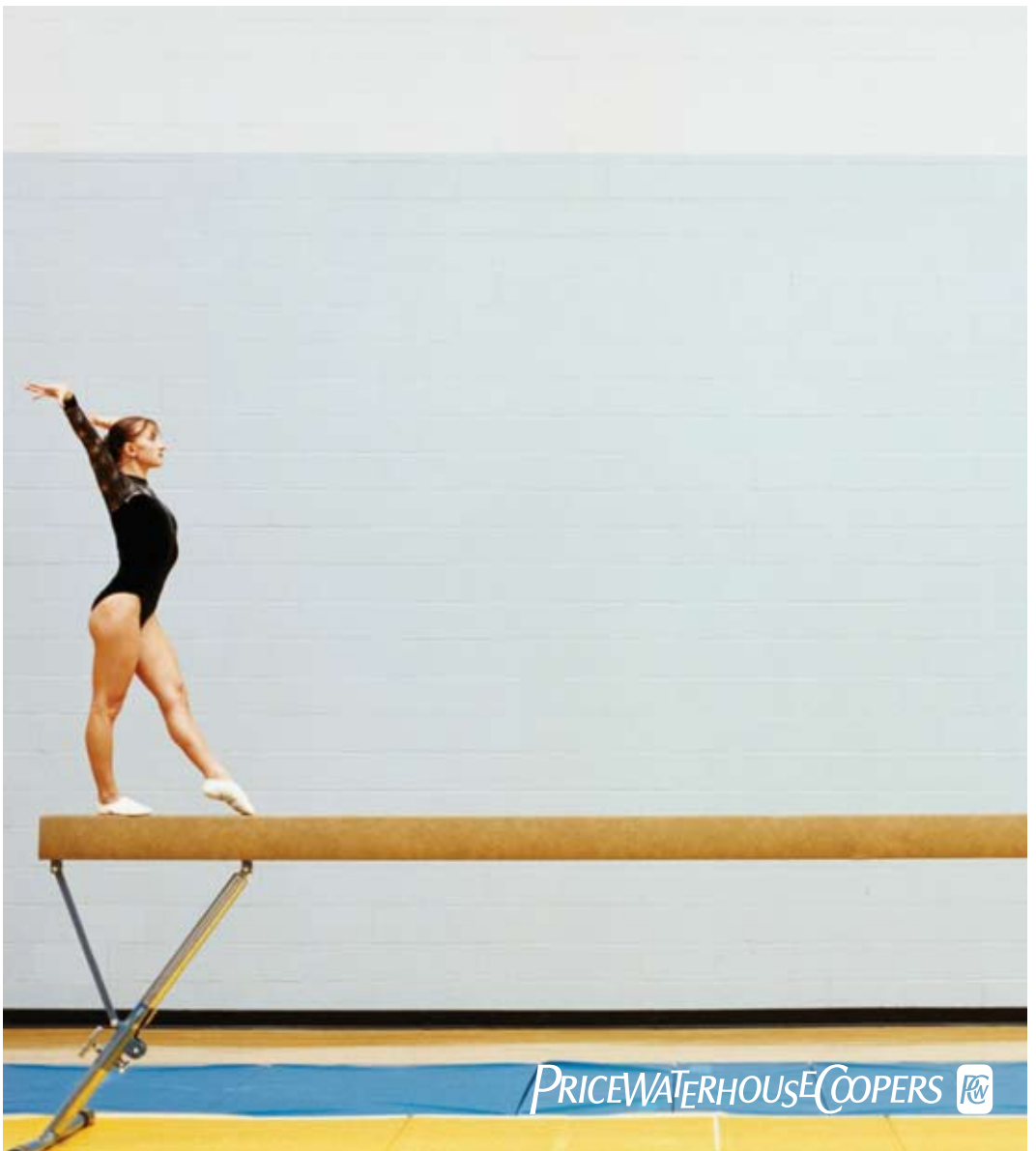


Telecommunications,
Media and Technology

Timing is everything

Releasing the value of spectrum

A PwC perspective for telecommunications,
media and technology executives



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“...we estimate that spectrum released across Western and Eastern Europe may fetch some €40bn at auction, or just under €50 per mobile subscriber in Europe.”



Summary

There will be significant awards of spectrum bandwidth over the next few years in a range of countries across the world as regulators seek to promote the efficient use of spectrum. The release of the 3G expansion band and the analogue TV spectrum are two of the most significant awards. This spectrum is expected to be used by telecoms companies and broadcasters, and potentially others, to help facilitate the launch of new communications services including 4G mobile services, high speed wireless internet services and high definition television services.

