

**BEFORE THE  
FEDERAL COMMUNICATIONS COMMISSION  
WASHINGTON, DC 20554**

Competitive Bidding Procedures and Certain	)	AU Docket No. 17-182
Program Requirements for the Connect	)	WC Docket No. 10-90
America Fund Phase II Auction (Auction 903)	)	

**COMMENTS OF THE AMERICAN CABLE ASSOCIATION  
IN RESPONSE TO THE PUBLIC NOTICE**



**I. INTRODUCTION AND SUMMARY**

The American Cable Association (“ACA”) hereby provides comments in response to the *Public Notice* by the Federal Communications Commission (“Commission”)<sup>1</sup> on the competitive bidding procedures and certain program requirements for the Connect America Fund Phase II Auction (“Auction”). These comments are somewhat atypical for ACA because they do not march through all the issues and proposals in the *Public Notice* to provide detailed comments on each. Rather, ACA’s sole focus is to tell the Commission that the inordinate complexity of the proposed Auction design and procedures will deter, if not thwart, participation by a large number of providers and thereby will not achieve efficient outcomes. This is especially troubling because, as then-Commissioner Pai stated approvingly in addressing one aspect of the Auction rules, “we adopt rules designed to induce new entrants like wireless Internet service providers, small-town cable operators, and electric utilities to participate.”<sup>2</sup> As such, ACA urges the

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<sup>1</sup> *Comment Sought on Competitive Bidding Procedures and Certain Program Requirements for the Connect America Fund Phase II Auction (Auction 903)*, AU Docket No. 17-182, WC Docket No. 10-90, Public Notice, 32 FCC Rcd 6238 (2017) (“*Public Notice*”).

<sup>2</sup> *Connect America Fund et al.*, WC Docket No. 10-90 *et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 5949, 6109 (2016) (“*Phase II Auction Order*”) (statement of Commissioner Ajit Pai approving in part and concurring in part). See *id.* at 6106 (statement of

Commission to step back and rework its proposals to provide for a simpler, more straightforward Auction, one that better serves the public interest.

## II. THE PROPOSED AUCTION DESIGN AND ASSOCIATED PROCEDURES IN THE *PUBLIC NOTICE* WILL NOT MAXIMIZE PARTICIPATION AND THEREBY WILL NOT PROVIDE FOR EFFICIENT OUTCOMES

ACA represents approximately 750 local providers of broadband Internet access, voice, and video programming services to residential and commercial customers. Many ACA members either abut or are located near areas eligible for the Auction or otherwise have expressed interest in participating in the Auction. As such, the Commission should be keenly interested in whether ACA members and similarly-situated providers participate because they represent a significant number of the potential bidders and, if they bid, the Commission can achieve its goal “to maximize the value the American people receive for the universal service dollars we spend.”<sup>3</sup> That said, despite their general interest and potential participation, whether they (and other non-price cap carriers) actually participate in the Auction will be dictated in significant measure by whether the Auction is structured with clear, straightforward, and fair procedures and requirements.<sup>4</sup>

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Commissioner Mignon L. Clyburn) (“The Order also encourages smaller entrants to participate in the competitive auction.”).

<sup>3</sup> *Public Notice*, 32 FCC Rcd at 6239, para. 2.

<sup>4</sup> See *Phase II Auction Order*, 31 FCC Rcd at 5950-51, para. 2. In this decision, the Commission provided “general guidance on auction design, with specific details to be determined by the Commission at a future date in the *Auction Procedures Public Notice*, after opportunity for comment.” *Id.* at 5951, para. 2 (italics in original). The Commission also expressed a preference “for a multi-round auction format and for setting the minimum biddable unit as a census block group containing any eligible census blocks.” *Id.* ACA notes that nowhere in this decision did the Commission analyze directly whether this auction design would maximize participation, especially by smaller providers, which would result in more robust bidding. Rather, it surmised in conclusory fashion that this complex design would “facilitate a viable aggregation of geographic areas in which to construct networks and enable competition to drive down support amounts.” *Id.* at 5979, para. 88.

