Learning from each other: symbiosis between academics and practitioners in spectrum auction design

In the last three decades, spectrum auctions around the world have demonstrated the successful application of theory to practical regulatory processes to award licences to mobile phone companies to utilise valuable airwaves. In his new open-access book, **Geoffrey Myers** *shows how theory and practice are intertwined in a continual cycle of learning and improvement.*

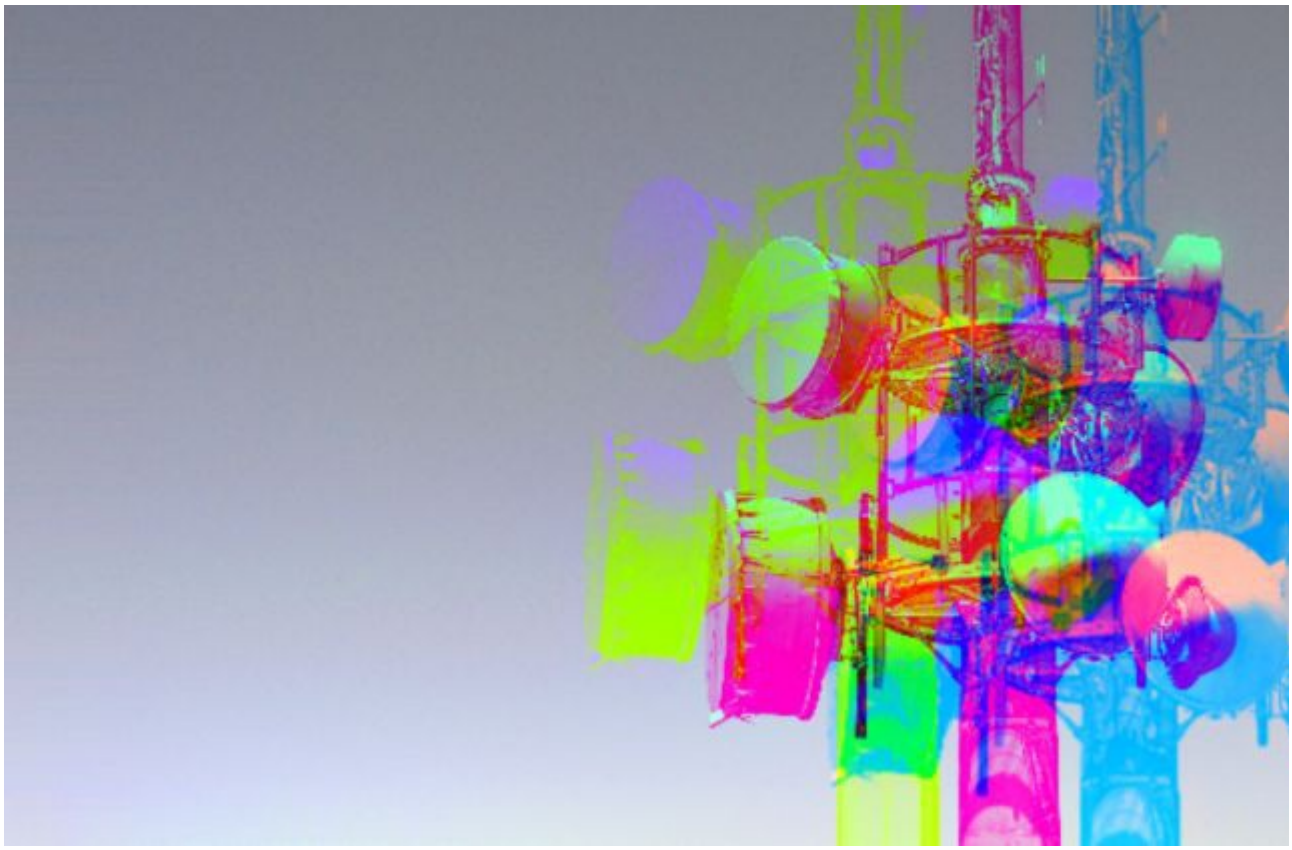
The desirability of learning between academia and public policy decision-making is a key theme in my new book about spectrum auctions. The radio spectrum is a scarce natural resource that we use every day of our lives, whether browsing the internet or checking social media on our smartphones, watching terrestrial or satellite television, listening to the radio, opening car or garage doors with a remote key fob, travelling on taxis, buses, trains, boats or airplanes that use wireless communication, or using the emergency services if something goes wrong. It is now mainstream practice worldwide to utilise auctions in order to award licences, which provide rights to use specific frequency bands in part of the radio spectrum, especially for cellular mobile services. Auctions can work out broadly as expected, be highly successful, or go embarrassingly wrong. This applies in both developing and developed countries, where the regulators designing and running the auctions face different circumstances and are characterised by varying degrees of institutional strength.

