Econ 2230: Public Economics

Lecture 16: Auctions

Competitive mechanisms

- Lotteries increase public good provision relative to VCM
- Lottery purchase imposes a negative externality on others. This effect counteracts the positive externality that results from giving to the public good.
- Do other competitive mechanisms have a similar effect? Winner pay auctions ?
- Charity auctions typically held at social events in the form of English auction (item awarded to bidder with the highest value at a price equal to the value of the second highest bidder)
  - standard oral ascending auctions
  - silent auction – write down increasing bids by a certain time
- Internet charity auction same items offered for sale both in for-profit and not-for profit auctions (e.g., eBay and eBay Giving Works).

Auctions

1. Charity auction
2. Winner pay auction
   a. Charity auction vs. non-charity auction
   b. Lottery vs. winner pay auction
3. All pay auctions
   a. Laboratory
   b. Field

1. Charity auctions

- Will winner pay auctions give rise to same negative (counteracting) externality as that seen for lotteries?
- Negative externality: raising bid decreases likelihood that others will win item

- Additional benefits of winner pay auction? Advantage over lottery?
- Winner deterministically determined – highest value bidder wins the price.

- Disadvantage of winner pay auction relative to lottery?
- Only winner pays bid (vs. lottery where all pay)

1. Charity auctions

- Related
  - Burkart (1995) bidding among creditors in bankruptcy auctions
  - Engelbrecht-Wiggans (1994) bidding among heirs for a family estate
- Goeree et al (2005) Model:
  - independent private value of the prize and incomplete information
  - bidders' values independently and uniformly distributed on [0,1]
  - auction's proceeds accrue to a public good that benefits the bidders. Assume every bidder receives $a from $1.00 spent on the public good. Bidders in the auction receive aR in addition to their usual payoffs, where R is the auction's revenue.
  - Let Y^n_k denote the kth-highest order statistic from n value draws

- Revenue in first price charity auction versus first price auction?
- Revenue greater in first price charity auction

Goeree, Maasland, Onderstal, and Turner (2005)

- The revenue of any winner-pay auction for a=0?
- $E(Y^n_2)$

- Benchmark: what are the consequences on revenue in winner pay when individuals value giving to public good as equivalent to keeping money a = 1?

- The revenue of any winner-pay auction is $E(Y^n_1)$ for a = 1

- Note revenue of winner-pay remains *finite* even when bidders value a dollar donated the same as a dollar kept
- Intuition: winning an item eliminates the ability to free ride off of someone else's bid. This causes revenues to be suppressed.

First vs. second price auction

- What is the revenue for intermediate charity auctions i.e. when $0<a<1$?
- Which is preferred first or second price auction when $0<a<1$?
- Bidders not only benefit from winning the item but also from the revenue
- Second highest bidder determines the price paid by the winner, provides an incentive to drive up the price in second price auction
- Engers and McManus (2007) show that for winner pay charity auctions second-price dominates first-price auction (revenue equivalence broken for charity auctions)
- What about third price?

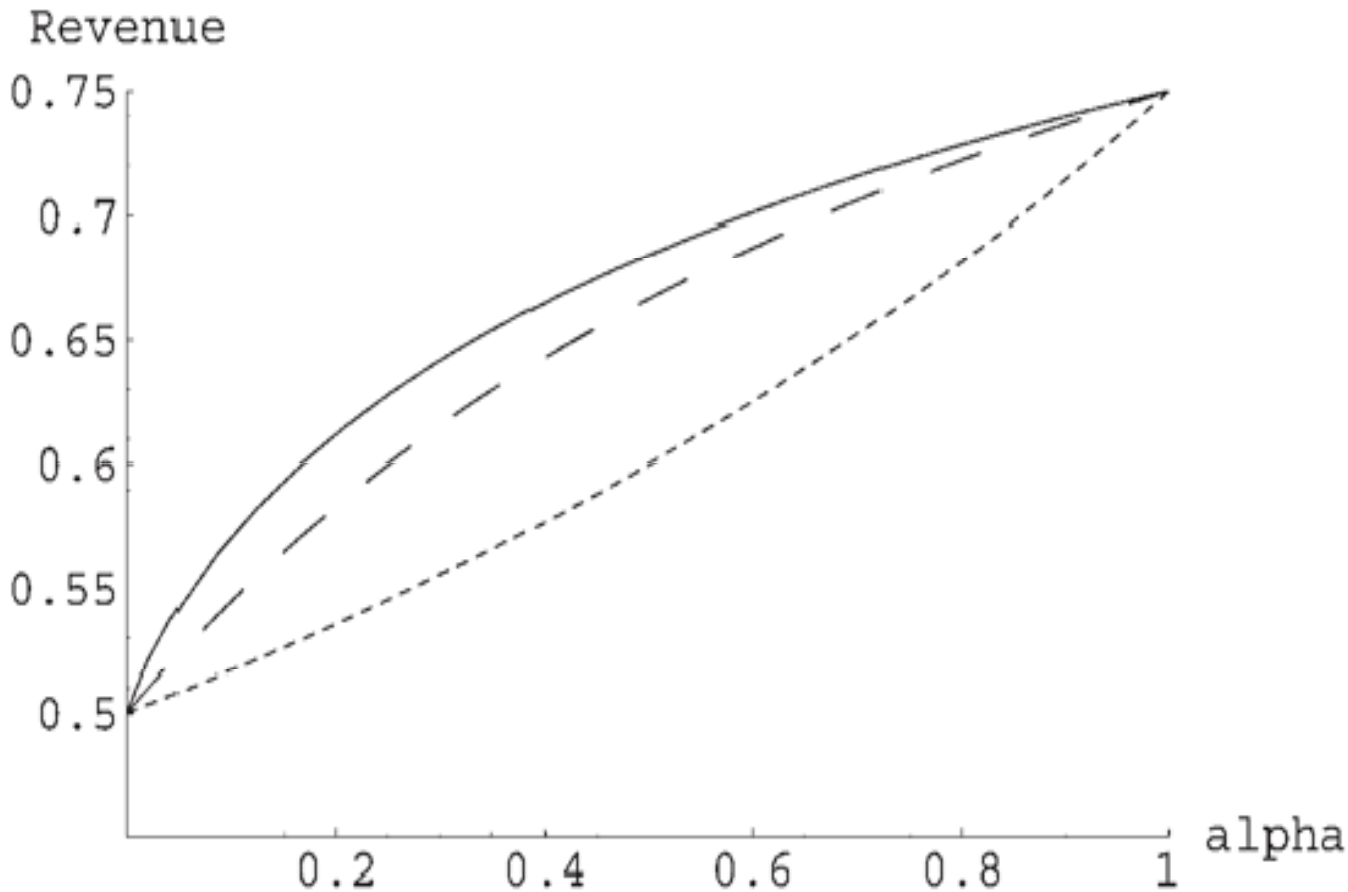


FIG. 1.—Revenues from a first-price (short dashes), second-price (long dashes), and third-price (solid line) auction with three bidders for $0 \leq \alpha \leq 1$.

Goeree, Maasland, Onderstal, and Turner (2005)

- Winner pay auction inferior: winning an item eliminates the ability to free ride off of someone else's bid. Caused suppressed bids in winner pay charity auction resulting in finite revenue even when a =1.

- What is the revenue in lottery when a =1?

- What is the revenue in an all pay auction when a =1 ?

Goeree, Maasland, Onderstal, and Turner (2005)

- Consider a kth-price all-pay auctions in which the highest bidder wins, the n-k lowest bidders pay their bids, and the k highest bidders pay the kth-highest bid.

