

5. Applying expertise in decision-making processes

Summary

- Effective experts assist, rather than supplant, policymakers by having an inclusive perspective that grapples with practical challenges and acknowledges wider values. In turn, policymakers obtain dividends, such as avoiding embarrassing failures, from taking notice of well-chosen expert advice.
- Auction design can raise challenges for lay policymakers, such as under-confidence in using more complex solutions like the CCA design. Or there can be opposing risks of overconfidence in the relatively simple mechanics of sealed-bid auctions and the SMRA format, which can obscure their strategic complexities.
- Regulators can be blamed for spectrum auctions that are perceived as failures. Or blame can boomerang to politicians, such as when revenue was below expectations in the UK's 2013 auction.
- When allocating decision-making authority between political ministries and regulators, the balance differs depending on the policy issue at stake, such as coverage or competition. There are advantages for socially important mobile coverage extension judgements to be made by ministries, headed by politicians with democratic legitimacy. In contrast, independent regulators with specialist expertise are better placed to make more technocratic decisions about competition measures.
- There is a temptation to incorporate coverage obligations into auctions as a way of extending rural coverage. But this should be balanced with recognition of regulatory failure risks of overpromising and under-delivering. Such risks stem from behavioural biases of excessive attention on simplified headlines and limited attention on 'the devil in the details'.
- Other ways to improve coverage exist and can be preferable to obligations in auctions. For example, direct procurement in the 2020 coverage agreement between the UK government and mobile operators offered more in public value and economic efficiency.

(Contd.)

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(Continued)

- Litigation can result from contentious regulatory decisions. Expert witnesses can be most effective by shedding light (not heat) on the issues to assist the court, instead of focusing just on defensive advocacy.

This chapter explores challenges about applying expertise in practical decision-making processes, using a range of examples drawn from experiences in spectrum auctions. The first section covers the auction design, and subsequent sections address promoting downstream competition, extending mobile coverage, and the role of experts in litigation (taking the example of contentious competition measures). For narrative purposes, the stories are told in this order. Key points and cross-cutting themes are summarised in Figure 5.1. The columns show the three topics of designing the auction, promoting downstream competition, and extending mobile coverage. The rows show four cross-cutting issues: the role of experts, behavioural biases, blame and reputation management, and coordination between public organisations.

The role of experts in practical processes is present in all three topics in the first row of Figure 5.1. For auction design it illustrates differing demands of communicating rational-comprehensive analysis and sufficient use of expertise in incrementalist decision-making. In litigation about promoting downstream competition, the expert needs to translate mastery of economic analysis to the different arena of the courts where issues are framed to answer questions of law. For extending mobile coverage it is experts in spectrum engineering who can demystify complex technical dimensions of mobile coverage.

Experts can also play a role in mitigating risks from behavioural biases in human decision-making in the second row of Figure 5.1 (while recognising that experts have their own biases, such as from the world view of their professional norms).¹ There are potential biases of under- or over-confidence in the choice of auction format. For coverage requirements, the salience of headlines and limited attention on implementation details give rise to regulatory failure risks of overpromising and under-delivering.

Blame and reputation management in the third row are influenced by the issues that attract public or media attention. The revenue generated tends to dominate media reporting of auctions even though it is generally less important than economic efficiency and public value. Politicians were the unjustified blame magnet for revenue from the UK's 2013 auction falling £1 billion below the pre-auction forecast. It was unjustified because the forecast was made by an independent agency, it was the regulator not politicians that controlled the auction design and implementation decisions, and maximising revenue was not an auction objective. For mobile coverage extension, policy announcements can attract public credit. But potential blame for subsequent under-delivery is obscured by a disconnect from messy implementation details.

The last row in Figure 5.1 relates to coordination between public organisations. In general, organisations can suffer from selective perception, Achilles heels, and blind spots. Multi-organisational sub-optimisation can arise from turf wars.² Where there is a degree of policy interdependence, three specific types of problem can arise: information mismatch, overlap (or 'underlap') in authority, and policy inconsistency.³ Ministers are responsible for deciding competition measures in some countries, not regulators, which can pose problems of information mismatch. Mobile coverage is a policy area

Figure 5.1. Cross-cutting decision-making issues in Chapter 5

Issue	Designing the auction (Section 5.1)	Promoting downstream competition (Sections 5.2 and 5.4)	Extending mobile coverage (Section 5.3)
Experts	<p>Auction design experts communicating their rational-comprehensive approach to decision-makers.</p> <p>Incrementalism leading to flawed auctions without sufficient use of design expertise.</p>	<p>Antitrust expert witnesses adapting to the demands of litigation to shed light not heat for the court.</p>	<p>Engineering expertise clarifying complications of how to set and monitor coverage requirements.</p>
Behavioural biases	<p>Lay policymakers having under-confidence in the CCA format and overconfidence in the SMRA format.</p>		<p>Salience of headline requirements and lack of attention on complex implementation details leading to regulatory failure of overpromising and under-delivering.</p>
Blame and reputation management	<p>Blame boomerang to politicians from media attention on the 2013 auction revenue falling below expectations.</p>		<p>Credit from attention focusing on policy announcements, with complexities obscuring blame for under-delivery in implementation.</p>
Coordination between public organisations		<p>Coordination being required between organisations (as in Australia), or integrated decisions by a single regulator (as in the UK).</p> <p>Australia changing from the minister making the decisions to the spectrum regulator for auctions after 2021.</p>	<p>Overlap in responsibilities in the UK between the government and the regulator risking policy inconsistency.</p> <p>Policy tools differing between direct procurement by the government and coverage obligations by the regulator.</p>

Source: Author.

where the government and the regulator can have an overlap in authority (as in the UK) using different policy tools – direct procurement by the government, compared to coverage obligations imposed in spectrum auctions by the regulator – with an associated risk of policy inconsistency. Later sections of this chapter develop an argument for a contrast in allocating decision-making roles, striking a different balance between the values in play and specialist expertise. For socially important mobile coverage extension, there are virtues in direct procurement by ministries, headed by politicians with

democratic legitimacy. In contrast, independent regulators are better placed to make more technocratic decisions about competition measures. Consistent with this view, a change occurred in Australia to shift decision-making for competition measures from the minister to the spectrum regulator. The change reduced the required coordination between organisations. But two agencies are still involved, unlike integrated decisions by a single agency as in the UK.

After summarising these four cross-cutting issues, the rest of the chapter provides practical examples, starting with the topic of auction design decisions. The final section then draws out wider lessons for public policy.

5.1 Governance and expertise in auction design decisions

The Covid-19 pandemic highlighted questions about the role of experts in public policy decisions.⁴ This section assesses such issues for market design experts, whether external advisers such as leading scholars, or internal employees of the regulator. High-level lessons are for experts to see beyond their technical skills, and for policymakers to have access to sufficient expertise. In the first subsection, experts require skills in communication and influencing to mitigate risks of biases in decision-making from auction formats which have complexity front and centre (CCA) or less obvious (SMRA). A second set of difficulties is to combat outside challenges like low revenue falling below expectations, highlighting that the regulatory core skill set includes reputation management. The last subsection shows examples of the role for consensus-building, bargaining, and incrementalism. It illustrates risks for decision-makers without enough expertise to appreciate implications of the auction design choices.

