

# Agenda

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## Spectrum auctions and trading: dealing with competition problems on airwaves

The auctions for 4G spectrum are currently taking place in a number of countries. Many regulators are agreed that auctions in which mobile operators bid for spectrum are an effective way of allocating this economically valuable resource. However, stakeholders are split on how exactly the auction should be conducted and regulated, whether spectrum should be reserved for smaller entrants, and how far spectrum trading should be allowed in the aftermath of the auction

The use of wireless services has expanded over the past decade. As well as the switchover from analogue to digital broadcasting and the expanding take-up of data services on smartphones and tablet devices, wireless technologies are increasingly being employed for transport, health, defence, and other commercial and non-commercial purposes. It is therefore no surprise that policy-makers around the world are placing increasing emphasis on the mechanisms through which spectrum—the resource underlying all wireless services—is allocated, to ensure that it is assigned to those who can make the most efficient use of it.

The European Commission and many national governments have a long-standing objective to liberalise spectrum within the EU and introduce market-based mechanisms for its use and allocation. Spectrum auctions were introduced in some countries when the 3G licences were assigned in the early 2000s.<sup>1</sup> Other countries, too, have since found auctions to be an effective way of allocating spectrum in the context of the ‘digital dividend’—the release of spectrum previously used by analogue television—and other spectrum bands used for 4G mobile communications (including 800MHz, 900MHz, 1800MHz and 2.6GHz). A number of countries have also allowed secondary trading of licences.

Given the vast economic value of spectrum, policy-makers are faced with a ‘positive’ problem: how to maximise revenues to the state when spectrum is auctioned (for example, in Germany and the UK, £30 billion and £22.5 billion respectively was paid for the 3G licences,<sup>2</sup> albeit the more recent auctions have generally generated lower revenues), while ensuring efficient market outcomes in the longer term. While there are well-established economic arguments to

suggest that the fees paid in auctions are unlikely to distort pricing or even investments,<sup>3</sup> spectrum allocations do affect operators’ capacities and cost structures, which, in turn, can have implications for their competitive positions. In other words, spectrum is a factor that can, to some extent, be substituted by investments in network hardware. Furthermore, given technical constraints and interference issues, spectrum licences are divided into blocks of channels, and (depending on the band) a certain amount of spectrum will be required to operate even a small ‘minimum efficient scale’ network. Consequently, regulators face a trade-off between promoting efficient network build and enabling a maximum, yet economically viable, number of operators in the market.

Given these economic characteristics, spectrum holdings do, indeed, shape long-term market structures, and the economic gains to the state generated through auctions should be assessed against their implications for competition, and consequently for economic welfare. This article discusses how policy-makers can take competition into account in spectrum management, and asks how auctions can be designed to generate competitive market outcomes, and what can be done to ensure an effective secondary market.

### Spectrum allocation

Spectrum auctions provide governments with a fair and transparent framework for allocating spectrum to mobile operators, and it is now relatively widely accepted that auctions are more likely to achieve an efficient allocation than alternative methods such as ‘beauty contests’ (ie, the assignment of spectrum based on judgement by government representatives). While auctions are now frequently used by regulators

around the world to allocate spectrum, their design often poses significant challenges. There is no one-size-fits-all approach to auction design, because there are often factors that are specific to a given mobile market.

A question that often arises in the early stages of a spectrum auction process is whether different groups of licences should be awarded simultaneously or sequentially. The values that operators attribute to particular licences typically depend on other licences in their portfolio. While operators may consider some licences to be substitutes if they provide similar services to end-users, other licences may be seen as complements—for example, when a minimum of two licences is required in order to deliver a particular wireless service. If such interactions are important, a simultaneous sale of licences is generally expected to lead to a more efficient allocation of spectrum (as in the upcoming 4G auction in the UK), because bidders can determine their values for each licence based on the other licences they expect to win.