- All pay auctions dominate comparable winner pay auctions and lotteries
  - All bidders pay, highest bidder wins
  - secures highest value bidder gets item (as in winner pay auction)
  - secures that increased bid doesn't eliminate payment from others (as in lottery)

- Show that the nth price all pay auction dominates – i.e., lowest price all pay auction

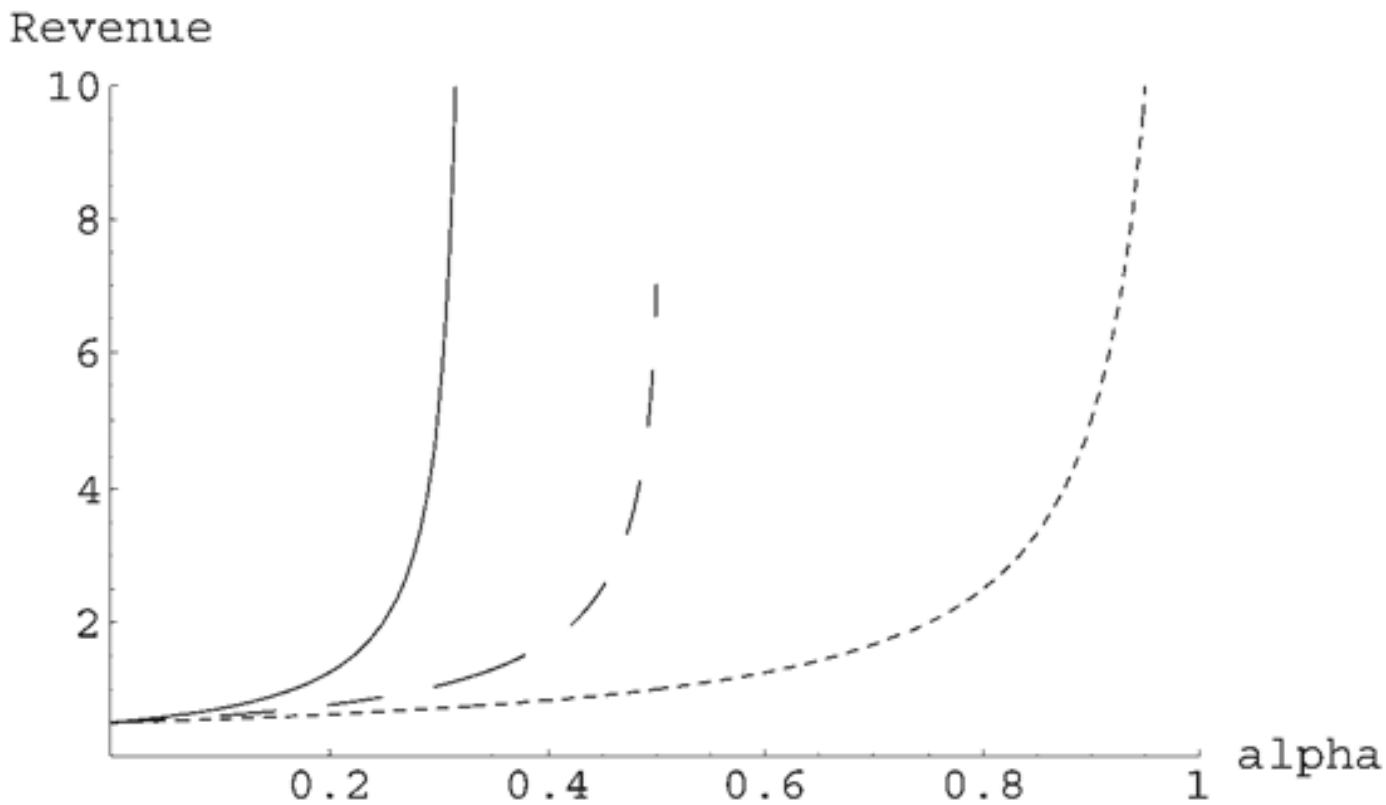


FIG. 2.—Revenues from a first-price (short dashes), second-price (long dashes), and third-price (solid line) all-pay auction with three bidders for $0 \leq \alpha \leq 1$.

2.a. Is revenue in charity auction greater than in non-charity auction?

- Isaac and Schnier (2005)
- Examine bidding behavior in silent auctions. Using data from three naturally occurring fundraising auctions and six laboratory sessions (primary focus bidding behavior).
- Typical silent auction
  - There are multiple goods at auction.
  - All items are displayed to all bidders, each of whom is free to bid on any number of items.
  - The auctions are held simultaneously for all goods and close according to a common clock
  - The auctions are ‘‘silent’’ oral ascending auctions (i.e., each bidder writing bids on the item’s bidding sheet)
  - Public goods component to the seller’s revenues

Isaac and Schnier (2005)

- Examine bids in actual charity auctions
  - Auction 1: for urban church preschool. Auction offered 135 items for sale. 88 active bidders
  - Auction 2: for urban church preschool. 194 items,77 bidders.
  - Auction 3: a private school. 181 items, 198 active bidders.
- Are bids greater than expected absent the charity component?
- No overbidding in church auction, and only happens 10% of the time in the school auction, with only half exceeding the minimum increment
- What does this tell us about revenue in charity versus non-charity auction?
- Need to know underlying valuations
- Even then need to comparable charity and non-charity auction to determine if increase in winning bid

Is revenue greater in a charity auction?

- Elfenbein and McManus (2007)
- Non-experimental data
- Identify similar items on eBay and eBay's Giving Works charity auctions
- eBay Giving Works sellers choose
  - charity that will receive the donation.
  - share of revenue donated. Nearly all auctions have donation shares of 10% or100%.

- What would you look for in determining whether charity component matters?

2.a. Is revenue greater in a charity auction?

- Elfenbein and McManus (2007)
- A 6% revenue premium for items with a charity component (premium of 5% in 10% -share auctions and 7% in 100%-share auctions)
- Premium for 100%-share auctions declines with value of the non-charity matched products (diminishing marginal utility of donation)
- Bids in 100%-share charity auctions submitted half a day earlier than bidders in non-charity auctions
- second-, third-, and fourth- highest bids in charity auctions are larger than the corresponding bids in non-charity auctions. Those who bid in both a charity and a non-charity auction for identical items bid more in charity auctions, regardless of whether they win.

2.a. Is revenue greater in a charity auction?

- Popkowski and Rothkopf (2006)
- Field experiments: simultaneously run charity and noncharity auctions for identical products in on-line auctions and vary the percentage donated to charity.

- Substantial premium for the charity auctions
  - Prices are increasing in the percentage donated to charity.
  - Auctions with a contribution of 25% of revenues significantly increased bid prices - by more than 41%
  - Auctions with 25% of revenue donated to charity had higher net revenue than non-charity auctions.
  - Increase in revenue high enough to be profitable to an auctioneer even after the charitable contribution is made (explanation for CSR)

Salmon and Isaac (2006)

- Computational examples show that little difference in revenue is expected if return from public good does not depend on who contributes (i.e. pure altruism)
- How does preference for public good affect bids?
- Preference for public good
  - Amount bidder is willing to pay if he wins increases
  - Makes losing the auction more attractive and decreases willingness to pay because the bidder receives utility from seeing the auctioneer raise money.
  - These counterbalancing incentives theoretically net out - leading to little change in bidding.
- In addition difference between second price and first price auctions is quite small– important as standard overbidding in first price thus can reverse ranking

2.a. Revenue in charity vs. non-charity auctions

- Isaac, Pevnitskayay, and Salmon (2008)
  - Present a set of hybrid lab-field experiments to test the behavioral predictions of a model of charitable bidding
  - Experimental findings:
    - Revenue response very sluggishly to increases in the charitable preferences as predicted by the theory
    - In sessions where the auction revenue is donated to actual charities find little difference between the revenue in the rounds in which the revenue is donated to charity and the rounds in which it is not. Even when using populations who are committed to the non-profit.