Under-confidence in the CCA and overconfidence in the SMRA

Taking the CCA format first, the intention and basic ideas can be communicated and readily understood: package bidding to allow bidders to express synergies in their values for the spectrum in the auction, and a second-price rule seeking to incentivise straightforward bidding. But senior decision-makers probing beneath the surface or delving into greater detail, as they typically would in any major regulatory project, run into an unusual problem in my long experience in regulation across a wide range of disparate issues. Despite best efforts, it is genuinely difficult to explain some of the important intricacies of the CCA in a way that allows intelligent and experienced people, but non-experts in auction design, to feel confident about the depth of their understanding to make judgement calls. Examples include the following difficulties (see Section 8.1 and Annex B for detailed explanations of the CCA format):

- Thinking in terms of package bids and second prices is much less intuitive to most people than individual bids and pay-as-bid prices.
- In a package auction context, the meaning of highest losing bids to set second prices can be complicated (as an example, there are eight distinct highest losing bid components to Vodafone's price in the UK's 2013 auction).
- The winning spectrum allocation is determined using a 'black box' algorithm, which finds the best fit of the highest-value package bids to the available spectrum.

- The CCA has complicated mechanics. An example is the ‘activity rules’, which place restrictions on the bids that an operator is permitted to make depending on its earlier bids, such as not increasing the amount of spectrum bid for as prices rise. The intention is to encourage straightforward bidding. But understanding the detail requires a degree of expertise and is difficult for non-specialists.

The complications of the CCA can induce suspicion of ‘smoke and mirrors’. One type of reaction can be along the lines of ‘that’s very clever, but is it too clever?’. This refers to a general and reasonable concern that something could go wrong due to the complexity, such as mistakes in running the auction or bidders exploiting loopholes that are hard to foresee. Complexity similarly presents governance challenges for decision-making processes of bidders. One consequence is that an unusually high degree of trust is required by the decision-makers in the reliability and judgement of their experts, whether internal or external. Another is that the lesser degree of confidence about the depth of their understanding can lead regulatory decision-makers to be more susceptible to stakeholder pressure. Heavy stakeholder criticism can make decision-makers hesitant that they – or their experts – may be missing something.

Criticisms by operators can be a mix of meritorious points and rent-seeking intended to shift the design in their favour. Because every spectrum auction design has weaknesses, there are valid arguments that can be made against the CCA format. But there is also empirical evidence of higher prices in CCAs than in SMRAs.⁵ Bidders’ self-interest, sometimes combined with genuine concerns, can lead to vehement complaints about price-driving risks in the CCA. Price driving, a bid strategy designed to increase the auction prices paid by rivals, is a possibility, as explained in Sections 8.3 and 8.4. However, it is also the case that the main alternative format, the SMRA, is prone to demand reduction or market division (tacit collusion), which are types of strategic bidding designed to reduce auction prices. So price differences between CCAs and SMRAs could in part be explained by artificially low prices in the SMRA as well as, or instead of, unduly high prices in the CCA.

The CCA is certainly not an auction format to be adopted lightly and is especially risky for a regulator without sufficient access to expertise, including reputational exposure from its complexity and contentiousness. But the consequence of the pressures is that under-confidence in the CCA can be a barrier to its adoption, even in suitable circumstances. It is not an insuperable obstacle, as CCAs have been run in a range of countries including Austria, Australia, Canada, Denmark, Ireland, Mexico, the Netherlands, the Slovak Republic, Slovenia, Switzerland, Trinidad and Tobago, and the UK. But it remains a practical impediment to be overcome nonetheless.

The SMRA design presents an opposite governance challenge of overconfidence, which is a commonly observed feature of human decision-making.⁶ Despite the simpler auction mechanics, as explained in Section 8.2, bid strategies in the SMRA can suffer from complexities for bidders seeking to manage risks of aggregation if there are synergies. Substitution risk can also be a concern as it is possible for bidders to get stuck as the standing high bidder for lots they do not want. For the regulator, strategic bidding such as demand reduction and market division can be a threat to the auction objectives being successfully achieved. However, with the much more intuitive mechanics of the SMRA, there is a risk that decision-makers can be overconfident about the depth of their understanding and as a result underweight the weaknesses.

Part of the expert’s role is to counterbalance these contrasting risks of bias in the decision-making process through effective engagement, building rapport, and demonstrating trustworthiness and reliability. Far from hiding complexities or risks, they should be addressed directly through

explanation of their roles and benefits. Experts should also be attentive and responsive to policymakers' concerns and practicalities, even if they stray outside core analytical issues.⁷ Effective expertise is about carrying justified influence in policy debates, not just being able to apply the complex auction theory. A cartoon by Randy Glasbergen provides a cautionary tale, the opposite of what is required, of a man telling his wife over dinner: 'I gave a presentation today but I only pretended to know what I was talking about. Fortunately, my audience was only pretending to listen.'⁸

Money left on the table and blame magnets

For politicians engaged in the 'blame game', as well as presentational and policy strategies, blame can be shifted to public agencies through delegation of authority.⁹ Regulators have decision-making powers and are often blamed for unsuccessful auctions, such as criticism of Portugal's 2021 auction by the Prime Minister.¹⁰ However, blame can also boomerang, rebounding back to politicians.

An issue with CCA or sealed-bid auctions using the second-price rule is the potential for reputational embarrassment from the perception of money being left on the table. This is due to the gap between the amount of the winning bids and the prices. For example, the first spectrum auction in New Zealand used a sealed-bid, second-price format with no reserve prices. Some extremely low prices caused adverse publicity – as noted in Section 3.3, some winners paid less than 0.1 per cent of their own bids due to very large gaps to the highest losing bids. Even short of these extreme examples, Sky Network TV paid a price of NZ\$ 0.4 million each for three lots, representing only 17–18 per cent of its winning bids of NZ\$ 2.2–2.4 million.¹¹ However, the gap between prices and bids with a second-price rule, including in the CCA, is a feature not a bug. The rationale is that, in a simple case, it provides incentives for companies to bid straightforwardly at their full value.¹² A lower bid only reduces firms' chances of winning and does not affect the price they pay if they win, because the price depends on the highest losing bids made by other bidders. Because, by definition, losing bids are lower than the winning bids, a gap can arise in well-designed auctions, as shown in Figure 5.2 for the UK's 2013 auction. The operators that won spectrum in the auction are in the rows. The first column shows the bid amounts of the winning bids in millions of pounds. The second column shows the prices paid for the spectrum, set according to a second-price rule. The third column shows the gap – the price expressed as a percentage of the operator's winning bid.

Figure 5.2. The gap between winning bid amounts and prices in the UK's 2013 auction

Operator	Winning bid amount (£ million)	Price paid (£ million)	Price as a percentage (%) of winning bid
BT	340	186	55
EE	1,050	589	56
H3G	566	225	40
Telefónica	1,219	550	45
Vodafone	2,075	791	38
Total	5,249	2,341	45

Source: Author from Ofcom auction documents.

