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WHAT CAN WE LEARN FROM THE EUROPEAN 800 MHZ AUCTION RESULTS?

Outline

- Aim of the paper
- Methodology
- What are the typical features of the 800 MHz allocation processes?
- Data sources and data challenges
- Findings

Aim of the paper

- what features were used in the European 800 MHz allocation processes
- quantitative analysis of the effects of these features on prices paid by the winners of the licences
 - builds on the results of the analysis of the allocation processes of the 3G era by Madden et. al. in numerous papers

it is an ongoing research with preliminary results

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³ Papp, B

Price of the 800 MHz spectrum

- average price paid by the winners
- only results of auctions considered
 - but sometimes there was no real competition
- beauty contests or payments by new entrants/weaker players for reserved spectrum were intentionally left out
- prices are for 2x1 MHz /population
- prices are standardized for 15 years
 - duration adjustment methodology based on Dotecon (2012) and calculated with regulated WACC

Methodology

- quantitative assessment by
 - simple statistics
 - linear regression for identification of what features and controls explain the differences in the average prices paid by the winners

Data

- 23 European countries where the 800 MHz spectrum allocation had happened by April 2014
 - Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Latvia, Lithuania, the Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK + Switzerland and Norway
- Allocation data sources:
 - allocation process features and results: Cullen International spectrum database, documents published about the processes and the results by the national regulators
 - selling price, reserve price, spectrum caps, other feature data,
- Control variables: data for 2011
 - Eurostat: GDP per capita, population density, population
 - Digital Agenda Scoreboard: ARPU, mobile penetration, mobile broadband penetration

Challenges - Prices

- What is the average price of the 800 MHz spectrum in case if a multiband and especially a Combinatorial Clock Auction was used and the regulator did not published the prices?
 - prices are unknown and nonlinear
 - in most of the cases the winner had to pay the second price
- partial solutions
 - linear estimates if possible
 - equiproportional price premium above the reserve price if the price was just slightly higher than the reserve price
- some CCA countries had to be left out because of intractability of the problems
 - Netherlands, Switzerland → sample size: 21

Prices - Limitations

- reserve prices are not informative about the value
- suspiciously neither the selling prices
 - huge difference between the cheapest and most expensive per MHz per capita selling price
- no information about the country specific costs (CAPEX, OPEX)
 - no adjustment or control for that
- neither for the annual spectrum fees
 - but they are different

Allocation features

- type of the spectrum allocation process
 - single band/multiband/Big Bang
- auction methods
 - Sealed Bid/ Multiple Round Ascending/Combinatorial Clock Auction
- other elements of the allocation process
 - license duration
 - coverage obligations
 - set aside spectrum for new/small players
 - spectrum caps
 - reserve price
 - mvno access obligation
 - roaming obligation

Challenges – allocation features

- coverage obligations: hard or soft?
 - difficult to judge objectively
 - solution: dummy 1 if the obligation is prescribed for all operators, 0 if for maximum one
- spectrum caps: tight or loose?
 - calculated effective spectrum cap (MHz) for each participant according to their current endowments (and with other additional plausible assumptions if needed)

800 MHz allocations by years and bands

	Single or multiband		
Year	Single band	Multiband	Total
2010	0	1	1
2011	2	4	6
2012	2	3	5
2013	5	5	10
by 2014 (April)	0	1	1
Total	9	14	23

n = 23

Allocations by year and auction type

	Auction type		
Year	CCA	SMRA	SB
2010	0	1	0
2011	1	4	1
2012	4	0	1
2013	4	4	2
2014 (till May)	1	0	0
Total	10	9	4

n = 23

Average price of 800 MHz spectrum

Price / 2x1 MHz / population (calculated for a 15 years license)	Average	Standard deviation	Minimum	Maximum
€ on exchange rate	0.928	0.729	0.024	3.48 ⁺
€ with PPP adjustment	0.931	0.666	0.039	3.19 ⁺

⁺This value is an indicative estimate for the price paid for the 800 MHz spectrum in the Netherlands

n = 23

maximum/minimum > 100

Allocation process features

multi	1 if there was a multiband allocation process 0 else	14 9
bigbang	1 if there was a Big Bang auction 0 else	6 14
cca	1 if there auction was a Combinatorial Clock Auction 0 else	10 13
sealed	1 if the auction was a sealed bid tender 0 else	4 9
reserve	1 if the regulator reserved some blocks of the 800 MHz band for new entrant or weaker incumbent operator 0 else	6 17
caprule	1 if the average spectrum cap for 800 MHz for the operators was higher than 2x10 MHz 0 else	9 14
coverall	1 if there was coverage requirements for all operators winning 800 MHz blocks 0 else	16 7
roaming	1 if there was roaming provision obligation for the winner of 800 MHz blocks 0 else	8 15
mvnoaccess	1 if there was mvno access obligation for the winner of 800 MHz blocks 0 else	2 21

