9. Promoting downstream competition

Summary

- Major spectrum auctions can strongly affect downstream competition in services provided to the public. So, an assessment of the likely competition effects of auction outcomes is crucial. Three steps are recommended in a structured analytical framework.
- Step 1 identifies the risk of downstream market failure occurring after the auction, which might cause a weakening in competition by affecting the number of operators or reducing the strength of competition between them. Step 2 assesses possible upstream market failure – the risk that the worrying outcomes identified in step 1 occur in the auction. Finally, in step 3 the regulator judges what effective and proportionate competition measures to impose, such as caps to limit spectrum acquisitions or reservations of spectrum for new entrants, paying attention to regulatory failure risks.
- Decisions on competition measures in the UK and an example from Australia highlight the benefits of including all three steps to ensure appropriate measures, while avoiding the excessive intervention that can result from neglecting any aspect of the framework, such as whether operators who need spectrum could acquire it in the auction without any additional regulation (step 2), and the potential downsides of restrictive competition measures (step 3).

The leading auction theorist, Paul Klemperer, has noted: 'The most important issues in auction design are the traditional concerns of competition policy – preventing collusive, predatory, and entry-deterring behavior'.[1] Chapter 8 covered some of these points, including reduced competition in the auction (such as tacitly collusive market division, or predatory price driving). This chapter assesses concerns about strategic investment, namely bidding behaviour in the auction that is designed to deter entry or otherwise weaken competition in the downstream market, adversely affecting consumers and

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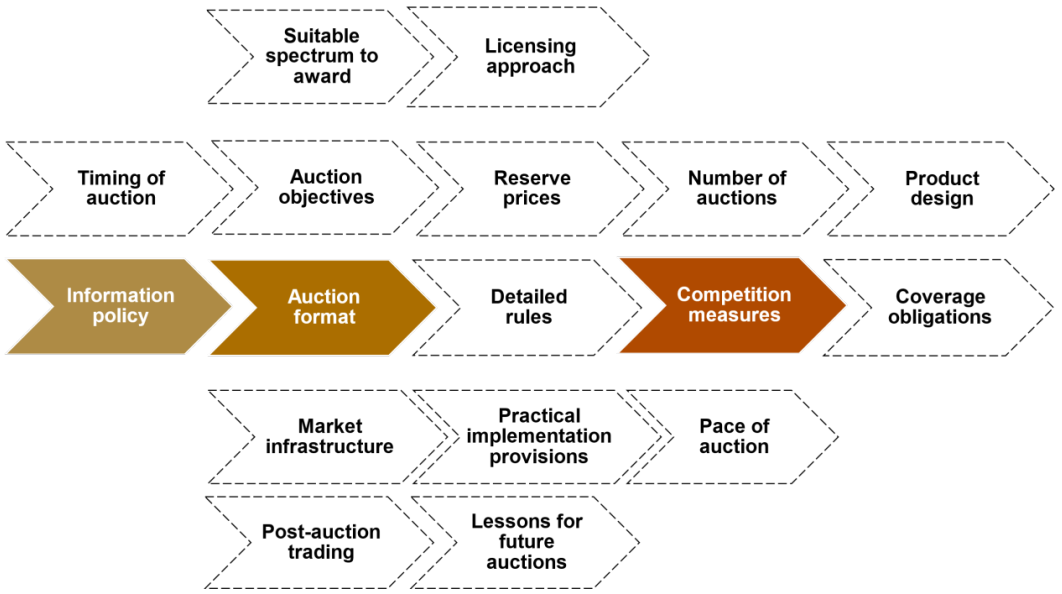
Figure 9.1. Auction decisions relevant to Chapter 9



Source: Author.

output efficiency. The concerns can be addressed by imposing competition measures in the auction. The auction format and information policy are also relevant as they can facilitate or constrain anti-competitive bidding incentives. These three elements are highlighted in Figure 9.1.

Spectrum is a key input into downstream wireless markets, and what ultimately matters for consumers is how well served they are by competition in those markets in the short and long run through prices, quality, choice, and innovation. At issue here are the effects at two market levels: how outcomes in the *upstream* auction market affect operators' spectrum portfolios, and how those in turn impact on outcomes in *downstream* markets for services sold to consumers. The first relationship is easier to measure in terms of, for example, operators' total spectrum holdings and relative spectrum shares. However, the overall absolute and relative strength of an operator's spectrum portfolio also depends on additional considerations beyond these relevant but fairly crude metrics, such as the portfolio composition (for example between coverage and capacity spectrum), and how it interacts with commercial strategies. The second relationship about the impact on downstream outcomes is harder to establish. Though spectrum is a necessary requirement for new entry by a wireless operator, there is no rigid relationship between concentration in spectrum holdings and downstream market concentration, nor between market concentration and consumer welfare.[2] It is important to keep these nuances in mind when assessing the rationale for any competition measures in the auction.

The first section explains the role of spectrum policy in promoting mobile competition, drawing on the UK's experience. The second section sets out the UK regulator's structured framework to assess competition effects and to decide which competition measures to apply in the auction. The framework is applied, first, to UK auctions, and then in the third section to an example from Australia in 2021.

9.1 Promoting mobile competition through spectrum policy in the UK

The UK regulator Ofcom has developed and applied a structured framework for rigorous, evidence-based analysis. Competition measures are usually contentious with the industry because operators have divergent interests, and in the UK the asymmetries between mobile operators' spectrum portfolios have made them especially controversial. As a result, the regulatory analysis has been intensely examined and tested (including through litigation – see Section 5.4). Nonetheless, the UK has been proactive in applying measures to promote competition, and Figure 9.2 shows how the spectrum caps and reservations affected the auction outcomes (the final column), although in later auctions they acted more as safeguards without being binding constraints. The measures also included innovation in design through the use of spectrum floors in the UK's 2013 auction – flexible spectrum reservation where, instead of being chosen by the regulator before the auction (set-aside), the spectrum ultimately reserved was determined through bids within the auction, so as to mitigate regulatory failure risk (see Section 10.1).

