

***GUEST EDITORIAL*** - by Mark Jamison (1), Len Waverman (2) and Niall Levine (3)

***“Competition in Wireless: Spectrum, Service and Technology Wars”***

It is by now well understood that wireless is becoming the dominant mode for voice telecommunications worldwide. According to the International Telecommunications Union (ITU), the number of mobile phones was to exceed the number of fixed line phones by 2003 (ITU, 2000). This pattern first emerged in Cambodia in 1993 and by the year 2000 it was also true for thirteen developed countries and twenty-two developing countries. (ITU, 2002) It appears that even in the United States (US) – long the holdout developed country for significant mobile telephone growth because of its high fixed line penetration – the conventional wisdom is that the number of fixed line phones is declining as customers drop their fixed line service for mobile service.

This advancement of wireless telecommunications is changing the nature of telecommunications policy issues, which fixed-line issues have historically dominated. At the physical and service layers, mobile telephony has standards, spectrum allocation and spectrum assignment issues that wireline telephony has largely avoided. Standards issues affect services offered, network compatibility and coverage, business models and market structure. For purposes of this paper, spectrum allocation means reserving portions of the radio spectrum for particular uses, such as mobile telephony or satellite communications. Spectrum assignment means licensing or otherwise permitting someone to use the radio spectrum for the designated purpose. Spectrum allocation affects the services and quality of service offered in a country, the technologies used and the market structure. Methods of spectrum assignment also affect services offered and market structure and may affect prices paid by customers.

Once standards and spectrum issues have been resolved, there remain issues of competition and regulation. The nature of competition in mobile telephony is different from that of fixed line telephony because the licensing policies are different, the cost structures are different and how customers use the services are different. Many developed countries place no limits on the number of fixed line licenses issued, but limit the number of mobile licenses because of concerns about spectrum capacity. The conventional wisdom is that competition is difficult to sustain in fixed line telecommunications because the high fixed costs of local lines are a barrier to entry. Furthermore, rival fixed line networks would generally duplicate some network access lines, which could result in an increase in costs and give the industry the cost characteristics of a natural monopoly.<sup>1</sup> Mobile service does not appear to suffer from this fixed cost problem. Mobile has proportionately fewer fixed and customer-specific costs than does fixed line. Also, the experience to date appears to be that competition in mobile is viable and can be quite aggressive. Customers consider coverage when choosing a mobile service provider, something that is largely not at issue with fixed line service. This means that mobile service can be and is a competitor to fixed line service at least in some countries, but fixed line telephony can only be an imperfect substitute for mobile telephony.

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<sup>1</sup> This conventional wisdom fell out of favor in the 1990s, but is experiencing resurgence as the development of fixed line competition is slower than some thought would be the case.

These wireless policy issues were the topic of a symposium *Competition in Wireless: Spectrum, Service and Technology Wars* that was held at the University of Florida on February 19-20, 2002 and that was co-sponsored by the Global Communications Consortium at the London Business School and the University of Florida's Public Utility Research Center, Center for International Business Education and Research and Public Policy Research Center, with financial support from Motorola. With one exception –Darin Lee's paper on the Nigerian GSM auctions – the papers in this issue of *Telecommunications Policy* are from this symposium.

The papers selected for this issue of *Telecommunications Policy* examine the range of topics outlined above. Beginning with the physical layer of wireless networks, Neil Gandal, David Salant and Leonard Waverman examine how technical standards for networks and mobile phones affect service expansion. In the late 1980s and early 1990s policy makers in the US and Europe debated whether governments should mandate technology standards for digital mobile telephony, also called second generation or 2G wireless. In Europe the belief was that a single, government-mandated standard would lower costs and improve coverage, so the European Union mandated the GSM standard. US policymakers believed that competitive markets were more efficient than governments for choosing technical standards, so the US allowed service providers and customers to make this choice. The result has been that several technologies have coexisted in the US, including GSM, CDMA and TDMA.

José Leite Pereira-Filho examines another physical-layer issue, the allocation of spectrum for broadband mobile telephony, also called third generation or 3G. He focuses on the issues faced in Brazil and other Latin American countries. There exists overlap between the radio spectrum bands that the ITU recommends these countries use for 3G and that they use for 2G and Multipoint Multichannel Distribution Service or MMDS, which is the wireless technology used for cable television or other broadband signals that go from a single sender point to multiple receiving points. The ITU recommends that 3G use the 1920 – 1980 MHz and 2110 – 2170 MHz bands, but 2G uses the 1930 – 1990 MHz band and MMDS uses the 2150 – 2162 MHz band. Absent an economical technology that allows these services to share radio spectrum, it is necessary for these countries to move 2G and MMDS to other parts of the radio spectrum find an alternative portion of the radio spectrum that is suitable for 3G and unused by other services, or not license 3G. Brazil resolved the 2G-3G conflict by shifting 2G to another part of the radio spectrum. This was accomplished with little disruption because existing 2G operators in Brazil were not yet using the 1930 – 1990 MHz band. However, the decision was still difficult because Brazil is a technology follower, which means that Brazil had to consider the prospects for an international market for 3G equipment in the 1920 – 1980 MHz band, issues of international roaming and scale economies in production and operation to name a few.