Note: Winning bids and prices are rounded to the nearest £ million

All of the information in Figure 5.2 was published by Ofcom at the end of the auction, showing a large gap as prices were only 45 per cent of winning bids overall. EE had the smallest gap but still paid only 56 per cent of its winning bid. Of course, the winning bids were as large only because the bidders knew that a second-price rule was being used. If a first-price rule had been used in the sealed-bid stage of the CCA, there would have been very strong incentives for 'bid shading', bidding below full value to obtain lower prices (balanced by bidders against reducing their chances of winning). Therefore, the use of a second-price rule does not mean that the prices paid are necessarily lower, despite the perception of leaving money on the table. For example, in an SMRA, the winning bidders do not have to bid up to their full value and need only to outbid the losers. Indeed, as noted previously, prices in CCA spectrum auctions tend to be higher.

The absence of a statutory objective for revenue-raising seemed to insulate Ofcom's reputation to a large extent from criticism or adverse publicity. For example, the report by the National Audit Office, an organisation whose role includes criticising public agencies for not obtaining value for money or a fair return on public assets, did not do so in this case. It recognised Ofcom's objectives derived from its statutory duties, and indeed suggested that promoting benefits from efficient use of spectrum were more important than maximising revenue.¹³ In the immediate news reporting at the time, there may have been a benefit from the complexity of the CCA. While all the information in Figure 5.2 was in the public domain, it was not presented in such a stark way, and it required people who knew their way around the data to put it together. Most countries running CCAs just publish the winning outcome of the spectrum allocation and the prices, not the winning bid amounts, meaning that the gap is never made public.

Another explanation for the relative lack of public criticism of Ofcom is that politicians provided an alternative blame magnet. The news reporting focused on the gap between the revenue of £2.3 billion and the pre-auction revenue forecast by an independent agency, the Office of Budget Responsibility, of £3.5 billion.¹⁴ Some analysts provided well-informed, more sophisticated commentary.¹⁵ But the general sentiment was summed up in a cartoon by Kip Williams of an auctioneer at a lectern with a gavel saying: 'What am I bid for this ritual humiliation of the Chancellor?'.¹⁶ As an objective assessment of the auction, this was hardly fair, as the Chancellor of the Exchequer, head of the UK finance ministry, neither designed the auction nor produced the revenue forecast, and economic efficiency matters more than revenue. However, the media and public reaction is not always objective, nor is blame necessarily a fair process.

Consensus, bargaining, and incrementalism: muddling through

Another dimension is the type of decision-making process that is in play. Section 4.1 described the models of rational-comprehensive decision-making and muddling through. The in-depth analysis of auction design in Part II reflects a rational-comprehensive approach. Here, aspects of muddling through are explored: consensus, bargaining, and incrementalism.

Consensus is internal to the regulator, initially at team level and then through governance. The multi-disciplinary team investigates, develops its analysis, works up options, and develops a preferred view (see Section 4.2 for coordination challenges in team dynamics). Internal experts are deeply involved throughout and external experts consulted at key points. Different professional skill groups make complementary contributions, such as economists, accountants, policy advisers, engineers, and lawyers. Disagreements are worked through, usually strengthening the analysis. Senior decision-makers are consulted individually and collectively, first to provide steers and stress-test the team's work, and then

for decisions. It is not that everyone will necessarily agree with all the decisions, but a good process will illuminate the debate, narrow the areas in dispute, and give all a fair opportunity to make their case.

Some elements of that process are also relevant to engagement with external stakeholders. It is good practice for consultation documents to articulate the issues, the available evidence, and the regulator's thinking. This assists stakeholders to set out what they agree and disagree with, and why. Mobile operators have their own expertise and often wide experience from participating in auctions in other countries. The regulator should take their points seriously, in some cases adjusting its analysis and in others giving reasons for rejecting stakeholder submissions. The reasoning can be detailed, both to provide a full explanation and in light of the litigation risk to a legal standard (in the UK) that includes taking due account of the merits, not just procedural concerns. However, there is not an expectation that the regulator will always reach consensus with stakeholders, who in any case usually hold divergent views as their interests are often in conflict. It is very rare that a regulatory decision is greeted with universal approval. The opposite is more common, as exemplified by the litigation discussed in Section 5.4 which included two appellants making opposing criticisms.

The UK's 2021 auction illustrated where bargaining and incrementalism could be part of the process. The initial phase was rational-comprehensive, with an innovative CCA design initially proposed in the December 2018 consultation that benefitted greatly from external expert advice on how to integrate the procurement of onerous coverage obligations (see Section 10.2). Then, bargaining entered the frame, as the government was in a negotiation process with mobile operators. They finally reached agreement in March 2020 on rural coverage extension (the Shared Rural Network), superseding the regulator's proposed coverage obligations.¹⁷

Taking coverage obligations out of the auction removed the key analytical rationale for a CCA. Therefore, the regulator proposed a different design using the SMRA format. So far, so rational-comprehensive for the auction design. The incrementalism was the extent to which the 2021 SMRA design was then refined by reference to the successful 2018 auction. On some specific issues, fresh analysis was needed (such as reserve prices). But for the rest, instead of a greenfield assessment from first principles, the analysis was largely in terms of similarities and incremental differences compared to circumstances in 2018. Some changes were made to the detailed rules, but the resulting auction design was very similar to that for the 2018 auction. Although different spectrum was being awarded, this incremental approach made sense in this case as there were many parallels. However, where circumstances are sufficiently different, an incrementalist approach can be risky.

The incrementalist approach is used more prevalently by some other regulators. For example, a horses-for-courses, rational-comprehensive approach is usual in the UK (and elsewhere, such as Australia, Austria, Canada, the Netherlands, Sweden, and the USA). But in Germany, for example, there is a different approach of sticking with a tried and trusted design in different circumstances, with only incremental modifications. Incrementalism carries risks if there is insufficient expertise to appreciate ramifications of the modifications. One illustration is the nine-month 2013 auction in Finland, referred to in previous chapters. It amended an established SMRA design used elsewhere in Scandinavia, with embarrassing consequences.¹⁸ Similarly, while the design elements of Portugal's 2021 auction were not novel, an unfortunate – yet predictable – confluence of features led to world-record bidding duration (see Section 11.2 for details). When announcing its decision on the auction design, the regulator had forecast the auction would finish in January 2021 – in fact, bidding only ended in late October 2021.¹⁹ The auction was heavily criticised, and some design flaws were pointed out during consultation. The moral of these stories is that *expertise matters*, even when seeking only to muddle through.

5.2 Coordination challenges for competition measures

In public policy decisions, is it better to have a single agency making decisions encompassing diverse aspects, or to coordinate across multiple public organisations? Taking the example of Australia, the process to set spectrum caps and set-aside in the 2021 auction was not integrated because decision-making was split between three organisations. The competition authority, the Australian Competition and Consumer Commission (ACCC), provided advice. The decision-making authority for competition measures resided with the relevant minister. The spectrum regulator, the Australian Communications and Media Authority (ACMA), then incorporated the caps and set-aside into the auction design and ran the auction.

