COST 605

Econ@Tel. A Telecommunications Economic COST Network

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FORMATS FOR SPECTRUM AUCTIONS

José Luis GÓMEZ-BARROSO

UNED – Universidad Nacional de Educación a Distancia (Spain)

Introduction

Beauty contests have been the predominant mechanism (although not the only one) for primary spectrum allocation

Auctions started proliferating, attempting to reach the optimum allocation mechanisms for the spectrum in terms of efficiency as well as of revenue maximization

★ Those results are depending on the ***design of the auction***

- Assignment processes for digital dividend are going to put (are putting) the focus on auctions

Auction design

- Open auction (bidders can see each others bids)
  Sealed bid auction (each bid is secret)
- One single round
  Multiple-Round Auction
- First-price auction (PWYB, pay what you bid)
  Second-price auction
- Sequential auction (bidders bid for one lot after another)
  Simultaneous auction (bids for all lots at the same time)
- Individual bidding (bids for individual items)
  Combinatorial or package bidding (bids for combinations of items)

Structure

- Variables in the design of an auction
  - Open vs. sealed bid
  - Pricing rules
  - Sequential vs. simultaneous auctions
  - Individual lots vs. packaged lots
  - Other variables
- Some interesting particular types of auctions
- Examples of recent auctions

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Open bid vs. sealed-bid

	Benefits	Costs	Risks
Open bid	If there is common value, allows bidders to learn from the behaviour of competitors. However common value unlikely	Weak bidders may be discouraged from participating Can also be complex and costly to run	Risk of collusion between bidders and low participation
Sealed bid	Encourages participation where there are bidder asymmetries Less susceptible to collusion Simple and easy to run	Bidders cannot learn from other bids	Requires strategic approach to bidding, particularly where winners pay what they bid

Pricing rules

	Advantages	Disadvantages
Pay what you bid	Strategic manipulation with asymmetric bidders is much more costly Fewer possibilities for collusion Simplicity	Less efficient as bidders would shade down their bids
Opportunity cost (Second price) (Vickery-Clarkes Grove mechanism)	More efficient outcome likely because bidders have incentive to bid their true valuation	Inefficient where there are bidder asymmetries Can allow significant gains from collusion In practice, the incentives to bid real valuations may not work

Sequential and simultaneous auctions: Definition

- Sequential auctions: Licenses are sold one at a time in separate auctions
- Simultaneous auctions: Groups of related licenses are sold at the same time in different auctions and bidders can bid on any of the items. All auctions would close at the same time when no new bids are received in any license for a period of time

Aggregation risks

- Complement lots:
  - A number of lots are required for fulfilling operator's plans
  - When different lots are different licenses:
    - Gains in value could arise from obtaining two or more geographically neighbouring licenses (local synergies)
    - Gains in value accrue from obtaining increased numbers of licenses or markets (global synergies: economies of scale or scope among multiple licenses)

➡ Aggregation risk: bidders get an insufficient number of lots

Sequential vs. simultaneous auctions

	Benefits	Costs	Risks
Sequential auctions	May allow bidders to learn from observing other bids and is relatively simple to run	Bidders may need to understand the coordination costs of their bids at every stage. Costly to implement, and time consuming	Significant aggregation risks if lots are complements (failure to acquire all lots may leave some lots stranded) Substitution risks if lots are substitutes
Simultaneous actions	Allows bidders to manage substitution and aggregation risks	Weak bidders may be discouraged because it is easier for strong bidders to overbid Bidders cannot learn from each other's bids.	Inefficiency may result if there is some common value uncertainty

Individual lots vs. packaged lots

	Advantages	Disadvantages
Package bidding	It allows bidders who require complementary lots to acquire them It reduces aggregation risks	Threshold risk for smaller bidders Inability of bidders seeking single lots to displace aggregators seeking various lots

Generic vs. specific lots

	Benefits	Costs	Risks
Generic lots	Simplicity All lots can be assigned on a contiguous basis	A follow-up process is required to assign actual blocks between winning bidders	Inhibition of bidding when bidders have strong preferences between lots
Specific lots	Important when proximity to other bands of spectrum matters or coordination requirements exist	It requires evaluating individual preferences between lots. Particularly so for noncontiguous lots	Small risk of exclusionary bidding in bids for multiple lots

Combinatorial auctions

- In combinatorial or package auctions, bidders are allowed to choose the packages for themselves
  - These auctions allow the participants to bid both for complete packages (all-or-nothing bids) as well as for individual licenses
- Their usage is not yet generalised due to their complexity both for the auctioneer (in the solution of the winner determination problem) and for the bidders when placing their bids