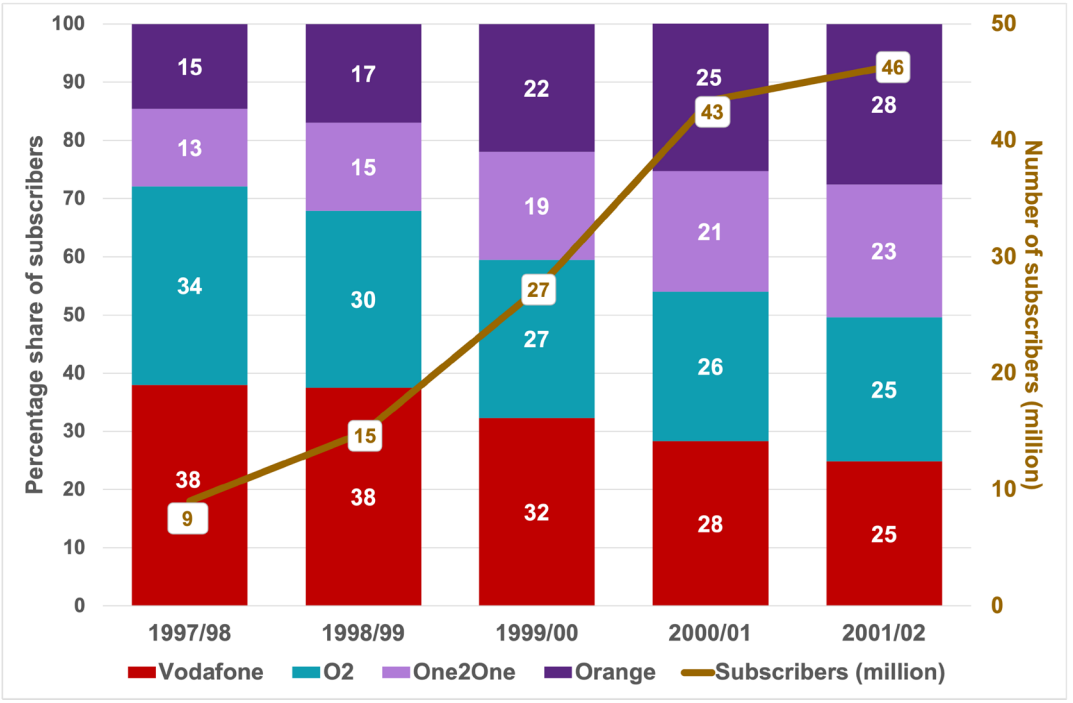
Historically, UK regulators have always recognised the importance of spectrum policy in shaping downstream competition in wireless services. Even before auctions were introduced, spectrum allocation was deployed to improve the competitive structure of the mobile market. The original mobile spectrum (900 MHz band) was administratively allocated in 1985 to two operators: Vodafone, and Cellnet which adopted the brand name O_2 many years later and was taken over by Telefónica. In 1991 when further mobile spectrum became available (1800 MHz), 80 per cent of the band was administratively allocated to new entrants, Orange and One2One, changing the UK from a two-player to a four-player market. This was very successful in promoting competition. The new entrants caught up with incumbents, achieving similar market shares through acquiring customers at a time when the

Figure 9.2. Summary of competition measures in high-stakes auctions in the UK

Auction	Spectrum caps	Reservations	Outcome
2000, 3G auction	Bidders were limited to at most one licence.	One licence was reserved for a new entrant.	One new entrant (changing the downstream market from four to five operators).
2013, 4G auction	Two caps: • Total spectrum • Low frequency spectrum	There was flexible reservation (spectrum floors) for a new entrant or the smallest incumbent (H3G).	Both caps were binding. H3G won the floor in 800 MHz (maintaining four operators in the downstream market).
2018, PSSR auction	Two caps: • Total spectrum • Immediately useable spectrum	None	The total spectrum cap was not a binding constraint. The other cap prevented EE from bidding for the 2.3 GHz band.
2021, 5G auction	One cap on total spectrum.	None	The cap was not a binding constraint.

Source: Author from Ofcom auction documents.
Note: Annex A1 sets out further details of the sizes of caps and reservations in these auctions.

Figure 9.3. Percentage market shares of UK mobile operators, and expansion in the number of mobile subscribers, 1997 to 2002



Source: Author from Oftel (2003).
Note: Total of shares in 2001/02 does not sum to 100 per cent due to rounding.

market was expanding rapidly from one million subscribers in 1992 to more than 40 million a decade later. Figure 9.3 shows the latter part of this period. The combined share of the new operators, Orange and One2One (shown in darker and lighter purple), increased from less than 30 per cent in 1997/98 to just over 50 per cent in 2001/02. The brown line in Figure 9.3 also shows that the size of the total market grew five-fold from 9 to 46 million subscribers over this period (from 15 to 78 per hundred population).[3] Unlike many countries which have one or two much larger operators, in the UK there has been healthy jockeying for position, yielding benefits to consumers in keenly priced, decent-quality mobile services.[4]

In the 2000 auction there was a further change to the market structure, with one of the licences reserved for a new entrant (acquired after the auction by H3G, operating with the brand name Three). The UK became a five-player market once H3G launched services in 2003. A decade later in 2010 there was a consolidation back to four operators when EE was created by the merger of Orange and One-to-One (which in the intervening years had become T-Mobile). After that, a four-player market of EE, H3G, Telefónica, and Vodafone was maintained, assisted by competition measures in auctions including spectrum reservation in 2013. Outside the auctions, a competition authority decision in 2016 blocked a proposed mobile merger between H3G and Telefónica (which would have reduced the market to three operators).[5] Other mergers were cleared, such as BT acquiring EE in 2016 and H3G acquiring a small wireless operator, UK Broadband, in 2017.[6]

Access to spectrum is necessary but usually not sufficient for a new operator to be successful. Additional regulation could assist an entrant to meet the challenges of customer acquisition and substantial sunk-cost investments in a new network. For example, the entrant via spectrum in the 2000 auction, H3G, was also supported by a requirement on incumbent operators to offer 2G wholesale national roaming. H3G could then provide 2G services seamlessly to its retail customers to mitigate coverage gaps in its own network. The regulation lasted for some years, but was a transitional measure in order to avoid the regulatory failure risks of an inefficient operator becoming overdependent on regulation to prop it up. Similarly, national roaming was a supporting measure used in Portugal's 2021 auction to assist new entry.

Retail competition in the UK is not only about the four national mobile network operators. As well as competing in the retail market themselves, these incumbents all supply wholesale services to mobile virtual network operators (MVNOs), that is, firms which sell their own branded mobile telecoms services to customers, while relying on the infrastructure of one of the major incumbents. MVNOs form an active market segment which increased from 9 per cent of subscribers in 2001 to 17 per cent in 2018.[7] Both the sector regulator and competition authorities have viewed healthy competition from the four national network operators as benefitting consumers directly through retail competition between them, and indirectly via rivalry to supply wholesale services to MVNOs.

