Centro
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Informed Entry in Auctions

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Motivation

"…major area of concern of practical auction design is to attract bidders, since an auction with too few bidders risks being unprofitable for the auctioneer..." (Klemperer, 2002, p. 106)

- Do potential bidders have preferences over auction formats?
  - If bidders have preferences over auction formats, then some auction formats may attract more bidders than others
  - Can theory suggest which auction format is prefered?

Motivation

"Bidders in oral auctions may need or want to spend less effort acquiring and interpreting information than in sealed-bid auctions. Thus, it costs less to participate in oral auctions than in sealed-bid auctions. ***The lower participation cost makes oral auctions more attractive to bidders.*** *So more bidders enter. And, everything else being equal, the auction with more bidders generates higher expected revenue for the seller. Therefore, oral auctions will generate more revenue for the seller than would sealed-bid auctions...and will do so even in the case of independently distributed, privately known values."*
(Engelbrecht-Wiggans 2001)

Klemperer (2002) *suggests that given that ascending auctions are vulnerable to predatory behavior, "even modest bidding costs may be a serious deterrent to potential bidders".*

Research Questions

(1) Are entry decisions invariant across formats?

- Compare bidder preferences?
  - First Price vrs. English Clock Auctions

(2) Are there individual characteristics that seem to determine entry decisions?

- Do these vary across auction formats?

Motivation

- The auction literature largely focuses on a fixed number of bidders
- Literature that allows for a costly entry decision:
  - Potential bidders learn their value
    - *Before* entry decision
    - *After* entry decision

Literature

- Potential bidders observe value *after*
  - Assymetric pure strategy entry equilibrium
    - McAfee and McMillan (1987), Engelbrecht-Wiggans (1993)
  - Symetric mixed strategy entry equilibrium
    - Engelbrecht-Wiggans (1987), Levin and Smith (1994), Pevnitskaya (2004)
  - Experimental results seem to favor a stochastic model with symmetric mixed-strategy entry
    - Smith and Levine (2001)
  - Further, subjects who enter the auction tend to be less risk averse than those who stay out
    - Palfrey and Pevnitskaya (2008)

Literature

- Potential bidders observe value *before*
  - Pure strategy entry equilibrium: cutoff strategy
    - Menezes and Monteiro (2000), Cao and Tian (2010)
  - Small entry costs have observable effects on bidder participation
    - Reiley (2005)
  - Winner's-curse effects attenuated with costly entry in CV auctions
    - Cox et al.(2001)

Theoretical Framework

- $N \equiv 1, \ldots, n$ risk-neutral potential bidders
- Each has independent private value: v_i
  - v_i is iid draw $F(V)$
- All bidders face same common cost c
- After observing v_i and c, bidders decide whether to participate (and incur c)
- If decide to participate, they incur c and submit bid b_i
- Item is awarded to bidder *i* who submits *max* b_i

Theoretical Framework

- Threshold Entry Strategy:

$$v_c F(v_c)^{n-1} = c$$

$$WTP = v_c F(v_c)^{n-1}$$

  - Invariant across auction formats and *information on number of bidders (m)*
  - Thus, resulting auction with m bidders and a truncated valuation distribution: $F(v|v \geq v_c) = \frac{F(v_i) - F(v_c)}{1 - F(v_c)}$

- Revenue equivalence holds

Experimental Design

Stages:

1. Observe v_i
   - $v_i = U[0, 100]$, $c = U[1, 30]$
2. BDM: Enter (max) wtp_i for entry (e)
3. If $wtp_i < c$ → $e = 0$, pastime (tic tac toe) & observe c
3. If $wtp_i \geq c$ → e = 1, observe c & submit bid (b_i)
   - Number of bidders participating in the auction is always revealed
4. Observe number of bidders that participated, all bids, c, price and profit (π_i)
   - $\pi_i = v_i - b_i - c$ if $wtp_i \geq c$ and *win*
   - $\pi_i = -c$ if $wtp_i \geq c$ and *not win*
   - $\pi_i = 0$ if $wtp_i < c$

Observe Value & Entry (BDM)

Entry Confirmation

Experimental Design

- 2x2 design:
  - Auction Format (between-subjects)
  - Group size (within subjects)
    - *G5* (10 periods), *G3* (10 periods), *G5* (10 periods), *G3* (10 periods)
    - Vary order: 5353 or 3535
  - Information on number of bidders (*m*) always revealed

First Price Auction (40 periods)	**English Clock Auctions** (40 periods)
5353	5353
3535	3535
3535	3535
5353	5353

  - Use experienced subjects

Experimental Parameters

- N={3,5} potential bidders
- $v_i \sim U[0, 100]$
- $c \sim U[1, 30]$

$$wtp_i = V_i^N / 100^{N-1}$$

$$v_c = 100 \times \sqrt[N]{c/100}$$

Cutoff value:

- $v_{c3} \in [21.5, 66.9]$
- $v_{c5} \in [39.8, 78.6]$

Three regions:

