

Spectrum Valuation

A Holistic Approach

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1 Abstract

The mechanism for spectrum allocation¹ has evolved over the years from “beauty contests”, to lotteries, onto the present market driven auctioning process. In the coming years, we are going to witness a significant amount of spectrum being put up for auction. A variety of factors including technological advancements, increased efficiency of broadcasting technologies, and the tendering of remaining 3G frequencies to meet increasing data demand are combining to create a market for spectrum. The single biggest challenge for operators in constructing winning bids for the spectrum is to reconcile the gap between internal valuation and market perception of the price of the spectrum. Consequently, operators run the risk of either over-bidding or under-bidding for the assets and losing out in a competitive auction. It is also pertinent to note that peer market comparisons serve only a limited purpose while arriving at spectrum pricing. The wide variation in auction prices around the world makes sole reliance on any such benchmarking exercises fraught with risk.

In this paper, Capgemini proposes a four-step approach for arriving at the right price for the spectrum. The first stage involves a comprehensive understanding of auction specificities and the key success factors for a winning bid. Subsequently, operators need to quantify the economic value of the license that they can realize. This is followed by the evaluation of the competitive context wherein they look at the competitor business case and financial strengths to gauge the expected market value of spectrum. Finally, the inputs from the earlier stages are aggregated to define the bid price for the spectrum which maximizes the chances of a successful bid while being aligned to the operator objectives.

¹ Spectrum allocation refers to the issuance process for usage rights of radio frequency bands of the electronic spectrum, by the government or the regulator. Currently, the process in most developed markets involves auctions to arrive at a market determined price for these assets.

2 Introduction

The coming years are going to witness a significant amount of spectrum being put up for auction

Evolution of Spectrum Auctions

Historically, spectrum allocation has evolved significantly in terms of the methodologies adopted by governments the world over. In the US, for instance, the evolution of the spectrum distribution has moved from a command-and-control structure towards a market-driven process. In the initial years, the US communications regulator, FCC², used comparative hearings to determine spectrum allocation. In this process, applicants set out their cases for being awarded a license and the licensing authority then determined the best applicant based on a combination of objective and subjective criteria. As an evolution from comparative hearings, the FCC tried lotteries in the mid-1980s. The lottery system was designed to be fair and more transparent than comparative hearings. However, this system saw the FCC receive thousands of applications. Spectrum allocations finally moved to a market-driven process through auctions, which were inherently transparent and encouraged only the serious participants to take part.

For regulators, auctions offer a potent mechanism for ensuring that the owner of the spectrum—the government—receives a fair value. Moreover, since market forces are involved in discovering the price for the spectrum, the process is perceived to be fair.

Current Market Opportunity

Across Europe and most of the developed world, regulators are looking at spectrum auctions driven by the explicit need to address distinct market opportunities for next generation services and to raise funds. A combination of factors is contributing to spectrum release, chief amongst which is the advent of new technologies and associated spectrum dynamics. Technological developments have given rise to the usage of the 2.6 GHz spectrum band for LTE³. Similarly, improvements in broadcasting technologies (such as the advent of DTT⁴) have led the industry towards a path of spectrum optimization thereby enabling usage of existing spectrum for other purposes. This spectrum is part of what has been considered the digital dividend for the telecom industry. In many European countries, regulators are eventually looking at tendering the remaining 3G frequencies as data demand continues to grow driven by the advent of high-powered smartphones such as the Apple iPhone. Spectrum release is also tied to local market consolidation. In markets that see mergers and acquisitions among operators, a portion of spectrum could also be potentially released back into the open market.

Keeping in mind these market opportunities, a number of European countries have initiated the process to auction spectrum for next-generation services over the coming years (see Figure 1).

