EXCLUSION, HETEROGENEITY AND TWO PRIZES IN THE ALL-PAY AUCTION

An Experimental Investigation

Dietmar Fehr and Julia Schmid, TU Berlin

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Motivation

- Contests/All-pay-auctions are pervasive in our society
- Aim of the contest designer: selecting the most able contestant, and/or maximizing overall revenue
- When maximizing overall revenue is the goal: trade-off between having strong contestants and the homogeneity of the contest
- Baye, Kovenock, de Vries (AER, 1993) analyze this trade-off theoretically
- Clark and Riis (AER, 1998) extended their work to multiple prizes
- In the PGA-Tour, when Tiger Woods is playing, the performance of the other professionals is lower then when he does not participate (Brown, 2007)

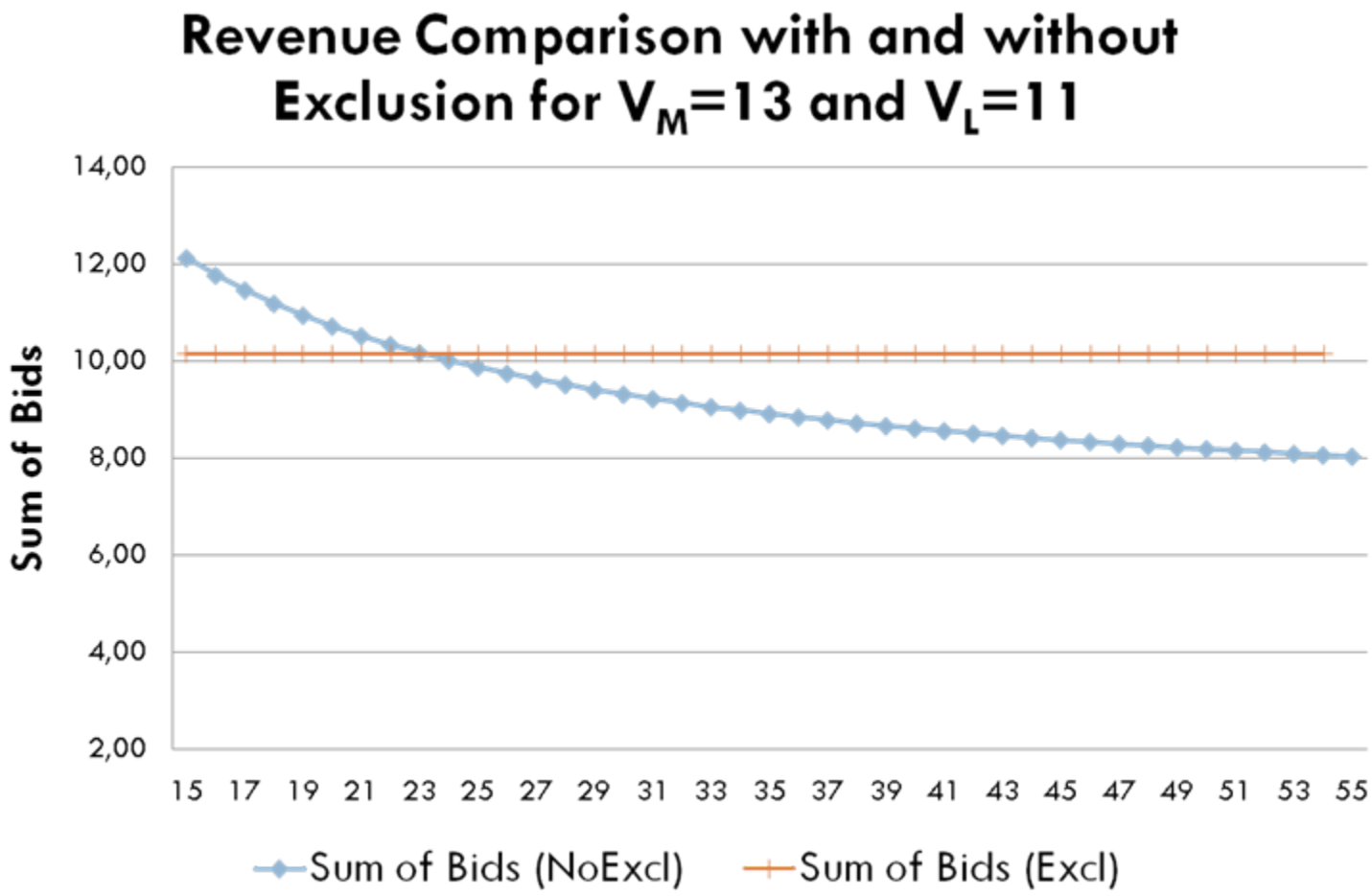
Theory I

Baye, Kovenock, De Vries: "Rigging in the Lobbying Process: An Application of the All-Pay-Auction", AER (1993)

- one prize, complete information, $v1 \geq v2 \geq v3 \geq \ldots$
- goal of contest designer is to maximize total bids (effort)
- under certain conditions it can be advantageous to exclude the bidder with the highest valuation from participating in the contest → exclusion principle
- intuition: the presence of one superior bidder drives out the effort to win the auction of the other bidders & therefore lowers total bids

  → trade off between contest homogeneity & participation of superior bidders
- $Vi=Vj/2$, $Vj=(Vj)^2/Vi$

Theory I: Illustration



Theory II

Clark and Riis: "Competition over more than one prize", AER (1998)

- All-pay auction with $n \geq 1$ identical prizes, N players, different commonly known valuations, $v1 > v2 > v3 > \ldots$
- In this talk: VH denotes the valuation of the strongest bidder, VM the valuation of the medium and VL of the weakest bidder

Results:

- Multiple prizes have the effect of increasing contest homogeneity and thus overall revenue
- Depending on the degree of homogeneity, multiple prizes should be distributed simultaneously or sequentially

