not support UMTS/HSDPA with the U.S. frequencies (850 MHz and 1900 MHz versus 2100 MHz in Europe). Second, the e61 is a high-end device, offering capabilities such as support for high-speed UMTS and Wi-Fi, and retailing in Europe for between \$400 and \$500. In that price range, it would have faced stiff competition in the U.S. from Blackberry, Windows Mobile PDAs and Palm devices. These platforms are more widely used in the U.S. than the Symbian operating system used in the e61. More importantly, the e62 was designed to sell at a much lower price than the e61 — \$149 with a 2-year contract — as an inexpensive device aimed at a growing market: wireless email for mobile professionals below executive ranks and for consumers. The low cost was made possible by scaling back or dropping various features, one of which was Wi-Fi.<sup>55</sup> This price / performance tradeoff was deemed worthwhile: The same article that Professor Wu cites by Gary Krakow describes the e62 phone as “spectacular ... It may just be the best smartphone around.”<sup>56</sup>

Professor Wu’s claim that American carriers have “blocked” the installation of Wi-Fi on wireless devices also appears to be wrong. Aside from the e62, an example discussed above, Professor Wu does not offer any examples of “Wi-Fi blocking.” Professor Wu observes that AT&T will soon offer the Apple iPhone, which has Wi-Fi capabilities, but in fact AT&T already offers various smartphones that permit both cellular voice and Wi-Fi access on both business and consumer plans.<sup>57</sup>

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the Commission Recommendation On Relevant Product and Service Markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communication networks and services, 11 February 2003, [2003/311/EC], p. 31.

<sup>55</sup> A. Greengart, *Nokia E62 - Cingular: Product Assessment*, Current Analysis, Sept. 29, 2006. “We are taking a positive stance on Nokia's E62 at Cingular, because it brings a solid enterprise-class QWERTY smartphone down to an unprecedented price of just \$149, making it the first full QWERTY smartphone to debut below \$199.” The reviewer adds: “Cingular is aggressively pricing it [the E62] at \$149 in the hopes that enterprises will be willing to roll out mobile e-mail to more employees if there is a lower upfront cost. Nokia's similar E61 has Wi-Fi and UMTS; these were removed for the U.S. to keep the price down.”

<sup>56</sup> Gary Krakow, *The Nokia E62: The Best Smartphone Ever?*, <[www.msnbc.msn.com/id/14456766/](http://www.msnbc.msn.com/id/14456766/)>.

<sup>57</sup> Business plans and consumer plans are described, respectively, at <http://business.cingular.com/businesscenter/solutions/wireless-laptop/wifi-service-plans.jsp> and <http://www.cingular.com/cell-phone-service/cell-phone-plans/wi-fi-laptop-connect-plans.jsp>.

### 3. Restrictions on Applications

Under the heading “Discrimination in 3G Broadband Services,” Professor Wu lists various data services that Verizon and AT&T prohibit from being used in their “unlimited” wireless broadband plans. Professor Wu does not explain in what sense these restrictions constitute “discrimination.” His Wi-Fi discussion in the same section (Wu, page 12) suggests that the goal is to prevent consumers from using applications or services that compete with the carriers’ own value-added offerings, but no attempt is made to identify such competing offerings. On the other hand, virtually all the applications that Professor Wu lists can consume very large amounts of bandwidth. Thus, it is quite likely that these restrictions are motivated in large part by bandwidth considerations. The plans in question are offered for relatively modest prices (e.g., \$60 per month in one of the ads cited) and, while advertised as “unlimited,” they are aimed at certain classes of “normal” users and specific uses, not at a minority that would exploit the unlimited feature to consume entirely disproportionate resources at those prices.

The prohibited uses include: (1) uploading, downloading or streaming of movies, music or games, (2) server devices and host computer applications, such as Web camera posts or broadcasts, automatic data feeds, VoIP, automated machine-to-machine connections, or peer-to-peer file sharing, and (3) using the device as a substitute or backup for private lines or dedicated data connections. Such applications can be abused to consume disproportionate network capacity relative to the price charged for these plans.

Potentially, this issue might be addressed by charging for usage or setting quantity limits. However, there are problems with such an approach. First, the congestion costs imposed on the network depend not only on cumulative usage over a given period, but also on the intensity of use at particular times, and efficient usage-based prices would need to consider such variations (and, thus, are likely to be quite complex). Second, it is not easy for all consumers to determine beforehand with a variety of data applications how much bandwidth will be consumed, and many consumers that are relatively heavy users value the predictability of knowing that they will not exceed their limit. To offer such predictability, the network may be willing to offer “unlimited plans” but subject to prohibiting certain uses that, in the wrong hands, could vastly exceed the usage envisioned by the network.

Significantly, the regional carrier Alltel includes the same application restrictions in its unlimited broadband wireless plans.<sup>58</sup> The use of similar practices by a carrier that presumptively lacks market power undercuts the claim that the purpose is “discrimination.”

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<sup>58</sup> Alltel’s Unlimited Access Broadband and Mobile Link services cannot be used for: “1. Up/down-loading or streaming of movies, music, or games; 2. With server devices or with host computer apps, including web camera posts/broadcasts, automatic data feeds, VOIP, or file sharing; 3. As a substitute or backup for private lines or dedicated data connections. 4. Peer-to-Peer (P2P) file sharing.” See [http://www.alltel.com/business/enhanced/office\\_mobility.html](http://www.alltel.com/business/enhanced/office_mobility.html) (last visited Apr. 24, 2007).

