Foreclosure Auctions

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Conference in Memory of Artyom Shneyerov, Montreal, October, 2018

Motivation – Some Facts

- in 2013, 609,000 residential sales in the U.S. were foreclosure related (10.3% of total residential sales)
- during the financial crisis, 4 million families lost their homes to foreclosure
- preceding the foreclosure wave, the securitization of mortgages increased from 30 per cent in 1995 to 80 per cent in 2006
- "collapsing mortgage-lending standards and the mortgage securitization pipeline lit and spread the flame of contagion and crisis" (Report of the Financial Crisis Inquiry Commission of the U.S. Congress)

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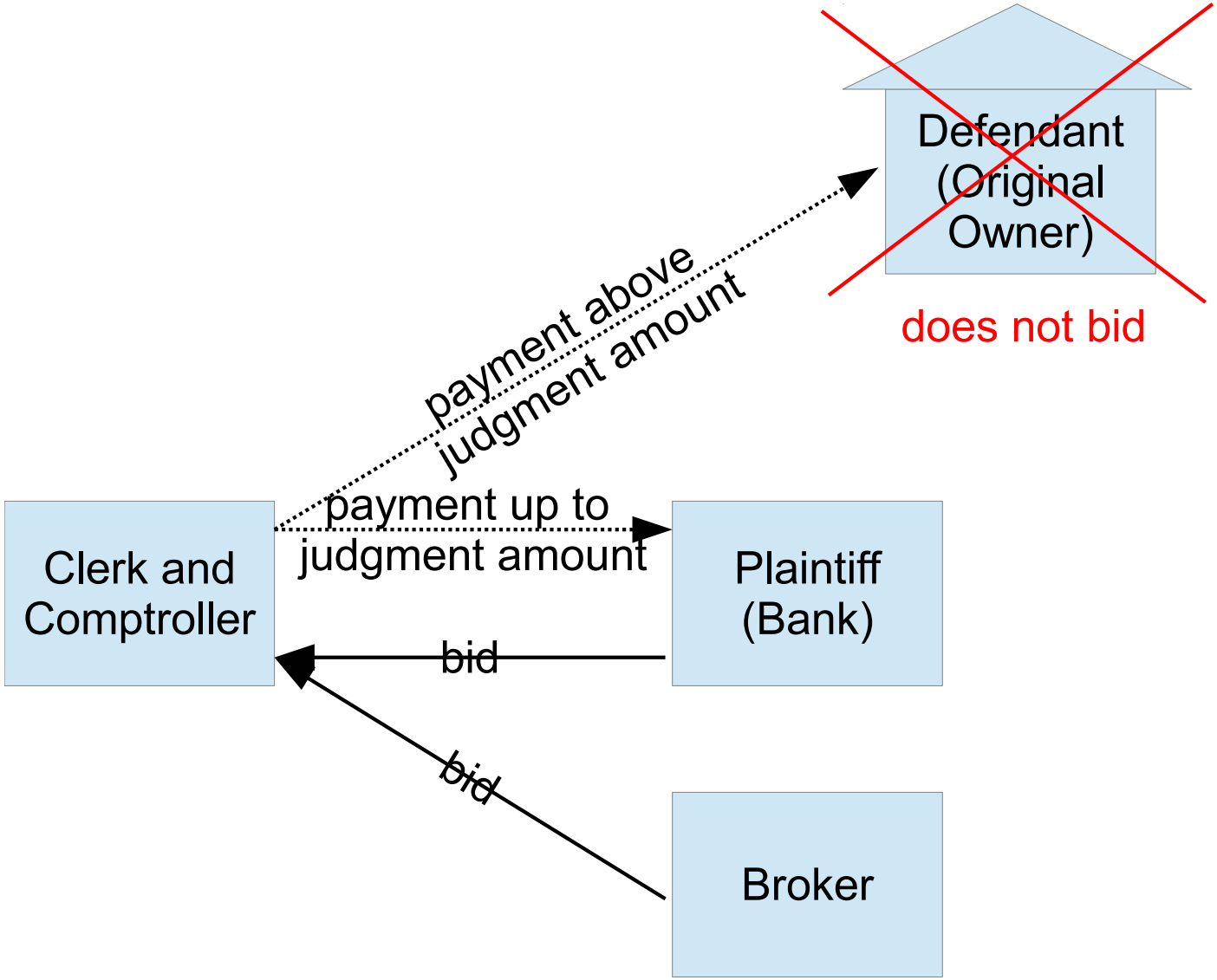
Foreclosure Auction – Traditional