The timing could not be more challenging. Tough financial conditions mean that companies face a difficult assessment of the benefits and costs of acquiring spectrum:

- How valuable is the first mover advantage to companies who face a bleak economics outlook and tough capital constraints?
- How long can investors and management wait for payback for new services following upfront cash payments for spectrum?

It is therefore evermore important for potential bidders to think hard about the value of spectrum, in terms of the direct value from the delivery of new services, the opportunity cost of not acquiring spectrum and the impact on their overall competitive position.

We present a clear framework that helps companies make a robust decision on whether to bid for spectrum and how much to pay.

Using this framework, we estimate that spectrum released across Western and Eastern Europe has a value of some €40bn, or €50 per mobile subscriber in Europe. This would require telecommunications operators, broadcasters and other interested bidders to secure capital amounting to 8% of the market capitalisation of the leading telecoms and media companies in Europe. This is a significant sum in an economic environment that shortens time horizons for investments and constrains the capital required to fund bids.

1 Introduction

Providers of wireless services will have greater access to the airwaves than ever before as new spectrum capacity is released on the switch to digital broadcasting and the award of the '3G expansion band'. Access to new capacity will enable the expansion of existing, and the introduction of new, wireless services. These include more digital terrestrial television channels in standard and high definition and faster and more reliable internet and other data services on mobile phones and other portable devices. Eventually these services will enhance customers' experience of wireless services and herald a new era of converged innovation and competition between providers. Many new services require new network deployments and technology developments and hence may not be ready for commercial launch until after 2012.

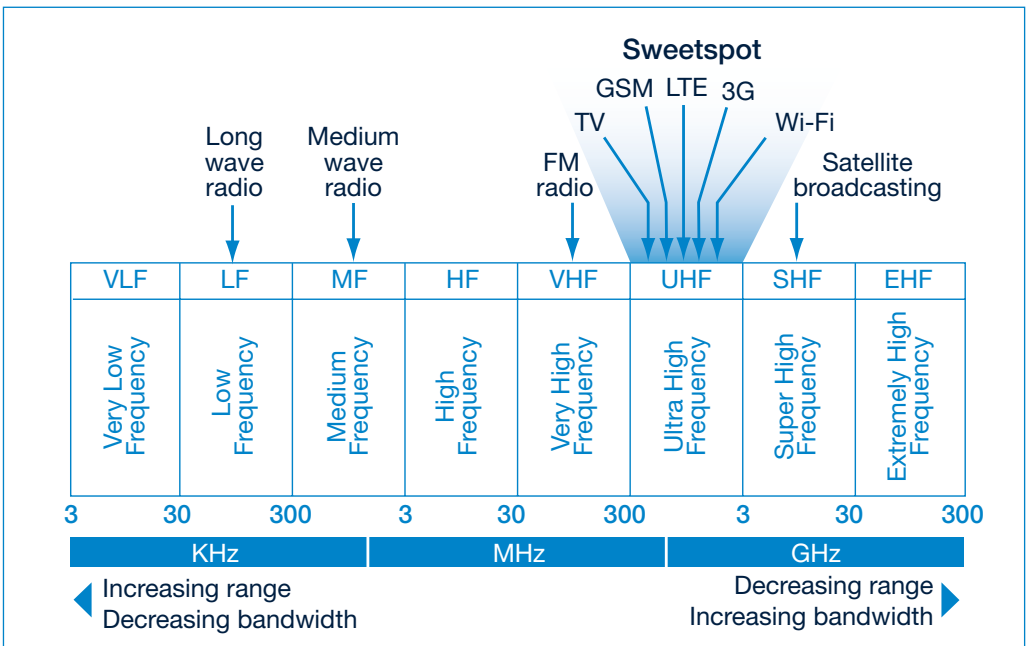
Wireless communications services, such as radio, television and mobile telecommunications, are provided using varying frequency ranges within the electromagnetic spectrum. Due to interference issues at low frequencies and limited signal range at high frequencies, the spectrum which is most suitable for broadcasting and telecommunications is focused on the so called 'sweet spot' of frequencies. This is illustrated in Figure 1. As this bandwidth is a scarce commodity, it is generally licensed by regulatory authorities, often through an auction process.