(1) Never enter
(2) Enter strategically
(3) Always enter

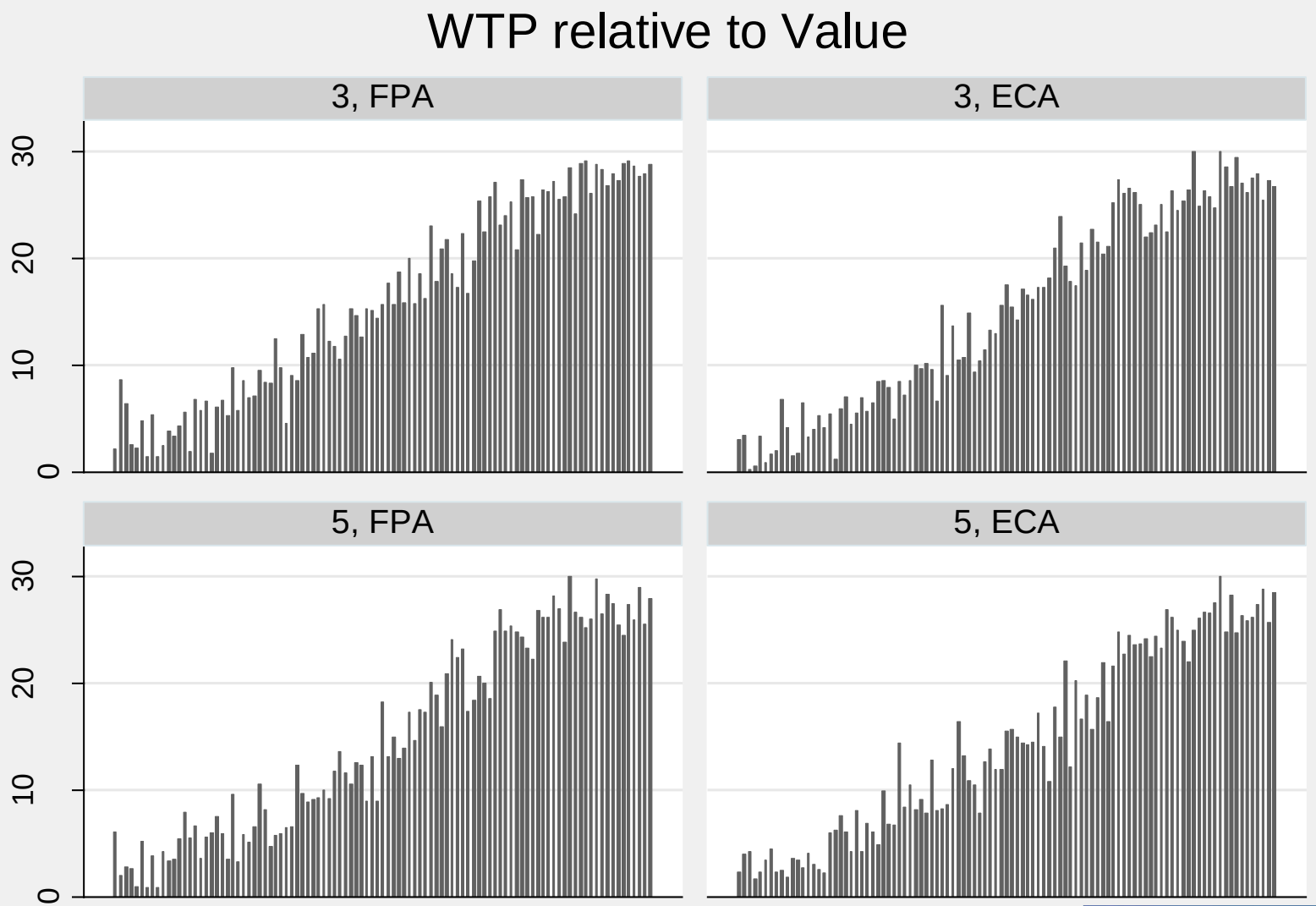
Experimental Protocols

- Use strategy method (BDM) to elicit threshold entry strategies (WTP)
  - Compare revealed to theoretical WTP

