KELLOGG, HUBER, HANSEN, TODD, EVANS & FIGEL, P.L.L.C.
SUMNER SQUARE
1615 M STREET, N.W.
SUITE 400
WASHINGTON, D.C. 20036-3209
(202) 326-7900
FACSIMILE:
(202) 326-7999

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Federal Communications Commission
Office of the Secretary

Via Hand Delivery

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Room TW-A325
Washington, D.C. 20554

Re: CC Docket 95-116; WC Docket 07-149; WC 09-109

Dear Ms. Dortch:

On behalf of Neustar, Inc., I have attached, for inclusion in the above-captioned dockets, an economic study prepared for Neustar by University of Michigan Ross School of Business Professor Scott E. Masten, an expert in the economics of procurements, entitled, "Scale and Transactional Economies in NPAC Services and the Design of Competitive Bidding Procedures."

Neustar supports the LNPA selection process set forth by the Commission in its May 16, 2011, Order. Although the Commission's process permits the selection of one or more administrators, Telcordia, Inc. filed with the Commission a paper arguing for the advantages of requiring the selection of multiple regional providers of Number Portability Administration Center ("NPAC") services.[1] The analysis underlying that paper is significantly flawed; we are accordingly supplementing the record with Professor Masten's analysis. Professor Masten's study addresses economic considerations that the Commission should take into account in supervising the Request for Proposal process that the North American Portability Management LLC ("NAPM LLC") is designing for number portability database platforms and services in the United States.

[1] William P. Rogerson, *An Economic Analysis of Competitive Procurement Process Design Options for NPAC Services,* September 13, 2011.

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Professor Masten's study considers the potential costs and benefits of constraining the NAPM LLC's RFP process to ensure that the contract for provision of NPAC services is awarded to at least two providers rather than a single provider. The study notes that it is undisputed that the provision of NPAC services is characterized by significant economies of scale. Such economies of scale tend to favor the selection of a single provider rather than two or more providers because of the higher costs associated with the selection of multiple providers. Professor Masten's study discusses the supposed advantages identified by Professor Rogerson's report from selection of two providers rather than a single provider for the provision of NPAC services, and concludes that those benefits are speculative or insignificant. Professor Masten also explains that (1) an RFP that requires the award of contracts to multiple providers is likely to increase the cost of NPAC services relative to winner-takes-all procurement; and (2) a prohibition of package bidding, *i.e.*, bids for the combination of all regions, conflicts with the information and efficiency objectives of competitive bidding.

Professor Masten's report underscores the importance of providing the NAPM LLC flexibility to design an RFP process that best serves the interests of the industry and consumers. The members of the NAPM LLC have the experience and the proper incentives to ensure that the Local Number Portability Administrator (or Administrators) provides reliable, innovative, and low-cost services. The introduction of artificial regulatory constraints on the competitive bidding process is more likely to prevent, rather than to promote, an efficient bidding process. Neustar respectfully submits that the Commission should continue to allow the NAPM LLC to use its judgment on how best to design the forthcoming RFP.

Sincerely,

Aaron M. Panner
Counsel for Neustar, Inc.

Enclosure

cc: Ann Stevens
Sanford Williams
Marilyn Jones
Diane Griffin Holland
Maureen Duignan
Frank Inserra
Kalun Lee
Mel Clay
Tim Decker

Scale and Transactional Economies in NPAC Services and the Design of Competitive Bidding Procedures*

Scott E. Masten
Professor of Business Economics and Public Policy
Stephen M. Ross School of Business
University of Michigan
Ann Arbor, MI 48104-1234
semasten@umich.edu

November 22, 2011

*Prepared for NeuStar, Inc.

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Scale and Transactional Economies in NPAC Services and the Design of Competitive Bidding Procedures

Scott E. Masten

I. INTRODUCTION

The Wireline Competition Bureau of the Federal Communications Commission has established procedures for the selection of the next local number portability administrator ("LNPA"), a component of which will be the issuance of a Request for Proposals. At the request of the current LNPA, Neustar, Inc., I have prepared an economic analysis of issues concerning the RFP process, including the number of vendors that will yield the best economic outcome. I also comment on the analysis prepared for Telcordia Technologies, Inc., by Professor William Rogerson regarding both the optimal number of service providers and the structure of the bidding process.

First, I have considered whether, in light of the characteristics of NPAC services, the employment of different vendors in two (or more) separate regions is likely to lead to a more efficient outcome than the selection of a single vendor to serve the entire United States. My analysis indicates that significant cost advantages exist to using a single vendor for the provision of NPAC services, and that these advantages are likely to outweigh any potential benefit that might arise from requiring that different vendors serve separate regions of the U.S. In particular, I conclude that the benefits that Professor Rogerson attributes to procurement from multiple vendors are either nonexistent or highly speculative and, consequently, would be unlikely to justify sacrificing the substantial economies that accrue to use of a single vendor.

Second, to the extent that uncertainty exists about whether selection of a single vendor would yield the best economic outcome, I have considered whether benefits are likely to arise from structuring the RFP process to ensure the selection of multiple vendors or from otherwise restricting bidders from submitting bundled bids covering the entire area where NPAC services will be provided. I conclude that (i) in light of the significant economies of provision by a single vendor, and of the effects that mandating contract awards to two or more vendors would have on vendor bidding strategies, procurement designs that required awards to more than one vendor would likely increase rather than decrease the cost of NPAC services relative to a sole-source, winner-takes-all procurement; and (ii) prohibition of package bidding is fundamentally in conflict with the information and efficiency objectives of competitive bidding. Moreover, because any competitive benefits that might derive from multiple sourcing in the future are speculative and impossible to quantify, inserting these considerations into the bid evaluation process would introduce additional complexity and indeterminacy into what will already necessarily be a complex process.

II. Procurement Organization and the Efficient Number of Suppliers

The ways in which firms (and individuals) purchase goods and services is a longstanding subject of economic analysis. Some products, particularly commodities like oil or wheat, are traded in well-developed spot markets while others can be purchased "off the shelf" at posted (or listed) prices. When procurement involves complex and specialized (nonstandard) goods and services, however, prices and other terms of trade are likely to be determined through either

negotiation or competitive bidding.[1] A sizeable economics literature exists that analyzes the properties of competitive bidding (or auction) schemes in different settings, on the one hand, and the circumstances under which better procurement results are likely to be achieved through negotiation rather than competitive bidding, on the other.