National regulatory authorities are adopting different approaches to the release and award of this spectrum from competitive auctions where the highest bidder wins to administrative processes where spectrum is

awarded for no direct fee and operators bear the cost of key licence obligations. Auctions and administrative allocation processes are due to take place at increasing pace over the next few years. The structure and timing of the release of spectrum has a very large impact on the sums of money companies ultimately pay. This is demonstrated by the award of the original 3G licences across Europe which began in 2000.

The recent auction of 700MHz spectrum in the US in 2008 demonstrated the value that companies expect new wireless services to bring. Although this took place before the economic downturn took hold, auction proceeds reached some US\$19bn, or US\$75 for every mobile subscriber in the US.

Figure 1: The electromagnetic spectrum and the 'sweetspot'



Source: Ofcom, PricewaterhouseCoopers

The economic downturn presents regulators, Governments and companies with difficult and immediate decisions over the award of spectrum.

On the one hand, regulators believe that timely release of spectrum provides certainty over access and incentivises the early development of new services. The value of new services deployed using auctioned spectrum will be determined over the entire life of the licence, by which time the outlook may be more positive than at present.

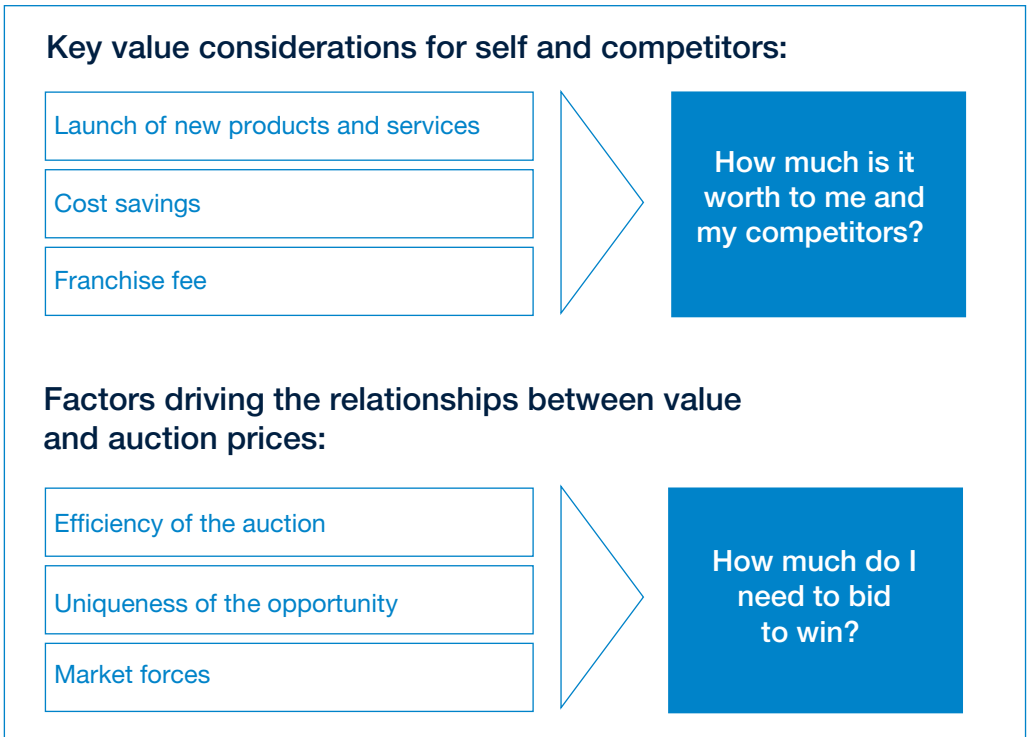
On the other hand, bidders may take a more short-term view. The prospect of paying large sums today for spectrum that might not generate cash flow returns until some time in the future may not be attractive against a backdrop of cost cutting, limited investment in today's services and shortened time horizons for assessing the pay back from any investment in new services.

If regulators continue to press ahead with their objective of auctioning spectrum over the next few years, companies may be forced to pay significant sums for an asset that has no immediate benefit to their bottom line today. This is a question for Governments to consider as they consider the appropriate timing of the various award processes.

In this paper we help companies break through this complexity by setting out a commercial and pragmatic approach to spectrum valuation and bidding. This helps companies to answer two important questions: (1) should I bid for this spectrum?; and if the answer is yes, (2) how much should I bid?

Figure 2 sets out a checklist that companies should follow when undertaking assessments of the value and prices of spectrum. We discuss each aspect in turn.

Figure 2: Checklist for assessing spectrum value and auction prices



Source: PwC analysis

2 The changing spectrum landscape

The competitive landscape and economic environment in which spectrum awards take place is changing, a shift that encompasses the increased use of auctions and a change in the competitive dynamics between bidders.