Focusing on WiFi and 3G technologies, William Lehr and Lee McKnight examine how technology standards and spectrum licensing policies affect business models, services and competition in wireless broadband. WiFi is a technology for wireless local area networks that is gaining in popularity in the US. WiFi uses an unlicensed portion of the radio spectrum, which means that there is no spectrum assignment – anyone who purchases WiFi equipment can use it anywhere. This makes WiFi end-user centric, meaning that residential customers, business users and retail business, such as Starbucks coffee shops and hotels, can set up their own WiFi networks and connect them to the Internet. Some companies, such as Deutsche Telekom and Boingo, sell WiFi networking and Internet access to businesses such as Starbucks so that these businesses can provide their customers with broadband wireless Internet access. 3G represents a different business model than WiFi. Based on the traditional mobile telephony business model, 3G is based on a top-down, service provider-central business model. The service provider obtains a spectrum license and offers customers a vertically integrated service. Lehr describes the

differences and similarities of WiFi and 3G and concludes that the future will be a heterogeneous mixture of WiFi-like and 3G-like technologies.

There are several methods that governments can use to determine who should receive spectrum licenses. Stephen McDowell and Jenghoon Lee explain how India's experiences with mobile licensing illustrate how license granting procedures evolve as countries gain experience. In the early 1990s, India followed the path of many developed countries, auctioning spectrum licenses for fixed fees and finding that some licensees had difficulty meeting their fee payment obligations. This problem, coupled with India's desire to stimulate network deployment in rural areas and provide competition for fixed line services, led the country to try two other licensing mechanisms. For some licenses, India imposed fees based on a percent of operating company revenues. For other licenses, India required license holders to introduce service simultaneously in rural, semi-urban and urban areas. The latter approach uses an implicit urban-to-rural subsidy, reminiscent of some traditional fixed line subsidy systems. Both approaches add to the marginal costs of expanding service, which should depress output according to economic theory. Additional research, perhaps along the lines proposed by Johannes Bauer's paper in this issue, would be needed to determine if these approaches have been superior to simply lowering the fixed fees.

A key feature of spectrum auctions is auction design. Chris Doyle and Paul McShane describe lessons from the first "Anglo-Dutch" spectrum auction, the Nigerian GSM auction that occurred in January 2001. An "Anglo-Dutch" auction combines elements of the ascending clock and sealed bid auction formats. Doyle and McShane examine two important aspects of the Nigerian auction. First, they provide an extensive explanation of the technical and strategic decisions that the government made to apply the economic theory underlying the auction. Second, they describe the lessons learned from several last minute changes the government made to the auction rules. Doyle and McShane take a positive view of the auction. They emphasize the positive public opinion, the transparency of the process and the amount of money paid for the licenses. There is general consensus that the auction was a success even though the last minute rule changes complicated bidding strategies. Lee largely concurs with Doyle and McShane, but adds that he believes that the government might have raised more money through the auction with a slight change in the auction rules. He illustrates his suggestion with an example, but further research is needed to ensure that the bidders in his example would truly be willing to make the example bids given the auction rules he suggests. Lee also explains that the appearance of auction mechanisms matters. In the Nigerian case, bidders objected to using a coin toss to break ties. Their objections were not based on concerns about the outcome, but on using what could be viewed as a trivial mechanism to decide something as important as a telecom license.

Johannes Bauer examines the important issue of how fees paid for spectrum licenses affect prices and market structure. The recent high prices paid by some European telecommunications operators for 3G licenses, which seem to have placed operators in financially precarious positions, have stimulated a debate over whether high spectrum fees result in high market prices for mobile service. Persons on one side of the debate believe that such fees are a fixed cost and so do not affect prices. Persons on the other side argue that higher fees can cause higher retail prices by increasing capital costs (and as a result marginal operating costs if the fees increase the riskiness of the firm) or by providing incentives for collusion. Furthermore, they argue, the license fees are actually repeated over time, giving firms an incentive to ensure that prices raise if license fees rise. Bauer provides an initial step for empirically testing these opposing views of the effects of license fees on service prices. Although his data set is too small to draw strong conclusions, his model implies that there is insufficient evidence to conclude that higher license fees result in higher market prices.