- Schram and Onderstal – also find that charity component (MPCR= 0 vs MPCR = 0.5) does not affect behavior

2.a. Is revenue greater in a charity auction?

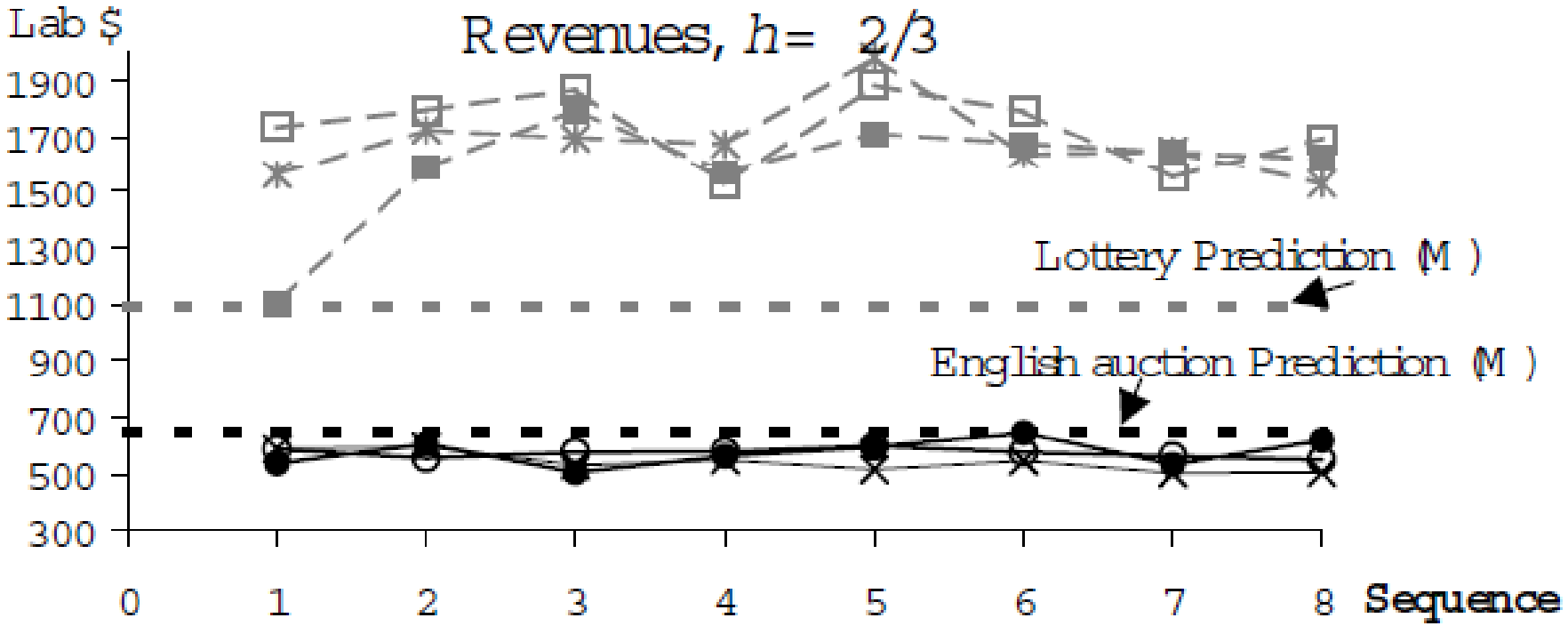
- With exception of Popkowski and Rothkopf limited effect of adding a charity component to the auction
- Isaac and Schnier (2005): main aspect of <u>charitable donation is from those donating items</u> to the organization to be auctioned rather than in the bids of the individuals showing up to bid on them.
- Orzen (2010): Charitable winner-pay auctions observed in the field should hence not be seen as incentivized fundraising mechanisms but rather as <u>a simple way of converting donated items into cash</u>

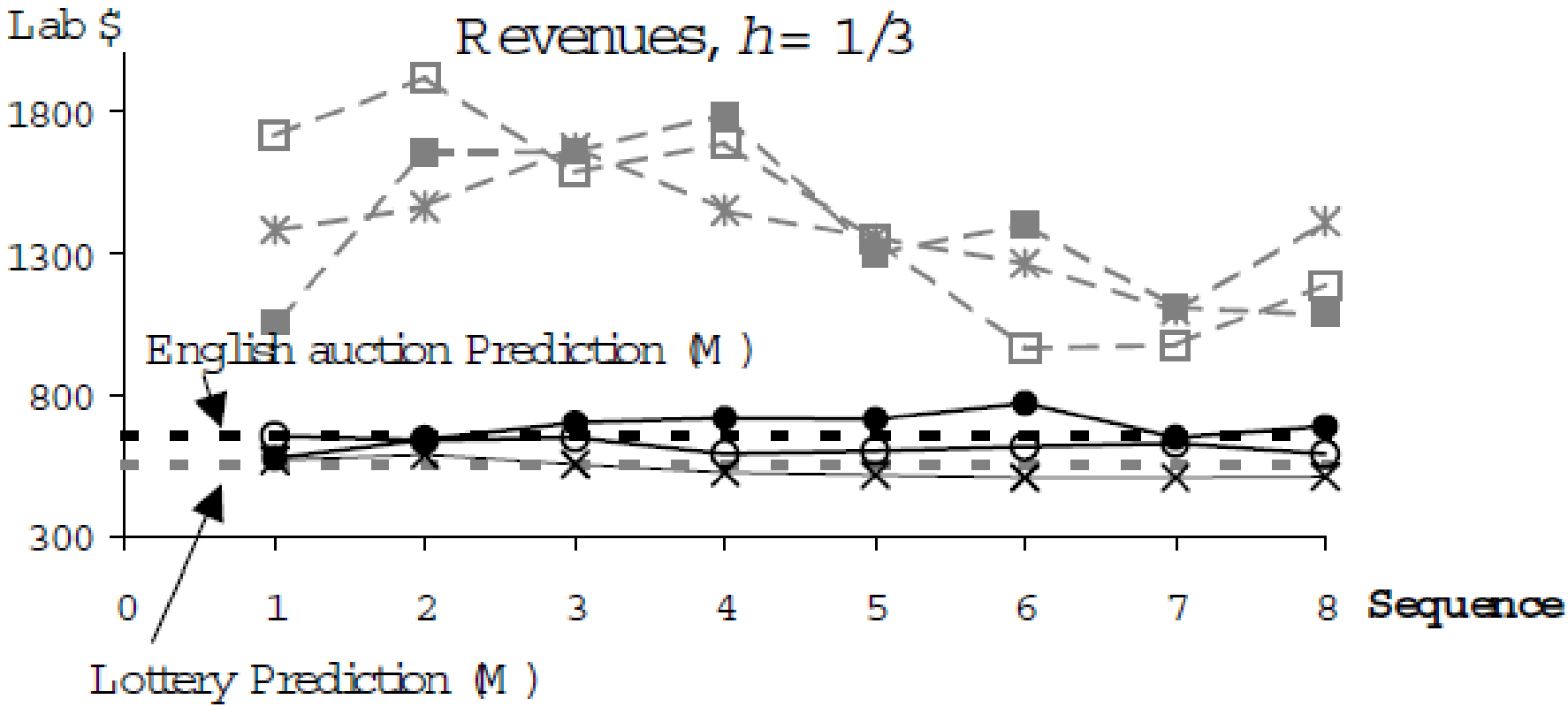
2.b. Lottery vs Winner Pay Auction?

