

nationwide networks that cover approximately 87.5 percent of the U.S. population.¹ In addition to national carriers, the wireless industry consists of a large number of regional and rural carriers, as well as mobile virtual network operators and wholesalers.² Exhibit 1 presents the average spectrum holdings and shares of the six largest wireless carriers in the 50 largest U.S. markets.

6. Verizon, a joint venture of Verizon Communications and Vodafone, is the largest wireless communications company on a subscriber basis. Verizon Communications is the majority owner (55 percent) in Verizon Wireless and retains management control of the joint venture.³ Verizon provides wireless voice and data services across the U.S. to business, consumer, wholesale, and government customers.⁴ Additionally, Verizon offers equipment, consisting of wireless handsets and accessories, through their on-line and retail stores and third-party retailers.⁵ During the first three quarters of 2011, Verizon's domestic wireless operations generated \$51.9 billion in operating revenues and \$14.2 billion in operating income serving more than 107 million U.S. wireless connections.⁶

B. Proposed Spectrum Sale and Joint Marketing Agreements

7. This Docket addresses two related transactions. The first is between Verizon and SpectrumCo; the second is between Verizon and Cox.
8. On December 16, 2011, Verizon and SpectrumCo applied for a transfer of spectrum from SpectrumCo to Verizon. SpectrumCo is a firm jointly owned by three cable companies: Comcast, Time Warner Cable, and Bright House Networks.⁷ The spectrum in this transaction consists of 122 licenses in the Advanced Wireless Services ("AWS") band

¹ 15th Annual Competitiveness Report, FCC, June 27, 2011, pp. 31, 34.

² 15th Annual Competitiveness Report, FCC, June 27, 2011, pp. 31-32, 35-36.

³ Verizon Wireless, Company Website, About Us Facts-at-a-Glance Section, <<http://aboutus.verizonwireless.com/atagance.html>> (Accessed February 16, 2012); Verizon Communications, Company Website, Investor Relations – Corporate History Section, <<http://www22.verizon.com/investor/corporatehistory.htm>>, (Accessed February 17, 2012); Associated Press, "T-Mobile loses subscribers, beat by Verizon, AT&T," May 6, 2011, <<http://www.crainsnewyork.com/article/20110506/FREE/110509907>>, (Accessed on February 19, 2012).

⁴ Verizon Wireless, Company Website, About Us Facts-at-a-Glance Section, <<http://aboutus.verizonwireless.com/atagance.html>> (Accessed February 16, 2012); Verizon Communications, Annual Report 2010, p. 46.

⁵ Verizon Communications, Annual Report (Form 10-K), for the fiscal year ended December 31, 2010, pp. 13, 14, 155.

⁶ Verizon Communications, Quarterly Report (Form 10-Q) for the period ending September 30, 2011, pp. 18, 29.

⁷ WT Docket 12-4, Verizon Wireless-SpectrumCo Application, FCC Form 603, Exhibit 1, p. 2.

covering 120 markets.⁸ In addition to the transfer of spectrum from SpectrumCo to Verizon, there are related agreements between Verizon and the cable companies addressing joint R&D and the marketing and resale of wireline and wireless services.⁹

9. On December 21, 2011, Verizon and Cox applied for a transfer of spectrum from Cox to Verizon. The spectrum in the transaction consists of 30 AWS licenses in 29 markets with 20 MHz of spectrum in each market.¹⁰ Cox is also a party to related agreements similar to those identified in the previous paragraph.¹¹

C. Cable Providers in This Transaction

10. SpectrumCo was founded in 2006, when a number of cable companies and Sprint teamed up to bid in the 2006 auction for wireless spectrum in the AWS band. SpectrumCo won 137 licenses, 20 MHz of nearly nationwide spectrum. SpectrumCo paid \$2.37 billion for these licenses. Comcast contributed \$1.29 billion, TWC contributed \$632 million, and Cox contributed \$248 million.¹²
11. Sprint left SpectrumCo in 2007. A year later Cox pulled some spectrum out of the joint venture to create its own wireless network. Cox announced recently that it will shut down its wireless network on March 30, 2012.¹³ The remaining spectrum held by SpectrumCo covers more than 80 percent of the continental United States and Hawaii.¹⁴ Currently, ownership shares of SpectrumCo are: Comcast – 64 percent, Time Warner Cable – 31 percent, and Bright House Networks – 5 percent.¹⁵
12. Cox TMI Wireless, LLC is a subsidiary of Cox Communications, which is in turn a subsidiary of Cox Enterprises, a digital cable television, telecommunications and wireless

⁸All but one of the licenses have 20 MHz of spectrum, the exception is the license in Houston which has 30 MHz of spectrum. WT Docket 12-4, Verizon Wireless-SpectrumCo Application, FCC Form 603, Exhibit 1, p. 1.

⁹ WT Docket 12-4, Verizon Wireless-SpectrumCo Application, FCC Form 603, Exhibit 1, pp. 23-24.

¹⁰ WT Docket 12-4, Verizon Wireless-Cox Application, FCC Form 603, Exhibit 1, p. 1.

¹¹ WT Docket 12-4, Verizon Wireless-Cox Application, FCC Form 603, Exhibit 1, p. 20.

¹² J.P. Morgan, "Impact of Verizon Buying SpectrumCo – 20 MHz of AWS Spectrum Across ~260m pops," December 2, 2011, p. 2.

¹³ J.P. Morgan, "Impact of Verizon Buying SpectrumCo – 20 MHz of AWS Spectrum Across ~260m pops," December 2, 2011, p. 2; Cox Communications, Company Website, Customer Support Section, <<http://ww2.cox.com/residential/omaha/support/wireless-message.cox>>, (Accessed February 19, 2012).

¹⁴ J.P. Morgan, "Impact of Verizon Buying SpectrumCo – 20 MHz of AWS Spectrum Across ~260m pops," December 2, 2011, p. 2.

¹⁵ J.P. Morgan, "Impact of Verizon Buying SpectrumCo – 20 MHz of AWS Spectrum Across ~260m pops," December 2, 2011, p. 2.

service provider in the United States. Cox Communications continues to provide high speed internet, digital telephone services and digital cable services for homes and businesses.¹⁶

IV. FCC REVIEW PROCEDURES FOR WIRELESS LICENSE TRANSFER REQUESTS

13. The FCC has adopted an increasingly flexible policy approach through the years with regard to the allocation of electromagnetic spectrum to mobile voice and data services, the assignment of use permits (licenses) for the spectrum, and approval of license transfers following the initial assignment. In 1982, when first licensing 50 MHz of Cellular spectrum, the FCC required that two different licensees serve each wireless market in order to promote competition between mobile telephony providers.¹⁷ In 1994, in advance of the PCS auctions, the FCC adopted a spectrum cap, under which no entity could control more than 45 MHz out of 180 MHz of Cellular, SMR, and broadband PCS spectrum in any given wireless market.¹⁸
14. In 2003, in the interest of increasing regulatory flexibility, the FCC eliminated the “inflexible” spectrum cap. The Commission concluded that a “case-by-case approach [to the review of spectrum transactions] is more flexible and reduces the possibility of blocking transactions that are actually in the public interest or, alternatively, permitting transactions that are not in the public interest.”¹⁹ One tool the Commission has adopted under this more flexible approach to merger and license transfer review is a spectrum screen “to assist in [the] analysis of potential competitive concerns raised by transactions in which providers were aggregating spectrum.”²⁰ Initially, only Cellular, SMR, and PCS