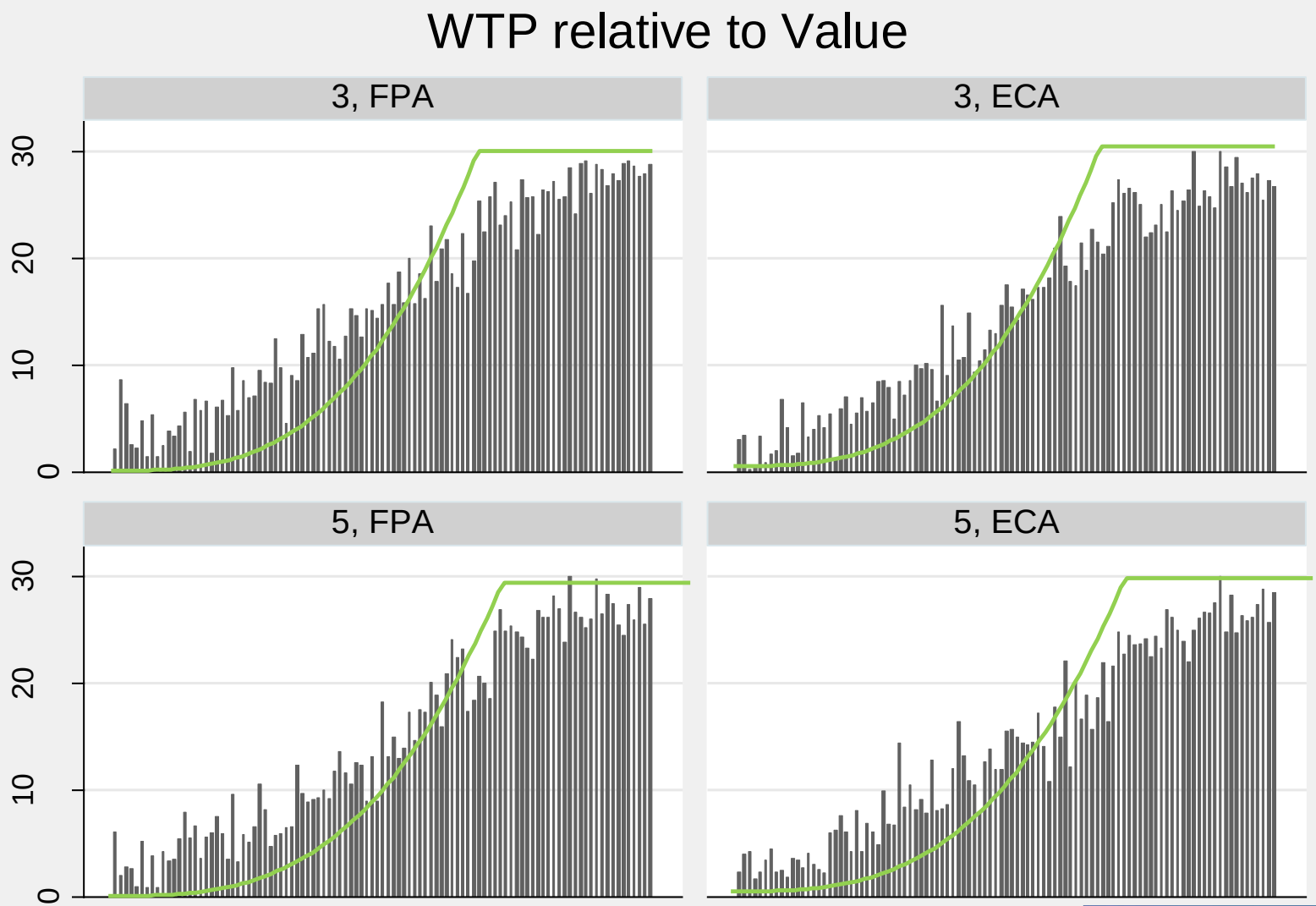
$$wtp_i = V_i^N / 100^{N-1}$$

- Experienced subjects
- Explicit participation cost

Entry Threshold Strategies

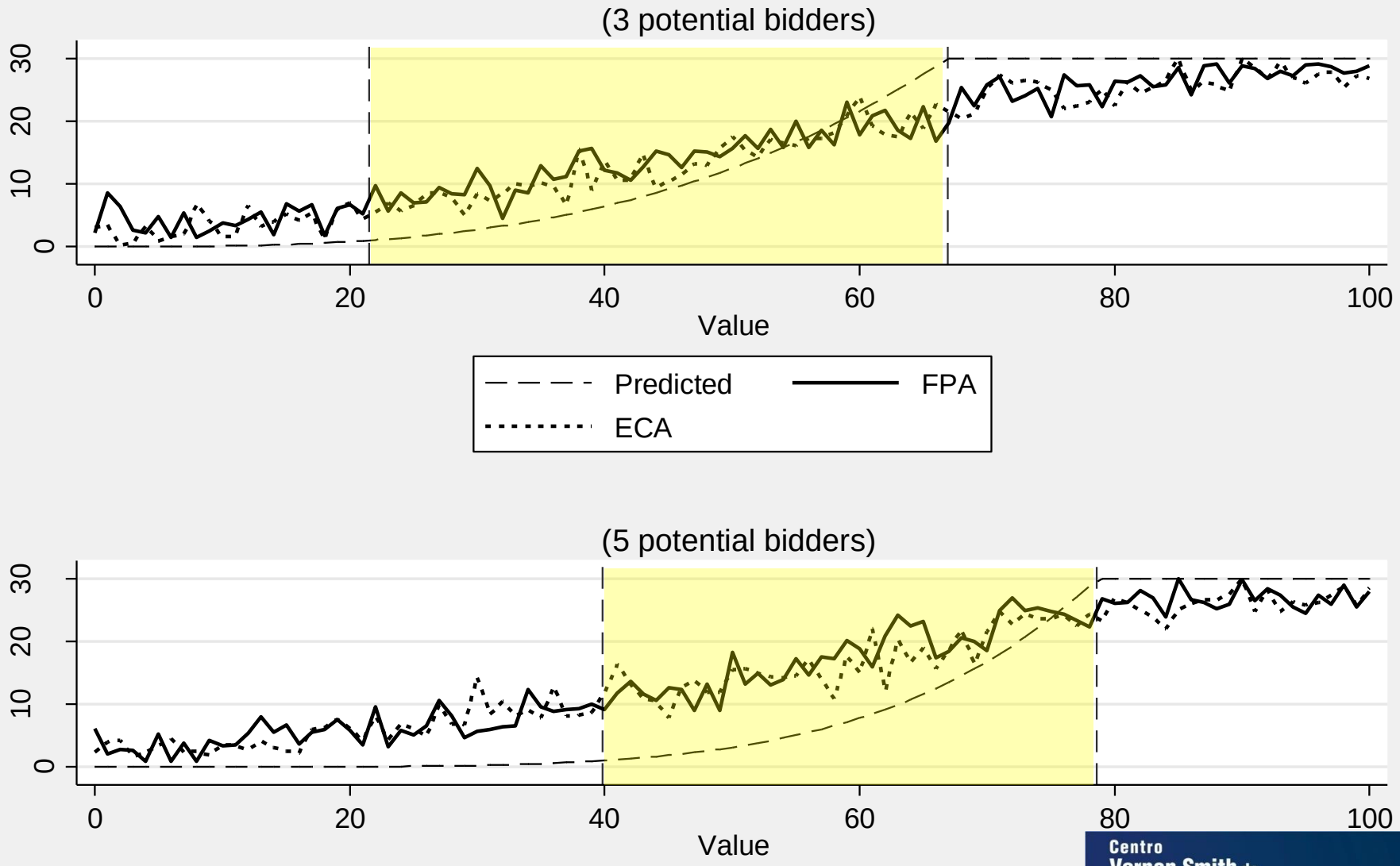


Entry Threshold Strategies & Values



Graphs by Number of Potential Bidders in group and Auction institution

Entry Threshold Strategies



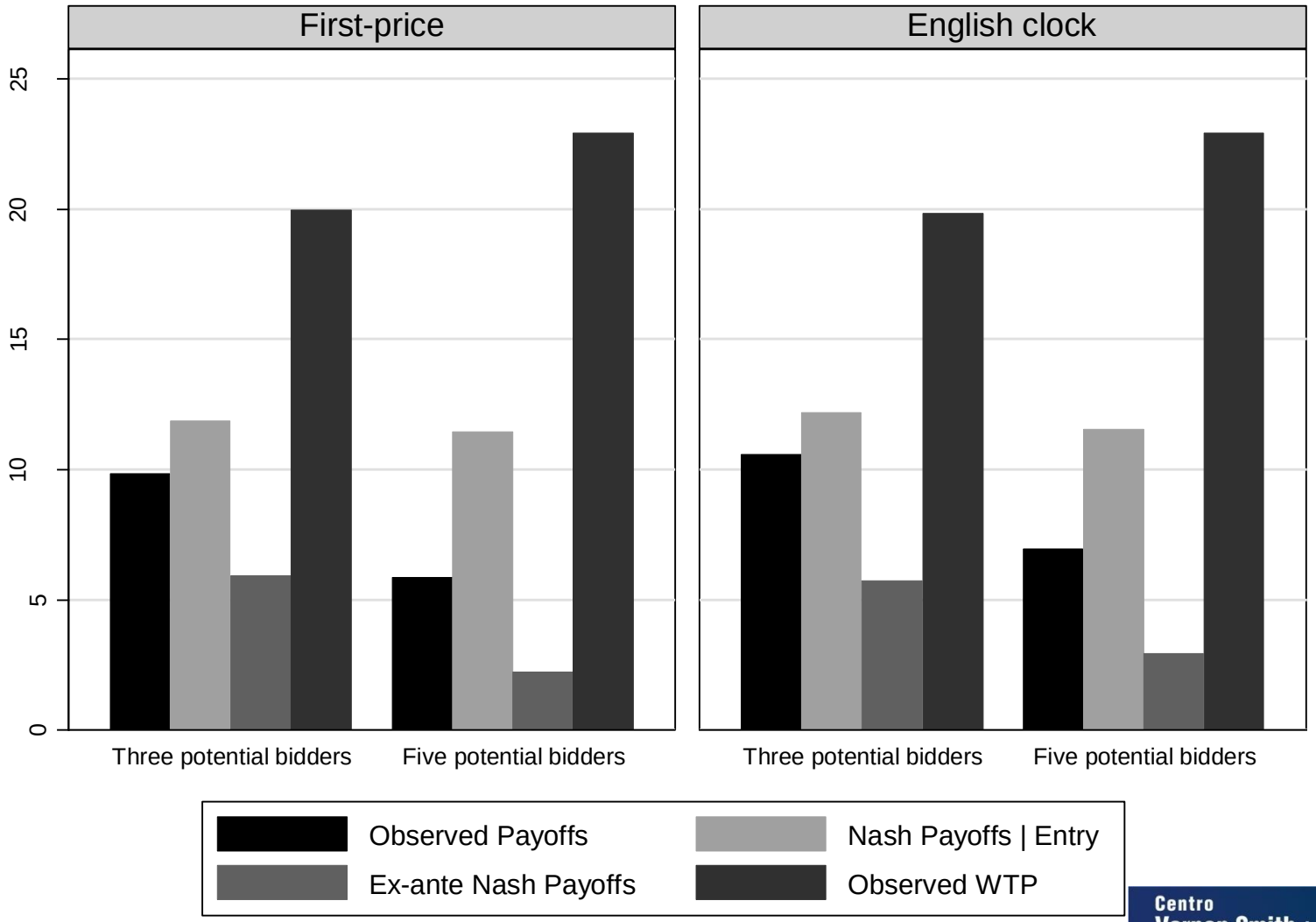
Cutoff Strategies on Entry relative to Theory for region2
Random Effects (at the individual level) Tobit estimates
Dependent Variable: Revealed WTP

	All periods		Second half (last 20 periods)	
	(1)	(2)	(3)	(4)
Predicted WTP	0.653***	0.648***	0.748***	0.754***
	(0.039)	(0.039)	(0.058)	(0.058)
Predicted WTP * FPA	0	0	0.058	0.060
	(0.045)	(0.045)	(0.066)	(0.066)
First Price Auction (FPA)	1.028	-3.161	-0.449	-3.847
	(1.499)	(2.251)	(1.771)	(2.653)
Predicted WTP * Groups of 5	0.022	0.024	-0.055	-0.063
	(0.046)	(0.045)	(0.066)	(0.066)
Groups of 5	5.920***	5.796***	6.888***	6.723***
	(0.560)	(0.561)	(0.813)	(0.812)
Natural log of (Period+1)		-0.596*		-3.681*
		(0.244)		(1.469)
Male		-2.712		-1.866
		(1.972)		(2.305)
FPA * Male		7.284*		5.983+
		(2.830)		(3.305)
Constant	5.742***	25.168***	4.737***	35.667***
	(1.094)	(7.067)	(1.314)	(9.642)
Additional controls (age, order effects)	NO	YES	NO	YES
Mean of dependent variable	14.894	14.894	14.494	14.494
Number of Observations	2,494	2,494	1,292	1,292
Log Likelihood	-7208.2	-7198.7	-3650.3	-3642.8
Bayesian (Schwarz's) information criterion	14479.0	14499.0	7357.9	7378.7

Entry (WTP) Puzzles

- What accounts for preference for larger group sizes?
  - $WTP_5 > WTP_3$
- What accounts for male preference for first price auctions?