In early spectrum awards many regulators allocated and licensed spectrum for specific types of service. Spectrum offered for GSM mobile would only attract interest from companies looking to provide GSM services. This meant regulators were effectively determining, and therefore restricting, the types of services consumers could access. We are now seeing an increase in demand for the use of spectrum driven by an increase in applications and an increase in the supply of spectrum driven by the shift in policy and move towards market allocation. Regulators are adopting less prescriptive approaches by offering spectrum licences on a technology and service neutral basis, thereby allowing market forces to shape the allocation of spectrum to

technologies and services. Put simply, the bidder offering the most wins, and uses the spectrum for whichever services it chooses to offer.

Convergence is changing the competitive dynamics between bidders radically, widening the range of interested parties. This makes it harder for bidders to predict how much they may need to bid for spectrum given the range of potential uses and bidders competing with them. At the same time, partnerships are becoming ever present in the value chain as a way of sharing risk, cost and knowledge. Deciding when to compete or partner will be a critical decision for any bidder, navigating competition law issues along the way.

“Convergence is changing the competitive dynamic between bidders radically, widening the range of interested parties”

3 Lessons from previous auctions

In order to decide on whether to bid for the spectrum or not, companies need to determine the value of spectrum to their business. This requires them to be mindful of the lessons of the past, in particular the challenges of estimating the revenue potential of spectrum usage.

There are two key awards taking place across different countries: the spectrum released following digital switchover which is particularly valuable given its lower frequency and therefore attractive propagation characteristics and the '3G expansion band' which was historically reserved for mobile services and is now

being released as the uptake of 3G services has expanded.

Figure 3 below summarises the recent US auction held by the Federal Communications Commission (FCC) of 700MHz spectrum which generated auction proceeds of US\$19bn.

Figure 3: Case Study: US auction of 700MHz in 2008

The US FCC held its 2008 auction of 700MHz (spectrum released by the switchover to digital television) spectrum in Oct 2007 ('Auction 73'). Over 200 bidders qualified to take part in the auction, which lasted for two months over 260 rounds of bidding.

The auction was expected to attract a lot of interest from bidders for two reasons:

1. 700MHz has relatively attractive propagation characteristics compared to most spectrum previously available; and
2. The FCC planned to allow the spectrum to be used on 'technology neutral grounds'. Licences could be used for fixed, mobile, and broadcast uses, including fixed and mobile wireless commercial services; fixed and mobile wireless uses for private, internal radio needs; and mobile and other digital broadcast needs.

A key issue in the auction was the FCC's requirement that the winner of the largest bandwidth lot for sale ('Block C') would have to provide open access to all devices and applications. This would prevent an operator from offering exclusive services using this spectrum and aimed to provide assurance to companies like Google that customers would have ready access to their services without limitations imposed by the operator of the spectrum. This condition created uncertainty over the value of the spectrum to the winner because they needed to consider how the independent strategies of other application and device providers could impact on their own strategy for monetising the spectrum.

The auction raised US\$19bn, with Verizon Wireless paying US\$9.6bn and AT&T \$6.6bn.

Source: FCC and PwC analysis

It remains to be seen in the US whether the returns will justify the price paid for spectrum. However, the sheer size of the financial commitment underlines how important it is for market players to be certain of the value of spectrum they are buying. The risk is that they over-pay or miss out on other opportunities that could have been funded by the capital used to bid for spectrum. Awards of further spectrum at this frequency are expected across Europe and although no awards have yet taken place in Asia, South Korea,