- Theory: comparative static depends on the parameter of the environment
- Davis, Razzolini, Reilly, and Wilson (2006)
  - Laboratory experiment
  - Treatments: English auction vs. lottery, changing MPCR and distribution of values
  - Private value
  - Complete information: each bidder informed about how much other bidders value the object for sale
  - What is the predicted winning bid in the English auction when MPCR>0?
  - Given perfect information prize will be driven up to the highest valuation

Table 1. Predicted Revenue Comparisons: English Auction and Lottery (in cents)

Value Set	English Auction			Lottery		
	h=0	h=1/3	h=2/3	h=0	h=1/3	h=2/3
L: {500, 500, 500, 500}	500	500	500	375	563	1125
M: {650, 500, 425, 425}	500	650	650	364	546	1092
H: {800, 500, 350, 350}	500	800	800	335	502	1004


Lab $
Revenues, h= 2/3
1900
1700
1500
1300
1100
900
700
500
300
Lottery Prediction (M)
English auction Prediction (M)
0
1
2
3
4
5
6
7
8
Sequence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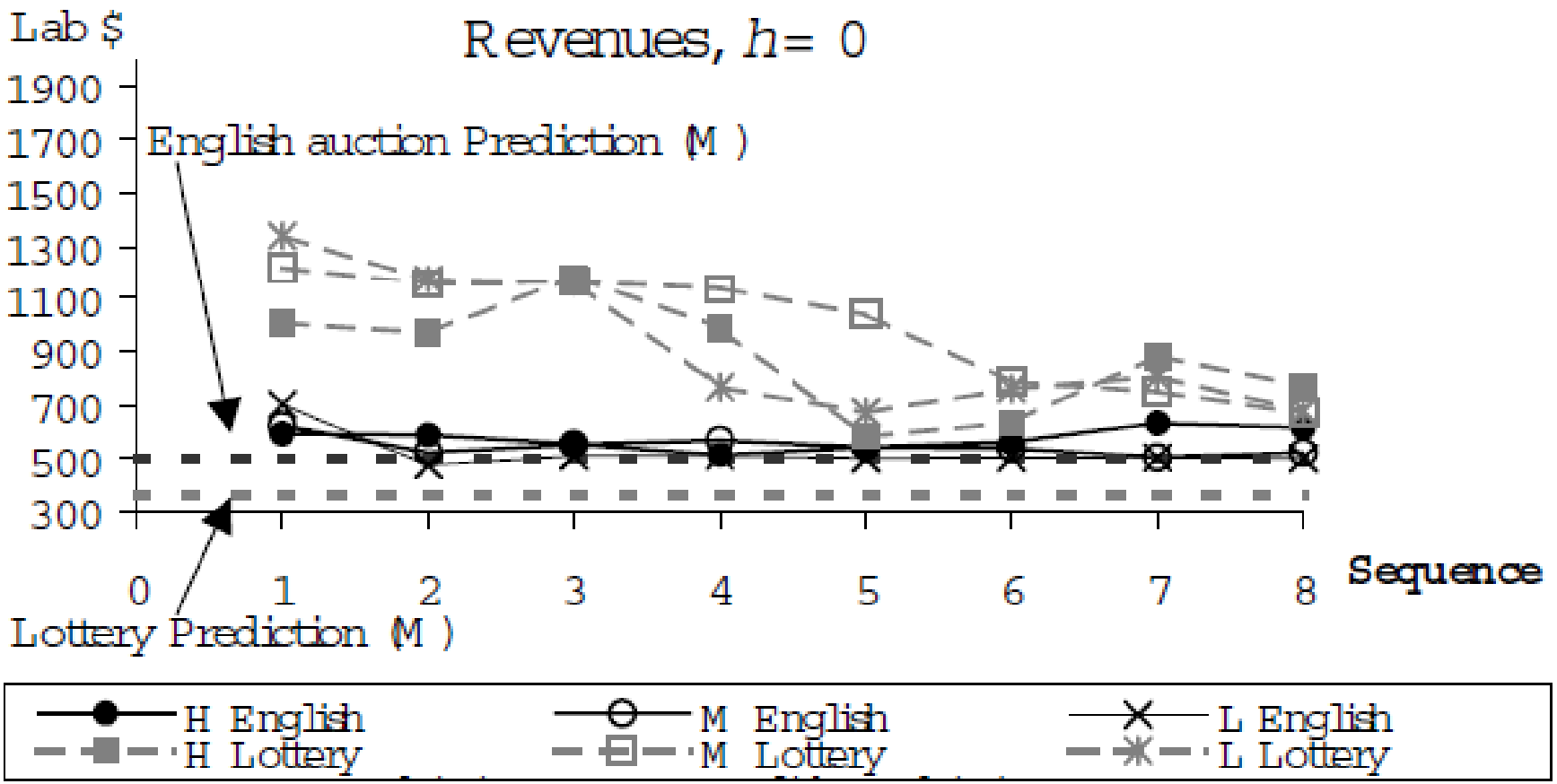

Lab $
Revenues, h= 0
1900
1700
1500
1300
1100
900
700
500
300
English auction Prediction (M)
Lottery Prediction (M)
0
1
2
3
4
5
6
7
8
Sequence
H English
M English
L English
H Lottery
M Lottery
L Lottery

Davis, Razzolini, Reilly, and Wilson (2006)

- Findings
  - Contributions in English Auction dominated by those w/ lottery
  - Result is robust with respect to the distribution of private values, and the rate of return from the public good

- Schram and Onderstal (2009)
  - Private value – incomplete information
  - Examine environment where lottery predicted to equal WP (313 vs. 300)
  - Results: Revenue LOT>WP

3.a. All pay auction: lab experiments

- Goeree, Maasland, Onderstal, and Turner (2005)
  - lotteries and winner-pay auctions have lower expected revenue than all-pay auction
  - The revenue-maximizing type of auction is a lowest-price all-pay auction where all players pay the lowest bid.

Orzen (2008)

- 180 undergraduate students
- 15 sessions, three in each of five treatments
- 12 participants per session
- Twenty-five periods
- Each round randomly and anonymously rematched in groups of four
- Endowments of 100 tokens and MPCR = 0.5
- Common value auction 100 tokens (extend the results of Goeree et al from private value to common value and complete information)

- How do you secure non-negative provision of the public good?
- A common exogenously given starting point for all treatments. Prize in prize treatments and bonus in non-prize treatments (100 point prize or lump sum bonus for all of 50 tokens in the VCM and LCD)

