BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
Petition for Rulemaking or, Alternatively, a Waiver of the Closed Bidding Rules for C Block Licenses in the Broadband Personal Communications Services	)	RM – 11019

DECLARATION OF
SIMON J. WILKIE

JULY 30 2004

I. INTRODUCTION

1. My name is Simon J. Wilkie. I am a Senior Research Associate at the California Institute of Technology. I am also an academic affiliate of ERS Group, an economic and financial consulting firm. Prior to joining the faculty at the California Institute of Technology, I was a member of the technical staff at Bell Communications Research, a scholar of the Milken Institute, and a visiting professor at Columbia University. Over the past fifteen years, my academic research has focused on the areas of industrial organization, regulation, and game theory or business strategy with a particular emphasis on the telecommunications industry. From 2002 to 2003, I served as Chief Economist at the Federal Communications Commission ("FCC" or "Commission"). While at the Commission, I oversaw economic analysis related to the Commission's review of the 70-80-90 GHz plan, the incentives for Rural Development Notice of Public Rulemaking, and DBS Spectrum Order. I also oversaw the economic analysis of several license transfer transactions, including the proposed merger of Echostar and Hughes-DirecTV, the merger of AT&T Broadband and Comcast, and the News Corporation acquisition of a controlling interest in Hughes-DirecTV. I hold a Bachelor of Commerce degree in Economics from the University of South Wales, and an M.A. and Ph.D. in Economics from the University of Rochester. A copy of my *curriculum vitae* is attached to this declaration as Appendix One.

2. I have been retained by T-Mobile USA, Inc. ("T-Mobile") to evaluate whether the use of the Designated Entity ("DE") eligibility restrictions in Auction No. 58 constitute the most efficient and effective mechanism for deploying spectrum licenses in a manner consistent with the public interest. The opinions expressed in this declaration

are based on my expertise in the areas of game theory and auction design, as well as my review of the academic literature on auction design in general, and on airwave auctions in particular. I have also considered the results of the Commission's prior experience in implementing auctions for the various blocks of PCS spectrum.

3. In this declaration, I carry out an economic analysis of the DE set-asides and provide several arguments against the use of these restrictions at the upcoming Auction No. 58. Generally speaking, DE set-asides severely undermine the role of auctions in two fundamental ways: (1) by preventing auctions from allocating scarce resources to the highest-value bidders, and (2) by disrupting the auction's ability to efficiently aggregate private information held by different bidders. Moreover, I conclude that a winning DE may find it in its self-interest to "hold up" a nationwide provider seeking to acquire its license, because the former can extract the maximum surplus from the buyer by being the last company to sell. This hold-up problem makes it more difficult for national service providers to fully exploit the economies of scale and scope prevalent in the communications business, entails significant transaction costs, and may interfere in the provision of competitive service to the public.

4. DE set-asides and the Commission's installment payment conditions granted to DEs were mainly responsible for the trail of defaults, bankruptcies, and continuous litigation involving winning bidders in the C-block auction. To the extent that these legal hurdles introduce delays and/or lead to the outright suspension of service to the public, consumers suffer from this special treatment to DEs. I estimate that this delay of service has caused billions of dollars of harm to consumers. Moreover, today there are no public interest benefits from retaining DE set-asides in Auction No. 58. DE set asides

and closed auctions were one element of the Commission's package of market structure regulations that it used when designing a market *de novo* for PCS service back in 1994. As the market has matured, the Commission has relaxed other market structure rules such as the spectrum cap and the PCS/cellular cross ownership limitations. Whatever perceived public interest benefit set asides for PCS spectrum had in 1994, there is clearly no public interest benefit from continuing to apply a failed policy to the PCS market in 2004.

5. In addition, I conclude that, in the current mature market, alternative procedures – namely, the standard application of antitrust principles, or an unrestricted auction combined with preferential treatment to certain target groups in the form of bidding credits – are much more effective mechanisms to achieve Congress' goals of efficient use of the spectrum and diversification in the spectrum ownership. Importantly, bidding credits not only promote participation of small firms but may increase government revenues as well. Finally, I present an estimate of the social costs of these policies caused by the failure of the C-block auction, which turns out to be significant.

II. ECONOMIC ANALYSIS OF DE SET-ASIDES

A. DE Set-Asides Undercut Auctions

6. The existence of DE eligibility restrictions prevents the auction mechanism from fulfilling one of its primary objectives, namely, the allocation of the auctioned item to the highest-value bidder. In a competitive market, we can expect that private values coincide with social value. Therefore, by awarding a license to a low-value bidder, production and consumption decisions are distorted and the social surplus is

not maximized. At the very outset, any interference in the auction process, such as a closed format, must have some other public interest gain to offset the induced inefficiency costs.

7. Another rationale for the use of auctions is related to what economists refer to as information revelation or price discovery. That is, auctions provide an efficient mechanism by which bidders' private information is aggregated into prices. By the use of an open auction, the amount of information transmission is maximized, which is valuable in discovering the efficient allocation in a situation of uncertainty. Indeed, this has been the guiding principle in the Commission's approach to auction design, and it is the very reason for using the open ascending bid Simultaneous Multiple Round ("SMR") auction format. To reprise, in common-value auctions such as the Commission's spectrum auctions, the true value of the item is not known, but each bidder has a private estimate of its true value. Such auctions are subject to what the economic literature has called the "winner's curse" phenomenon, *i.e.*, winning an auction may actually turn out to be bad news for the winner because it indicates that the other bidders estimated the true value of the item to be lower.[1] Thus, the winning bidder may find itself *ex –post* owning an item that is not as valuable as expected during the auction. Moreover, if the true value of the good is not large enough to cover the winning bid, the bidder may be forced to declare bankruptcy. The great benefit of an open SMR auction is that bidders, by learning the bids of others, can glean better information about the true