Governments have used auctions since Roman times, but the first spectrum auctions took place in New Zealand and Australia from the late 1980s. They were somewhat troubled with bidder default problems in Australia and questions in New Zealand about allocation efficiency and low revenue (85% less than forecast). In contrast, the 1994 auction in the USA was widely regarded as a great success. One of the key things different about the design for this auction was heavy involvement from academia of auction theorists.

A two-way feedback loop between auction theory and practice has, therefore, been in play since the USA's 1994 auction. The auction format proposed by the theorists and adopted by the US regulator, the Federal Communications Commission (FCC), did not come from the textbook, but was newly developed for the challenges of that auction. Professor Paul Milgrom of Stanford University was one of the developers of what came to be known as the Simultaneous Multiple Round Auction (SMRA) and he later became a Nobel Memorial prize winner in Economics in 2020 for auction theory. He described how he was inspired by practical observation of silent charity auctions, where multiple items are offered simultaneously within a fixed time window, bidders write their names and bids on a sheet of paper for each item, and displace the current provisional winner by making a higher bid. The influence was to learn from both successful attributes and weaknesses.

Like silent charity auctions, the SMRA provides clarity which bidders are winning at any point in the auction through a 'standing high bid' mechanism. The auction is simultaneous, with multiple items being awarded in the same process, allowing bidders to switch between them, and for prices to rise if there is excess demand. A problem in silent auctions is that a bidder can swoop in at the last minute leaving no time for others to respond ('bid sniping'), which has also been observed in internet auctions such as on eBay. Mitigating features introduced in the SMRA are that companies always have an opportunity to bid back if their standing high bids are displaced, and an 'activity rule' which prevents a firm from increasing the amount of spectrum it bids for as prices rise to stop it from hiding its demand and engaging in a 'snake-in-the-grass' strategy, like bid sniping.

The interaction between theory and practice is two-way as the complexity of real-world experiences highlight gaps in the theory, often leading to subsequent scholarly developments providing new, richer insights. The practical use of the SMRA in 1994 spurred the theorists to develop a better understanding of the attributes of this auction format. Various modifications have then been developed to mitigate previously unforeseen behaviour by bidders. An example is to limit 'jump bids', where bidders increase their bid amounts by more than a single bid increment, which can provide signals to other bidders, either as invitations to collude or threats to warn other bidders off their 'patch'. Another type of development is to incorporate new theoretical insights such as 'generic lots' to group similar but not identical frequencies for a faster, more efficient bidding process due to 'thicker markets' (more transactions per item).



In response to limitations of the SMRA, theorists have also invented new auction designs. A difficulty for bidders in the SMRA format is ‘aggregation risk’ where different spectrum lots in the auction are complements so that a bidder can be left stranded, winning one lot but not the other needed to realise the synergies. Allowing package bids that win or lose in their entirety removes aggregation risk for bidders. Theorists (again including Paul Milgrom) developed a new auction format with package bidding, which was then put into practice by regulators as the Combinatorial Clock Auction (CCA). Another example of a new format is the descending clock auction where prices start high and fall until supply and demand are matched, developed (yet again by Paul Milgrom and colleagues) to address the hugely complex challenges of buying spectrum from TV broadcasters in the USA’s 2016/17 ‘incentive auction’ – the broadcasting spectrum was then ‘repacked’ and sold to mobile broadband operators in a companion ascending clock auction.

Auction design therefore requires both theoretical expertise to appreciate the conceptual interactions and deep practical understanding to fit the design to the specific circumstances and maximise the chances of successfully achieving the auction’s

objectives. This is an area of economics where the top theorists like Paul Milgrom are also the leading practical advisers. The symbiotic fields of academic study and practical implementation are constantly evolving, seeking both evolutionary improvements and more innovative, revolutionary step-changes, affected by each of real-world experiences and scholarly learning. Both practitioners and scholars are players in this repeated game and they can learn from each other to improve auction design choices and thereby benefit the public, industry and the economy.

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