

UK and Irish spectrum auctions

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General disclaimer

DotEcon Ltd. has provided advice to both Ofcom and ComReg on the design of the auctions discussed in this presentation.

All comments in these slides are provided in a personal capacity and do not express any opinions of these regulators or a corporate position of DotEcon Ltd.

I will discuss some auction designs currently subject to consultation by Ofcom and ComReg. Clearly these are open matters and these regulators may make changes.

Broad approaches taken to date

UK

- **Early adopter of combinatorial auctions**
 - (2006) 412-414 MHz – first-price sealed-bid combinatorial auction
 - (2008) 10-40 GHz – experimental CCA with simple absolute caps
 - (2008) L-band – CCA with relative caps for
 - (2013) 800 MHz and 2.6 GHz– CCA with relative caps
 - (2018) 2.3 and 3.4 GHz – **SMRA-clock hybrid**

Ireland

- **Most auctions have been CCAs**, with some use of combinatorial sealed bids for fixed link bands
- (2012 “MBSA”) 800, 900 and 1800 MHz – CCA with relaxed activity rules including time slices
- (2017) 3.5 GHz – CCA with regional licensing and relaxed activity rules

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Different competitive environments

- *4 wholesale competitors protected in 2013 auction through competition floor*
- *Further entry not a major consideration*
- *3 networks operators following Telefónica / Three merger in 2013*
- *Entry of Aircell in 3.5 GHz auction (small cell carrier services provider)*

Current 5G auctions slated for 2020 (both subject to consultation)