[1] *See, e.g.*, McAfee, Preston R. (2002), COMPETITIVE SOLUTIONS: THE STRATEGIST'S TOOLKIT, Princeton University Press, Princeton and Oxford, pp. 307-311.

values of the licenses through the auction process, thereby reducing the uncertainty and the winner's curse.[2]

8. One problem with DE set-asides is that, by excluding bidders, they prevent spectrum auctions from efficiently aggregating bidders' private information. In addition, given that DEs are generally not incumbents, their estimates of the value of the licenses may be very inaccurate relative to those of other firms that are already in the market and that can develop more informed estimates. These two factors exacerbate the winner's curse problem inherent to all common-value auctions. As discussed above, when the winner's curse problem is severe, it may be the case that the winning bidder is awarded a license that it is significantly less valuable than the bid price, leading to bankruptcy and/or litigation, as the winning firms try to stop the government from reclaiming the licenses. This result partially explains the series of defaults and significant litigation by DEs who took part in the C-block auctions.

B. Set-Asides Hamper the Realization of Economies of Scale and Scope

9. There are significant economies of scope and scale in the wireless communications industry. For instance, consumers have placed a high value on nationwide roaming, causing the marketplace to shift toward nationwide services in most mobile wireless categories.[3] Small firms, basically those that benefit from the DE eligibility restrictions, are, in most cases, incapable of competing on this large, national

[2] *See* e.g., Milgrom, Paul and Weber, Robert (1982), "The Theory of Auctions and Competitive Bidding," *Econometrica*, Vol. 50, pp. 463-483.

[3] For example, Peter Cramton cites additional economies of scale and scope arising from bargaining advantages over equipment suppliers and scale economies in marketing. *See* Cramton, Peter, "Lessons from the United States Spectrum Auctions," Prepared Testimony of Peter Cramton Before the United States Senate Budget Committee, February 10, 2000.

basis. Therefore, a consequence of the DE set-asides is the promotion of companies with questionable viability that are incompatible with the industry trend towards firms with a national reach.

10. In addition, it is possible that nationwide firms would prefer to aggregate, through mergers or through purchase of licenses, many small regional firms to take advantage of these economies of scale and scope. But each small firm selling its license would attempt to be the last entity to sell, so that it can extract as much surplus as possible from the prospective buyer. This bargaining process, which may entail significant transaction costs, will also harm consumers, as they will not receive desired services in a timely fashion.

11. Similarly, there are technological economies of scale in spectrum holdings up to a point. For example, a firm operating a GSM network in a market with 20 MHz of spectrum can serve more customers or offer higher quality service than can two firms each with 10 MHz of spectrum.[4] Thus, because of economies of scale, the marginal 10 MHz will be more valuable to an incumbent currently with 10 MHz than to a new entrant. However, with closed auctions the incumbent cannot purchase the license in open competition, but rather must deal with the winning DE who now has the incentive and ability to extract an economic rent from the incumbent. This battle between firms over the rent can delay deployment of service and efficient aggregation causing harm to

[4] At 10 MHz a GSM network has seven times the spectral efficiency of analogue, where as with 20 MHz a GSM network has 10 times spectral efficiency of analogue nearing, its full potential efficiency. This represents an increase in effective supply of approximately 42 percent. See Declaration of William Hogg and Mark Austin, AT&T Wireless Services, Inc., Transferor and Cingular Wireless Corporation, Transferee, WT Docket No. 04-70 (March 17, 2004), at ¶¶ 28, 33.

consumers.[5] To the extent that the winning DE is subject to the winner's curse, because it overestimated the value to the incumbent that it can resell the license for, then these problems are compounded and delays to deployment more likely.

C. The Eligibility Requirements for DEs Were Partly Responsible for Bankruptcies in the C-block

12. To encourage participation of small businesses in the C-block auction, the Commission ultimately supplemented the DE set-asides with generous financial terms to participating firms. In particular, C-block winners were granted attractive installment plans,[6] being required to pay only five percent of their bid prices at the end of the auction, five percent at the time of award, and the remaining amount in installment payments extended over ten years with interest payments based on the 10-year United Stated Treasury note rate.[7] Also, some winning DEs had the option to schedule their payments so as to cover interest for the first six years and repay the remaining principal and interest over the subsequent four years.

13. These payment conditions led DEs to speculative bidding. For example, bidding activity in the C-block auction was much higher than in the A and B block auction, with average net prices of $39.88 per pop in the C-block, compared to only

[5] The literature on this issue is vast, see for example; Williamson, Oliver. (1985): The Economic Institutions of Capitalism. New York: Free Press or Grossman, Sanford. J., and Oliver. D. Hart (1986): "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economy*, 94, 691–719.

[6] Short-form applications, bidding credits, and other price preferences were also offered. *See*, *e.g.*, Munson, Mark, "A Legacy of Lost Opportunity: Designated Entities and the Federal Communication Commission's Broadband PCS Spectrum Auction," *Michigan. Telecommunications. Technology. Law. Review*, p.. 217.

[7] During the time the auctions took place, the 10-year Treasury note rate was approximately 6.5 percent.

$15.54 per pop in the A and B-block MTA auction.[8] Likewise, the C-block auction raised record "nominal" government revenues exceeding $10 billion.[9] However, only $1.2 billion of the total amount was effectively collected by the government, because excessively aggressive bidding led to defaults and bankruptcies by the major bidders and to costly litigation as DEs went to court to retain their licenses and to avoid penalties for their failure to comply with auction regulations. More importantly, these legal actions have not only been costly to the parties involved, but also to consumers, who have not received any services over the intervening years, explicitly contradicting one of the goals for auctions mentioned by Congress.