Foreclosure Auction – Electronic

2016CA003604	$670,700.00	$100.00	10:29 AM	**Upcoming**

Case #:	2016CA003604
Final Judgment Book/Page:	28483/1603
Plaintiff:	HRB MORTGAGE HOLDINGS LLC
Defendant:	DEBORAH AUSTIN AKA DEBORAH J AUSTIN; OPTION ONE MORTGAGE CORPORATION; THE ANDOVER ASSOCIATION INC
Judgment Date:	8/2/2016
Final Judgment Amount:	$ 661,976.07
Address:	2705 Windham Ct, Delray Beach, FL 33445, Delray Beach, 33445
Legal:	LOT 63, OF ANDOVER SECTION II, ACCORDING TO THE PLAT THEREOF, AS RECORDED IN PLAT BOOK 54, AT PAGE 123, OF THE PUBLIC RECORDS OF PALM BEACH COUNTY, FLORIDA.
Links:	Docket | Property Appraiser

Foreclosure Auctions



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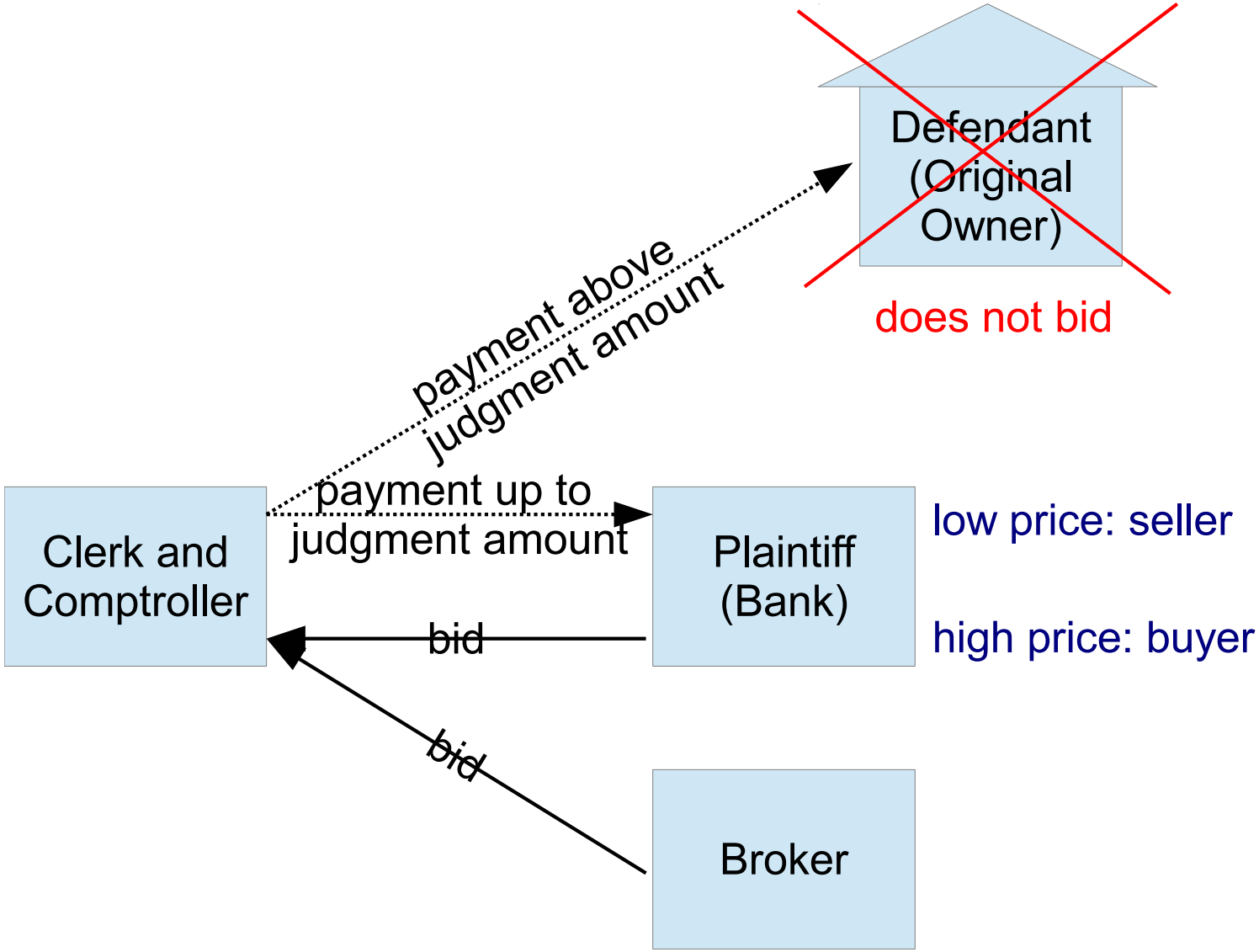

