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The next (5G) telecom auction in Austria: an international perspective

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It should also be noted that the Simple Clock Auction and Combinatorial Multiple-Round Auction (CMRA) formats discussed in this Presentation are relatively new. Neither Communications Chambers nor Nick Fookes have conducted detailed testing of these formats to identify vulnerabilities or strategic bid opportunities or risks associated with them. The views outlined in this Presentation reflect Nick Fookes' current understanding, based primarily on his review of consultation documents published in connection with the forthcoming 3.5GHz auction in Austria.

Note: these slides are intended to complement other presentations delivered at the 9 April seminar, and do not describe the workings of all auction formats under discussion

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Agenda – three key questions

1. Is a regional award appropriate for the allocation of 3.5GHz in Austria?

2. Given a regional award, which auction format is most suitable?

3. Could a multilateral spectrum trading round post-auction lead to greater efficiency?

Is a regional award appropriate in Austria?

Pros

Broadband operators could use 3.5GHz for fixed-wireless 5G in non-urban areas (where the cost of fibre might be prohibitive), while mobile operators may seek extra capacity in urban areas; a regional award could lead to more diverse and efficient use

Cons

3.5GHz is quickly becoming a prime mobile band, as higher-order 'MIMO' technology improves coverage; a regional award makes it harder to secure national usage rights, could lead to inefficient fragmentation; increases auction complexity and risk

- European precedents for regional awards:
  - Ireland 3.5GHz award (2017); no major objections during public consultation
  - Spain 2.6GHz (2011); politically driven? 3.5GHz (2016) awarded nationally!

- UK (2018) and Switzerland (proposed) 3.5GHz on a nationwide basis

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Review of (some) key auction risks

	Examples
Fixed budget constraints	Hard to manage in CCA, due to lack of price transparency (e.g. UK 2012 multiband auction: Telefonica O2 secured least spectrum despite ostensibly needing it most and having funds to buy more).
Punitive or disruptive bidding	Scope to raise prices paid by competitors in CCA in particular[1]. Seeking to avoid adverse price differentials can distort bidding and lead to very high prices (e.g. Austria and The Netherlands, 2012-2013).
Exposure risk	Only arises if values are super-additive[2]; e.g. risk of being stranded in a lone region, leading to a loss due to lack of scale. May distort bidding. Spectrum trading offers mitigation (e.g. Netherlands 1998 2G auction).
Risk of unsold lots	Unsold lots may result from the auction format and design. May also arise due to excessive reserve prices. Moderate impact: may be resolved in subsequent award.
Strategic demand moderation	Suppressing bids (for larger packages) to limit price inflation may lead to less efficient distribution of lots. Lesser concern for bidders: more worried about getting fair share of industry bandwidth at lower price.

Decreasing severity

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[1] Punitive strategies also available in regional SMRAs with full disclosure of bids
[2] Super-additive or 'complementary' values: Value of (A and B) > Value (A alone) + Value (B alone)

Given a regional award, which auction format is most suitable?

Generally…	SMRA	'Simple Clock Auction'	CCA
Fixed budget constraints	Pay as bid, hence easy to manage	Pay as bid, hence easy to manage	**Catastrophic failures with fixed budgets; high impact**
Punitive or disruptive bidding	Moderate risk (subject to design and circumstances)	**Scope for disruptive strategies leading to chaotic process[1]**	**High risk, high impact**
Exposure risk	**Highest risk (if values super-additive); medium-high impact**	Low risk	Non-existent
Risk of unsold lots	Lowest risk	End-to-end, slightly higher risk than CCA	Medium risk, moderate impact
Strategic demand moderation	**High risk, low impact**	**High risk, low impact**	Low risk (limited incentives)

Decreasing severity

Could CMRA offer a better solution?

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[1] e.g. drive up prices to induce them rivals reduce demand across lot categories; may also drop out, hoping to pick up lots cheaply later. Empirical evidence: goods sold later in sequential auctions are often sold cheaper. Limiting transparency to mitigate these risks would impede price discovery.

Could CMRA[1] offer a better solution?