14. While the financing arrangements, such as installment payments for DEs was a significant factor in the C-block experience, it does not fully explain the bidding behavior in the auction.[10] An additional factor contributing to the "high-bid, broke-winner" equilibrium problem can be found in the corporate structure of the DEs themselves, where the incentives of their managers do not necessarily coincide with those of their financial backers. In fact, several high-powered speculators were lured into providing funds to DEs, mostly drawn by the possibility of making significant arbitrage profits by exploiting the Commission's low-cost financing. For example, NextWave Telecom was backed by major investors such as the California Public Employees'

[8] *See* Cramton, Peter, (1997)"The FCC Spectrum Auctions: An Early Assessment," *Journal of Economics and Management Strategy*, 6:3, pp. 431-495.

[9] NextWave Telecom accounted for $4.7 billion of the $10.2 billion revenues raised by the government on the C-block spectrum auction.

[10] *See* for example Wilkie, Simon (1997) "Explaining Price Anomalies in the PCS License Auctions" Caltech Working Paper and Zheng, Charles, (2001) "High Bids and Broke Winners," *Journal of Economic Theory,* Vol. 100, pp. 129-171.

Retirement System, the Ziff and Tisch families, and Trust Company of the West. Fidelity Investments, Mario Gabelli, and venture capital firm Kleiner Perkins were also supplying funds to other DE startups.[11]

15. Because of the legal separation that Commission imposes between the DE's backers and effective control of the company in order to qualify as a DE, these financial backers had virtually no legal control over the decisions made by the DEs, and therefore, did not have any final say over the bids submitted by them in the spectrum auctions. This lack of shareholders' control of DEs prompted these companies to ignore the "winner's curse" problem and overbid, leading to default and ultimately bankruptcies as investors withdrew all financial support.

16. This is an example of what is referred to as a "principal-agent" problem of modern finance.[12] Because of the control structure required to qualify as a DE, management has different incentives than investors. If a DE that is a new entrant wins a license, then the management team is in business. If they win no licenses, then they have to return the funding and obtain nothing. Thus, the eligibility requirements drive a wedge between the incentives of investors and management, provide an incentive to overbid, and can cause liquidity problems for a DE that wins licenses.

17. Consistent with this observation is the subsequent collapse in auction prices in the F-block auction, where installment payments were also available, as the capital market, burned by its C-block experience, cut back on lending.

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[11] *See, e.g.*, Institutional Investor, "Trouble on the C block", Vol. 31, No. 8, Aug 1997, p. 41.

[12] *See, e.g.*, Copeland, Thomas E., J. Fred Weston, & Kuldeep Shastri, (2004), FINANCIAL THEORY AND CORPORATE POLICY, Addison-Wesley (4th ed.).

18. These problems affect the ability of any DE attempting to build out a network to raise financing. In order to meet the eligibility restrictions a firm cannot have more than $500 million in assets. Yet the *minimum* opening bid for the licenses in the proposed closed licenses in Auction 58 is over $327 million! Thus, any DE hoping to become a significant entrant and provide new facilities will likely exhaust its capital in acquiring licenses and thus need to take on mostly debt financing. Even under the best-case scenario, if the closed auction format is successful on its own terms, the auction creates a highly leveraged, under-capitalized firm that is the 7th entrant into a highly competitive market.

19. We are thus left with two possibilities. If the venture capital market backs several DEs and we have a competitive closed auction with vigorous bidding, the winning DE will likely have paid too much for its license and we face the probability of delay in deployment. These delays will be due to both the hold up problem, as DEs who entered the auction to engage in regulatory arbitrage try to extract a profit from the incumbents, and because of the problems in raising further capital to build out a network. Conversely, if the capital market shies away from the auction, we then face the real issue of unjust enrichment. Paradoxically, the C-block auction has shown us that the Commission, through DE set asides, can have both problems at once. For example, NextWave overpaid in the C-block auction and declared bankruptcy, leading to an eight-year deployment delay. Yet eight years later, it still holds the licenses and is able to sell

10 MHz of its New York license to Verizon for $930 million, almost tripling its bid per MHz, an enormous profit. [13]

III. BIDDING CREDITS AND COMPETITION POLICY ARE MORE EFFECTIVE MECHANISMS THAN SET-ASIDES

20. There are better tools for achieving the Commission's public interest goals than set-asides. The economic literature proposes other methods that are more effective than DE set-asides at both increasing government revenue and allowing DEs to obtain spectrum licenses. Several scholars[14] have proposed the use of bidding preferences as an effective mechanism to simultaneously achieve the goal of a less concentrated ownership of spectrum licenses, while accruing more revenues to the Treasury. [15]

21. For example, a bidding credit scheme could grant a DE a 10 percent preference, which means that it will be awarded the license if its bid is not more than 10 percent lower than a bid by a non-DE. The economic rationale is as follows. Presumably, DEs have a lower willingness (or ability) to pay for licenses than non-DEs. In an open auction without bidding credits, non-DEs will not have to bid aggressively in

[13] *See* Verizon Wireless News Release, "Verizon Wireless to Purchase NextWave Spectrum in New York," http://news.vzw.com/news/2004/07/pr2004-07-081.html (July 8, 2004). Net of credits NextWave bid $994 million for the 30 MHz New York license, which is a price of $331.4 million for 10 MHz.

[14] *See*, *e.g.*, Cramton, Peter, (1997) "The FCC Spectrum Auctions: An Early Assessment," *Journal of Economics and Management Strategy*, 6:3, pp. 431-495; Ayres, Ian and Cramton, Peter, (1996), "Deficit Reduction Through Diversity: How Affirmative Action at the FCC Increased Auction Competition," *Stanford Law Review*, 48, pp. 761-815; and McMillan, John, (1994), "Selling Spectrum Rights," *Journal of Economic Perspectives*, Vol. 8, No. 3, pp. 145-162.

