Loss Aversion and Competition in Vickrey Auctions: Money Ain't No Good

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Second-price Auction with Private Values

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  - It is a (weakly) *dominant* strategy for each bidder to bid his value
  - $\Rightarrow$ bids do not vary with the intensity of competition
- This result is very robust:
  - It also holds if values are correlated and/or if bidders are risk-averse

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  - In induced-value auctions: in the (unique) symmetric equilibrium bidders bid their value
- These predictions are *unique* to the KR model
  - In Vickrey auctions, risk aversion, regret, ambiguity aversion, level-k cannot be distinguished from the standard risk-neutral model

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- Our findings are aligned with the predictions of the KR model
- In real-object auctions, we find that increasing the intensity of competition pushes bidders to *reduce* their bids (on average)
- In induced-value auctions, we find that the intensity of competition has *no significant effect* on bids
- We also replicate an experiment from Sprenger (forthcoming, JPE) aimed at distinguishing the KR model from models of Disappointment Aversion (Bell, 1985; Loomes and Sudgen, 1986; Gul, 1991)
    - We interpret this as additional evidence that what's going on in the auctions is due to loss aversion

Related Literature

1. Evidence on KR preferences
   - Lab: Abeler *et al.* (2011), Ericson-Marzili and Fuster (2011), Gill and Prowse (2012), Karle *et al.* (2015), Sprenger (forthcoming, JPE)
   - Field: Crawford and Meng (2011), Bartling *et al.* (forthcoming, MS)
2. Auctions with KR bidders
   - Lange and Ratan (2010), Eisenhuth and Ewers (2012), Eisenhuth (2012), Ratan (2013), Banerj and Gupta (2014)
3. Experiments on Vickrey auctions
   - Kagel and Levin (1993), Cooper and Fang (2008), Garratt *et al.* (2012), Georganas *et al.* (2015)

Outline

1. Theoretical Framework
2. Experimental Design
3. Results
4. Conclusions

Setup

- Risk-neutral seller auctions an object to $n \geq 2$ bidders using a sealed-bid second-price auction with no reserve price
- Bidders have IPVs

  (independence is not crucial, but it simplifies the analysis)
- Each bidder's valuation $\theta_i \overset{H}{\sim} [0, \overline{\theta}\,]$ with positive density h
- Focus on symmetric strategies

Kőszegi-Rabin Preferences

Gain-Loss Utility

- For a riskless consumption outcome (θ, p) and riskless expectations $\left(r^{\theta}, r^{p}\right)$, a bidder's total utility is given by

$$U\left[(\theta, p) \mid \left(r^{\theta}, r^{p}\right)\right] = \theta - p + \mu\left(\theta - r^{\theta}\right) + \mu\left(r^{p} - p\right)$$

where

$$\mu(x) = \begin{cases} \eta x & \text{if} \quad x \geq 0 \\ \eta \lambda x & \text{if} \quad x < 0 \end{cases}$$

with $\eta > 0$ and $\lambda > 1$.

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- If reference point is a pair of probability distributions $\Gamma = \left(\Gamma^{\theta}, \Gamma^{p}\right)$, then a bidder's total utility from the outcome (θ, p) is

$$U\left[(\theta, p) \mid (\Gamma^{v}, \Gamma^{p})\right] = \theta - p + \int_{r^{\theta}} \mu\left(\theta - r^{\theta}\right) d\Gamma^{\theta} + \int_{r^{p}} \mu\left(r^{p} - p\right) d\Gamma^{p}$$

An Example

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- If he loses the auction:

$$U_L = 0 + \eta\lambda(0-\theta)q + \eta(p-0)q$$

- In expectation:

$$EU = qU_W + (1-q)U_L = q(\theta - p) - \Lambda q(1-q)(\theta + p)$$

where $\Lambda = \eta(\lambda - 1) > 0$

Real-object Auctions

- Let $F(b)$ denote a bidder's probability of winning with a bid equal to b and let $F(p)$ denote the probability of paying a price less or equal to p, conditioning on winning the auction
- The expected payoff of a type-θ bidder is

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- **Assumption** (*No dominance of gain-loss utility*): $\Lambda \leq 1$

Real-object Auctions (cont'd)

- Equilibrium bid (Lange and Ratan, 2010):

$$\beta^*(\theta, n) = \theta \left\{ \frac{1-\Lambda\left[1-2H^{n-1}(\theta)\right]}{1+\Lambda} \right\} + \frac{2\Lambda}{(1+\Lambda)^2} \int_0^\theta z \left\{1-\Lambda\left[1-2H^{n-1}(z)\right]\right\} e^{\frac{2\Lambda\left[H^{n-1}(\theta)-H^{n-1}(z)\right]}{1+\Lambda}} dH^{n-1}(z)$$