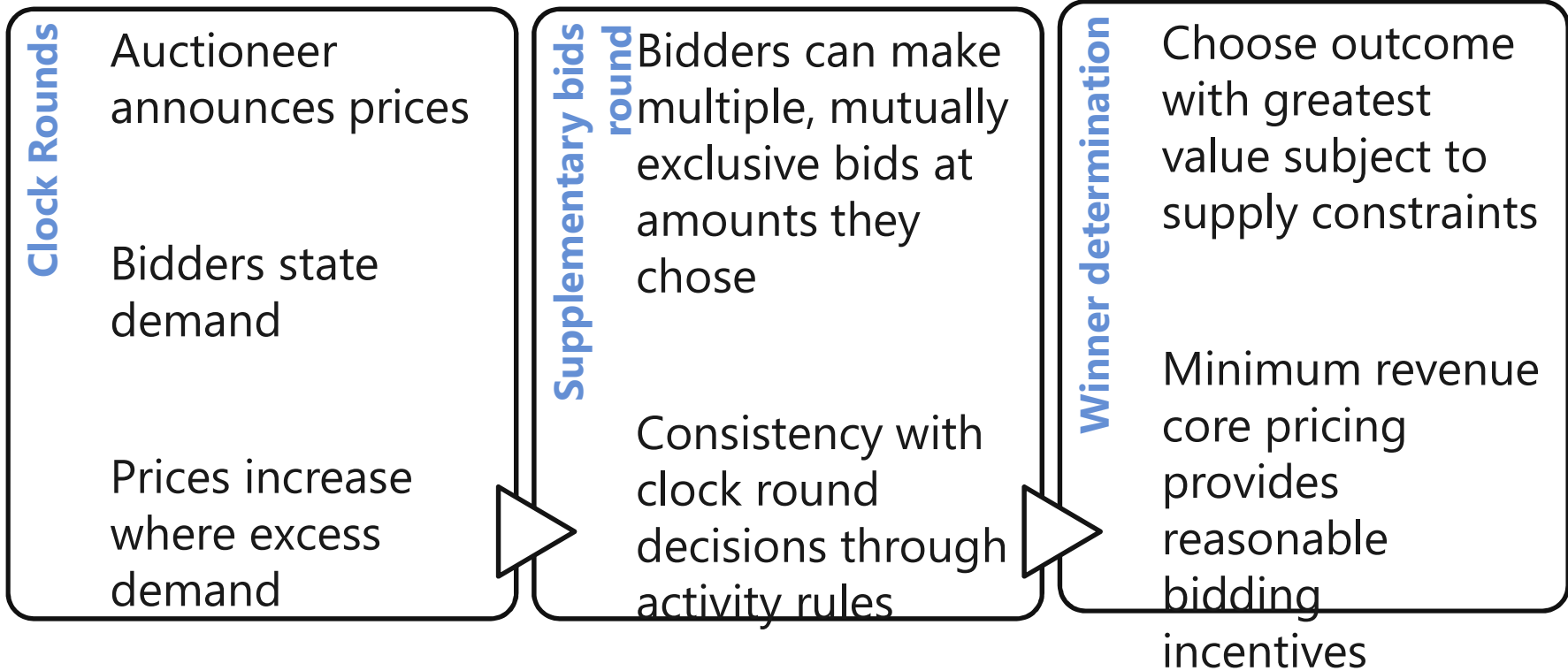
UK

- 700 MHz and 3.6-3.8 GHz auction
- Initial proposals for a **CCA including coverage obligations** as additional lot categories
- Combinatorial auction needed to handle combining of spectrum with coverage lots due to strong complementarities
- Negotiation between MNOs and UK Government recently concluded with **voluntary undertaking to build a shared rural network** (c. £500m from operators and £500m subsidy to achieve 95% geo coverage by 2025)
- **Auction proposals now switched to SMRA-clock hybrid** as coverage lots not needed and consultees said complementarities not significant