- Package bidding, like CCA: either win an entire package or nothing at all
  - Eliminates exposure risk: can't be stranded on an unwanted subset of a bid

- Place '**Headline bids**' in successive rounds, based on prevailing clock prices; option to place one or more '**Additional bids**' in each round, for which:
  - Bid values cannot exceed the sum of clock prices for each lot in the package
  - Bid values are also capped by relative valuations implied in prior bids

- Headline bids and Additional bids are all taken into account in each round to determine whether the auction ends, and if not, which lot prices must increase

- Auction ends if a bid-value maximising solution exists in which all bidders who placed a Headline bid (in the current round) are winners
  - No chance of unexpected 'knock out' (unlike CCA, which has a final, single sealed bid round): one is sure to stay in the game if one places a Headline bid

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[1] CMRA: Combinatorial Multiple Round Auction; implemented in Danish 1800MHz auction in 2016. Source: Information Memorandum, 1800MHz Award, issued by the Danish Energy Agency, June 2016

CMRA –illustrative example

Consider 2 bidders pursuing 2 identical lots; each bidder can bid for a package of either 1 or 2 lots. Let the valuations be as follow:

Values	For 1 lot	For 2 lots	Marginal value
Bidder A	40	100	60
Bidder B	70	90	20

At a round price **p=25** per lot:

Bids	For 1 lot	For 2 lots	Marginal bid
Bidder A	-	**50**	50
Bidder B	**25**	45	20

> **'Headline bids' in bold**
> 'Additional bids' in blue

2 lots to 'A' maximises bid-value, but would not include all bidders with 'Headline bids'

At a round price **p=40** per lot:

Bids	For 1 lot	For 2 lots	Marginal bid
Bidder A	40	**100**	60
Bidder B	**40**	60	20

2 lots to 'A' maximises bid-value, but would not include all bidders with 'Headline bids'

> Placing 'Additional bids' in a CMRA generally increases the chances of finding a quicker (and cheaper) solution

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CMRA – illustrative example *(cont.)*

At a round price **p=60** per lot:

Bids	For 1 lot	For 2 lots	Marginal bid
Bidder A	40	100	60
Bidder B	**60**	80	20

'A' has no 'Headline bid', and could be knocked out

But there is a bid-value maximising solution that includes 'B': granting one lot each. The auction ends.

'A' and 'B' are both winners, and pay their winning bids:
Bidder A pays 40 while bidder B pays 60 for an identical lot

- The 'pay as bid' rule makes it easy to manage fixed budget constraints
  - Full visibility of price exposure at each point, unlike CCA where prices reflect opportunity costs (i.e. one's own prices are driven by the losing bids of rivals)

- But price disparities (as with CCA) can be embarrassing and hard to explain to stakeholders

- Because all bids are binding until the end of the auction, there are fewer opportunities for disruptive bidding than in the Simple Clock Auction

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CMRA versus SMRA

	SMRA	CMRA
Fixed budget constraints	Pay as bid, hence easy to manage	Pay as bid, hence easy to manage
Punitive or disruptive bidding	Moderate risk (subject to design and circumstances)	Moderate-low risk
Exposure risk	**Highest risk (if values super-additive); medium-high impact**	Non-existent
Risk of unsold lots	Lowest risk	Medium risk, moderate impact
Strategic demand moderation	**High risk, low impact**	**High risk, low impact**

Reducing severity

Uniform prices

Risk of adverse price differentials

CMRA appears to be less vulnerable to disruptive strategies

...But unless values are wildly super-additive, bidders may themselves still prefer trusty old SMRA:

- Simple

- No adverse price differentials

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10

Wider efficiency considerations

Even if individual spectrum auctions are technically efficient, successive awards may lead to a suboptimal distribution of scarce resources:

- Over time, most operators secure comparatively small chunks of spectrum across many bands

- Smaller 4G and 5G channels perform less well[1], and deploying (and maintaining) equipment across numerous bands is costly

It might be more efficient overall for individual operators to hold larger quantities in fewer bands

[1] Note that carrier aggregation across multiple bands may allow the creation of wider logical channels, improving performance. But this still requires the deployment and maintenance of separate RF units, which is more costly than creating wider channels in a single band.

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Multilateral spectrum trading

Including a multilateral spectrum trading round after each award could offer the prospect of:

- Correcting inefficiencies that may arise in individual awards (e.g. unsold lots)

- Improving aggregate allocation efficiency by enabling spectrum swaps, which may help reduce overall spectrum fragmentation

Would not guarantee improved efficiency, but risk-free opportunity if there are willing parties.