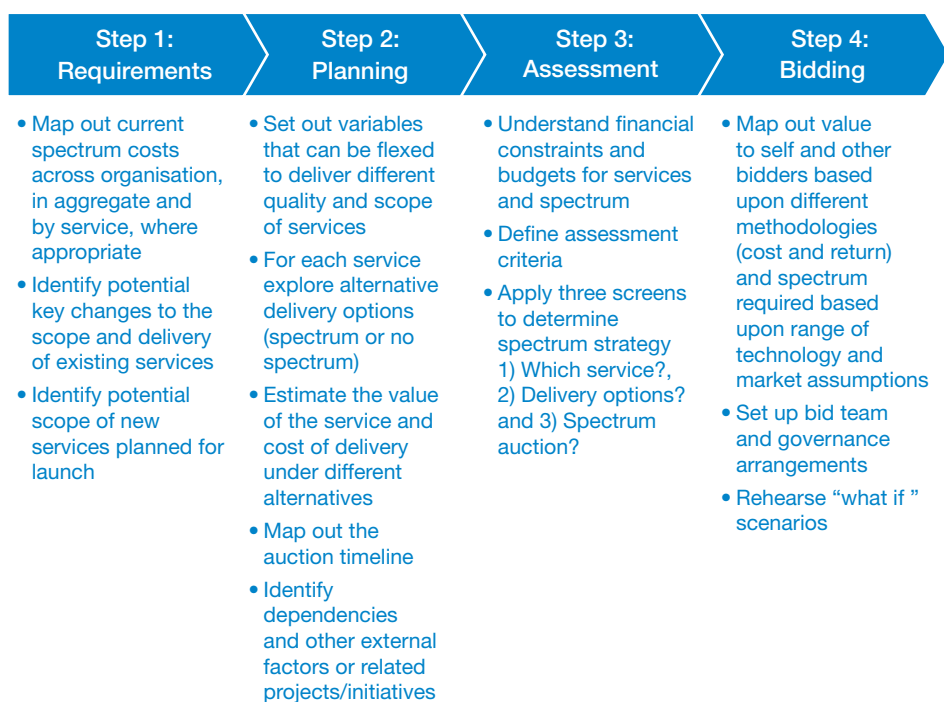
for example, is expected to open up its 700MHz band in 2012.

2.6GHz spectrum awards have taken place recently and generated significant sums. The prices paid have been lower than the 700MHz auctions in the US, reflecting the less attractive propagation characteristics of this spectrum. Scandinavia led the way with the auction of this spectrum, with awards in Norway and Sweden. The Hong Kong Government raised HK\$1.5bn from its sale of the 3G expansion in January 2009.

Adopting a holistic view of the value of the spectrum under consideration in light of other spectrum requirements and alternative technology will go along way to shape informed commercial decisions and to avoid these risks.

Figure 4 below sets out the steps that we advise companies to follow to evaluate their spectrum requirements and auction strategies. The valuation of spectrum is a critical component of planning and decision-making throughout the process.

Figure 4: Four key steps in spectrum bid preparation



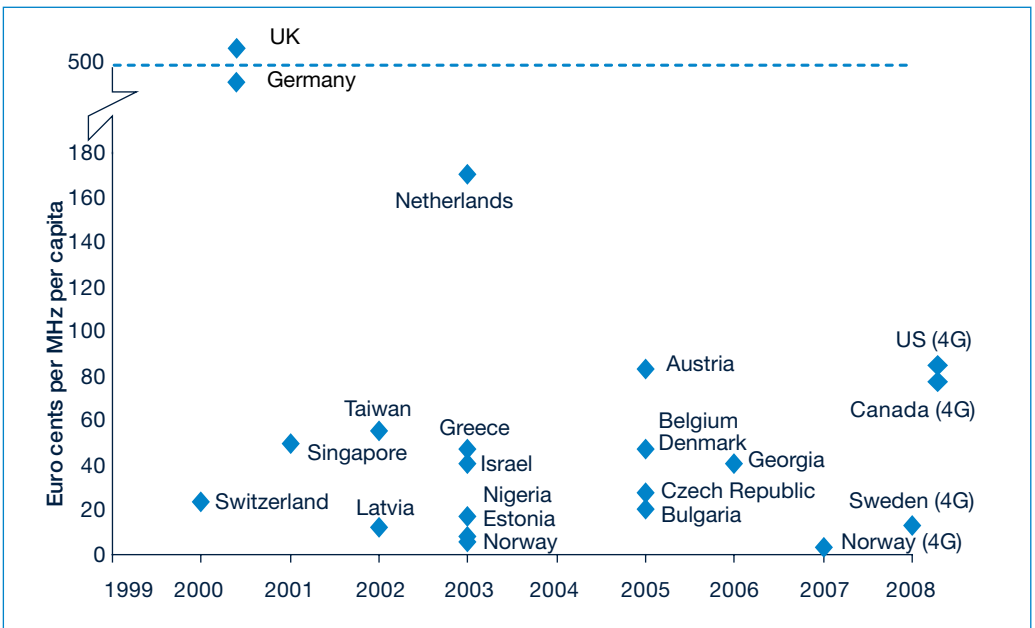
Source: PwC analysis

“A holistic view of the value of spectrum... will go a long way to shape informed commercial decisions.”