[15] Ayres and Cramton (1996) argue that "affirmative action bidding preferences, by increasing competition among auction participants, increased the government's revenue by $45 million" on the FCC's regional narrowband auction. Ayres, Ian and Cramton, Peter, (1996) "Deficit Reduction Through Diversity: How Affirmative Action at the FCC Increased Auction Competition," *Stanford Law Review*, Vol 48, pp. 761-815.

order to win the auctions, as DEs will not exert significant competitive pressure. On the other hand, a bidding preference mechanism would stimulate competition, because non-DEs will be forced to submit higher bids in order to win the license. Therefore, this policy could address the government's objective of diversifying license ownership, while simultaneously help increasing government's revenue.[16]

22. A second rationale for set asides could be to encourage a new entrant to foster further competition. In the current competitive market, this argument lacks justification and the sound application of standard antitrust principles is a better tool than DE set-asides. Indeed, such set asides may well harm competition when compared with the alternative outcome of the smaller incumbents winning additional spectrum.

23. In the PCS market, spectrum is an essential input that limits capacity and sets a firm's ability to compete to grow its market share. This is an example of a market structure that is a "capacity-constrained oligopoly."[17] When a firm is spectrum-constrained it has no ability to serve additional customers without degrading service quality and so it does not have the incentive compete for the marginal customer. In any market, it is this competition for the marginal customer that determines price in

[16] As discussed by McMillan (1994), this mechanism is effective as long as the level of bidding credits is set in a way such that its revenue-raising effect (derived from non-DEs bidding more aggressively) outweighs the revenue-lowering effects (derived from the fact that a DE may win an auction and pay a lower price). *See* McMillan, John, (1994) "Selling Spectrum Rights," *Journal of Economic Perspectives*, Vol. 8, No. 3, pp. 145-162.

[17] *See e.g,* Froeb, Luke, Tschantz, Steven and Crooke, Philip (1999) "Simulating Merger Effects Among Capacity constraines Firms" Working paper Owens School of Management, Vanderbilt University, and Haskel, Jonathan and Martin, Christopher (1994) "Capacity and Competition: Empirical Evidence on UK Panel Data" *Journal of Industrial Economics*, Vol. 42 pp. 23-44.

equilibrium. If additional spectrum becomes available to the smaller incumbents in the market, they would have the greatest incentive to cut price to gain market share. In contrast, a small new firm with strictly limited capacity will likely act a "price follower."

24. DE set-asides may result in a market structure where small and capacity-constrained firms compete with a relatively few number of large firms. In such a market, it is the large companies who determine the price, which is likely to be set at a higher level than in the case where small firms are able to compete for the marginal customers. In such a market, the prudent application of competition policy is straightforward. It requires that no one firm or group of firms grows so large in capacity relative to the small firms that they unilaterally or jointly would have the incentive to withhold capacity from the market. Absent this capacity disparity, prices are set to clear markets at the capacity constraint independent of the number of firms.

25. This point is best illustrated by a simple hypothetical example. Suppose a market with 100 MHz of spectrum. If there were 5 firms each with 20 MHz of spectrum then the total available supply, given each firm's spectral efficiency, is 200 units times five firms or 1000 units measured in "analogue equivalent units."[18] The market is competitive and price is then determined by the equation' supply equals demand. Suppose further that the market price is $10, and the elasticity of demand is 2. Now if we had a market with the same 100 MHz of spectrum and 10 firms, each with 10 MHz of spectrum, then, because of the reduced spectral efficiency each firm, (7 times analogue) the total available supply would be 10 firms times 70units =700 units. With the same demand curve as before this amounts to a 30 percent reduction in capacity. The elasticity

[18] *See* Hogg and Austin Declaration, *supra* note 4.

tells us the percentage change in quantity demanded for a percentage change in price; its inverse tells us the percentage change in price for a given change in supply. Therefore, in this example, a 30% reduction in supply leads to a 30 percent times 1/2 or 15 percent increase in price to $11.50. The policy of artificially increasing the number of firms harms consumers.

26. The key assumption in the above example is that the market price is the competitive price when we have five firms. It is straightforward to show that in the example this is so, no single firm can benefit from a unilateral reduction in its supply to raise prices.[19] The economic principle is that as long there is not a large capacity disparity, between firms, then no firm can profitably with-hold capacity and then prices are set by to clear markets at the capacity constraint independent of the number of firms. In such a market, an industrial policy of creating new entrants does nothing to foster further competition. In fact, as the example shows, with economies of scale, it may lead to higher prices.

IV. ESTIMATES OF PUBLIC INTEREST HARMS FROM THE C-BLOCK AUCTION

27. The C-block auction was an example of well-intended public policy with unintended consequences. The series of defaults, bankruptcies, and associated litigation involving winning bidders in the C-block auction rendered most of its spectrum capacity unusable. This restriction in supply was harmful to consumers of wireless services.

[19] A 10 percent reduction in one firms supply (i.e. 2 MHz) is only a 2 percent change in market supply, and so the induced price rise is only 1 percent and the withholding firm loses revenues.

28. In order to provide some guidance to the Commission regarding the cost to consumers generated by DE set-asides, below I perform a calculation of the loss in consumer surplus resulting from the use of C-block auctions. Consumer surplus represents the difference between the maximum amount that a consumer is willing to pay for a good and the amount actually paid.[20] It represents a measure of how much better off consumers are, in the aggregate, because they can buy goods in the market.

29. The C-block auction harmed consumers because it impeded the use of 30 MHz of additional spectrum capacity. Had the C-block spectrum been fully utilized, consumers would have benefited from a significant increase in supply[21] and consumer surplus would have been higher as a result of lower prices. Moreover, the increase in consumer surplus would have accrued to consumers for several years. In particular, if we assume that the additional capacity from the C-block will be put into the market by 2006, then consumers would have received additional consumer surplus for a period of 10 years, since the C-block auction ended in May 1996.