Further Special Feature of Foreclosure Auctions

- banks get an appraisal of the property prior to granting a mortgage (cost of appraisal: ca. $800)
- bidders are not allowed to enter the property prior to the auction
- bank may have an informational advantage

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Key Points

- theory of foreclosure auctions: auction in which one participant sometimes acts as a seller and sometimes as a buyer
- bank may have superior information about the quality of the house
- surprising empirically testable predictions of the theory
- foreclosure auction data from Palm Beach County, Florida, between 2010 and 2013: 12,788 observations, total judgment amount $4.2bn
- predictions consistent with data

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Securitization

- securitization allows banks to sell their mortgages on the capital market as mortgage backed securities
- advantage: banks get liquidity
- disadvantage: banks don't have enough "skin in the game", they collect insufficient information about
  - the financial soundness of the borrower (this is what the literature has considered so far)
  - the **value of the collateral** (this is what we look at)
- if the bank collected information about the value of the collateral when granting the mortgage, then it will have an informational advantage at the foreclosure stage
- data show:
  - asymmetric information for non-securitized mortgages
  - no evidence of asymmetric information for securitized mortgages
- consistent with moral hazard (or adverse selection)

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Related Literature

- auctions with informed seller: Jullien, Mariotti (2006), Cai, Riley, Ye (2007), Lamy (2007)
- "auctions with informed buyers": large literature starting with Milgrom and Weber (1982)
- securitization with focus on mortgages: Mian and Sufi (2009), Keys, Mukherjee, Seru, Vig (2010), Dewatripont, Jewitt, Tirole (2010)
- securitization in general: e.g. von Thadden (2000), Dang, Gorton, Holmström (2013), Gorton, Metrick (forthcoming)
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Simplified Model

- simplified version of model for presentation (will discuss more general model later)
- bank's (seller's) signal $x_S \sim F_S$ (private information), seller's utility from keeping house: $u_S(x_S) = x_S$
- 1 broker (buyer) with signals $x_B \sim F_B$ (private information), utility $u_B(x_B, x_S) = \alpha x_S + (1 - \alpha)x_B$ with $\alpha \in [0, \frac{1}{2})$
- special case $u_B(x_B, x_S) = x_B$ (i.e. $\alpha = 0$): independent private values, otherwise common value component
- judgment amount v_J (public)
- ascending price English auction
- seller and buyer(s) choose dropout prices p_S and p_B; they bid via a bidding proxy
- buyer(s) observe when the bank drops out, they can update their dropout prices

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Model

- broker's utility:

$$w_B(p_S, p_B) = \begin{cases} \alpha E[x_S|p_S] + (1-\alpha)x_B - p_S & \text{if } p_B > p_S, \\ 0 & \text{otherwise.} \end{cases}$$

- bank's utility:

$$w_S(p_S, p_B) = \begin{cases} x_S - p_B + r(p_B) & \text{if } p_S > p_B, \\ r(p_S) & \text{otherwise,} \end{cases}$$

where the bank's proceedings from the foreclosure given auction price p are

$$r(p) = \begin{cases} p & \text{if } p \leq v_J \\ v_J & \text{otherwise.} \end{cases}$$