A related question — and one that affects the method of procurement as well as the design of bidding procedures — is whether supplies can be more efficiently procured using a single supplier or by employing multiple suppliers. The answer to that question depends, in large measure, on the extent to which there exist economies of scale or scope in production or savings in administrative and coordination costs for the vendor or customers from using a single supplier and, if so, whether benefits from dual-, or multiple-, sourcing exist that might outweigh the cost savings from single sourcing.[2]

A. The Advantages of Using a Single Provider for NPAC Services

Based on my experience with the economic analysis of procurement decisions, and my understanding of the nature of NPAC services, it appears that the use of a single provider of such services would very likely offer significant economic efficiencies relative to the use of two (or

[1] When problems procuring from an independent supplier or suppliers are expected to be particularly severe, buyers may forgo external procurement altogether and vertically integrate production of intermediate goods and services within the firm. Although the large number of users of NPAC services effectively precludes standard vertical integration as an option, alternative organizational arrangements, such as a buyer cooperative in which, here, the carriers would jointly own the NPAC, might achieve some of the benefits of vertical integration. Such arrangements have drawbacks and limitations of their own, however, that make them unsuitable in many settings.

[2] In most settings, including the economics literature and defense procurement, the terms "sole sourcing" and "dual sourcing" are used to refer to the number of suppliers who supply a good or service as opposed to whether prices and other terms are arrived at through negotiation or competitive bidding. See, e.g., Thomas P. Lyon, "Does Dual Sourcing Lower Procurement Costs?" *Journal of Industrial Economics*, 54(2), 2006, pp. 223-252, at pp. 223-4.

more) providers. In particular, the existence of substantial scale (or scope) economies, as well as significant transactional economies, favors the use of a single provider for these services.

A.1. The Nature of Number Portability Administration Center Services[3]

To understand the issues involved in procurement of NPAC services, as with procurement of any good or service, it is necessary to understand the nature of the service and the problems and challenges associated with its delivery. In the abstract, the core function of "porting" or transferring a customer's telephone number from one phone company, or carrier, to another seems a relatively simple and straightforward task. In actuality, providing accurate, timely, reliable, and secure porting for thousands of carriers serving millions of customers presents numerous practical and technical obstacles. When a consumer initiates a change in telephone service providers (while remaining within the relevant geographic region), one of or both the old and new providers will send an electronic notification to the NPAC. On receiving the notification(s), the NPAC performs validation checks and attempts to match the notifications from the new and old carriers. If the notifications are valid and agree, then on receipt of an "activate" message indicating that the customer has been physically connected to the new carrier's network, the NPAC broadcasts the new routing information to local NPAC databases and, from there, on to the internal networks of every carrier.

Problems and complications with the preceding sequence of operations can arise for numerous reasons. The old or new carrier may fail to send a change notification or the

[3] Material in this section is based on the North American Numbering Council (NANC) Functional Requirements Specification, Number Portability Administration Center (NPAC), Service Management System (SMS), Release 3.4.0f, May 31, 2011; discussions with NPAC technical experts; and other generally available public sources.

notifications received may contain incomplete, inconsistent, or otherwise invalid information. Carriers may also disagree about the carrier to which the customer belongs (because of a customer's contractual obligations, for instance). Transaction failures may occur because of message transmission and reception problems with the carriers involved in the port but also with the more than 2,000 carriers in the system, each of whose internal databases must remain synchronized with the NPAC system. To assure accuracy and reliability, the NPAC must maintain and implement protocols for every such contingency, track the completion of each transaction, record and retain a history of each failure, and provide an audit function to trace sources of problems and ensure synchronization and data integrity across the entire network. The NPAC must also maintain, in addition to its primary system, a fully redundant, real time, synchronized back-up system that can substitute for the primary system in the event of a service interruption or disaster. Both the primary and back-up systems must be capable not only of providing carriers with network, subscriber, notification, and system update information that a carrier missed during periods when the carrier's own system was down or otherwise not available to receive messages from the NPAC but also of informing each carrier of out-of-sync conditions in *other* carriers' systems.

Major contributing factors to the incidence and variety of problems encountered by the NPAC are the number and diversity of companies providing telephone services in the U.S. Carriers maintaining telephone numbers in the NPAC have grown in number from approximately 500 in 1997 to over 2,100 in 2011 (far more than in any other country). These carriers range from the large public corporations like Verizon and AT&T serving tens of millions of customers to small, independent companies providing service to a few thousand, often rural customers. The

companies vary greatly in their technical sophistication and financial resources; in the level of automation of their operations; and in the design, age, features, and quality (e.g., speed and reliability) of the equipment and software running their internal networks. Although porting transactions are standardized at the level of the NPAC, the heterogeneity of carrier networks means that communications from the NPAC may be handled differently within each carrier's own system. Unless carriers were forced to standardize their internal networks — an enormous and expensive undertaking that would likely drive out smaller carriers and thereby reduce competition — the NPAC must be flexible enough to accommodate the variety and idiosyncrasies of carrier systems. The introduction of wireless number porting in 2003, and VoIP (Voice over Internet Protocol) number portability in 2007, on top of the expense of adapting the NPAC system to accommodate a set of new carriers using different technologies, further increased the heterogeneity of carriers and the volume of porting transactions.[4]

Finally, these operations must be performed at enormous volumes and in a timely fashion. Currently, the U.S. NPAC performs well over one million porting transactions per day, or over fifty thousand per hour, many of which require several communications to and from a customer's current carrier, the carrier to which the customer wishes to switch, and network systems across the industry. In 2010, the NPAC handled several billion of these interactions, involving over 300 message types, many of which have required service response times measured in seconds.

[4] Another change that required significant up-front adjustments and increased complexity was the implementation in 2001 of national number pooling, which extended the life of 10-digit telephone numbers by allowing more efficient allocation of the available stock of numbers.

A.2. Scale and scope economies in NPAC service provision

Economies of scale or scope arise when the average cost of providing a good or service declines with the level of output or with the number of goods or services produced. (Whether extending service to an additional region is considered an increase in output or the addition of a distinct service is immaterial for the analysis.) Average costs may decline for a variety of reasons. One is the need to incur large start-up or setup costs that do not vary significantly with output. The existence of such setup costs will contribute to declining average costs as the "fixed" component of these costs is spread over more units. Scale and scope economies can also arise for technological reasons or because production involves assets (physical, human, or "intellectual") that can be shared among outputs or products at low cost. Finally, though often overlooked, cost economies related to the number of suppliers or service volume can also arise on the customer side if it is less expensive for customers to deal with a single supplier than with multiple suppliers.