30. To establish the true cost of this delay we would have to calculate the cost of withholding in each market for the duration that the spectrum was unavailable in that market. To simplify the analysis we first calculate the deadweight loss as if all of the C-block spectrum was with held from the market and then I assume that the loss was felt in

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[20] *See, e.g.*, Pindyck, Robert S. and Daniel L. Rubinfeld, (2000) MICROECONOMICS, 5th Edition, Prentice Hall, pp. 123-127.

[21] The total spectrum capacity available is 180 MHz, of which 30 MHz correspond to the Cblock. Assuming that this block is not in use, then the usable spectrum capacity is 150 MHz. That is, spectrum capacity would increase by a 20 percent if the 30 MHz from the C-block were to be fully used.

half the markets. This is probably a conservative approach given that for example the licenses won by NextWave account for a large fraction of the high population markets. Table One provides estimates of the loss in consumer surplus that resulted under alternative assumptions regarding the elasticity of demand and the portion of the 30 MHz from the C-block that was not deployed. Assuming no C-block spectrum was deployed, the second column in the table presents the annual loss in consumer surplus caused by the restriction in supply for selected values of the price-elasticity of demand for wireless services. Also assuming no C-block spectrum was deployed, the third column in the table shows the present discounted value (as of 1996) of the consumer surplus loss for a period of ten years. Columns four and five present similar information assuming one-half of the spectrum in the C-block was deployed. A detailed explanation of the methodology used can be found in Appendix Two of this declaration.

TABLE ONE
LOSS IN CONSUMER SURPLUS DUE TO C-BLOCK AUCTION

Price Elasticity of Demand (a)	Assuming No C-block Spectrum Deployed		Assuming One-half of C-block Spectrum Deployed	
	Annual Loss in Consumer Surplus ($ Billions)	Present Value of Loss in Consumer Surplus ($ Billions)	Annual Loss in Consumer Surplus ($ Billions)	Present Value of Loss in Consumer Surplus ($ Billions)
-1.00	16.6	64.1	8.3	32.0
-1.25	13.5	52.2	6.8	26.1
-1.50	11.4	44.1	5.7	22.1
-1.75	9.9	38.1	5.0	19.1
-2.00	8.7	33.6	4.4	16.8
-2.25	7.8	30.0	3.9	15.0
-2.50	7.0	27.1	3.5	13.6

31. As shown in Table One, assuming that no C-block spectrum was deployed, the estimated annual loss in consumer surplus caused by the unavailability of the C-block spectrum capacity ranges from $7 billion to $16.6 billion, depending on the value of the demand elasticity parameter considered.[22] Moreover, the value as of 1996 of losing this surplus flow for a period of ten years ranges from $27.1 billion to $64.1 billion for demand elasticity parameters in the range of -1.0 to -2.50.[23] Assuming that one-half of the C-block spectrum was deployed, the estimated annual loss in consumer surplus ranges from $3.5 billion to $8.3 billion, depending on the value of the demand elasticity parameter considered. The last numbers are the most relevant for Auction 58, what has been lost is lost, but looking forward and assuming that service is being provided by C-block licensees covering half of the population, then each extra years delay of service continues to cost consumers at least $3.5 Billion in forgone surplus. These figures are significant and plainly illustrate the harm caused to consumers by the DE eligibility restrictions if they are applied in Auction 58.

[22] Several empirical studies provide different estimates of the own-price elasticity of demand for wireless services. For example, using data on wireless consumption between 1999 and 2001, Ingraham and Sidak have found that the own-price elasticity of demand for wireless services is between -1.12 and -1.29. Okada and Hatta compute own-price elasticities for the Japanese market ranging from -1.4 (fixed-line telephone services) to -3.96 (mobile services). Using panel data on mobile telephony for 56 countries, Maden, Coble-Neal and Dalzell estimate an own-price elasticity of -0.53 for high-income countries. *See* Ingraham, Allan and Sidak, J. Gregory, (2003) "Do States Tax Wireless Services Inefficiently? Evidence on the Price Elasticity of Demand", *AEI Working Paper Series*; Okada, Yosuke and Hatta, Keiko, (1999) "The Interdependent Telecommunications Demand and Efficient Price Structure", *Journal of the Japanese and International Economies*, Vol. 13, pp. 311-335; Madden, Gary, Coble-Neal, Grant and Dalzell, Brian, (2004) "A Dynamic Model of Mobile Telephony Subscription Incorporating a Network Effect", *Telecommunications Policy*, Vol. 28, pp. 133-144.

[23] Because more inelastic demands imply a greater damage suffered by consumers, my estimates of consumer surplus loss are based on elasticity values in the more conservative range of 1.0 to 2.5 (in absolute value), despite the fact that some studies report lower levels of demand elasticity (see previous footnote).

32. I also examine losses in producer surplus based on the results on the A and B-block auctions.[24] These auctions are a relevant benchmark because they were unrestricted auctions and did not lead to bidders' bankruptcy. Thus, it is reasonable to assume that had not the Commission used the DE set-aside for the C-block, it would have conducted an auction with the same features as those of the A and B-block auctions. According to Commission data, the combined revenue from the two auctions was $7.7 billion.[25] Given that we are considering a single auction, we must divide this figure by two, yielding an average price for the spectrum asset of $3.85 billion.[26] At the time these auctions took place (late 1994-early 1995), the cost of capital for the industry was approximately 14 percent.[27] Under the more conservative assumption that one-half of the C-block spectrum was deployed, applying this discount rate to the spectrum asset price yields a loss in producer surplus of over $269 million a year. The discounted present value of this stream of income over time has also been lost and it should be added to the total public interest harms.

33. The above analysis is simplified because of the tremendous growth in the wireless market. The UBS Report finds that industry revenues grew at 12.7% (quarter

[24] Producer surplus is the sum over all units produced by a firm of differences between the market price of a good and the marginal costs of production. *See, e.g.,* Pindyck, Robert S. and Daniel L. Rubinfeld, (2000) MICROECONOMICS, 5th Edition, Prentice Hall, pp. 123-127.