WTP vs Payoffs

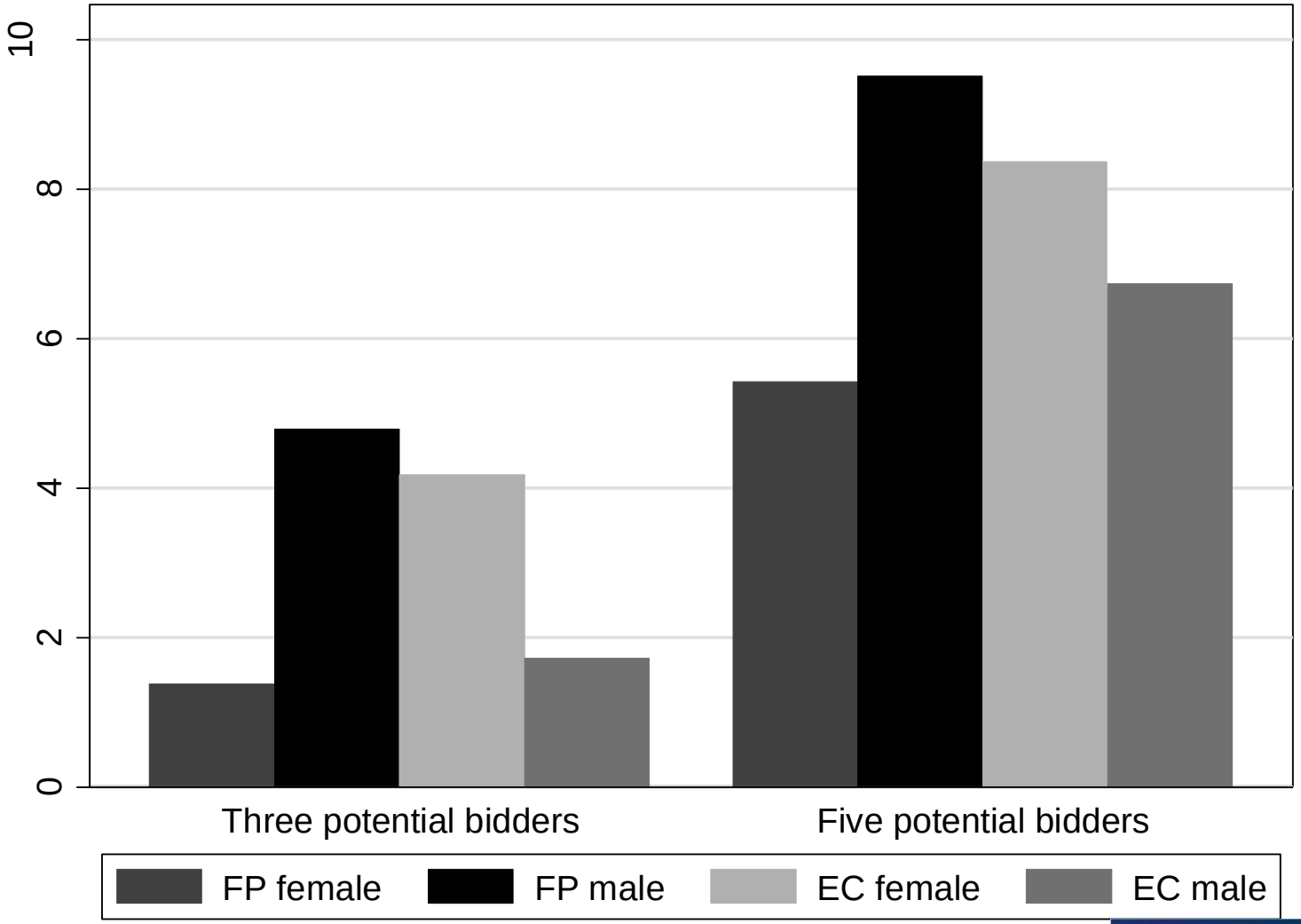


WTP Puzzles

What accounts for male preference for first price auctions?

- H1: Males are more competitive
  - Niederle and Vesterlund (2007)
- H2: Males are less risk averse
  - Eckel and Grossman (2008), Crosson and Gneezy (2009)
- H3: Male preference for strategic uncertainty

WTP by Gender



WTP, Males & First-Price Auctions

What accounts for males prefering first price auctions?

- H1: Males are more competitive
  - Niederle and Vesterlund (2007)
- H2: Males are less risk averse
  - Eckel and Grossman (2008), Crosson and Gneezy (2009)
- H3: Male preference for strategic uncertainty

H1: Competitiveness

Can *Competitiveness* explain male higher WTP for FPA?

- Data on competitiveness for a subset of subjects
  - Competitiveness (risk-preferences) data on 83.2% of subjects,
  - Collected during different experiment
- Competitiveness task similar to Niederle and Vesterlund (2007), except choice NOT binary
    - Choose % of compensation from Tournament

Regression Results: Competitiveness

Cutoff strategies on entry relative to theory for region
Random effects (at the individual level) Tobit estimates
Dependent Variable: Revealed WTP

	All periods	
	(1)	(2)
Groups of 5	5.956***	5.957***
	(0.620)	(0.620)
Dummy for male	-1.864	-2.426
	(2.350)	(2.348)
FPA * Male	6.527*	7.567*
	(3.323)	(3.346)
Competitiveness		0.045
		-0.028
FPA * Competitiveness		
ECA * Competitiveness		
Number of Observations	2,076	2,076
Log Likelihood	-5,912.3	-5,911.0
Bayesian (Schwarz's) information criterion	11,924.0	11,929.0

Standard errors in parenthesis.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Note: Table reports results only of variables of interest. Full specification is same as in regression table 1. Full specification includes predicted WTP, predicted WTP interacted with treatment variables (FPA and Groups of 5), FPA, natural log of (period+1), order effects, gender, age.

WTP, Males & First-Price Auctions

What accounts for males prefering first price auctions?

- H1: Males are more competitive
  - Niederle and Vesterlund (2007)

No support for H1

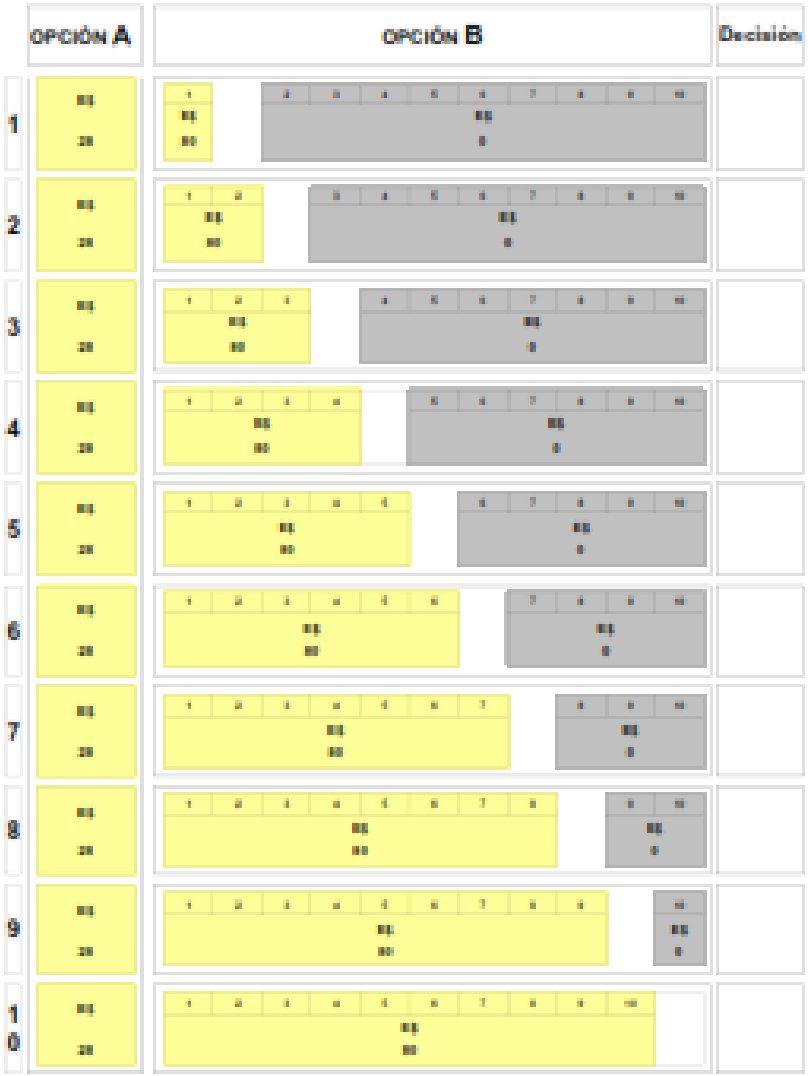
- H2: Males are less risk averse
  - Eckel and Grossman (2008), Crosson and Gneezy (2009)
- H3: Male preference for strategic uncertainty

H2: Risk Preferences

Can Risk-Attitudes explain male higher WTP for FPA?