The discussion in this Section III permits several broad conclusions:

- Variety, options, and greater “openness” can entail various costs. Restrictions by wireless carriers that might strike some as excessive can reflect sound business judgments about relevant tradeoffs.
- The wireless industry, especially broadband, is rapidly changing and competing carriers are experimenting with various practices and business models. There is no obvious “right answer” nor is there likely to be a single right answer for all consumers.
- The practices identified by Professor Wu can serve clearly efficient purposes, including coordinating the performance and interoperability of devices, the network, and applications to preserve quality of service; bandwidth management to economize on costs; and protection of privacy and security. These motives can be alternative explanations, or co-exist with, “revenue protection” in explaining various carrier practices, and policy makers will face inherently grave difficulties if they attempt to discern why various things are being done.
- Most importantly, it is not fruitful to attempt such an inquiry. Section II has established presumptions, based on various structural and conduct indicators, that wireless industry does not suffer lack of competition nor any clear performance problem. Professor Wu’s practices do not overturn these presumptions: the practices neither indicate lack of competition nor are they harmful on their face. In such circumstances, second-guessing firms’ decisions is economically unwarranted.

The next section explains why the precedent invoked by Professor Wu as ostensibly justifying regulation in fact do not apply, and explains some of the serious distortions that such regulation would create if attempted in the U.S. wireless industry.

#### **IV. ACCESS REGULATION IN WIRELESS: THE *CARTERPHONE* ANALOGY DOES NOT APPLY, AND REGULATION WOULD BE ESPECIALLY PROBLEMATIC**

Despite the facts that neither the structure of the mobile wireless industry nor its practices offer a basis for contemplating access regulation, Professor Wu argues that *Carterfone* precedents suggest that such regulation would be justified and successful in the wireless arena. The analogy fails on two grounds. First, *Carterfone* remedies were premised on competitive failures in a monopoly wireline industry that do not exist in today’s wireless industry. In addition, wireless technology is considerably more complex and rapidly changing than 1960s wireline technology, which suggests that attempted regulation is likely to impose considerable collateral damage. We address these two points in turn.

**A. *Carterfone* Type Regulation Is Normally Reserved for Bottleneck Monopolists That Pose a Serious Threat of Monopolizing Adjacent Markets**

*Carterfone* was adopted for the price-regulated and vertically-integrated Bell system monopoly — a firm that had both the clear *incentives* and *unilateral ability* to stifle competition in adjacent markets. Today's wireless industry is not price-regulated (nor vertically-integrated), and none of the competitive carriers enjoys anything approaching a dominant position — the cornerstone for concerns with leverage into adjacent markets. Consequently, the relevant conditions in the mobile wireless industry bear little resemblance to those of the Bell system.

Regarding incentives, it is well understood that price regulation as applied to the Bell system can induce a monopolist to integrate into adjacent markets that require access to the core monopoly service and stifle competition in those markets. This arises when the monopolist is subject to tighter price regulation if selling its core monopoly service than if selling adjacent services. The firm can then increase its overall profit by restricting, through technological discrimination, competitors' access to the monopoly service so as to shift sales to its affiliate.<sup>59</sup> Such profit-shifting foreclosure incentives *cannot* be extrapolated to an unregulated monopolist (let alone competitive wireless carriers). Foreclosing independents will degrade the supply of services that are *complementary* to the monopoly service — raise their cost, or reduce their quality or variety — which depresses demand for that service. This demand reduction would not significantly reduce profit for a monopolist whose rate of return on the core service is tightly regulated, but will do so for an unregulated monopolist, showing that it has a lot to lose from foreclosing independent suppliers of complements. While an unregulated monopolist might have other reasons to limit competition from independents (*e.g.*, to foster price discrimination), such opposing reasons cannot be presumed to dominate, and the analysis must be case specific.<sup>60</sup> Furthermore, an unregulated *competitive* wireless carrier — rather than a monopolist — has an added reason not to inefficiently deny access to complementary suppliers: the demand reduction for its service will be greater than for a monopolist carrier because consumers have the added option of switching to competing carriers.

Regardless of any incentives to foreclose in complementary markets, there remains the threshold question of *ability*. Today's wireless marketplace is far removed from the *Carterfone* scenario. No carrier is dominant, and there is no remote prospect of any carrier monopolizing handsets or other adjacent markets, as was the case with the Bell system in the days of the *Carterfone* decision. Numerous independent competitors provide equipment or applications, and there is little integration by carriers into these adjacent markets or long-term exclusivity

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<sup>59</sup> In addition to such (non-price) access discrimination, there can be an incentive to engage in procurement favoritism. If the firm is subject to cost-of-service regulation on its core monopoly product (local service) but allowed to supply itself with inputs (such as equipment) from an affiliate at prices that permit a higher margin, it will have incentives to discriminate in favor of that affiliate in its purchasing practices. For a discussion of these issues, see Timothy J. Brennan, *Why Regulated Firms Should Be Kept Out of Unregulated Markets: Understanding the Divestiture in United States v. AT&T*, *Antitrust Bulletin*, 32, 741-93 (1987); Jeffrey Church and Roger Ware, *Industrial Organization: A Strategic Approach*, Chapter 26.3 (McGraw-Hill, 2000).

<sup>60</sup> See, *e.g.*, Joseph Farrell and Philip J. Weiser, *Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age*, 17 *HARV. J.L. & TECH.* 85-134 (2003).

arrangements with independents. For these reasons alone, *Carterfone* presents no rationale for imposing access rules on wireless carriers.