In contrast, the independent regulator in the UK, Ofcom, analyses and determines the case for competition measures and also implements them in the auction design. Ofcom has expertise in competition analysis – for example, it is itself a competition authority for electronic communications, because the UK operates a concurrency regime for competition law, meaning that each sector regulator has jurisdiction in its industries, along with the general competition authority, the Competition and Markets Authority (CMA). In a number of other countries the spectrum regulator may not have the competition expertise to assess such issues. In Australia, due to legislative amendments, the involvement of the three public bodies was changed for later auctions, so that the decision would be made by the ACMA after consultation with the ACCC (and the minister only able to issue policy statements to be considered by the ACMA). The revisions to the Australian regime made it more similar to the UK's. A remaining difference is that the ACMA has to consult with the ACCC, whereas there is no corresponding requirement in the UK for Ofcom to take advice from the CMA.

Sequential versus simultaneous decisions

The nature of the linkages between decisions affects the challenges raised by a sequential approach to decisions, as in the old regime in Australia (analogously, when deciding whether to auction spectrum bands simultaneously or sequentially, demand linkages are a crucial consideration – see Section 7.4). One potential set of linkages is between decisions about competition measures and auction design. A rationale for imposing spectrum caps is to avoid auction outcomes that weaken downstream competition arising from strategic investment, an operator winning additional spectrum just to prevent its rival from acquiring it and being a stronger retail competitor. The incentive to engage in strategic investment can be affected by the choice of auction format. For example, due to different pricing rules, in the SMRA the strategic bidder pays a higher price for all the spectrum it acquires, whereas in the CCA the strategic investment can be less costly – and hence more attractive – as the higher price may only be for the additional spectrum. The auction format will often not be a deciding factor whether or not to impose a competition measure. But, if it is, there is the challenge of coordination across sequential decisions made by different agencies. Another possibility is the use of spectrum floors, flexible spectrum reservation as in the UK's 2013 auction. This type of competition measure involves more profound linkages between the competition assessment and the auction design. For example, the approach depends on the flexibility in the CCA format and may be hard to implement in other auction formats. Similarly, there can be risks of regulatory failures in implementing competition measures in the auction design – a specific example for Australia analysed in Section 9.3 is whether the reserve price for set-aside spectrum in the 2021 auction was higher or lower than the market price

for unreserved spectrum. Such risks are relevant to deciding whether the competition measures are proportionate to impose in the first place.

Therefore, the relevant linkages affect the most appropriate sequencing of decisions between competition measures and auction design. However, a sequence of decisions by separate agencies may be hardwired into the construction of the regime, not case-by-case assessment. In many cases there is not a tight interaction between the decisions, with the appropriate competition measure not strongly affected by the selected auction design, and vice versa. But there are situations where simultaneous decisions would be much more appropriate – which the revised Australian regime has enabled.

Specialist expertise and democratic legitimacy

Competition assessment for spectrum auctions is based on a tailoring of standard antitrust analysis (see Chapter 9). In a large number of countries the competition authority is an independent agency, separated from political control. In Australia, the ACCC and the ACMA are well-established and respected independent agencies with authority to make decisions within their respective statutory remits. Yet in the old regime for spectrum auctions, the minister made decisions on competition measures. This contrast is interesting, especially as agencies with specialist expertise are generally better suited to make more technocratic decisions like spectrum caps or set-aside. The direct democratic legitimacy that such agencies lack, compared to politicians, is less of a concern than for broader social or public value questions like mobile coverage, which is discussed later in this chapter. The rationale for the legislative changes for the revised regime in Australia explained that ‘the Minister will have less involvement in day-to-day spectrum management decisions that are more properly the responsibility of the regulator’. It also noted that the ACMA’s decision-making authority on competition measures was part of ‘granting ACMA greater independence and discretion in administrative processes’.²⁰

The old Australian regime fits with a broader historical theme of the way spectrum policy is often perceived, reflecting its origins in command-and-control regulation, with the role of markets only being grafted on later. Typically the spectrum regulator was initially part of a political ministry, and this remains the case in many countries (and applied in the UK until 2003). By contrast, in most countries there is a longer history of competition authorities being more independent agencies, reflecting the framing of antitrust and mergers as more technocratic and non-political (with important exceptions such as media mergers that often involve ministers in decision-making). While the most suitable approach depends on the country context, there are benefits in technocratic decisions being made by agencies with the right expertise.

5.3 The political economy of extending coverage

Insufficient or patchy coverage, especially in less densely populated areas, is a source of major public concern common to most countries. It reflects the importance of mobile communications to everyday life including the delivery of public services. Improved mobile coverage yields broad societal benefits but also incurs additional costs of network provision. Mobile coverage therefore combines both political and economic questions. This section first assesses the balance between market and regulatory failures in extending mobile coverage. Then it examines who is best placed to address this policy problem.

Coverage obligations in auctions: risks of market and regulatory failures

Insufficient coverage can be characterised as a market failure, especially with the inclusion of broader social value in the analytical framework, as explained in Section 4.1. For example, improved mobile coverage can: provide a safety net for emergency situations such as car breakdown or a medical emergency; increase social capital (value created by social relationships); promote sustainability of rural communities; and support improved provision of public services such as technology-driven solutions in healthcare.²¹ The extent of coverage that is commercially attractive for mobile network operators to provide, even where coverage is an important dimension of competition between them, falls short of public expectations. It is usually below the coverage level that maximises public value (although this also depends on costs, a key point that we will come to).

One policy instrument is direct procurement using government funding to obtain the desired level of mobile coverage. This can involve targeted funds, such as in Ghana, New Zealand, and Tunisia. Or there can be competitive tendering, as for universal service procurement auctions in the USA.²² Another example is that the Mexican government tendered for coverage improvements in 2016, offering use of the valuable 700 MHz band for a new, wholesale-only shared network, Red Compartida. The requirement of the operator winning the tender, Altán, was to achieve 92.2 per cent population coverage by 2024.²³ A further approach is for the government to reach agreement with mobile operators to extend mobile coverage, either with financial compensation or through other measures of value to operators (such as favourable variation in licence conditions), such as in France, Peru, and the UK.²⁴

A different policy instrument, commonly used throughout the world, is procurement through coverage obligations on mobile operators included as licence conditions for spectrum in auctions. Such obligations generally attract widespread public and cross-party political support, though often resistance from mobile operators. In the public debate during the policy development phase, there is interest in the headline features, such as the percentage of the premises, population, or landmass to which the obligations plan to extend coverage. Examples of variation in such headline obligations in the UK's high-stakes auctions are shown in the last column of Figure 5.3. All five licences awarded in the 2000 auction included an obligation for 3G coverage to at least 80 per cent of the population. In the 2013 auction there was one obligation for 4G indoor coverage to 98 per cent of premises. The obligations in the final row of Figure 5.3, achieved through direct procurement outside of an auction, were for 95 per cent coverage of UK landmass.

However, beyond the headline, the devil is in the detail for effective implementation and meaningful service delivery to mobile consumers. Crucial details include the technical engineering description of the quality of coverage to be provided, and sanctions for breaches of the obligations. Mobile coverage is not a simple binary concept and has various spectrum engineering dimensions. Examples are the probability of receiving a mobile signal, the ability to make just telephone calls or access data services, the speed of data services considered to be sufficient for good quality coverage, the contiguity or patchiness of outdoor coverage, and the extent of coverage indoors in homes and offices such as differences between reaching locations that are shallow or deep indoors.