¹⁶ CDMA Development Group, Company Website, About the CDG, CDG Members Section, <<http://dev.cdg.org/about/members/cox.asp>>, (Accessed on February 17, 2012); Cox Communications, Company Website, Our Story Section, <<http://www2.cox.com/aboutus/our-story.cox>>, (Accessed on February 19, 2012); Our Story-Our Services Section, <<http://www2.cox.com/aboutus/our-story/our-services.cox>> (Accessed on February 19, 2012); Customer Support Section, <<http://ww2.cox.com/residential/omaha/support/wireless-message.cox>>, (Accessed February 19, 2012).

¹⁷ 15th Annual Competitiveness Report, FCC, June 27, 2011, p. 160, para 270.

¹⁸ 15th Annual Competitiveness Report, FCC, June 27, 2011, pp. 163-164, para 280.

¹⁹ WT Docket 01-14, *2000 Biennial Regulatory Review*, FCC, December 18, 2001, p. 26, para 48; 15th Annual Competitiveness Report, FCC, June 27, 2011, pp. 163-164, para 280.

²⁰ 15th Annual Competitiveness Report, FCC, June 27, 2011, p. 164, para 281.

spectrum were considered in the spectrum screen analysis. Furthermore, only the mobile telephony sector was considered in the market definition. As 700 MHz, AWS, and BRS spectrum became available, new spectrum bands were included in the spectrum screen analysis.²¹ In 2008, recognizing that the mobile services marketplace had evolved, the FCC revised its spectrum screen tool to examine both mobile telephony and mobile broadband services.²² The Commission has used this tool, along with others, to assist it in identifying markets where further analysis of the competitive effects of a transaction are necessary. Depending on the outcome of additional analysis, the FCC has required spectrum divestiture in certain markets.²³

15. The FCC has emphasized the need for regulatory flexibility,²⁴ and the agency's move towards a flexible approach in its review of spectrum transactions mirrors recent changes in competition guidelines from other agencies for the review of mergers and other transactions. For example, in a press release accompanying the 2010 release of the revised Merger Guidelines, the Department of Justice and the Federal Trade Commission stated that one purpose of the new guidelines was to "clarify that merger analysis does not use a single methodology, but is a fact-specific process."²⁵ The 2010 guidelines contain language not found in the prior guidelines stating that the purpose of devising HHI guidelines is "not to provide a rigid screen."²⁶ Below, pursuant to the flexible approach that the FCC and other federal agencies have recently articulated, I undertake a preliminary analysis of the economics of the proposed transactions between Verizon and the cable companies. While the spectrum screen is discussed, I also address factors that are important to understanding the economic impact of this transaction that would not be considered under a strict application of a spectrum screen or HHI standard.

²¹ 15th Annual Competitiveness Report, FCC, June 27, 2011, p. 164, para 281.

²² 15th Annual Competitiveness Report, FCC, June 27, 2011, pp. 164-165, para 281.

²³ 15th Annual Competitiveness Report, FCC, June 27, 2011, p. 164, para 281.

²⁴ See, e.g., Statement of Julius Genachowski, FCC, Hearing on "Ensuring Competition on the Internet: Network Neutrality and Antitrust Law," Before the Subcommittee on Intellectual Property, Competition, and the Internet, Committee on the Judiciary, U.S. House of Representatives, May 5, 2011.

²⁵ Federal Trade Commission Press Release, "Federal Trade Commission Seeks Views on Proposed Update of the Horizontal Merger Guidelines," April 20, 2010, p. 1.

²⁶ Department of Justice and the Federal Trade Commission, *Horizontal Merger Guidelines*, April 20, 2010, p. 19.

V. ECONOMIC ISSUES RELEVANT TO THE PROPOSED TRANSACTION

A. The Economics of Capacity

16. A central outcome of economic models is that imperfectly competitive markets tend to have too little output relative to the social welfare maximizing level. An increase in output would lead to lower prices and more consumption. In economic models, increases in output are desirable as long as price is above marginal cost.
17. This simple prediction of economic models provides a convenient lens to examine the social welfare implications of spectrum assignment. If the market for wireless services is imperfect, then output is below the social welfare-maximizing level. All else equal, assignments of spectrum that create higher total output are more desirable relative to outcomes that would result in lower total output.
18. Indeed, the idea that spectrum should be assigned to those entities that are most likely to use the spectrum intensively was the initial rationale for the FCC's adoption of spectrum auctions as a means of assigning spectrum. As the FCC noted, because "a bidder's ability to introduce valuable new services and to deploy them quickly, intensively, and efficiently increases the value of a license to that bidder, an auction design that awards licenses to those bidders with the highest willingness to pay tends to promote... the efficient and intensive use of the spectrum."²⁷ However, the allocation of spectrum does not instantly create wireless services for consumers; spectrum owners must make investments in building out and utilizing that spectrum. The choices that incumbents make in building and using the spectrum after purchase will influence the extent to which the spectrum creates output useful for consumers.
19. In auctions, as well as transactions on the secondary market, there can be circumstances under which the acquiror of spectrum will not utilize the spectrum as "quickly, intensively, and efficiently" as another licensee might. There are two potential categories of circumstances where this can occur. Firstly, of course, the licensee's circumstances may change. In particular, information may be revealed after the license is awarded that

²⁷ Third Report and Order, FCC, May 10, 1994, p. 6, para 12.

makes the licensee less eager to invest in deploying communications infrastructure than the licensee expected it would be at the time that the license was awarded. For example, Cox cited the substantial costs of developing its own network and the difficulty of accessing the best handsets as the reasons for not developing a network based on the AWS licenses purchased at auction in 2006.²⁸

20. Secondly, under certain conditions a firm may face incentives to acquire spectrum with the intention to hoard or not to utilize it. Economic theory recognizes there are circumstances in which the owner that obtains the highest private value from controlling a scarce asset is not the owner that would create the most social value from that asset. The issue of hoarding is specifically addressed in analyses of spectrum auction policy.²⁹ In addition, the economics literature has addressed the possibility of a dominant firm having a high willingness-to-pay to hoard a scarce input that could be used by competitors, in the alternative, in a variety of settings.³⁰ In this scenario, the benefit to the licensee of owning the spectrum derives not from social welfare enhancing utilization, but from preempting rivals from building out that spectrum. That is, in addition to any value the firm derives from the spectrum, additional value is generated by preventing a rival from using that spectrum. The potential benefits of buying and hoarding spectrum are greatest for an established industry incumbent with a large market share. The large incumbent gains from hoarding spectrum because it is the incumbent's substantial existing profits that are protected from the competition that other firms could unleash using the spectrum. Appendix B lays out a formal economic model showing this.