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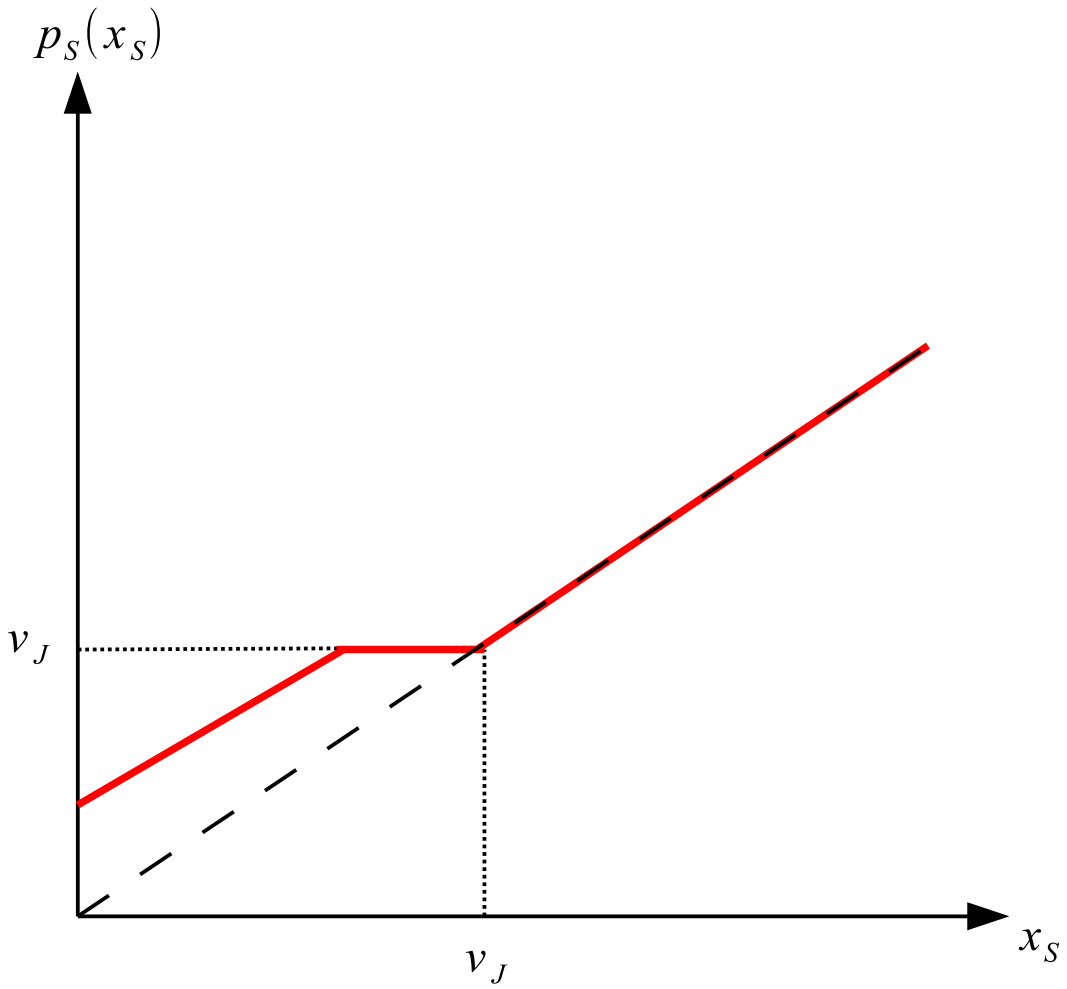
Strategies – Independent Private Values ($\alpha = 0$)



Common Value Component ($\alpha \geq 0$)

- price set by seller is a signal about quality x_S
- approach with 3 steps:
  1. consider no money owed to bank ($v_J = 0$): bank and broker both act as buyers, fully separating equilibrium without bunching
  2. consider infinite amount owed to the bank ($v_J = \infty$): bank always acts as seller, fully separating equilibrium without bunching
  3. take a positive finite v_J: full separation for high and low values of x_S, bunching for intermediate values