Other variables

- Transparency – the details of the participants are either revealed or not revealed
- Bidder association – this is either explicitly prohibited or not
- Reserve price
- Possibility of withdraw
- Eligibility rules
- Activity rules

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Simultaneous Multiple-Round (SMR) Auctions

- Also called the Simultaneous Ascending Auction
- Discrete, successive rounds where participants submit a series of single-item bids for the desired licenses
- The higher bids for each license become the standing prices for the next round of bidding
- The auction ends when no new bids are posted in a round in any license

Iterative combinatorial auctions

- At the beginning of each round, bidders submit prices for one or more packages
- Then the auctioneer solves the winner determination problem, announces provisional allocation and asks prices for the next round
- The auction ends at a fixed deadline or when no new bids are submitted

Ascending proxy auctions

- Bidders report their valuation about packages to a proxy agent
- The proxy agents iteratively submit package bids, selecting the best profit opportunity according to the inputted values
- The auctioneer considers all bids (from present and past rounds) and chooses his best feasible collection of bids
- The auctioneer announces provisional allocation and the process continues until no new bids are submitted

Clock-proxy auction

- Hybrid auction format that begins with a clock phase and ends with a final proxy round
- In the clock phase, the auctioneer announces prices for each item being sold and bidders indicate the demanded quantities. Prices will continue going up until there are no items with excess demand
- The auction finishes with a proxy round in which bidders submit their preferences to a proxy agent

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Spectrum auctions

- The first country in using spectrum auctions was New Zealand in 1989
- The turning point for auctions happened in 2000-2001 with European 3G (UMTS) licences auctions
- In June 2002, Nigeria held the first combinatorial auction for regional fixed wireless access (FWA) licenses
- The "digital dividend" resulting from the television analogue switch off represents a great opportunity for introducing some criteria attempting to increase the efficiency in the usage of the spectrum
- The United States 700 MHz FCC wireless spectrum auction has put the focus on auctions

UMTS auctions

- Denmark: Sealed bid auction
- Greece: Sealed bid auction (three phases)
- United Kingdom, The Netherlands, Belgium: Simultaneous ascending auctions
- Germany and Austria: Simultaneous ascending auctions (two stages: Only bidders who won at least two spectrum blocks in the first stage were allowed to participate in the second stage)
- Italy
  - First stage: beauty contest
  - Second stage: open bid multiple round auction

FCC. Auction 73 (700 MHz band)

- March 2008
- Simultaneous Multiple Round Auction. PWYB
- Package bidding on C block licenses
  - Individual bids on C Block licenses for REAGs 1-12
  - Package bids on the following combinations of C Block
    - (i) REAGs 1-8 (the "50 States" package)
    - (ii) REAGs 10 and 12, comprising the "Atlantic" package
    - (iii) REAGs 9 and 11, comprising the U.S. Pacific territories

Ofcom. Award of 1781.7–1785 (paired with 1876.7–1880) MHz

- April 2006
- Sealed bid auction
- Single round
- PWYB
- The number of Licences awarded could have been either 7, 8, 9, 10, 11 or 12, to be determined by the award process
  - Each bidder was able to make up to six separate but parallel bids, one for each of the different numbers of licences that could be awarded

Ofcom. Award of 1781.7–1785 (paired with 1876.7–1880) MHz

	Option (number of licences on offer)					
Bidder	**7**	**8**	**9**	**10**	**11**	**12**
British Telecommunications PLC	£305,112	£295,112	£275,112	£275,112	£275,112	£275,112
Cable and Wireless UK (England)	£281,002	£281,002	£101,002	£51,002	£51,002	£51,002
COLT Mobile Telecommunications Ltd	£1,513,218	£1,513,218	£1,513,218	£1,513,218	£1,513,218	£1,513,218
Cyberpress Ltd	£151,999	£151,999	£151,999	£151,999	£151,999	£151,999
FMS Solutions Ltd	£113,000	£113,000	£113,000	£113,000	£113,000	£113,000
Mapesbury Communications Ltd	£76,660	£76,660	£76,660	£76,660	£76,660	£76,660
O2 (UK) Ltd	£209,888	£209,888	£209,888	£209,888	£209,888	£209,888
Opal Telecom Ltd	£155,555	£155,555	£155,555	£155,555	£155,555	£155,555
Orange Personal Communications Services Ltd	£50,000	£50,000	£50,000	£50,000	£50,000	£50,000
PLDT (UK) Ltd	£88,889	£88,889	£88,889	£88,889	£88,889	£88,889
Shyam Telecom UK Ltd	£101,011	£101,011	£101,011	£101,011	£101,011	£101,011
Spring Mobil AB	£50,110	£50,110	£50,110	£50,110	£50,110	£50,110
Teleware PLC	£1,001,880	£1,001,880	£1,001,880	£1,001,880	£1,001,880	£1,001,880
Zynetix Ltd	£50,000	£50,000	£50,000	£50,000	£50,000	£50,000
Option total	**£3,618,664**	**£3,721,664**	**£3,622,665**	**£3,687,212**	**£3,738,214**	**£3,788,324**