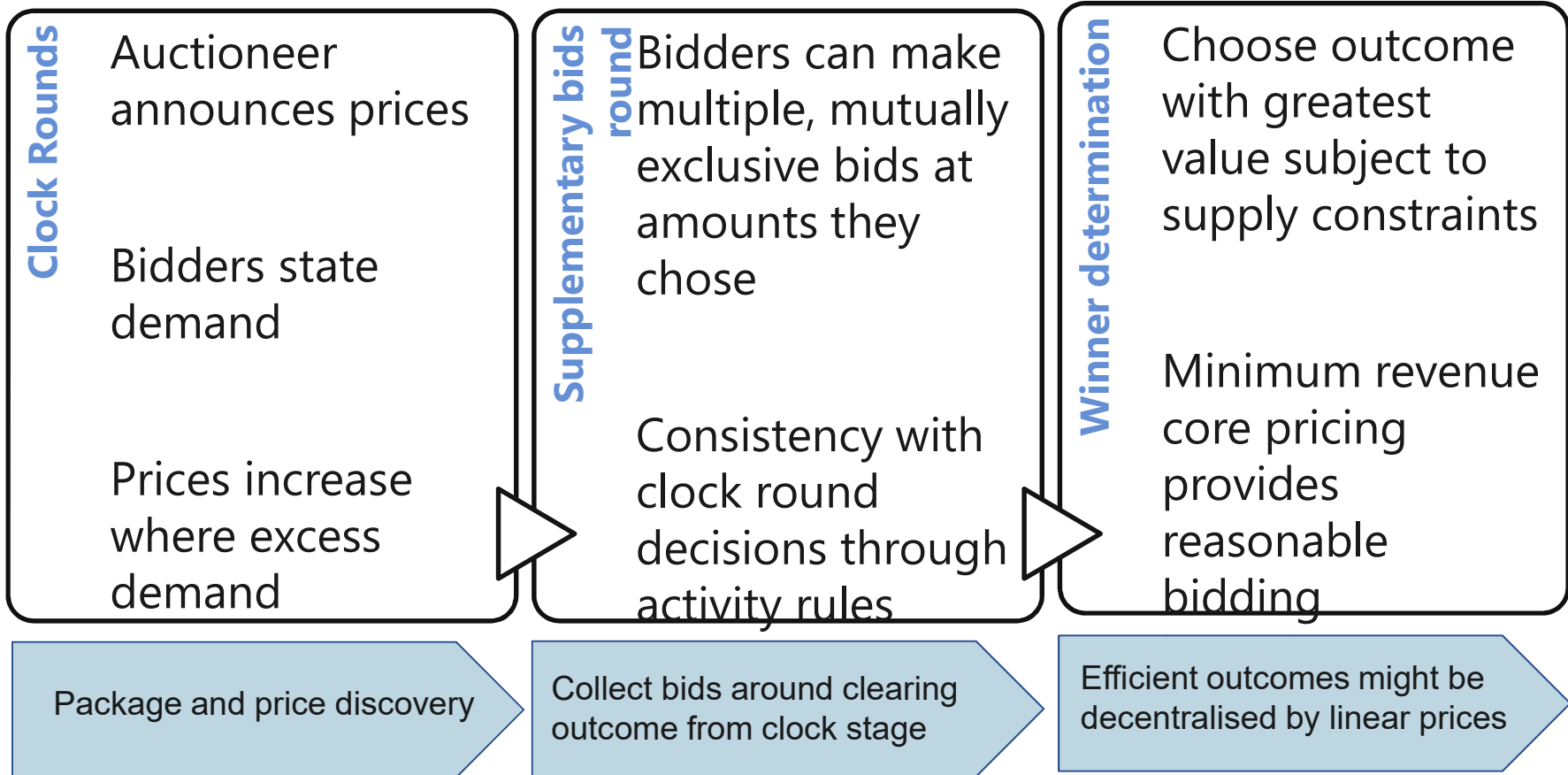
Ireland

- 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz ("MBSA2")
- CCA with relaxed activity rules and time slices
- CCA used due to possible complementarities for entrants and issue of fluid switching of blocks of multiple lots across capacity bands
- Existing operators have licences expiring at different dates. Time slice approach used to allow different lengths of new licences terminating at the same date.

CCA outline structure



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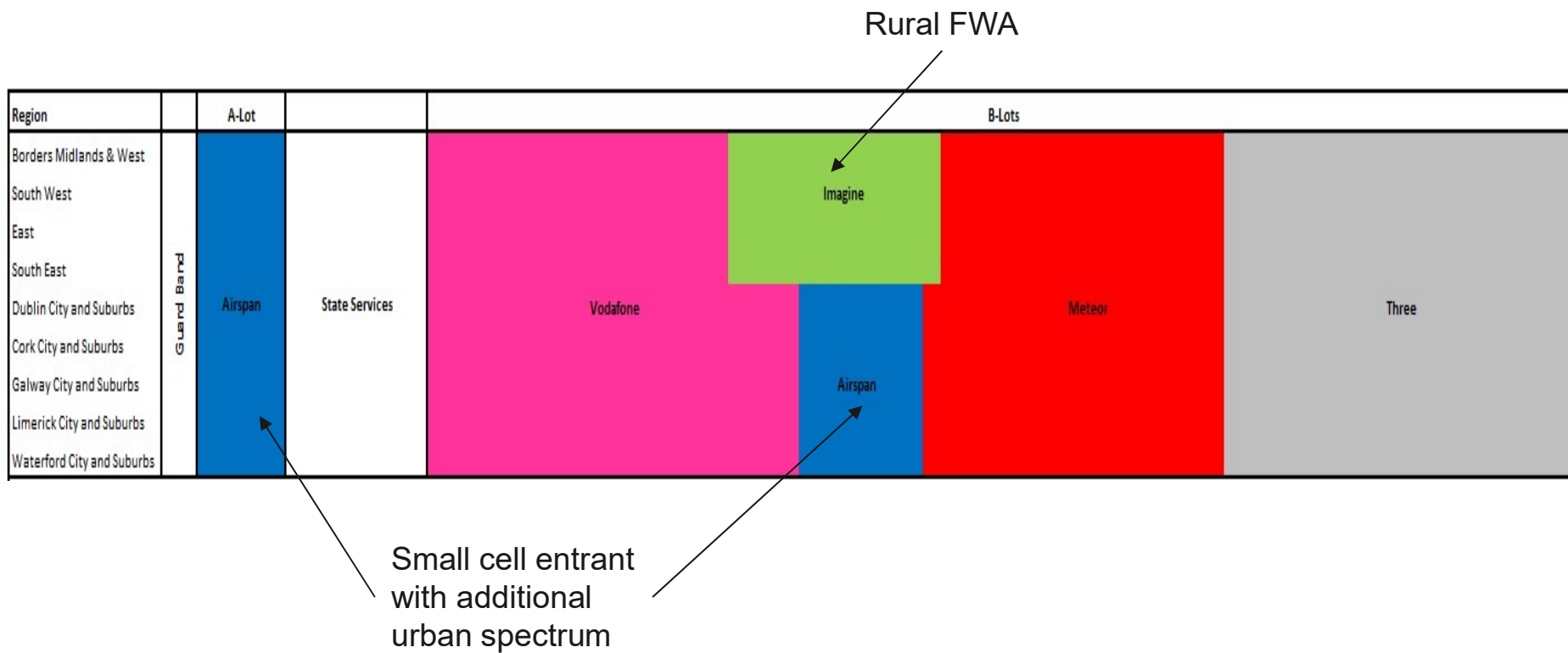