9.2 Competition assessment framework

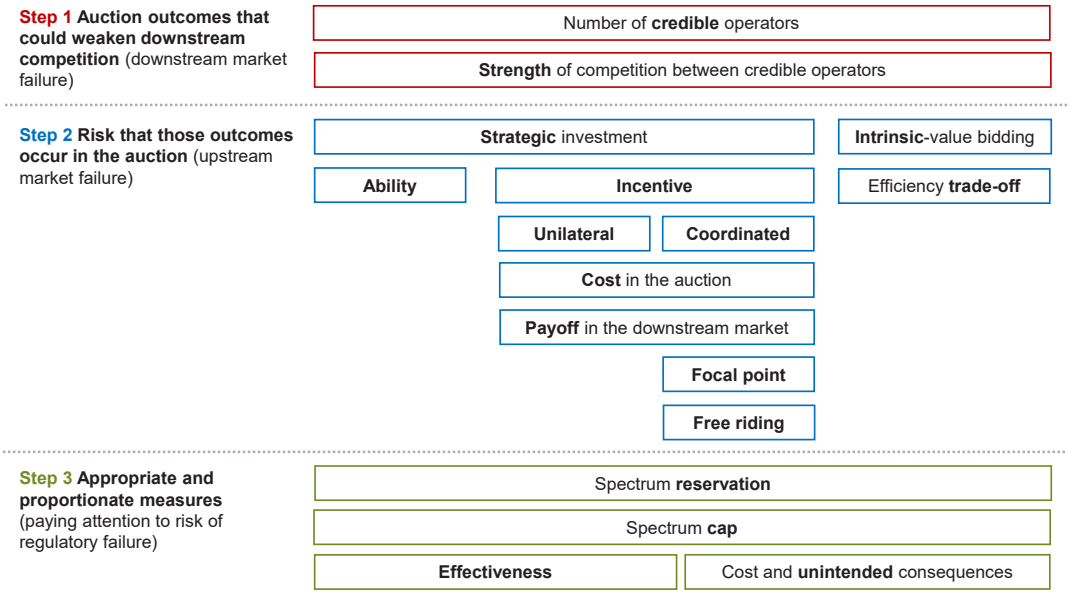
The UK regulator's competition assessment framework for spectrum auctions has drawn on standard techniques and approaches for antitrust analysis, but tailored it to the auction context. Figure 9.4 shows the three-step framework initially developed for the 2013 auction and maintained subsequently. Step 1 (in red) identifies auction outcomes that might lead in the future to downstream market failure, by weakening competition to the detriment of consumers in the short or long term, taking into account operators' pre-existing spectrum holdings. Step 2 (in blue) assesses the risk of upstream market failure of each of those outcomes occurring in the auction itself, in the absence of competition measures. Step 3 (in green) considers possible competition measures that might address the identified concerns in appropriate and proportionate ways, paying attention to their risks of regulatory failure.

Market conditions and other circumstances can change markedly between auctions. So, although the framework is applied consistently, each competition assessment is specific. Auctions contain different spectrum bands that are more relevant to particular dimensions of competition, such as providing coverage or expanding capacity. The spectrum useable for mobile services has increased over time with developments in technology and spectrum policy decisions (see Section 6.1).[8] For example, the pool at the time of the UK's 2000 auction comprised 332 MHz of spectrum, of which 120 MHz (36 per cent of the total) was awarded. Two decades later the mobile spectrum pool was over three times bigger at 1,117 MHz, so that the larger spectrum amount auctioned in the 2021 auction (200 MHz) was only 18 per cent of the total.

Step 1 – Will auction outcomes risk competition concerns from a change in the number of credible operators, and/or a change in the strength of competition between them?

After a spectrum auction a firm could end up with less than the minimum spectrum portfolio needed to be a credible operator, one capable of exerting an effective constraint on rivals across a *wide range*

Figure 9.4. The three steps in the UK's competition assessment framework



Source: Author from Ofcom auction documents.

of mobile services and customers. For example, after the UK's 2013 auction the smallest incumbent operator, H3G, could have ended up with less than the minimum spectrum portfolio it needed to remain a credible competitor. Such a minimum portfolio would provide sufficient capability in: (i) capacity and average data rates; and (ii) quality of coverage.[9] This theory of harm led the regulator to reserve spectrum in the auction (after also assessing steps 2 and 3).

Of course, the competitiveness of a market depends on many more factors than just the number of competitors. Accordingly, the empirical relationship between the number of players and consumer welfare is context dependent, especially when comparing outcomes from competition between three or four credible operators. This question has been contested in a range of merger decisions throughout the world. The relationship of more competitors to lower prices is clearer – both in theory and empirically – than the more ambiguous effects on investment or quality.[10] Spectrum auctions provide a potential opportunity for market entry, given the necessity of suitable spectrum. In some cases, regulators may seek to use auctions as a vehicle to increase the number of network competitors, as in the UK in the 2000 auction (although downsides should also be considered, including risks of excessive intervention under step 3). The question in the next auction in 2013 was the opposing risk of a decrease in competitors – a four-player market with high barriers to entry becoming a three-player market, as a consequence of the outcome of a spectrum auction making an operator unsustainable. Such a result would be a substantial and serious change, without facing the intensive and fact-specific investigation by the competition authorities that would apply to a merger. It seems wise, therefore, to avoid such an outcome via the auction, without precluding any post-auction merger activity that would face the requisite merger assessment.

A second concern is that substantial asymmetry in spectrum holdings between firms could lead to weaker competition for a particular *sub-set* of services or customers, such as highly data-intensive

users.[11] For instance, before the 2013 auction EE had the largest share of spectrum – too much spectrum asymmetry after the auction could have meant that one or more of the other credible operators would have been at a disadvantage competing against EE for highly data-intensive customers. For this second theory of harm the regulator set a cap on total spectrum holdings (comprising pre-existing holdings plus spectrum acquired in the new auction).

The concern that spectrum asymmetry could adversely affect competition in a sub-part of the market is likely to be less serious than the loss of a credible competitor.[12] More fundamentally, the inherent desirability of spectrum symmetry between competing operators remains an open question. Asymmetry could lead to weaker competition from operators with smaller holdings, and reduce head-to-head rivalry. Alternatively, asymmetries could allow operators with large holdings to offer better quality services to more customers, or stimulate competitors to adopt more differentiated commercial strategies that could widen consumer choice. An example of a regulatory decision consciously leading to asymmetry was Ofcom's 2012 modification of EE's spectrum licence to allow it to use its 1800 MHz spectrum for 4G. Rival operators only gained access to spectrum to launch their own 4G offerings later on, such as by acquiring 4G spectrum in the 2013 auction. EE launched its 4G services in October 2012, while Telefónica and Vodafone only did so in August 2013, and H3G in December 2013. This asymmetry may well have stimulated faster UK rollout of 4G (although a rigorous causal assessment of the effect of asymmetry has not been undertaken). Instead of all operators delaying the cost of rolling out the new technology, a competitive dynamic occurred where EE sought to obtain a 4G lead and stay ahead, stimulating its rivals to catch up. The asymmetry did not lead to a particular disparity in subscribers between firms, because most growth in 4G subscribers occurred after all four operators launched 4G services. However, years later in 2020 spectrum asymmetries still seemed to be reflected in commercial strategies, such as EE continuing to offer the fastest download speeds.[13]

Another reason for not seeking to impose spectrum symmetry is that operators have alternative ways to increase network capacity – for example, building additional base stations and using more efficient technology. The UK experience shows the potential for firms' downstream market shares to depart from their shares of spectrum holdings. Since 2010 the two largest operators by number of subscribers have been EE and Telefónica. Yet their shares of spectrum have been very different. Both had a similar share of network subscribers (33 per cent) in 2016, but EE's spectrum share (42 per cent) was three times larger than Telefónica's (14 per cent).[14]

In general, there is no rigid relationship between the degree of spectrum asymmetry and the impacts on downstream competition and outcomes for consumers. However, spectrum asymmetries can go too far and lead to unmatchable competitive advantages for operators with large spectrum shares. Or there can be restrictions on the competitiveness of operators with small spectrum shares (for example, the marginal cost of expanding capacity through alternatives to spectrum could make it more profitable for them to compete less strongly).