[25] Source: FCC Auctions – Auction 4 Fact Sheet.

[26] This is correct since the A and B-block were perfect substitutes, and thus, they should both carry the same price.

[27] During 1998, cost of equity capital estimates for wireless companies ranged from 13.08 percent based on the CAPM model) to 16.92 percent (based on 3-Factor Fama-French model). In 2003, these estimates were 13.59 percent (CAPM model) and 15.10 percent (3-Factor Fama-French model). Sources: COST OF CAPITAL 1998 YEARBOOK, Ibbotson Associates, 1998 and COST OF CAPITAL 2003 YEARBOOK, Ibbotson Associates, 2003.

over quarter) in third quarter 2003.[28] The wireless sector continues to see growth in total revenues and revenue per customer. Similarly, as the value of license reflects the net present value of being in that market, and this market exhibits such robust growth, we have seen a general increase in the values of spectrum licenses. Thus to the extent that my calculation are based on current data, looking forward they probably under estimate the future social costs of further delays in deployment.

V. CONCLUSIONS

34. In 1994, when the Commission issued the Fifth Report and Order that established the DE provisions, it was engaged in a legitimate exercise of industrial policy.[29] This was a new market with unknown demands and great technological uncertainty. The DE set aside and closed auctions were just one of many tools that were used in an attempt to design a vibrant and competitive marketplace *de novo.* In particular, the Commission's goals were to ensure new firms would enter the market and to foster technological innovation. The DE set asides were just one of many policies, such as the spectrum cap and limits on PCS/cellular cross-ownership, to achieve these goals. Despite the failure of the DE policy overall, the PCS auctions stand as one of the Commission's great triumphs – it did indeed achieve a vibrant and competitive market place delivering enormous consumer value and technological innovation.

35. Today the policy problem is quite different. The market is now maturing, and we have several years of experience with the industry. The appropriate policy

[28] *See* Wireless 411, UBS INVESTMENT RESEARCH, January 2004 ("The UBS Report").

[29] Fifth Report and Order, *Implementation of Section 309(j) of the Communications Act – Competitive Bidding*, 9 F.C.C. Rcd 5532 (July 15, 1994).

framework is not industrial policy but rather the sound application of antitrust and competition policy. As I have pointed out above, based on the structure of the market and the technological economies of scale in spectrum usage, artificially creating a new entrant would not increase consumer welfare over the marginal incumbents increasing their spectrum holdings by the amount of the set asides. Thus, at this point in time, a closed auction has no logical foundation in competition or antitrust policy.

36. Thus, the only possible public interest benefit from having a closed auction is to foster innovation, either the development of new services or serving niche markets. However, in this respect the world is also very different from 1994. In particular, this Commission has boldly championed the growth of unlicensed spectrum. In stark contrast to the experience with set asides, this policy has been a huge success in fostering a wealth of new products and services and true entrepreneurial activity. Unlicensed spectrum was a policy tool that was both little understood and under utilized in the past, and now enables the Commission to foster real entrepreneurship without requiring that entrepreneurs use their capital on acquiring licenses. Similarly, with regard to serving underserved market niches, this Commission has found a better policy tool through the fostering of secondary markets and creative leasing solutions. Again this new tool allows an entrepreneur wishing to serve a niche area the ability to find a market solution for access to spectrum, without the capital expense of acquiring a license in the auction. Once again, this Commission has risen to the challenge and created a new regulatory solution to the problem, that is far superior to the blunt instrument of set asides that the Commission had in 1996.

37. Thus, even though in 1996 there was perhaps a theoretical case for the DE set asides, the industry history and market development has demonstrated that those putative benefits did not materialize, and today we have better regulatory tools to attain those benefits. The FCC's public interest standard requires that this at best speculative benefit must be weighed the enormous public interest harm of delayed deployment and reduced competition. One of the fundamental principles of antitrust is that the higher the consumer losses the greater certainty that must be attributed to claimed benefits to overcome the consumer harms.[30] The adoption of closed auctions reverses this calculus weighing the ever more speculative gains that have never materialized against the history of consumer losses. With each passing year the sum of lost consumer benefits rises higher and higher.

38. To the extent that the set asides for this spectrum, just as in the past, result in DEs overbidding or engaging in opportunistic behavior, then continuing with this failed policy will further delay deployment adding to these consumer welfare loses and the C-block will continue to bedevil this and future Commissions.

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[30] *See, e.g.*, United States Department of Justice and Federal Trade Commission, HORIZONTAL MERGER GUIDELINES, Issued April 2, 1992 and revised April 8, 1997, and U.S. Department of Justice("*DOJ/FTC Guidelines*"). §4, Complaint, *U.S. v. EchoStar Communications Corp. et al.*, Case No. 1:02CV02138 (D.D.C. Oct. 31, 2002) at ¶¶ 102-103.

APPENDIX ONE

CURRICULUM VITAE OF SIMON J. WILKIE

SIMON J. WILKIE

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EDUCATION

Ph.D. (Economics) University of Rochester, 1990

M.A. (Economics) University of Rochester, 1988

B.Comm. Honors. (Econ) University of New South Wales, 1984

APPOINTMENTS

Senior Research Associate, California Institute of Technology, July 2002- present.

Chief Economist, Federal Communications Commission, Washington DC; July 2002-October 2003.

Assistant Professor, California Institute of Technology; 1995-2002.

Lecturer, California Institute of Technology; 1994- May 1995.

Member of Technical Staff, Bell Communications Research; 1990-94.

Assistant Professor, Columbia University; 1992-93 Visiting.

Post-Doctoral Fellow, Bell Communications Research; 1989-90.

AWARDS AND FELLOWSHIPS

California Institute of Technology Graduate Student Council: 1997 Mentoring Award.

California Universities for Research in Earthquake Engineering: "Social Economic and System Aspects of Earthquake Recovery and Reconstruction," co-PI with James Beck, Caltech, and Anne Kiremidjian, Stanford, $400,000 for 1997-1999.