Irish experience with CCAs

- ComReg has used market mechanisms to solve various problems
- **Time slicing** issue created by previous unsynchronised licences
- **Liberalisation “in-place”** of existing licences with technology restrictions at market prices set within auction
- **Regional licensing** of 3.5 GHz spectrum together with national level demand
- Algorithmic **pruning of frequency assignments** to avoid fragmentation, plus **alliance bidding**
- Very strict approach to limiting information about participation due to competition concerns

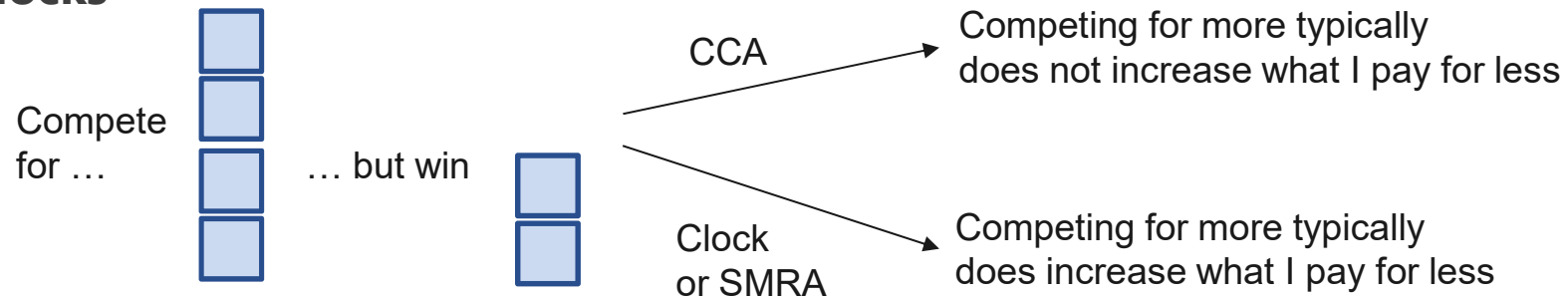
	MBSA lot structure	
	2013-15	2015-30
800 MHz	6	6
900 MHz	5	7
1800 MHz	6	15
	+ Bidder specific lots	

Irish 3.5 GHz outcome



Bidding incentives in CCA vs. SMRA or clock auction

MRC pricing approach gives strong incentives to compete for additional blocks



- Regional structure of Irish 3.5 GHz may have provided a good opportunity for entry
- Entrant able to contest for significant bandwidth to full amount of its business case, not just fit in with FWA operator

UK 800 MHz and 2.6 GHz (2013)

- Auction complicated by **competition “floors”**
 - Minimum number of operators needed to achieve certain minimum sizes of spectrum packages
 - One operator appears to have focussed on the opportunity this created to win discounted spectrum and did not win anything at 2.6 GHz
- Rather asymmetric eligibility points set for 800 MHz and 2.6 GHz bands, which may have led to **sequential rather than simultaneous competition**
- Relaxed activity rules would probably have been used by bidders if available

UK 800 MHz and 2.6 GHz (2013)