Theory II

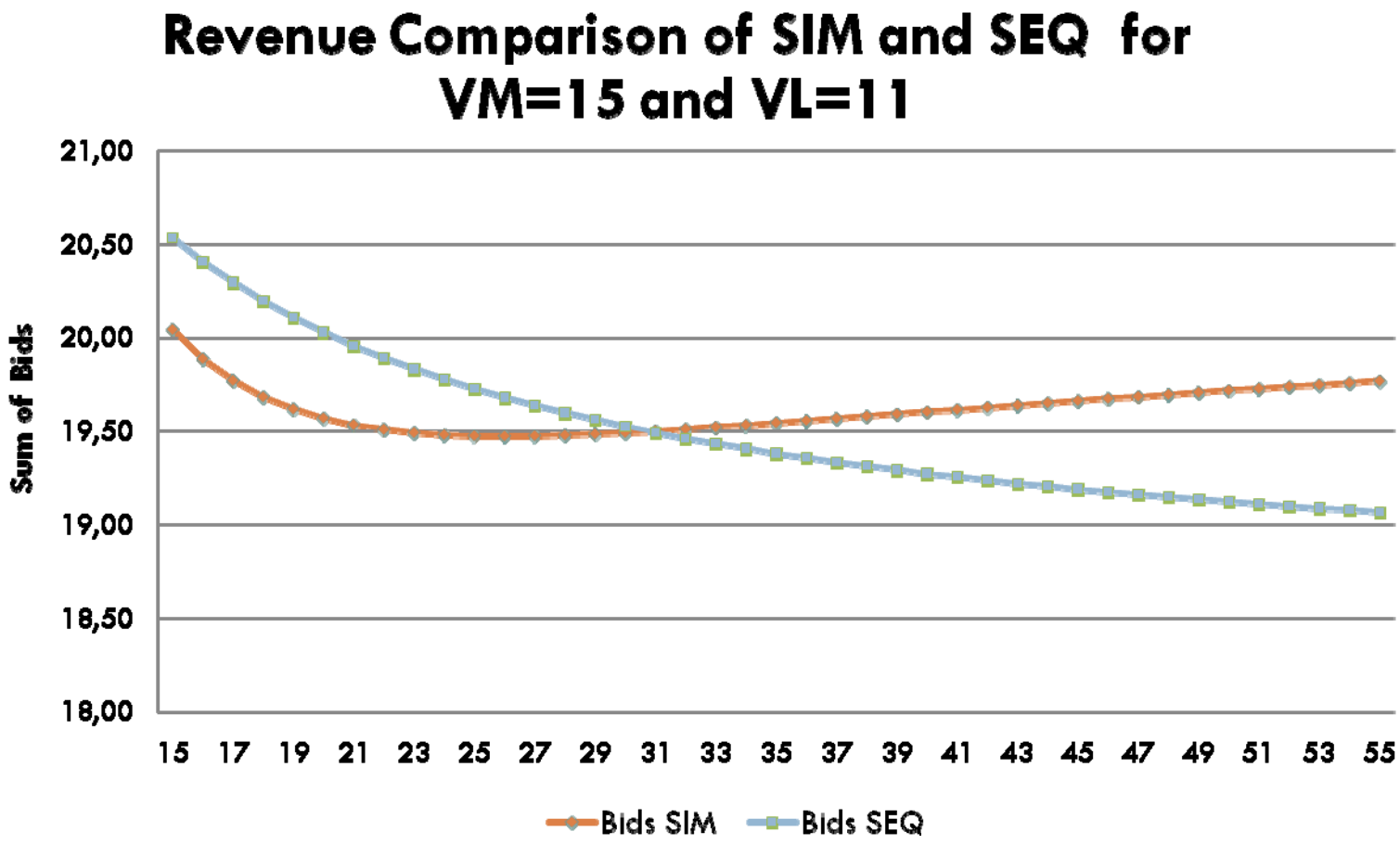
Case with 2 prizes and 3 bidders:

- Simultaneous auction: as $V_H \rightarrow \infty$, also $p_H \rightarrow 1$
  - The strongest bidder "excludes" herself by winning the "first" prize and the two remaining bidders compete for the "second" prize → **endogenous exclusion principle**

- Sequential auction for $V_H \rightarrow \infty$:
  - The weakest bidder participates only on the second stage
  - If he faces the strongest bidder as a competitor on stage 2 his effort is lost

→ *When there is **one particularly strong contestant**, prizes should be distributed **simultaneously** rather than sequentially in order to maximize overall revenue*

Theory: Illustration



Questions

- Does excluding the strongest bidder indeed increase overall revenue?

- Exclusion of participants might be impossible or not wanted
  - What is the effect of a second prize?
  - Lead different auction mechanisms to different outcomes?
  - How to deal best with heterogeneity of the contestants?

  - Do players capture the strategic aspects of the auction mechanisms?