Step 2 – Are the potential harmful outcomes likely to occur in the auction or not? And what types of auction bidding can raise competition concerns?

If an operator needs to win spectrum in the auction in order to remain competitive, it may be able to acquire it without any competition measures being imposed. But there are two sources of potential upstream market failure. There could be circumstances where one operator (for example, H3G in the UK in 2013) is outbid through *intrinsic-value bidding* by rivals, resulting in reduced competition. A potential reason is differences in operators' private intrinsic values, the profit they expect to

derive from the spectrum, which do not take account of the benefits to consumers from increased downstream competition.[15] There is an efficiency trade-off for the regulator to consider. Allocating spectrum to H3G in 2013 when another operator has higher intrinsic value could enhance output efficiency by creating greater downstream competition. However, it could reduce auction efficiency, and potentially damage output efficiency as well by denying the spectrum to the highest-value bidder, who could use it to offer more or better-quality services to its potentially large customer base.

A second source of upstream market failure is that an operator could fail to acquire the spectrum it needs for its downstream competitive position because of *strategic investment* by one or more of its rivals. Rivals could use a foreclosure strategy designed to weaken competition, by bidding above their intrinsic values in order to deny spectrum to the vulnerable operator (such as H3G in 2013).[16] Successful strategic investment involves no efficiency trade-off and is unambiguously an undesirable outcome, worsening output efficiency. Like many other foreclosure concerns in antitrust regulation, the risk can be analysed in terms of the ability and incentive.[17] The ability to foreclose depends on whether it is feasible for the strategic investor(s) to acquire the spectrum needed to deny it to the victim, and thereby restrict downstream competition. Such analysis can highlight specific spectrum acquisition patterns that would need to occur for there to be a foreclosure effect. The incentive depends on the balance between the cost in the auction to the strategic bidder and its expected payoff in downstream markets (comprising both the retail market and the wholesale market for sales to MVNOs).

The strategic investment could be undertaken by a single bidder acting *unilaterally*. The strategic investor's cost is the excess of the price it has to pay to acquire the spectrum over its intrinsic value. The auction price is set by the victim's intrinsic value, which the strategic investor must outbid. If the spectrum is important to the victim's competitive position, as is especially the case if its credibility is at stake, then the victim has a relatively high intrinsic value and so strategic investment is more costly. The payoff is the strategic investor's expected gain from a reduction of competition in downstream markets, which depends on the extent to which the victim is weakened as a competitor and the causally related increase in profit. For example, the victim may be capacity-constrained or unable to match the quality of service of competitors, leading to its customers switching away. The strategic investor's expected payoff depends on the profitable customers it can acquire, and any price increase it can make once there is weaker competition in the market. In a four-player market, customers switching away from the victim operator (H3G in our 2013 example) have a choice of three other networks. Therefore, the unilateral strategic investor cannot expect to obtain all these customers – the two other operators would also benefit, despite not incurring any of the costs of this strategy. Similarly, if the strategic investor can increase its prices in the downstream market, the two other operators are also likely to be able to do so. In other words, these operators can freeride on the strategic investor.

Generally, the cost and the payoff are correlated. The more that strategic investment weakens the victim, the higher the cost is likely to be. Although correlated, the overall profit gain from weaker competition can be larger than the cost of strategic investment, because industry profits are generally larger in a less competitive market (for example, a monopoly in the extreme).[18] However, since a unilateral strategic investor incurs all of the costs but obtains only some of the payoff, this reduces the incentive to engage in the foreclosure strategy. The cost can also exceed the payoff because the strategic investor has to outbid the victim's marginal value. It might have to do so on a relatively large amount of spectrum beyond its own intrinsic value.

This takes us to the possibility of *coordinated* strategic investment by multiple bidders 'ganging up' on a weaker rival. Here, the incentive is increased because the cost is shared among multiple strategic

investors. However, the coordination needs to be achieved successfully (and legally).[19] Each strategic investor has an incentive to engage in freeriding, avoiding the cost but still receiving a proportion of the payoff, making coordination more difficult to achieve. But it is made easier if the auction circumstances provide a clear focal point, obvious to all the coordinating players. An example of a possible focal point in the UK's 2013 auction was three strategic investors each acquiring 20 MHz of the 60 MHz available in the 800 MHz band, in order to deny it to H3G. An equal amount of spectrum would not necessarily mean an equal cost for each strategic investor. Some could have had lower intrinsic values for the 800 MHz band, and so faced a higher cost of strategic investment (and some could have faced no cost at all if they had the highest intrinsic values). But with this focal point, each strategic investor would know that if it did not go through with its part of the strategy, the foreclosure effect would not be achieved, so it would not obtain the payoff.

It is unlikely that the regulator can accurately quantify all of these effects. But it can reach an informed judgement about the risk of adverse outcomes by applying the framework of considerations in Figure 9.4 to the applicable circumstances of the auction and market conditions. The auction outcome arising from intrinsic-value bidding involves a trade-off between different types of efficiency. The risk of unilateral or coordinated strategic investment can be evaluated by considering the cost, expected payoff, focal point, and potential for freeriding. The UK regulator's analysis for the 2013 auction led it to take seriously the risk of the focal point for strategic investment in the 800 MHz band as part of its case for imposing spectrum reservation in the auction. In other cases, the step 2 analysis can help the regulator to avoid basing any competition measures on outcomes that are very unlikely to occur (such as rejecting sub-caps in the 2021 auction, as explained in the next subsection).

The regulator can also influence the risk of strategic investment through the auction design in at least two ways:

- Information policy: Revealing less information to bidders can make it harder for strategic investors to know whether they are targeting the victim or just competing against rivals who are not vulnerable, or whether other parties in an attempted coordinated strategy are doing their part. If a potential strategic investor faces a greater risk of incurring the cost without obtaining the payoff, foreclosure is less attractive.
- Auction format: Strategic investment is generally more costly for strategic investors in auctions using the SMRA than the CCA format. Bidding for more spectrum increases the price of all lots bought in the SMRA. A strategic investor also faces a risk of bidding for a large number of lots at a price above its intrinsic value, but only winning some of them and failing to achieve the foreclosure effect. By contrast, in the CCA format, the package bid either wins or loses in its entirety. In addition, with non-linear pricing, bidding for a larger package does not necessarily increase the price of a smaller package or infra-marginal lots. (This is the other side of the coin of the CCA being less prone to demand reduction – see Section 8.3).

Other options for regulation could potentially affect the payoff from foreclosure. For example, strategic investors might expect a regulator clearly committed to promoting competition to respond to successful foreclosure in an auction by introducing tighter regulation afterwards. Or successful strategic investment might make the regulator more likely to reserve spectrum for a new entrant in a future auction. Both regulatory threats could shorten the duration of the foreclosure effect and so reduce the expected payoff.

