Executive Summary

Markets have long been recognized as an often astonishingly efficient means of allocating resources. In 1993 Congress granted the FCC authority to design and run auction markets for the assignment of spectrum licenses. The FCC first began holding auctions for spectrum licenses in 1994, and ultimately developed the simultaneous multiple round auction based on substantial input from economists within the FCC and in academia. This basic auction format, with various modifications and extensions, continues to be used today. Since 1994, the FCC has held more than 80 auctions, has issued more than 36,000 licenses, and has raised more than $50 billion for the United States Treasury.\textsuperscript{1} The program has been viewed as a great success and has been emulated around the world.

Until now, FCC auctions have focused only on getting licenses designated by the FCC into the hands of buyers. Users of spectrum have relied on these auctions as well as privately negotiated secondary market transactions to adjust their holdings as demand, technology, and the set of market participants evolve over time. However, things are about to change. In February 2012, Congress authorized the FCC to conduct an “incentive auction,” which will transfer a set of licenses to be determined by the incentive auction itself from television broadcasters to providers of mobile wireless services, while recovering proceeds sufficient to fund the transition. This leaves the FCC in the position of needing to develop a centralized market that provides incentives for broadcasters to relinquish spectrum rights, “repacking” those who do not (reassigning them to different channels), and reassigning the reformulated licenses to wireless service providers, all while generating revenue for the public.

\textsuperscript{1}Congressional Hearing on “Keeping the New Broadband Spectrum Law on Track” (U.S. House Energy and Commerce Committee, 12 Dec. 2012), statement of FCC Commissioner Jessica Rosenworcel.
In this paper, we review the existing literature and provide new results. We show that the problem of designing an incentive auction is fundamentally different from the problem of designing a standard auction. We highlight six key ways in which a two-sided incentive auction differs from the standard one-sided auction.

1. **Efficient two-sided mechanisms do not generate positive revenue.** In a two-sided market, in order to guarantee that goods are reassigned to the highest-valuing users, the market designer must be willing to take a loss. An intuition for this result comes from considering bargaining between one buyer and one seller. The buyer has an incentive to call out a low price and the seller has an incentive to call out a high price, so even when trade “should” happen, it is possible for negotiations to fail if the buyer’s bid is below the seller’s ask. A market maker is required to accept a negative spread in order to facilitate the transaction. In contrast, in a standard one-sided auction environment, an ascending-bid auction with no reserve price is efficient and generates positive revenue.

2. **The revenue-efficiency tradeoff is steeper in an incentive auction.** Generating maximal revenue from an incentive auction has a higher opportunity cost in terms of lost efficiency than in a standard auction, i.e., to maximize revenue, the market designer must give up more in terms of the market’s ability to assign licenses to the highest valuing users. Although the legislation authorizing incentive auctions does not require that the FCC raise a minimum amount of revenue or that it maximize proceeds from the auction, statements made by both members of Congress and FCC Commissioners reveal that substantial revenue is expected from the auction. To the extent that current thinking is grounded in the revenue-efficiency tradeoff present in the traditional one-sided spectrum license auctions, parties may not fully appreciate the consequences of their demands on the incentive auction.

3. **The simultaneous auction of government-held spectrum along with the incentive auction may offer benefits.** In designing the incentive auction, the FCC has the option of adding additional spectrum licenses to the supply in the market, which can potentially soften the trade-off between revenue and efficiency. In particular, a combined market design can lead to efficient assignments while still generating positive revenue.

4. **Traditional arguments for open market designs are less clear in the case of the incentive auction.** The effects of the information revealed through an open mar-

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2In order for the auctioneer to discover whether it is efficient for trade to occur, the bidders must be induced to reveal the values at which they are willing to trade. Analogously to a one-sided auction, they will be willing to reveal these values only if the prices they pay or receive are “better” than and do not depend on these reported values. But if each side is to receive a better price than that corresponding to the efficiently traded quantity, the auctioneer must be willing to make up the difference between the price the buyer pays and what the seller receives.
ket design, such as an ascending-bid auction, are more nuanced in an incentive auction than standard auctions. In a standard auction where bidders have interrelated values for the objects being sold, bidders lower their bids in order to avoid the “winner’s curse.” Open designs provide information to bidders that leads to more aggressive bidding and higher revenue. However, in an incentive auction releasing information may either increase or decrease expected revenue (e.g., positive information might increase bids by both buyers and sellers, but revenue, which is related to the gap between those bids might increase or decrease), so the argument is less clear. A key argument for a closed market design, such as a sealed-bid auction, is robustness to collusion. In an incentive auction, one must consider the additional possibility of coordination between buyers and sellers, but whether an incentive auction is more or less susceptible to collusion remains an open question.

5. **Increased complexity may have lower benefits and higher costs in an incentive auction.** More complex auction designs can allow bidders more flexibility to address substitutability and complementarity among licenses. However, in an incentive auction, achieving the optimal matching of buyers and sellers may be more important than the role of substitutes and complements. The optimal trading network can be quite intricate and a single omitted bid can lead to a substantial change in the network of trades. In addition, a major concern in the design of the incentive auction is whether potential bidders are able to understand the auction and whether bidders will act as intended by the designer. Such concerns may be heightened in two-sided settings where complementarities between buyers and sellers and uncertainty over available supply may lead to greater complexity in analyzing potential bids and developing optimal strategies.

6. **The exclusion of strong buyers can have more severe consequences in an incentive auction.** An incentive auction can be more sensitive to the exclusion of a strong buyer than a standard auction. The impact on auction outcomes is more pronounced if the excluded buyer is stronger or if there are fewer total buyers. In addition, in an incentive auction, a reduction in the amount of spectrum transacted has broader implications because it means that less spectrum will be reassign from broadcaster to providers of mobile wireless services and could potentially affect the repacking of the remaining broadcast licenses.

The FCC’s original spectrum license auctions were novel, with design choices that were guided by insights from the economics literature (and economists) of the time. The FCC’s incentive auction design will again necessarily be novel. As with the design of the initial auctions, the design of the FCC’s incentive auction will rely on intuitions gained from the economics literature. Because some of the key tradeoffs differ between the two environments, one must be careful in using intuitions gained
from standard auctions in the design of the incentive auction. As was the case with the initial spectrum license auctions, the efforts spurred by the incentive auctions will spur new economic research that ultimately influences practice around the world.