ACA notes further that, unlike the recent *Mobility Fund Phase II Order*, the *Public Notice* does not explore “Encouraging Participation.” *Connect America Fund, Universal Service Reform – Mobility Fund*, WC Docket No. 10-90, WT Docket No. 10-208, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 2152, 2205-06, paras. 130-131 (2017) (“*Mobility Fund Phase II Order*”). In that decision, the Commission rejected restricting participation in the auction by, for

Over the years, by virtue of overseeing so many auctions, the Commission and its leadership have developed great understanding of what drives a successful auction, and at the top of the list is making the auction process straightforward and open. As Commissioner O’Rielly explained in the *Incentive Auctions* proceeding, “[s]implicity and transparency are key to ensuring that stakeholders can make the necessary business plans to enable and promote participation” so that resources are allocated efficiently.<sup>5</sup> Commissioner Rosenworcel concurred in this approach, stating “that a bias towards simplicity is crucial” and will enable participants “to come armed with little more than a willingness to participate, not a bevy of experts and lawyers.”<sup>6</sup> The Chairman too has highlighted the value of having an “auction as simple as possible” and not introducing “unnecessary complexities that could lead to failure.”<sup>7</sup>

In the attached brief paper, Professor Peter Cramton, a recognized auction expert who has been retained by ACA, highlights that for any auction to be successful, it should achieve four key and interrelated objectives – efficiency, simplicity, transparency, and fairness.<sup>8</sup>

- Efficiency – Economic efficiency lies at the heart of any successful auction. The aim is to use the limited funds to maximize social welfare.<sup>9</sup>

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instance, limiting participation to small, rural providers. *Id.* The Commission explained that it wanted to “provide a fair opportunity for all serious, interested parties to participate.” *Id.* at 2206, para. 131. ACA shares that objective, but the proposed complex auction design in the *Public Notice* will *de facto* not achieve that result.

<sup>5</sup> *Procedures for Competitive Bidding in Auction 1000 et al.*, AU Docket No. 14-252 *et al.*, Public Notice, 30 FCC Rcd 8975, 9128 (2015) (“*Incentive Auctions*”) (dissenting statement of Commissioner Michael O’Rielly). Commissioner O’Rielly also stated, “[a]s I have repeatedly stated, the success of the auction depends on the Commission’s ability to bring certainty and a fair process to all interested parties.” *Id.*

<sup>6</sup> *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567, 7036 (2014) (statement of Commissioner Jessica Rosenworcel).

<sup>7</sup> *Id.* at 7038 (dissenting statement of Commissioner Ajit Pai).

<sup>8</sup> See Attachment, Peter Cramton, “On the Design of the Connect America Fund Phase II Auction” (Sep. 18, 2017) (“Cramton”).

<sup>9</sup> *Id.* at 1.

- Simplicity –The design should be as simple as possible, and this aspect is best measured in terms of the simplicity of participating in the auction. Simpler auction designs tend to avoid guesswork and limit risks to bidders. Simpler designs also tend to promote efficiency by letting the bidder express preferences more simply and effectively. Thus, complicating features should only be added if they are necessary and consistent with the core principles.<sup>10</sup>
- Transparency – A requirement of transparency is clear and unambiguous rules that map bids to outcomes. With a transparent design, bidders understand how the auction is progressing so they can make informed choices about their bids. A transparent auction ensures the integrity of the process by enabling bidders to know why they won or lost and can confirm that the auction rules were followed.<sup>11</sup>
- Fairness – Equal opportunity is a basic requirement of fairness. Rules should be clear and understandable, even by less sophisticated parties, and should not unreasonably discriminate among parties. In particular, the design should refrain from favoring or disfavoring any party based on that party's size or market status.<sup>12</sup>

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<sup>10</sup> *Id.* at 2. As for the applicability of this objective in the Auction, Professor Cramton explains in his paper: “For example, a straightforward descending clock design that facilitates outcome discovery, both with respect to clearing prices and the prospects for winning, is a simpler design than a static auction in which bidders, especially those with many options (*e.g.*, bidding areas and technologies), must engage in substantial guesswork and speculation to determine an effective bidding strategy. This becomes even more important with the CAF Auction because the costs to deploy the required broadband service may not be known with sufficient precision (*e.g.*, there may be no information about how far locations may be from major roads or whether it is possible to obtain access to poles at a reasonable cost).” *Id.*

<sup>11</sup> *Id.* Professor Cramton notes, “[t]he designer also should recognize that, to encourage participation, it may need to permit some parties to share access to auction experts (albeit with requirements to inhibit collusion/coordination).” *Id.*

<sup>12</sup> *Id.* at 2-3. Professor Cramton adds regarding the Auction: “The FCC has sought to attain this objective by establishing public interest and deployment obligations applicable to all bidders and by establishing a methodology to weight bids based on technology. Prior to permitting a party to bid using a technology, the FCC should ensure that it can meet the obligations it has established to preserve the fairness and integrity of the auction.” *Id.* at 3.