Moreover, given the structure and operation of the wireless industry, durable exclusive arrangements (or vertical integration) would not be particularly troubling. In the case of a monopolist or dominant carrier, if an equipment or application supplier fails to obtain access to that carrier's network, it may be foreclosed from the entire market, raising a legitimate concern that valuable independents may be left out if only because of imperfect information by the carrier. By contrast, with competing carriers as in wireless, an independent supplier rejected by one carrier can turn to others. The availability of such competing platforms makes it unlikely that an independent that can add significant value will be foreclosed. Carriers that admit such an independent will advance their competitive position versus carriers that do not. Sound economic policy therefore displays broad tolerance for exclusivity relations and other superficially "restrictive" arrangements in markets characterized by significant rivalry among platforms.<sup>61</sup> Such exclusives can have important pro-consumer benefits, for example, through encouraging closer collaboration and investments by both parties.<sup>62</sup>

In sum, none of the *Carterfone* era circumstances applies, so *Carterfone* provides no economically sound precedent for imposing broad access regulation on the wireless industry. Moreover, the ill effects of regulation are likely to be much greater today, as explained next.

## **B. Access Regulation in a Complex and Rapidly Changing Technological Environment Like Wireless Would Be Especially Problematic**

### **1. Cellular *Carterfone***

Professor Wu advocates extending the *Carterfone* rules to mobile networks. (Wu, p. 2.) First, carriers should "stop blocking the registration of non-carrier affiliated telephones" and, on GSM networks, should stop locking equipment to a single network. (*Id.*, p. 21.) More importantly, the "industry or the FCC should, ... define a basic interface to which any equipment manufacturer could build a mobile device and sell to consumers." He portrays this as analogous to Part 68 of the FCC's rules, which allow the attachment of Customer Premises Equipment

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<sup>61</sup> Professor Wu's complaint about AT&T's exclusive relation with Apple for the iPhone (Wu, p. 5.) should be viewed in proper context. While this limits the ability of consumers to mix-and-match phones and networks, it hardly rises to the level of a policy concern. Moreover, exclusivity for particular models can be a common aspect of competitive differentiation, and can increase the return to providers of complementary innovations (such as Apple) and, hence, their incentive to innovate. The reason is that competing carriers must "bid" for exclusivity, and this bid reflects the role of the innovation in shifting subscribers among carriers when (and only when) the innovation is sold exclusively rather than non-exclusively. According to analysts, this logic characterizes Apple's exclusive deal with AT&T for the iPhone. Scott Moritz, *Apple Deal Bites Into AT&T*, TheStreet.com, <http://www.thestreet.com/newsanalysis/techtelecom/10350951.html> (Apr. 17, 2007); David Haskin, *iPhone will test loyalty of cellular customers*, Computerworld, <http://www.macworld.com/news/2007/04/24/loyalty/index.php> (Apr. 24, 2007).

<sup>62</sup> Michael D. Whinston, *Lectures on Antitrust Economics*. MIT Press: 2006 (chapter 4); Patrick Rey and Jean Tirole, "A Primer on Foreclosure," forthcoming in *Handbook of Industrial Organization* (section 5; observe that their article addresses foreclosure by a dominant firm, which is absent in the U.S. wireless industry).

(CPE) to the wireline telephone network through a standardized jack. (*Id.*) In support of the analogy, he cites Professor Noam (2001).

It is difficult to tell precisely what is envisioned here, but it is clear that the analogy ignores important technological constraints. One interpretation is that any handset should be able to work on any U.S. wireless network.<sup>63</sup> However, unlike the wireline network that employed a uniform technology nationwide, wireless carriers in the U.S. employ incompatible technologies, such as CDMA, iDEN and GSM in 2G, and additional ones in 3G. Making versatile phones that would work on all networks is more expensive,<sup>64</sup> and it is doubtful there is sufficient consumer demand in the U.S. to justify the extra cost since all the major U.S. carriers provide national coverage and pricing plans with no roaming charges.

Indeed, a main issue that Professor Noam's proposal sought to address — high roaming rates (Noam 2001, p. 10) — is being resolved in the U.S. through market forces: broad deployment of carrier facilities, competition, and favorable roaming arrangements among carriers have brought down U.S. roaming rates considerably. Data collected by CTIA show that between the second half of 2001 (six months ending December 2001) and the first half of 2006 (six months ending June 2006), average wholesale roaming prices paid by carriers have fallen from 12.9 cents per minute to 3.8 cents per minute.<sup>65</sup>

A more modest interpretation of the “basic interface” being requested is that it should enable any device to work seamlessly on any network that uses the same technology (e.g., GSM 850/900/1800/1900), but even this is problematic. As we have discussed in Section III, there are legitimate reasons why a carrier may insist on certifying devices, such as the need to ensure that they contain the necessary functionalities for OTA control. In principle, all such functionalities could be specified through extensive standards. However, the rapid technological advances in mobile wireless imply that the functionalities required of devices are in flux. Rather than attempting to codify new requirements in formal standards, which can be a slow and cumbersome process, a carrier and its equipment suppliers may reasonably prefer to adopt “pre standards” (*i.e.*, standards before they are fully codified) in order to get to market faster. This approach, by its nature, requires more individual certification of devices.

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<sup>63</sup> This interpretation is suggested by Professor Noam's article, which envisions a system where a single handset could be used on any carrier's network, and on a call-by-call basis. Professor Noam writes that a user could select “for any given call, another wireless service provider . . . [s]uch an arrangement . . . more importantly, permits a user to select service providers depending on circumstances. . . . A user encountering a circuit busy could switch to another carrier.” (Noam 2001, p. 22.).