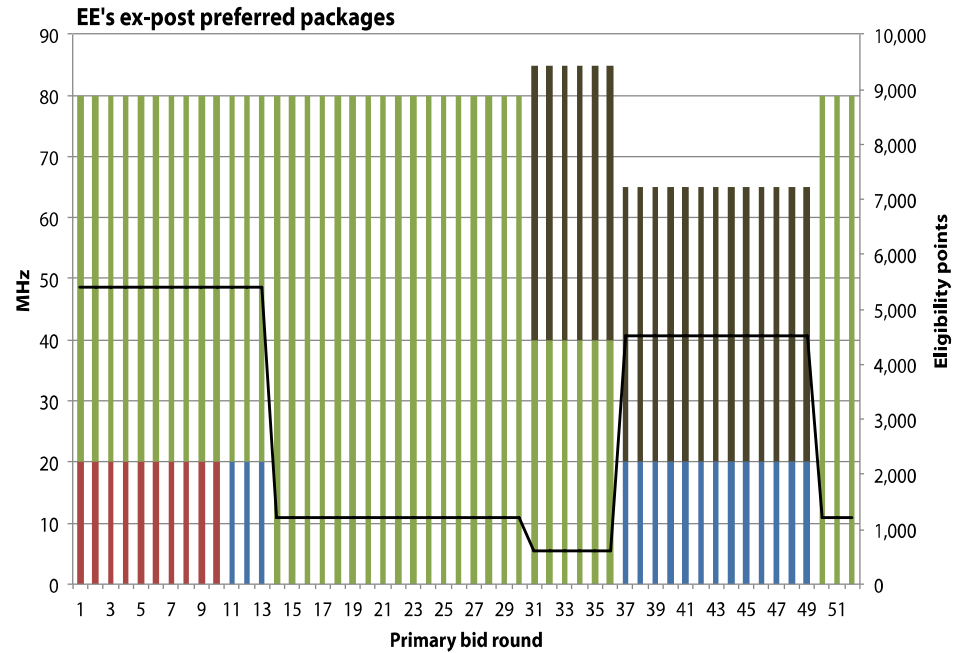
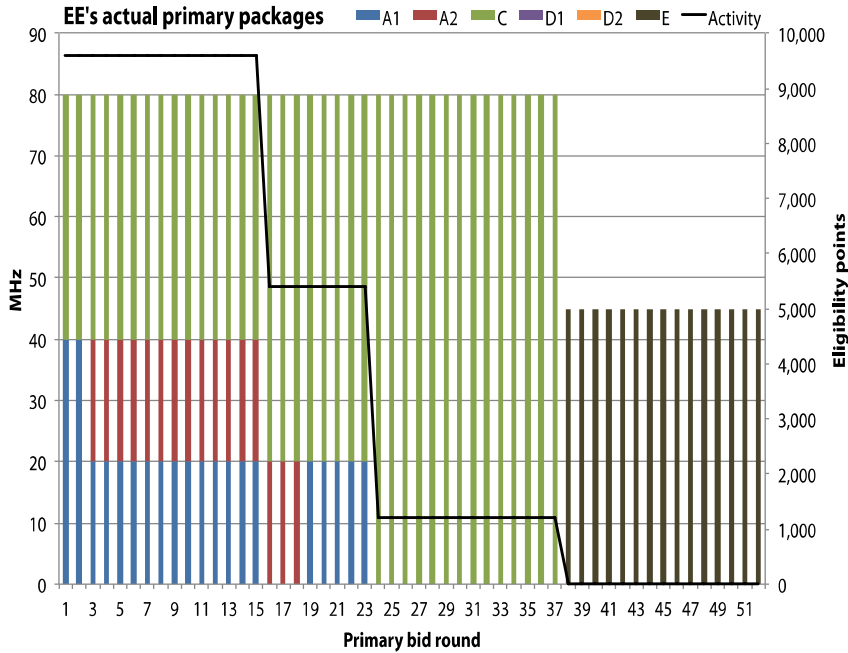
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General lesson: details matter for auction design performance

EE's bidding behaviour shows relaxed activity rules can be important

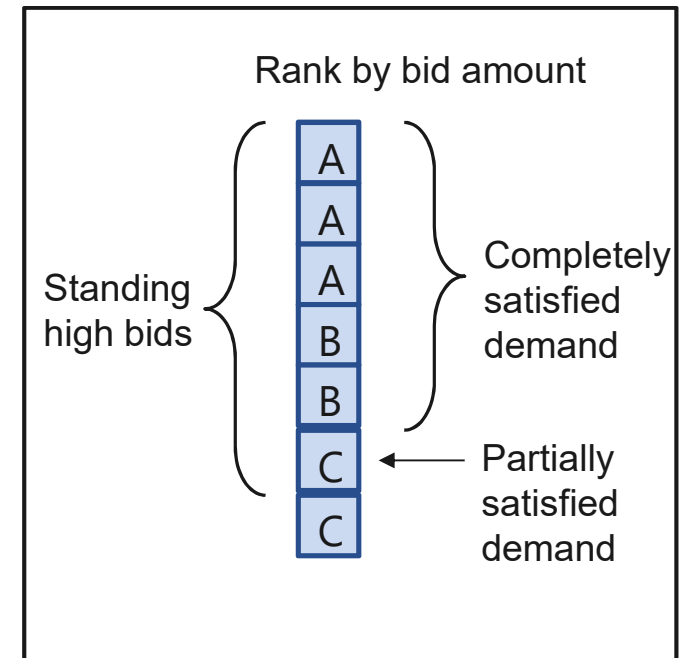
Actual bidding shows EE switching to 2.6 GHz (E lots) and getting “stuck”