- Data on risk-preferences for a subset of subjects
  - Data on 89.7% of subjects,
  - Collected during previous experiment on entry in auctions
- Risk-elicitation task similar to Holt & Laury (2002), except choice between safe option (A) vs. Lottery (B)
    - A = 28
    - B = {80, 0}

Risk Preferences



A = 28 B = {80, 0}

Risk Neutral Choices	If switch from A --> B in this decision row, then:	
A	$r <$ -1.19331	Risk Seeking
A	-1.19331 $< r <$ -0.53306	
A	-0.53306 $< r <$ -0.14684	
B	-0.14684 $< r <$ 0.127194	
B	0.127194 $< r <$ 0.339748	
B	0.339748 $< r <$ 0.513417	
B	0.513417 $< r <$ 0.660252	Risk Averse
B	0.660252 $< r <$ 0.787446	
B	0.787446 $< r <$ 0.89964	
B	0.89964 $< r$	

- 21.9% multiple-switching (*M. S.*)

Number of A Options Selected

	0	1	2	3	4	5	6	7	8	9
All	3.1%	0.0%	4.0%	19.3%	32.0%	25.0%	11.8%	4.4%	0.0%	0.4%
Non-M. S.	3.9%	0.0%	4.5%	19.7%	32.6%	24.7%	9.6%	4.5%	0.0%	0.6%
M. S.	0.0%	0.0%	2.0%	18.0%	30.0%	26.0%	20.0%	4.0%	0.0%	0.0%

Regression Results: WTP and Risk

Estimated cutoff strategies on entry relative to theory for region
Random effects (at the individual level) Tobit estimates

Dependent Variable: Revealed WTP	All periods			Second half (last 20 periods)		
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy for male	-2.523	-3.157	-3.12	-1.945	-2.567	-2.749
	(2.031)	(1.988)	(2.023)	(2.378)	(2.336)	(2.372)
FPA * Male	6.386*	6.869*	6.828*	5.497	5.948+	6.152+
	(2.944)	(2.868)	(2.899)	(3.442)	(3.367)	(3.398)
# of Safe Choices		-1.436**			-1.480*	
		(0.497)			(0.586)	
FPA * # of Safe Choices			-1.474*			-1.283+
			-0.635			-0.745
ECA * # of Safe Choices			-1.374+			-1.806+
			-0.812			-0.961
Number of Observations	2,237	2,237	2,237	1,166	1,166	1,166
Log Likelihood	-6,487.0	-6,482.9	-6,482.9	-3,304.6	-3,301.5	-3,301.4
Bayesian (Schwarz's) information criterion	13,074.2	13,073.8	13,081.5	6,701.0	6,701.8	6,708.7

Standard errors in parenthesis.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Note: Table reports results only of variables of interest. Full specification is same as in regression table 1. Full specification includes predicted WTP, predicted WTP interacted with treatment variables (FPA and Groups of 5), FPA, natural log of (period+1), order effects, gender, age.

WTP, Males & First-Price Auctions

What accounts for males prefering first price auctions?

- H1: Males are more competitive
  - Niederle and Vesterlund (2007)

No support for H1

- H2: Males are less risk averse
  - Eckel and Grossman (2008), Crosson and Gneezy (2009)

No support for H2

- H3: Male preference for strategic uncertainty

WTP and Strategic Uncertainty

- Sources of uncertainty in Auctions:
  - (1) Values
  - (2) Rivals´ strategies (given values)
    - Strategic uncertainty
- FPA subject to greater ***strategic uncertainty***
  - ECA → weakly dominant strategy
    - Uncertainty from values, not from strategy (regardless of how others play)
  - FPA → If others are not following RNNE, what is my best response? What is my optimal strategy?

Summary and Conclusions

We find partial support for the theory

- Entry increases with value
  - Risk aversion deters entry
- Entry invariance across auction formats
  - No preferences in aggregate
  - …but some heterogeneity: males prefer FPA
    - Not explained by risk preferences or preferences for *competitiveness*
    - Could be explained by differences in preferences over *strategic uncertainty*?

Summary and Conclusions

We find partial support for the theory… but some deviations:

- We observe considerable over-entry relative to theory
  - Entry level greater
  - Threshold decisions not as sensitive to value as theory suggests
- Surprisingly: higher entry thresholds for larger groups
    - Partially explained by competitive preferences

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COMMENTS / QUESTIONS

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ADDITIONAL SLIDES

with Hernan Bejarano and Lucas Rentschler

Determinants of observed bidding in auctions with more than one participant
Random Effects estimated via genearlized least squares (GLS)
Dependent Variable: Observed Bid

	English clock auctions			First price auctions		
	(1)	(2)	(3)	(4)	(5)	(6)
Groups of 5	-0.001	0.966	7.848	1.604	1.485	1.207
	(3.598)	(3.637)	(4.124)	(1.471)	(1.793)	(3.136)
Value	0.747***	0.747***	0.824***	0.675***	0.671***	0.734***
	(0.040)	(0.042)	(0.033)	(0.050)	(0.050)	(0.051)
Value * Groups of 5	-0.033	-0.042	-0.142*	-0.002	0	-0.009
	(0.063)	(0.061)	(0.065)	(0.022)	(0.022)	(0.050)
Number of Bidders participating in Auction	0.61	1.396***	2.036***	0.759	0.327	-0.268
	(0.513)	(0.247)	(0.390)	(0.596)	(0.269)	(0.848)
Number of Bidders * Groups of 5	-0.159	-1.579***	-3.551***	0.077	1.534	2.532
	(0.364)	(0.402)	(0.741)	(0.182)	(1.018)	(1.431)
Cost of Participation	-0.353***	-0.218***	-0.184*	-0.416***	-0.398***	-0.528***
	(0.045)	(0.064)	(0.094)	(0.097)	(0.091)	(0.128)
Cost of Participation * Groups of 5	0.037	-0.133	-0.183	-0.039	0.021	0.012
	(0.109)	(0.117)	(0.244)	(0.033)	(0.083)	(0.108)
Natural log of (Period+1)		0.753	0.367		2.464**	4.020*
		(1.176)	(6.049)		(0.898)	(2.006)
Constant	9.053***	-0.507	2.759	2.388	-10.264	-12.725
	(1.466)	(12.268)	(27.430)	(2.035)	(10.230)	(12.747)
Additional controls (age, gender, order effects)	No	Yes	Yes	No	Yes	Yes
Number of Observations	837	837	407	1,428	1,428	682
Overall R-squared	0.613	0.619	0.611	0.712	0.721	0.789

Robust standard errors clustered at the session level in the Random Effects GLS and Fixed