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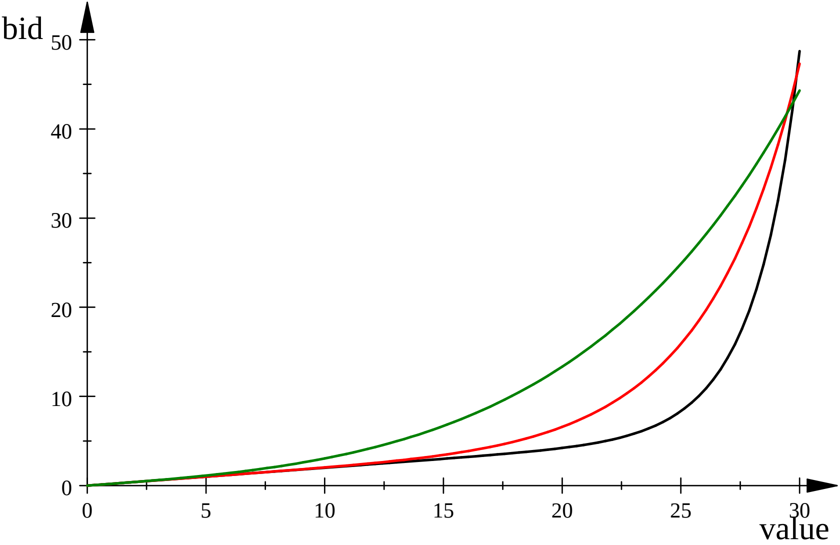
- If $\Lambda \leq 1$, then $\frac{\partial \beta^*(\theta,n)}{\partial n} < 0$ for all θ such that $\log(H(\theta)) < -\frac{1}{n-1}$
- $\Rightarrow$ as $n \uparrow$ low-value bidders bid less aggressively while high-value bidders bid more aggressively

Graphical Illustration



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- Equilibrium bid (Lange and Ratan, 2010):

$$\beta_{IV}^{*}(\theta) = \theta$$

- Bids do not vary with n

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- Related to *mental accounting* and the *endowment effect*

Auction Task

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  - (iii) a second-price auction with 11 competitors ($n = 12$)
- For every auction, each subject had a $30 budget
- In every auction, subjects were allowed to bid any integer between $0 and $30

The Prizes

- In each session we had real-object auctions with 3 different products:
    (i) University of Sydney hoodie ($49.95)
    (ii) Logitech Boombox ($49.95)
    (iii) Voucher for two cinema tickets ($39)

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- In each session we also had induced-value auctions
- Monetary values $x \overset{U}{\sim} \{1, 2, 3, ..., 29, 30\}$ were drawn independently across subjects
- A subject's value x was kept constant throughout the session
- Subjects' own monetary values were their private information, but the distribution of values was common knowledge

Screenshot


Auction num
1 of 12
The money voucher is up for auction.
Payment Voucher
The money voucher is for $21.
There are 2 other people in this auction.
YOU
In your wallet is $30.
How much are you willing to bid for the money voucher?
Bid $

Summary Statistics

Table 1: Summary statistics of bids for each good

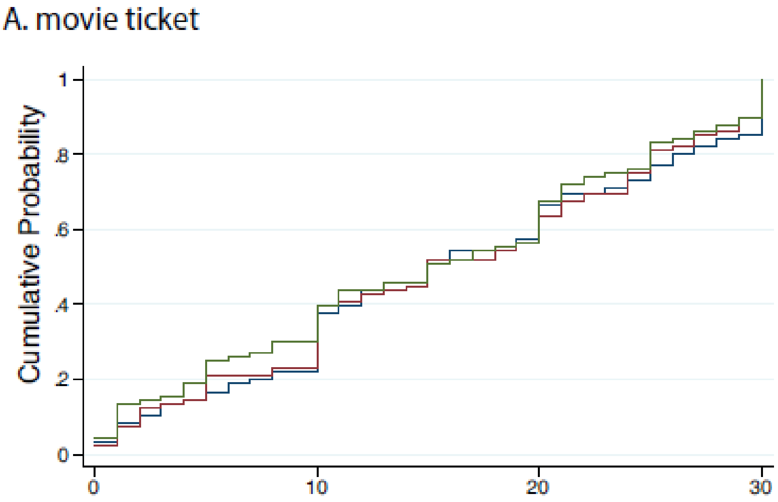
	mean	standard deviation (SD)	mean within id-good SD
movie tickets	15.72	9.62	2.09
boombox	19.22	10.51	2.88
hoodie	17.76	10.68	2.36
money voucher	14.04	9.69	1.64

