Death by a thousand bids

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What’s it all about...

- Since 2010, Vodafone has spent about $35 billion in complex auctions
  - More than 60 auctions in 25 countries across our footprint.
  - Some countries had four or more auctions in decade (Albania, Australia, Czech, India)
  - Diverse mixture of 2G renewals, 3G, 4G and 5G.
  - Every format and tweak you can think of (sealed bid, SMRA, clock, CCA).
  - Like trying to master 25 different versions of chess

- What’s the theory?
  - Auctions should be better than administrative assignment / beauty contests at finding an **efficient allocation of spectrum**, benefiting economy 10-100x revenues at auction
  - Auctions should discover the **correct market price** for spectrum
  - Reserve prices should deter frivolous bidding, be just higher than next best usage (e.g. costs of clearing a band); or may dis-incentivise bidder collusion in some cases
What goes wrong in auctions? (Distorting the efficient outcome)

Outcome of Auction (MHz)

Spectrum acquired by Bidder A (MHz)

Spectrum acquired by Bidder B (MHz)

Efficient Auction Outcome
(Highest combined value for A + B + Others)

Actual Auction Outcome
How to distort the efficient outcome...

• Restrict supply (including setting reserve price far too high) and/or constrain demand (setting spectrum caps too tight)
  • Examples of premium unsold spectrum in many markets (Portugal, Romania, Czech, Albania, Australia, India) even after follow-up auctions.

• Use faulty packaging or allocation; makes an efficient outcome impossible.
  • Across Europe, 400 MHz of C-Band (premium 5G band) is badly fragmented
  • Many regulators allowed existing FWA operators to keep part of spectrum; forced 5G onto the rest. Germany (2019) reserved 1/4 of the spectrum for local industrial licences (and forced four bidders onto remaining 300 MHz)
  • Italy (2018) made only 200 MHz available for four bidders. Efficient split would have been 40/40/60/60 (or something like that). But government created 20/20/80/80 packages. Six weeks (and €5 billion) later, a 5G duopoly
What goes wrong in auctions? (Distorting the prices paid)

“Minimum Revenue Core” = lowest price among “core” outcomes

Generalised “2nd price” rule.

Note: Might not be a unique point
How to distort prices paid...

- Set high reserve prices (low enough to sell all spectrum, but >> MRC price).
  - e.g. Greece usually manages to sell spectrum, but at high reserve
  - Ratchet effect: low revenue countries benchmark their reserve prices on high revenue countries (without adjustment). Then high revenue countries benchmark up in turn (but using adjustment)
- Set spectrum caps too weak, so bidders have to bid huge sums to survive
  - Netherlands (2012) and Austria (2013) were fights for survival. No caps (NL), or duopoly caps (AT). CCA left bidders in the dark, narrowly avoiding disaster.
  - Australia: another market where weak caps allow duopoly outcomes
- Use rules which create irrational tension/over-pricing e.g. loser pays, winner's curse
  - Auctions with small excess demand and linear pricing (common price per
Other things to get wrong...

- Occasional extreme engineering to extract revenue. India has this down to a fine art
  - Restricting supply, insane reserve prices; bidding for survival (supply of 8.8 MHz; two incumbents on 4.4 MHz; minimum bid amount set to 5 MHz)
  - Blatant dollar auctions (2nd placed and 1st placed bidder win same amount of spectrum, at same price, but 2nd placed gets broken up rubbish => furious, unresolvable fights for 1st place).
- Information restrictions which do more harm than good
  - Bidders have value not just for the spectrum they win, but for the difference in spectrum endowments between themselves and competitors (ahead, co-equal, close 2nd place, poor 3rd place?).
  - Most auctions hide this sort of information, and so leave bidders guessing about how much to bid towards end of auction. Can create serious inefficiency if they guess wrong. Bid teams consume a lot of time trying to...
Regulators’ single biggest mistake...

CTRL-C, CTRL-V
What did we do last time? Same rules again then...

- Odd effects include bidding with fax machines (or rules allowing fax for back-up bids... regulator's number doesn't work any more!).
- Little local customs/folk traditions perpetuating 25 variants of auction design. Lots of CRTL-C/CTRL-V for advisors too.
- May explain recurring obsession with problems of late 90s/early 00s
  - Operators had huge margins / gains from 2G. Get lots of money from them!
  - Must encourage a new entrant (who later exits; revolving door effect)
  - Must hide bid info because bidders might collude to keep prices down
    - 21st century had 4 very expensive open auctions in Germany; 2 in Italy
- Worries about aggregation risks => complex package formats (CCA)
  - Complexity tends to lower auction efficiency, not raise it
Why is all this so damaging?

- Loading high cost of licences onto company debt is unsustainable and ultimately hits dividends.
  - Most MNOs are suffering these effects. Regulators seem to be telling investors to abandon the sector and put their money somewhere else.
  - Tragic given the high social value of mobile network investment.
  - Strong evidence from GSMA study that high spectrum prices really do hurt investment (“Sunk cost” analysis is incorrect).

