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The use of spectrum auctions to attain multiple objectives: Policy implications

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ABSTRACT

The first spectrum auctions generally assigned the chosen number of licences of predetermined size to the highest bidders, but auctions now allow a greater choice of outcomes, with bidders with existing spectrum portfolios competing, with others, for multiple lots, often in different bands. Modern auctions also contain design features expressly directed at efficiency and equity objectives. In relation to efficiency, spectrum caps or set asides for new entrants can be incorporated to combat the exercise of market power downstream. In relation to equity objectives, licence conditions may specify obligations to provide coverage in non-commercial areas, or promises of the attainment of social objectives can be given a weighting, with revenue, in the determination of winning bids. The paper provides and overview of the wide use of such tools and the consequences for the operation of the auction process. Some lessons are drawn for future spectrum auctions.

1. Introduction

This paper reviews the set of 'complications' to auction design associated with the wider efficiency and equity objectives set out below. It asks: to what degree have these amended designs achieved their stated goals, and have they rendered auction assignment methods so complex as to bring into question their continuing use?

Spectrum auctions first saw the light of day in New Zealand in 1990 (McMillan, 1994), and – crucially – were adopted, developed and tested in the United States from the early 1990s via a highly successful programme of theoretical research and practical application of economic analysis orchestrated by the FCC.

Auctions of spectrum for mobile communications then caught on around the globe. They offered revenue to governments and gave spectrum regulators the prospect of some relief from beauty contests – the increasingly contentious alternative method of spectrum assignment. However, the beautiful simplicity and objectivity of selling rights of access to spectrum to the highest bidder came under attack by operators which generally preferred the previous system under which spectrum was normally assigned without charge.

As demand for mobile communications grew, spectrum in additional bands was auctioned, operators built up varied portfolios, and their market shares diverged. The old system of assigning to the highest bidders a chosen number of licences of equal and predetermined size in a single band gave way to multi-band auctions in which the auction process itself determined the size of the

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award gained by each operator.[1] This increased the competitive tension in the auction, which was good for revenues. It also allowed a more efficient allocation of spectrum when operators' market shares differed. But it also raised the question whether spectrum assignment by auction might lead to *inefficient* outcomes in downstream markets particularly in bands used for mobile communications, where the overwhelming majority of auctions took place. The concern was that auctioning spectrum to the highest bidders made it possible for the largest operator(s) to bid in a manner designed to extend their market power, by weakening or excluding their competitors; in other words, to respond to what has been called the 'foreclosure motive' to acquire spectrum as well as the efficiency one.

This concern led to the hotly debated inclusion in auctions of spectrum caps (limitations on how much spectrum any operator could acquire) or to the reservation of a quantity of spectrum (known as a set-aside) for smaller or otherwise specified applicants.

A further less widely examined efficiency concern relates to the fact that, while firms base their bids in auctions on the revenues which they expect to appropriate from the private value their prospective customers derive from them, they ignore the externalities associated with the services which they plan to provide, such as wider benefits accruing to society or the economy, since the provider cannot monetise them. Taking such externalities into account would therefore require some amendment to auction design.

As far as equity objectives are concerned, it is recognised that many simple auction designs ignore objectives unrelated or not solely related to economic efficiency. The main remedy in response to this consideration is the inclusion of a geographical coverage requirement within particular spectrum licences. The government's intention is to offer a discount on the price of the licence in return for an obligation to serve some 'non-commercial' customers. Another less frequently observed example associated with an equity objective on the supply side of the market is the inclusion in auctions of so-called 'bidding credits' designed to encourage small or minority-owned firms.

The paper's contribution is to provide a non-technical survey, that represents a synthesis of how regulators have integrated their policy objectives into spectrum auctions. It was driven by consideration as to whether there are grounds for supposing that spectrum auctions will return to their pristine simplicity.

Section 2 discusses interventions in spectrum auctions calculated to enhance economic efficiency and Section 3 assesses interventions aimed at equity-based objectives. Section 4 contains our conclusions.

2. Economic efficiency

This section describes and analyses the types of intervention or complication associated with spectrum auctions designed to promote efficiency, where the market failures responsible for the inefficiency are the classic ones of abuse of market power and failure to take account of externalities. Some of the problematic issues in auction design are addressed first in Section 2.1. Then four broad types of intervention are considered in Sections 2.2–2.5, the first three dealing with market power issues, the final one with externalities. Section 2.6 sums up the conclusions on efficiency.

2.1. Policy issues in auction design

As set out in the Introduction, auction design has become more complex and has attempted to address more policy issues over time. There are also two other issues which add to the complexity, but which are not analysed in detail.

The first is that spectrum auction design itself is a burgeoning field. Auction design houses and a rich literature on optimal auction design challenge the capacity of national administration when they choose an auction format. Multi-national acquirers of spectrum at auction devise bidding strategies based on experience that has not been gained by the seller. At the same time, government finance departments expect optimal auction outcomes.

The second is that in many jurisdictions, the government decides in advance what the use of the spectrum is to be. In effect, the policy directive to the auctioneer is to seek highest value users rather than highest value use. One of the features of more complex auction processes is that they contribute to the identification of highest value users. The US incentive auction is an example of such a complex auction (FCC, 2016).

2.2. Spectrum caps

A spectrum cap is designed to ensure that operators do not acquire spectrum in excess of what they need for efficient production – doing so to deprive access to that spectrum by their rivals, whose costs are raised or who may be even be forced to exit the market. This is what the US Department of Justice refers to as the 'foreclosure motive' in auction behaviour in its ex parte submission to the FCC's review of "Policies Regarding Mobile Spectrum Holdings" (Department of Justice, 2013).

The spectrum cap can apply to specific bands which are considered to be of key importance (for example, spectrum below 1 GHz, which is good for coverage, or spectrum above 1 GHz, which is good for capacity). Or it can cover all bands. Spectrum caps have the potential to prevent anti-competitive conduct by large firms, by reducing hoarding and thus promote allocative efficiency. However, they have the potential to penalise successful operators which have won a large number of customers and hence have a need for spectrum to deliver services at an appropriate quality of service. A further predictable effect of caps is to reduce revenues.

[1] Thus instead of auctioning four lots each of 20MHz (one for each of four operators), 16 lots of 5MHz would be made available, to be distributed by the auction process to an indeterminate number of successful bidders.