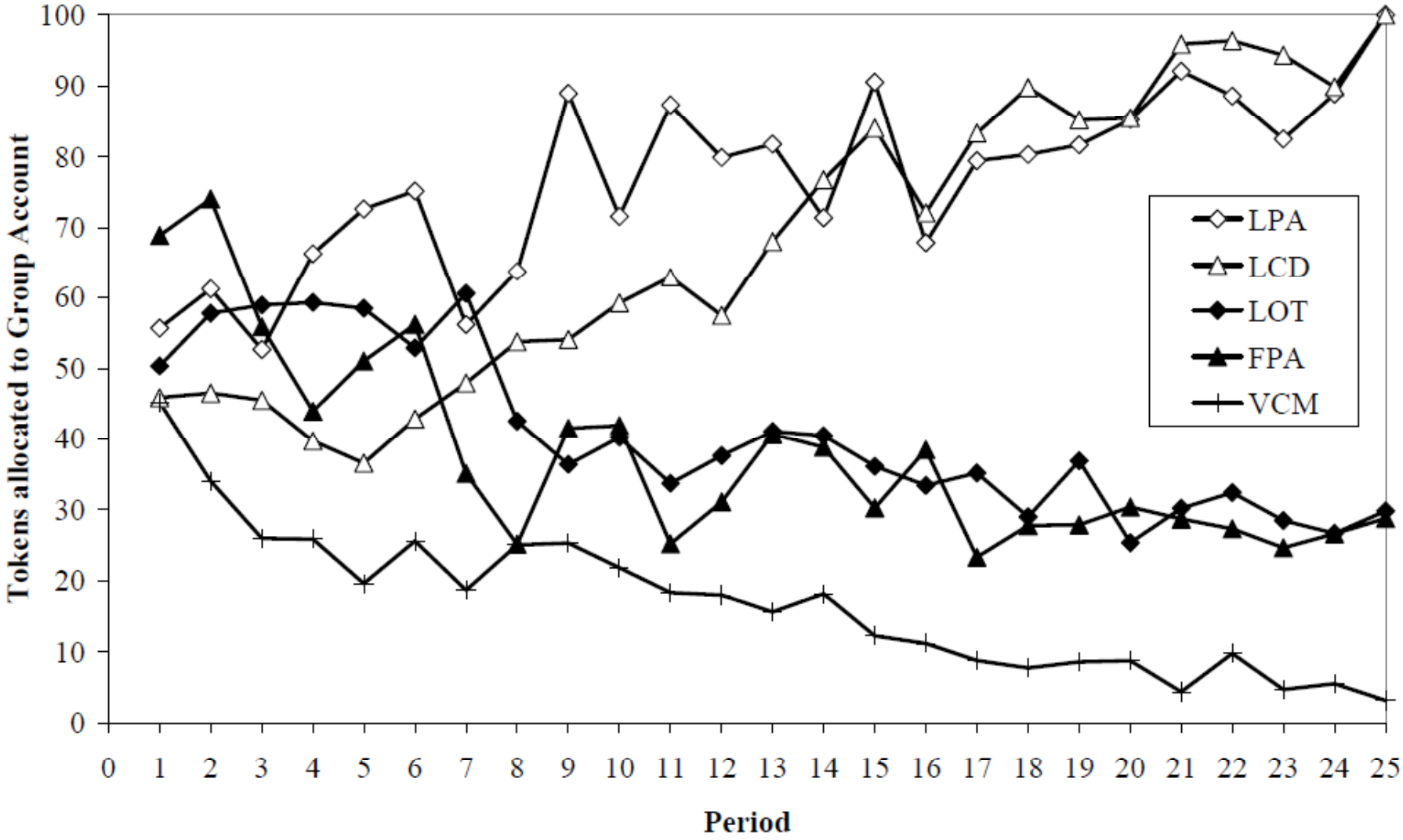
Orzen (2008) Design

Table 1: The five fundraising mechanisms

	Contribution rule	
Prize allocation rule	*Pay as you bid*	*Pay lowest bid*
Highest bidder wins	FPA	LPA
Lottery	LOT	—
No Prize	VCM	LCD

Note FPA – is not a first price winner pay auction – but a first price all pay auction

Figure 2: Average contributions over time



Orzen (2008)

- Difference between behavior in first-round versus end of the experiment.
- first round: contributions similar across treatments. The only mechanism to elicit significantly higher contribution than the VCM is the first-price all-pay auction, but FPA does not systematically outperform the VCM in terms of public good provision
- end of experiment: all schemes outperform VCM. LPA and LCD are efficient.
- Does FPA perform as predicted?

Table 7: Chances of outperforming the VCM‡

Rounds	*LOT*	*FPA*	*LPA*	*LCD*
1-5	72%	75%	78%	70%
6-10	66%	55%	90%	88%
11-15	65%	56%	99%	99%
16-20	70%	62%	100%	100%
21-25	73%	68%	100%	100%

‡ Probability that a randomly composed group of four in a treatment contributes more than a randomly composed group of four in VCM.

Schram and Onderstal (IER 2009)

- Independent private value and incomplete information (Recall Orzen common value and complete information)
- Argue examine environment which most closely mirror that of the field
- Treatments: WP, LOT, AP with and without public good component
- Environment
  - 28 rounds. 4 blocks of 7 rounds. Alternate between blocks with and without a public good (MPCR = 0.5 or 0)
  - Each round randomly paired in groups of three. Unknown to subjects done within sets of 6 subjects (two groups). ‘‘Matching groups’’ constitute statistically independent units of observation
  - Individual valuations determined in each round by independent draws from a uniform distribution on [0,500].
  - First price winner pay (WP), lottery (LOT) and first price all-pay (AP)
  - 290 subjects, 18 sessions

TABLE 1

SUMMARY OF THE TREATMENTS

Mechanism		Order of Rounds	# Sessions	# Groups	# Independent Observations
First-price winner-pay	WP	NC-C-NC-C	2	12	6
		C-NC-C-NC	2	8	4
Lottery	LOT	NC-C-NC-C	2	12	6
		C-NC-C-NC	2	8	4
First-price all-pay	AP	NC-C-NC-C	2	12	6
		C-NC-C-NC	2	8	4

NOTES: NC-C-NC-C: rounds 1–7 and 15–21 without charity; rounds 8–14 and 22–28 with charity. C-NC-C-NC: rounds 1–7 and 15–21 with charity; rounds 8–14 and 22–28 without charity.

TABLE 2

EXPECTED REVENUE IN EQUILIBRIUM

	Winner-Pay (WP)	All-Pay (AP)	Lottery (LOT)
Without charity ($\alpha = 0$)	250	250	156
With charity ($\alpha = 0.5$)	300	500	313

TABLE 2

EXPECTED REVENUE IN EQUILIBRIUM

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MPCR = 0: WP = AP > LOT as stochastic winner determination in LOT depress bids

MPCR = 0.5: WP < LOT < AP

How do these mechanisms compare to VCM?

TABLE 3

EFFICIENCY AND REVENUE (ALL ROUNDS)

			Efficiency	Revenue	Ex Post Nash Revenue
Winner-pay	NC-C-NC-C	No charity	0.94	301	256
		Charity	0.88	282	301
	C-NC-C-NC	No charity	0.90	285	255
		Charity	0.89	271	300
All-pay	NC-C-NC-C	No charity	0.83	373	247
		Charity	0.85	373	441
	C-NC-C-NC	No charity	0.81	322	228
		Charity	0.79	404	502
Lottery	NC-C-NC-C	No charity	0.70	290	149
		Charity	0.69	330	318
	C-NC-C-NC	No charity	0.81	343	150
		Charity	0.70	346	301

NOTES: NC-C-NC-C: rounds 1–7 and 15–21 without charity; rounds 8–14 and 22–28 with charity. C-NC-C-NC: rounds 1–7 and 15–21 with charity; rounds 8–14 and 22–28 without charity. Ex post Nash Revenue = revenue predicted by the Nash equilibrium, for the actual values drawn.

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TABLE 4

REVENUE AND MECHANISM

	Without Charity	With Charity
Constant	325.17 (15.86)**	379.91 (15.90)**
Winner-pay	−16.85 (0.67)	−107.56 (3.64)**
All-pay	41.19 (1.64)*	–
Lottery	–	−48.95 (1.66)*
Order	−4.27 (0.20)	11.98 (0.49)
Experience	−24.55 (2.07)**	0.91 (0.07)
LR-test for random effects	$p < 0.001$	$p < 0.001$
Test of $\beta_1 = \beta_2$	$p = 0.02$	$p = 0.05$

NOTES: The table gives maximum likelihood estimates of the coefficients in Equation (6) with t-values in parentheses (*,** denote that the coefficient is statistically significantly different than 0 at the 10% and 5% levels, respectively). In each equation, one mechanism dummy is dropped and included in the constant term. The dummy dropped is the mechanism for which a different equilibrium revenue is hypothesized than for the other two. A test for equality of the coefficients of the other two mechanisms is presented in the last row. The LR-test for random effects tests $\sigma_u = 0$, which is strongly rejected in both cases.