B. Not All Spectrum is Equal

21. In evaluating the proposed transactions in this Docket, it is important to understand that different parts of the spectrum have different technical characteristics so that some

²⁸ Gabriel, Caroline, "Verizon adds Cox's spectrum to its LTE plan," *Rethink Wireless*, December 19, 2011, <<http://www.rethink-wireless.com/2011/12/19/verizon-adds-coxs-spectrum-lte-plan.htm>>, (Accessed on February 15, 2012).

²⁹ For example, see Crocioni, Pietro, "Is allowing trading enough? Making secondary markets in spectrum work," *Telecommunications Policy*, 2009, Vol. 33, pp. 451-468; Cave, Martin, "Anti-competitive behavior in spectrum markets: Analysis and Response," *Telecommunications Policy*, 2010, Vol. 34, pp. 251-261.

³⁰ For example, Borenstein (QJE, 1988) addresses this issue in the context of airlines and airport landing slots and Shaffer (BEJEAP, 2005) and Marx and Shaffer (JEMS, 2010) in the context of large packaged goods manufacturers and supermarket slotting allowances.

frequency bands are better suited for some purposes than others. Within the bands allocated for mobile broadband services in the U.S., it is commonly accepted that the lower the frequency the farther a signal will travel and be useful at a given power.³¹ In addition, frequencies below 1 GHz penetrate buildings more readily and thus are more valuable than higher frequencies. As a result, spectrum in the 700 MHz and 800 MHz bands is more valuable than higher frequency spectrum such as PCS and AWS.³² The Commission has recognized the fact that not all spectrum is equal in both its recent Qualcomm Order³³ as well as its Mobile Wireless Competition Reports.³⁴ The current approach to calculating a spectrum screen underestimates the impact of more valuable spectrum holdings on competition. Holders of the more valuable spectrum appear to have less market power in the Commission's screen than they actually have.

22. While spectrum can differ in its overall quality, it can also differ in its complementarity to existing competitors' infrastructure. For example, the spectrum being sold in this transaction is valuable to carriers other than Verizon, including T-Mobile. Practically all of the licenses held by T-Mobile are for spectrum in the PCS and AWS bands, with a considerable amount in the AWS band.³⁵ As a result, the spectrum at issue in this transaction would complement both T-Mobile's current holdings in the AWS band and the soon-to-be acquired spectrum from the break-up with AT&T to create a robust AWS footprint. Currently, T-Mobile is using its AWS spectrum primarily for its HSPA+ network.³⁶ The additional spectrum would be valuable for the deployment of LTE.³⁷

23. Additionally, the spectrum being sold in this transaction may be valuable to Metro PCS, which holds AWS and PCS spectrum in many markets of the U.S. In the fourth quarter

³¹ J.P. Morgan, "Spectrum Valuation Overview – Carrier by Carrier Base-Case Spectrum Value Across Wireless Industry." November 30, 2011, pp. 2, 8.

³² J.P. Morgan, "Spectrum Valuation Overview – Carrier by Carrier Base-Case Spectrum Value Across Wireless Industry." November 30, 2011, pp. 1, 2, 8.

³³ WT Docket No. 11-18, In the Matter of Application of AT&T Inc. and Qualcomm Incorporated For Consent to Assign Licenses and Authorizations, December 22, 2011, pp. 20-22, para 46, 49.

³⁴ 15th Annual Competitiveness Report, FCC, June 27, 2011, p. 169, para 289.

³⁵ T-Mobile has one cellular license in the Georgetown, SC RSA.

³⁶ Sarnataro, Valerie, "Apple iPhone 5 to Support T-Mobile's AWS Spectrum," *Brighthand*, January 11, 2012, <<http://www.brighthand.com/default.asp?newsID=18515&news=T-Mobile+iPhone+5+AWS+spectrum+support>>, (Accessed on February 17, 2012).

³⁷ Sarnataro, Valerie, "Apple iPhone 5 to Support T-Mobile's AWS Spectrum," *Brighthand*, January 11, 2012, <<http://www.brighthand.com/default.asp?newsID=18515&news=T-Mobile+iPhone+5+AWS+spectrum+support>>, (Accessed on February 17, 2012).

of 2010, Metro PCS was the first U.S. wireless provider to launch a network using LTE technology. Metro PCS has announced plans to further expand its LTE coverage by leveraging its AWS and PCS spectrum holdings.³⁸

C. The Distribution of Spectrum Does Not Fully Capture the Effect of a Transaction on Competitors

24. The Commission's spectrum screen is one of several tools the agency uses in its oversight of licensees. However, as discussed above, and as reflected in the Commission's flexible approach to merger and transaction review, the distribution of spectrum across firms does not necessarily correspond to the distribution of customers across firms. A simple spectrum screen analysis also does not speak to the issue of whether a proposed transaction may impact the ability of competitors who are not party to the transaction to compete in the marketplace.
25. This is particularly important in a situation where capacity constraints are tight. According to a recent survey of 38 "key decision makers" at wireless operators globally, global average peak network utilization rates were at 65 percent in 2011. In contrast to that, operators in the U.S. were reporting peak capacity utilization of 80 percent, which was the highest of any region in the world.³⁹
26. In the 15th annual CMRS report, the Commission noted that the weighted average HHI across U.S. cities was 2,848 in mid-2010, citing 2,500 as the threshold for considering a market to be "highly concentrated."⁴⁰ The report showed that, in August 2010, 68 percent of Americans were in local areas served by four or more wireless carriers, while 82 percent were in local areas served by three or more wireless carriers.⁴¹
27. Therefore, there are circumstances in which a substantial spectrum transaction could have important impacts on the ability of other carriers to compete effectively in the market or in a segment of the market. These circumstances are related to the two issues discussed

³⁸ 15th Annual Competitiveness Report, FCC, June 27, 2011, pp. 57, 161; Metro PCS Press Release, "MetroPCS Launches First 4G LTE Services in the United States and Unveils World's First Commercially Available 4G LTE Phone", September 21, 2010, < <http://investor.metropcs.com/phoenix.zhtml?c=177745&p=irol-newsArticle&ID=1473355&highlight=>>, (Accessed February 13, 2012); MetroPCS, Annual Report (Form 10-K), for the fiscal year ended December 31, 2010, p. 35.

³⁹ Credit Suisse, "IT Hardware and Global Telecom Equipment," August 31, 2011, p. 13.

⁴⁰ 15th Annual Competitiveness Report, FCC, June 27, 2011, p. 16.

⁴¹ 15th Annual Competitiveness Report, FCC, June 27, 2011, p. 43, Table 7.

above: that all spectrum is not alike, and that different firms have different incentives to utilize new potential capacity depending on their relative dominance in the market. The extent to which this concern applies to the proposed transactions is discussed below.