The delivery of NPAC services involves facilities and equipment, software, and personnel, all of which are likely to contribute to some degree to the existence of scale economies in service provision. First, all parties acknowledge that setting up data processing operations entails considerable up-front fixed costs. These costs include nonrecoverable facilities and equipment costs but also substantial software development and testing costs.[5]

[5] In addition to repeated references to start-up costs, Professor Rogerson refers in a number of places in his report to the "advantages" of incumbency. Such "advantages" reflect the fact that the incumbent has already incurred the high fixed costs associated with establishing a service and therefore, unlike a new provider, would not need to incur those costs again. Similarly, what Professor Rogerson refers to as the "information advantages" of incumbency are costs that customers and/or regulators, as well as a new provider, would have to incur to achieve the level of familiarity and transactional facility already possessed by an existing provider. Such start-up costs are real
continued on the next page

Second, the nature of NPAC services is also likely to generate scale economies in production. The central inputs into the provision of NPAC services are the hardware to make connections, store data, perform operations, and manage billing; the software that handles each of these functions; and the personnel who develop, maintain, and solve problems arising with these systems, including those who interact with the North American Portability Management, LLC (NAPM), the North American Numbering Council (NANC), and individual carrier-customers to address problems, develop improvements, and manage transactions. Although existing regulation requiring the division of NPAC service into separate service regions creates a degree of separability in production in principle, in fact, as currently configured, the communications and applications systems (and parts of the database systems), consisting of equipment and software, as well as the personnel who maintain and operate these systems, are housed within a single secure facility. The ability to share these assets across NPAC regions results in significant savings that would be forfeited if these facilities and systems had to be duplicated in each of two or more regions to accommodate service provision by multiple vendors.[6]

Finally, intellectual property such as software, network design, subject matter expertise, and business methods is, by its very nature, largely "nonrivalrous," that is, once developed, it can be applied at low, often zero, cost to additional units of output. In the context of NPAC services, software that performs the central porting operations (receiving, validating, and executing

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costs that, because they are only incurred by a new provider, can be saved or avoided by continuing procurement from an already existing provider.

[6]A related question is whether the current separation of operations between regions would exist without the divisions mandated by regulation, and whether additional cost savings would accrue or operational efficiencies be realized if currently separate regional operations could be further combined and integrated. I have not separately addressed that issue in this report.

requests), maintains and backs up databases, records transactions, and manages client accounts and billing can be applied in every region served by a provider with very little additional cost. Similarly, technical, operational, and managerial expertise developed in one region can be disseminated across regions, meaning that solutions to problems and improvements in methods need not be rediscovered or re-developed separately in each region.

A.3. Transactional economies

The discussion above focuses on production cost economies associated with a provider's operations. Economies from using a single provider may arise on the carrier-customer side as well. First, just as providers incur production costs to supply NPAC services, carriers incur hardware and software costs in order to connect and interact with the provider's systems. These costs, moreover, may vary with the number of providers. An example is the savings in carrier time and expense to install a single circuit to process portability transactions with a single provider serving all seven regions compared to the time and expense that would be required to install multiple circuits to multiple providers serving separate regions.

More important, however, are likely to be the costs associated with assuring system compatibility with multiple NPAC vendors. For example, to assure system reliability in the event of a disaster, the NPAC currently conducts annual two-day long "failover" tests requiring the participation of every carrier. Introducing a second NPAC vendor (or more) would create the need to test the recovery capabilities of each vendor's system as well as add to the complexity of the testing (and of the back-up system itself) by requiring coordination of back-up and recovery systems and procedures between vendors as well as with carriers. Adding NPAC vendors is likely also to increase hardware and software costs for carriers. For carriers to access and

interact successfully with the NPAC system, each carrier must have hardware and software that is compatible with the provider's system. If vendors used different hardware or software, it is possible that each carrier would have to acquire, test, and operate two or more sets of systems. At a minimum, the order management and local routing systems used by carriers, typically purchased from third-party vendors, would have to be coded to each NPAC provider's system, increasing their expense. Finally, before a system could be connected to the NPAC, and for each new feature activated, industry-mandated "full regression and feature testing" has to be performed. These hardware, software, and testing costs, which are considerable even with a single provider, would increase significantly to accommodate multiple providers. Moreover, because many of these system compatibility costs are unrelated to a carrier's size, any increase in their magnitude is likely to be particularly burdensome for small carriers.[7]

The increased cost associated with connecting to multiple providers might be reduced if all NPAC providers were required to use exactly the same software and fully compatible hardware.[8] Such standardization would be a far from trivial undertaking, however, and would introduce a set of new problems. First, neither hardware nor software is static. As a result, assuring compatibility among providers would mean not just that initial hardware and software deployments be standardized but that each and every subsequent hardware adoption or software modification be coordinated among all providers. Inevitably, disagreements between NPAC

[7] Inasmuch as the introduction of multiple providers increases carrier fixed costs of accessing the NPAC system, a consequence of efforts to increase competition at the NPAC provider level may be a reduced competition at the carrier level as smaller carriers are driven out of the market.

[8] This is the solution apparently envisioned by Professor Rogerson, who remarks that potentially greater transaction costs deriving from dealing with multiple service providers "can be largely dealt with by requiring providers to use a standardized interface to deal with customers" (p. 11, note 10). See also *infra* at p.12.

vendors, providers about the benefits, costs, and timing of proposed modifications would require the involvement and intervention of the NAPM and NANC (or their successors) — and potentially the FCC — resulting in increased costs and delays in the deployment of system corrections and improvements.[9] Moreover, as discussed in more detail below, forcing the standardization and harmonization of hardware and software systems would inhibit innovation and undermine much if not all of the competitive performance benefit that might possibly derive from use of multiple vendors.

In addition to these technologically driven costs, the use of multiple suppliers is likely to increase certain "transaction costs," that is, costs of activities such as coordinating, negotiating, and contracting that, while not technologically required for service provision or reception, nonetheless unavoidably arise in the course of transacting.[10] The original contract for NPAC services, a sixty-six page document with numerous appendices amounting to hundreds of pages, includes provisions covering, in addition to detailed primary service level requirements, NPAC vendor responsibilities for testing, user training, security, and back-up, reliability, and disaster recovery; pricing schedules and price adjustment methods; liquidated damages for service delays; ownership and licensing of intellectual property; and restrictions on ownership and

[9] Technical changes requiring NAPM involvement and/or approval have been frequent, numbering in the hundreds since 1997. Myriads of other changes that did not necessitate NAPM involvement when there was only a single vendor would, presumably, require such involvement to maintain system compatibility among multiple vendors.