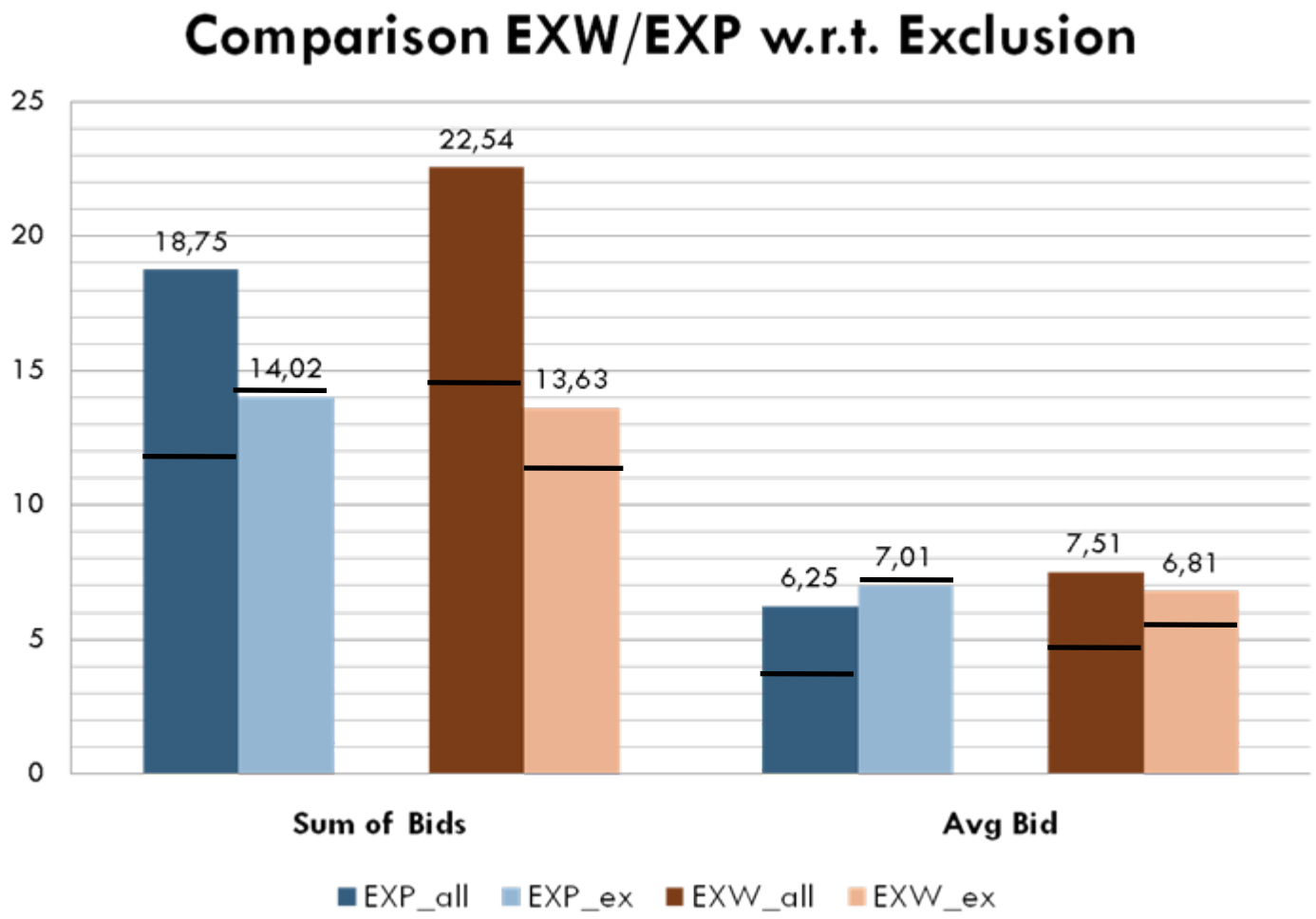
Experimental Design

- 4 treatments:
  - EXP and EXW, with and w/o Exclusion of Vmax, one prize
  - SIM and SEQ with simultaneous resp. sequential distribution of two prizes
- 50 rounds each, 1 trial period
- two parts per treatment
  - Measure of risk preferences: choice between a save option and a lottery
  - Auction
- 12/12/24/20 groups of three per treatment
- two groups of three are one matching group
- random matching within one matching group