An indication of these complexities and how the headline level of the obligation is far from a complete picture is provided by the obligation in the 2013 auction. The headline was 98 per cent indoor coverage: 'mobile broadband service for indoor reception to users in an area within which 98 per cent of the UK population live.'²⁵ However, the technical requirements in the licence condition formally specifying the obligation were about outdoor signal strength, not indoors. This was due to

Figure 5.3. Coverage obligations in the UK's high-stakes auctions including headline levels

Auction	Number of obligations	Headline level of obligations
2000	All 5 licences	80% population coverage of 3G by the end of 2007
2013	1 obligation	98% of premises with indoors coverage of 4G by the end of 2017 (Also: at least 95% in each nation: England, Northern Ireland, Scotland, and Wales)
2018	No obligations in auction	
2021	No obligations in auction, because superseded by the Shared Rural Network (SRN), a 2020 government agreement with all four mobile operators for 95% landmass coverage of 4G by the end of 2025	

Source: Author from Ofcom auction documents.

complications in verifying indoor coverage, which depends on the building materials and structure such as the thickness of walls. As explained by the regulator:

In practice, this means that in many premises a good service will be available in all, or a wide range of interior locations, although reception is likely to be best at locations closest to the exterior of the building. In some cases, where the style of construction of the building is more challenging, the service may only be available in a limited range of indoor locations, for example close to windows. We recognise, however, that in a few cases where buildings both are in difficult-to-serve locations and have challenging construction types, it may be impossible to receive a 2Mbps indoor mobile broadband service.²⁶

The consequence of the disparity between the headline and the detailed technical requirements was that the obligation did not guarantee the headline level of indoor coverage in all premises in the 98 per cent coverage area. Nor did it ensure mobile coverage deep indoors for these buildings.

Therefore, although attention being focused on the headline feature is understandable, it is only the tip of the iceberg and can give a false impression of the realised consumer experience. The complexity of the technical detail is a serious barrier to more precise public debate, despite the crucial implications for the coverage experienced by people in practice. It exacerbates the well-established behavioural bias of limited attention only on salient features, such as simpler headlines.²⁷ This situation of complexity and limited attention is a recipe for risks of regulatory failure from *overpromising* and *under-delivering*. The first reason is that the headline features of obligations could give a false impression of the realised consumer experience, such as the 2013 obligation not in fact providing 98 per cent indoor coverage. The relevant operator (Telefónica) complied with the obligation by the deadline of the end of 2017. It had more extensive 4G coverage than other operators, yet the regulator's measurement in 2018 was that it provided good quality indoor coverage to only 95 per cent of premises (with even lower coverage deeper indoors).²⁸ Another example is the obligation on all operators from the 2000 auction which did not specify a specific quality of 3G service for 80 per cent population coverage. It left open the possibility that compliance could be achieved by 'thin and crispy' coverage, instead of 'deep pan' coverage offering more meaningful 3G services to consumers. This was especially relevant because a downturn in the stock market meant that the operators were even more strongly incentivised than usual to minimise their costs of meeting the obligation.

A second source of regulatory failure is excessive attention on headlines that are not always tightly related to benefits. For example, obligations are sometimes specified in terms of landmass coverage (as in the 2020 agreement), but benefits can differ markedly depending on the way that coverage level is achieved. Mobile users are likely to gain greater benefits from operators achieving contiguous coverage by removing ‘not-spots’ in populated areas that have patchy coverage, compared to extending coverage to remote areas that people rarely visit.

Another risk is that headlines can be maintained at higher levels, attracting more favourable publicity, through watering down the technical specification of the required quality of coverage that is only visible to those with specialist knowledge. The wider public debate tends to focus on the benefits of more extensive coverage, but balancing benefits against costs is of great importance in the regulatory process to justify the obligations and engage with the concerns of the operators who expect to bear those costs. Hence, reducing the technical specification, and thereby lowering the cost to operators, can diminish the strength of their opposition to the obligations.

A fourth source of regulatory failure is the behavioural bias of treating headline policy development as the focus of public and political attention, disconnected from subsequent implementation which is left as boring details for the technocrats. An example is the methodology to measure operators’ 3G coverage levels and compliance with the 2000 auction obligations not being defined at the time. It was in fact only developed many years later and finalised in 2007, less than a year before the deadline for achieving compliance.²⁹ In assessing compliance, there can be aligned interests of all parties for the targets to be seen to be met: mobile operators to avoid sanctions and public organisations to demonstrate success. There is a risk of a ‘wilful blindness’ about whether reported ‘success’ masks measurement problems and gaming, or actually achieves the desired consumer experience of improved mobile coverage.³⁰

These endemic challenges of communication and regulatory failure do not necessarily mean that coverage obligations fail to deliver meaningful public value. But they point to significant risks of less than complete effectiveness (under-delivery) and unintended consequences. The best ways to manage the regulatory failure risks depend on the characteristics of the decision-maker for coverage obligations. The question of decision-making roles for political ministries and independent regulators is considered next.

Decision-making roles: technocratic issues and public value

The boundaries between the respective remits of ministries and regulators are usually not defined precisely, and there is typically overlap of policymaking authority. For example, Ofcom’s duties include ‘the availability throughout the United Kingdom of a wide range of electronic communications services’³¹ so that it can be the independent regulator deciding the coverage obligation, as in the 2013 auction. The relevant ministry is also active, reflecting the public importance of coverage concerns and perhaps also under-delivery from coverage obligations in auctions. For example, there was direct procurement in the form of agreements between the UK government and mobile operators to extend coverage in 2010, 2014, and 2020:

- In 2010, the 3G coverage obligations were increased from the 80 per cent level in the 2000 auction up to 90 per cent of the population. This was part of a package of measures, some of which enhanced the value of operators’ licences as compensation, such as changing the licences awarded in 2000 from having a fixed term to indefinite duration.

- In 2014, new obligations were introduced for voice and text coverage for each operator across 90 per cent of the UK landmass by the end of 2017.³²
- The 2020 agreement for a Shared Rural Network was for obligations to achieve 95 per cent landmass coverage for 4G services by the end of 2025. The mobile operators agreed to invest to remove nearly all ‘partial not-spots’ (where some but not all network operators provided coverage), and the government to provide more than £500 million to fund the elimination of ‘total not-spots’ (where no operator had good quality coverage).

In all three cases, the role of the independent regulator was to advise the government during the negotiations, implement the agreed coverage obligations through conditions in spectrum licences, and enforce the obligations.³³ For example, the regulator’s advice included technical details about the obligations, such as the quality of service that constitutes good coverage (which it assessed through evidence obtained in a programme of research). For the 2020 agreement, Ofcom had a further type of engagement in the process. The initial government expectations were that Ofcom would include coverage obligations in the 5G auction (ultimately held in 2021).³⁴ The government had a stated political objective of 95 per cent landmass coverage, which derived from the Conservative Party’s election manifesto.³⁵ In 2018, Ofcom proposed two coverage obligations but for only 90 per cent landmass coverage, raising the question of policy consistency.³⁶ This sparked the negotiation process between the government and the operators. The government was looking to achieve its 95 per cent target. Possible motivations of the operators to enter negotiations were a desire to reach a settlement with the government to resolve the ‘running sore’ of the coverage problem at least for a period of time, and to establish the principle of government funding for coverage extension. The operators also strongly preferred a different auction design than in Ofcom’s 2018 proposals.