**Low correlation between features (except from trivial connections)
show that there are many various combinations**

	bigbang	cca	sealed	reserve	caprule	coverall	roaming	mvnoaccess
multi	0.47	0.37	-0.33	0.47	0.09	0.05	0.21	0.24
bigbang		0.68	-0.27	0.54	0.33	-0.3	-0.02	-0.18
cca			-0.40	0.48	0.37	0.01	0.10	-0.27
sealed				-0.27	-0.13	0.05	-0.09	-0.14
reserve					0.33	-0.25	0.19	0.16
caprule						0.14	-0.21	-0.25
coverall							0.28	0.20
roaming								0.42

n = 23

Anova for means of feature variables

	average	sd.	p-value
multi	0: 0.53 1: 1.03	0.38 0.46	0.018
coverall	0: 0.52 1: 0.96	0.30 0.51	0.046
roaming	0: 0.66 1: 1.13	0.38 0.56	0.033

n = 21

Sample

- challenge: small sample ($n = 21$)
- because of
 - too few countries
 - even fewer because of dropped observations: Netherlands, Switzerland
- but
 - all of the countries in the sample are EU or EEA countries, with quite similar regulatory systems and methods
 - many company groups are present in more than one market (Vodafone, T-Mobile, Telefónica, Hutchison, Orange, Telenor, Telekom Austria, Tele2, ...)

Explanatory and control variables

selling price: $\text{sellppop15}/\text{sellppop15ppp}$

explained by

- minimum price: $\text{minppop15}/\text{minppop15ppp}$
- market: $\text{gdppop}/\text{gdppopppp}$; popdens , arpu , mpen , mbbpen
- features: multi , coverall , ...

Different competition measures (were used separately)

- *runpwin*: ratio of number of participants and number of winners
- *compdem*: ratio of sum of sub 1 GHz caps /available sub 1 GHz supply after set aside spectrum being distracted
- *compcap*: ratio of the sum of the estimated effective 800 MHz caps and the available 800 MHz supply after set aside spectrum being distracted
- *complexcomp*: dummy variable calculated from three other competition dummy measures
 - *bigbang*, *incnumcomp*, *overdemcomp*
 - 1 if the sum of these ≥ 2

Results: selling price

	(1)	(2)	(3)	(4)	(5)
VARIABLES	sellppop15	sellppop15	sellppop15	sellppop15	sellppop15
minppop15	0.539** (0.248)	0.512* (0.241)	0.499** (0.231)	0.589** (0.255)	0.476* (0.242)
multi	0.377* (0.142)	0.365** (0.139)	0.31** (0.137)	0.365** (0.144)	0.36** (0.134)
coverall	0.292* (0.163)	0.346** (0.16)	0.34** (0.153)	0.377** (0.17)	0.305* (0.162)
gdppop	6.9 e-6 (4.8 e-6)	8.3 e-6* (4.5 e-6)	8.5 e-6* (4.2 e-6)	8.4 e-6* (4.7 e-6)	
west					0.345** (0.14)
compcap	0.36* (0.182)				
compdem		0.37** (0.167)			
complexcomp			0.339** (133)		
runpwin				0.694* (0.369)	0.686** (0.338)
Constant	-0.551* (0.281)	-0.631** (0.289)	-0.218 (0.177)	-1.035* (0.515)	-0.914* (0.483)
Observations	21	21	21	21	221
R-squared	0.716	0.729	0.75	0.71	0.749

20

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Results: selling price with PPP adjustment

	(1)	(2)	(3)	(4)	(5)
VARIABLES	sellppop15ppp	sellppop15ppp	sellppop15ppp	sellppop15ppp	sellppop15ppp
minppop15ppp	0.441**	0.421**	0.409**	0.448**	0.441**
	(0.204)	(0.195)	(0.186)	(0.206)	(0.199)
multi	0.449***	0.440***	0.395***	0.445***	0.459***
	(0.133)	(0.130)	(0.130)	(0.134)	(0.130)
coverall	0.312**	0.357**	0.351**	0.399**	0.279*
	(0.140)	(0.136)	(0.131)	(0.143)	(0.140)
caprule					0.271**
					(0.127)
compcap	0.299*				
	(0.153)				
compdem		0.325**			
		(0.146)			
complexcomp			0.294**		
			(0.117)		
runpwin				0.618*	
				(0.320)	
Constant	-0.280	-0.344	0.023	0.703	0.067
	(0.259)	(0.259)	(0.130)	(0.467)	(0.131)
Observations	21	21	21	21	21
R-squared	0.735	0.749	0.765	0.734	0.745

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Discussion of the results

- minimum price matters
 - in a well designed competitive auction it should not
- higher GDP per capita results in higher price
 - but not significant in PPP
- competition matters
 - whatever measure is used
 - competition is not only the question of the number of players
 - the situation can be made more competitive by other means, like higher (looser) spectrum caps
- multiband auctions are resulting in higher spectrum price
- coverage requirements for all licenses seem to result in higher average price
 - counterintuitive
 - but this obligation was frequently prescribed in economically advanced countries

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