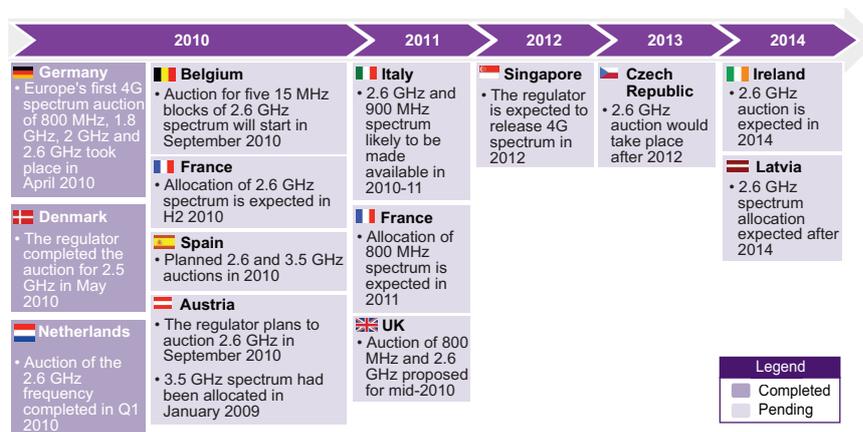
² Federal Communications Commission.

³ Long Term Evolution.

⁴ Digital Terrestrial Television.

In this paper, we look at key challenges associated with pricing spectrum for a bidder. We also present the case for a holistic approach that strives to work beyond the challenges and adopts a highly structured approach towards pricing spectrum.

Figure 1: Spectrum Auction Calendar



Source: Various regulator websites; Fitch Ratings, *European Telecoms—Spectrum Issues for the Fore*, November 2009 Note: The auction dates for certain geographies are Capgemini estimations based on industry interactions

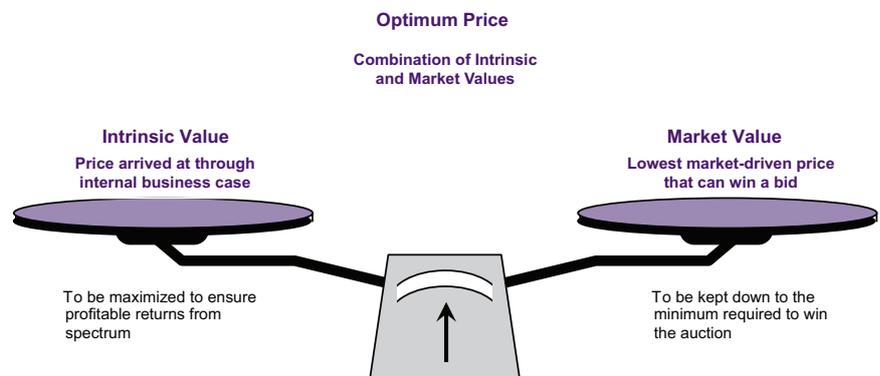
3 Challenges in Spectrum Pricing

The key challenge for spectrum acquisition is less about valuation and more about pricing

Telcos need to arrive at an optimum price for spectrum based on a combination of the business-case driven value and the market-perceived value to a contender. Here, the key challenge is less about valuation and more about pricing. Examples from recent spectrum auctions are proof of this challenge. For instance, the recent auctions of remaining 3G blocks in Italy and France led to very different spectrum prices reflecting contrasting competitive bid situations rather than fundamentally different economic spectrum value for the bidders. In Italy, three out of the four Italian operators each bought a block of 5 MHz for €88.8-90.2 million (slightly above the reserve price of €88.7 million) whereas French auctions led to €582 million for two blocks (far above reserve price of €120 million per block).

While operators can have a better understanding of how they value spectrum based on their own projections (intrinsic value), the market perceptions strongly vary from market to market and with every round of the auction (market value). Consequently, telcos face significant challenges in arriving at an optimum price that will see them win a spectrum bid. The biggest challenge for telcos is to arrive at a price that will see them neither over-bid nor under-bid. The optimum price is usually a function of bidder's objectives including profitability, need-to-win, brand image, and other external factors including financing capacity, impact on share price consequent to winning or losing a bid, or other potential indirect impacts on future auctions (see Figure 2). Telcos should also exercise caution in using peer-market comparison techniques such as benchmarking in arriving at an optimal price.