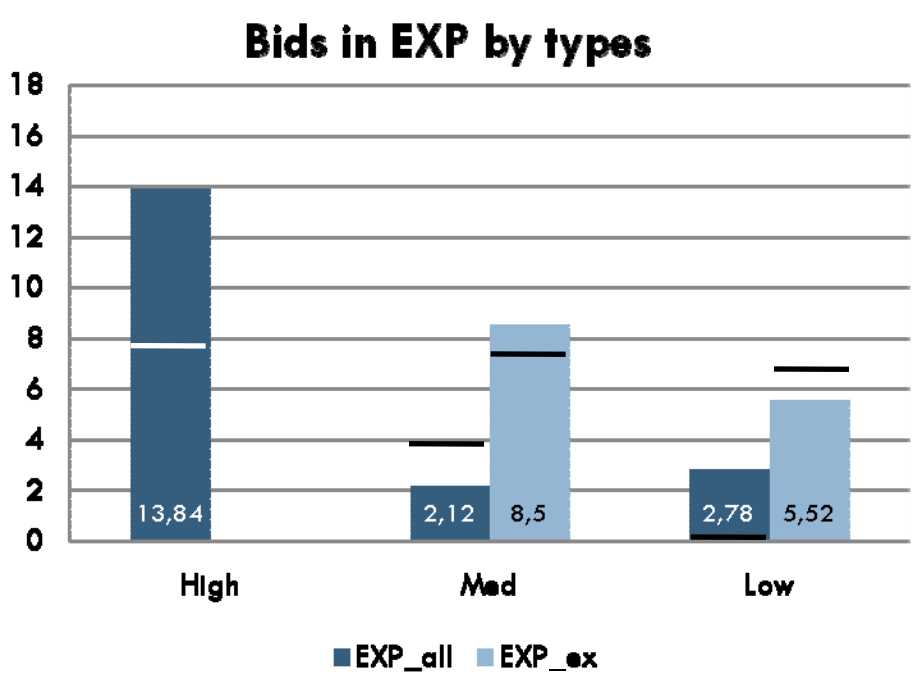
Experimental Design

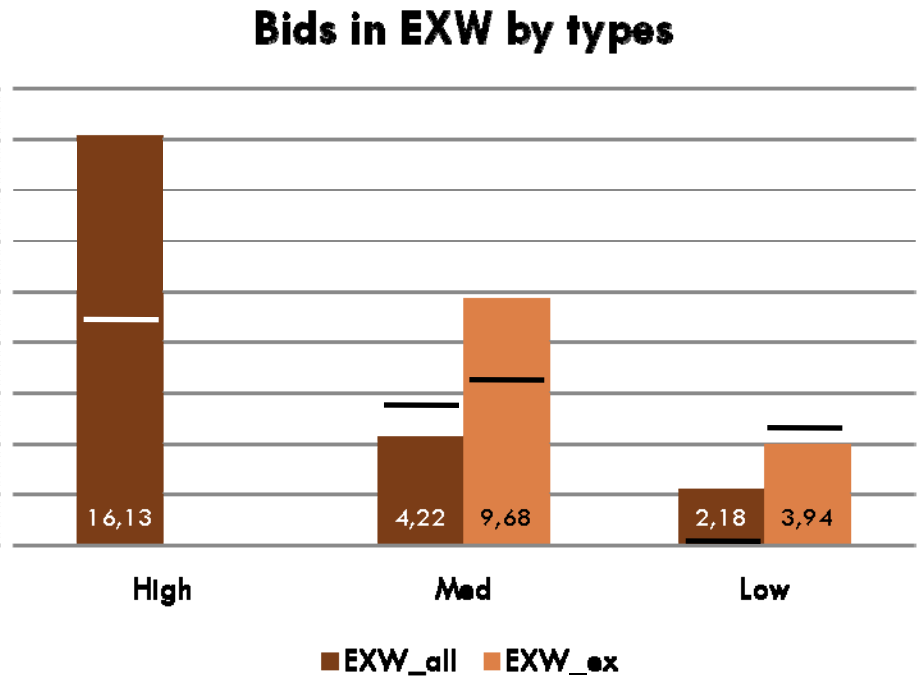
- In EXP and EXW the bidder with the highest valuation was excluded from the auction with probability ½
- SIM and SEQ with simultaneous resp. sequential distribution of two prizes
- Valuations in the auctions:
  - drawn randomly in advance
  - V_2 and V_3 ~U[11,20], discrete values
  - V_1 from [15,55], such that Exclusion pays off in EXP and does not in EXW, resp. the sum of bids in SIM is greater than the sum of bids in SEQ in half of the cases
  - randomly assigned to the players within one group
  - new valuations in each period
  - commonly known

Results Overview EXP and EXW



Results Overview EXP/EXW





→Mainly the high type overbids in _all, but also the low type

→In almost 2/3 of the cases the high type bids as least as high as the valuation of the medium type

	dependent variable:			
	Sum of Bids	Bid of High	Bid of Med	Bid of Min
V_H	0.074**	0.143***	0.017	−0.008
V_M	0.458***	0.751***	0.266*	0.022
V_L	0.192	−0.232	−0.119	0.103
treat	3.357**	−0.856	0.302	0.512
excl	−5.200***	-	5.402***	2.146***
extreat	−3.796***	-	−0.431	−1.064
$(win\_type)_{n-1}$		1.363	10.920***	7.363***
$\text{ex}(win\_type)_{n-1}$		-	−8.380***	−2.784**
riskaversion		0.273	−0.128	−0.338***
Constant	6.192**	−3.578	−1.274	2.08
R^2	0.11	0.12	0.31	0.17
χ^2	$\chi^2_{(5)} = 168.05$	$\chi^2_{(6)} = 39.75$	$\chi^2_{(9)} = 352.95$	$\chi^2_{(4)} = 171.26$
N	1200	385	803	797

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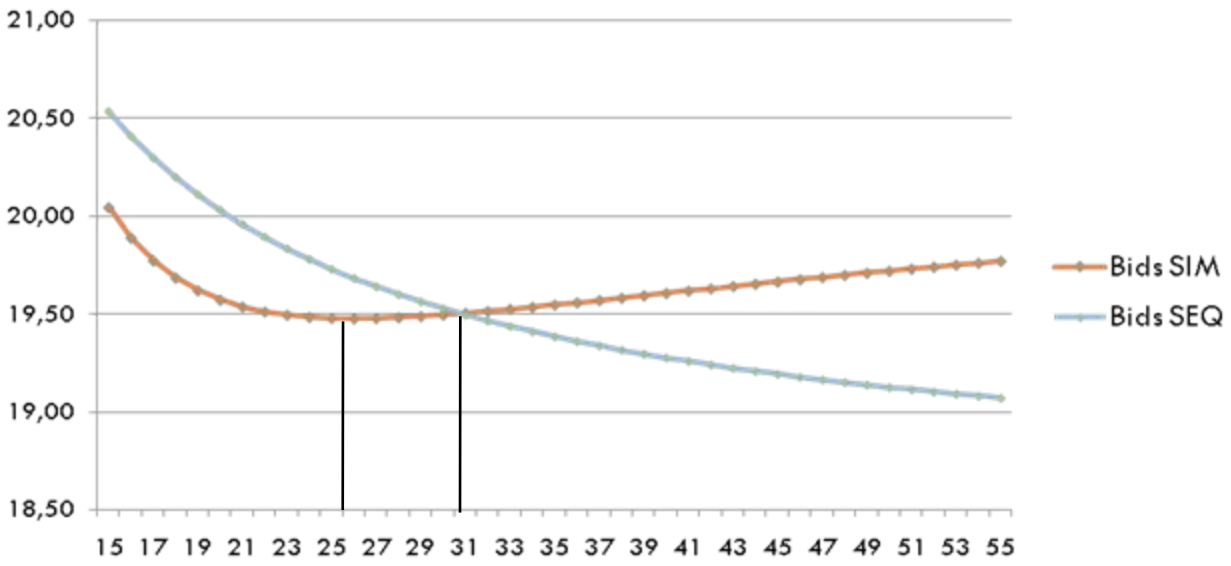
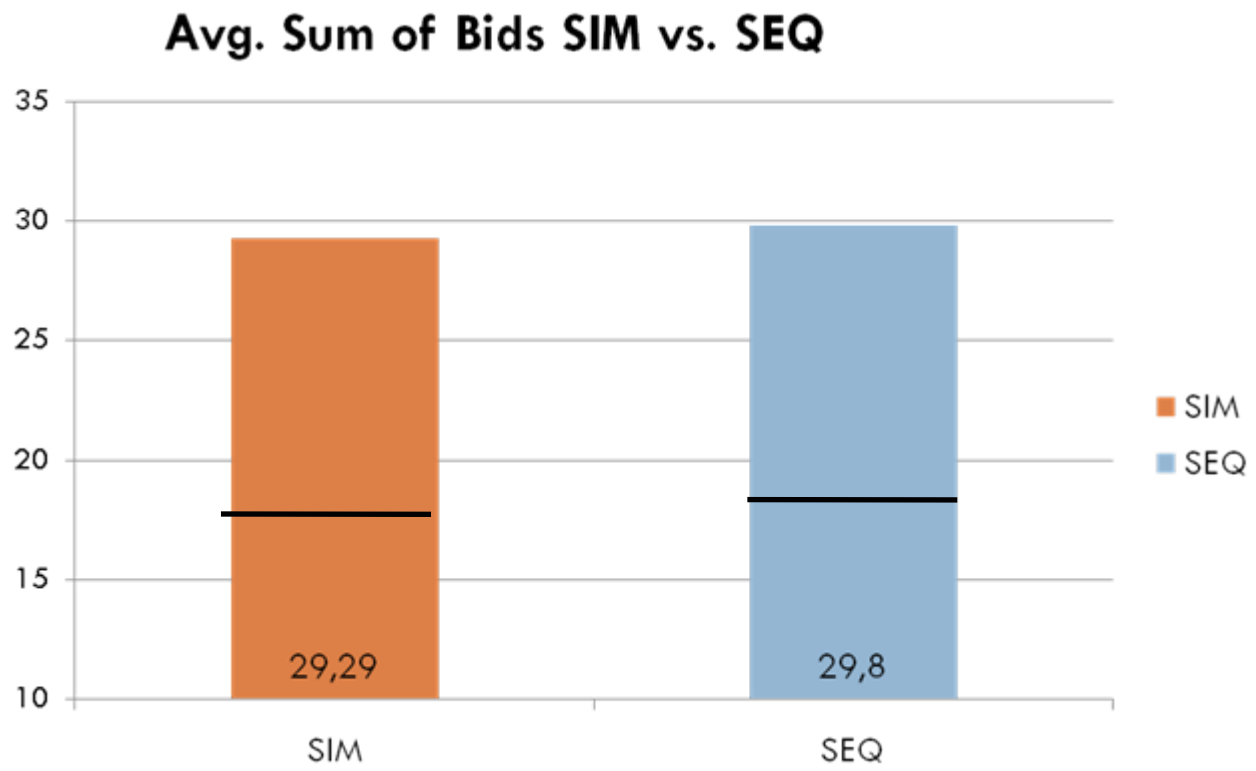
Two Prizes and Heterogeneity