VI. IMPACTS OF THE SALE

A. Spectrum Transfer Impact

28. With the foregoing analysis in mind, the spectrum transfer at issue poses concerns in several of the largest U.S. markets due to the concentration of high-quality spectrum in Verizon's control. The following analysis describes Verizon's spectrum aggregation in the top 50 U.S. markets, and compares Verizon's current and to-be acquired AWS spectrum to that of other carriers.
29. As shown in Exhibit 1, Verizon currently holds AWS spectrum in 34 of the 50 top markets. If the spectrum transfer is approved, Verizon will receive at least 20 MHz of AWS spectrum from the cable companies for 46 of the 50 markets, thus securing AWS spectrum in all but one of the 50 largest markets. The company's holdings of AWS spectrum would increase from an average of 22 MHz to 34 MHz in its AWS-licensed markets within the top 50 U.S. markets. Verizon already has on average 29, 20, and 31 MHz of Cellular, PCS, and 700 MHz spectrum, in its licensed markets, respectively, within the top 50 markets. Thus, as a result of the transfer Verizon would hold a considerable amount of spectrum in each of the Cellular, PCS, AWS, and 700 MHz bands in nearly all of the top 50 markets.
30. Moreover, if this transaction is approved, Verizon would have the largest AWS license holdings in the top 50 markets, in addition to holding a 45 percent share of Cellular and 700 MHz spectrum licenses, as shown in Exhibit 1.⁴² AT&T has comparable Cellular and 700 MHz holdings, with 45 percent share in these bands. However, AT&T holds only 6 percent the AWS spectrum, on average, in the 18 markets in which it has AWS licenses. The spectrum holdings of the two largest wireless carriers stand in sharp contrast to T-

⁴² Licenses in the SMR and BRS bands are not included in the calculations.

Mobile's and those of smaller carriers like Metro and Leap, which are almost exclusively above 1 GHz.⁴³

31. Furthermore, Exhibit 2 shows that Verizon currently holds 27 percent of total spectrum in the Cellular, 700 MHz, PCS and AWS bands in the top 50 markets. For these bands, Verizon holds at least 35 percent of licensed spectrum, on average, in 6 markets, at least 30 percent in 12 markets and at least 25 percent in 31 of the top 50 markets, as shown in Exhibit 2. If this transaction is approved, however, Verizon's average share of spectrum in the Cellular, 700 MHz, PCS and AWS bands would increase to 32 percent. Verizon would hold, on average, at least 40 percent of the Cellular, 700 MHz, PCS and AWS spectrum in 6 of the top 50 markets and at least 30 percent in 33 markets. If the FCC approves this transaction Verizon will have less than 25 percent share of the Cellular, 700 MHz, PCS and AWS bands in only three of the 50 largest markets. In contrast, AT&T, Sprint, and T-Mobile hold 28 percent, 11 percent and 18 percent of total spectrum for these bands in the top 50 markets, respectively.⁴⁴ The increase in Verizon's share of total spectrum holdings for these bands positions it significantly ahead of other wireless carriers in the top 50 markets. It is important to note that these share figures do not account for the higher value of spectrum in the Cellular and 700 MHz bands, relative to spectrum in the PCS and AWS bands.

B. Verizon's Lack of Need for Capacity

32. According to Verizon's own public statements and reports of industry analysts, Verizon does not have a short-term or medium-term need for additional spectrum. Instead, Verizon has openly admitted that it is investing in additional spectrum now in anticipation of future data demands. Furthermore, reports by industry analysts show that a significant portion of Verizon's spectrum remains unused several years after it has been acquired and is likely to remain unused for several years into the future.
33. As described in Section VI.A, Verizon currently has considerable spectrum holdings in the top 50 U.S. markets. A significant portion of Verizon's spectrum holdings is

⁴³ T-Mobile has one Cellular license in the Georgetown, SC RSA.

⁴⁴ These values are population weighted averages. T-Mobile's holdings include licenses transferred from AT&T to T-Mobile as a condition of the merger cancellation.

currently not deployed. Verizon's 700 MHz license holdings are an example of spectrum that is currently in the initial stages of deployment.⁴⁵ These licenses constitute more than one third of the spectrum licensed to Verizon in the top 50 markets. Verizon acquired much of its 700 MHz spectrum at auction in 2008,⁴⁶ after which the company CEO announced that Verizon has a "sufficient [amount of] spectrum to continue growing our business and data revenues well into – and possibly through – the next decade..."⁴⁷ In 2009, Verizon announced that it would leverage the 700 MHz spectrum for deployment of LTE in 2010.⁴⁸ Its first LTE services were launched in December of 2010 and a year later Verizon's CFO stated that the company was in the "beginning stages" of deploying its 700 MHz spectrum and that the company does not see a need to look for new spectrum "at least until 2015."⁴⁹

34. Other Verizon spectrum that could generate efficiency gains with changes in utilization includes its Cellular and PCS spectrum. These frequencies are currently tied up in the company's 3G network.⁵⁰ Verizon has already announced its intentions to re-purpose this spectrum for use in LTE technology. For example, at the Wells Fargo Securities Technology, Media & Telecom (TMT) Conference in November 2010, a Verizon spokesperson stated the following: "over time as more and more of our 3G traffic starts to

⁴⁵ Fran Shammo, Verizon Communications Inc. at Morgan Stanley Technology Media & Telecoms Conference, November 17, 2011, p. 8.

⁴⁶ Verizon Press Release, "Verizon Wireless Says Spectrum Additions From FCC's Auction 73 Will Further Company's Broadband Strategy," April 4, 2008, <<http://news.verizonwireless.com/news/2008/04/pr2008-04-04.html>>, (Accessed on February 19, 2012).

⁴⁷ Verizon Press Release, "Verizon Wireless Says Spectrum Additions From FCC's Auction 73 Will Further Company's Broadband Strategy," April 4, 2008, <<http://news.verizonwireless.com/news/2008/04/pr2008-04-04.html>>, (Accessed on February 19, 2012).

⁴⁸ Verizon Press Release, "Verizon Wireless, Verizon Wireless Fosters Global LTE Ecosystem as Verizon CTO Dick Lynch Announces Deployment Plans", February 18, 2009, <<http://news.verizonwireless.com/news/2009/02/pr2009-02-18.html>>, (Accessed on February 19, 2012).

⁴⁹ Fran Shammo, Verizon Communications Inc. at Morgan Stanley Technology Media & Telecoms Conference, November 17, 2011, p. 8; Verizon Press Release, "Verizon Wireless, Verizon Wireless Launches The World's Largest 4G LTE Wireless Network on Dec. 5", December 1, 2010, <<http://news.verizonwireless.com/news/2010/12/pr2010-11-30a.html>>, (Accessed on February 17, 2012).