Step 3 – What types of competition measures are proportionate and appropriate?

Spectrum caps are a common competition measure and can be implemented by regulators in different ways. A cap can limit how much spectrum in a specific band can be acquired by any one bidder in the auction, as in the UK's 2000 auction when bidders could win at most one licence. Alternatively, a cap can restrict the total of any operator's pre-auction holdings plus the spectrum it acquires in the auction, as in the UK's 2013, 2018, and 2021 auctions. Or, a cap can apply to a subset of spectrum, such as the cap on low-frequency spectrum (especially valuable for coverage) which also applied in the 2013 auction.

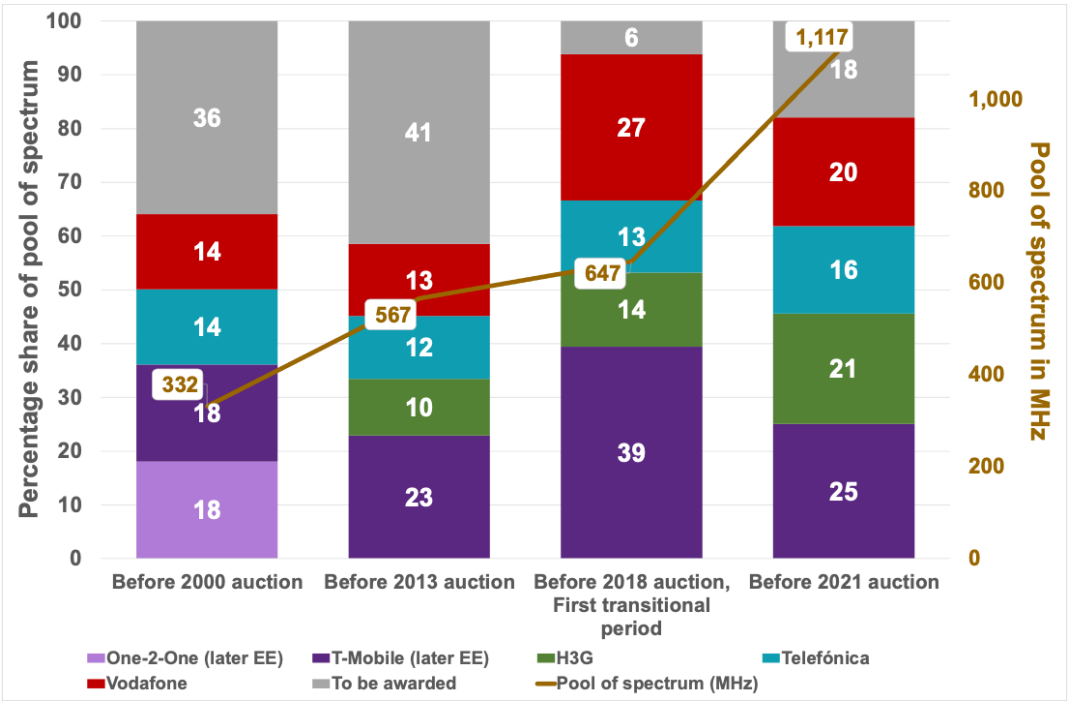
The other main measure is spectrum reservation, which splits operators into those eligible to bid for reserved spectrum and others who can only bid for unreserved categories.[20] For example, in the 2000 auction all bidders could compete to win one of four licences, but only new entrants were permitted to bid for the fifth, reserved licence. With a restricted set of bidders, reserved spectrum usually sells at a lower price than similar unreserved spectrum, as occurred in the 2000 and 2013 auctions. (However, an exception in Australia is discussed in the next section.)

Any analysis of the appropriateness of these types of competition measures to address the potential harms should also consider the potential costs and risks of regulatory failure, especially where undesired outcomes are unlikely to occur. The disadvantages of measures include whether they can be effective in combatting the specified competition concerns, and potential unintended consequences. For instance, imposing caps may reduce the economic efficiency of the auction's spectrum allocation, a risk that increases with the restrictiveness of the cap. Most disadvantages are reduced if the measure is limited to the minimum needed to address the concern. More interventionist regulation like spectrum reservation comes with a risk of correspondingly greater detriment, because it denies the spectrum to existing operators who could use it to expand or improve their services to consumers. Such a measure is generally only considered appropriate to address serious concerns about the number of credible operators. Other potential unintended consequences include: unsold or underutilised spectrum; losing downstream competition and innovation benefits from asymmetric spectrum holdings; operators modifying their bids to influence future regulatory decisions; and the level of the cap acting as a focal point to make coordinated strategic investment in the auction easier.[21]

On the risks to credible competitors, Figure 9.5 shows the spectrum shares of mobile operators before each UK auction, highlighting how much was at stake in 2000 and 2013 when 36 per cent and 41 per cent of total spectrum was to be awarded. On both occasions the regulator assessed a significant risk of undesirable outcomes occurring through intrinsic-value bidding or strategic investment, and imposed the spectrum reservation detailed in Figure 9.2 and Annex A1.[22] Later auctions in 2018 and 2021 did not raise the same credibility concerns, so that there was no spectrum reservation. The brown line in Figure 9.5 also shows the large increase in the pool of spectrum for each successive auction competition assessment.[23] As well as reducing the likelihood of credibility concerns, because of each operator's larger spectrum portfolio, it emphasises the importance of making the analysis forward-looking.

Of course, the number of operators is also affected by merger and acquisitions activity amongst operators. The assessments of UK mergers made by the competition authorities covered a range of retail and wholesale questions, with spectrum issues sometimes being prominent. For example, the EE merger in 2010 was cleared by the competition authorities with remedies including spectrum divestment – EE had to divest 30 MHz of the 1800 MHz band, which it sold in 2012 to the rival firm H3G.[24]

Figure 9.5. Spectrum shares before UK auctions with differing degrees of asymmetry, and the growing pool of spectrum for competition assessment



Source: Author from Ofcom auction documents.

Turning to the strength of competition between operators and spectrum asymmetry, all operators need to be able to expand capacity, given the rapid growth in mobile data. In considering total spectrum caps, what is the threshold level of asymmetry that leads to sufficient concerns to require action? There is no simple or clear-cut answer. One pragmatic benchmark is a 40 per cent spectrum share for the operator with the most spectrum, because in a four-player market it would have double the average share of its three competitors. The UK regulator used a 37 per cent threshold, the level at which it first set the total spectrum cap in the 2013 auction, and then subsequently in the 2018 and 2021 auctions. This is not a 'magic' number, and other thresholds could also be reasonable, but maintaining a consistent approach can have benefits of regulatory certainty. Figure 9.5 shows that the spectrum shares between the four operators were relatively symmetrical before the 2000 and 2021 auctions, compared to much greater asymmetry before the 2013 and 2018 auctions. Accordingly, while spectrum caps were imposed in all four auctions, there were especially significant competition concerns about spectrum asymmetry in 2013 and 2018.