- For heterogeneous valuations the sum of bids in SIM should be greater than the sum of bids in SEQ
- For homogeneous valuations it should be vice versa
- In SEQ, the sum of bids should constantly decrease in V_H
- In SIM, the sum of bids should increase in V_H given that $V_H > V_M + V_L$



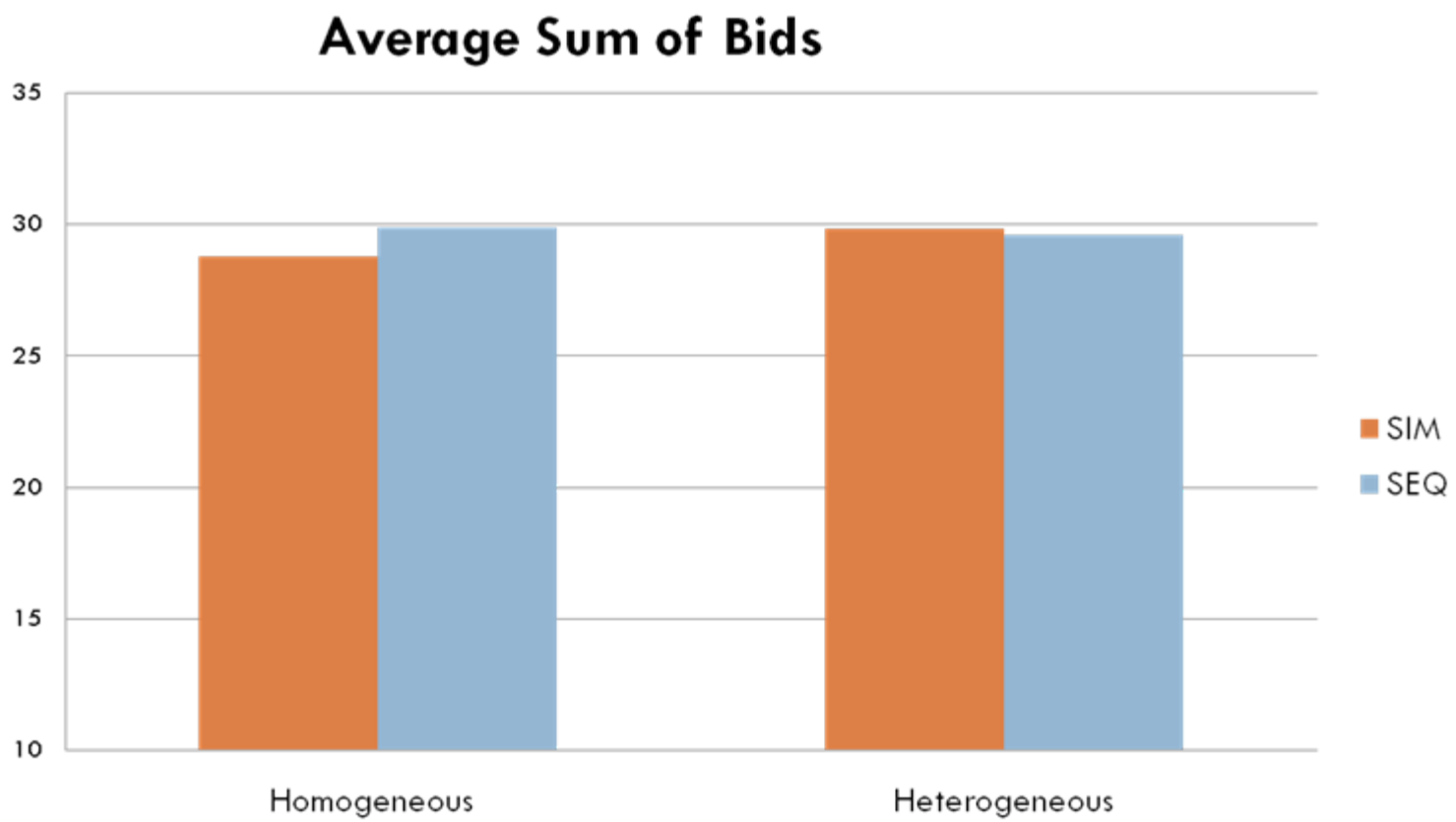
Results Overview SIM/SEQ



→The average sum of bids do not significantly differ in the treatments

→Significant overbidding in both treatments

Results w.r.t. Heterogeneity



The average sum of bids is not significantly different across treatments, neither for homogeneous nor for heterogeneous valuations