⁵⁰ Wells Fargo Securities, "LEAP/VZ: Spectrum Swap Announced," December 6, 2011, p.1; VZ-Verizon at Wells Fargo Securities Technology, Media & Telecom (TMT) Conference, November 10, 2010, pp. 2 and 5.

migrate to 4G, we will start to free up some of that cellular and PCS spectrum that we use today for 3G, and we will again use that spectrum to grow our 4G network.”⁵¹

35. Finally, Verizon currently has an average of 22 MHz of AWS spectrum in 34 of the top 50 markets.⁵² This spectrum remains undeployed more than five years after the close of the AWS auction in 2006.⁵³ According to one analysis, Verizon is not planning on beginning its deployment of AWS spectrum until 2013.⁵⁴ The company itself stated that it plans to use AWS for LTE, only after rolling out LTE at 700 MHz.⁵⁵
36. In light of the growing data demands and limited spectrum resources, the FCC should give careful consideration to the most efficient use of the spectrum that is available or potentially available on the secondary market. I showed in Section V that, as a matter of economics, it is possible that a large incumbent could have a higher willingness to pay for spectrum than a smaller market participant, and yet still not be planning to create as much new capacity for consumers as the smaller market participant would. Thus, it is possible that the AWS spectrum that Verizon proposes to acquire would be better utilized by a smaller market participant poised to undertake build out in the AWS band. For example, the Declaration of Neville R. Ray states that T-Mobile’s spectrum “has been fully utilized consistently” in contrast to Verizon’s “spectrum ‘overhead.’”⁵⁶
37. The transaction between SpectrumCo, Cox and Verizon, if consummated, would eliminate the potential opportunity for other market participants, including T-Mobile, to acquire valuable spectrum. This should be a matter of public concern because, as I have explained above, generally a smaller competitor would have an economic incentive to put this spectrum to use serving consumers as quickly and efficiently as possible, whereas Verizon may have an incentive to use the spectrum less quickly and less intensively, in order to limit overall output in the market and drive up prices.

⁵¹ VZ-Verizon at Wells Fargo Securities Technology, Media & Telecom (TMT) Conference, November 10, 2010, p. 5.

⁵² See Exhibit 1.

⁵³ 15th Annual Competitiveness Report, FCC, June 27, 2011, p. 161, para 274.

⁵⁴ Morgan Stanley, “Verizon. Quick Comment: LTE Labs Showcase Wireless Future,” September 6, 2011, p. 1.

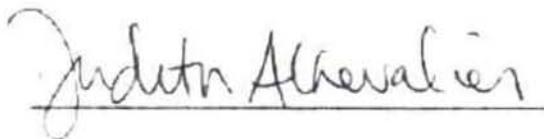
⁵⁵ J.P. Morgan, “Impact of Verizon Buying SpectrumCo – 20 MHz of AWS Spectrum Across ~260m pops,” December 2, 2011, p. 1.

⁵⁶ Declaration of Neville R. Ray, para 19.

VII. CONCLUSION

38. In conclusion, in its long-standing goal to promote the public interest in mergers and transfers of spectrum, the FCC has recognized that a flexible approach is needed in evaluating such transactions. Important economic factors in the spectrum market are difficult to analyze solely through the formulaic application of a “spectrum screen.”
39. A dominant firm can face economic incentives to acquire and hoard a scarce asset, in order to disadvantage rival firms. An examination of the welfare effects of any spectrum transaction should consider whether the acquiror faces incentives to hoard spectrum. The spectrum transfer under consideration in this case poses concerns because of Verizon’s substantial existing holdings of high-quality spectrum and the incentives it would face to hoard the spectrum newly acquired from SpectrumCo and Cox.
40. Verizon has clearly stated that its current spectrum holdings are sufficient for its business plan; the company has substantial spectrum holdings that are not currently being fully utilized and will not be fully utilized in the near future. The transaction between SpectrumCo, Cox and Verizon, if consummated, would eliminate the potential opportunity for other market participants, including T-Mobile, to acquire valuable spectrum. This should be a matter of public concern because generally, a smaller competitor would have an economic incentive to put this spectrum to use serving the public as quickly and efficiently as possible, while Verizon may instead have an incentive to use the spectrum less quickly and less intensively, in order to limit overall output in the market and drive up prices.

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



Judith A. Chevalier
February 21, 2012

APPENDIX A

Curriculum Vitae Judith A. Chevalier

Home:

236 Edwards St.
New Haven, CT 06511
(203) 787-6518

Email: judith.chevalier@yale.edu

Office:

School of Management
Yale University
135 Prospect Street
New Haven, CT 06520
(203) 432-3122

Primary Positions:

September 2007-June 2009, Deputy Provost for Faculty Development, Yale University.

February 2005-present, William S. Beinecke Professor of Economics and Finance, Yale School of Management.

June 2001- February 2005, Yale University School of Management, Professor of Finance and Economics.

July 1999-May 2001, University of Chicago, Graduate School of Business, Professor of Economics.

July 1997-June 1999, University of Chicago, Graduate School of Business, Associate Professor of Economics.

July 1994-June 1997, University of Chicago, Graduate School of Business, Assistant Professor of Economics.

July 1993 - June 1994, Harvard University, Department of Economics, Assistant Professor of Economics.

Other Positions:

Co-editor, *Rand Journal of Economics*, May 2009-present.

Prize committee, Fisher Black Prize, American Finance Association, 2008.

Editorial Board, *Journal of Industrial Economics*, 2006-2011.

Nominating Committee, American Economic Association, 2007-2008.

Nominating Committee, American Academy of Arts and Sciences, 2006, 2009, 2010.

Co-Editor, *American Economic Review*, November 2004-June 2007.

Steering Committee, Committee on Yale College Education, 2010- .

Chair, Faculty Section and Steering Committee, Committee on Yale Reaccreditation, 2008-2010.

Search Committee, American Economics Association committee for the editor of the AEA Journal of Microeconomics, Fall 2006.

Executive Committee, American Economic Association, January 2005- January 2008.
Elected member, Finance committee member. Member of ad hoc committee on journals.

Visiting Committee, MIT Economics Department, February 2005, February 2007, March 2011.

Member, Dean Search Committee, Yale School of Management, 2004- 2005, 2009-2010.

Chair, Yale University Committee on Cooperative Research, 2003-2006. Member, 2002-2003.

Member, Provost's Committee on Sexual Misconduct, 2009-2010

Member, Council of the Women's Faculty Forum, Yale University, 2003-present.

Member, Board of the Chief Executive Leadership Institute, 2005-present.

January 2002-December 2004. Board member, Committee on the Status of Women in the Economics Profession (CSWEP), American Economic Association.

January 2002-present. Fellow, Davenport College, Yale University. Member, Summer 2005, search committee for Davenport College Dean.

February 2003- October 2004. Editor, The B.E. Journals in Economic Analysis and Policy.

AEA Search Committee for Editor of the Journal of Economic Literature, 2003.

January 2002-present. Advisory Board, *Quantitative Marketing and Economics*.

January 2001-July 2002. Associate Editor, *American Economic Review*.

March 2000-September 2004. Associate Editor, The *Journal of Finance*.