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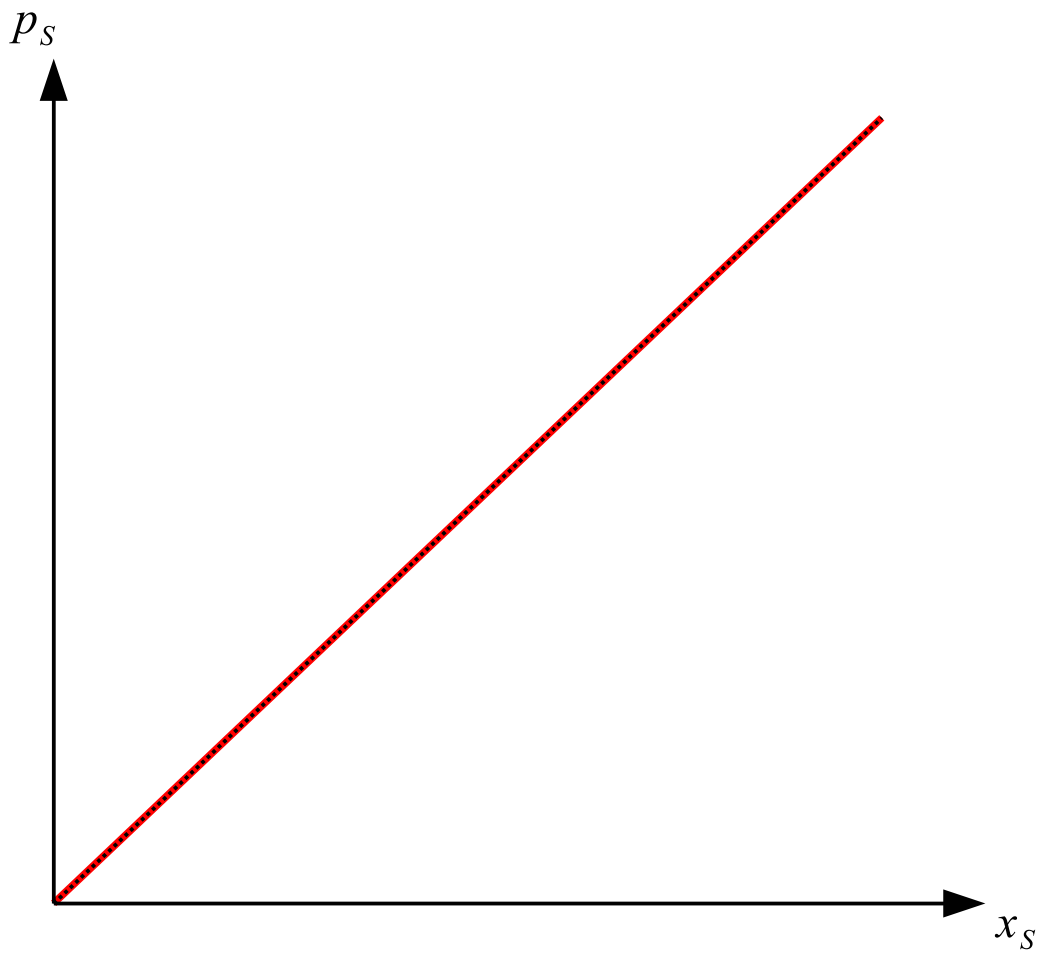
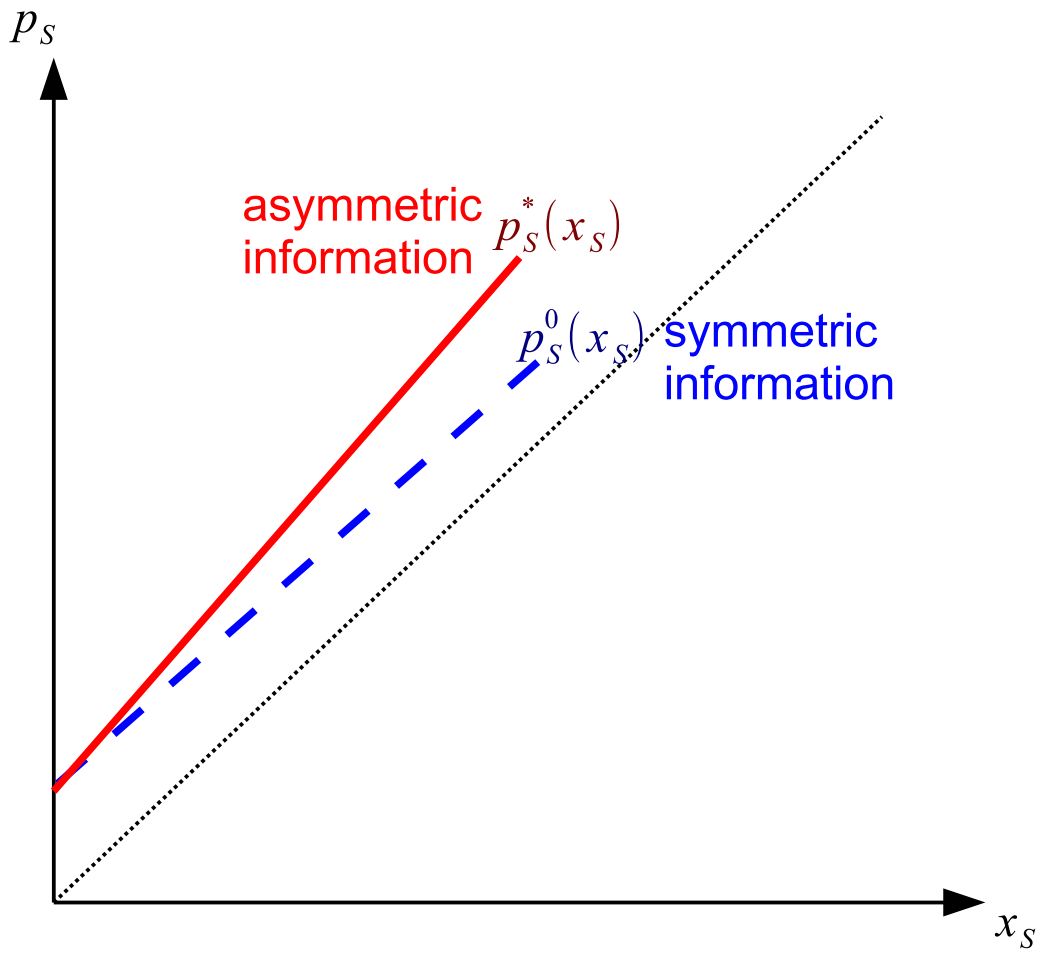
Common Value Component, $v_J = 0$