(A) WINNER-PAY AUCTIONS, (B) ALL-PAY AUCTIONS, AND (C) LOTTERIES

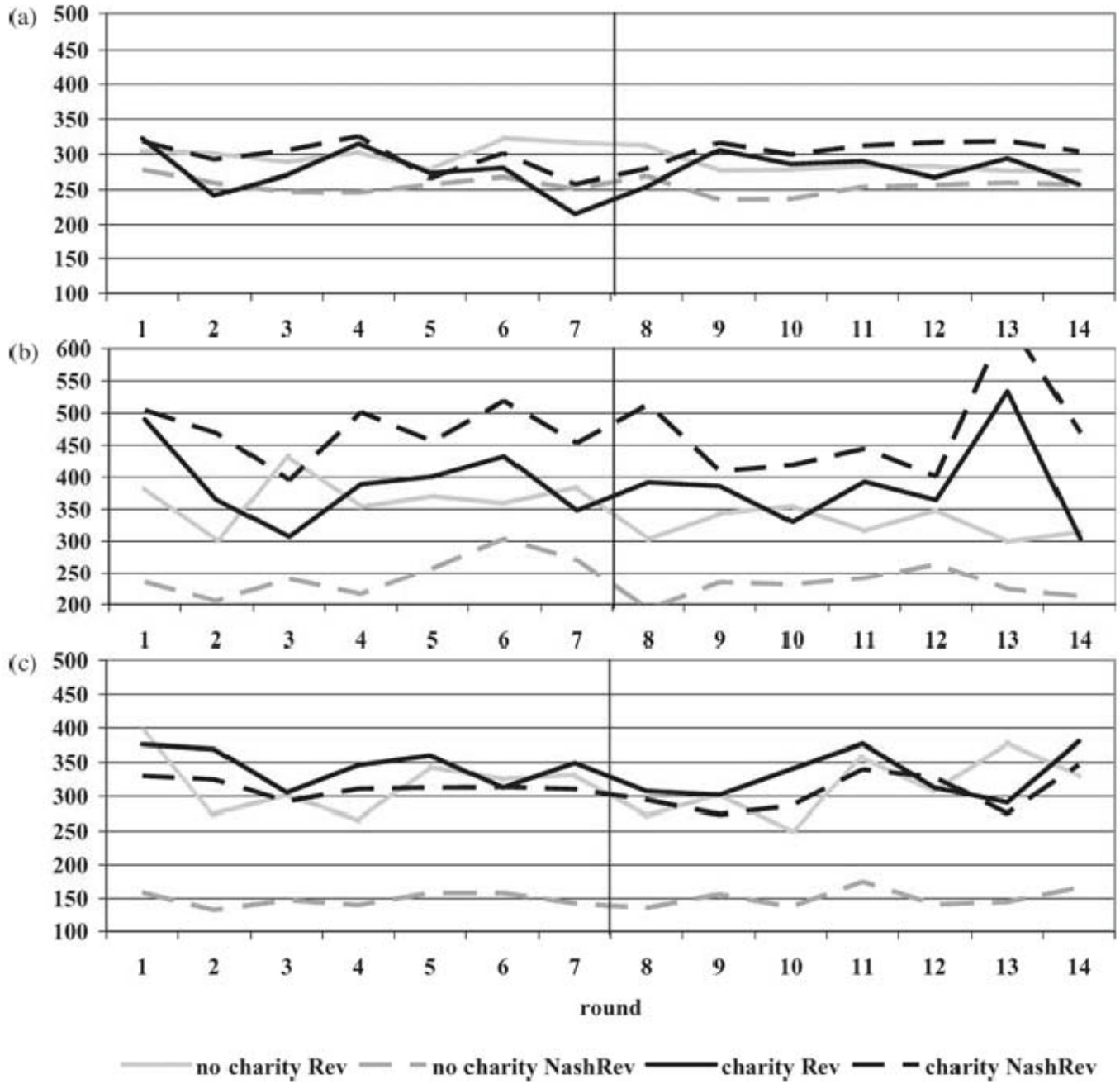


TABLE 5

REVENUE AND CHARITY

	WP	AP	LOT
Constant	286.40 (33.30)**	363.31 (12.62)**	278.40 (7.64)**
Charity	−3.21 (0.31)	56.15 (2.04)**	26.30 (1.35)
Order	−6.92 (0.64)	−71.17 (1.78)*	60.51 (1.09)
LR-test	$p = 0.45$	$p = 0.04$	$p < 0.001$

NOTES: The table gives maximum likelihood estimates of the coefficients in Equation (6) with absolute z-values in parentheses (*,** denote that the coefficient is statistically significantly different than 0 at the 10% and 5% levels, respectively). The LR-test for random effects tests $\sigma_u = 0$, which is rejected for AP and LOT, but not for WP. The difference between AP and LOT is not statistically significant ($p = 0.12$).

Results:
Schram and Onderstal (IER 2009)

- Effect of charity: not present for WP and LOT (evidence of WP seen previously, evidence on lottery contradictory to Morgan and Sefton's finding on Bad Lot (MPCR = 0 vs. 0.75, common value)
- Effect on public good provision: larger revenue with all-pay auction. For the value distributions they consider they find that relative to the all-pay auction the lottery would reduce the revenue by about 50 whereas the winner pay auction would reduce revenue by 100
- Argue that revenue of a recent charity auction for Eric Clapton's legendary 1956 Fender Stratocaster "Brownie" could have been raised by at least 100,000 from $497,500 if an all-pay auction had been used instead of a winner pay auction.
- Robustness check
  - examine WP and AP with larger groups and lower MPCR (n=5, MPCR=0.3)
  - Same results:
    - Revenue in AP>Revenue in WP
    - Only AP is affected by charity

Corazzini, Faravelli and Stanca (2007)

- Treatments: voluntary contribution mechanism (VCM), lottery (LOT) and all-pay auction (APA).
- Common value prize of 240
- Heterogenous endowments: randomly and anonymously assigned an endowment of either 120, 160, 200, or 240 tokens at beginning of experiment
- randomly and anonymously rematched in groups of four players.
- MPCR = 0.5 (to avoid decimals – private account multiplied by 2 public account multiplied by 1)
- VCM = bonus of 120, prize 240