- Sometimes these things are done deliberately. More often, they are mistakes.
  - Almost all of our 60+ auctions suffered one or more of these problems.
  - It is far easier to get an auction wrong than to get it right.
Bidding Starts at 5c
But surely no real auctions are like this?
German 2015 auction: Starting Price €1.5 billion
Plenty of Spectrum
Only three bidders.
Should be simple, right?
Round 84: Total Spend €2.77 billion

One block excess demand
Any bidder could now drop this and close the auction...
Round 180: Final Spend €5.08 billion
Total cost of fight over one block: €2.31 billion

Telefonica paid €550m to lose the block
German 2019 auction: bidders spent €4 billion fighting over the last 10 MHz... 1&1 Drillisch was the paying loser.

Once you recognise the “loser pays” principle, dollar auctions start to look ubiquitous...

So... what SHOULD we be doing?
What really matters?

• Investment and Infrastructure Competition
  • Each generation 2G->3G->4G->5G lowers costs of data by an order of magnitude,
  • Social benefits of everyone being connected everywhere (and ultimately every thing being connected) are measured in $ trillions.
  • Optimising infrastructure players is a balancing act
    • Too few creates complacent monopoly/cosy duopoly.
      (One reason why single wholesale networks or things like them - mandated national roaming - are bad news)
    • Too many lowers margins, and leaves players struggling to rollout
      (Cherry-picking sites, geographical coverage suffers)
  • Not the same as retail competition (3 or 4 MNOs, MVNOs etc.)
    • Can reduce present retail margins and prices by a few percentage points
    • But counter-productive if it destabilises/destroys network investment
What really matters (summary)?

• Spectrum allocation should ensure *enough* infrastructure players have *enough each* to stay competitive.

• After that, spectrum *at the margins* should be priced to find the efficient allocation.

• In most markets, promoting “new entrants” should not be a goal of spectrum auctions at all (though free to enter if they believe they can do a better job than incumbents).
What would that mean for auction design?

• Take the minimum revenue principle **seriously**. Revenue really ought to be **minimum** to get the right result.

• Outcomes of auctions should be pro-competitive as well as efficient. So don't even allow bidding on anti-competitive outcomes
  • e.g. Three players may each need 25% of spectrum to stay viable.
  • So offer them "floor" packages at reserve price (e.g. each 25%). Then have competitive bidding for the remaining 25%. Greece did something like this.

• Avoid dollar auctions over last lot or lots.
  • e.g. 20 lots. Demands are 7,7,7. Allocate all bidders 6 lots at reserve price then invite ascending bids only for other two lots (three bidders for two lots).
  • Price point will naturally find the marginal value of third bidder; no
Excluding extreme, anti-competitive outcomes....
Modifying the SMRA ...

- Start with an open SMRA format (like Germany), with similar activity rules.

- **Additional rule**: overbids in any category must be on the **most expensive** high bid(s) of a competitor in that category.

- Example: 5 lots, 6 demands. Provisional outcome is (A 2, B 1, C 2), with these standing high bids:
  
<table>
<thead>
<tr>
<th>Lot</th>
<th>Bidder</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bidder A</td>
<td>10m</td>
</tr>
<tr>
<td>2</td>
<td>Bidder A</td>
<td>5m</td>
</tr>
<tr>
<td>3</td>
<td>Bidder B</td>
<td>8m</td>
</tr>
<tr>
<td>4</td>
<td>Bidder C</td>
<td>9m</td>
</tr>
<tr>
<td>5</td>
<td>Bidder C</td>
<td>7m</td>
</tr>
</tbody>
</table>

  If bidder B prefers outcome (A 1, B 2, C 2), then he needs to outbid bidder A on lot 1. Why? Bidder A has already expressed a marginal value of 10m for two lots vs one. For bidder B's preferred outcome to be efficient, he must express a higher value than that.

  Or if B prefers outcome (A 1, B 2, C 1), he needs to outbid C on lot 4.
Results in a second price rule like a CCA...

- Running simple simulations, bidders’ lots “freeze out” in turn at the prices where competitors reduce marginal demand. So should be very similar to MRC prices.

- Possible issues/imperfections:
  - Bidder A has a large package value (2 lots or nothing) and gets “stuck” with 1 lot at end of auction. Allowing a withdrawal rule and run-off auction as in Germany would help with this (A's unwanted lot would in many cases re-sell close to the price at which it froze out, so minimal withdrawal penalty)
  - Bidder A bids reserve price for lots 1 to 4 and 1bn for lot 5, and gets standing high bids for all of them. Competitors have a budget < 1bn so no-one else can now bid for anything. This is a reason to disallow large jump bids.
  - Single excess demand that moves around between bands could still lead
Other points...

- Things that probably *won’t* go wrong (but which do go wrong in CCAs)
  - Bidders deliberately inflating demand on blocks they don’t expect to win, to increase each other’s prices
    - It will be too easy to see this happening and retaliate. % activity rules would actually help here. “You escalate; so I do too”.
  - Bidders getting budget squeezed and not being able to bid competitively
    - Bidders will have full knowledge of the prices of their lots which have frozen out, and so know how much budget is remaining for other lots
    - This contrasts to a CCA, where budget-constrained bidders face a real dilemma over how to distribute budget in the supplementary round.
- Has anyone ever studied this format before? Anyone want to collaborate?