American Finance Association nominating committee, 1999.

July 1999 – July 2002, Associate Editor, *Review of Financial Studies*.

January 1999 – December 2003, Associate Editor, *Quarterly Journal of Economics*.

January 1999 – December 2003, Associate Editor, *Journal of Economic Perspectives*.

July 1997-October 2004, Associate Editor, *Journal of Industrial Economics*.

January 1996-October 2004, Associate Editor, *Rand Journal of Economics*.

September 1999-present, Research Associate, National Bureau of Economic Research.

September 1993-September 1999, Faculty Research Fellow, National Bureau of Economic Research.

Consortium Faculty, Cardean University, Unext.com, 1999-2001. Consulted on design of web-based strategy course.

Research Interests:

Time use. Competition in high technology industries and telecommunications. Competition and regulation in retail industries; implications of retail pricing behavior for macroeconomics. Competition on the Internet and for information goods. The problems facing durable goods manufacturers. The interaction between firm capital structure and product market competition. The impact of liquidity constraints on markup, inventory, and capital expenditure cyclicality. Testing models of agency and career concerns. The impact of “noise traders” on financial markets. Cross-subsidization of activities within conglomerate firms.

Education:

May, 1993, Ph.D., Economics, Massachusetts Institute of Technology.

May, 1989, B.A., *summa cum laude*, Yale University, Distinction in the Major, Economics.

Honors and Awards:

National Science Foundation research grant for 2011-2014, SBR 1128322, “Strategic Shoppers.”

William F. O’Dell Award, *Journal of Marketing Research*, 2011. For paper published in the *Journal of Marketing Research*, August 2006.

Elected member, American Academy of Arts and Sciences.

nominated paper, Smith Breeden prize, *Journal of Finance*, 1999. For paper published in the *Journal of Finance*, June 1999.

recipient, first annual Elaine Bennett Research Prize. This prize is intended to recognize research by a young woman in any area of economics. The prize is administered by the American Economic Association Committee on the Status of Women in the Economics Profession. Presented January 1999.

Alfred P. Sloan Foundation, Sloan Research Fellow, Awarded for 1997-1998, and 1998-1999 academic years.

Smith Breeden “Distinguished Paper” prize, *Journal of Finance*, 1995. Prize awarded for paper published in the *Journal of Finance*, September 1995.

National Science Foundation research grant SBR 94-14141 for 1994-1996.

Review of Economic Studies tour (one of seven doctoral students presenting work at conferences in Europe and Israel), Summer, 1993.

National Science Foundation Graduate Fellowship, 1989-1992.

Dickerman Prize, Yale University, for Best Senior Thesis in Economics, 1989.

Publications:

With Keith Chen, “Are Women Overinvesting in Education? Evidence from the medical profession,” forthcoming, *Journal of Human Capital*.

With Austan Goolsbee, “Are Durable Goods Consumers Forward Looking? Evidence from the College Textbook Market”, *Quarterly Journal of Economics* vol 124, November 2009.

With Keith Chen, "The Taste for Leisure, Career Choice, and the Returns to Education", *Economics Letters* Vol. 99 (May 2008), 353-356.

With Fiona Scott Morton, "State Casket Seller Restrictions: A Pointless Undertaking?", *Journal of Law and Economics*, August 2008.

With Dina Mayzlin, "The Effect of Word of Mouth on Sales: Online Book Reviews", *Journal of Marketing Research*, August 2006.

"What Do We Know About Cross-subsidization? Evidence from Merging Firms.", *Advances in Economic Analysis & Policy* 2004: Vol. 4: No. 1, Article 3.

<http://www.bepress.com/bejeap/advances/vol4/iss1/art3>

with Austan Goolsbee, "Valuing Internet Retailers: Amazon and Barnes and Noble", *Advances in Applied Microeconomics* 12: Organizing the New Industrial Economy, 2003.

with Austan Goolsbee, "Measuring prices and price competition online: Amazon vs. Barnes and Noble," *Quantitative Marketing and Economics* I (2), June 2003.

with Anil Kashyap and Peter Rossi, "Why don't prices rise during periods of peak demand? Evidence from scanner data," *American Economic Review*, March 2003.

with Dennis Carlton, "Free riding and sales strategies on the internet," *Journal of Industrial Economics*, December 2001.

with Chris Avery, "Identifying Investor Sentiment from Price Paths: The Case of Football Betting," *Journal of Business*, October 1999.

with Glenn Ellison, "Are Some Mutual Fund Managers Better than Others? Cross-sectional Patterns in Behavior and Performance", *Journal of Finance*, June 1999.

with Chris Avery, "Herding over the Career," *Economics Letters*, June 1999.

with Glenn Ellison, "Career Concerns of Mutual Fund Managers," *Quarterly Journal of Economics*, May 1999.

with Chris Avery and Scott Schaefer, "Why Do Managers Undertake Acquisitions?: an Analysis of Internal and External Rewards to Acquisitiveness", *Journal of Law, Economics, and Organization*, April 1998.

with Glenn Ellison, "Risk Taking by Mutual Funds as a Response to Incentives," *Journal of Political Economy*, December 1997. Reprinted in P.L. Joskow and M. Waterson, eds., *Empirical Industrial Organization*, Edward Elgar, 2004.

with David S. Scharfstein, "Capital Market Imperfections and Countercyclical Markups: Theory and Evidence," *American Economic Review*, September 1996.

"Do LBO Supermarkets Charge More? An Empirical Analysis of the Effects of LBOs on Supermarket Pricing," *Journal of Finance*, September 1995.

"Capital Structure and Product Market Competition: Empirical Evidence from the Supermarket Industry," *American Economic Review*, June 1995. Reprinted in P.L. Joskow and M. Waterson, eds., *Empirical Industrial Organization*, Edward Elgar, 2004.

with David S. Scharfstein, "Liquidity Constraints and the Cyclical Behavior of Markups," *American Economic Review Papers and Proceedings*, May 1995.

Working Papers/Work in Progress:

With Dina Mayzlin and Yaniv Dover, "Promotional Reviews: An Empirical Investigation of Online Review Manipulation", January 2012.

With Chris Avery and Richard Zeckhauser, "The CAPS Prediction System and Stock Market Returns", NBER Working Paper 17298, August 2011. In revision.

With Anil Kashyap, "Best Prices", February 2011, NBER Working Paper 16680.

With Fiona Scott Morton and David Harrington, "Regulating Direct Cremations: The Cost of Seemingly Small Regulatory Changes", January 2011.

With Fiona Scott Morton and David Harrington, "Differentiated to Death", Yale School of Management working paper, April 2010.

with Austan Goolsbee, "Entry and Market Size: The College Textbook Market."

Popular Publications/ Teaching Cases:

With Jaan Elias, "Potash Corporation of Saskatchewan", Yale Case 11-031, October 2011.

New York Times, "A Carbon Cap that Starts in Washington", 12/16/07.

New York Times, "In Search of Wireless Wiggle Room", 10/21/07.