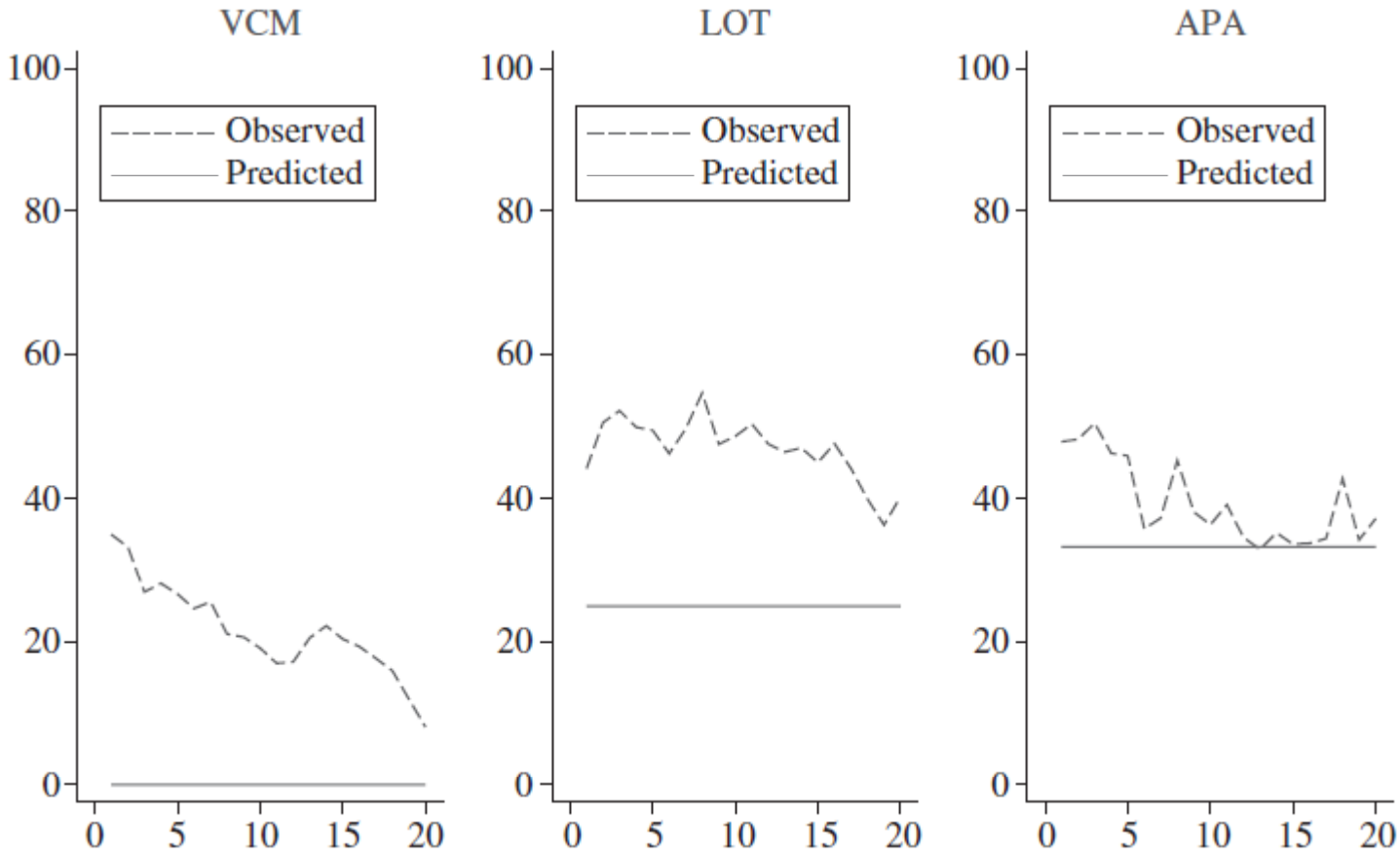


Fig. 1. *Average Relative Contributions Over Rounds, By Treatment*

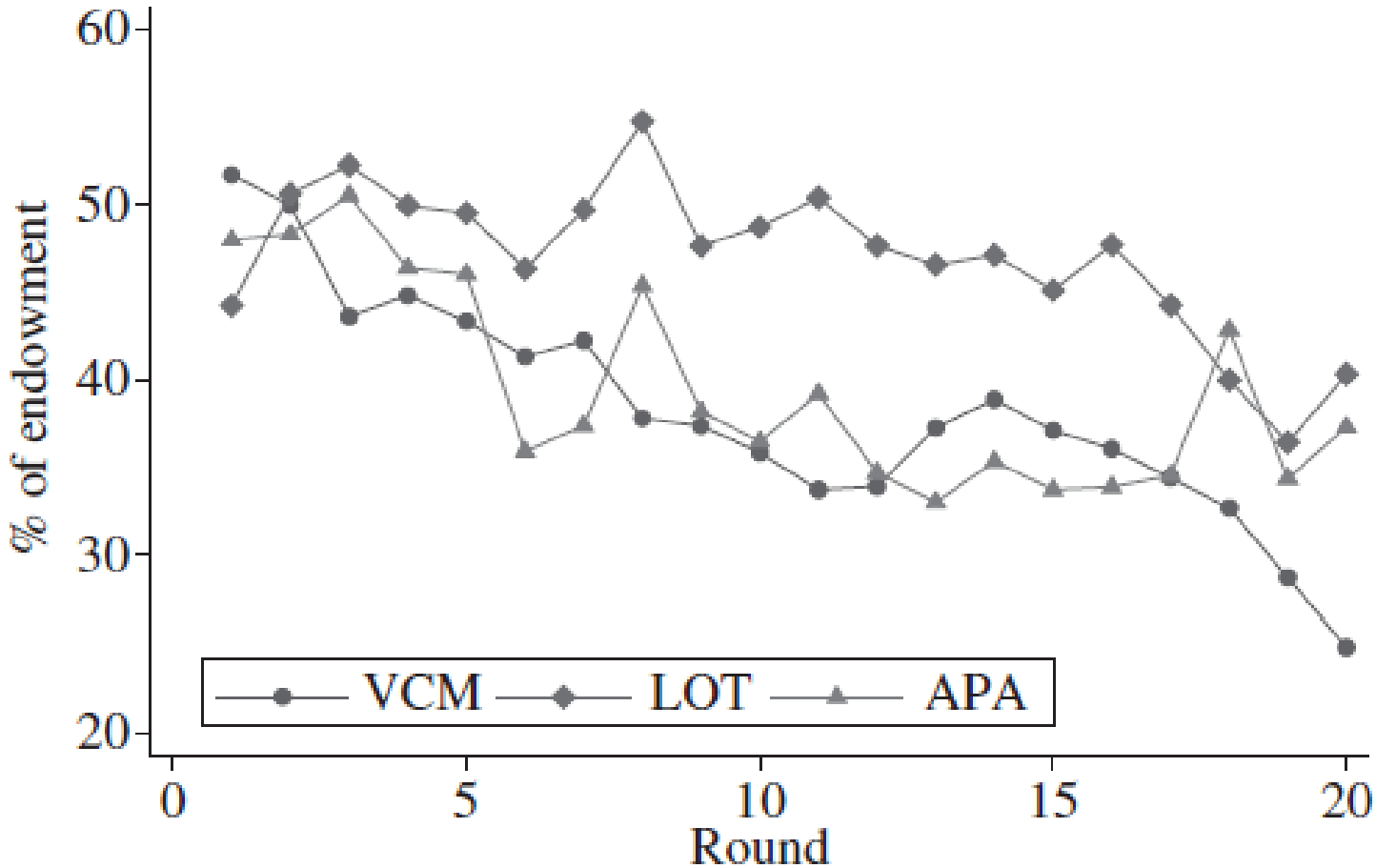
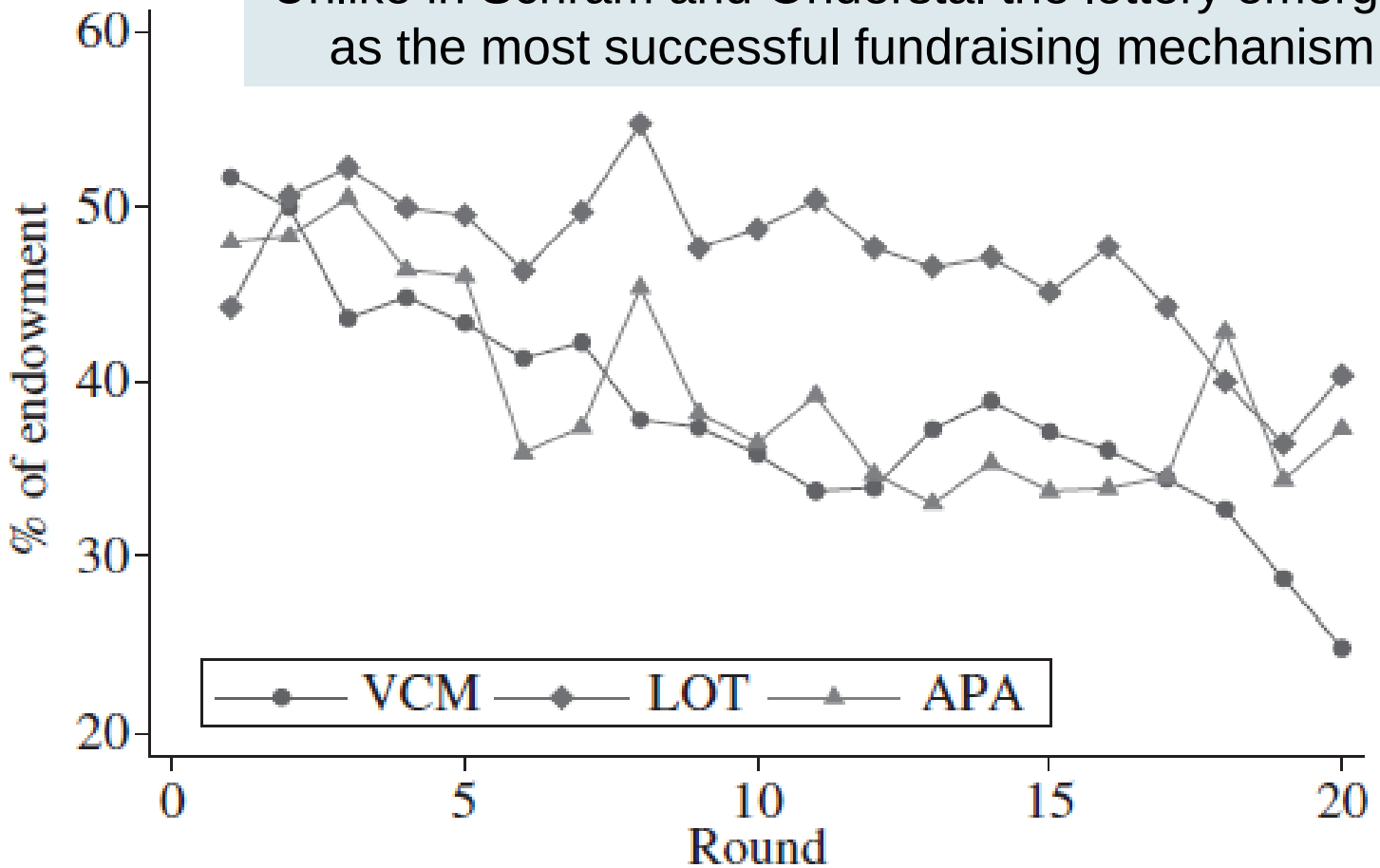


