




Spectrum Pricing

GSMA Public Policy Position

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Executive Summary



To deliver affordable, high quality mobile broadband services, operators require fair access to sufficient radio spectrum. As a result, governments and regulators carefully manage mobile spectrum, which in turn supports a vibrant digital economy. Sometimes this includes charging a price for access to spectrum to encourage efficient use. However, evidence shows that when prices are too high, consumers can suffer from more expensive, lower quality mobile services.

The issue of spectrum pricing has never been more vital. Additional spectrum is central to expanding and upgrading mobile broadband services – and will be core to the success of 5G. However, instances of spectrum licences being sold for extremely high prices, or going unsold due to the cost, are becoming more common. These outcomes undermine consumer mobile services and the wider digital economy. The cause of these extremely high prices are typically policy factors that appear to prioritise maximising short-term state revenues above long-term support for the digital economy through improved mobile services.

Spectrum is a valuable state asset and governments have the option to use it to raise revenues to fund vital state activities. However, the primary goal in all awards should be to encourage the most efficient use of spectrum through investment in widespread, high quality networks. Efficient spectrum awards maximise access to affordable mobile broadband services, which in turn have a major impact on the digital economy. Evidence shows that higher state revenues from excessive spectrum pricing are outweighed by losses incurred to the digital economy.

Many countries around the world successfully strike the right balance between raising revenues and delivering efficient spectrum awards. However, those countries that make maximising revenues a top priority are putting their national mobile services, and the overall digital economy, at risk.

This paper outlines the GSMA's key spectrum pricing positions:

- 1. High spectrum prices threaten affordable, high quality mobile broadband services**
- 2. Governments should prioritise improved mobile broadband services – above revenue maximisation – when awarding spectrum**
- 3. Avoid limiting the supply of mobile spectrum, publish long-term spectrum award plans and hold open consultations**
- 4. Set modest reserve prices and annual fees, and rely on the market to determine spectrum prices**
- 5. Avoid creating unnecessary risks that put operators' current or future services in jeopardy**
- 6. Consult with industry on licence terms and conditions and take them into account when setting prices**
- 7. Auctions must be well designed and implemented to be an effective award mechanism**
- 8. There is no single best approach to estimating the value of spectrum and international benchmarks should be used with caution**
- 9. Spectrum pricing decisions should be made by an independent regulator in consultation with industry**
- 10. The rise in the total cost of spectrum is a threat to mobile broadband growth – especially 5G**



Background

In most cases, an up-front price is paid for spectrum licences, normally at auction but occasionally through administrative awards such as beauty contests.¹ Licensees also normally pay an annual fee to cover the costs of managing spectrum. In some cases, the annual fee can be higher where licences have been renewed without an up-front cost, or where lower up-front charges were applied.

The primary goal of charging a fee for spectrum is to award spectrum to those who will use it most efficiently to deliver the maximum benefits for society. In this way, a well-designed auction will assign spectrum to those who value it most, thus incentivising them to use it efficiently through investment in widespread, high quality mobile networks. However, charging for spectrum can also provide substantial state revenues. This can lead governments to seek to prioritise maximising revenues by artificially inflating spectrum prices – at the expense of efficient spectrum use and the wider economy.

There are several ways governments and regulators can inflate spectrum prices. Most notably, they can set excessive reserve prices (ie. the minimum amount paid for spectrum sold at auctions). They can also restrict the supply of spectrum, or set an inappropriate auction design or lot sizes. Outside of auctions, they can directly set high prices for annual spectrum fees or administrative awards.

Globally, spectrum prices reached all-time highs with the 3G auctions at the start of the millennium, before falling gradually until 2007. From 2008-2016, when 4G auctions became common, the average final price paid for spectrum sold at auction increased significantly – by 3.5 fold.² This average rise was largely due to the increase in awards of sub-1GHz bands, which tend to be more valuable, higher reserve prices³, as well as a number of outlier auctions where final prices were extremely high.