Unfortunately, the auction design and procedures proposed in the *Public Notice* neither meet the benchmarks established by the Commission and Commissioners nor will achieve the objectives set forth by Professor Cramton. As Professor Cramton states, “[h]aving and encouraging participation among qualified bidders is at the heart of successful auctions,”<sup>13</sup> but the FCC’s proposed design for the Auction “is more complex than it needs to be” and “will adversely limit competition among participants.”<sup>14</sup> All but the most sophisticated and well-funded potential bidders will at best struggle to understand all the bidding rules and potential strategies and at worst throw up their hands and “cry uncle” as they grapple with the *Public Notice*’s proposed multi-round auction design with variable decrements in each round that permits bidders to create individualized packages of geographic areas coupled with self-selected “minimum scale percentages” and then to shift their performance tier and latency combinations among geographic areas with each round.<sup>15</sup> While ACA respects the Commission’s guidance in the *Phase II Auction Order* about the design for the Auction and the great experience and expertise of the Commission’s auction staff, the auction design proposed in the *Public Notice*, although potentially sound in some ways, will achieve the opposite of its intended purpose. Not only will the proposed procedures and requirements turn off many serious bidders, but they are not essential to ensure the auction operates efficiently and with integrity. In the end, because they will result in potential bidders refraining from participating, the proposals in the *Public Notice* will enable larger interests to win bids in far more areas for amounts much closer to the reserve price than would occur with an auction designed to foster maximum participation.

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<sup>13</sup> *Id.*

<sup>14</sup> *Id.*

<sup>15</sup> *See Public Notice*, 32 FCC Rcd at 6264, paras. 90-93.

There are, however, ways the Commission can be a better steward of its universal service coffers. The Commission can design an auction that propels vigorous bidding by multiple providers, thereby driving prices lower to efficient levels. In fact, the Commission already adopted features of such an auction design in the Mobility Fund Phase I reverse auction, whose relatively straightforward procedures stand in contrast to the complex ones proposed in the *Public Notice*.<sup>16</sup> In that auction, the Commission adopted procedures that included:

- Geographic areas for bidding that established predefined aggregation of eligible census blocks into census tracts to further “speed and simplicity of implementation.”<sup>17</sup>
- The ability for a bidder to bid on multiple individual census tracts but not to group individual census tracts into packages to simplify “the process of determining which bids will be awarded support” and to potentially simplify bidding.<sup>18</sup>

The Mobility Fund Phase I reverse auction clearly was a much simpler, more straightforward process,<sup>19</sup> and it succeeded in generating sufficient interest among providers, with 52 applicants being deemed qualified to bid.<sup>20</sup> Moreover, as the Commission noted favorably in the recent

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<sup>16</sup> *Mobility Fund Phase I Auction Scheduled for September 27, 2012, Notice and Filing Requirements and Other Procedures for Auction 901*, AU Docket No. 12-25, Public Notice, 22 FCC Rcd 4725 (WTB 2012).

<sup>17</sup> *Id.* at 4762, para. 135.

<sup>18</sup> *Id.* at 4763, para. 137.

<sup>19</sup> ACA is not suggesting the Auction should have only a single round with sealed bids like the Mobility Fund Phase I reverse auction.

<sup>20</sup> *Mobility Fund Phase I Auction, 52 Bidders Qualified to Participate in Auction 901*, AU Docket No. 12-25, Public Notice, 27 FCC Rcd 10919 (WTB 2012). See *Mobility Fund Phase II Order*, 31 FCC Rcd at 2155, para. 7 (stating there were 33 winning bidders eligible to receive almost \$300 million in support).

*Mobility Fund Phase II Order*, the Mobility Fund Phase I auction not only enabled participation by smaller providers, but resulted in numerous smaller carriers placing winning bids.<sup>21</sup>

ACA submits that the Phase II reverse auction, while not needing to replicate the entire design and procedures of the Mobility Fund Phase I auction, should include those key features of this prior auction that will encourage participation and further efficient outcomes. ACA therefore recommends the Commission *at least*:

- Eliminate package bidding. As in many prior FCC auctions, the simultaneous clock auction without package bidding would still give bidders ample opportunity to piece together a desirable package of areas, without the complexity and bias inherent in a package auction.<sup>22</sup>
- Eliminate the ability of a bidder to shift its performance/latency tier once established in its initial bid. This simplification avoids complex gaming strategies that would otherwise undermine price discovery.<sup>23</sup>