A central element of auction design is the encouragement of competition during the auction. More competitive auctions generally lead to more efficient outcomes and higher revenues for the auctioneer. One of the main competition concerns in auctions is collusion between bidders. Collusion may lead to low revenues for the government and, if the colluding bidders agree to divide the available spectrum between them, to more winners than is socially optimal.<sup>4</sup> This issue can be addressed by providing bidders with limited information about the identities and/or bids of their rivals, which makes coordination between them more difficult; at the same time, this approach reduces bidders' ability to update valuations for the licences sold. This type of learning has been shown to potentially increase the efficiency of auctions in which bidders are not perfectly informed about the value of the goods and services they are bidding for. In the upcoming UK 4G auction, Ofcom has decided to address the trade-off (between informed and competitive bidding behaviours) by providing bidders with information about the aggregate level of demand for certain groups of licences, without revealing who is bidding for how many licences.

Another central element that regulators need to consider is how the outcome of the auction may affect operators' spectrum portfolios, and thereby competition in the market.<sup>5</sup> Simply giving licences to those who value them most may not always be the preferred outcome for consumers. Although this is usually the case, strong bidders may have an incentive to bid beyond their intrinsic spectrum valuations on certain licences if this prevents one or more competitors from acquiring a sufficient amount of spectrum to compete

effectively in the market. Such a strategy is profitable if the higher licence fees paid in the auction can be recouped in the long term through higher fees for wireless services owing to reduced competition in the mobile market.<sup>6</sup>

Measures are available for regulators to reduce the risk of overly concentrated spectrum holdings, and to promote long-term competition in the mobile market. One is the use of spectrum caps, which limit the amount of spectrum that each bidder can win in the auction, taking pre-existing spectrum holdings into account. Spectrum caps are frequently used in spectrum auctions because they reduce bidders' ability to engage in exclusionary bidding (as described above), but are considered to have a limited distortionary effect on the auction (if set at a sufficiently high level).

Another means of promoting competition is the use of spectrum reservations for weak bidders, such as new entrants. Spectrum reservations encourage bidders to participate in the auction who would otherwise not have a realistic chance of winning sufficient spectrum. Regulators have used spectrum reservations to guarantee a minimum number of winners where there have been concerns that a small number of strong bidders might have an incentive to (jointly) exclude one or more weaker bidders. In the upcoming 4G auction in the UK, for example, Ofcom is planning to reserve a pre-defined portfolio of licences to Hutchison, the smallest incumbent in the UK mobile market, and potential new entrants.<sup>7</sup> The question of whether spectrum reservation is legitimate is under debate.<sup>8</sup> The three main UK mobile operators—Vodafone, Telefónica and Everything Everywhere—expressed concern that the spectrum reservation is likely to lead to low prices to Hutchison, particularly if insufficient entry eliminates competition for the reserved spectrum. Some operators argued that low prices would amount to state aid.<sup>9</sup>

This debate demonstrates the inherent tension in the design of spectrum auctions. While, on the one hand, regulators need to ensure that the auction assigns spectrum efficiently—ie, that licences are allocated to the bidders who can make the best use of them—it may sometimes be necessary to interfere with this principle in order to give weaker bidders a realistic chance of winning, thereby improving the expected long-run performance of the mobile market. This may involve sacrificing some auction revenues.

## Spectrum trading

Market-based schemes are not limited to auctions used in the initial allocation of spectrum. The European Commission has a long-standing objective to liberalise spectrum and introduce spectrum trading—a broad

concept encompassing various means of introducing a 'secondary market' for spectrum rights of use. While spectrum auctions initially seek to achieve an economically optimal allocation of spectrum, spectrum trading also aims to ensure that operators face continual incentives to use the resource productively in the long term, by framing their production decisions in the context of the opportunity cost of using the spectrum.<sup>10</sup> Spectrum trading is typically linked to benefits in terms of:

- removing barriers to entry by providing operators and start-ups with the opportunity to acquire spectrum rights of use more readily, thereby promoting the development of market competition;
- allowing operators increased flexibility to accommodate shifting demand driven by market changes;
- correcting inefficient auction outcomes.