[10] An example using a simpler, albeit related, technology may help illustrate the distinction: The cost of phone service includes a consumer's cost for a phone with which to receive calls as well as the phone company's costs of connecting phone users. The need for a phone, and thus its cost, is technologically determined and would, economically, be considered a production cost even though incurred by the consumer, whereas the phone company's costs of billing and account maintenance and the customer's cost of paying its bill (or of disputing a charge) would both be considered transaction costs.

investments designed to assure vendor neutrality and prevent conflicts of interest, to name just a few broad areas. In the intervening years, that contract has been extended and modified numerous times: Between January 1997 and present, the contract has undergone nearly fifty amendments, covering both manners of business and hundreds of technical and operational changes. The introduction of additional NPAC vendors, particularly if vendors are allowed to adopt different technologies or methods, stands to complicate both the initial contracting and subsequent modifications.

Finally, introducing multiple providers will increase communication and bookkeeping costs at both the provider and carrier level. Carriers will have to maintain accounts and relationships with two (or more) vendors with different personnel possessing different levels of knowledge and expertise, different contact information, different documentation, and different processes, methods, and procedures for billing.

The combination of economies of scale in service production and access, and transactional economies in dealing with a single producer, imply a significant cost advantage to maintaining a single NPAC provider relative to multiple providers. Forgoing those economies would only make economic sense if the even larger advantages would be expected to arise from splitting the provision NPAC services among multiple providers.

B. Professor Rogerson's Provider Number Analysis

Professor Rogerson bases his analysis of the best number of NPAC providers on a tradeoff between higher costs of production that would result with multiple providers if production exhibited significant economies of scale or scope, on the one hand, and a set of benefits that he argues would derive from dividing the U.S. into two roughly equal number-

portability service areas and awarding each to different providers. His conclusion that the economics of NPAC services justify introducing a second provider in a separate region turn ultimately on his assessment that these benefits outweigh any forgone economies of scale or scope. I first discuss Professor Rogerson's relatively brief consideration of the potential costs of multiple providers (and thus the advantages of sole-source procurement) and then turn to his more extensive discussion of what he sees as potential benefits of requiring two providers.

B.1. Professor Rogerson's Discussion of Advantages of Sole Source Procurement

While acknowledging that scale or scope economies could tilt the calculation in favor of using a single provider, Professor Rogerson's analysis contains no specific inquiry — of the type that would normally be conducted to evaluate the existence and size of such economies — into either the technology of producing NPAC services or the nature of NPAC production costs and how they vary with output. His treatment of potential administrative or transactional savings from maintaining a single provider is similarly spare: In a pair of footnotes, Professor Rogerson's report briefly acknowledges — and just as quickly dismisses — the possibility that the addition of providers could increase either carrier costs of using NPAC services or exacerbate the transaction costs associated with those services:[11]

> One possible such benefit is that the transactions costs of dealing with NPAC services provider(s) could conceivably be smaller if there was a single provider. However, this can be largely dealt with by requiring providers to use a standardized interface to deal with customers (footnote 10)

and

[11] As I note below, the standardization that Professor Rogerson proposes to avoid coordination and transaction costs would also undermine the benefit of greater innovation that he imputes to the use of multiple providers.

> Note that having multiple providers should not create large coordination problems that could further increase costs. This is because each of the seven databases for each of the seven NPAC regions is separate and telephone numbers are not allowed to be transferred across databases. Therefore, so long as the two regions served by the two providers are created by aggregating the NPAC regions, there will not be any need for the providers to transfer telephone numbers between one another or to jointly manage any database (footnote 13).

At the same time that he downplays the significance of scale economies in the choice of the number of NPAC providers, however, Professor Rogerson invokes their existence to justify his recommendations on other issues. Specifically, Professor Rogerson's report refers to start-up costs or scale economies

(i) as a justification for the use of long term contracts: "In NPAC services procurements, relatively long contracts lasting approximately five years must be offered to provide potential competitors with some assurance that they will be able to recover *the relatively substantial start-up cost involved with creating the software and purchasing the hardware necessary to create a functioning data center*" (p. 12, emphasis added; see also pp. *ii*, 8, 11).

(ii) as a source of cost advantage for incumbents at contract renewal intervals that justifies maintaining a second provider to provide future competition: "Incumbency in one region likely provides some advantages for competing in future NPAC procurements for other regions. For example,...*an incumbent in one region may have lower costs of providing service in an additional region than a non-incumbent to the extent that there are economies of scale/scope.* This means that choosing more providers in the current NPAC services procurement will increase the amount of competition that exists in future NPAC procurements" (p. 15, emphasis added);

(iii) as an explanation for why declining per-transaction expenditures in the period 2002 to 2011 is not evidence of competitive pricing: "The decline in per transaction expenditures in and of itself cannot and should not be interpreted as providing any assurance at all that prices are being set at or anywhere near the competitive level. *To the extent that there are economies of scale associated with transactions volumes*, it may well be that procurement costs should have dropped much more dramatically than they have actually dropped" (p. 7, emphasis added; referring Table 1 and Figure 2).

In other words, Professor Rogerson speculates that scale economies are significant enough to justify long-term contracts, to prevent future competition unless multiple providers are required in the current procurement, and to explain the observed decline in average prices (per-transaction expenditures) — yet are not large enough to justify use of a single provider. It is conceivable that, but would be quite extraordinary if, scale economies just happened to be so large that that they supported Professor Rogerson's other arguments but not so large as to be an important consideration in determining the number of providers. Put another way, to outweigh even the scale economies that Professor Rogerson acknowledges (in (i) to (iii) above) would require a compelling case for very large benefits from multiple sourcing. The burden becomes even greater when appropriate account is taken of the administrative, coordination, and other transactional economies from using a single provider that Professor Rogerson dismisses as unimportant but that, as I have explained above, are in fact substantial.

B.2. Professor Rogerson's Characterization of the Benefits of Multiple Providers

Professor Rogerson identifies four advantages to using multiple providers under the headings (a) benchmarking performance and change orders; (b) more and better innovation; (c) back-up capability; and (d) more competition for future NPAC procurements and related procurements. Far from supporting his conclusion that those advantages justify sacrificing the economies associated with the choice of a single provider, the benefits that Professor Rogerson identifies are either non-existent or, at best, highly speculative. I consider each of these benefits below.

B.2.a. Benchmarking and change-order pricing

According to Professor Rogerson, the existence of at least one additional provider stands to improve outcomes by providing the procurement agency with more information on which it can base provider incentives and negotiate change-order pricing. Specifically, Professor Rogerson states that multiple regional providers of NPAC services would allow procurement agents "to directly compare the performance of different providers doing essentially identical sorts of jobs in different regions of the country" (p. 12) and thereby devise "better incentives for providers to devote their best efforts to solving problems and maintaining and improving the quality of their service (*id.*). He also posits that, by comparing provider estimates and explanations of costs of implementing changes, the procurement agency will be able to negotiate better prices for change orders than if dependent on reports from a single provider.