Focusing primarily on Germany, Annegret Groebel examines rivalry in mobile telephony to determine whether regulation or competition law is better suited for oversight of mobile telephony. Groebel believes that the primary difference between regulation and competition law is that regulation seeks to create an environment in which market forces can control market power while competition law seeks to remedy the abuse of market power. She concludes that regulation is largely unnecessary for mobile telephony because, in contrast with fixed service, there is no legacy of market dominance and no vertically integrated incumbent. Because in any particular geographic area there is a limit on the number of mobile telephony licenses that a government will issue, the mobile market is a natural oligopoly. This does not imply a need for regulation, however, because mobile markets are national and at least in Germany, no operator or operators have sufficient market share to be considered dominant. This applies to call termination as well as call origination because each operator must negotiate call termination prices with each of its national competitors. Furthermore, countering the argument that each operator has substantial market power for calls terminating on its own network, Groebel explains that this argument leads to the conclusion that market power is a permanent fixture in mobile telephony. She believes that this conclusion is contrary to her notion of regulation, which is that of a non-permanent activity focused on creating an environment for competition. Therefore, she concludes, this sort of permanent market power is not something that regulation can address.

Another important competition question for mobile communications is the extent to which competition exists between fixed and mobile networks. Mark Rodini, Michael Ward and Glenn Woroch examine this important issue by empirically testing the substitutability of mobile telephony for fixed line telephony. In many countries, it is taken for granted that wireless phones provide competition for fixed line phones. This has not been the case in the US, where approximately 95 percent of all households have a fixed line phone and 2G telephony was initially slow to develop, at least compared to Europe. Motivated by recent reports that some US customers are dropping their fixed line service and relying on mobile phones, Rodini, Ward and Woroch estimate cross-price elasticities between fixed and mobile telephony in the US. They conclude that the US appears to be different from most other countries. Their results indicate that it is premature to infer that mobile service constrains fixed line service prices in the US, but they do find evidence that second fixed lines and mobile service are substitutes.

The policy issues in wireless telephony are critical to the development and use of telecommunications infrastructure. They also provide a rich field of research for scholars. The papers from the *Competition in Wireless: Spectrum, Service and Technology Wars* symposium make important contributions to our understanding of how standards and standards setting, spectrum allocation and assignment and regulation affect the development and deployment of wireless and wireline services, business models, welfare and market structure. But many questions remain. How does standards policy affect technology evolution? Lehr points out that the direction of technology evolution will be a critical outcome of the choices made about WiFi and 3G, but we lack an empirical test of the welfare effects of standards policies. We also lack empirical tests of spectrum allocation policies to know if less or more spectrum use oversight is needed and under what conditions it is optimal to change a spectrum allocation to accommodate new uses. We also need to examine the precise nature of the rivalry/complementarities between WiFi-like and 3G-like technologies and who is most likely to make the critical choices. WiFi and 3G differ in their physical properties, making one more suitable than the other in some geographic areas and the other more suitable in other geographic areas. Their different business models make it possible for disruptions in market structure if, for example, vertically integrated carriers are forced to give way to retail businesses and cities that sell telecommunications based on their geographic locations.

There is much that we do not know about the effects of spectrum auctions and spectrum license fees. Case studies provide useful guidance for policy makers who need to implement ideas. Detailed studies – such as the Nigerian study by Doyle – of how decisions are made and how stakeholders respond to the decisions and the decision-making process are needed. But case studies cannot identify common themes and market responses. To address these issues, Bauer-like studies are needed to see if fixed fees truly have different effects than do usage- or revenue-sensitive fees and to see who – operators or customers – pays the rents that governments extract from spectrum markets. It would also be useful to understand how governments use the monies collected through spectrum fees to determine if these are simply substitute taxes or new money to the government, who benefits from the monies collected and whether higher fees are really indicators of success.

Lastly, as Lehr-McKnight, Groebel and Rodini-Ward-Woroch point out, there are much that we do not know about the nature of competition and the role of regulation in wireless. In addition to the business model questions that we have already described, there is a need to understand how to measure rivalry in mobile networks and between mobile and fixed networks. There is also a need to examine the effectiveness of regulation. The question of whether regulation is by nature transitory or permanent is critical to Groebel's analysis and highlights a need to move beyond the studies that examine how the strength of regulatory institutions affect market outcomes (Levy and Spiller, 1994; Guitierrez and Berg, 2000; Henisz and Zelner, 2001; and Hamilton, 2002) and into detailed analysis of the effects of specific regulatory mechanisms and policies.

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