Average Bids

Table 2: Mean bid by good and auction size

	3 participants	6 participants	12 participants
movie tickets	16.10	15.93	15.12
boombox	19.70	19.32	18.64
hoodie	18.04	18.21	17.02
money voucher	14.02	14.06	14.05

Empirical CDFs



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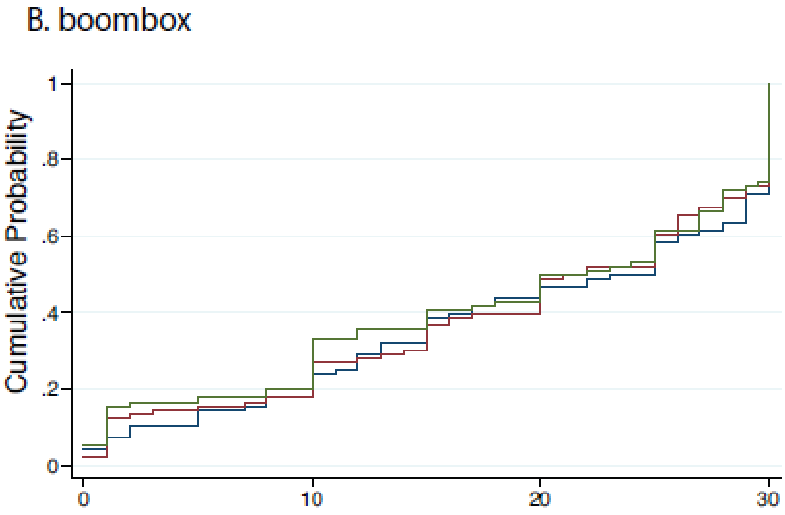

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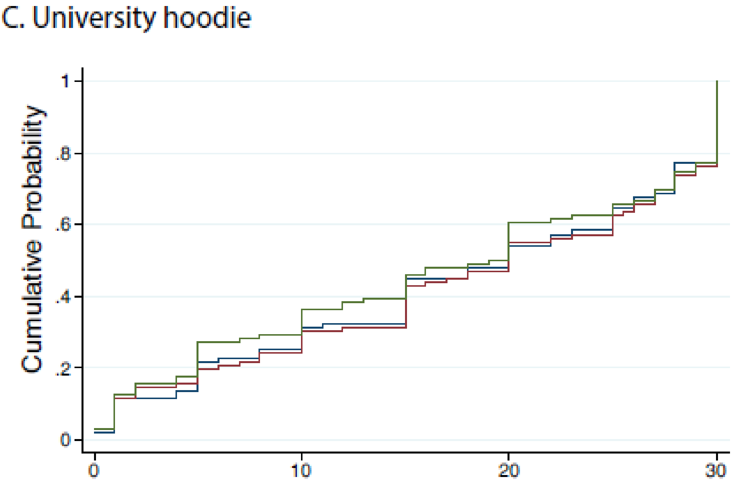

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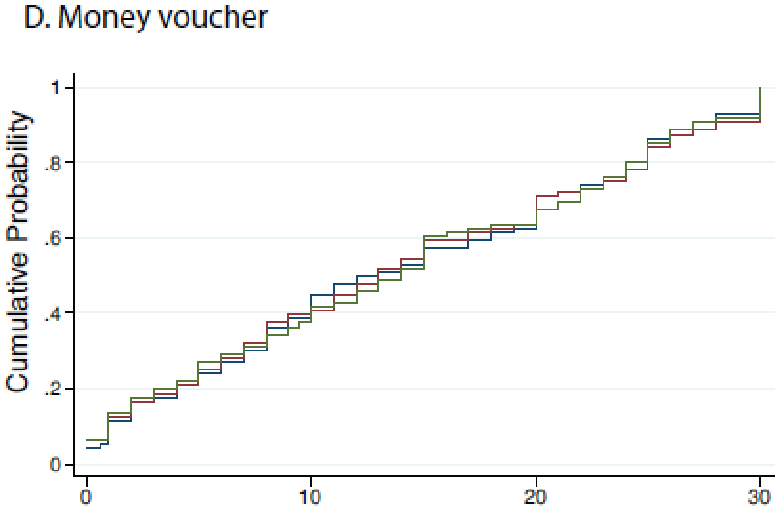

Fixed Effects

	movie tickets	boombox	hoodie	money voucher
3 bidders	0.99*	1.06	1.02*	−0.03
	(0.50)	(0.71)	(0.57)	(0.47)
6 bidders	0.81	0.68	1.19**	0.02
	(0.50)	(0.71)	(0.57)	(0.47)
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# obs	288	288	288	288

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- $\widehat{\beta}_3 \neq \widehat{\beta}_{12}$ at 10% for hoodie

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- Effect for boombox not significant (budget-constrained?)