National Science Foundation, SES Grant "Applied Mechanism Design," $38,113 for 2000-2002.

National Science Foundation, PEER Grant "A Decision Theoretic Approach to Evaluating Building Specific Losses," $75,000 for 2000-2002.

REFEREED PUBLICATIONS

"Incremental Export Subsidies," with Martin Richardson, *The Economic Record*, March 1986, pp. 88-92.

"The Bargaining Problem Without Convexity: Extending The Egalitarian and Kalai-Smorodinsky Solutions," with John Conley, *Economics Letters*, 1991, Vol. 36, pp. 365-369.

A Generalization of Kaneko's Ratio Equilibrium," with Dimitrios Diamantaris, *Journal Of Economic Theory*, 1994, Vol. 62, No 2, pp. 499-512.

"Incremental R&D Subsidies," with Martin Richardson, *The Journal of Regulatory Economics*, 1995, Vol. 7, pp161-175.

"Implementing the Nash-Extension Bargaining Solution," with John Conley, *Economic Design*, 1995, Vol. 1, pp. 205-216

"Auctioning the Airwaves: The Contest for Radio Spectrum," with Bhaskar Chakravorti, Yossef Spiegel and William Sharkey, *Journal of Economics and Management Strategy*, 1995, Vol. 4, pp. 344-373.

"On the Set of Pareto Efficient Allocations in Economies with Public Goods," with Dimitrios Diamantaris, *Economic Theory*, 1996, Vol. 7, pp. 371-379.

"An Extension of The Nash Bargaining Solution to Non-Convex Problems," with John Conley, *Games and Economic Behavior*, 1996, Vol. 13, pp. 26-38.

"Investment in New Technology as a Signal of Firm Value Under Regulatory Opportunism," with Yossef Spiegel, *Journal of Economics and Management Strategy*, 1996, Vol. 5, pp. 251-276.

"Comment on Spiller's `A Positive Political Theory of Regulatory Instruments: Contracts, Administrative Law or Regulatory Specificity?' " *The Southern California Law Review*, 1996, Vol. 69, pp. 517-519.

"Double Implementation of the Ratio Solution by a Market Game" with Luis Corchon, *Journal of Economic Design*, 1996, Vol. 2, pp. 325-337.

"Reference Functions and Possibility Theorems for Cardinal Social Choice Problems," with John Conley and Richard McLean, *Social Choice and Welfare*, 1997, Vol. 14, pp. 65-78.

"Axiomatic Foundations for Compromise Theory: The duality of Bargaining Theory and Multi-Objective Programming," with John Conley and Richard McLean, 1997, forthcoming, *Games and Economic Behavior*

"Implementation of the Walrasian Correspondence by Market Games," with Carmen Beviá, and Luis C. Corchón, *Review of Economic Design*, 2003, Vol 7, pp. 429-442.

"Current Regulatory Realities: Overcoming the Regulatory Quandary," *Michigan State DCL Law Review*, 2003 Issue 3 pp599-605.

"Universal Service Regulation and Entry in Local Telecom Markets," with Charles R. Plott, forthcoming, *Journal of Public Economic Theory.*

"Solutions for Economies with Public Goods, an Axiomatic Approach," forthcoming, *Journal of Public Economic Theory*.

"Economic Analysis at the FCC," with Mark Bykowsky, Jonathan Levy, William Sharkey and Tracy Waldon, *Review of Industrial Organization, 2003*, Vol. 23, pp. 157-174.

"Endogenous Games and Mechanisms: Side Payments Among Players," with Matt Jackson, forthcoming , *Review of Economic Studies.*

"Open Networks, the Roles of Regulation and Competition," forthcoming in *Journal of Telecommunications and High Technology Law."* 2004

OTHER PUBLICATIONS

"Economic Policy In the Information Age," *Engineering and Science*, Vol. LXIV, No 1. 2001. Pp. 28-37.

"Memorial to Jeffrey Scott Banks," *Journal of Public Economic Theory*, 2001, Vol. 3 No. 4, pp. 551-554.

"Local Competition and Universal Service," with Charles Plott, *Jobs and Capital*, 1995 Vol. 4, pp. 43-45

"Installment Payments and the FCC Spectrum Auctions." *Jobs and Capital*, 1996, Vol. 5, pp. 26-29.

WORK IN PROGRESS OR SUBMITTED

"Optimal Multi-Product Non-Linear Pricing with Correlated Types," with Yossef Spiegel, revised 2001. Revise and resubmit at *Journal of Economic Theory*.

"Credible Implementation," with Bhaskar Chakravorti and Luis Corchon, revise and resubmit at *Games and Economic Behavior*.

Sequencing Lifeline Repairs after an Earthquake," joint with Marco Casari, 2002 revise and submit at *The Journal of Regulatory Economics*.

"Equilibrium Exit from a Long Term Contract," joint with David Sibley, 2003 submitted to the *International Economic Review*

"Electoral Competition Among Heterogeneous Candidates," joint with Stephen Callender, 2002. Under revision.

"Analytic Foundations of the FCC media ownership Rules," In progress

"Defining Economic Impairment: Alternative Standards for Unbundling Telecom Facilities," joint with Daniel Shiman. In progress.

"An Ordinal Egalitarian Bargaining Solution," with John Conley, 1997, revised 2004.

"Implementing Valuation Equilibria," with Dimitris Diamantaris, 1999 revised 2001

"A Note on Cost Share Equilibria and the Core," revised 2002.

"Decision Support Tools for Earthquake Recovery: Interim Report," with Jim Beck Anne Kiremidjian, and S. King, Y. Achkire, R. Olson, J. Goltz, K. Porter, A. Irfanoglu, M. Casari, J.M Legrue, F. Boehmke and A. Gonzales CUREe-Kajima Project Report 1999.