4 Using previous auction experience to benchmark the value of spectrum today

The results of previous spectrum auctions can be used to guide the value of spectrum, with a healthy dose of caution and interpretation. The difficulties in valuing spectrum are underlined by the prices paid in previous awards. Figure 5 below shows the average price paid per MHz per capita in selected auctions over the past ten years.

Figure 5: Comparison of trends in spectrum prices is difficult across markets



Source: PwC analysis using publicly available sources

Figure 5 shows that it is difficult to use any single simple metric as the basis of spectrum value, as there is a range of factors that influence the prices paid at auctions. We have developed a

benchmarking model as a guide to future values, drawing on past experience and a high level analysis of the relevant factors driving value.

“It is difficult to use any single simple metric as the basis for spectrum value.”

Figure 6 below sets out a simple methodology to value the upcoming spectrum released at analogue switchoff and allocation of the 3G expansion band.

Figure 6: Estimating the value of future European spectrum awards using past auction experience

This approach aims to estimate an indicative value for the 'digital dividend' (450-862MHz) and the 3G expansion band (2,500-2,690MHz) which will be licensed across Europe over the next few years.

Our starting point is the prices paid for similar spectrum in recent spectrum auctions on a price per MHz per capita. For example:

- In May 2008, Sweden auctioned the 3G expansion band raising €225m or €0.13 per MHz per capita. We use this benchmark as a guide to the value of the 3G expansion band; and
- In March 2008 the US auctioned 700MHz raising \$19bn, or €0.83 per MHz per capita. We use this benchmark as a guide to the value of the digital dividend.

We have controlled for key factors that drive differences in the value of spectrum across countries:

- Average Revenue Per User (ARPU) from mobile services;
- A measure of mobile market concentration (Herfindahl Index);
- Fixed-line broadband penetration; and
- Mobile penetration.

We recognise that these factors are more applicable to the mobile telecoms sector in comparison to broadcasting. However, in our view mobile operators are more likely to drive the ultimate prices paid for spectrum compared to broadcasters, when they are competing for the same spectrum.

These factors have been weighted in their application to the benchmarks, based on our view of their relative importance in driving spectrum valuation value. For example, ARPU was assigned the highest weighting because it approximates the value of consumers' willingness to pay for mobile services, which drives cash flows supporting the value of spectrum.

We have therefore taken our base price per MHz per capita, adjusted it for the key factors described above for each territory and then multiplied by the population and assumed bandwidth for each country.

We estimate that the spectrum awards of the digital dividend and the 3G expansion band in Europe are worth €40bn. Around €10bn is attributable to the 3G expansion band and €30bn to the digital dividend, reflecting the more attractive propagation characteristics of the digital dividend.

Source: PwC analysis

This valuation is designed to provide an indication of the quantum of value attributable to this new spectrum. This approach can be used by companies as a 'sense check' to their own valuations. However, bidders in auctions should

conduct a much more detailed analysis when assessing how much they are prepared to pay, as many other factors will come into play in addition to those we have described above.

5 Three pillars of spectrum valuation

Spectrum can be valued in three main ways:

1. Value arising from the launch of new products and services made possible directly from acquiring spectrum;
2. Cost savings arising as a direct result of acquiring spectrum; and
3. The 'franchise fee', or the ability to protect existing business as a result of acquiring spectrum.

1. New products and services

Launching new products and services involves a number of technology choices. Whatever these may be, it is vital to have a well-defined and robust business plan that clearly sets out the service offering and its anticipated revenues and costs.

Of particular importance is the relationship between assumed pricing of products and services and the valuation of spectrum. Pricing should determine the value of spectrum independently, rather than the other way round. The prices that consumers are willing to pay for services determine the profitability and hence value associated with new services. For example, companies may want to build market share by adopting penetration pricing in the early stages of launch of new products, and this will impact on the value of spectrum in the context of supporting this particular business model. A relevant example would be the success of the mobile broadband offering from UK mobile network operators, which is driving significant capacity requirements. Operators are likely to require further spectrum to meet consumer demand for bandwidth – penetration pricing has been adopted which may limit revenue generation, which in turn may impose a constraint on how much operators are willing to pay for additional spectrum.

2. Cost savings

The release of the Digital Dividend opens up opportunities to provide cheaper coverage networks and in-building coverage. For example, this spectrum can provide cost savings for mobile operators based on their current products and services, and consumer demand. Using spectrum at lower frequency compared to spectrum currently used by mobile operators may generate significant network costs savings. Furthermore, a multi territory spectrum acquisition strategy may also generate further cost savings through economies of scale on both network equipment and handsets.