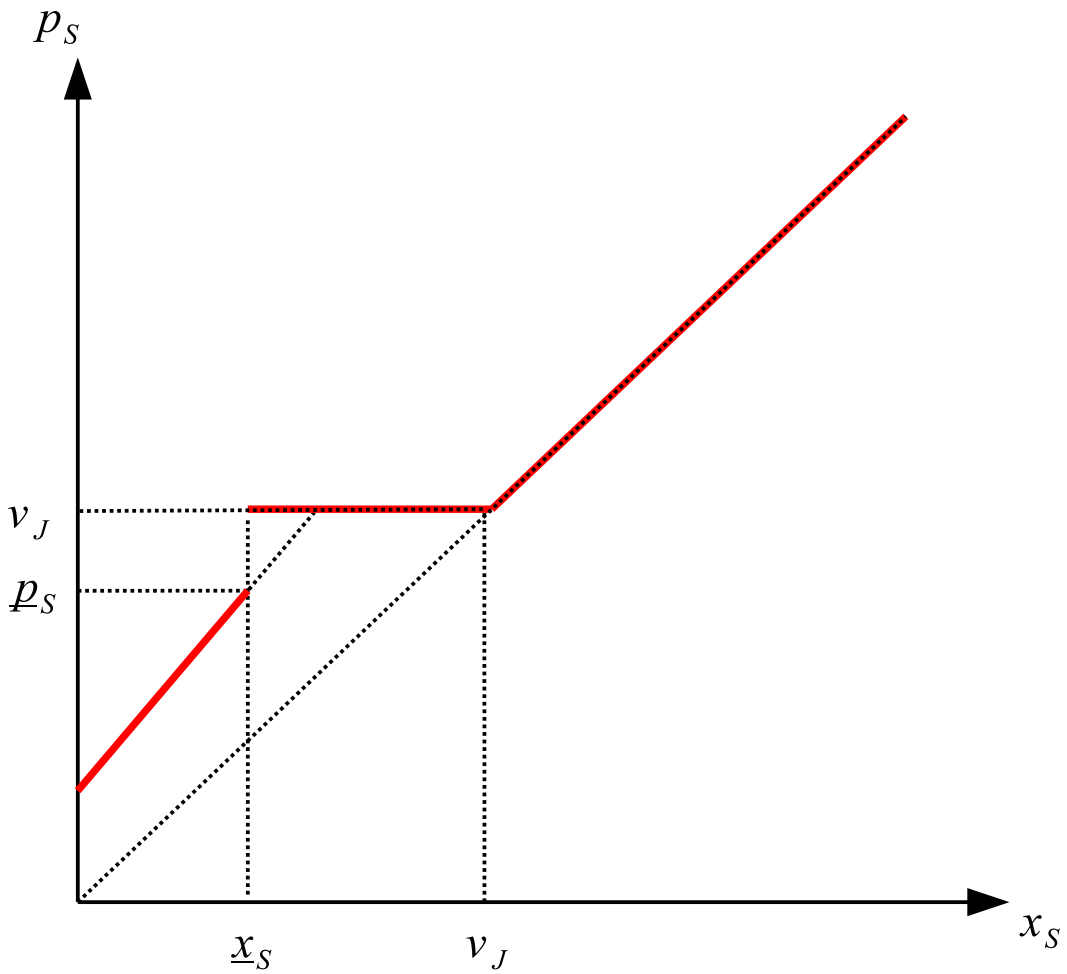
by an argument following Milgrom and Weber (1982)