Fig. 2. *Average Public Good Provision Over Rounds*

Unlike in Schram and Onderstal the lottery emerges as the most successful fundraising mechanism



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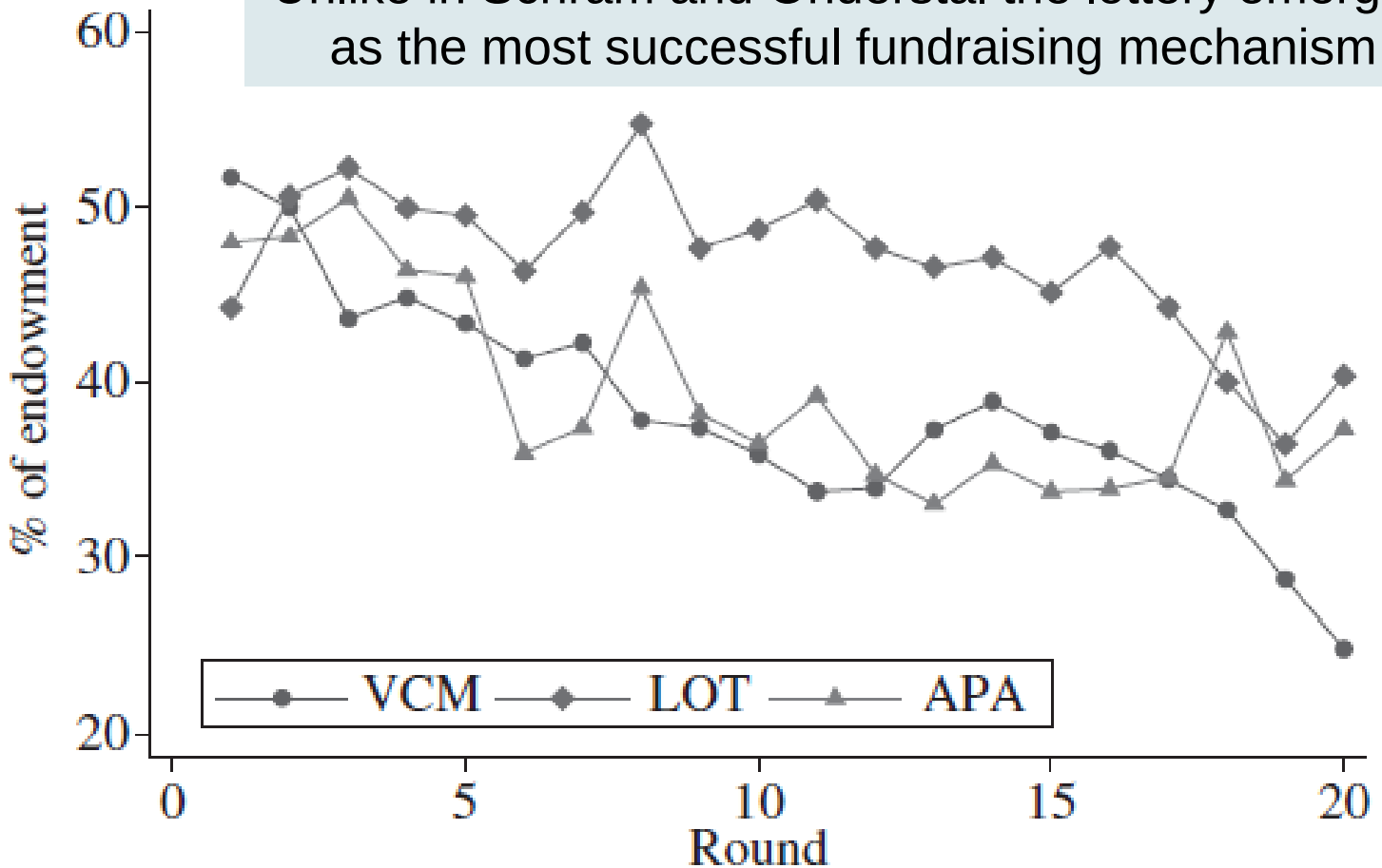

subjects choose zero contributions about three times as often in APA as in LOT (20.8% and 5.83%)

Lab experiments AP vs LOT

- Common value and complete information:
  - Orzen: LOT = FPAP < lowest price all pay auction
- Private value and incomplete information
  - Schram and Onderstal: FPAP> LOT
- Private value, private endowment, incomplete information
  - Corazzini, Faravelli and Stanca (2010): LOT> FPAPA
- Bos (2009) show that with private value but complete information lottery may dominate all pay auction if valuations are sufficiently asymmetric. Encourages studies of private value and complete info.

3.b. Field experiments

- Carpenter, Holmes, and Matthews (2008)
- Design
  - Field experiment
  - Treatments: first price (FP), second price (SP) , first price all-pay (FAP)
  - Four different preschools
- Results:
  - Revenue: FP > SP > FAP
  - Caused by low participation in FAP: FP 53%, SP 39% , FAP 13% and 14%
  - perhaps due to differential participation costs (all-pay auction perceived as less fair and significantly more difficult to understand)

- Continue with Onderstal, Schram, and Soetevent (2011)