Also more likely to generate successful trades than bilateral processes (e.g. 3-way swaps may be required to achieve an efficient outcome)

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Multilateral trading concept

1 Bidders submit package bids

Operators submit concurrent bids (valuations) for all packages of interest. A package would typically include some resources already held by the party.

2 Trading of lots between bidders by proxy

Lots are traded efficiently on behalf of the bidders by the auctioneer, on the basis of the package valuations supplied by bidders in step 1.

3 Final allocation: bid-value maximising

The winning combination of bids is chosen such as to maximise aggregate bid value, with each participant winning at most one of its bids.

4 Cash transfers from net buyers to net sellers

Transfers between bidders as a result of trading are computed by the auctioneer, as a function of bid values.

Key benefits

Pros

1 Economic efficiency — More likely to lead to successful trades than bilateral processes.

2 Freedom to trade or not to trade — Trading only occurs if there are willing buyers and willing sellers (fail-safe process).

3 Low transaction costs — A regulator-sponsored 'spectrum fair' may offer a ready and low-cost platform for trading.

Cons

1 Numerous valuation points — Operators need to value a potentially large number of packages (same issue as with any multiband auction).

Extra slides

CMRA –example 2

Let the valuations be as follows:

Values	For 1 lot	For 2 lots	Marginal value
Bidder A	70	100	30
Bidder B	80	100	20

At a starting price **p=15** per lot:

Bids	For 1 lot	For 2 lots	Marginal bid
Bidder A	-	**30**	30
Bidder B	10	**30**	20

> **'Headline bids' in bold**
> 'Additional bids' in blue

Cannot accommodate all bidders with 'Headline bids', hence auction must continue

At a price **p=30** per lot:

Bids	For 1 lot	For 2 lots	Marginal bid
Bidder A	30	**60**	30
Bidder B	**30**	50	20

1 lot each is value maximising. The auction ends here. Both 'A' and 'B' pay 30 each.

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CMRA –example 3 (strategic demand moderation)

Let the valuations be as per example 2:

Values	For 1 lot	For 2 lots	Marginal value
Bidder A	70	100	30
Bidder B	80	100	20

At a starting price **p=15** per lot, with strategic demand moderation:

Bids	For 1 lot	For 2 lots	Marginal bid
Bidder A	**15**	30	15
Bidder B	**15**	30	15

'Headline bids' in bold
'Additional bids' in blue

The auction ends immediately, as it is possible to accommodate both bidders with a bid-value maximising solution (granting 1 lot to each bidder); both pay 15 each
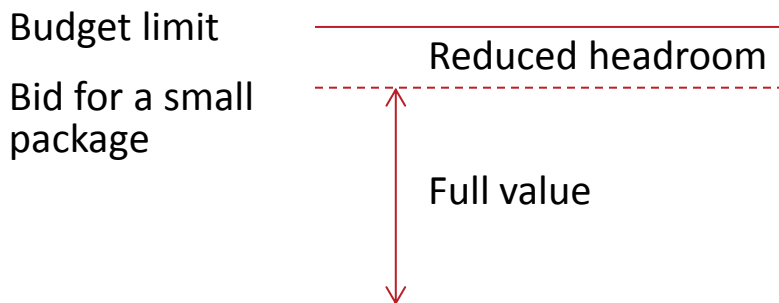
Both bidders achieve a higher profit than in example 2, by suppressing their marginal bids for a second lot

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The budget-constraint problem in a CCA

Hard budget constraints prevent bidders from expressing their relative preferences across the full range of packages of interest. This introduces a significant strategic dilemma.