	dependent variable: $\sum$bids			
	SIM	**SEQ**	**SIM**	**SEQ**
Heterogeneity	-2.265***	-2.674***	-0.994	-0.495
	(0.549)	(0.762)	(0.849)	(1.271)
V_H			0.092**	0.012
			(0.044)	(0.066)
V_M			0.288**	0.459**
			(0.129)	(0.189)
V_L			1.541***	1.455***
			(0.125)	(0.174)
Constant	30.425***	31.107***	0.528	1.400
	(1.095)	(1.554)	(2.478)	(3.455)
R^2	0.01	0.01	0.18	0.11

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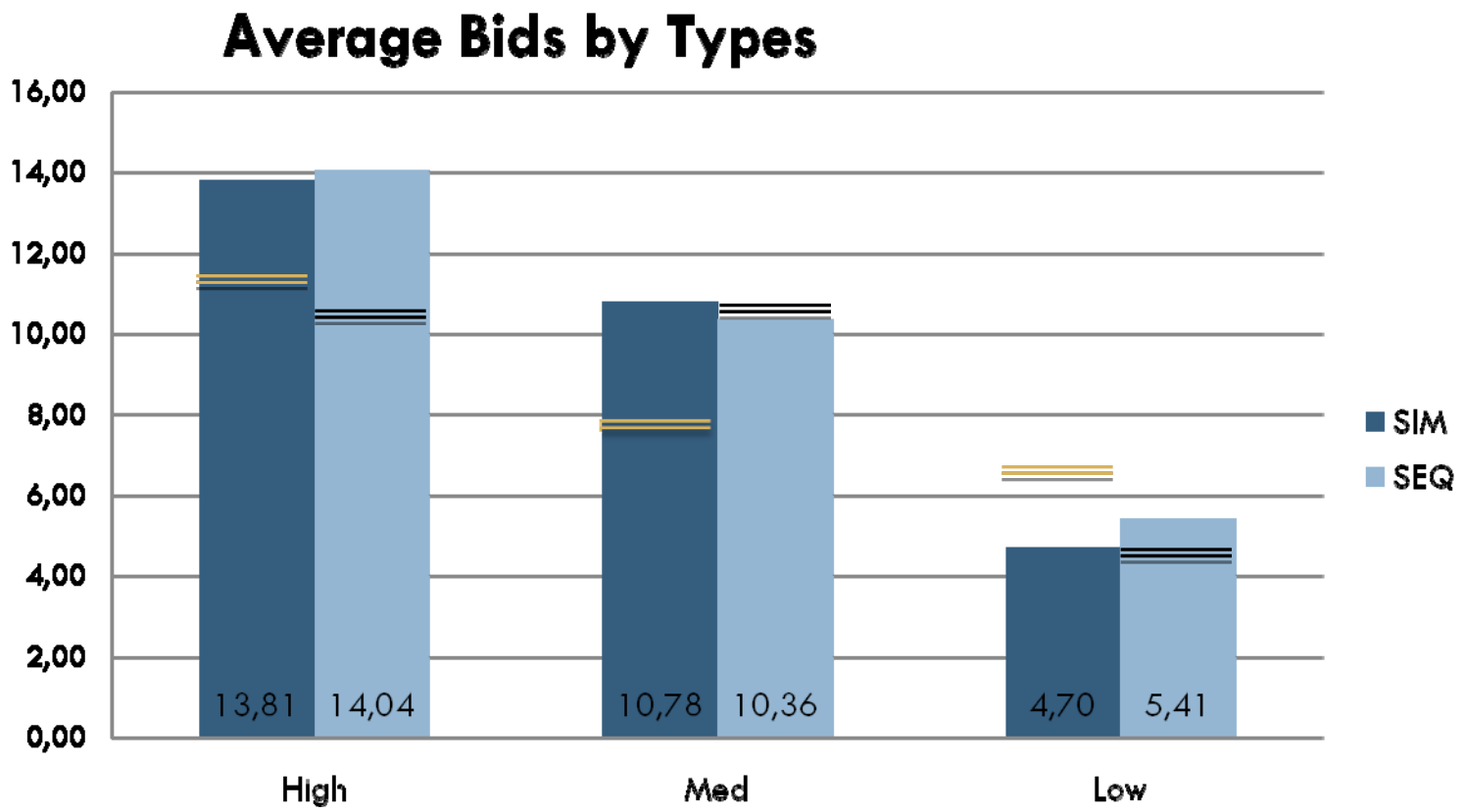
Results by Types