Figure 2: The Spectrum Pricing Challenge



Source: Caggemini TME Strategy Lab Analysis

Risk of Over-bidding

One of the biggest challenges facing mobile operators across the world is to accurately estimate the perceived importance of spectrum to competitors and the perceived attraction of newer services to consumers, along with their inclination to pay. The fluid nature of these assumptions almost always results in mobile operators ending up bidding significantly higher than what can be called a fair market price, considering the incremental revenues which would accrue due to the spectrum assets. A classic example of such a situation was witnessed in the 3G spectrum auctions in the early part of this decade. While operators over-bid one another, the bigger challenge proved to be in coming up with applications at price points that would encourage mass uptake.

The intangible factors involved in valuing spectrum also sometimes play a much larger role than was intended. A case-in-point is that of Vodafone UK. In 2001, the operator believed that their market leadership would be under threat if they did not acquire 3G spectrum at the first auction. Consequently, the company took a strategic bet on the importance of the spectrum and raised their bid, factoring in a premium for this strategic potential. When the results were out, it was revealed that Vodafone paid £6 billion for spectrum for which the other operators O2, T-Mobile, and Orange paid £4 billion each. This over-bidding accompanied by a large debt hastened Vodafone's decline to a number two position in the market.

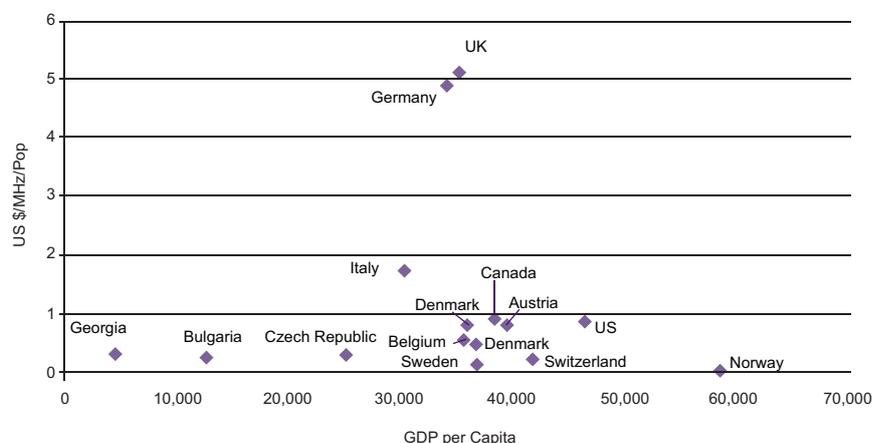
Risk of Under-bidding and Losing

While operators face a significant risk of over-bidding in their enthusiasm to ensure that their bids are accepted, there also exists a real challenge of operators potentially under-bidding in comparison to their market peers, especially in single-round auctions. At its core, the key issue around under-bidding lies in estimating the extent to which competitors can and will stretch themselves in a bidding war.

Limitations of using Range-bound Assumptions

While the discovery process of optimal spectrum price from a combination of intrinsic and market price is a popular approach, many telcos also use peer-market comparison too as a guide for spectrum pricing.

Figure 3: Spectrum Price Paid in Select European 3G Auctions and Worldwide 4G Auctions in US\$/MHz/Pop, in Relation with GDP per Capita



Source: Capgemini TME Strategy Lab Analysis; Telecom ParisTech, *Spectrum Valuation—Principles and Methodology*, October 2008; Fitch Ratings, *European Telecoms—Spectrum Issues to the Fore*, November 2009. Note: 3G auction prices adjusted with 2007 exchange rates.