Although more information is generally valuable in crafting incentives and in negotiations, the magnitude of information benefits that might accrue to requiring multiple providers is unclear. First, the use of "benchmarking" requires that service and cost characteristics across regions served by different providers be sufficiently similar for comparisons to be informative. Differences in such factors as region size (geographic and demographic); porting transaction frequency; carrier numbers, characteristics, and concentration; costs and reliability of electric power service; and labor, materials, and facilities costs could all affect provider performance in ways that would make performance comparisons problematic. Second, and more important, "benchmarking" has value as a means of creating incentives only to the extent that providers have latitude to vary their systems in ways that significantly affect performance. That latitude would be severely circumscribed, however, if all providers were

required to standardize and harmonize their systems, as Professor Rogerson advocates would be necessary to avoid coordination problems from arising (as noted above at p. 13).

The value of multiple providers in negotiating change-order pricing is subject to similar limitations. Although system standardization would enhance cost comparability (by reducing the number of factors differentiating providers' costs), regional cost and service differences would, at a minimum, complicate the comparison of providers' cost estimates for pricing purposes. Without standardization, the actual cost of proposed changes could very well depend on differences in system features or customer characteristics that make some modifications more expensive for one provider serving its region than for others serving theirs, in which case, comparing cost estimates for purposes of pricing would have little value.

All of the preceding presumes that the information providers supply procurement agents when multiple providers are employed would be at least as accurate and truthful as the information provided by a single supplier. Good reasons exist to doubt this would be the case, however. Although any supplier has an incentive to withhold information from its customer in hopes of securing a negotiating advantage, a sole supplier has less reason to worry that information that it does provide will reveal sensitive information to its competitors (a particular concern if system variations are allowed). It is certainly conceivable that losses due to provider reluctance to supply information because of such competitive concerns would outweigh any negotiating advantage a sole provider might derive from withholding information.

Finally, the value to be derived from introducing one or more additional providers, both for "benchmarking" and pricing purposes, depends on the knowledge, expertise, and incentives of those charged with making procurement decisions. In the case of NPAC services, the

procurement agency (subject to regulatory approval) is composed of representatives of the companies who use and pay for NPAC services. These companies have expertise in the relevant technologies and the incentive to propose cost saving and service improving adjustments and to negotiate the pricing of those adjustments aggressively. At the same time, the existing provider has strong incentives to maintain good relationships with its carrier-customers, on whom it is dependent for its core business and, increasingly, to whom it wishes to sell non-NPAC services.

B.2.b. Innovation

Professor Rogerson argues that the use of multiple providers will increase innovation as a result of both the increased incentives from benchmarking discussed above and because increasing the number of providers increases the chances that one will happen on a new idea. The effects of multiple providers (or dual sourcing, as it is called in most of the literature) on innovation are far more complex than suggested by Professor Rogerson's very brief discussion, however. As I noted above, the value of benchmarking and the likelihood that it will lead to innovations that improve performance are severely constricted if providers are required to standardize their systems. By the same token, standardization, by reducing provider "diversity" (Rogerson, p. 14) is also likely to reduce the likelihood of a second or subsequent provider stumbling on a new idea.

A requirement of multiple providers may reduce innovation incentives for several other reasons as well. As Professor Rogerson has written elsewhere, "Policies such as dual sourcing

that reduce economic profit on production contracts may reduce innovation."[12] In the case of NPAC services, a provider who is restricted to serving only a region of a larger market has a smaller market over which to earn a return on its innovation, thus reducing the incentive to invest in innovative activities. Furthermore, to the extent that the procurement agency is able to use the existence of, or information gathered from, multiple providers to drive down NPAC service prices, the resulting appropriation of service improvements or cost savings accruing to an innovation would significantly weaken the incentive to innovate.[13] A system standardization requirement, in addition to reducing opportunities for discovering and developing new technologies, would further reduce incentives to innovate (i) by delaying adoption of new

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[12] William P. Rogerson, "Profit Regulation of Defense Contractors and Prizes for Innovation," *Journal of Political Economy*, 97, 1989, pp. 1284–1305, at p. 1292.

[13]For example, in Riordan and Sappington's (1989) model, R&D incentives are greater if the buyer commits to using a single provider (sole sourcing). Michael H. Riordan. and David M. Sappington, "Second Sourcing," *RAND Journal of Economics*, 20, 1989, pp. 41–58. Professor Rogerson elaborated on this point in a Rand Corp. report related to his 1989 article:

> Dual-sourcing involves having two firms build separate assembly lines for the same weapon system and then competitively bid for shares of successive annual production lots. ... The standard analysis of the costs and benefits of this practice is as follows. The cost is that the nonrecurring expenses of setting up the production facility must be incurred twice. A not quite so obvious cost is that the individual firms will move more slowly down their learning curves given that they are splitting production. A benefit is that firms will strive to minimize production costs as part of the competition to win more production. Another benefit is that any economic profit that would have been earned in a sole-source situation will be competed away.
>
> From the perspective of this report the second cited benefit may in fact be an additional cost. *The removal of all economic profit on production contracts will also remove the firms' incentives to innovate in an effort to win them. Dual-sourcing therefore illustrates the point [that, a]lthough dual-sourcing may encourage productive efficiency, it may also discourage future innovation.*

William P. Rogerson, "Profit Regulation of Defense Contractors and Prizes for Regulation," RAND National Defense Institute, R-3635-PA&E. Santa Monica, CA: RAND Corp., 1992, at p. 17 (emphasis added). See also Lyon (2006, at p. 249): "The results reported here focus on the price benefits of competition and do not attempt to measure contractors' innovation investments, or how they are affected by competition. Rogerson [1989] emphasizes that Defense Department policy has traditionally provided incentives for innovation by allowing firms to collect economic profits during the production phase of procurement. Introducing competition in production reduces those profits and threatens to weaken incentives for research and development."

technologies while negotiating acceptance and (presumably) the licensing of the new technology to other providers and (ii) because of the risk that nonpatentable technologies will be revealed to and appropriated by competitors.