These extremely high price auctions were typically the result of national policy decisions, including setting excessive reserve prices, making insufficient spectrum available for auction, and a lack of clarity on future releases or the process of renewing expiring

licences. Such factors can create uncertainty, artificial scarcity of spectrum and encourage excessive bidding above operators' true valuations of the licences on offer.⁴

A key consequence of very high prices can be unsold spectrum. In-demand digital dividend spectrum - which has propagation characteristics that make it ideal for connecting billions of unconnected people to the Internet – has gone unsold in several developing markets⁵ due to excessively high reserve prices. Failure to assign this spectrum stalls the development of broadband services, especially in rural areas, impacting citizens and the economy.⁶

High spectrum prices also have other serious consequences for consumers. A recent study linked high spectrum prices with more expensive, lower quality mobile broadband services. It also showed that increased treasury revenues from higher spectrum prices were outweighed by consumer welfare losses from more expensive mobile services.⁷ Several other recent studies also support these findings.⁸

These studies contradict earlier research that used classical economic theory to conclude that spectrum costs are 'sunk' and are therefore unable to impact consumer prices and network investment.⁹ One such recent study used behavioural economics, financial theory and economic theory to prove that high spectrum prices affect consumer pricing and network investment.¹⁰ This means high spectrum prices may be regarded a 'deadweight loss' tax given they cost more to the wider economy than they raise in additional state revenues.

Policy makers' approaches to spectrum pricing range from those who focus on maximising revenues to those for whom revenue raising is of lesser or no importance. In general, most countries seek to generate some revenue from spectrum but their statements as well as their policies show that revenue is secondary to an efficient award. This is especially the case in more developed mobile markets, such as Sweden and Germany, where encouraging efficient assignments and investment in high quality networks are the top priorities.

1. In beauty contests, governments or regulators directly award licences based on various criteria. But determining and applying the criteria is complex and outcomes can be subject to bias, so auctions are now more prevalent.

2. 'Effective Spectrum Pricing: Supporting better quality and more affordable mobile services' by NERA Economic Consulting (2017)

3. Reserve prices increased over five-fold in this period

4. Ibid – NERA (2017)

5. In 2016 alone, part or all digital dividend mobile spectrum went unsold in Ghana, Senegal and India

6. The economist Jerry Hausman valued the consumer welfare loss from a 7-10 year regulatory delay impacting mobile services in the US at up to \$24.3bn a year (in 1983 dollars).

7. Ibid – NERA (2017)

8. 'The effects of spectrum allocation mechanisms on market outcomes' by T. Kuroda and M. Forero (2016) found that 'auctions, when used to raise public revenues, not only transfer profits to government but also sacrifice consumer surplus'. A Policy Tracker study for the European Commission (2017) concluded that countries with low spectrum auction prices, long licence lengths and less onerous coverage obligations tend to have better network coverage, a wider choice of services, better take-up and healthy competition. Spectrum 5.0: Improving assignment procedures to meet economic and social policy goals by Gerard Pogorel and Erik Bohlin recommended governments prioritise mobile network investment rather than maximizing spectrum fees

9. Evan Kwerel, Federal Communications Commission, 2000, Spectrum Auctions Do Not Raise the Price of Wireless Services: Theory and Evidence

10. Ibid NERA (2017)

Positions

1. High spectrum prices threaten affordable, high quality mobile broadband services

High spectrum prices are associated with more expensive, lower quality mobile broadband services and irrecoverable losses in consumer welfare worth billions of dollars worldwide.¹¹ Research shows that when prices are too high, operators are likely to invest less in their networks – which impacts the quality and reach of services. This is not helped by the fact that spectrum costs are rising at the same time that many mobile markets are saturated and ARPUs are flat.¹² Operators are also less able to engage in price competition leading to more expensive mobile broadband services for consumers. Consumer losses from more expensive services also significantly outweigh the increased treasury revenues from higher spectrum prices.

Naturally, some spectrum auctions may produce unusually high prices due to normal competition between bidders. However, most cases of very high spectrum prices are due to policy factors.¹³ These include high reserve prices, limited spectrum availability, no spectrum roadmap and auction rules that serve to artificially inflate prices.

2. Governments should prioritise improved mobile broadband services – above revenue maximisation – when awarding spectrum

Spectrum is a scarce resource that enables wireless services that deliver profound socioeconomic benefits. Governments typically price spectrum to recover the costs of spectrum management, but many go beyond this by actively trying to raise state revenues. Both aims are perfectly acceptable, as long as revenue-raising is not so excessive that consumers of mobile services, and the wider digital economy, suffer. The primary goal in all spectrum awards should be to encourage efficient spectrum use and the significant investment necessary to provide high quality mobile services.

Policy measures that inflate the price of spectrum can result in spectrum going unsold, or sold at such a high price that the affordability and quality of services are adversely affected – both have a negative impact on the mobile economy. The mobile economy – which relies on spectrum – is extremely valuable. In 2016 alone, mobile services (directly and indirectly) contributed US\$3.3tn to the global economy¹⁴ – and provided vital social benefits including improved healthcare and education.