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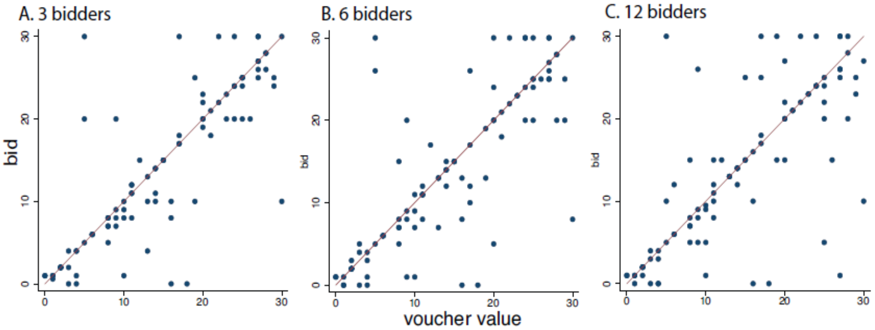
- $\widehat{\beta}_3 \neq \widehat{\beta}_{12}$ at 10% for hoodie
- $\widehat{\beta}_6 \neq \widehat{\beta}_{12}$ at 11% for movie tickets
- $\widehat{\beta}_6 \neq \widehat{\beta}_{12}$ at 5% for hoodie
- Effect for boombox not significant (budget-constrained?)
- No effect for money vouchers

Random Effects Tobit (right-censored at 30)

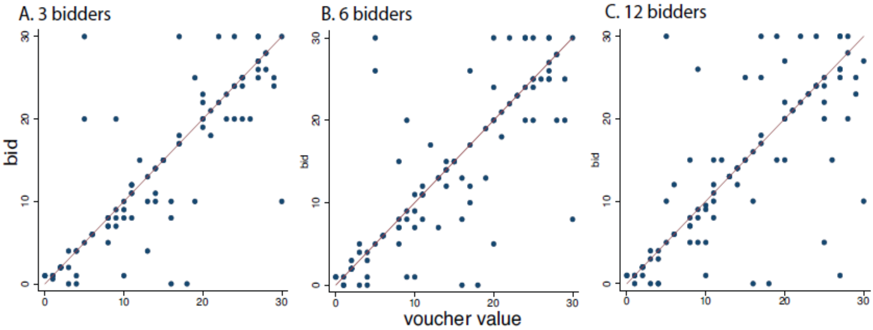
	movie tickets	boombox	hoodie	money voucher
3 bidders	1.17**	1.29	1.18*	−0.05
	(0.56)	(0.94)	(0.71)	(0.51)
6 bidders	0.86	0.88	1.45**	0.03
	(0.56)	(0.94)	(0.71)	(0.51)
constant	15.67	20.97	19.07	14.39
	(1.11)	(1.48)	(1.49)	(1.06)
# obs	288	288	288	288

- Subjects could not bid more than \$30 → Tobit model accounts for censoring of bids
- Results are similar (slightly bigger magnitudes)

Bidding in induced-value auctions



Bidding in induced-value auctions



- 40% of value-bidding; 38% under-bidding and 22% over-bidding

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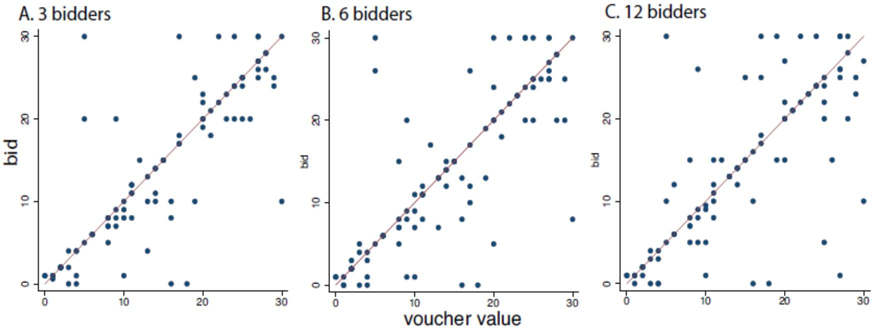

- 40% of value-bidding; 38% under-bidding and 22% over-bidding
  - Kagel and Levin (1993): 27-32.5%; 5.7-9.6% and 57.9-67.2%
  - Cooper and Fang (2008): 44%; 16% and 40%
  - Garratt *et al.* (2012): 21.2%; 41.3% and 37.5%
  - Banerji and Gupta (2014)*: 60%; 20% and 20%

Conclusions

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- Supporting evidence for KR model in Vickrey auctions
- Varying the number of bidders affects bids in real-object auctions
  - Potential implications for seller's revenue (Bulow and Klemperer, 1996)
- Real-object auctions differ from induced-value ones

  $\Rightarrow$ *money ain't no good*