Finally, it is important to note that the most likely potential bidders for the right to provide NPAC service to the United States have operations in other countries (as does the current U.S. provider). An argument that allowing one or more of these existing providers access to a portion of the U.S. market will spur innovations that would not otherwise occur requires either that the nature of number portability in other countries is somehow so different from that in the U.S. that such innovations could only be realized by allowing additional providers to operate in the U.S., or that benchmarking is a far more powerful inducement to innovation than the present case supports. Under the existing arrangements, the U.S. has created the most advanced and reliable number porting system in the world. The superiority of the current U.S. NPAC system notwithstanding, a company that developed a significantly and demonstrably innovative (as opposed to marginally improved) number porting system would likely have little trouble displacing an incumbent provider at the next contract renewal interval. The prospect of doing so likely presents a far stronger incentive to innovation than any incentive that might result from a highly imperfect benchmarking arrangement.

B.2.c. Back-up capability

Professor Rogerson also contends that the use of multiple providers "would allow for back-up capability in the event that one firm turned out to have either technical or financial difficulties that prevented it from performing adequately" (p. 14). Reliability is unquestionably an important concern of carriers. The addition of providers seems more likely to reduce than

enhance reliability for several reasons, however. First, any risks from technical failures that could be reduced through system redundancy could be achieved just as readily through contractual requirements for system redundancy with a single provider. In the extreme, the single provider could, in principle, be required to maintain exactly the same system capacity that a second provider would provide. Second, as Professor Rogerson's own analysis suggests, introducing a second provider is likely to increase the risk of technical failures (p. 14):

> The primary risk of technical failure likely occurs when a new entrant is initially developing its system. Once a provider is set up and operating successfully, it seems less likely that it would suffer a major technical problem. Thus the risk of technical failure is likely higher for a new entrant than the incumbent.

Given that risks associated with technical failures can be effectively addressed through contractual redundancy requirements, the increase in failure risk associated with introducing a new provider is completely avoidable simply by continuing with an existing provider.[14]

Introducing one or more additional providers as a hedge against financial risk is also of doubtful value. Both the NAPM and the carriers it represents have an interest in keeping a sole NPAC vendor financially viable and can affect the provider's profitability and viability through its pricing of NPAC services as well as through restrictions on its debt exposure or through other financial requirements. In fact, the introduction of multiple providers will increase the risk of financial distress to the extent that the existence of multiple providers is used to force prices to levels that threatened a provider's solvency. Even if a provider did become insolvent, however,

[14] When wireline number portability was first introduced in the U.S. in the late 1990s, two vendors were initially selected for different regions. One of those vendors, Perot Systems, was unable to pass performance testing and, for that reason, Neustar's predecessor, Lockheed Martin, became the supplier of NPAC services nationwide.

the bankruptcy system is designed to permit economically valuable operations to continue to during reorganization.

B.2.d. Future competition

Finally, Professor Rogerson argues that "even if it was predicted that dual sourcing would result in higher award prices than sole sourcing on the current procurement, dual sourcing would still be the best choice" if other benefits, including "lower pricing on future procurements" were large enough (p. 19). This argument, however, amounts to advocating incurring a certain loss today for a benefit that, given the pace of technological change in this industry, may never materialize. Even assuming the expected benefit of competition in the future were positive, introducing competition in the current procurement (instead of at a later renewal interval) would only be worthwhile if the eventual benefits from added competition over subsequent contract periods were sufficiently large to offset the gains from deferring losses from the initial introduction of providers until a later contract. Put in other terms, it is not sufficient simply to add uncertain benefits assumed to accrue to future competition to tip the scales in favor of introducing additional providers in a current procurement without considering the option value of waiting to see if the net benefit of adding or switching providers becomes positive at a later date.

B.3. Evidence on the Value of Using More than One Provider (Dual Sourcing)

Reliable empirical evidence on the effects of procurement from multiple suppliers is scant and would be difficult to generalize from given the highly context-sensitive nature of the associated costs and benefits. The Lyon study (2006) cited by Professor Rogerson emphasizes this point: "The results should be viewed as preliminary rather than definitive, given the

relatively small size of the data set and the complexity of the institutional environment, which includes information asymmetries, agency problems, and political considerations" (p. 224). In addition to the difficulty of generalizing from a study of missile procurement to the provision of LNP services, it is important to note that Lyon's findings of savings from dual sourcing are for procurements that the Defense Department had selected as good candidates for dual sourcing. What Lyon's analysis shows is whether systems that the Defense Department chose to dual source yielded savings; it does not show what would happen if systems not selected for dual sourcing had been dual sourced.[15] In fact, when the Defense Department's selection decisions are ignored, Lyon finds no statistically significant effect of dual sourcing. However comforting evidence of wise government procurement decisions may be, the existence of savings when dual sourcing is correctly applied (in Defense procurements or any other context) does not imply that any savings, much less savings comparable to those estimated in Lyon's study, could be achieved if all procurements were dual-sourced.[16]

[15] To illustrate the point in the simple terms, suppose that the Defense Department procured equal numbers of two types of systems: "A" systems, which are suitable for dual sourcing and would save 20 if dual sourced; and "B" systems, which are not suitable for dual sourcing and would increase costs by 20 if dual sourced. If the Defense Department chose systems to dual source randomly, a study examining the effect dual sourcing on procurement costs would show no difference in the average cost of dual- and single-sourced systems even though gains exist to dual sourcing type A systems. If, by contrast, the Defense Department accurately dual sourced only A systems, studies would show that dual sourcing yielded significant savings, but such a finding would obviously not imply that the Defense Department should dual source B systems as well. The point is that the merits of dual sourcing can only be assessed taking into account the particular features and circumstances of the procurement at hand.

[16] See Lyon (2006, p. 243). On the problems of inferring the performance effects of governance choices in general, see S.E. Masten "Transaction Costs, Mistakes, and Performance: Assessing the Importance of Governance," *Managerial and Decision Economics*, 14, March-April 1993, pp. 119-129.

III. Competitive Bidding and Bid Design

A very large theoretical literature (and more limited empirical literature) examines bidding mechanisms and bidder strategies in various settings. This research yields insights into such things as how the number of bidders affects expected bid prices, how alternative bidding rules affect bidding strategies, and the importance of committing in advance to base awards on pre-defined criteria.[17] In the following, I draw on insights from that literature and from research on procurement organization more generally to evaluate Professor Rogerson's analysis and recommendations concerning the design of the competitive bidding process for NPAC services.