The differences between bids of types are not significant across treatments

Results by Types

	dep. variable: bid			*dep. variable:* bid (stage 1)		
	SIM			**SEQ**		
	High	Medium	Low	High	Medium	Low
V_H	0.100***	-0.017	-0.032	0.100***	-0.065***	-0.037**
	(0.012)	(0.018)	(0.020)	(0.023)	(0.018)	(0.015)
V_M	0.107*	0.521***	-0.296***	0.255**	0.21***	-0.023
	(0.056)	(0.075)	(0.090)	(0.107)	(0.082)	(0.070)
V_L	0.635***	0.266***	0.673***	0.109	0.070	0.217***
	(0.053)	(0.073)	(0.088)	(0.101)	(0.077)	(0.066)
Constant	-0.050	-1.311	1.399	1.500	0.151	0.721
	(1.077)	(1.312)	(1.592)	(1.968)	(1.444)	(1.212)
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Results for Stage 2

	dependent variable: bid (stage 2)		
	High	Medium	Low
own valuation	0.141***	0.616***	0.795***
	(0.030)	(0.079)	(0.071)
rival's valuation	0.462***	-0.25***	-0.119***
	(0.093)	(0.027)	(0.025)
bid stage 1	-0.096	-0.273***	0.191***
	(0.058)	(0.048)	(0.053)
Constant	0.884	3.196**	-5.272***
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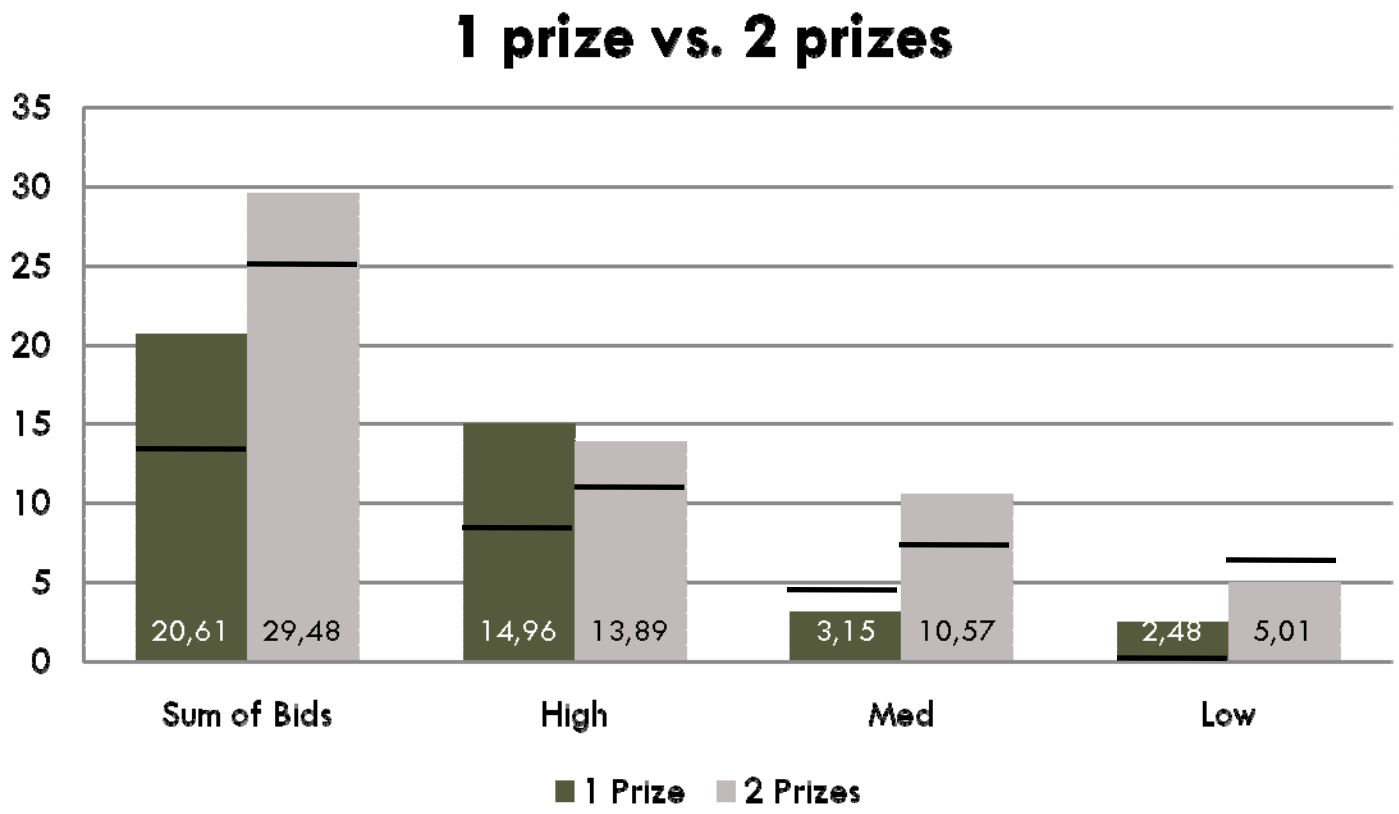
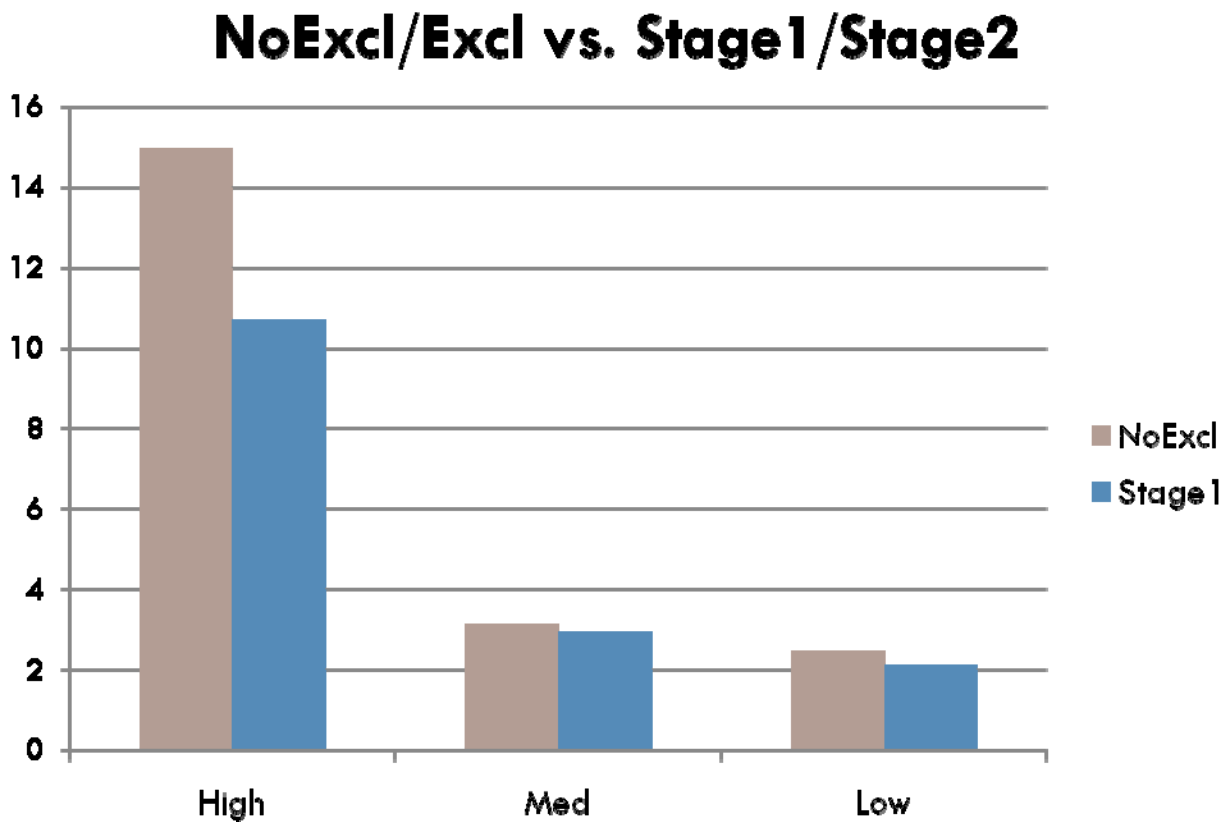
Effect of a Second Prize