<sup>64</sup> In future, technological advances may permit such versatility at lower cost. Specifically, developments in software-defined radio may allow equipment to send or receive over a wide band of frequencies in various modulation formats by using programmable hardware that is controlled by software. However, this is not imminent. *See* Louis E. Frenzel, “The elusive software-defined radio,” *Electronic Design*, vol. 54, no. 20, pp. 56-67 (Sept. 2006) (software defined radio is “still a work in progress”) and Roy Rubenstein, “Radios get smart,” *IEEE Spectrum*, vol. 44, no. 2, pp. 46-50 (Feb. 2007) (“[s]omeday, 10 or 15 years from now, all cellphone handsets probably will be based on software-defined radio . . .”).

<sup>65</sup> We calculated average wholesale roaming price using figures from CTIA Indices 2006 (Table 32 on roaming revenues and Table 106 on roaming minutes).

In sum, the seemingly obvious analogy to attachment of devices to the traditional wireline network does not fit.

## 2. Application Interfaces

Professor Wu is also critical of the difficulties that some handset software application developers might encounter due to carriers' qualification requirements for granting access to certain APIs and due to the absence of uniform standards. (Wu, pp. 15-16, 23. We addressed some of these issues in Section III.) However, he doubts that government can play a useful role in this area and instead urges carriers, manufacturers, and developers to create a "standardized development environment." (*Id.*, p. 23.) Others, though, have called for specific regulatory intervention. Skype's recent petition to the FCC asserts that "... the Commission should create a mechanism to establish similar [to Part 68] technical standards updated to take into account the unique environment of the mobile Internet."<sup>66</sup> Skype apparently wishes to regulate aspects of mobile device operating systems, especially those pertaining to the logical, computational and memory functions concerned with user control and information.<sup>67</sup> Doing so would ignore the fundamentally distinct technical characteristics of wireline versus wireless CPE.

*Carterfone* type regulation, including the Part 68 rules, was successful largely because the interfaces between the CPE and the wireline network were relatively *simple* and *stable*. Regarding simplicity, the wireline access network employed two relatively rudimentary signaling technologies (dial pulse and touchtone) and one transmission technology (analog). As an example of the relative simplicity of interfaces, many of the pages of Part 68 contain straightforward circuit diagrams and mechanical drawings showing the dimensions of plugs and jacks. The remaining pages are mostly concerned with administrative matters.<sup>68</sup> Regarding stability, landline telephone sets typically are kept in service for a long time; this was especially true in a pre-Part 68 world. With no jacks on the ends of the telephone cords (since these were defined by Part 68), a telephone set was permanently wired to its plate on the wall. Because so many different vintages of sets were in use at any given time, changes to the interface between the set and the network could happen only very slowly. Any change to basic telephone sets was required to be backward compatible. This is still true now, for example, some 100 year old antique telephones will work on the public wireline network today.

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<sup>66</sup> Skype Petition, p. 30.

<sup>67</sup> "[T]he Commission should establish a mechanism to create technical standards that protect the *Carterfone* principle with respect to the market for applications that run on 3G Internet access networks." *Id.*, p. 31. Skype advances this proposal under the heading of protecting consumers' right to run applications of their choice. Professor Wu's main recommendation in this area is for regulators to scrutinize the contractual bans that some carriers impose on consumers' use of certain applications in certain pricing plans. (Wu, p. 22.) We addressed such bans in Section III.

<sup>68</sup> Over time, the administration of Part 68 has become even more routine. The FCC privatized many aspects of this process in 2000. The Commission established the Administrative Council for Terminal Attachments (ACTA) to adopt technical criteria and to act as a clearinghouse, publishing technical criteria for terminal equipment developed by American National Standards Institute accredited standards development organizations. ACTA does not make substantive decisions regarding the development of technical criteria, but does maintain the registration database of equipment approved as compliant with such standards. Both functions previously were performed by the FCC.

This historic success of Part 68 in wireline would be a poor predictor of future success for similar rules in wireless. Attempting to apply Part 68-like rules to simplify cellular handsets for independent software application providers, as Professor Wu and Skype suggest, would likely result in failure — because, quite unlike the wireline world, the wireless handset environment is exceedingly *complex* and *dynamic*.

Cellular handsets are highly sophisticated, using computer controllers that require operating systems. Several such systems have been written specifically for the mobile device environment, including Symbian (a joint venture of major cellphone manufacturers) and Windows Mobile.<sup>69</sup> David Wood, the co-founder of Symbian, discussed the complexity of mobile systems in a book addressed to application developers:

There is no escaping the reality that the world of the new mobile phones is tremendously complex. The goal of Symbian OS is to tame the complexity and hide it from users, but that doesn't make the complexity go away (in fact, it actually makes the development task even harder). For companies that wish to develop new mobile phone solutions, a solid knowledge of the technicalities of Symbian OS is an excellent starting point, but it's by no means sufficient.<sup>70</sup>

The cellular technological environment is also very dynamic. New handset models with increased capability are released frequently. Compared to wireline telephone sets, consumers replace wireless handsets often. As cellphone computational power, memory and display resolution have increased, cellular operating systems have been revised and expanded accordingly. For example, the latest version of Symbian is release 9.5 and the latest version of Windows Mobile is release 6. Different cellphone models may use different subsets of the full operating system, depending upon memory limitations and need. Peripherals (*e.g.*, keyboards and keypads) will have different interface software (*i.e.*, drivers) depending upon hardware design. Operating systems may also be augmented by suites of programs that provide additional commonly used functionality (such as UIQ and S60 for Symbian and .NET Framework for Windows). Programmers, using languages such as C, C++ and Java, call upon operating system capabilities through application programming interfaces (APIs).