It is widely accepted that all forms of taxation are an overall economic burden (ie. a ‘deadweight’ loss) as greater economic benefits would have accrued had taxpayers spent this money themselves. As such, governments try to develop tax policy that minimises this deadweight loss. Such is the positive knock-on effect of the mobile industry on the overall economy¹⁵, a well-respected study has shown that spectrum costs (which are essentially a tax) create a more significant deadweight loss than general taxation.¹⁶ Therefore, decisions to prioritise maximising spectrum revenues may create a short-term windfall for the treasury, but will have a negative impact on the overall economy in the longer run.

3. Avoid limiting the supply of mobile spectrum, publish long-term spectrum award plans and hold open consultations

It is essential that regulators proactively work towards releasing additional spectrum for mobile services. A sufficient amount of spectrum, in the right frequency bands, is essential to deliver affordable, high quality mobile broadband services. Rapidly growing consumer demand for mobile data services and new technologies (e.g. 4G and 5G) – which require significant spectrum to operate most effectively – is only making demand for spectrum more intense. When insufficient spectrum is available to meet that demand, operators can be forced to pay excessively in auctions due to artificial scarcity. The result is that consumers are more likely to suffer from lower quality mobile services, as mobile operators struggle to invest in networks, especially outside of urban areas.

To realise the full potential of mobile services, regulators should aim to license spectrum as soon as operators have a business case to use it. This will ensure the amount of available mobile spectrum keeps pace with demand and ensures network investment is optimised leading to higher quality services. Regulators should hold open consultations and publish long-term spectrum roadmaps detailing exactly what bands will be made available, and when, to meet future demand. This will give operators confidence that policy makers support future mobile broadband growth, and encourage sustainable, long-term investment. Spectrum roadmaps also allow operators to improve their valuations and bidding strategy at auctions as they know when future spectrum will be made available.

11. Ibid NERA (2017)

12. The Telegeography Global Comms Database shows 67 out of 83 mobile operators in OECD countries reported declining ARPUs between 2010 and 2015. This excludes 9 operators where 2015 data is not yet available

13. Ibid NERA (2017)

14. GSMA Mobile Economy Report 2017

15. A US study found that every \$1 spent on mobile services resulted in \$2.32 of total economic spending (Source: ‘Mobile Broadband Spectrum: A Vital Resource for the American Economy’)

16. What really matters in spectrum allocation design by Hazlett, Munioz and Avanzini (2012)

4. Set modest reserve prices and annual fees, and rely on the market to determine prices

The most efficient way to assign spectrum is by allowing the market to set the price. This is the fundamental purpose of an auction, but is only possible if the reserve price is set well below any prediction of market value, to allow price discovery. High reserve prices discourage participation and at worst leave vital, in-demand spectrum unsold, or at best artificially increase the final price paid which risks reduced network investment and higher consumer prices.

Annual fees should be set at modest levels with a view to recovering the regulator's spectrum management costs. If higher annual fees must be levied then they should still be moderate and predictable to ensure they do not negatively impact consumers. These higher annual fees should also be treated as an important component of total spectrum cost - so expectations for potential auction prices should be reduced accordingly.

5. Avoid creating unnecessary risks that put operators' current or future services in jeopardy

Governments and regulators can create an environment that incentivises heavy investment in networks. Conversely, they can also introduce uncertainties and risks that artificially inflate prices and jeopardise widespread network rollouts. These include auction and assignment decisions that encourage excessive bidding, thereby putting current or future mobile services in jeopardy:

- Auction formats that limit price discovery can mean operators are forced to bid blindly and risk overpaying or not getting spectrum
- When the size or number of spectrum lots is not carefully planned, operators can risk failing to win enough spectrum to support their customers
- When spectrum packaging or bidding rules are not sufficiently flexible, operators may be forced to buy, as part of a package, some frequencies that others may value more
- Payment terms that force operators to make large payments before the spectrum is available introduce an additional risk outside their control

6. Consult with industry on licence terms and conditions and take them into account when setting prices

The terms and conditions associated with a spectrum licence have a major impact on its value. Where regulators set coverage or other obligations, they must be factored into the reserve price and annual fee. Expensive spectrum licences coupled with onerous obligations can cause a variety of problems: the licences may go unsold, the obligations may prove impossible to meet¹⁶, or they could lead to reduced investment in networks or higher retail prices.

Sweden has adopted a novel way to match spectrum prices to coverage obligations. The regulator auctioned 800 MHz licences with a duration of 25 years in 2011. Only one licence had a coverage obligation, to avoid duplication of networks and improve the business case for rural coverage. The regulator made the licence attractive by allowing operators to count SEK150m-300m (USD22m-44m) in investments in rural infrastructure as part of their bid. This created an implicit discount for the licence. As of June 2017, Sweden has 99.9% 4G population coverage.