Restricted to ec auctions with 2 or more participants

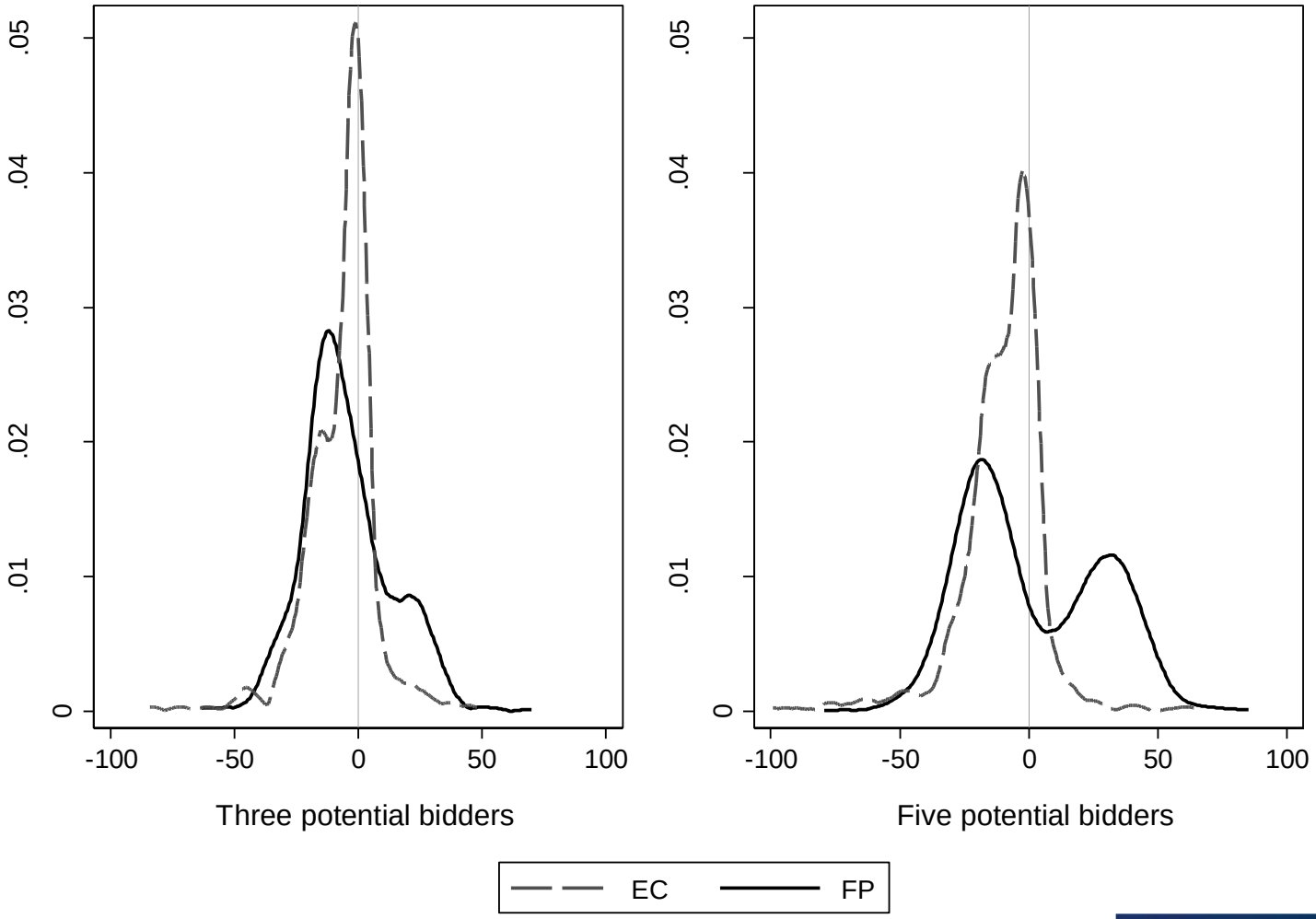
* p<0.05, ** p<0.01, *** p<0.001

Bidding relative to theory in first price auctions with more than one participant
Random Effects estimated via GLS

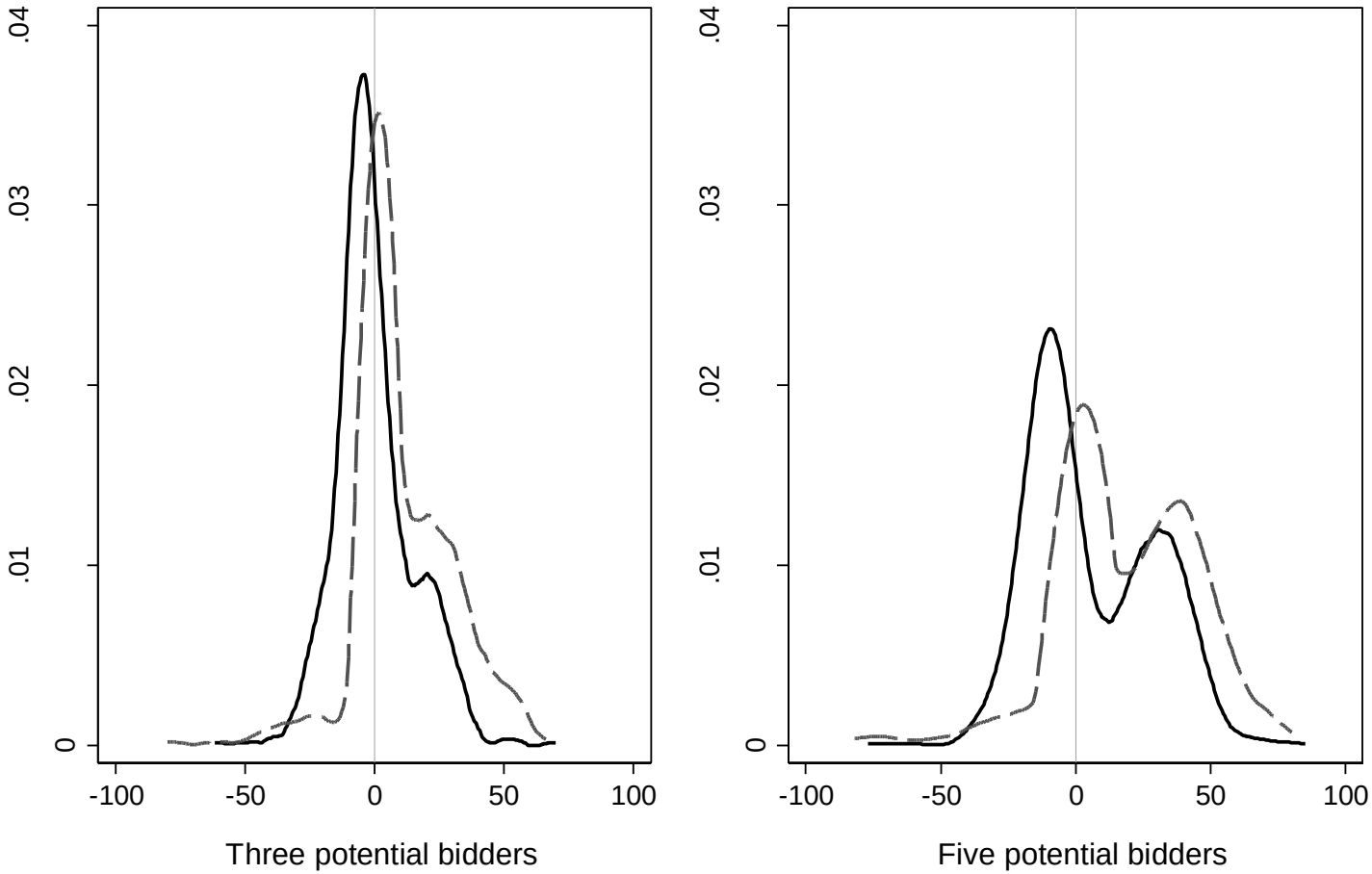
Dependent Variable: Observed Bid	All periods		Second half (last 20)	
	(1)	(2)	(3)	(4)
Responsiveness to value relative to theory	1.030***	1.030***	1.089***	1.092***
	(0.071)	(0.067)	(0.084)	(0.085)
Responsiveness to value relative to theory * Groups of 5	-0.148***	-0.139***	-0.145	-0.143
	(0.036)	(0.032)	(0.076)	(0.078)
Responsiveness to theoretical cutoff value	0.178***	0.225**	0.134	0.178
	(0.050)	(0.075)	(0.081)	(0.093)
Responsiveness to theoretical cutoff value* Groups of 5	0.220**	0.176*	0.198	0.214
	(0.085)	(0.082)	(0.132)	(0.135)
Groups of 5	-3.18	-2.205	-3.816	-3.916
	(1.998)	(1.411)	(3.384)	(3.119)
Natural log of (Period+1)		3.361***		7.061*
		(0.590)		(3.398)
Constant	1.903	-14.228	2.858	-26.461
	(2.006)	(9.420)	(1.875)	(16.951)
Addtitional controls (age, gender, order effects)	No	Yes	No	Yes
Number of Observations	1,428	1,428	682	682
Overall R-squared	0.67	0.688	0.729	0.735