Simulation under relaxed activity rules shows they would have switched back to 800 MHz



UK 2.3 and 3.4-3.6 GHz auction

- Ex-post review by NAO raised concerns about complexity of previous 800 MHz and 2.6 GHz auction, with strong operator support for SMRA type auction next time
- Switch away from previous CCAs to a **SMRA-clock hybrid**
 - Bands treated as **identical lots** for main auction stage
 - Bidders say **how many lots** they want in each band at a given price set by auction (clock-like)
 - **Standing high bidders** selected at the end of each round (SMRA-like)
 - SMRA selection rule minimises partially satisfied demand
 - **Withdrawal** possible for partially satisfied bidders, subject to switching current activity
 - Onerous withdrawal penalties if released lots not sold
 - Bidders could set a **minimum requirement** on number of lots won if any won at all

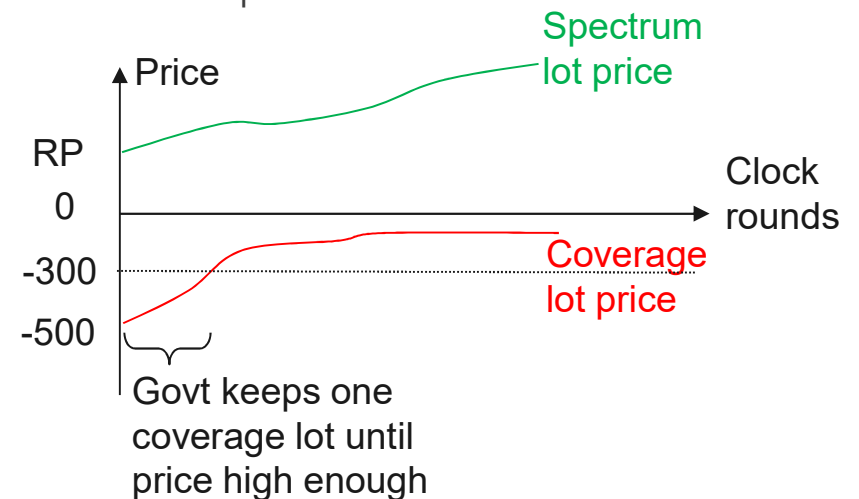


UK 700 MHz and 3.6-3.8 GHz auction and coverage

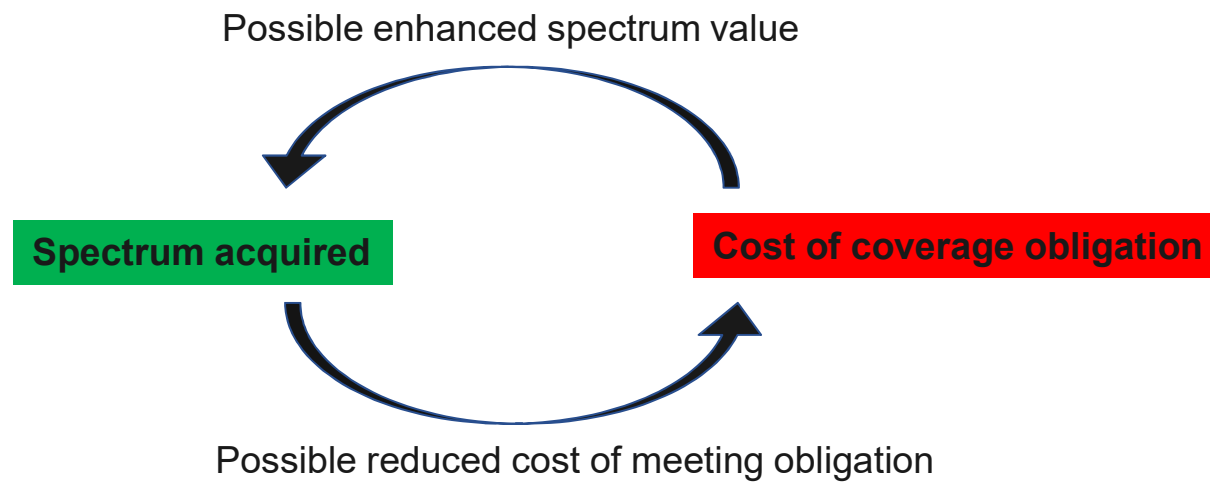
- Initial proposal for one or two coverage obligation lots at a negative price within a CCA
- Bidders could bundle coverage lots at a negative price with spectrum at a positive price
- In clock rounds, price of coverage lots goes up (i.e. less negative) just like spectrum lots
- Restriction that can only bid for packages with positive prices
- CCA activity rules work fine, with small modification that price of any package must be at least zero even including coverage lots
- Approach is quite flexible – Government can make reserve bids to express its value for allocating various combinations of coverage lots