Caps on subgroups of spectrum are based on other theories of harm. For example, the concern that led to the sub-cap on low-frequency spectrum in the 2013 auction was asymmetry in spectrum holdings especially well suited to providing coverage, because two operators (Telefónica and Vodafone) held all the pre-existing low-frequency spectrum (900 MHz band).[25] Signals using lower-frequency spectrum travel further, making it less costly to provide coverage – fewer base stations can be deployed

with larger coverage footprints. The primary competition issue in 2013 was indoor coverage because signals at lower frequencies also tend to penetrate inside buildings more effectively (although this depends on a range of other factors as well, including building materials).

In competition assessments for other auctions, the UK regulator rejected calls for sub-caps, such as for either low-frequency or 5G spectrum in the 2021 auction. Applying the framework set out here, Ofcom concluded that the theory of harm was not strong enough to justify extra regulation. In part, this was based on a view in step 2 that operators with less low-frequency or 5G spectrum would be able to acquire it, as indeed subsequently happened (see Annex A5).

In many countries, use of spectrum caps is routine. Reservations to promote new entry are less common, and the experience has been mixed.[26] The UK provides a positive case of a sustainable entrant benefitting consumers through valuable contributions to market competitiveness. In France a new entrant (Free, a subsidiary of Iliad) initially obtained spectrum through set-aside in an administrative allocation. It undercut incumbents' prices and grew quickly in a retail market historically less competitive than the UK, to achieve a market share approaching 20 per cent.[27] However, there are also less successful examples. Set-aside failed to attract new entrants in Austria, the number of mobile operators has gone up and down over the years in the Netherlands, and there have been criticisms of spectrum reservation in Canada.[28] Reservation was used in Portugal's 2021 and Belgium's 2022 auctions, leading to two new entrants, but the overall success in promoting competition is not yet evident at the time of writing (in 2022).[29] To see how the framework can be applied to future circumstances or in different countries, the next section looks at an Australian case.

9.3 Cap and set-aside measures in Australia's 2021 auction

Australia's 2021 auction included a cap on low-frequency (sub-1 GHz) spectrum holdings and set-asides for two incumbent operators. At the time, Australia's mobile operators were Telstra (42 per cent retail market share), Optus (26 per cent), and TPG (17 per cent) – while the remaining 15 per cent was accounted for by MVNOs.[30] The auction included 70 MHz of low-frequency, paired spectrum comprising 20 MHz in the 850 MHz 'expansion' band and 50 MHz in the 900 MHz band. Three public organisations with regulatory functions were involved in the auction. The competition authority, the Australian Competition and Consumer Commission (ACCC), provided advice. The decision on competition measures was then made by the responsible minister, who directed the spectrum regulator, the Australian Communications and Media Authority (ACMA), to implement them in the auction. The minister decided to impose a cap on sub-1 GHz spectrum broadly in alignment with the ACCC's advice. But another decision was to set aside spectrum for two of the incumbent mobile operators (Optus and TPG), against the advice of the ACCC.[31]

Sub-1 GHz cap

For the sub-1 GHz spectrum cap, the ACCC in effect analysed steps 1 and 3 of the framework. Before the auction, Optus had 20 MHz of low-frequency spectrum, whereas Telstra held 60 MHz and TPG 50 MHz.[32] Under step 1 (downstream competition concerns), the ACCC concluded that, because Optus had the smallest pre-auction low-frequency holdings, its ability to compete would be constrained if it did not acquire more sub-1 GHz spectrum in the 850/900 MHz auction. This reference

to a constrained ability to compete suggests that strength of competition between operators from spectrum asymmetry was the concern, rather than Optus's credibility being at risk (although the ACCC did not make this distinction).

The public version of the ACCC's analysis contained no articulated discussion for step 2, the risk of the harmful outcomes occurring in the auction. Under intrinsic-value bidding, without competition measures, Optus failing to acquire spectrum could represent an upstream market failure. However, this would involve a judgement about the trade-off between auction and output efficiency. If the ACCC was concerned about strategic investment, a coordinated strategy seemed a more significant risk than a unilateral approach. Strategic investment coordinated between Telstra and TPG might well have provided a large enough combined expected payoff to offset the cost. The issue would be whether a focal point would enable Telstra and TPG to coordinate to acquire all the spectrum in the auction between them, and each obtain a reasonable net payoff. Two possible focal points for the 70 MHz available in the auction could be 40/30 or 50/20, with Telstra acquiring the bigger amount, given its larger expected payoff due to its much greater retail market share (42 per cent vs TPG's 17 per cent).[33]

By contrast, unilateral strategic investment could be costly, given Optus's high intrinsic value for the spectrum it would need to remain a strong competitor, thus requiring a commensurately large expected payoff to the strategic bidder. Telstra would be the more likely unilateral strategic investor because it might expect a larger payoff from weakened competition. But if Optus could outbid TPG, Telstra would need to acquire a large amount of spectrum. In the limit Telstra would need to acquire all 70 MHz in the auction to prevent Optus from acquiring any spectrum.[34]

Under step 3 of the framework, the ACCC concluded that a cap on sub-1 GHz spectrum of 40 per cent or 80 MHz would promote competition and investment. This cap would restrict Telstra to 20 MHz and TPG to 30 MHz or less, and so ensure that Optus could acquire at least 20 MHz in the auction (assuming it could outbid any other bidders). However, there was no explicit discussion of regulatory failure risks.

Why did the 2021 auctions in Australia and the UK treat caps on the sub-1 GHz spectrum differently, despite the regulators apparently using quite similar analytical frameworks? Compared to the UK, 'regional Australia' has a much more extensive, less densely populated geographic landmass (outside major population areas), where the advantages in wider area coverage provided by sub-1 GHz spectrum are especially important. Although there is a superficial similarity in having a cap level of around 40 per cent in both countries, in Australia's three-player market this constrained the distribution to be relatively more symmetric than required in the UK. The corresponding pragmatic logic in the UK of limiting the operator with the largest holdings to double the average of its competitors would imply a looser limit of 50 per cent. The ACCC provided little specific justification for the 40 per cent cap to restrict spectrum asymmetry. However, these are matters on which there is no definitive number, and it falls within a reasonable range for judgement about balancing the risks of market and regulatory failure. The minister broadly accepted this advice and directed the ACMA to impose a sub-1 GHz cap.[35]

Set-aside for Optus and TPG

The set-aside measures in Australia's 2021 auction were not about promoting new entrants. Instead the theory of harm related to Optus and TPG relying on the 900 MHz band for their 3G services.[36] This spectrum was already in use by the operators but was due to be cleared by 30 June 2024, and

would be reallocated in the 2021 auction for use after that date. The concern was that any failure of Optus and TPG to reacquire at least 10 MHz in this band would jeopardise the policy objective of continuity of service for their customers, especially in regional areas. The ACCC characterised this concern as primarily a competition issue, because an operator failing to provide service continuity could see the loss of its customers to rivals. So, 'Optus and TPG would have strong incentives to ensure that their customers would not experience service disruptions'.[37] The ACCC concluded that set-aside was not needed because the proposed sub-1 GHz cap would promote the policy objective by allowing both firms a reasonable opportunity to acquire some 900 MHz spectrum. An economic efficiency advantage would follow from allowing the auction 'to determine the value that Optus and TPG place on the ability to continue to provide existing services in the band'.[38] These points effectively fall under steps 2 and 3 of the framework.