Robust standard errors clustered at the session level
* p<0.05, ** p<0.01, *** p<0.001

Bid deviations from Nash



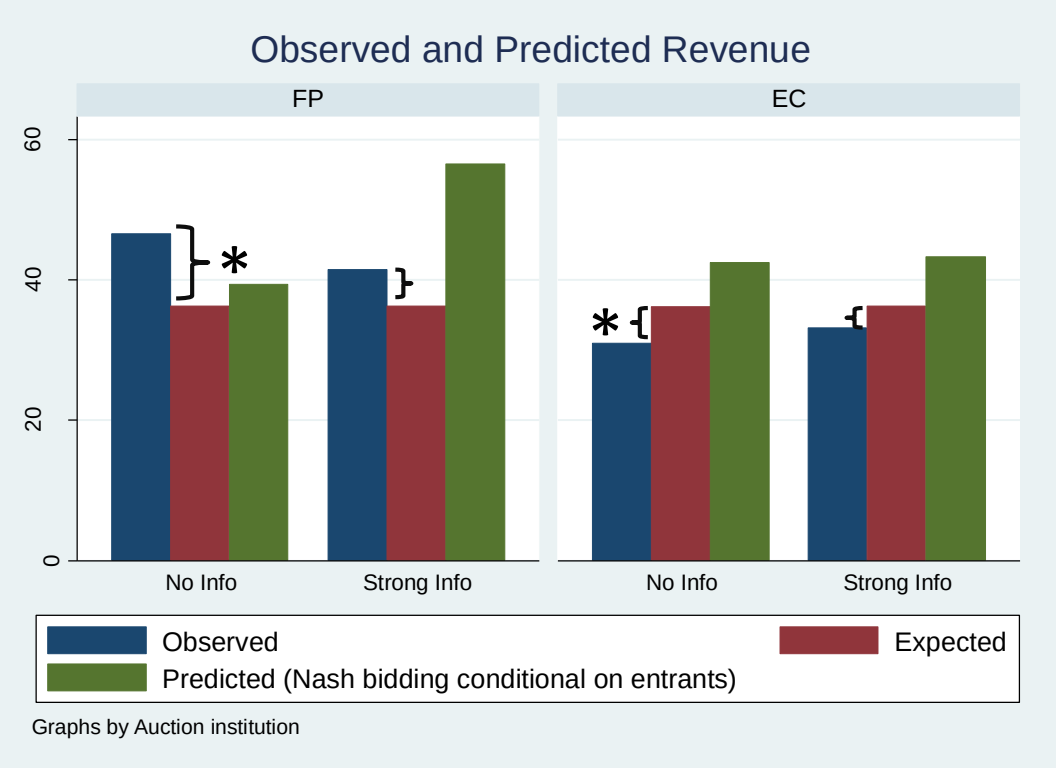
Bid deviations from Naive



Summary AEP1

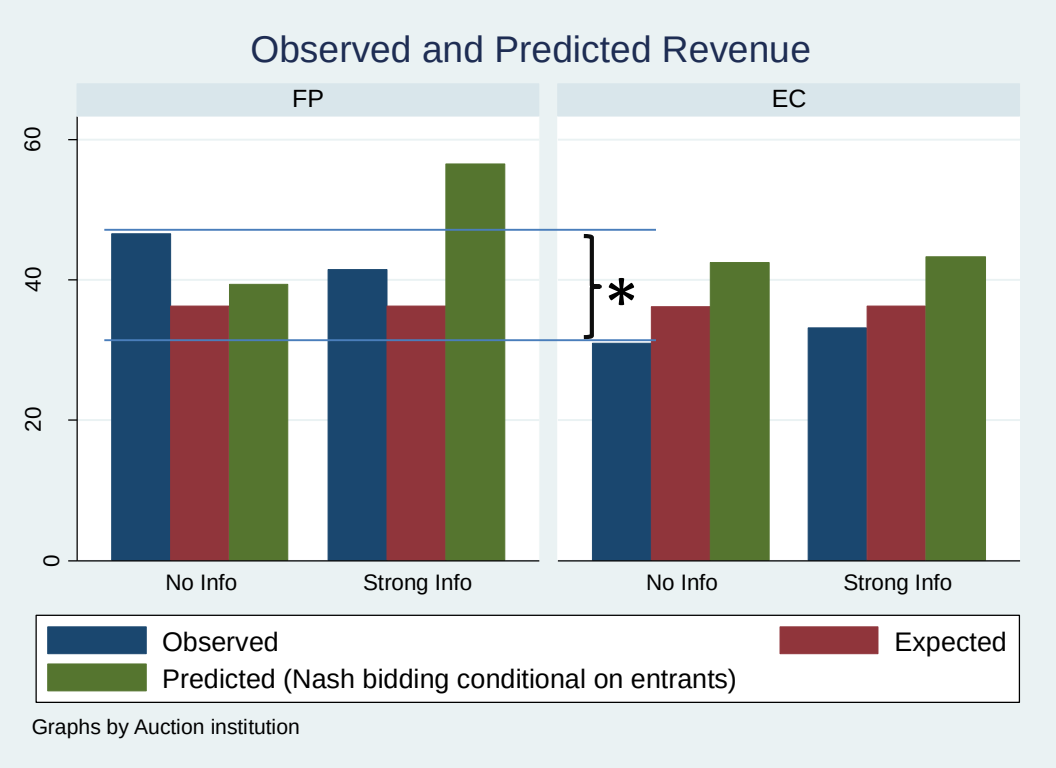
- Over-entry relative to theory
  - Consistent with experimental literature on entry
    - Camerer and Lovallo (1999), Goeree and Holt (2005), Fischbacher and Thoni (2008)
  - No differences in entry by auction format or information structure
    - Low power?
- Overbidding in FPA
  - Particularly when uninformed about number of bidders
- Revenue in FPA dominates EC
  - FPU > FPI > EC
  - Revenue ranking driven by overbidding conditional on entry