An additional opportunity to make cost savings is to share spectrum and infrastructure i.e. a network/tower-sharing agreement. For example, tower-sharing exists in Canada, where the regulator cited environmental reasons for requiring incumbent operators to share their masts with new entrants. In the UK, T-Mobile and 3 are developing a site sharing deal covering their 3G networks. Operators with high market shares seeking to collaborate should however be aware of the potential for legal challenge on competition and regulatory grounds.

3. 'Franchise fee'

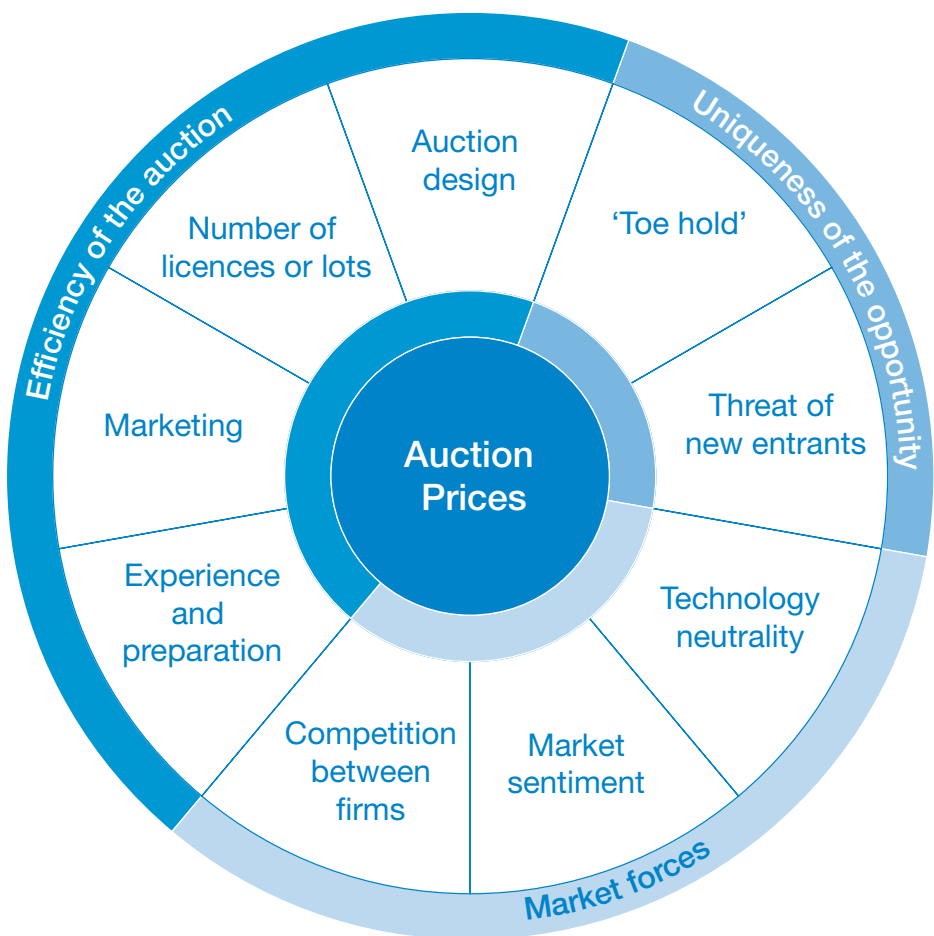
The 'franchise fee' represents the loss in value to an operator if it does not acquire spectrum. We believe that a significant proportion of the large sums paid in the early 3G auctions were likely to have represented a 'franchise fee'. Underpinning the bids was a need to protect existing GSM mobile businesses against the threat of new entrants who would offer more enhanced services using 3G technology, potentially making GSM services redundant at a faster rate than operators had been assuming.

There may also be brand value from being considered at the forefront of mobile innovation and technology. Brand perception has an impact on retail success. Experience shows that operators may face customer churn if they stand by while other players in the market migrate to more advanced technologies. So operators who are slow to adopt more advanced technologies risk losing a significant proportion of their existing revenues and stranding existing investments in customers and networks.

6 The relationship between spectrum value and auction prices

The price paid to acquire spectrum does not necessarily equate to the value that each winner places on the spectrum it has acquired. In most auctions the price paid is usually the final bid of the losing bidder rather than the highest price the winner may have been prepared to pay. In addition, there are a number of other key factors that will impact on auction prices summarised in Figure 7 below.