The minister's explanatory statement disagreed with the ACCC's conclusion, but did not bring in any considerations additional to its analysis. Instead the minister reached a different judgement placing more weight on the risk to service continuity.[39] Three important aspects in the framework in Figure 9.4 were omitted in the minister's statement. The forward-looking scale of the concern (under step 1) was unclear. For example, there was no analysis of the number of customers that would still rely on 3G services in Australia by mid-2024 when the old 900 MHz licences ran out, taking account of any mitigating steps that Optus and TPG would have time to implement (such as migrating their customers to 4G devices).

A second omission was assessing upstream market failure: the risk that Optus or TPG would fail to acquire the spectrum they apparently needed for 3G service continuity (step 2 in the framework). This risk looked to be especially small because, with the sub-1 GHz cap in place, it was not feasible for Telstra to prevent both Optus and TPG from acquiring 10 MHz each. Recognising that both the 850 MHz and 900 MHz bands could be used for 3G, Telstra would have needed to acquire all 70 MHz in the auction – yet the cap limited Telstra to acquiring at most 20 MHz. There was an argument for focusing just on the 900 MHz band, given that the 850 MHz band may have been an imperfect substitute involving additional cost for 3G use (such as equipment changes). Even so, the cap prevented Telstra from acquiring the amount needed for successful strategic investment (more than 30 MHz of the 50 MHz available).

In effect, therefore, the set-aside was protecting Optus from TPG and vice versa, and not from the largest operator, Telstra. For example, it was theoretically possible for Optus to be denied 10 MHz. But it would have required Telstra and TPG to acquire all 70 MHz, by Telstra winning its maximum 20 MHz under the cap and TPG obtaining 50 MHz (or considering only the 900 MHz band, Telstra 20 MHz and TPG 30 MHz). This scenario would have involved TPG taking on a bigger share of any coordinated strategic investment against Optus. The expected payoff would have needed to be large enough to justify the cost of purchasing spectrum above its own intrinsic value (and this cost was likely to be higher in 900 MHz than 850 MHz to the extent it was more valuable to Optus by making service continuity cheaper). The auction regulator ACMA's chosen format was a version of an SMRA, a linear price auction, so that Telstra and TPG would have needed to pay the same high price, in excess of TPG's marginal value for 10 MHz, on all of the spectrum.[40] This would have seemed an unattractive prospect for TPG, especially as Telstra, a much bigger operator, might have gained a larger payoff.

A third omission from the minister's analysis was not assessing any downsides of imposing the set-aside (needed in step 3 of the framework), such as complications and potential unintended consequences from integrating set-aside into the auction design.[41] The ACMA's approach required Optus and TPG to decide whether to take up their set-asides before bidding started, so other bidders would

have certainty about the amount of unreserved 900 MHz spectrum they could bid for.[42] The ACMA decided to specify distinctive reserve prices for set-aside spectrum that were 25 per cent higher than the reserve prices for the rest of the band.[43] By definition, this was the final price because there could be no competition for spectrum that was reserved for individual, named operators. However, depending on bidding in the auction, the set-aside price could have turned out to be either lower or higher than the market price of unreserved spectrum, and the ACMA recognised concerns about both eventualities. If the set-aside price turned out to be lower, there could be a competitive advantage to Optus/TPG.[44] If higher, Optus/TPG would be disadvantaged by set-aside, because they would have been better off without it – which is what happened when the auction took place. Only Optus decided to take up its set-aside, and in the event it paid about $50 million extra as a result.[45]

The set-aside in this case can, therefore, be seen as a regulatory failure arising from the minister imposing his own view about both the scale of the 3G continuity issue and the risk of it occurring. The minister's decision that the set-aside was warranted was contrary to the competition authority's assessment, and also substituted for the commercial judgement of the operators which could have been reflected in their auction bids. A possible rejoinder might be that set-aside is a safeguard provision. If it merely imposed an outcome that would have occurred anyway, it should not cause distortions. However, in this case, the result was that set-aside was unnecessary for one of the supposed beneficiaries, TPG, which opted not to take it up, and it made the other 'beneficiary', Optus, worse off.

The Australian example is helpful in showing that gaps in explicit competition assessment can create costs even when established institutions with reputations for high-quality analysis are implementing policy. The exercise of comparing the analysis of the sub-1 GHz cap and set-aside in Australia against the analytical framework reaffirms the value of all three steps in the assessment recommended here. For example, steps 2 and 3 help to clarify what is at stake and the benefits from imposing the competition measure relative to the costs. They can mitigate a potential failing from competition measures that are more restrictive than necessary, which risks distorting the auction outcome for the industry in the upstream market and for the public in the downstream market.

Conclusions

Competition considerations play an important role when using spectrum auctions to award strategic assets in oligopolistic markets. The value of the three-step framework set out in this chapter is to assist in the inclusion of relevant considerations and to organise a process of consistent, structured judgement, while also guarding against adopting ineffective or unduly restrictive competition measures.

Notes

[1] Klemperer (2004, chapter 3, p.103).

[2] There are limited theoretical and empirical analyses of the relationship between spectrum concentration and consumer welfare. The model of oligopoly competition by Loertscher and Marx (2014) considers the implications of spectrum holdings for reducing network costs, and the model by Lhost, Pinto, and Sibley (2015) for capacity and network quality. The empirical results of Woroch (2020), using data from 700 areas in the USA, show an inverted-U relationship between spectrum concentration and subscriber penetration rates.

[3] Because some consumers had more than one subscription, the proportion of the UK population with a mobile phone was less than 78% in 2001/02. For UK population figures, see Office of National Statistics 'Mid-1851 to Mid-2014 Population Estimates for United Kingdom', https://perma.cc/47Z3-AN28.

[4] See, for example, the detailed analysis in Ofcom (2017, annex 1), and Ofcom (2020a, annex 3).

[5] The H3G/Telefónica merger decision in European Commission (2016) was later overturned by the courts on appeal – see EU General Court (2020).

[6] Competition and Markets Authority (2016, 2017).

[7] Ofcom (2020a, figure A3.4). These subscriber shares include MVNOs with mobile operator ownership, such as Tesco Mobile (a joint venture between Tesco and Telefónica).

[8] Ofcom regarded mobile spectrum as becoming useable once it satisfied three conditions: (i) it was allocated and could be used for mobile services; (ii) there were no major constraints on use (for example, due to co-existence with other spectrum users); and (iii) the device ecosystem was sufficiently developed, such as the band being included in popular smartphones — see Ofcom (2017, paragraph 5.14).