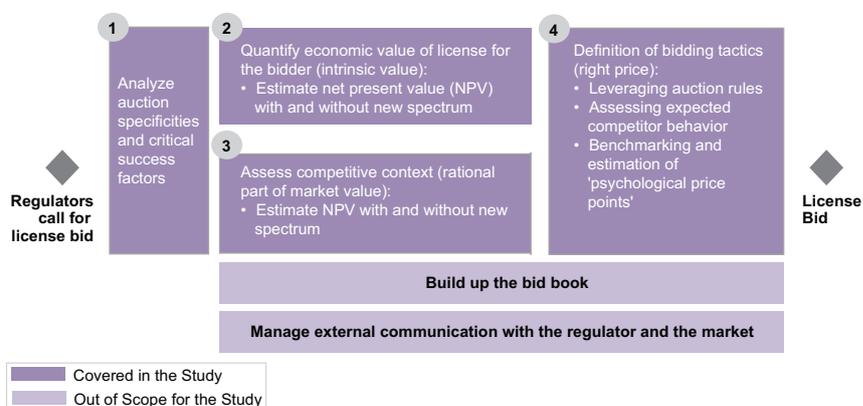
Spectrum price is affected by a host of local factors, resulting in wide variations across geographies

A key drawback of using comparisons from other geographies as a reliable approach towards valuing spectrum lies in the fact that the price paid for spectrum in each market is closely tied to a host of local factors, resulting in wide variations in these values between geographies (see Figure 3). While broader metrics around price of spectrum per capita can be derived from other markets and used as pointers, in reality, a combination of macro and micro factors impact spectrum valuation. An indicative set of such factors include the market saturation, threat of new entrants, number of licenses on offer, round of spectrum licensing, financial strength of incumbents, population density, and economic spending power of potential consumers in that region. Under these circumstances, it is prudent that operators use such benchmarking approaches as only one of the input methods towards spectrum valuation rather than as a full-fledged methodology that drives their auction strategy, given its simplistic approach to the complex issue.

4 Holistic Approach for Spectrum Pricing

Based on projects conducted for operators in different geographical settings, Capgemini has built a robust methodology for a successful spectrum bid process, which captures the key lessons from various engagements (see Figure 4).

Figure 4: Capgemini Consulting Approach to Successful Bidding



Source: Capgemini TME Strategy Lab Analysis

Analyze Auction Specificities

The details of the spectrum allocation directive, as defined by the regulator, should be analyzed in-depth as the first step of the spectrum valuation process. The specificities of the allocation process help in the identification of the critical success factors for a successful spectrum bid. The various clauses for the spectrum allocation process also give a sense of the attractiveness of participating in the process, by detailing parameters such as amount of spectrum on offer, coverage obligations, and the bid process. The eligibility criteria laid down by the regulator also gives a sense of the likely competitors during the spectrum auctioning process.

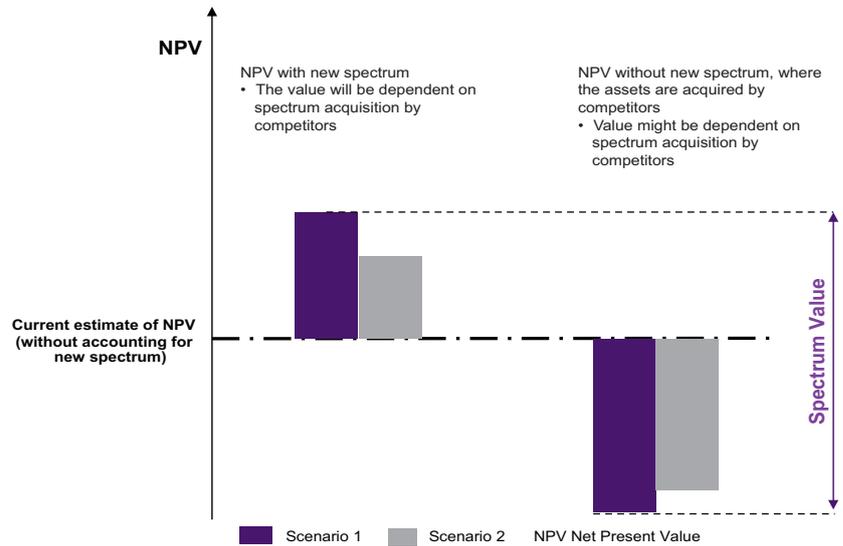
The details of the auction specifics help in establishing the various analyses that would need to be carried out. For example, if there are multiple blocks of spectrum available, a detailed analysis is required to understand whether all of them are identical in terms of the allocation process and fit with the bidder's requirements. This step is crucial in establishing the timelines for the various steps subsequent to this stage.