As an example of the dynamic nature of the industry, Symbian versions 8.0, 8.1, 9.1, 9.2, 9.3 and 9.5 were released between February 2004 and March 2007.<sup>71</sup> These releases, spanning just three years, contained additions and improvements in areas such as:

- 3D Graphics
- Java optimization
- Remote device management capability

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<sup>69</sup> Other operating systems for small mobile devices include a proprietary system used on the BlackBerry and a specialized version of the open source Linux.

<sup>70</sup> David Wood, *Symbian for Software Leaders: Principles of Successful Smartphone Development Projects*, p. 18 (John Wiley & Sons 2005).

<sup>71</sup> <http://www.symbian.com/symbianos/releases/symbianosreleases.html> (last visited Apr. 16, 2007).

- Network roaming
- Handset identification
- Bridge and router gateways
- Security
- Memory demand paging
- Configuration loading
- Software migration
- Firmware updating

If it attempted to impose Part 68 type regulation on aspects of mobile device operating systems (such as Symbian), the FCC would face a level of technological complexity in an area not traditionally regulated by the Commission. Because of the dynamic nature of these systems, regulatory involvement would be ongoing. Thus, while Part 68 for wireline CPE was an unqualified success, arguably one of the most successful regimes in telecommunications regulation, the analogy to wireless CPE does not hold. Simply put, regulation of APIs used in mobile radio devices will be considerably harder than establishing the phone jack. There is a strong likelihood of getting things wrong and stifling innovation.

Although Professor Wu recognizes the risks and does not call for such regulation, he criticizes the inconsistencies among mobile operating systems and calls on the industry to establish a standardized development environment by adopting clear, open and unified standards for developers. (Wu, pp. 2, 23.) As noted above, in the U.S. there are several major mobile operating systems (more than are available for desktop systems). These systems are indeed inconsistent, and standardization could reduce costs for developers. However, standardization also would have its own costs. The diversity of operating systems reflects their different origins and provides variety which is valuable to consumers. For example, Symbian was created by a group of cellphone manufacturers and contains very strong telecommunications functionality. Windows Mobile applications, not surprisingly, integrate well with Windows desktop applications. The proprietary operating system used on the Blackberry has robust email functionality but is less well suited for third-party software applications.<sup>72</sup>

While ideally one operating system would combine the best of all features, the complexity and dynamic nature of operating system design suggests that such a combination would be difficult to achieve. In its absence, permitting diverse approaches in the wireless world offers users in the U.S. a greater variety of choices and can foster strong technological competition among wireless smartphones. Mandating a standard, or doing so too soon, can sacrifice variety or result in adoption of a wrong standard. Entrusting standard setting to a cooperative industry body can slow down innovation due to the need to reach consensus, and can sacrifice unique and useful features in favor of a lowest common denominator.

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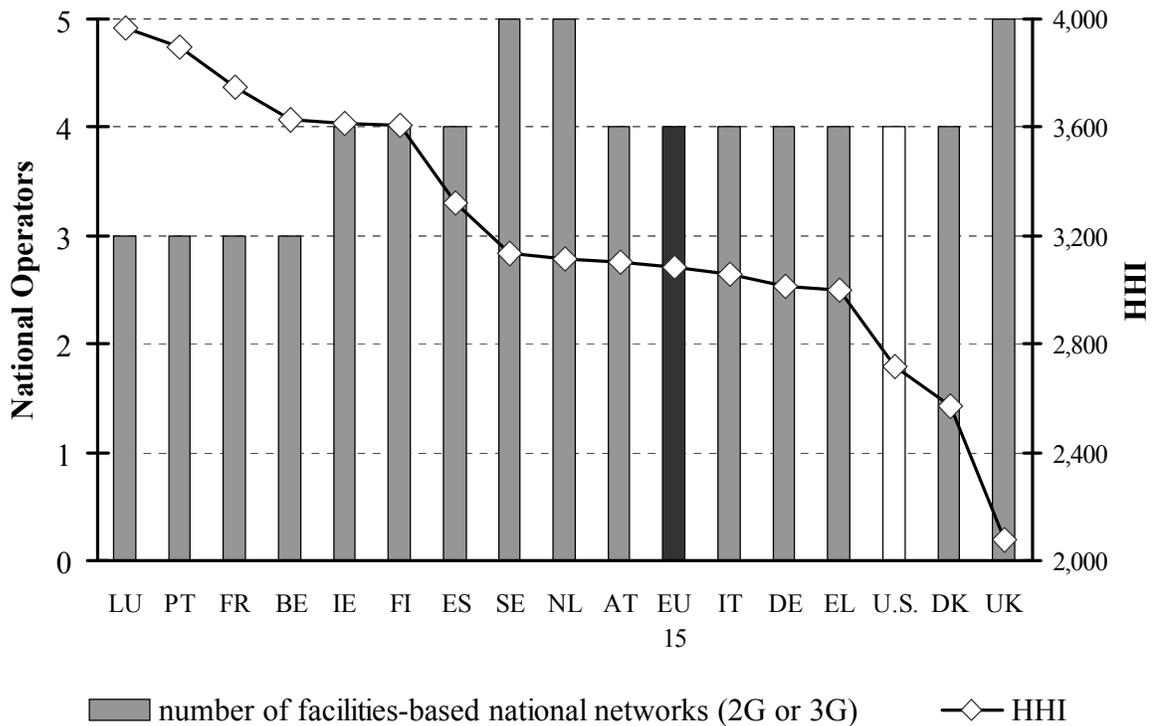
<sup>72</sup> A series of articles on the various operating systems available for mobile devices can be found at <http://searchmobilecomputing.techtarget.com> (last visited Apr. 16, 2007).