In addition, so that smaller providers can access assistance from auction experts at affordable rates, the Commission should affirm that a third-party consultant or consulting firm can consult with multiple parties bidding in the same state on bids and bidding strategies so long as bidders employing the consultant/firm ensure any exchanges do not facilitate “prohibited

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<sup>21</sup> *Mobility Fund Phase II Order*, 31 FCC Rcd at 2210, para. 140. The Commission made this statement when it rejected adopting small business bidding credits for the Mobility Fund Phase II auction. *Id.* The Commission also noted that AT&T commented that the “Commission awarded most of the Phase I support to non-national wireless providers.” *Id.* at 2209, para. 139.

<sup>22</sup> Cramton at 4. *See also* Letter from Grant B. Spellmeyer, Vice President – Federal Affairs & Public Policy, U.S. Cellular, to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No. 10-208 *et al.* (Sep. 15, 2017) (“We also highlighted our ongoing concerns regarding the potential for the use of statewide package bidding in conjunction with the CAF2 auction. We indicated an intent to file comments in the proceeding in opposition to the use of statewide package bidding.”).

<sup>23</sup> Cramton at 4.

communications.”<sup>24</sup> ACA believes parties sharing consultants can implement this requirement by establishing written procedures, which the Commission may request, identifying specific types of prohibited communications and sharing these procedures with all individuals involved in the bidding.

As for financial qualifications, ACA is not opposed to having “experienced” applicants without audited financial statements being required to submit unaudited statements with their short-form applications.<sup>25</sup> ACA, however, submits that if the Commission adopts its proposed financial “five-point scale,” it recognize that the financial information provided by these applicants may not indicate that they have in fact sufficient financial capability to be a viable provider.<sup>26</sup>

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<sup>24</sup> *Public Notice*, 32 FCC Rcd at 6244, para. 21.

<sup>25</sup> *Id.* at 6255-57, paras. 55-61.

<sup>26</sup> *Id.* at 6256, para. 58.



### III. CONCLUSION

ACA herein focuses on the critical question about whether the Commission's auction design and procedures will encourage maximum participation in the Auction, which can then lead to efficient outcomes. As discussed, the design and procedures in the *Public Notice* are far too complex to achieve this result. The Commission should change course and make the auction design and associated procedures more amenable to participation by all interested parties.

Respectfully submitted,

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September 18, 2017

Attachment: Peter Cramton, "On the Design of the Connect America Fund Phase II Auction" (Sep. 18, 2017).

**ATTACHMENT**

# On the Design of the Connect America Fund Phase II Auction

Peter Cramton<sup>1</sup>

18 September 2017

## Summary

I have been asked by the American Cable Association to comment on the auction design for the Connect America Fund Phase II Auction (hereafter CAF Auction), which the Federal Communications Commission (FCC) plans to conduct in 2018. My comments are based on my review of Public Notice FCC 17-101 in which the FCC outlines a proposed auction design. My comments also are based on my twenty-five years of experience designing spectrum auctions for governments around the world, as well as my experience advising bidders in major auctions, including over forty major spectrum auctions. My comments today will be brief. I only summarize key points. A more detailed analysis of the issues will follow on 18 October 2017, when Reply Comments are due in this proceeding.

The complexity of the economic problem that the auction must solve necessarily requires a sophisticated design. But the FCC should avoid an unnecessarily complex CAF Auction that would inhibit participation. My purpose here is to present the basic objectives of auction design, how they should be addressed in the CAF Auction, and how the FCC's proposed design is flawed.

## *Objectives*

Auction design begins with the objectives. Then the designer tailors the design to best serve these goals given the economic setting. In broadest terms, the FCC seeks to make the best use of limited Connect America Fund support. This involves bringing efficiently broadband services, whose quality the FCC has established, to unserved areas and close the “digital divide.”

Many factors complicate the economic problem of achieving best use from limited funds. Three are especially important in the context of broadband services and the CAF Auction: 1) the quality of the service is variable, 2) the cost of providing service may depend on many variables, including whether the bidder is providing broadband services in neighboring areas or the technology used to deliver the service, and 3) the auction may impact the market structure for broadband services in significant ways. The designer must consider how the auction design effects competition and innovation for broadband services, both locally and nationally.