Estimate the Intrinsic Value of Spectrum for the Bidder

Successful acquisition of spectrum assets results in potential revenue uplift, through provisioning of new services, ability to accommodate a greater number of customers on the network, cost savings, and by preventing competitors from taking certain positioning in the market. The intrinsic value of spectrum captures this potential revenue uplift by assessing the difference between the operator net

present value (NPV) with and without new spectrum (see Figure 5). However, the analysis of benefits accruing from new spectrum must also factor in the cost of licence and coverage obligations.

Figure 5: Estimation of Spectrum Value by Calculating the Deviation from Base Case NPV



Source: Capgemini TME Strategy Lab Analysis

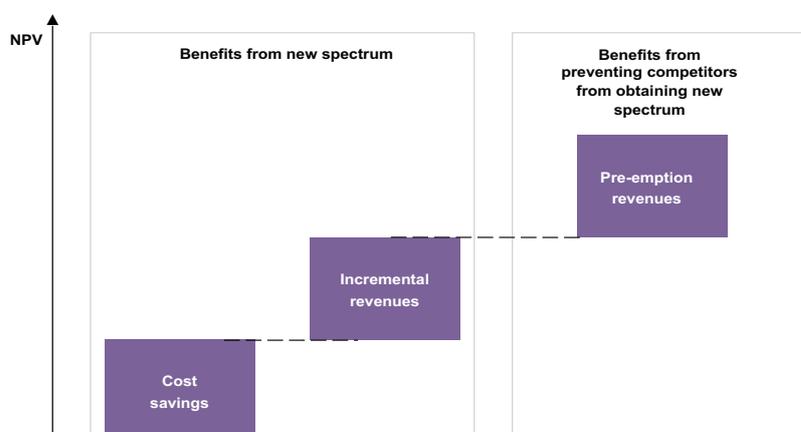
The NPV from the scenario where the operator is unable to secure new spectrum might be drastically different from the base case NPV. Strategic plans rarely capture the base case scenario, which estimates the NPV in the absence of fresh spectrum allocation in the market. Alternative strategies to compensate for the absence of additional spectrum such as investments in other technologies and densification of existing network need to be captured in this analysis. The possibility of other players in the market establishing a strong competitive advantage through the acquisition of new spectrum and the resultant negative impact must also be factored into the business case.

The business case and hence the intrinsic value is specific for each operator. It is a function of its positioning in the market, its long term strategy for utilizing the spectrum, and its existing assets such as the network infrastructure. Consequently, the business case for the market leader will vary significantly from that of the third or fourth placed player in the market for the same spectrum asset.

The intrinsic value for markets with a scarcity of spectrum has an additional component to reflect the value of obtaining spectrum to prevent the access to this asset for competitors. In these cases, pre-emption revenues need to be considered and the intrinsic value of spectrum should be adjusted accordingly to a higher figure (see Figure 6).

Assess Competitive Context

In order to arrive at a winning bid, telecom operators also need to consider the other crucial piece of the puzzle, the market price. The market price is the minimum amount an operator would need to pay to ensure a successful bid for spectrum. The market price is a function of the willingness of operators to pay for spectrum assets, which also reflects the spectrum scarcity in the geography in which it is being auctioned. If there is enough spectrum for each potentially interested player, asset value will come close to the reserve price defined by the

Figure 6: Intrinsic Value from Spectrum Acquisition Reflecting Pre-emption Revenues

Source: Capgemini TME Strategy Lab Analysis

A holistic approach is required to arrive at the right spectrum price

regulator. On the contrary, if there is perceived scarcity, operators are likely to increase price to their limit (either maximum intrinsic value or perceived value for competitors).

For instance, European 2.6 GHz LTE auctions are currently characterised by availability of significant amount of spectrum (2*70MHz) in comparison to the 800 MHz LTE spectrum. This led to very low price levels for the 2.6 GHz spectrum as compared to 800 MHz LTE auctions where spectrum is more constrained and characterised by better propagation features. In Germany where both spectrum blocks were allocated in the same process, price per MHz for 800 MHz band went 32 times higher the price for 2.6 GHz band.