Advocates of spectrum trading often emphasise the potential of a secondary market to foster further competition and investment in the communications market, with the potential to spur greater innovation in new technologies and reduce lead times from innovation to market.<sup>11</sup>

While the rationale for spectrum trading is to promote efficient market outcomes, it does not come without risks. Put simply, if spectrum is controlled by too few market players, such concentration could result in cost and capacity advantages to certain operator(s) and lead to a more concentrated market in the long term—for the same reasons as with auctions. Regulators therefore need to ensure that spectrum trades do not lead to distortions to competition, and some national regulators have implemented, or are implementing, competition frameworks for spectrum trading—ie, guidance on and procedures for how the competition effects of spectrum trades would be assessed, and under what circumstances the regulator might intervene or even block a trade. One such country is Ireland, where Oxera has recently advised ComReg, the communications regulator, in developing such a framework.<sup>12</sup> Oxera's analysis established that the following principles seem important in the context of the regulatory approach towards spectrum trading.

- **Spectrum trades do not affect operators' competitive positions directly.** Without a corresponding sale of the hardware assets and customer base, operators' market shares in the downstream markets (in terms of subscribers) are unaffected in the direct aftermath of the trade. Therefore, any assessment of the competitive implications of spectrum trades should, on a forward-looking basis, recognise the mechanisms through which spectrum allocations influence the

operators' ability to compete—ie, the aforementioned capacity and cost structure implications, together with a recognition of their substitutability across spectrum bands in terms of their use in the downstream markets.

- **Consistency with merger control.** The spectrum trading framework should be consistent with the merger control regime in several ways. Notably, trades should be assessed before rather than after the trade takes place—for example, it is preferable to prevent distortions to competition rather than deal with them once they have already arisen. Furthermore, the competition test standard (ie, threshold of intervention) should be consistent and in line with the 'substantial lessening of competition' test. Put simply, spectrum concentration resulting from a trade can lead to a more concentrated retail market, which can be detrimental to consumers even if no single operator gains a dominant position.
- **Licence conditions post-trade.** Should licence conditions 'travel' with the trade? From a policy perspective, a regulator may want to ensure that the current policy (eg, population coverage) enshrined in licence conditions is maintained after a trade. However, it may not always be proportionate to apply the same licence conditions to the new licence holder—for example, a small-scale operator may not have incentives to purchase spectrum (and increase its capacity to compete more effectively) if it is required to build a network that covers most of the country with that spectrum. In any event, the decision on whether licence conditions travel can have implications for the valuation of spectrum, and the post-trade market structure. Dealing with licence conditions in an auction context is generally more straightforward, since bidders can reflect the cost of the licence condition directly through their bids.
- **Spectrum hoarding.** In economic terms, hoarding can be an impediment to competition if an efficient operator's growth is constrained by an incumbent operator holding spectrum that it does not need for providing services to its current or projected customers (which is analogous to exclusionary behaviour or predation in auctions). In principle, hoarding should be dealt with when the licences are first designed to ensure that operators are incentivised to sell unused spectrum rights, but it could be further considered in the context of the ex ante competition assessment of trades. For example, if there were a concern that a trade could give rise to hoarding, the regulator might impose appropriate 'use-it-or-lose-it' licence obligations as a pre-condition for a cleared transfer, or apply efficient spectrum usage fees.

While spectrum trading has been possible in a number of countries for some time (such as the UK, New Zealand and Australia), there have been few substantial trades thus far. Operators may have limited incentives to sell their most valuable asset to competitors, even if they do not use the spectrum fully themselves.

## Spectrum auctions and spectrum trading work best in combination

Although discussed separately above, spectrum auctions and secondary trading are intrinsically linked. Economic theory has shown that, as long as market participants are free to trade with each other and there are no significant 'transaction costs', mutually beneficial trades will eventually lead to an efficient final allocation of goods. Importantly, the final allocation is independent of the initial distribution of goods between the market participants. This result suggests that—in theory—spectrum auctions do not matter much from an economic efficiency perspective as long as mobile operators are able to trade spectrum between each other after the auction.<sup>13</sup> However, in reality, transaction costs are rarely zero, and spectrum trades that would have been mutually beneficial in the absence of transaction costs do not always take place. In order to obtain an efficient distribution of spectrum that is sufficiently flexible to adapt to changes in market characteristics, it would therefore be essential to use

both spectrum auctions and spectrum trading. To ensure that efficient trades do indeed take place, the key would be to introduce licence measures that prevent inefficient hoarding in the first place, and also introduce trading frameworks that are not too restrictive and burdensome.