New York Times, "Welcome Stranger, Here's a Speeding Ticket", 9/2/07.

Slate, "Oversell" 12/12/06.

Financial Times, "The Pros and Cons of Entering a Market," *Financial Times Mastering Strategy Series*, November 1, 1999. Reprinted in *Mastering Strategy*, Prentice Hall, 2000

Financial Times, "When it Can be Good to Burn your Boats," *Financial Times Mastering Strategy Series*, October 25, 1999. Reprinted in *Mastering Strategy*, Prentice Hall, 2000

Teaching: "Competitor", Core class, Yale School of Management, Fall 2011.

"Technology Strategy", Yale School of Management, Fall 2009.

"Business, Public Policy, and the Information Economy", Yale School of Management, Spring 2012, Fall 2010, Spring 2007, Spring 2006, Spring 2005.

Undergraduate "Business, Public Policy, and the Information Economy", Yale University, Spring 2010, Spring 2008, Spring 2007, Spring 2006, Spring 2005, Spring 2004.

PhD. level Industrial Organization, Yale Economics Department, Spring 2003.

Competitive Strategy, Yale School of Management. 2002-present.

Competitive Strategy, Graduate School of Business, University of Chicago. Two sections, Winter 2001. Three sections, Winter 2000. Two sections, Autumn 1996; three sections, Autumn 1997; three sections, Autumn 1998.

Competitive Strategy, Executive MBA Program (XP), University of Chicago. One section, Winter 2001.

PhD. Industrial Organization, Graduate School of Business, University of Chicago. Co-taught with Dennis Carlton and Josef Perktold, Autumn 1996 and Winter 1997.

Economics of the Firm, Graduate School of Business, University of Chicago, Executive MBA course. Taught in domestic executive program in Autumn 1995, taught in international executive program in Barcelona, July-August 1996.

Microeconomics, Graduate School of Business, University of Chicago, MBA course. Seven sections, 1994-1995. One section, Autumn 1999.

Industrial Organization, Department of Economics, Harvard University, Ph.D. course, Spring, 1994. Co-taught with Glenn Ellison.

Corporate Finance, Department of Economics, Harvard University, Ph.D. course, Spring, 1994. Co-taught with Andrei Shleifer.

Corporate Control and Governance, Department of Economics, Harvard University, Undergraduate Course, Spring, 1994.

Strategy teaching for the Business Advisor program for RSM McGladrey, Inc., Graduate School of Business, University of Chicago. Autumn 1999, Spring 2001, Spring 2002.

Research/Seminar Presentations:

ABA Section of Antitrust Spring Meeting, Washington DC (scheduled for 3/2012).
American Economic Association (4)
American Finance Association (2)
American Institute for Economic Research
Boston University, Department of Economics
Brigham Young University Department of Economics
Brown University Department of Economics
Carnegie Mellon University GSIA (2)
Center for Research in Securities Prices, University of Chicago
Chief Executive Leadership Institute
Columbia University Business School (2)
Columbia University, Department of Economics (2)
Cornell University, Applied Economics and Management
Cornell University Business School
Cornell University Department of Economics
Dartmouth College, Tuck School of Business (2)
Dartmouth College, Department of Economics.

Duke University, Department of Economics(2)
 Duke University, Fuqua School of Business (2)
 Econometric Society Winter Meetings
 Federal Reserve Bank of New York
 Free University of Brussels
 Georgia Finance Forum
 Harvard Business School (2)
 Harvard University Department of Economics (3)
 Harvard University, Kennedy School of Government
 Harvard University Law School
 International Industrial Organization Society (2)
 Johns Hopkins University, Department of Economics
 London School of Economics
 Massachusetts Institute of Technology, Economics Department (4)
 Massachusetts Institute of Technology, Sloan School of Management (2)
 Milton Friedman Institute, University of Chicago.
 National Bureau of Economic Research, Corporate Finance Group (3)
 National Bureau of Economic Research, Ecommerce Group.
 National Bureau of Economic Research, Economic Fluctuations (2)
 National Bureau of Economic Research, Industrial Organization Group (5)
 National Bureau of Economic Research, Monetary Economics Group (2)
 New York University, Stern School of Business (3)
 Northwestern University, Kellogg School of Business (3)
 Northwestern University, Department of Economics
 Ohio State University, Department of Economics (2)
 Princeton University, Department of Economics and Woodrow Wilson School (2)
 Purdue University, Department of Economics
 QME Conference
 Rutgers University, Department of Finance
 Stanford University, Graduate School of Business (4)
 Tel Aviv University
 Texas A&M University, Department of Economics
 U. des Sciences Sociales (Toulouse, France)
 United States Department of Justice (2)
 United States Federal Communications Commission
 United States Federal Trade Commission (2)
 University of Arizona, Finance Department
 University of British Columbia, Summer industrial organization meeting
 University of California at Berkeley, Haas School of Business (5)
 University of California at Berkeley, Department of Economics
 University of California at Los Angeles, Department of Economics
 University of Chicago, Graduate School of Business (5)
 University of Connecticut, Department of Agricultural Economics
 University of Delaware, Department of Economics
 University of Florida, College of Business Administration
 University of Illinois, Department of Commerce and Business Administration (2)
 University of Illinois at Chicago, Finance Department.
 University of Indiana, Business School (2)
 University of Maryland, College of Business and Management
 University of Maryland, Department of Economics
 University of Michigan, Department of Economics (2)
 University of Michigan, School of Business Administration (2)
 University of Minnesota, Department of Economics
 University of Notre Dame, College of Business
 University of Oregon, College of Business Administration
 University of Pennsylvania, Wharton School (2)
 University of Rochester, Simon School of Business

University of Southern California, School of Law
University of Toronto, Department of Economics
University of Wisconsin, Department of Economics
Washington University in St. Louis
Yale University, Department of Economics (3)
Yale University, School of Management (3)
Yale University, Law School (2)

Non-academic positions:

Board member, the Foote School, 2005-present. Co-Treasurer and Chair of Audit Committee, 2006- 2008. Treasurer and Chair of Finance Committee, 2009-present.