The spectrum allocation process may also be designed to influence market prices, as regulators may try and meet their government's quest for new budget contributions. The tendering process may artificially boost spectrum value by granting asymmetrical features to the various auctioned spectrum blocks. Bidders might be tempted to bid higher for blocks that are offered without coverage, national roaming, or wholesale obligations. Similarly, some regulators tend to adapt the auctioning process to the level of expected competition. When the degree of competitiveness is unclear, regulators may favor low visibility auctions (sealed auctions) whereas clear demand for spectrum may lead to simultaneous multi-round auctions. The reserve price of the spectrum also plays a significant role in impacting the market value. If positioned too high, they will deter contenders from bidding or drive a "wait and see situation" as in Italy in 2009 when the 3G reserve price was set at close to €460 million. On the contrary, when positioned low in poor economic situation, they tend to polarize bids.

To estimate the "market value" of the spectrum, it is necessary for a bidder to assess the probable bid for each of its competitors. The assessment will have several elements such as quantifying the intrinsic value for each competitor through a business case, evaluating their ability to invest capital, stock exchange and shareholder sentiments, and assessing the character traits of likely competitors to ascertain their desire to emerge as the winner of the auction.

Building the business case for competitors is a complex but insightful task which helps to establish the amount competitors are likely to bid if they behave rationally. The NPV analysis will be conducted similarly in many respects to the one for the bidder, although less detailed. It provides a fairly reliable indication of

operator intent as most of these players are presently under fairly strict cost management scrutiny, therefore exhibiting less unpredictable behaviors. Specific customer dynamics profiles need to be built for each competitor within an overall consistent acquisition and churn market model. Similarly, specific network profiles have to be built for each provider.

Bidders will exhibit different bidding behaviors, based on the style of their management, their risk appetite, their willingness to get a good bargain, and their estimates of what a winning price would be. An aggressive bidder will use its maximum NPV (or the competitor's maximum NPV if required) whereas a cautious player will just try and position slightly above the "first loser", keeping room for maneuver within its own NPV range. Such behavioral patterns will help weigh the various NPV calculations made according to possible alternative market and technology scenarios. Hence, psychological levels should not be neglected when fine-tuning competitive price expectations.

Define the Right Price

In the end, defining the right price will be about designing bidding tactics and price levels that maximize winning chances vis-à-vis planned competitive bids, while being compliant with the bidder's objectives and external constraints. It is imperative that the right price captures the operators' motivations for acquiring spectrum while in some cases profitability will be the operative criterion for the interest in spectrum and in other cases the bidder might want to win the auction at any price, because of other factors.

Complex auction processes, which combine various criteria create opportunities for several approaches that need to be considered both for the bidder and their competitors.

In order to assess the probability of winning for each potential bid, we identify competitors' possible behavioral response and probabilities for various scenarios in a bid. These behaviors depend on the competitors' business case but also on non-rational elements such as psychological price points. Potential psychological price-points can be gathered through benchmarking references from spectrum allocations in international markets as well as by studying the local context. For example, previous allocation process in the home country, prior announcements around spectrum value, and analyst projections all contribute to setting these check-points for the bidders.

In the case of the intrinsic value being far above the estimated competitor willingness to pay, the right price will be defined by market value. In the case that the intrinsic value is lower than market value two types of behaviors are possible. If there is strategic value in winning the spectrum (e.g. brand benefit, better alignment with strategic goals, improvement in customer experience) that is not reflected in NPV calculation, an operator can bid above intrinsic value to maximize its chances to win. In other cases, some operators adopt a rational behavior and bid around their most probable intrinsic value.

In conclusion, arriving at the right price for spectrum is a complicated exercise. It requires appraisal of both the bidder's business case as well as that of other competitors that are participating in the exercise. A holistic approach that factors in all the variables in the process is required to arrive at the right price. The bid price for spectrum should maximize the probability of winning the bid, while being compliant with the bidder's objectives and external considerations.

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