Revenue AEP1: Relative to Theory



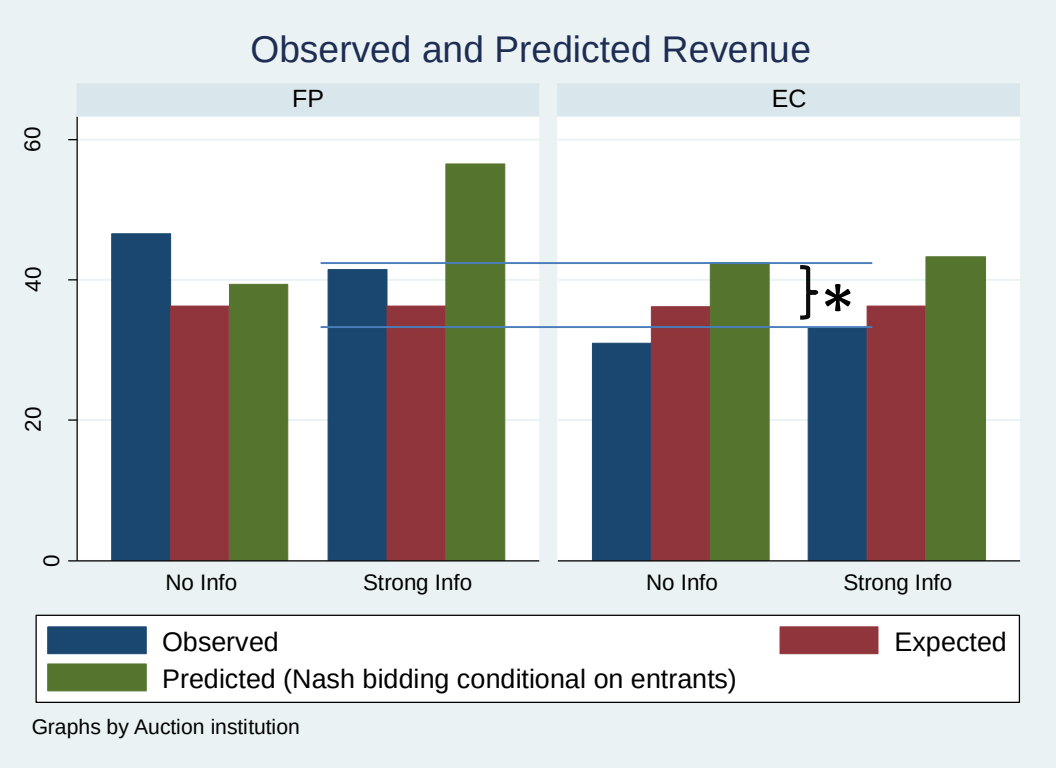
Significant difference in revenue relative to theory (when *m* is not revealed)

Revenue AEP1: Across Auction Formats



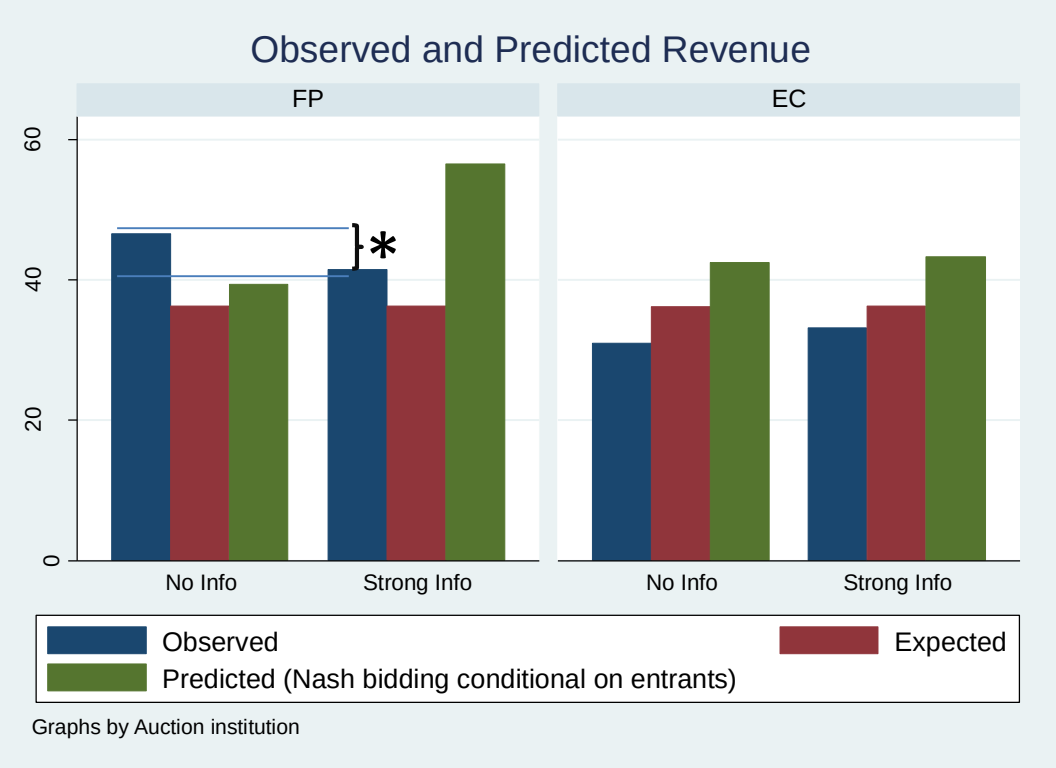
Significant difference in revenue across auction formats (*sign test p<0.01*)

Revenue AEP1: Across Auction Formats



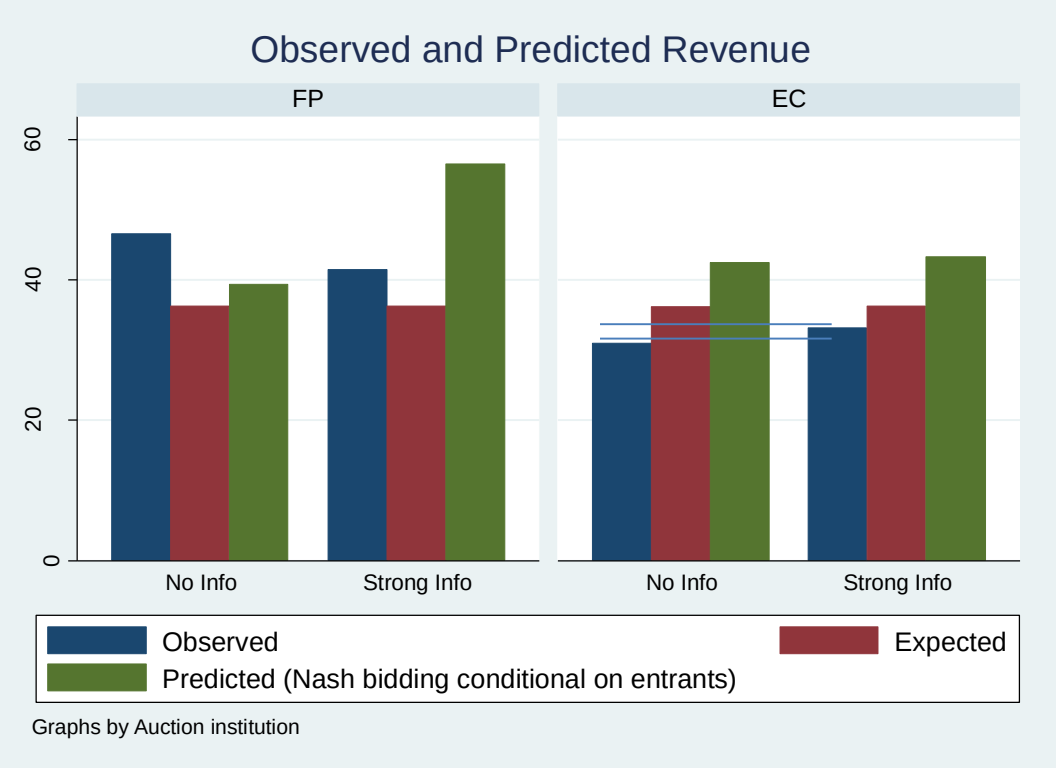
Significant difference in revenue across auction formats (*sign test p<0.05*)

Revenue AEP1: By Information Structure



Significant difference in revenue across information structure in FPA (*sign test p<0.01*)

Revenue AEP1: By Information Structure



No significant difference in revenue across information structure in ECA