Example

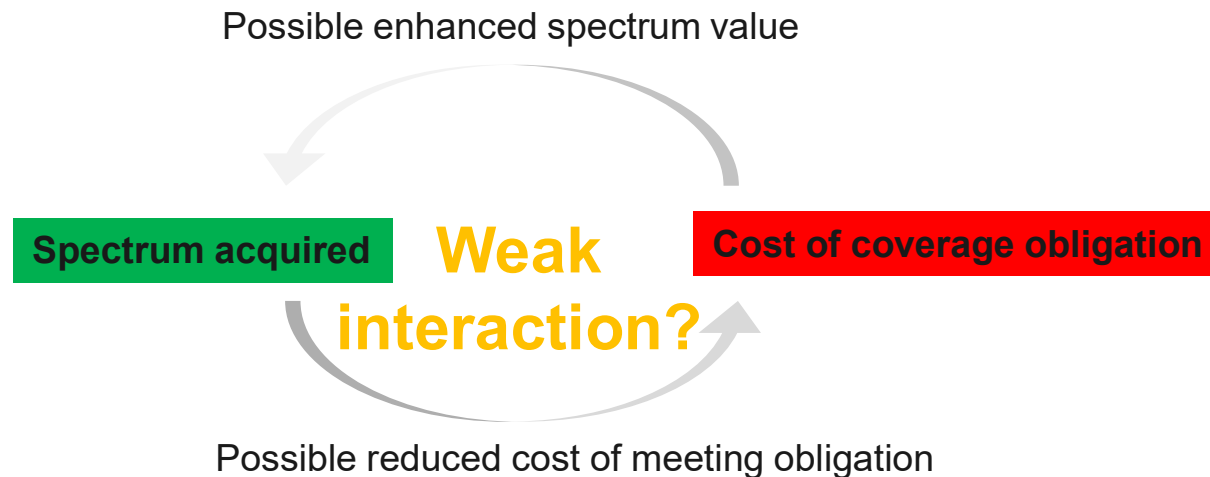
- One coverage lot allocated worth £500m, two worth £800m to the Government
- Start coverage lots at -£500m
- Government bids for one coverage lot until price reaches -£300m



Do spectrum allocation and coverage interventions need to be



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- Operators use spectrum portfolio to meet coverage obligations, not just the band available at auction
- Spectrum availability may not be a strong constraint in rural areas where coverage obligation bites

Approaches to spectrum allocation and coverage obligations

Bundling spectrum with coverage obligations

- Risk of inefficiency if spectrum is not valued most by the efficient coverage provider

Flexible packaging of coverage with spectrum

- Can use CCA approach to deal with strong interactions
- Some potential for leverage if one bidder advantaged in providing coverage

Separate follow-up procurement of coverage

- May be efficient if interactions are weak
- May be more competitive
- State might have more options as monopsonist

Latest Ofcom consultation on 5G

- Coverage issues resolved by negotiation prior to auction
- Auction design simplified and now reverted to SMRA-clock hybrid
- Big question is whether negotiated outcome with all operators be as cost effective as if **coverage commitments had been procured** after the spectrum auction
- A **reverse auction** would have given opportunity for the Government to express its value for different, possibly partially substitutable coverage interventions

Some lessons

- Where outcomes go awry it is often the details, rather than the broad auction format choice, that is to blame
- CCAs are flexible and can be adapted to many different situations
- CCAs are useful where there are strong and varied complementarities across lots, such as larger multi-band auctions
- SMRAs and clock auctions can sometimes be used effectively even where there are complementarities of certain forms, but rules need to be tinkered (e.g. withdrawals, minimum quantities to deal with minimum requirements)
- Views of entrants and incumbents about best approaches to auctions will diverge and regulators need to ensure that entry possibilities are properly considered, as these views are typically under-represented
- Where coverage obligations are interventionist in nature, inflexible bundling coverage with specific spectrum lots is likely to be increasingly unattractive
- Potential of reverse auctions for coverage interventions has not been fully tapped