Consistent with his analysis of the optimal number of providers, Professor Rogerson's principal concern in his analysis of the design of the bidding process is the tradeoff between increased competition and the sacrifice of scale economies as the number of providers increases: A procurement design that yields multiple providers, he maintains, "creates the four benefits of having multiple providers" described in his analysis of provider numbers (and discussed above), but may result in higher bid prices to the extent that NPAC service production exhibits economies of scale or scope (pp. 18-19): "Price under the multiple source design will tend to be higher to the extent that economies of scale/scope are forgone but lower to the extent that this design results in more competition" (p.19). Given his emphasis on the importance of competition relative to scale economies in his provider-number analysis, Professor Rogerson's procurement design analysis naturally tends to favor designs that would result in multiple

[17] Most of this literature is framed in terms of auctions rather than competitive bidding, but the results extend to situations in which a buyer "auctions" a contract to supply to the lowest bidder. Overviews of this literature can be found in R. Preston McAfee and John McMillan, "Auctions and Bidding," *Journal of Economic Literature*, 25, 1987, pp. 699–738; and Paul Klemperer, Auction Theory: A Guide to the Literature," *Journal of Economic Surveys*, 13(3), 1999, pp. 227-286.

providers. By the same token, multiple-source procurement designs would add cost and complexity to the bidding process without offsetting benefit if, as my analysis indicates, employing a single provider offers significant advantages relative to using multiple providers.

If a single provider of NPAC services is in fact most efficient, a procurement process that precluded that outcome by design would obviously be detrimental to the interests of both carriers and their customers. If, on the other hand, it cannot be determined in advance that a use of single vendor is the preferred outcome, it is important to understand more fully the implications of the procurement designs that Professor Rogerson discusses and recommends. In the following, I will address Professor Rogerson's arguments with respect to four issues: (i) the effects of committing to multiple providers on the number of bidders; (ii) the effects of committing to multiple providers on price; (iii) the desirability of allowing "package bidding" in "flexible procurement designs;" and (iv) the role and value of transparency in the bid evaluation process.

A. The Effects on the Number of Bidders of Committing to Multiple Providers

Professor Rogerson argues that using a multiple source procurement design that commits to awarding contracts to at least two providers is likely to increase the number of bidders (relative to either a single source design or "flexible" design that does not precommit to multiple providers) because (i) in "procurement of any complex one-of-kind system, potential competitors to the incumbent must incur significant costs merely to create a proposal and compete," and (ii) without a commitment to multiple providers, "potential bidders may be skeptical of the extent to which the U.S. is willing to embrace NPAC competition" if "they perceive that the incumbent has too large an advantage" (p. 18). The effect of committing to multiple providers on the number of bidders is unclear, however. In deciding whether to bid, a potential bidder will weigh

the cost of preparing and submitting a bid against the expected payoff to submitting a bid, consisting of the expected profit from winning a contract times the probability of winning. Committing to multiple providers would increase the probability of winning but also presumably decreases the profit from winning: Splitting one region into two identical regions that must be served by different providers, for example, would double the probability of winning but would also cut in half the revenue derived from winning a subregion relative to winning the one unified region. If costs of serving the subregions and the cost of bidding on a subregion also fell by half for every potential bidder, the incentive to submit a bid and, hence, the number of bidders for each subregion should be the same as the number for the unified region. If, however, the cost of serving a subregion is greater than half the cost of serving the unified region — because of the scale or transactional economies discussed in the previous section — the expected profit from winning a contract (holding bid prices constant) would fall, decreasing the expected payoff to submitting a bid and, thus, the number of bidders who would find it worthwhile to bid.[18] Similarly, if the cost of submitting a bid for a subregion is not at least half the cost of submitting a bid for the unified region — because, as would be the case in reality, the regions are not in fact identical and therefore require separate cost assessments — the cost of bidding on a subregion relative to the expected payoff of submitting a bid would increase, again discouraging some marginal bidders.[19]

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[18] Expected payoffs to submitting a bid could increase even if unit costs of serving a subregion rose if bid prices rose by a greater amount, but higher prices is clearly not an outcome that supports Professor Rogerson's position.

[19] It is likely that *incremental* cost of submitting a bid on a second subregion given that a bidder has decided to bid on one subregion is low relative to the cost of preparing the first bid, that is, there are probably economies of scope in bidding. This, however, just implies that bidders are likely to find it worthwhile to bid either on every

continued on the next page

B. The Effects on Price of Committing to Multiple Providers

Aside from any effects on the number of bidders, there are reasons to believe that a procurement design that required that awards be made to more than one provider would alter bidding strategies in ways that would lead to higher bids by all bidders and therefore to higher prices. The following heuristic explanation provides the essential intuition: In a competitive procurement for a single, unified region, each bidder knows that, to win, its bid must beat the second lowest bid. If the procurement design required two winning providers, however, each bidder would know that it could win a region simply by beating the third lowest bidder: Because the lowest bidder cannot win a second region, the second region would have to go to the second lowest bidder. Similarly, if three providers were mandated, a bidder would only need to outbid the fourth lowest bidder to win a region, and so on. Thus, each additional required provider would reduce the aggressiveness with which each bidder would have to bid to win one of the available regions.[20] Under certain conventional assumptions, the expected price that the buyer would pay *for each service region* would be the reservation price (or cost) of the second lowest cost bidder if only one provider were required, the reservation price of the third lowest cost

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subregion or none. The effects of subdividing regions on the number of bidders discussed above would not be affected if this were the case.

[20]The argument assumes that bidders costs of serving regions are highly rank correlated, so that the lowest cost provider has the lowest cost of service in all regions, the second lowest cost provider is second in all regions and so on. An alternative way to perceive the effect on price of bidding multiple regions is consider the outcome using a bidding design where contract awards are based on each bidder's bid but the price winning bidders receive is determined by the $n+1^{st}$ lowest bidder's bid, where n is the number required providers. Under such nondiscriminatory bidding rules, each bidder would bid its actual cost, and the n winning bidders would each pay the bid (cost) of the $n+1^{st}$ bidder. Under first-price (discriminatory) competitive bidding rules, winning bidders would pay their own bids but each would attempt to set its bid at a price just below the expected cost of the $n+1^{st}$ lowest cost bidder. Note that if the number of required providers equaled or exceeded the number of bidders, bidders could bid extremely high prices and still win.

bidder if two providers were required, the reservation price of the fourth lowest cost provider if three providers were required, and so on.[21] The important point is that, independent of the effect that committing to multiple providers has on the number of bidders, such a commitment will alter the bidding strategies of bidders in a way that is likely to increase the price the purchaser ends up paying.

C. The Desirability of Allowing "Package Bidding" in "Flexible Procurement Designs"

Although Professor Rogerson's report emphasizes the benefits of multiple source procurement, he acknowledges that the possibility of scale or scope economies could justify use of a "flexible procurement design" in which the number of winning bidders is not predetermined but rather decided on basis of the submitted bids (p. 21):

> A significant potential advantage of these flexible designs over designs predetermining the number of providers is that they essentially allow the procurement agency to make a better-informed decision when it chooses between a single provider system and a multiple provider system. This is because the procurement agency is able to actually see what the differential cost is between procuring the best possible single provider system and the best possible multiple provider system based on firms' actual bids. Thus, if there is considerable uncertainty about the likely magnitude of economies of scale/scope, flexible procurement designs offer the advantage that this uncertainty can be resolved before the procurement agency chooses between a multiple provider and single provider system.