"Decision Support Tools for Earthquake Recovery: Final Report," with Jim Beck Anne Kiremidjian, and S. King, R. Olson, J. Goltz, T. Salmon, A Mason, K. Porter, and A. Irfanoglu CUREe- Kajima Project Report, 1999.

"Optimal Multi-Object Auction with Correlated Types," with Tomoichi Shinotsuka, 1998, revised 2000.

"Discrete Bid Auctions," with Jin Yu, 1998 revised 1999.

"Explaining Price Anomalies in the FCC Spectrum Auctions," 1997 revised 1999.

"Efficient Public Networks: Computation and Implementation," 1997

"Implementation by Stable Social Conventions," with Luis Corchon, 1999

"Computers, The Productivity Puzzle, and Market Structure," with Luis Corchon, 1994

"Does Profit Sharing Regulation Benefit Consumers?" Bellcore Economics D.P#101, 1993

PROFESSIONAL ACTIVITES

Editorial Board Member: *Journal of Public Economic Theory*, 1997.

Referee: *The American Economic Review, Econometrica, Economic Design, Economic Theory, European Transactions on Telecommunications, Games and Economic Behavior, The International Economic Review, The International Journal of Game Theory, The Journal of Economics and Management Strategy, The Journal of Economic Theory, The Journal of Economic Behavior and Organization, The Journal of Industrial Economics, The Journal of Regulatory Economics, Telecommunication Systems, and Theory and Decision.*

Committee Memberships: Local Committee: 2002 Social Choice and Welfare Meetings, Pasadena. Session Chair: 1997 Summer Meetings of the Econometric Society. Member of the Organizing Committee: "Workshop on Computer Science and Game Theory," section of the Fourth International Conference on Game Theory, SUNY Stony Brook, July 28-30, 1993. "Workshop on Implementation," section of the Third International Conference on Game Theory, SUNY Stony Brook, July 8-10, 1992. "Workshop on Cost Allocation and Transfer Pricing," section of the Second International Conference on Game Theory, SUNY Stony Brook, July 8-10, 1991.

March 2004

APPENDIX TWO

1. This technical appendix describes the methodology used to compute the loss in consumer surplus arising from the C-block spectrum auction, as reported in Table One of this declaration.

2. I begin by specifying a constant-price-elasticity demand function for wireless services of the form:

$$Q = A \cdot P^{a}, \qquad (1)$$

where Q is the quantity of wireless services demanded, P is the price of wireless services, A is a free parameter to be calibrated from the data and a is the own-price elasticity of demand for wireless services.

3. The data used in the estimation is taken from a UBS analyst' report on the wireless industry,[31] which spans the 4Q01 – 3Q03 period and includes the following variables: Total Service Revenues ("TSR"), inclusive of roaming, for national, affiliate and regional operators and Monthly Average Revenue per User ("ARPU"), also inclusive of roaming.[32] These data are used in conjunction with equation (1) to compute changes in consumer surplus arising from changes in price of wireless services.

4. In particular, the monthly ARPU can be thought of as a proxy for the price of wireless services. Thus, by dividing the quarterly TSR by a quarterly ARPU, I can

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[31] *See* Wireless 411, UBS INVESTMENT RESEARCH, January 2004 ("The UBS Report").

[32] *See* Tables 17 and 21 on the UBS Report.

obtain a proxy for the variable Q in equation (1), which, in this case, will be number of users on a given quarter. By applying the same procedure to the other quarters, I obtain price-quantity observations for each quarter in the sample period, allowing me to calibrate the free parameter A, given a fixed value for the price elasticity parameter a.[33]

5. The total spectrum capacity available is 180 MHz, of which 30 MHz corresponds to the G-block. Assuming that this block is not in use, then the usable spectrum capacity is 150 MHz. That is, spectrum capacity would increase by a 20 percent if the 30 MHz from the C-block were to be put into use. Given a fixed demand function and assuming that the equilibrium quantity for wireless services increases by the same 20 percent, I am able to estimate the price effect of such additional capacity.

6. Specifically, I multiply the original quarterly values for the variable Q by a factor of 1.2 and use equation (1) to solve for the price P in each quarter. As a result, I obtain price-quantity observations when the additional spectrum capacity is available to consumers. By integrating equation (1) over the relevant prices, I compute the quarterly changes in consumer surplus due to a 20% increase in spectrum capacity over the period 4Q01 – 3Q03.[34] In order to simplify computations, I estimate a measure of annual loss in

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[33] There is a free parameter A for each quarter in the sample period.

[34] Given the tractable demand equation I chose, the loss in consumer surplus is given by the expression: $\left(\frac{A}{1+a}\right)\cdot\left(P_1^{1+a} - P_0^{1+a}\right)$ for a ? -1.0 and $A\cdot(\ln P_0 - \ln P_1)$ for a = -1.0, where P_0 is the equilibrium price when capacity is 150MHz and P_1 is the equilibrium price that results when spectrum capacity increases to 180 MHZ.

consumer surplus by accumulating the quarterly losses in consumer surplus for the period 4Q02-3Q03.

7. This annual flow of surplus would have accrued to consumers for several years. In particular, if we assume that the additional capacity from the C-block will be put into the market by 2006, then consumers would have received additional consumer surplus for a period of 10 years, since the C-block auction ended by May 1996.

8. Therefore, I estimate the future value of losing a given consumer surplus flow for a period of ten years and discount the resulting figure back to 1996. I use a discount rate of 7 percent to perform these calculations.[35]

[35] The 10-year Treasury note yield as of May 30, 1996 was 6.84 percent (Source: Yahoo! Finance). Use of this benchmark is standard in Cost-Benefit Analysis. For simplicity, I consider a percent discount rate to carry out the calculations.

I declare, under penalty of perjury, that the foregoing is true and correct. Executed on July 30, 2004.

By: _____

Simon J. Wilkie