1 Prize vs. 2 Prizes SEQ



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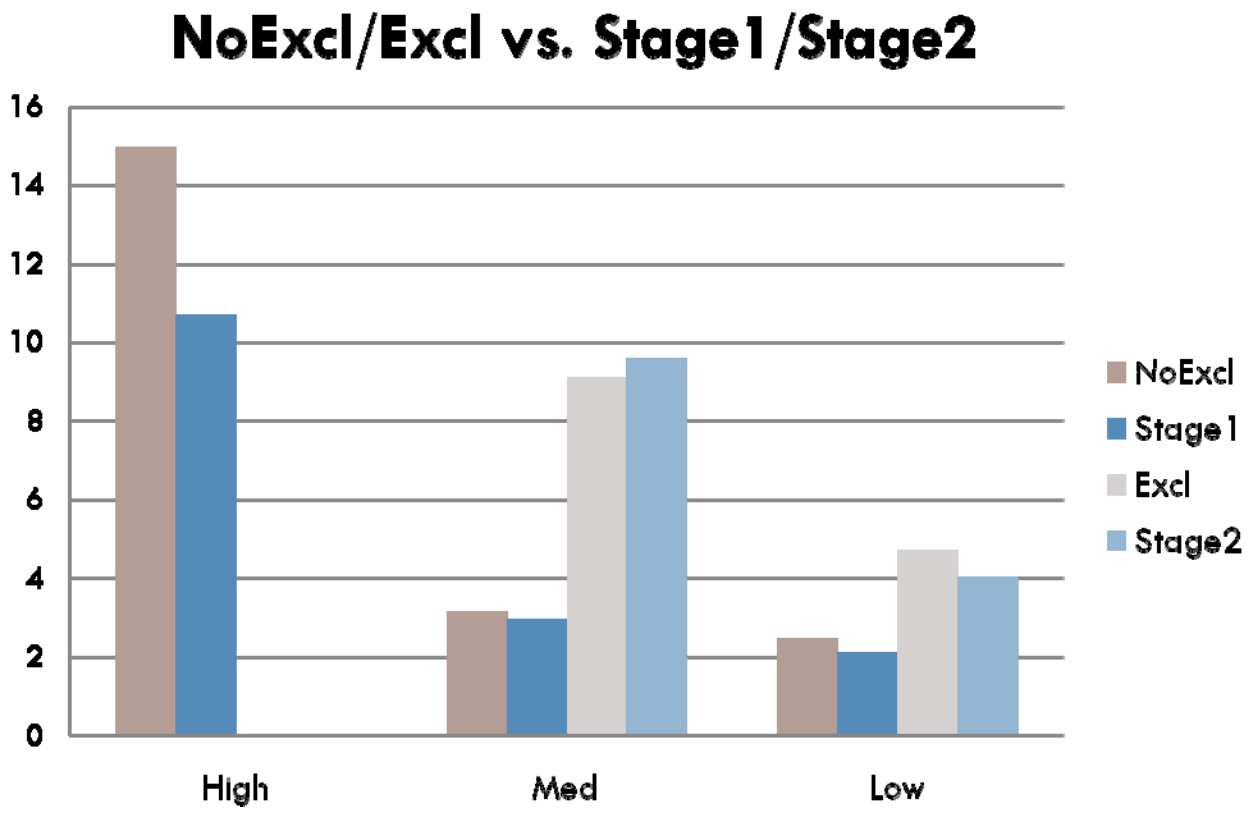

Summary I

- Exclusion does not increase overall revenue when it theoretically should, however the average bid increases through Exclusion
- Partly this is due to overbidding of the high type in the No-Exclusion condition
- There is no overbidding in the Exclusion condition
- Exclusion does motivate the weaker bidders
- The impact of Exclusion is less strong in EXP than in EXW

- A second Prize increases the sum of bids by 50%
- It motivates the weaker bidders

Summary II

- With two prizes, the way of distribution makes no difference in terms of revenue
- Bidders do not capture the strategic aspects of the sequential distribution mechanism; they behave as if there were two sequential auctions with one prize each
- There is substantial overbidding, mainly due to the high type
- Heterogeneity does not influence the outcome differently
- The valuations of the weakest bidder have the strongest influence overall

→ It does not matter how good the best, but how bad the worst is