Professor Rogerson's observation here is correct. But having just acknowledged the importance of potential scale economies to justify the use of a flexible procurement design, Professor Rogerson then proceeds to argue *against* the allowance of "package bidding," in which bidders are permitted to submit separate bids for each individual region *plus* another bid for the

[21]This prediction is an extension of the well-known result in auction theory known as the Revenue Equivalence Theorem. See, for example, McAfee and McMillan (1987), *supra* note 17.

combined regions. The value of package bidding, however, is precisely that, where significant scale economies exist, bidders could bid lower prices for the combined region than for individual regions reflecting the lower average costs of larger scale service provision. Prohibiting package bidding and allowing bidders only to submit bids on individual regions (out of concern, again, that the "advantages" of the incumbent might permit it to outbid an entrant) prevents the existence of scale economies from being revealed to the procurement agency, thereby undermining the rationale for using a flexible procurement design in the first place.

D. The Role and Value of Transparency in the Bid Evaluation Process

Professor Rogerson's report emphasizes the need for transparency in both performance specifications and selection criteria (p. 10):

> [T]he procurement should be designed to be very transparent in the sense that clear and complete information should be provided on (i) the desired features and performance characteristics of the system to be procured; (ii) the most important issues that the proposal must specifically address; and, (iii) precisely how the procurement agency will evaluate and compare different proposals with different features, characteristics, and prices.

Further on, Professor Rogerson elaborates briefly on bid evaluation (item (iii) in the preceding quotation), (p. 20):

> These are standard procurement decisions where the procurement agency can consider both price and non-price aspects to choose the best proposal. However, as noted above, it is critical that the procurement agency be transparent about what its scoring methods for technical and cost sections as well as for best value determination will be.

A recommendation for transparency in bid evaluation criteria is consistent with general principles concerning the design of competitive bidding, which emphasize the increased incentive to bid aggressively when purchasers commit in advance to pre-defined, objective

award criteria.[22] Professor Rogerson advances a different rationale as his primary reason for advocating the use of "transparent" bid evaluation criteria, however: "Transparency is especially necessary to level the playing field between the incumbent and potential entrants" (pp. *ii*; 10-11). As I noted earlier (at note 5), what Professor Rogerson refers to as the advantages of incumbency reflect real costs that a new entrant would have to incur that an incumbent does not. Unless the benefits of competition can be shown to be large enough, or the entrant can provide a sufficiently superior service, to outweigh the cost savings of continuing procurement from an already existing provider, transparency in performance specification and bid evaluation for the purpose of "leveling the playing field" alone contributes nothing to economic efficiency.

At a more fundamental level, however, Professor Rogerson's emphasis on transparency conflict with the importance he places on including potential competitive benefits in the evaluation of bids. Thus, on the one hand, he calls for the procurement agency to identify "*precisely* how [it] will evaluate and compare proposals with different features, characteristics,

[22] The benefits of adopting objective award criteria are not unqualified. Where complexity makes complete contract performance specification impractical or impossible, or the inability to measure or quantify performance criteria accurately prevents incorporation of important performance dimensions, purchasers may find it desirable to forsake objective scoring and either (i) allow more flexible (or subjective) comparison and evaluation of bids or (ii) permit a second stage of negotiation with bidder(s) selected in a first-stage round of bidding round. The advantage of these alternatives is that they allow the purchaser to make selections on the basis of more comprehensive information than is possible using objective scoring. An additional consideration in the case of NPAC services is that procurement decisions (subject to FCC approval) are made by a consortium of customers — the carriers as represented in the NAPM, LLC — who possess different technologies (wireline, wireless, VOIP), cost structures, business strategies, and financial resources (see the discussion *supra* p. 6). As a result of these and other differences, carriers will place different values on NPAC costs versus system features, making the prospect of consensus on weights to be assigned various system features and price in an ex ante scoring system all but impossible. Such disagreements will also arise with a more flexible selection process, but the potential for some of these differences to be resolved in post-bid negotiations increases the likelihood that practical compromises can be reached. Consistent with the these considerations and with the complexity of NPAC services and contracts, the Wireline Competition Bureau indicated in its *May 16, 2011, Order* its preliminary expectation (i) that NANC vendor selection recommendations are to be based on consensus, implying the NANC (and its working groups) is not limited to using pre-defined, objective scoring (at p. 7, ¶2); and (ii) that the terms of the contract with the selected vendor(s) are to be negotiated: "The Bureau finds that the NAPM has the expertise, experience and is in the best position to negotiate a contract with the selected vendor(s)" (p. 3, ¶8).

and prices" (my emphasis) and for the use of scoring methods to determine the best value, while proposing, on the other, that the benefits that he attributes to the use of multiple vendors "be thought of as a sort of quality difference ... the value of [which] needs to be taken into account just as the benefits from any other quality difference in the proposal scoring design" (p. 21). Given the uncertainty about existence, much less the magnitude, of competitive benefits from requiring multiple vendors, however, introducing their consideration into the bid evaluation process necessarily defeats the transparency that Professor Rogerson advocates: In the absence of a way to quantify and weight the prospective future effects of requiring multiple providers, a procurement agency could rationalize any award decision it so desired by appeal to the existence or absence of such benefits. In this sense, incorporating the purported benefits of multiple providers in the selection of vendors, on the one hand, and the objective of transparency, on the other, are fundamentally incompatible. At a minimum, inserting such considerations into the bid evaluation process would, given their highly speculative and unverifiable nature, introduce additional complexity and indeterminacy into what will already necessarily be a complex process.

IV. Conclusion

The choice and design of procurement arrangements cannot be adequately analyzed without an appreciation of the nature, problems, and challenges of production and exchange in the particular setting under consideration. My analysis of number portability production and transactions indicates that the complexity and substantial scope economies associated with the provision of NPAC services, and the limited benefits, if any, from maintaining different NPAC

vendors in two or more separate regions, supports the conclusion that the selection of a single provider of those services is likely to lead to the most efficient outcome. Even if the economic advantages of using a single vendor relative to multiple vendors were uncertain, the strength of the case for the efficiency of a single NPAC provider supports the conclusion that the RFP process should not be artificially constrained to require that awards be granted to different vendors in two or more regions.