Regulators need to ensure that the rules for spectrum trading are clearly defined before the auction.

Operators that participate in the auction require detailed information on the rules of the game in the secondary market, as their bidding strategy ex ante may depend on whether and how they can sell or acquire licences in the aftermath of the auction.

There are similarities between the issues that regulators need to consider when designing spectrum auctions and when developing the rules for spectrum trading. For example, both spectrum auctions and spectrum trading may have important long-term implications for competition in the mobile market. While, in spectrum auctions, measures may be required to prevent bidders from strategically excluding rivals, the rules of spectrum trading, and possible remedies imposed on traded spectrum, can prevent the concentration of spectrum holdings and inefficient hoarding. However, the implementation of such measures should build on a sound competition rationale, as they may have a significant impact on market outcomes and the potential to harm consumers.

<sup>1</sup> 3G and 4G are mobile communications standards. 3G, defined to cover Universal Mobile Telecommunications System (UMTS) and Code Division Multiple Access (CDMA) 2000 technologies, is used for voice and data communications. 4G broadly covers the next generation of mobile technologies enabling high-speed Internet access, including mobile-WiMAX (Worldwide Interoperability for Microwave Access) and Long Term Evolution (LTE) standards. For further information, see <http://www.3gpp.org/>.

<sup>2</sup> See, for example, <http://www.radio-electronics.com/info/cellulartelecomms/umts/3g-history.php>.

<sup>3</sup> Binmore, K.G. and Klemperer, P. (2002), 'The Biggest Auction Ever: The Sale of the British 3G Telecom Licences', *The Economic Journal*, 112:478, C74–C96.

<sup>4</sup> Consumers are likely to be harmed if there are too many winners in the auction, because a highly fragmented market generally leads to a loss in economies of scale, and therefore higher prices.

<sup>5</sup> Oxera (2012), 'Sold to the Slyest Bidder: Optimism Bias, Strategy, and Overbidding', *Agenda*, September.

<sup>6</sup> Note the similarity of this strategy to predatory pricing in ordinary markets. The firm that engages in a predatory strategy sacrifices profits in the short term in order to exclude a competitor through below-cost pricing. This softens competition (and may lead to a monopoly position), and enables the firm that engaged in the predatory strategy to raise its prices in the long term to recoup the sacrificed profits.

<sup>7</sup> Ofcom (2012), 'Ofcom Unveils Plans for 4G Auction of the Airwaves', news release, July 24th.

<sup>8</sup> Another question is the size of the spectrum guarantee that would be required for Hutchison or a new entrant to become a viable competitor.

<sup>9</sup> On the state aid point, see Telefónica, 'Telefónica's Response to Assessment of Future Mobile Competition and Proposals for the Award of 800MHz and 2.6GHz Spectrum and Related Issues: a Consultation by Ofcom', available at: [http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/responses/Telefonica\\_UK\\_Ltd.pdf](http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/responses/Telefonica_UK_Ltd.pdf).

<sup>10</sup> There are other, complementary, ways to achieve efficient allocations, such as setting spectrum usage fees.

<sup>11</sup> See, for example, Cave, M. (2002), 'Review of Radio Spectrum Management: An Independent Review for the Department of Trade and Industry and HM Treasury', March.

<sup>12</sup> Oxera (2012), 'Spectrum Trading Issues – a Framework for Competition Assessments', prepared for Commission for Communications Regulation, July 11th.

<sup>13</sup> This insight has sometimes been used to argue that policy-makers should not be too concerned about efficiency when designing an auction, and instead focus on maximising revenues for the government.

If you have any questions regarding the issues raised in this article, please contact the editor, Dr Leonardo Mautino: tel +44 (0) 1865 253 000 or email [l\\_mautino@oxera.com](mailto:l_mautino@oxera.com)

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