7. Auctions must be well designed and implemented to be an effective award mechanism

The majority of spectrum auctions allow the market to determine final prices, which encourages a fair and efficient outcome. However, there remain examples of auctions that are poorly designed where spectrum goes unsold; or sells for very high prices that ultimately pose risks for consumers of mobile services; or where the prices paid by bidders for similar spectrum varies significantly. It is essential that policy makers study best, and worst, practices when designing an award mechanism, and consult with potential licensees.

It is also important to note that spectrum auctions are not always the most appropriate method for assigning spectrum. Auctions are only warranted where demand for spectrum is expected to exceed supply. Where this is not the case, it can be simpler and quicker to award spectrum directly to operators through an administrative mechanism at a fair and reasonable price. For example, when planning an award, the German regulator always first consults with the market to understand demand for the spectrum and then only proceeds with an auction where this exceeds supply.

16. High reserves and onerous coverage obligations led Argentinian new entrant, Airlink, to default on its first 700 MHz licence payment. Its licence was subsequently revoked and has since failed to be put to use

8. There is no single best approach to estimating the value of spectrum and international benchmarks should be used with caution

Governments and regulators that try to maximise the revenues from auctions often rely on ambitious predictions of the market value of spectrum when setting reserve prices. Factors impacting spectrum value vary significantly between markets and there is significant scope for error. These factors include the general economy, the mobile market, competition, national topography and the broader state of spectrum availability. The risks associated with over-estimating spectrum value - and thus spectrum going unsold or sold at too high a price - are much more damaging than underestimating the value.

Spectrum valuations should be based on long-term business cases, involving assumptions about network deployment, and technical and commercial trends. Many of these assumptions are uncertain and subject to a variety of external risks, so valuations are typically subject to a wide margin of error. As such, reserve prices must be set sufficiently below any prediction of market value, in order to allow the auction to function through multiple ascending rounds and fulfil its purpose of determining the market price through competitive bidding.

Some policy makers look to international benchmarks (e.g. final prices in comparable markets) when assessing the value of spectrum. However, in practice, even small differences in local conditions between countries can make these comparisons wildly inaccurate. There can also be a temptation to choose the highest benchmarks, which are often caused by policy mistakes, and can then lead to negative outcomes for consumers and the digital economy. As such, it is prudent to base valuations on local market conditions at the time of the award, and err on the side of caution.

9. Spectrum pricing decisions should be made by an independent regulator in consultation with industry

The key aim when awarding spectrum should be to encourage its most efficient use through high quality

and affordable mobile services. This is undermined when governments prioritise maximising revenues from spectrum above improving the affordability and quality of mobile services. Mobile users and the wider digital economy are best protected when all spectrum management decisions, including pricing, are assigned to an independent regulator that is tasked with protecting their interests. Awards will also be most efficient when regulators consult with potential bidders on the viability of the auction format.

10. The rise in the total cost of spectrum is a threat to mobile broadband growth – especially 5G

The rising cost of spectrum is unsustainable and poses a major threat to the future development of mobile services. Both the cost of spectrum and the amount that operators require to meet user demand are rising, while at the same time, operator revenues per MHz of spectrum used is falling. Unless this changes it will become increasingly difficult, and ultimately impossible, to fund sufficient investment in future mobile spectrum and networks.

The problem is worsening as mobile users put ever greater demands on networks that in turn requires operators to use more spectrum. With the total amount of spectrum used and unit spectrum prices (ie. \$/MHz/pop) both rising, operators will struggle to make the significant investments required to support dense 4G and 5G networks. This is especially the case given that in many countries the mobile market is saturated and ARPUs are flat. A reduction in unit spectrum prices is vital in order to avoid total spectrum costs spiralling - especially as extremely wide millimetre frequency bands look set to play a key role in 5G. High spectrum costs also make it difficult to extend services more widely, especially in rural areas where the cost of delivering services is 25% higher than in cities.¹⁷ Regulators can respond by avoiding measures that artificially increase the cost of spectrum, and planning spectrum awards in a manner that enables a fall in spectrum prices in line with the increase in spectrum supply.

17. Opex per cell site is 25% higher in rural areas than cities – and 100% higher in remote areas (source: GSMA: 'Unlocking rural coverage' report)



GSMA HEAD OFFICE

Floor 2
The Walbrook Building
25 Walbrook
London EC4N 8AF
United Kingdom
Tel: +44 (0)20 7356 0600
Fax: +44 (0)20 7356 0601