Ofcom therefore contributed to the government’s bargaining position as a by-product of its proposed design to integrate coverage obligations into the auction (explained in Section 10.2), because it was disliked with varying degrees of intensity by the operators. The key source of operators’ concern was Ofcom’s proposal to use the CCA format (which, in particular, operators claimed would expose them to price driving – for views on both sides of this question see the discussion of under-confidence in the CCA in the first section of this chapter). The operators knew that agreeing a coverage deal with the government would remove the key analytical rationale for the CCA, and so lead the regulator to switch to a different auction design using the SMRA format that they much preferred. This is what happened.

When thinking about the best policy instrument to achieve public value of improved mobile coverage, there are superficial political attractions for governments of coverage obligations in spectrum auctions:

- In the blame game, the government can claim credit from directing the regulator to enhance mobile coverage, and leave the messy wrangling with the operators over complex implementation details to the technocrats in the regulator.
- The operators want valuable spectrum from the auction which induces them to take on the obligation without the need for explicit government funding.
- The implicit funding through reduced revenue from the auction due to the costs of the obligation is less obvious. It may not be transparent at all, depending on how the obligations are integrated into the auction design.³⁷

However, the 2020 coverage agreement illustrates some of the advantages of the alternative policy instrument of direct procurement:

- The decision-maker has political legitimacy to adjudicate appropriate levels of coverage and strike a balance between benefits and costs, avoiding policy inconsistency from independent agencies.
- The risk of distorting the efficient allocation of spectrum and/or the obligation is avoided. This can arise from including the obligation in the auction, because the most efficient, lowest cost provider of the coverage obligation may not have the highest value for the spectrum.
- In this case mobile phone users benefitted from the government agreement setting the level of the obligation at a much higher level than the regulator. As well as being 95 not 90 per cent, the agreement included all four operators whereas the regulator's proposals were for obligations on only two operators. The agreement included elimination of total not-spots, whereas the regulator's proposals focused on mitigating partial not-spots (which it considered had a more favourable cost-benefit balance).
- In part, this difference could have been because the government judged there to be larger benefits of extended coverage than the regulator believed it could justify.
- The agreement also achieved lower costs from the shared rural network between all four operators than the regulator could have ensured (as it was not within the regulator's powers to mandate such network sharing).

Risks of regulatory failure remain. The headline of the 2020 agreement was 95 per cent landmass coverage by the end of 2025.³⁸ But the detailed obligations were different: each operator to provide 88 per cent coverage by 30 June 2024, and 90 per cent by 30 June 2026, subject to certain conditions including the provision of government funding.³⁹ There was engineering modelling analysis linking the two, suggesting that each operator achieving 90 per cent would lead to collective achievement of 95 per cent coverage due to some non-overlapping operator coverage areas.⁴⁰ But what would actually be achieved on the ground remained to be seen. Another point is that the obligations were built around 4G, not the latest 5G technology that may be more in line with public expectations by the mid-2020s.

A further question is the cost-benefit balance for 95 per cent landmass coverage. The reason why Ofcom's 2018 proposals were for obligations at the lower level of 90 per cent was it considered that the incremental benefits of going beyond 90 per cent were unlikely to justify the incremental costs. Specifically, it took the plausible view that incremental benefits are expected to decline with higher coverage levels, because areas successively added have lower population density and are more remote. On the other hand, for similar reasons, it estimated that incremental costs would increase with higher coverage levels.⁴¹ The regulator asked itself a break-even question of whether it was likely that the incremental benefits would match or exceed the estimated costs. This is an example of structuring the required judgement in an impact assessment to assist reasoned decisions, neither gut feel nor spurious quantification (see Section 6.1).

The use of a shared network in the agreement lowered costs compared to these estimates. Also, different views can reasonably be taken about the scale of benefits as they involve much policy judgement. These considerations could change the incremental cost-benefit balance for greater landmass coverage compared to the regulator's view. Even if so, incremental public value per person living in or visiting remote rural areas would need to be large to justify the higher incremental costs of the last

few percentage points up to 95 per cent landmass coverage. Given the origin of the political target, there was a risk of retrofit by the government, a practice sometimes labelled as ‘policy-based evidence making’ (as a contrast to the rational-comprehensive approach of evidence-based policymaking). More positively, the 2020 agreement seemed to avoid some sources of regulatory failure. The required quality of service for good coverage followed the regulator’s advice.⁴² Also, a detailed compliance methodology was specified at the time of the agreement.⁴³ Measurement problems and gaming to achieve the target remained as future compliance questions.

Overall, coverage obligations in auctions implemented by the regulator can be an appropriate policy instrument. However, sometimes the hard slog of direct procurement by a political ministry with democratic legitimacy can achieve higher public value at lower cost. Whichever policy instrument is chosen, risks of regulatory failure from communication challenges are hard to avoid, due to complexity and limited attention. But they can be mitigated by joining up expert technocratic advice on implementation challenges with policy development, using appropriate technical specifications, and aligning headline requirements with beneficial consumer experiences on the ground.

5.4 Litigation: the expert’s role in court battles

Policy is developed for all major spectrum auctions in the UK in the shadow of litigation threats from mobile operators dissatisfied with the balance being struck by the regulator. For example, before the 2013 auction the government took steps to corral operators not to litigate and delay that auction. An appeal process was initiated before the 2021 auction, although it was not taken forward after the deferral of the auction arising from the Covid-19 pandemic. The 2018 auction was, however, delayed by around four months due to litigation at both the High Court and the Court of Appeal of Ofcom’s decisions on spectrum caps. One mobile operator (EE) challenged a cap as being too stringent. The appeal by another operator (H3G) was the opposite, that the cap was too lax. The episode ended happily for the regulator as the court judgment decisively supported its reasoning and decisions on spectrum caps.⁴⁴

In UK court proceedings there are witnesses of *fact*, who report events or information within their own knowledge, and *expert* witnesses who provide their professional opinion. In some proceedings, experts are appointed by the court or jointly by both claimants and defendant. However, in regulatory civil litigation, the various experts are employed by each side. The experts for the claimants set out reasoning supporting the cases being put forward to challenge the regulator’s decision, to which the expert for the regulator responds. It has been the consistent practice of Ofcom mostly to use as experts its own internal senior specialists who worked on the contested decision.⁴⁵ There is regular litigation of Ofcom decisions, so that I had the dubious pleasure of becoming experienced as an expert witness in a range of cases, including the litigation of spectrum caps. This particular High Court case involved only written expert evidence, with no oral cross-examination (unlike cases in the specialist tribunal, the Competition Appeal Tribunal, which hears many other regulatory cases). Regardless of who pays expert witnesses, they have a duty to assist the court that overrides any obligation to their clients.⁴⁶ Their role is to provide unbiased, reasoned analysis. They make a statement of truth, including a signed declaration that their report represents their ‘true and complete professional opinions.’⁴⁷ Some courts seem to allow more leeway than others in strict adherence to these responsibilities of the expert.