## *Efficiency*

Economic efficiency—using the limited funds to maximize social welfare—is the core objective. This core goal is complemented with three other auction objectives: simplicity, transparency, and fairness—all of which will bear on whether the efficiency aim is achieved.

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<sup>1</sup> Professor of Economics, University of Maryland and University of Cologne, [www.cramton.umd.edu](http://www.cramton.umd.edu). Since 1983, Peter Cramton has conducted research on market design; he has applied that research to design auction-based markets of radio spectrum, electricity, financial securities, and other products. I thank the American Cable Association for funding this research.

## *Simplicity*

The auction should be as simple as possible, but not simpler. In the case of the CAF Auction—a reverse auction—the economic problem to be solved is complex, and thus some complexity in the design is necessary. Still designers should strive to keep the design as simple as possible. Complicating features should only be added if they are necessary and consistent with the core principles.

Simplicity is best measured in terms of the simplicity of participating in the auction. Clear rules that make it straightforward to develop an effective bidding strategy get high marks for simplicity. Simpler auction designs tend to avoid guesswork. For example, a straightforward descending clock design that facilitates outcome discovery, both with respect to clearing prices and the prospects for winning, is a simpler design than a static auction in which bidders, especially those with many options (*e.g.*, bidding areas and technologies), must engage in substantial guesswork and speculation to determine an effective bidding strategy. This becomes even more important with the CAF Auction because the costs to deploy the required broadband service may not be known with sufficient precision (*e.g.*, there may be no information about how far locations may be from major roads or whether it is possible to obtain access to poles at a reasonable cost).

Simpler designs also limit risks to bidders. Again, dynamic designs with good outcome discovery often let the bidder better manage budget and portfolio constraints. Executing a business plan is often more straightforward in such designs.

Simpler designs tend to promote efficiency by letting the bidder express preferences more simply and effectively.

## *Transparency*

A first requirement of transparency is clear and unambiguous rules that map bids into outcomes. With a transparent design, bidders know why they won or lost and understand why their payments are what they are. Bidders are able—at least after the event—to confirm that the auction rules were followed.

Higher levels of transparency are achieved in auction designs that have excellent outcome discovery—both with respect to prices and prospects for winning. These are dynamic auctions, such as the descending clock auction, in which substantial information is provided to bidders to understand prices and winning prospects during the auction. Still the auction designer should recognize that the release of some information could potentially be used to foster collusion or improper coordination among bidders. The designer also should recognize that, to encourage participation, it may need to permit some parties to share access to auction experts (albeit with requirements to inhibit collusion/coordination). Transparent reverse auctions have an information policy that reveals information that is most helpful in understanding supply. Such designs promote outcome discovery, which generally promotes auction participation and competition.

## *Fairness*

Equal opportunity is a basic requirement of fairness. All potential participants should have access to the rules and the rules should not inappropriately discriminate among parties. The design should refrain from favoring or disfavoring any party based on that party's size or market status. The FCC has sought to attain

this objective by establishing public interest and deployment obligations applicable to all bidders and by establishing a methodology to weight bids based on technology. Prior to permitting a party to bid using a technology, the FCC should ensure that it can meet the obligations it has established to preserve the fairness and integrity of the auction.

### *Discussion*

Now that the four objectives have been defined, it is helpful to view them in combination. To a large extent, the objectives are complementary. The auction designer can choose a design that gets high marks with respect to each objective. This is most easily seen when we abstract from details and consider the auction of a single divisible good.

Consider a single-price descending clock auction in a competitive setting in which aggregate supply is reported after each round. Our claim is that this auction gets high marks with respect to all four objectives. First, the auction is a simple price discovery process. Bidding strategy amounts to figuring out what the bidder's cost of providing the good and then exiting when that reservation value is reached. Second, the auction is highly transparent. The rules are clear and it is easy to see why a bidder won or lost at a price. The revelation of aggregate supply promotes excellent outcome discovery, both about the market price and the prospects for winning. Third, the auction is fair. Every potential bidder faces the same rules and all trade takes place at the market-determined clearing price. And finally, the auction is efficient. Given the straightforward and effective bidding strategy of exiting when reservation values are reached, the auction is fully efficient, maximizing total surplus.

Of course, when we move from a straightforward descending clock auction and introduce complicating details, the design becomes much more complex and may reduce the ability to achieve the objectives. That is what has happened with the FCC's proposed CAF Auction, where the FCC must recognize variable quality of the service, complementarities in serving neighboring areas, and competition issues in the downstream market for broadband services. However, these issues can be addressed with a far simpler auction design so that it is still possible for the auction design to perform well with respect to the four complementary objectives, as we will see.