Submitted Expert Reports and Testimony:

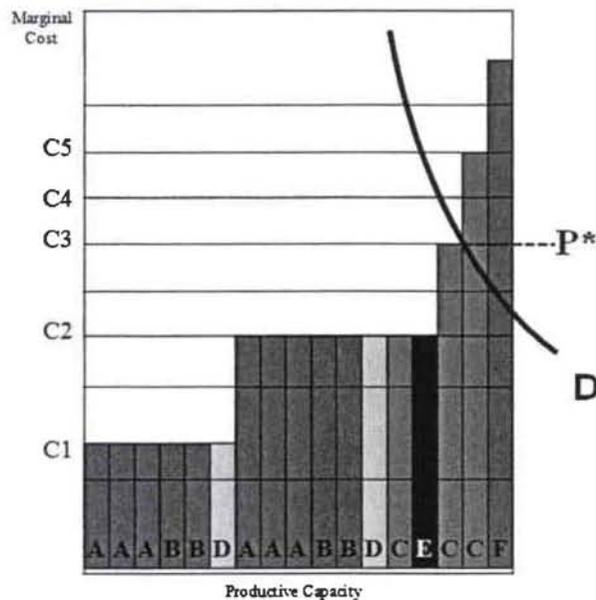
1. United States District Court, Southern District of Ohio
The Procter & Gamble Company v. The Coca-Cola Company, 1:02CV393
Report
2. American Arbitration Association
SESAC, Inc. v. Television Music License Committee, No. 13 133 01583 05
Report and testimony
3. United States District Court, District of New Hampshire
Presstek, Inc. v. Creo, Inc., Civil Action No. 05-CV-65-PB
Report and testimony
4. United States District Court, District of Delaware
Advanced Micro Devices, Inc., et al. v. Intel Corporation, et al., Civil Action No. 05-441-JJF
Report
5. United States District Court, District of Delaware
State of New York by Attorney General Eric T. Schneiderman, v. Intel Corporation,
Case No. 09-827 (LPS)
Report and testimony

APPENDIX B A MODEL OF SPECTRUM UTILIZATION

The differential incentive of different market participants to build out new capacity can be illustrated with a very simplified and stylized model. Consider the market depicted in Figure 1. There are four firms, A, B, C, and D, each producing a homogeneous product. Each firm has productive capacity as shown along the X axis. Each unit of capacity has a marginal cost of producing output as shown on the Y axis of the figure.

Thus, for example, Firm A has 6 units of capacity, of which 3 units have a marginal cost of $c1$ to produce output and 3 units have a marginal cost of $c2$ to produce output. Firm B has 4 units of capacity, 2 of which have a marginal cost of $c1$ and 2 have a marginal cost of $c2$. Firm C has 3 units of capacity which have marginal costs of $c2$, $c3$, and $c5$, respectively. Finally, Firm D has 2 units of capacity, with marginal costs of $c1$ and $c2$. The unit of capacity labeled E is a newly available unit and involves a marginal production cost of $c2$.¹ The demand curve for the final output is illustrated in the figure and denoted by D.

Figure 1: Full Capacity Equilibrium



¹ For our illustrative purposes, it is unimportant what the units are, only that Firm A has substantially more capacity than Firm D.

It is difficult to predict the outcome in this market without knowing the game governing competitive interactions that the firms are playing. If the firms Bertrand compete on price and produce to full capacity, the equilibrium price in this market will be $P^* = c_3$ (with unit E in production as well as all of the others). In this case the capacities and marginal costs shown constitute the market supply schedule. Other oligopoly game scenarios may produce equilibrium prices of $P^* \geq c_3$.

We will contrast the scenarios in which Firm A owns unit E to the scenario in which Firm D owns unit E. If Firm A owns E and puts it into production as shown in Figure 1, Firm A's total profits in the market are:

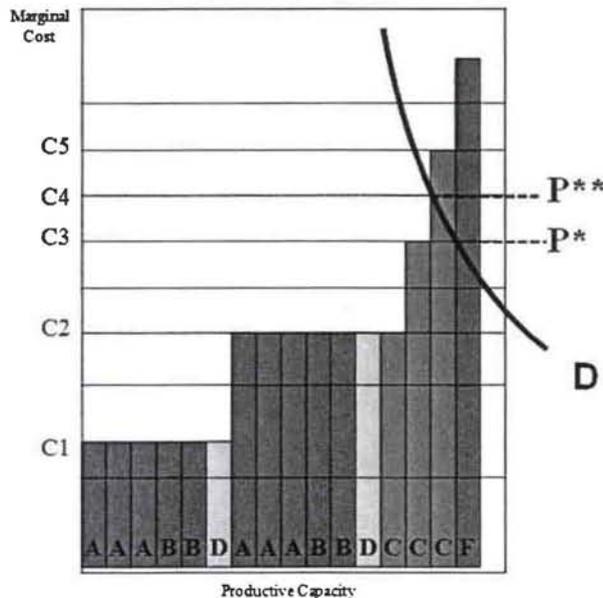
$$(7 \text{ units}) \times P^* - (c_1 \times 3 \text{ units}) - (c_2 \times 4 \text{ units}) = 7c_3 - 3c_1 - 4c_2$$

If Firm D owns unit E and produces with it, it earns profit:

$$(3 \text{ units}) \times P^* - (c_1 \times 1 \text{ unit}) - (c_2 \times 2 \text{ units}) = 3c_3 - c_1 - 2c_2$$

Now suppose that Firm A owns Unit E and does not produce with it, but holds it idle. That is, the Unit E is not “built out” and cannot be used. This is illustrated in Figure 2. The demand curve is exactly as before, but unit E removed from the supply schedule. Under this scenario, the demand curve crosses the supply schedule at $P^{**} = c_4$ rather than c_3 .

Figure 2: Undeclared Capacity Equilibrium



Firm A's profit becomes:

$$(6 \text{ units}) \times P^{**} - (c1 \times 3 \text{ units}) - (c2 \times 3 \text{ units}) = 6c4 - 3c1 - 3c2$$

If Firm D owns unit E and does not produce with it, Firm D's profit becomes:

$$(2 \text{ units}) \times P^{**} - (c1 \times 1 \text{ unit}) - (c2 \times 1 \text{ units}) = 2c4 - c1 - c2$$

Notice that Firm A is better off holding the capacity idle if:

$$6c4 - 7c3 + c2 > 0.$$

Or, equivalently:

$$6(c4-c3) - (c3-c2) > 0$$

The first term is the incremental profit from raising the price from $c3$ to $c4$. The second term is the profit lost from not selling an incremental unit at $c3$.

In contrast, Firm D is better off holding unit E idle if:

$$2(c4-c3) - (c3-c2) > 0$$

Again, the first term is the incremental profit from raising the price from $c3$ to $c4$, and the second term is the profit lost from not selling an incremental unit at $c3$.

Notice that, while both firms face the same lost profit from not producing one incremental unit of output, the price increase resulting from withholding production is incrementally beneficial to Firm A, because Firm A earns the price increase over more inframarginal units of production. Thus, if withholding a unit of production can function to raise the market price, withholding production is differentially attractive to the larger firm.

Intuition from the analysis above extends to more complicated situations. For example, a cost of building out unit E makes production less attractive for both Firm A and for Firm D. Furthermore, the intuition that withholding production can increase profits extends to the more subtle situation in which there are alternative uses for the capacity—one more production-intensive and one less production-intensive. The less intensive usage of the capacity will be differentially attractive to the firm with the larger installed capacity.

For example, consider a situation in which the unit E could be used either to create new output or could be used to lower the cost of producing existing output (for example, to lower cI). This usage of the new capacity may be particularly attractive to Firm A and could benefit Firm A by lowering its production costs. However, this usage of the capacity will not lower prices for consumers, because it lowers the cost of producing an inframarginal unit of output that does not play a role in determining the market price.