For an expert witness focusing on public value with no commercial interests, this set-up means that attributes which are often undervalued or even regarded as naive in other contexts are especially

important, such as balance, neutrality, perspective, calmness, and patience. The overall court process is adversarial, but an expert who is a truth-seeker proactively wishes to help the court, not advocate for a particular view. If good arguments are made against a point in the decision, they should be acknowledged. Issues involve trade-offs, so there are arguments and evidence on both sides of the debate. Moreover, in litigation it is inevitable that more arguable points will often be the focus of the claimants as that can increase their chances of success. If the regulator's decision is soundly based, there will be reasoning to counterbalance the challenge. If not, then it may be right for the point to be overturned (although this will generally also depend on other factors, such as its importance to the overall conclusion).

Section 3.3 described how experts can help the regulator reach decisions through drawing out intuition, explaining interaction between different parts of the analysis, and highlighting points that matter the most. There is a parallel with expert witnesses fulfilling their duty to assist the court. One of the more helpful tasks is to clarify areas of agreement as well as disagreement, instead of point scoring against the opposition. Experts can bend over backwards to characterise fairly the arguments to which they are responding, or even put forward a more coherent version: a 'steel man' not a 'straw man'.⁴⁸ This facilitates the court sorting the 'wheat' of the points it needs to decide from the 'chaff' of the often voluminous detail in the litigation documents.

Based on my involvement in a range of regulatory litigation, I have observed an apparent market failure in the employment of experts arising from behavioural biases of the client's emotions. Many clients seem to favour witnesses that they see as fighting their corner, advocating their case. Yet the relevant audience deciding the judgment is the court. Advocacy from experts is rather less effective and influential with the court compared to the neutral approach just described. Experts can strengthen their credibility and independence by going out of their way to present both sides of the story and to acknowledge good points made by opponents. Experts taking this approach are only likely to have a winning strategy where their case is sound. But if not, there may be no winning strategy. Nor perhaps should there be, when we are seekers after truth.

A degree of humility is warranted as the quality of the decision and the merits of the legal challenge matter rather more to the conclusion than the performance of the experts on each side. In this litigation, the regulator's decision being defended was thorough, careful, and nuanced, and whether affected by expert evidence or not, it survived the challenges.⁴⁹ The regulator's decisions on spectrum caps for the 2018 auction were therefore validated. More generally, this type of accountability strengthened the regulator's reputation for competition analysis in auction design, one of its core competencies. To the extent it affects the outcome, being persuasive as an expert witness in these types of court proceedings is less about defensive advocacy (which is instead the role of the lawyers) than balanced, dispassionate, and constructive analysis. At the heart of experts' effectiveness is adapting from the prior policy debate to understand that the essence of their role in this different legal arena is assisting the court to reach its decision.

5.5 Wider lessons for public policy

This chapter has drawn on practical experiences of decision-making processes in spectrum auctions on the topics of auction design, competition measures, and mobile coverage. The examples illustrate cross-cutting policymaking challenges for the role of experts in mitigating behavioural biases, playing the blame game, allocating decision-making authority, and coordinating between organisations. Such challenges arise in public policy processes far beyond spectrum auctions.

For example, experts can strengthen their role by engaging in the communication challenge of influencing pragmatic and political processes for public policy development. Effectiveness in market design depends on combining deep understanding of scholarly research with practical know-how and an eclectic, inclusive perspective to grapple with wider values and policy challenges in the public sphere. Policymakers have their own priorities and preoccupations, and effective experts *assist* their decision-making, and do not supplant them. Similarly, albeit in the rather different context of litigation, experts interested in public value can be most effective by adapting to different demands of the legal arena, fulfilling their role to assist the court and shed light (not heat) on the debate.

In turn, decision-makers can benefit from paying attention to effective experts. Spectrum auctions provide ample examples of why experts can be important to good policymaking. When incrementalism has been adopted for particular auction designs, it has led on occasion to bad experiences – even when muddling through, *sufficient* expertise is needed to appreciate the risks and avoid embarrassing failure. Such examples emphasise that policymakers shutting out expertise can be problematic, and taking notice of well-chosen expert advice can pay dividends.

The UK experience also shows that policy tools that seem *convenient* are not necessarily the most effective. Coverage obligations in spectrum auctions seem an easy policy vehicle to achieve improvements in mobile coverage. But there has been a chequered experience in the UK. Direct procurement by a political ministry has grown in importance over time, and has advantages. The 2020 agreement between the government and mobile operators illustrated how direct procurement can achieve greater benefits (such as higher coverage levels by more operators, and avoiding risks of distorting the spectrum allocation in the auction) and lower costs (improved cost efficiency through network sharing).




The bounded rationality of public decision-making is explored in the developing field of study of behavioural public administration. Spectrum auctions provide examples of *biases* in decision-making processes for both design choices and coverage obligations. The biases arose from overconfidence or focus on headlines where complications were beneath the surface. Or conversely from under-confidence or limited attention where complexity obscured effectiveness. For example, there can be overconfidence in the SMRA format, as its mechanics are intuitive, whereas strategic complexities for bidders are beneath the surface. In contrast, the CCA design can suffer from under-confidence due to the heavy machinery of its complicated mechanics masking its suitability in relevant circumstances (such as package bidding allowing bidders to express large synergies in their values for spectrum in the auction). Biases in determining target levels for increased mobile coverage can arise from excessive focus on headlines and limited attention on complex engineering details that affect the quality of services experienced by the public. There are practical examples of overpromising and under-delivering. Behavioural features are endemic to human decision-making when a need for judgement is paramount. But recognising when biases are present can assist to mitigate some of the worrying implications.

There are contrasting examples of reputation management and the *blame game* in public policy, which are interrelated with behavioural biases. Public credit can be earned from headline coverage requirements that sound more ambitious, contributing to the risk of overpromising. Conversely, the episode of media reporting of the 2013 auction revenue falling £1 billion below the pre-auction forecast showed politicians being an unjustified blame magnet – the forecast and design decisions were made by independent public bodies, and revenue-raising was not an auction objective. The media focus on revenue in reporting about auctions is itself a bias towards simpler headlines. Limited attention is paid to the greater complexity of economic efficiency and public value outcomes, which are nevertheless often far more important.

There are choices to be made for the allocation of decision-making authority between public organisations. As shown for the examples of competition and coverage decisions in spectrum auctions, there is a balance to be struck between *values* and *expertise*. The regulator has relevant specialist expertise for both, but the nature of values in play differs. Decisions on competition measures like spectrum caps and reservations are more technocratic. As such, there are benefits of independent regulators making these choices instead of political ministries (a change that occurred in Australia in 2021), whereas broader public values make the democratic legitimacy of politicians more central to judgements about socially desirable mobile coverage.

Overall, the successes of spectrum auctions show the *benefits* of markets. But the examples of failures also demonstrate the *risks*. Well-judged use of market design expertise can help to avoid embarrassing failures. It can substantially increase the chances of achieving successful outcomes to benefit the public, industry, and the economy.