## V. CONCLUSION

In any industry, there will be some consumers or outside observers who are not entirely satisfied with certain aspects of firms' offerings. But this hardly provides sufficient grounds for contemplating regulation. Regulation has a proper role to play when there is a clear and durable competitive failure and reasonable confidence that the regulation will not inflict undue harm. In the absence of convincing evidence of an initial failure — which Professor Wu's examples certainly do not provide — regulation should not even be entertained seriously. This is especially true in a complex and dynamic industry like wireless, where regulation is likely to produce considerable harm. The wireless industry is very far from needing regulatory remedies, let alone those as drastic as access regulation.

## APPENDIX A: Number of Operators and Concentration, U.S. versus Europe

**Figure 1: Number of Facilities-Based National Operators and HHI, U.S. (end of 2005) and EU-15 countries (October 2006)**



### Sources:

- USA: FCC Eleventh Report.
- Europe: “European Electronic Communications Regulation And Markets 2006” (EU Twelfth Report), European Commission, [COM(2007) 155], Brussels, 29 March 2007, Annex II, and GSM Association website.

### Notes:

- The HHI for the U.S. (2,716) is computed based on the number of subscribers of the four largest national carriers only (ATT, Sprint, T-Mobile, and Verizon) reported in the Eleventh Report, Appendix A, Table 4.
- The EU Twelfth Report does not report HHI figures directly; but reports the subscribers for each of the top two operators operator, and the total for the remaining operators. For EU 15 countries, the HHIs reported in the figure have been calculated assuming that the market share not accounted for by the largest two operators is equally divided among the other facilities-based operators. When there are more than three facilities-based operators, the HHI reported in the figure thus represents a *lower bound* for the actual HHI.
- EU 15 HHI and number of operators are computed as a population-weighted average.
- Entries ordered from right to left in descending order (by HHI).
- AT: Austria; BE: Belgium; DE: Germany; DK: Denmark; EL: Greece; ES: Spain; EU 15: weighted average (by subscribers) across the 15 European Union countries; FI: Finland; FR: France; IE: Ireland; IT: Italy; LU: Luxembourg; NL: Netherlands; PT: Portugal; SE: Sweden; UK: United Kingdom; U.S.: United States.
- The actual HHI value in the UK at the end of 2005 is 2,276 (source: “The Communications Market 2006”, OFCOM, 10 August 2006, Figure 3.40, p.151).

## APPENDIX B: Average Minutes of Use and Average Price in the U.S.

Table 1 below reproduces CTIA information, cited in the FCC’s Eleventh Report, on the Average Local Monthly Bill (ALMB)<sup>73</sup> per subscriber and Minutes Of Use (MOUs) per subscriber per month.<sup>74</sup> The MOUs reported by the FCC are monthly “local and roaming” billable MOUs;<sup>75</sup> Table 1 reports also monthly “local only” MOUs not cited by the FCC.<sup>76</sup>

**Table 1: ALMB and Monthly MOUs, 1993-2005**

	ALMB	Monthly MOU “local and roaming”	Monthly MOU “local only”	“Local only” minutes as % of “local and roaming”
1993	\$61.49	140	130	92.8%
1994	\$56.21	119	109	91.7%
1995	\$51.00	119	109	91.5%
1996	\$47.70	125	114	91.0%
1997	\$42.78	117	108	92.1%
1998	\$39.43	136	124	91.4%
1999	\$41.24	185	169	91.2%
2000	\$45.27	255	235	92.1%
2001	\$47.37	380	357	94.0%
2002	\$48.40	427	397	92.9%
2003	\$49.91	507	471	92.9%
2004	\$50.64	584	544	93.2%
2005	\$49.98	740	663	89.6%

Source: FCC Eleventh Report, CTIA Indices 2006.

Note: Data reported for each year is based on the last six months of the year.

In constructing an Average Revenue Per Minute as a proxy for the average price paid by consumers, one difficulty is the lack of publicly available information about retail roaming payments — payments made by a consumer to its carriers for calls when traveling outside that carrier’s coverage area. To estimate price, the FCC divides ALMB by local and roaming minutes. Since ALMB does not include roaming charges, this approach may underestimate price. However, since roaming minutes only comprise about 10% of local-and-roaming minutes (see Table 1), and since many consumers subscribe to “national plans” that levy no roaming charges,<sup>77</sup> the omitted revenue category is likely to be small, and therefore any bias is also likely

<sup>73</sup> The CTIA defines ALMB as to “include local service revenue, which consists of charges for airtime service and features billed by a carrier to its subscribers for services received in its market(s). Excluded are roaming charges, toll charges, taxes on service revenues, equipment sales, installation, and repair revenues.” CTIA Indices 2006, p.211.

<sup>74</sup> FCC Eleventh Report, Appendix A, Table 10.

