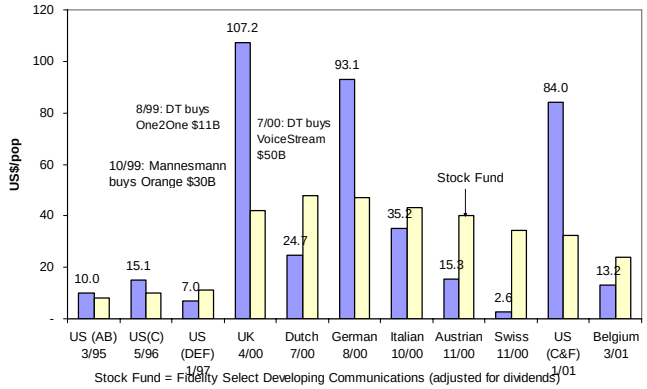
Spectrum Auctions

Peter Cramton
University of Maryland

Mobile Wireless Auction Prices (2 x 10 MHz + 5 MHz)



Prices are all over the place. Why?

- Auction design
- Auction competition
- Auction strategy
- Complex interaction of the above

Auction design

- Ascending auctions work well, but details are essential to success
  - Example: Need to understand existing market structure
- Key determinants of prices are
  - State of capital markets
  - Spectrum allocation
  - Sequencing
  - Reserve prices
  - Competition laws

US vs. Europe

- US uses simultaneous ascending auction
  - All licenses on the block at the same time
  - But some sequencing: AB, C, DEF, etc.
- Europe uses a sequence of ascending auctions
  - Clear sequencing
  - First mover advantage becomes important

Incumbent advantage

- Incumbent value = 3G value + value lost in 2G if do not win a license
- Entrant value = 3G value – extra cost of building network from scratch

$\Rightarrow$Incumbents have strong advantage

$\Rightarrow$Likely outcome is all incumbents win

Competition matters

Country	Bidders to Licenses	New entrants only
UK	13 for 5	9 for 1
Dutch	6 for 5	1 for 0
German	7 for 4 to 7 for 6	3 for 0 to 3 for 2
Italy	6 for 5	2 for 1
Austrian	6 for 4 to 6 for 6	3 for 1 to 3 for 3
Swiss	9 for 4	6 for 1
Swiss final	4 for 4	1 for 1
Belgium	4 for 4	1 for 1

Auction competition is endogenous

- Bidders will merge if big price impact
- Extra incentive to merge if
  - High prices in prior auctions
  - Low reserve price
  - Large value difference between marginal and sub-marginal bidder

German 3G Auction

- 12 blocks of 5 MHz each
- Can win at most 3, but at least 2
- Hence, between 4 and 6 winners
- 4 incumbents will surely win
- Question is whether incumbents give up 5 MHz to make room for 5th or 6th player

Strategy matters

- German auction should have ended earlier
  - DT and Mannesmann could have dropped to 10 MHz (from 15 MHz)

Round	Revenue (billion €)	Still to go	Event
127	32.2	18.3	Debitel drops out (down to 6 bidders)
146	42.4	8.1	All know that MobilCom dropped to 2
173	50.5	0.0	End of auction

Strategy matters

- Other cases of poor bidding
  - Vodafone in UK auction
  - Verizon in US auction
    - Paid over $2B for each 2 x 5 MHz in NYC
    - Could have ended bidding at $.8B if got 1, not 2
    - Throwing good money after bad?

Bid limits appear to be whole billion of local or home currency

UK 3G Auction		Crescent	3G	Epsilon	Spectrum	OneTel	WorldCom	Telefonica	NTL
Appearent Bid Limit		3 BU$	2 BP	2 BP	2 BP	6 BA$	5 BU$	1 TS	4 BP
home exchange		U 1.586043	E 1	J 167	Fi 10.1	A 2.66	U 1.586043	S 282	F 11.15
Dropout	min	C 1,819	A 2,001	C 2,072	D 2,100	E 2,181	D 3,173	C 3,668	C 3,971
local	max	E 1,952	A 2,210	D 2,122	C 2,180	C 2,289	C 3,396	D 3,829	D 4,044
Dropout	min	C 2,886	A 2,001	C 346,057	21,210	E 5,801	D 5,033	C 1,034,404	C 44,271
home	max	E 3,097	A 2,210	D 354,307	22,018	C 6,089	C 5,386	D 1,079,665	D 45,087

German 3G Auction	
Debitel Dropout	
min	9.8
max	10.8
Bid limit	10 BDM

Why were prices so high?

- Values based on stock prices, not expected cash flows
  - Telecom bubble led to high values
- Winner's curse
  - 9 potential entrants in UK for 1 license
- Failure to see options
  - Not offering 3G
  - Acquiring weakest winner after auction

Did high prices destroy telecom?

- Puts spectrum in hands best able to use it
- License fee is sunk cost
  - Does not distort subsequent decisions
  - Non-distortionary government revenues
  - Transfer from shareholders to taxpayers
- Capital markets may punish overbidding
  - Reduced capital available for future projects

Moving forward

- Package auctions with proxy bidding
  - Mitigate demand reduction
  - Better expression of preferences
  - Better control of pace of auction
  - Good price discovery to focus valuation analysis
- Two-sided auctions for encumbered spectrum
  - Efficient reassignment of spectrum
  - Encourage incumbent participation with new rights

Spectrum policy

- Command and control unworkable when technology is changing so rapidly
- Property rights
  - Favor flexible use, tradeable rights, interference temperature at borders
- Commons
  - Favor unlicensed spectrum, responsible use (hardware able to handle interference)
- Which model is best?
  - Scarcity
  - Externalities