At one extreme:
Bidding full value on smaller packages

Towards the other extreme:
Suppressing values for smaller packages

Budget limit

Reduced headroom

Bid for a small package

Full value

Budget limit

Greater headroom for marginal bid values

Bid for a small package

Suppressed bid value

Minimises the risk of 'knock out' (winning nothing), but reduces the opportunity to win larger packages and/or influence rival prices
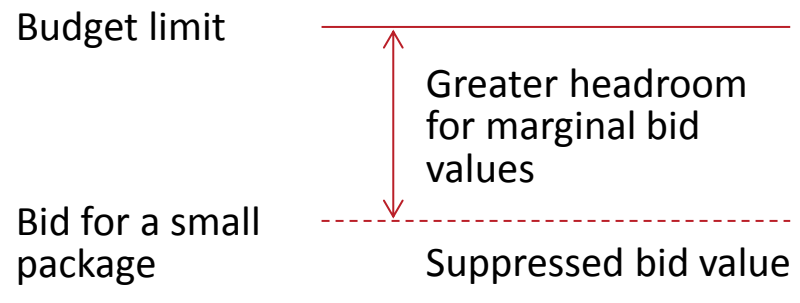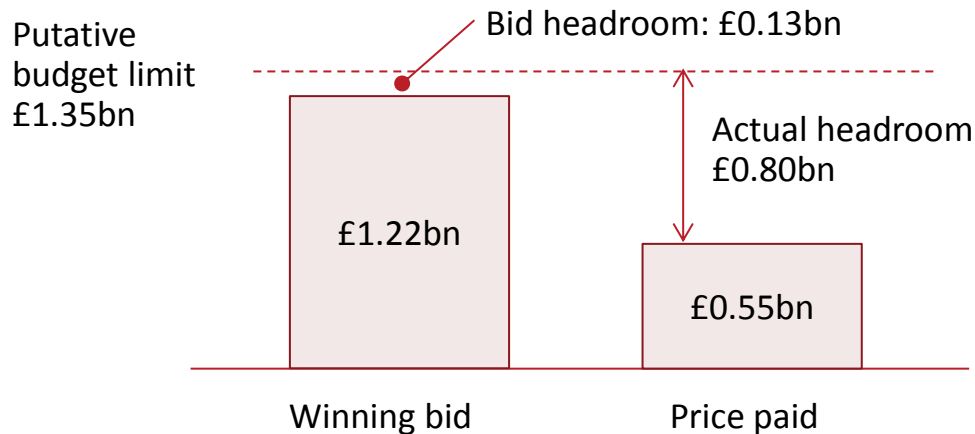
Maximises the opportunity to win larger packages and/or influence rival prices, but increases the risk of knock out

CCA example: UK Digital Dividend auction, 2012

O2 (Telefonica), the most spectrum-constrained operator[1], secured just 2x10MHz (8.5% of the available bandwidth).

The bids, made public after the auction, suggest O2 had a hard budget constraint of £1.35bn[2]. O2 bid £1.22bn on its winning package, leaving less than £0.13bn headroom to bid for additional bandwidth.

Putative budget limit £1.35bn

Bid headroom: £0.13bn

Actual headroom £0.80bn

£1.22bn

£0.55bn

Winning bid

Price paid

In the event, O2's 2nd price was less than half its winning bid of £1.22bn. But O2 had no way of knowing that its actual cash exposure was so low.

This may have compromised allocation efficiency, as reported by the NAO[3].

[1] *Pre-auction bandwidth per customer: 3Hz for O2 versus 4.3Hz for Vodafone, 5.3Hz for EE and 8.2Hz for Hutchison 3G (CommCham estimates)*
[2] *CommCham view based on analysis of auction data published by Ofcom*
[3] *'4G radio spectrum auction: lessons learned', House of Commons report by the National Audit Office, March 2014 –see extra slides.* *(link)*

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Biography & Contact details

Nick Fookes biography

Nick is a specialist in spectrum auctions, policy and valuation, with over 23 years international telecoms industry experience. He has advised mobile operators in connection with over twenty high-stakes spectrum awards, trades, licence renewals, and public consultations, underpinning over $2 billion in spectrum investments since 2010. Nick is a member of Communications Chambers, and an associate of Invictus Strategy Associates and Coleago Consulting. Key projects and clients include:

- Spectrum valuation for EE in connection with the UK Digital Dividend award, and advice on the disposal of 1800MHz spectrum mandated as a merger remedy
- Spectrum valuation and auction strategy advice for SingTel Optus in connection with the Australian Digital Dividend award
- Further clients include: Sunrise, Switzerland; Tele2, The Netherlands; Proximus, Belgium; Partner Communications, Israel; du, UAE; Omantel and TRA, Oman; Kyivstar, Ukraine; AsiaCell, Iraq; DTAC, Thailand; Personal Communications, Paraguay;

Relevant publications include:

- 'The Cost of Spectrum Auction Distortions', November 2014, a report for the GSMA
- 'Impact of budget-constraints on the efficiency of multi-lot auctions', paper for the Handbook for Spectrum Auction Design (Cambridge University Press, 2017)

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Thank you

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