[9] Ofcom (2012b, section 4). Another possible criterion is spectrum that provides an operator with a route to deploying the latest technology, e.g. 5G as noted by Ofcom (2020a, paragraph 4.316).

[10] For studies on the effects of mobile mergers see, for example, Genakos, Valletti, and Verboven (2018), and Ofcom (2020g).

[11] Competition concerns can be identified either with or without a formal market definition exercise. For example, in Australia, discussed in Section 9.3, market definition was included in the analysis. By contrast, Ofcom chose not to define the market for the following reasons (Ofcom, 2012b; paragraph A3.41): its analysis directly assessed competition concerns, it was consistent with a range of possible market definitions whether a single or separate markets, and there was the risk of an artificially binary market boundary given product differentiation and the long forward-looking timeframe.

[12] The distinction between the two types of concern (loss of a credible operator and weaker competition arising from spectrum asymmetry) is one of the tailored aspects in Ofcom's framework compared to standard antitrust analysis. The precise dividing line between these concerns can be a matter of judgement. However, the distinction is useful in capturing a significant difference in expected seriousness of concern and broadly mapping to different competition measures (reservations to address credibility concerns, and caps for spectrum asymmetry concerns).

[13] Ofcom (2020a, annex 5).

[14] Ofcom (2017, figure A1.58b, annex 1).

[15] Myers (2013). One way this could arise is if larger operators already had a degree of downstream market power.

[16] Loertscher and Marx (2014) describe strategic investment as 'warehousing' and formally model foreclosure incentives.

[17] For example, Competition and Markets Authority (2021, section 7).

[18] The strategic bidder's payoff relates to the scenario of a less competitive market, which has been weakened by the strategic investment. However, the victim operator's intrinsic value – and hence the cost of strategic investment – relates to the scenario of a more competitive market without this weakening of competition.

[19] Achieving coordination legally may require implicit or tacit behaviour, because auctions usually have strict rules against *explicit* collusion, including preventing communication of auction-sensitive information between bidders – for an example of a proposed fine for breach of such rules in a 2020 auction in the USA (for rural broadband procurement), see FCC 'FCC Proposes $100K Fine Against LTD for Prohibited Communications', 3 May 2022, https://perma.cc/6T8N-S4BV.

[20] Other possible policy instruments to enhance competition include bidding credits, band plans, auction design, and antitrust enforcement, as discussed by Cramton et al. (2011).

[21] Ofcom (2017, paragraphs 7.45–7.57).

[22] For the 2013 auction, see Ofcom (2012b, section 4 and annexes 2–3).

[23] The analysis for the UK's 2018 auction was complicated by three relevant time periods, of which – for simplicity – only the 'first transitional period' is shown in Figure 9.5 (relevant to the cap on immediately useable spectrum, affecting acquisitions in the 2.3 GHz band). There were larger pools that included spectrum to be awarded not only in 2018 but also 2021 for the 'second transitional period' (916.9 MHz, relevant to the cap on total spectrum, affecting acquisitions in both auction bands), and for the 'longer term' (1,116.9 MHz). For a detailed explanation, see Ofcom (2017, section 6).

[24] European Commission (2010).

[25] The sub-cap was set at 42 per cent of low-frequency spectrum. Given pre-existing spectrum holdings, the size of each lot of the 800 MHz band in the auction (10 MHz) in effect offered a practical choice between setting the level of the sub-cap at 35 or 42 per cent. Ofcom decided to adopt the latter, less restrictive approach.

[26] For example, for caps on low-frequency spectrum in 15 European countries, see Cave and Nicholls (2017, table 1). For an indication of CCAs that included caps and/or reservation, see Mochon and Saez (2017).

[27] See MuniWireless 'Iliad-Free gets fourth mobile license in France, plans innovative pricing and services', 20 December 2009, https://perma.cc/UMD3-XH8A, and Wikipedia 'Free Mobile', https://perma.cc/7S9T-CGPR.

[28] See criticism before Canada's 2008 auction by Crandall and Ingraham (2007), and afterwards by Hyndman and Parmeter (2015).

[29] In Portugal's 2021 auction, six bidders won spectrum: the three incumbents (NOS, MEO, Vodafone), an operator with an existing wholesale 'neutral host' business model (Dense Air), and two new entrants (Dixarobil and Nowo). The entrants won 95 and 70 MHz of spectrum, comprising both set-aside spectrum (in the 900 and/or 1800 MHz bands) in the 'new entrant

stage' and unreserved spectrum (in the 2.6 GHz and 3.6 GHz bands) in the main stage of bidding – see ANACOM 'Results of auction bidding phases', 27 October 2021, https://perma.cc/2XUK-LHSA. In Belgium's 2022 auction, five operators won spectrum including two newcomers, one of which (Citymesh) obtained 110 MHz of spectrum, comprising 60 MHz of set-aside spectrum (in the 700, 900, 1800, and 2100 MHz bands) and 50 MHz of unreserved spectrum (in the 3.6 GHz band) – see Belgian Institute for Postal Services and Telecommunications 'Radio spectrum auction raises 1.2 billion euros', https://perma.cc/8PV5-CHSX.

[30] ACCC (2020).

[31] See ACCC (2021), and Australian Government: Department of Infrastructure, Transport, Regional Development, Communication and the Arts 'Allocation limits for Australia's next 5G spectrum auction', 9 August 2021, https://www.infrastructure.gov.au/department/media/news/allocation-limits-australias-next-5g-spectrum-auction.

[32] These were holdings in major population areas, while in regional areas Telstra had 10 MHz more and TPG 10 MHz less – see ACCC (2021, figure 2).

[33] Although it was not inevitable that diversion ratios for customers switching away from Optus to competitors would be in alignment with 2019–20 market shares, they provided a useful reference point.

[34] To the extent that the 850 MHz band was an imperfect substitute for 900 MHz spectrum (such as due to differences in geographic configurations), acquiring a large amount of the 900 MHz band could have been sufficient to weaken Optus as a competitor.

[35] The minister's decision varied the cap between 40% (82 MHz) in major population areas and 45% (92 MHz) in regional areas.

[36] In 2021 Optus also used its 900 MHz spectrum for 4G services on some of its sites. But the focus here is on 3G continuity, as 4G services were not reliant to the same extent on 900 MHz.

[37] ACCC (2021, p.19).

[38] ACCC (2021, p.20).

[39] Fletcher (2021).

[40] The version of SMRA was described as enhanced or 'ESMRA' – see ACMA (2021c).

[41] ACMA (2021a).

[42] ACMA (2021b), and ACMA (2021c).

[43] ACMA (2021b).

[44] ACMA (2021a, p.37).

[45] Optus paid $66 million more for set-aside in major population areas (where unreserved spectrum sold for the 20% lower starting price) and $13 million less in regional areas – see ACMA 'Spectrum allocation and auction summary – 850/900 MHz band (2021)', https://www.acma.gov.au/spectrum-allocation-and-auction-summary-850900-mhz-band-2021.

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Note: 🔓 means an open access publication.

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