### *Recommendations*

In the 18 October 2017 revision of this paper, I will provide detailed recommendations on the auction design. Today, I simply state my recommendations. My key recommendation is that the FCC's proposed design is more complex than it needs to be to achieve its objectives. Indeed, the excessively complex design will adversely limit competition among participants, which will undermine the goal of a competitive auction and an efficient outcome. Having and encouraging participation among qualified bidders is at the heart of successful auctions. This point has been demonstrated throughout the FCC's 24-year history with auctions.

A simpler design can still have the same descending clock format as proposed, yet avoids many complicating features that are apt to discourage participation and favor certain parties, potentially dominant incumbents and others. For now, I will indicate two key changes that should be made.

- Eliminate package bidding. As in many prior FCC auctions, the simultaneous clock auction gives bidders ample opportunity to piece together a desirable package of areas, without the complexity and bias inherent in a package auction.
- Eliminate the ability of a bidder to shift its performance/latency tier once established in its initial bid. This simplification avoids complex gaming strategies that would otherwise undermine price discovery.

A further benefit of the simpler design is that it will be easier, less costly, and less risky for the FCC to implement the simpler design. I do understand the good intentions behind the complicating features. However, the FCC's proposal is needlessly complex.

## References

- Ausubel, Lawrence M., Peter Cramton, Marek Pycia, Marzena Rostek, and Marek Weretka, "Demand Reduction and Inefficiency in Multi-Unit Auctions," *Review of Economic Studies*, 81(4), 1366-1400, October 2014.
- Ausubel, Lawrence M. and Peter Cramton (2004), "Auctioning Many Divisible Goods," *Journal of the European Economic Association*, 2, 480-493, April-May.
- Ausubel, Lawrence M., Peter Cramton, R. Preston McAfee, and John McMillan (1997), "Synergies in Wireless Telephony: Evidence from the Broadband PCS Auctions," *Journal of Economics and Management Strategy*, 6:3, 497-527.
- Ausubel, Lawrence M., Peter Cramton, and Paul Milgrom (2006), "The Clock-Proxy Auction: A Practical Combinatorial Auction Design," in Peter Cramton, Yoav Shoham, and Richard Steinberg (eds.), *Combinatorial Auctions*, Chapter 5, 115-138, MIT Press.
- Brusco, Sandro and Giuseppe Lopomo (2002), "Collusion via Signalling in Simultaneous Ascending Bid Auctions with Heterogeneous Objects, with and without Complementarities," *Review of Economic Studies*, 69, 407-436.
- Cramton, Peter (1995), "Money Out of Thin Air: The Nationwide Narrowband PCS Auction," *Journal of Economics and Management Strategy*, 4, 267-343.
- Cramton, Peter (1997), "The FCC Spectrum Auctions: An Early Assessment," *Journal of Economics and Management Strategy*, 6:3, 431-495.
- Cramton, Peter (2013), "Spectrum Auction Design," *Review of Industrial Organization*, 42:2, 161-190, March 2013.
- Cramton, Peter, Evan Kwerel, Gregory Rosston, and Andrzej Skrzypacz (2011), "Using Spectrum Auctions to Enhance Competition in Wireless Services," *Journal of Law and Economics*, 54, 2011.
- Cramton, Peter and Jesse Schwartz (2002), "Collusive Bidding in the FCC Spectrum Auctions," *Contributions to Economic Analysis & Policy*, 1:1, 1-17.
- Cramton, Peter, Yoav Shoham, and Richard Steinberg (2006), *Combinatorial Auctions*, Cambridge, MA: MIT Press.
- Kagel, John H. and Dan Levin (1986), "The Winner's Curse and Public Information in Common Value Auctions," *American Economic Review*, 76, 894-920.
- Kagel, John H., Dan Levin, and Jean-Francois Richard (1996), "Revenue Effects and Information Processing in English Common Value Auctions," *American Economic Review*, 86, 442-460.
- Klemperer, Paul (2004), *Auctions: Theory and Practice*, Princeton University Press.
- Milgrom, Paul (2004), *Putting Auction Theory to Work*, Cambridge: Cambridge University Press.
- Pagnozzi, Marco (2010), "Are Speculators Unwelcome in Multi-object Auctions?" *American Economic Journal: Microeconomics*, 2:2, 97-131.