Ofcom. Award of 412-414 (paired with 422-424) MHz

- October 2006
- Sealed bid combinatorial auction with package bidding (four 2×500 kHz lots allowing bidders to bid for any single lot or for any combination of lots up to and including all four)
- Single round
- PWYB

Ofcom. Award of 412-414 (paired with 422-424) MHz

Frequency lot	*AirRadio Limited*	*Arqiva Limited*	*Motorola Ltd*	*T-Mobile (UK) Ltd*	*The Joint Radio Company Limited*	*Ventura Team Spectrum One Limited*
A	£200,037	£781,000	£205,000	No bid	£113,142	No bid
B	£200,037	£781,000	£205,000	No bid	£113,144	No bid
C	£200,037	£781,000	£205,000	No bid	£113,141	No bid
D	£200,037	£781,000	£205,000	No bid	£113,143	No bid
A and B	£200,037	£1,031,000	£205,000	No bid	£113,149	No bid
A and C	£200,037	£1,031,000	£205,000	No bid	£113,145	No bid
A and D	£200,037	£1,031,000	£205,000	No bid	£113,148	No bid
B and C	£200,037	£1,031,000	£205,000	No bid	£113,147	No bid
B and D	£200,037	£1,031,000	£205,000	No bid	£113,150	No bid
C and D	£200,037	£1,031,000	£205,000	No bid	£113,146	No bid
A, B and C	£200,037	£1,281,000	£205,000	No bid	No bid	£387,700
A, B and D	£200,037	£1,281,000	£205,000	No bid	No bid	No bid
A, C and D	£200,037	£1,281,000	£205,000	No bid	No bid	No bid
B, C and D	£200,037	£1,281,000	£205,000	No bid	No bid	£327,700
A, B, C and D	£200,037	£1,500,025	£205,000	£250,239	No bid	£387,700

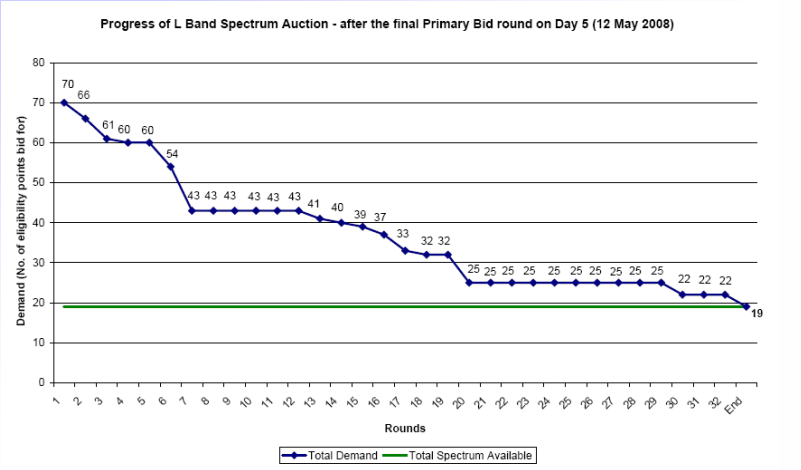
ComReg and Ofcom. Award of 1785-1805 MHz

- Ireland and Northern Ireland. May 2007
- Sequential auction
- Sealed bid auction
- Opportunity cost price
- First auction in Eire (holding the first auction in the jurisdiction which has the larger potential market may limit the potential impact of aggregation risks)

Ofcom. Award of 1452-1492 MHz

- May 2008
- Combinatorial clock auction
- Package bidding (packaging 1452-1479.5 MHz into 16 blocks each of approximately 1.7 MHz and packaging 1479.5-1492 MHz into a single 12.5 MHz lot)

Ofcom. Award of 1452-1492 MHz



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