Figure 7: Factors affecting auction prices



Source: PwC analysis

Uniqueness of the opportunity

The valuation of spectrum in use in a specific territory may not capture the value of a 'toe hold' strategy. This is relevant to companies who operate across multiple territories. By acquiring the same spectrum across different territories a company may be able to realise benefits from economies of scope and scale. For example, the early 3G auctions in the UK and Germany resulted in higher spectrum prices than in subsequent auctions. Bidders realised there was value from leveraging economies of scale and scope across countries. Once the toe-hold strategy was established subsequent bids were based only in the incremental value of the opportunity in the specific territory and may have even discouraged competition from other bidders who did not secure spectrum in earlier auctions.

The arrival of new entrants means that incumbents need to consider the 'franchise fee' element of their bid very carefully, as this provides a greater threat to their existing business. In this scenario, the franchise fee will represent a key factor influencing the price they may have to pay for spectrum.

In addition, if it is expected that the auction represents the one time chance to secure spectrum competition may be more intense. However, regulators are increasingly looking to establish secondary markets for spectrum which may enable new entrants, for example, to secure access to spectrum after the initial auction.

Market forces

The 3G auctions in the UK and Germany took place at the height of the dot com bubble. This positive market sentiment drove high expectations on future service revenues which may have had an impact on spectrum values. In the present economic climate we expect the opposite to be true. Given new services are potentially some time away from commercial launch, auction bids should be based on expectations about the economic climate in the long term. However, the economic downturn is constraining the capital available to companies for new investments. If companies are unable to access capital to fund auction bids this may reduce their ability to bid up to their own valuations. Indeed new entrants may find it particularly difficult to raise capital to fund bids.

In concentrated markets, competition for spectrum may be greatest and therefore bidders are more likely to be forced to bid up to their own spectrum valuations. In addition, bidders are more likely to have similar valuations for the spectrum if their business models are themselves similar. In less concentrated markets there is likely to be more differentiation between bidders' own valuations.

Efficiency of the auction

Regulators are looking at increasingly complex auction designs to ensure that the prices bidders pay reflect their underlying valuations to ensure that bidders with the highest valuations prevail. As Governments come under increasing pressure to raise funds, spectrum auctions may be perceived as a good way to generate income.

In the past, regulators have held auctions where more licences were being awarded than bidders participating. This leads to depressed auction values. Regulators are increasingly looking to maintain competition for spectrum in auctions by, dynamically adjusting the number of lots or licences in response to bidders' interest, or by ensuring they market upcoming auctions aggressively to generate interest and to ensure they understand the number of interested participants.

Regulators have in the past included obligations as part of spectrum licences, for example, time bound minimum coverage requirements. This can force winners to make uneconomic investment decisions that should be factored into spectrum valuation model.

7 Conclusions

The spectrum due for release across Europe is prime real estate which will be acquired by telecoms and media companies to enhance customer experiences of existing services and launch new services. We estimate that the spectrum has a value of some €40bn, representing 8% of the market capitalisation of the leading telecoms and media companies in Europe. This is a significant investment in the current economic climate; companies' ability to pay may be constrained particularly as the benefits of acquiring spectrum are more likely to be realised in the medium- to long-term.

Industry convergence widens the range of potential bidders, making it harder to predict likely motivations and strategies, and offers up opportunities to partner.

Valuation is considered to be more of an art than a science. Given the wide range

of factors influencing spectrum value, the application of sound judgement to complex models becomes more important than ever. This will enable interested parties to achieve the best possible economic outcome in the midst of significant uncertainty.

“The economic downturn presents regulators, Governments and companies with difficult and immediate decisions over the award of spectrum. We help companies break through the complexity by setting out a commercial and pragmatic approach to spectrum valuation and bidding.”



Contacts

Authors:



Simon Harris

+44 (0) 20 7804 9413
simon.harris@uk.pwc.com



Darren Waterman

+44 (0) 20 7213 5023
darren.waterman@uk.pwc.com



David Lancefield

+44 (0) 20 7213 2263
david.lancefield@uk.pwc.com



Alastair Macpherson

+44 (0) 20 7213 4463
alastair.macpherson@uk.pwc.com

Global Leadership Team

Information & Communications



Paul Rees

+ 44 (0) 20 721 34644
paul.g.rees@uk.pwc.com

Entertainment & Media



Marcel Fenez

+1 246 (852) 2289 2628
marcel.fenez@hk.pwc.com

Technology



Raman Chitkara

+1 (408) 817 3746
raman.chitkara@us.pwc.com

www.pwc.co.uk/telecoms

www.pwc.co.uk/valuations

www.pwc.com/eandm

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