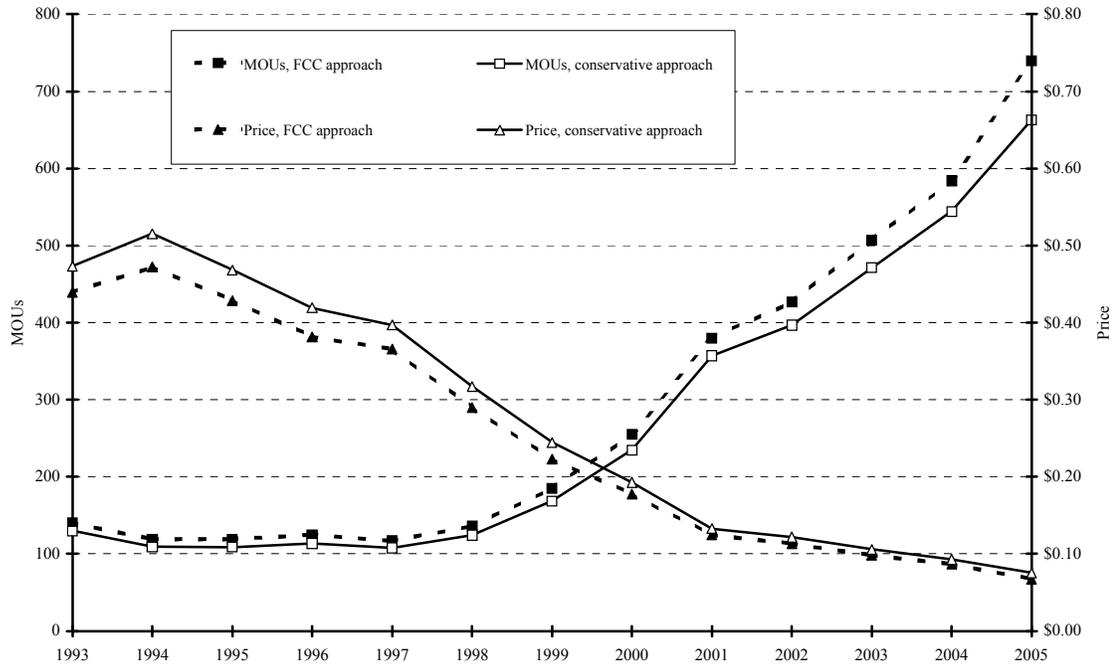
<sup>75</sup> CTIA Indices 2006, Table 111 (p. 228) (years 1993 to 2004) and Table 112 (p.229) (year 2005). Roaming minutes are those that carriers exchanged at wholesale to allow their respective subscribers to place and receive calls when outside the areas covered by their own networks.

<sup>76</sup> We computed monthly “local only” MOU per month using information on minutes reported in CTIA Indices 2006, Table 104 (p. 216) and on subscribers reported in Table 111 (p. 228).

<sup>77</sup> FCC Eleventh Report, ¶ 90.

to be small. A more “conservative” approach to calculating average price per minute involves dividing ALMB by “local only” monthly MOUs. Figure 2b reports prices computed using both approaches, as well as the corresponding monthly MOUs used to compute prices under each approach. The differences are fairly minor, and the trends are virtually identical.

**Figure 2b: Wireless Monthly MOUs and Price Per Minute in the U.S., 1993-2005**



Source: see Table 1, above.

## APPENDIX C: Methodology for U.S. versus Europe Performance Comparisons

### a) Minutes Of Use

Under CPP, MOUs statistics record the minutes a subscriber originates, but not those she receives, as in the U.S. In order to calculate how many minutes a European subscriber originated or received in a given month, we added:

- *Originated* domestic mobile-to-mobile minutes multiplied by two;
- *Originated* mobile-to-fixed minutes;
- *Received* fixed-to-mobile minutes (these minutes are included in wireline subscribers' MOU statistics, but are not typically reported as wireless MOUs enjoyed by mobile subscribers in Europe);
- *International roaming* minutes — when using her mobile phone abroad, a European subscriber gets charged both for call originated and call received. For this type of calls, usage statistics are kept in the same way on both sides of the Atlantic, so no adjustment is needed.

### b) Prices

We computed average per minute prices dividing the average retail monthly bill (voice charges only) by the MOUs computed as described above. Note that we did not “mark-up” the retail bill to account for the fact that fixed-to-mobile calls, while “free” for the mobile subscriber, produce revenues for the mobile operators through access (termination) charges paid by the wireline operators. We did not include these payments because the focus here is comparing *retail* prices paid by *mobile* end-users (that in Europe, but not the U.S., obtain incoming calls for “free”).

### c) Sources and methodology notes

#### France

Autorité de Régulation des Communications Electroniques et des Postes, *Rapport Public d'activité 2005*.

- SUBSCRIBERS: Unnumbered figure, Part 4, Chapter 2, Section C.2.1.1.2, p. 163 (active subscribers).
- MOUs:
  - Unnumbered figure, Part 4, Chapter 2, Section C.2.2, p. 168 (mobile-originated minutes, by receiving party: mobile on-net, mobile off-net, fixed, international, roaming).
  - Unnumbered figure, Part 4, Chapter 2, Section A.2.1, p. 156 (fixed-to-mobile minutes).
- MOBILE RETAIL VOICE REVENUES: Unnumbered figure, Part 4, Chapter 2, Section C.2.1.2.1, p. 165.

## Germany

Bundesnetzagentur für elektrizität. Gas, Telekommunikation, Post und Eisenbahnen, *Jahresbericht 2006*.

- SUBSCRIBERS: Unnumbered figure, page 71.
- MOUs: Unnumbered figure p. 72 (mobile-originated and mobile-received minutes).

### Methodology note:

As mobile-to-mobile on-net minutes do not generate termination access charges, they do not get recorded as mobile-received minutes. In the absence of detailed information on the percentage of mobile-originated calls that stay on-net, we assumed that all mobile-originated minutes are on-net, and doubled the corresponding figures to account for mobile-to-mobile on-net minutes received by mobile end-users in Germany.