Notes

- ¹ For example, Banuri, Dercon, and Gauri (2019) find evidence among UK government and World Bank policy professionals of confirmation bias driven by ideological predisposition.
- ² Wilson (1989), and Wegrich (2019).
- ³ Koop and Lodge (2014).
- ⁴ For example, in the UK the Scientific Advisory Group for Emergencies, <https://www.gov.uk/government/organisations/scientific-advisory-group-for-emergencies> .
- ⁵ For national licences, Koutroumpis and Cave (2018) report a much higher average price for ‘CCA with core pricing’ than for ‘standard SMRA’ (although ‘SMRA with augmented switching’ is much closer). Ihle, Marsden, and Traber (2018) find significantly higher prices with the CCA for low-frequency spectrum (sub-1 GHz) but not for capacity spectrum at higher frequencies.
- ⁶ Malmendier and Taylor (2015), and for public managers, Battaglio et al. (2019).
- ⁷ See the foreword by Evan Kwerel in Milgrom (2004).
- ⁸ See the cartoon by Randy Glasbergen, <https://perma.cc/YTX9-4WQ3> .
- ⁹ Hood (2002).
- ¹⁰ See Reuters ‘Mired in disputes, Portugal’s 5G auction drags on with no end in sight’, 22 October 2021, <https://www.reuters.com/business/media-telecom/mired-disputes-portugals-5g-auction-drag-with-no-end-sight-2021-10-22/> .
- ¹¹ A key problem with the design in New Zealand was that the licences were awarded at the same time but in separate, unlinked auctions that prevented bidders from taking account of them being substitutes or complements – see Milgrom (2004, p.12). In contrast, the CCA and SMRA formats award licences in a simultaneous process.
- ¹² There is also no gain from bidding above full value with a second-price rule, because this only increases a bidder’s chances of winning when it is loss-making. An illustrative example is a bidder with a value of 100, winning by making a bid of 120. Either the highest losing bid is less

than 100, such as 80, in which case it would have won with a bid of 100 and paid the same price of 80. Or the highest losing bid is more than 100, such as 110, in which case it pays a price of 110 which is higher than its value of 100 leading to a loss of 10.

¹³ National Audit Office (2014, p.23).


¹⁴ Office of Budget Responsibility (2012).

¹⁵ See Tim Harford ‘Don’t blame Ofcom if the 4G price isn’t right’, 20 February 2013, <https://perma.cc/69DB-GLU9> .

¹⁶ See the cartoon in The Guardian ‘Kipper Williams on the disappointing 4G auction’, 21 February 2013, <https://perma.cc/UDS3-KLEU> .

¹⁷ Department for Digital, Culture, Media & Sport (2020), and Shared Rural Network, <https://srn.org.uk/> .



¹⁸ The design problem in Finland related to bid withdrawals – see DotEcon (2019, pp.48–49).

¹⁹ See ANACOM ‘ANACOM announces conditions of the auction for 5G and other relevant bands’, 12 November 2020, <https://perma.cc/R5JV-5CZG> .

²⁰ Australian Parliament (2020, pp.1 and 32).

²¹ Ofcom (2018b, paragraphs A11.57–A11.72).

²² Kwerel et al. (2017, section 3).

²³ The Mexican Government’s website for the shared network is at <https://www.gob.mx/promtel/acciones-y-programas/red-compartida-255015>,  and the operator’s at <https://perma.cc/4HVB-V9D3> .

²⁴ See GSMA ‘Expanding Mobile Coverage – Partnerships for a Connected Future’, <https://perma.cc/J7C3-FR25> .

²⁵ Ofcom (2012b, paragraph 1.22).

²⁶ Ofcom (2012b, paragraph 5.31).

²⁷ DellaVigna (2009, section 4.2).

²⁸ Ofcom (2018c, figure 6).





²⁹ Ofcom (2007a).

³⁰ Bevan and Hood (2006).

³¹ Communications Act (2003, section 3(2)(b)).










³² Department for Culture, Media & Sport (2017b).







³³ For the 2010 agreement, Ofcom was directed by the Minister for Culture, Communications and Creative Industries (2010), and compliance is set out by Ofcom (2013). For the obligations agreed in 2014 and 2020, see Ofcom (2020d). The government retained a role in enforcement of the 2020 obligations due to the provision of public funding.

- ³⁴ Department for Digital, Culture, Media & Sport (2019).
- ³⁵ The Conservative and Unionist Party Manifesto (2017, p.78).
- ³⁶ Ofcom (2018b).
- ³⁷ For example, if the obligation is pre-attached to spectrum and there is other spectrum in the same band unencumbered by an obligation, the difference in bids by a bidder can indicate its expected cost of the obligation. But if obligations are attached to all spectrum in the band, the cost is not transparent.
- ³⁸ Department for Digital, Culture, Media & Sport (2020).
- ³⁹ Ofcom (2020d).
- ⁴⁰ See Shared Rural Network ‘Forecast Coverage Improvements by Region’, <https://srn.org.uk/forecast-coverage-improvements/> .
- ⁴¹ For example, estimated cost of £108–139 million for the increment of 90% to 92%, compared to £85–107 million for the increment of 88% to 90% – see Ofcom (2018b, annex 12).
- ⁴² The coverage requirement was defined in the 2020 obligations as ‘an electronic communications network that provides with a confidence level of more than 95% a mobile telecommunications service to users (i) with a sustained downlink speed of not less than 2 megabits per second, and (ii) on which 90 second voice calls can be made without interruption’ — see the definition of ‘Required Service’ in operator licences for spectrum in the 1800 MHz band, such as Ofcom (2020e, p.6).
- ⁴³ Ofcom (2020b).
- ⁴⁴ High Court (2017); subsequently, the Court of Appeal refused permission to appeal to H3G.
- ⁴⁵ This has given rise to claims that Ofcom witnesses should not be regarded as experts, which the courts have generally rejected. An example is Competition Appeal Tribunal (2014, paragraph 72): ‘Mr Myers was responsible for overseeing the economic analysis in the Determination, and to that extent his evidence was in part as a witness of fact.... In addition, however, Mr Myers gave evidence also as an expert economist. It was put to him that he was appearing as the “champion of Ofcom” to defend the Determination but Mr Myers denied this and said that he was very conscious of his duty to the Tribunal. We accept that answer and do not find that the fact that he was employed by Ofcom impeded his objectivity.’
- ⁴⁶ See Ministry of Justice ‘Rules and Practice Directions: Part 35 – Experts and Assessors, Rule 35.3’, <https://perma.cc/SH6Z-3E8Y> .
- ⁴⁷ See The Academy of Experts ‘Expert Declarations’, <https://perma.cc/S35L-T9WW> .
- ⁴⁸ See Issuepedia ‘Steel man’ <https://perma.cc/L4HB-GLFZ> .
- ⁴⁹ Examples from High Court (2017, paragraphs 155 and 183) are: ‘the reasoning in the Decision for the 37% cap was good and solid reasoning on its own merits’; and ‘Ofcom had a perfectly sensible and rational basis for ex ante regulation.’


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Note:  means an open access publication.

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