## Italy

### Sources and methodology note:

The main source we used, which reports figures for the period 2003-2005, is:

Autorità per le garanzie nelle comunicazioni and Autorità Garante della Concorrenza e del Mercato, *Indagine conoscitiva sui contributi di ricarica nei servizi di telefonia mobile a credito prepagato*, Allegato A - Delibera n. 659/06/CONS, November 2006. (Source A)

As for 2002 and 2001, we extrapolated backwards the data reported in the main source above using the year-on-year growth rates (minutes and mobile voice revenues) in:

Autorità per le garanzie nelle comunicazioni, *Identificazione ed analisi del mercato dell'accesso e Della raccolta delle chiamate nelle reti telefoniche Pubbliche mobili, sulla valutazione di sussistenza del Significativo potere di mercato per le imprese ivi operanti E sugli obblighi regolamentari cui vanno soggette le Imprese che dispongono di un tale potere (mercato n. 15 fra Quelli identificati dalla raccomandazione sui mercati Rilevanti della commissione europea)*, Allegato A alla delibera n. 46/06/CONS (Source B)

Information on fixed-to-mobile minutes comes from:

Autorità per le garanzie nelle comunicazioni, *Relazione Annuale sull'attività svolta e sui programmi di lavoro*, years 2002-2006. (Source C)

- ACTIVE SUBSCRIBERS: Table 2.5, p. 20 (Source A, '03-'05); Table 2, p. 38 (Source B: growth rates '01-'03).
- MOUs: Table 2.6, p. 21 (Source A, '03-'05); Table 2, p. 38 (Source B: growth rates '01-'03).
- MOBILE RETAIL VOICE REVENUES: Table 2.7, p. 22 (Source A, '03-'05); Table 2, p. 38 (Source B: growth rates '01-'03).

## **Spain**

Comisión del Mercado de las Telecomunicaciones, *Informe Anual 2005*.

- SUBSCRIBERS: Table 103, p.321.
- MOUs:
  - Table 90 (total mobile-originated minutes) and Table 91 (distribution of mobile originated minutes by receiving party: mobile on-net, mobile off-net, fixed, international, other), p. 316.
  - Table 53, p. 296 (fixed-to-mobile minutes).
- MOBILE RETAIL VOICE REVENUES: Table 96, p. 318.

### Methodology note:

Table 91 reports information for the period 2003-2005. we computed the number of mobile-to-mobile minutes (to be double counted) in 2002 and 2001 by extrapolating backwards the trend in the percentage of mobile-originated minutes that were mobile-to-mobile minutes (linear trend, with intercept), and applying the estimated percentage to the figures reported in Table 90.

## **United Kingdom**

Office of Communications, *The Communications Market 2006*, 10 August 2006.

- ACTIVE SUBSCRIBERS: Figure 3.36: Mobile active customers, p.149.
- MOUs:
  - Figure 3.50: Average minutes per active mobile connection, p. 159 (mobile-originated minutes, by receiving party: mobile on-net, mobile off-net, fixed, international, other).
  - Figure 3.49: Average voice minutes per residential fixed line, p. 159 (fixed-to-mobile minutes).
- MOBILE RETAIL VOICE REVENUES: Figure 3.35: Mobile retail revenue, p. 148.

## PENETRATION RATES

The cellular penetration rate is defined as the quantity of cellular phone numbers divided by the population. In 2006, the U.S. figure was 72.5%, compared to 82.3% in France, 100.7% in Germany, 133.8% in Italy, 103.6% in Spain and 109% in the UK.<sup>78</sup> However, as suggested by penetration rates exceeding 100%, this measure can significantly overestimate the number of active subscribers, and bias the comparison against the U.S. In the U.S., only about 10% of wireless users subscribe to prepaid rather than postpaid plans (at the end of 2005), while the prepaid share in Europe is 60% (as of October 2006).<sup>79</sup> Thus, U.S. subscribers are very likely to drop their initial carrier when signing up with another, because continuing also with the first incurs significant ongoing charges. By contrast, prepaid subscribers in Europe incur a much lower cost to maintain their old account instead of disconnecting it when switching to another primary carrier — even if they use the old account only minimally.<sup>80</sup> Penetration rates will therefore include many subscribers in Europe who make very little use of one or more accounts. As an indication of this bias, the 2006 penetration in Italy is 133.8% among all subscribers, but drops to 114.8% when considering only “active” subscribers.<sup>81</sup> Confining attention to “active” subscribers can still yield a significant overestimate of actual use since a subscriber who placed or received even a single call on an account in the last few months is still counted as “active.”

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<sup>78</sup> U.S. penetration, CTIA Indices 2006, Table 13 (p.30). European countries: EU Twelfth Report, Annex, Volume 2, Figure 35 (p.39)

<sup>79</sup> For the U.S., see FCC Eleventh Report, ¶ 3. For Europe, see EU Twelfth Report, Annex, Volume 2, Figure 36 (p. 40).

<sup>80</sup> These biases are noted in the FCC’s Eleventh Report, ¶ 190.

<sup>81</sup> Active subscribers in Italy in 2005 come from table 2.5 (p.20) of “Indagine conoscitiva sui contributi di ricarica nei servizi di telefonia mobile a credito prepagato,” *Autorità per le Garanzie nelle Comunicazioni* (AGCOM) and *Autorità Garante della Concorrenza e del mercato* (AGCM), November 2006 (published as Allegato A - Delibera n. 659/06/CONS, AGCOM). Italy’s population in 2005 comes from EU Twelfth Report, Annex II, Volume 2, table 8.7 (p.122).