Common Value Component, $v_J = \infty$



by an argument following Jullien, Mariotti (2006), Cai, Riley, Ye (2007)

Common Value Component ($v_J \in (0, \infty)$)



with a discontinuity at the boundary $\underline{x}_S$ of the separating and pooling region ▸ details

Formal Results

- formally, the bank's equilibrium bidding behavior is

$$p_S(x_S) = \begin{cases} p_S^*(x_S), & x_S \in [0, \underline{x}_S], \\ v_J, & x_S \in [\underline{x}_S, v_J], \\ x_S, & x_S > v_J, \end{cases} \tag{1}$$

- we prove existence of an equilibrium characterized by (1)
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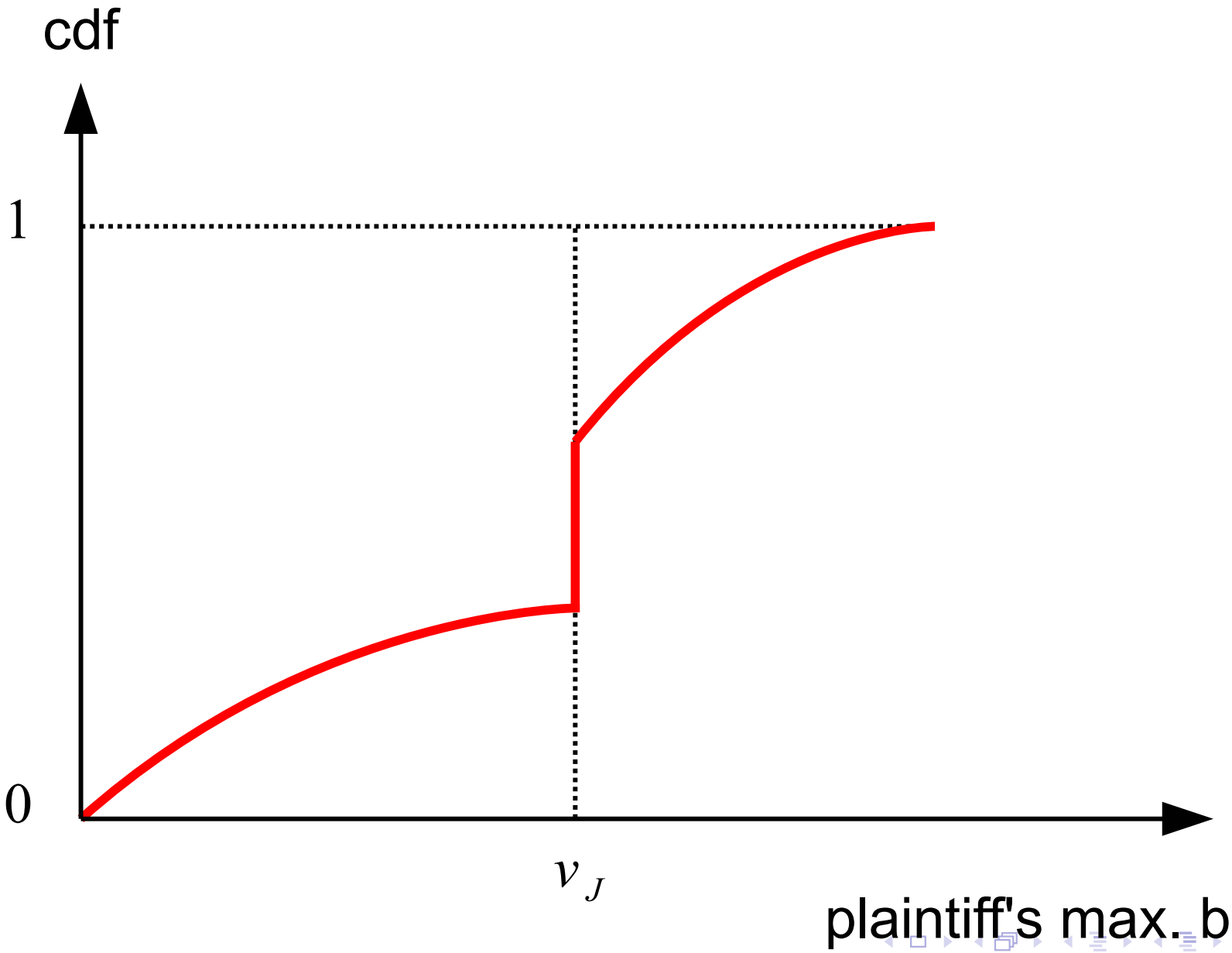
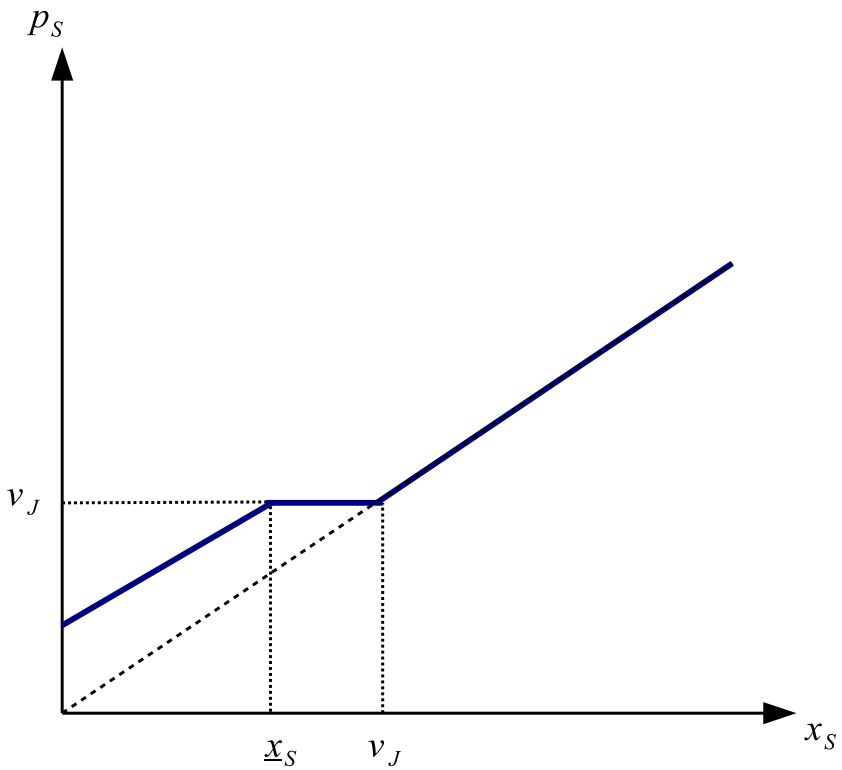
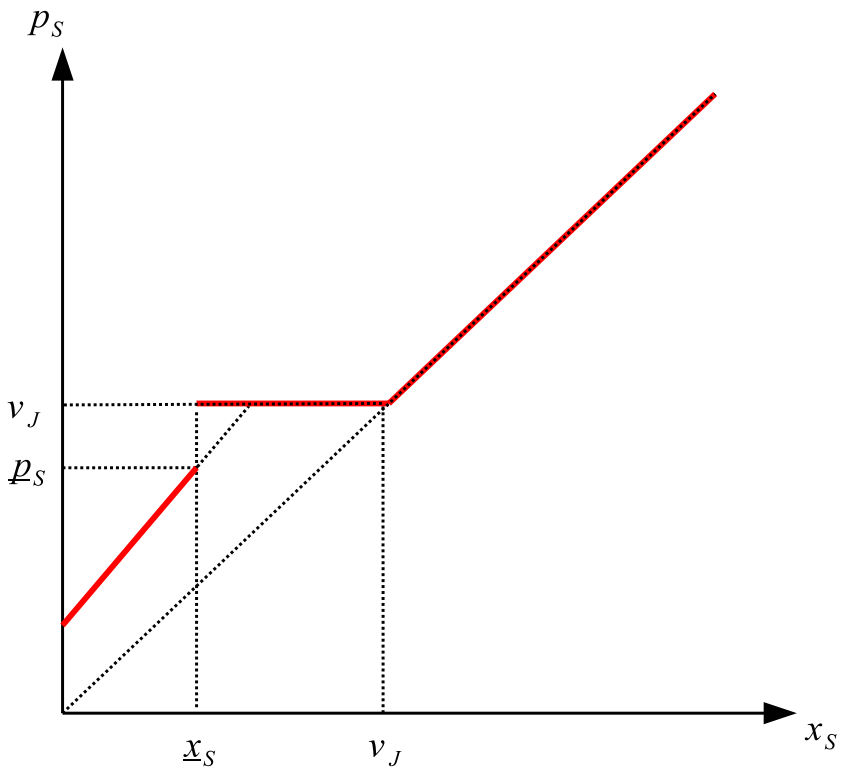
Empirical Predictions – Bunching



Independent Private Values



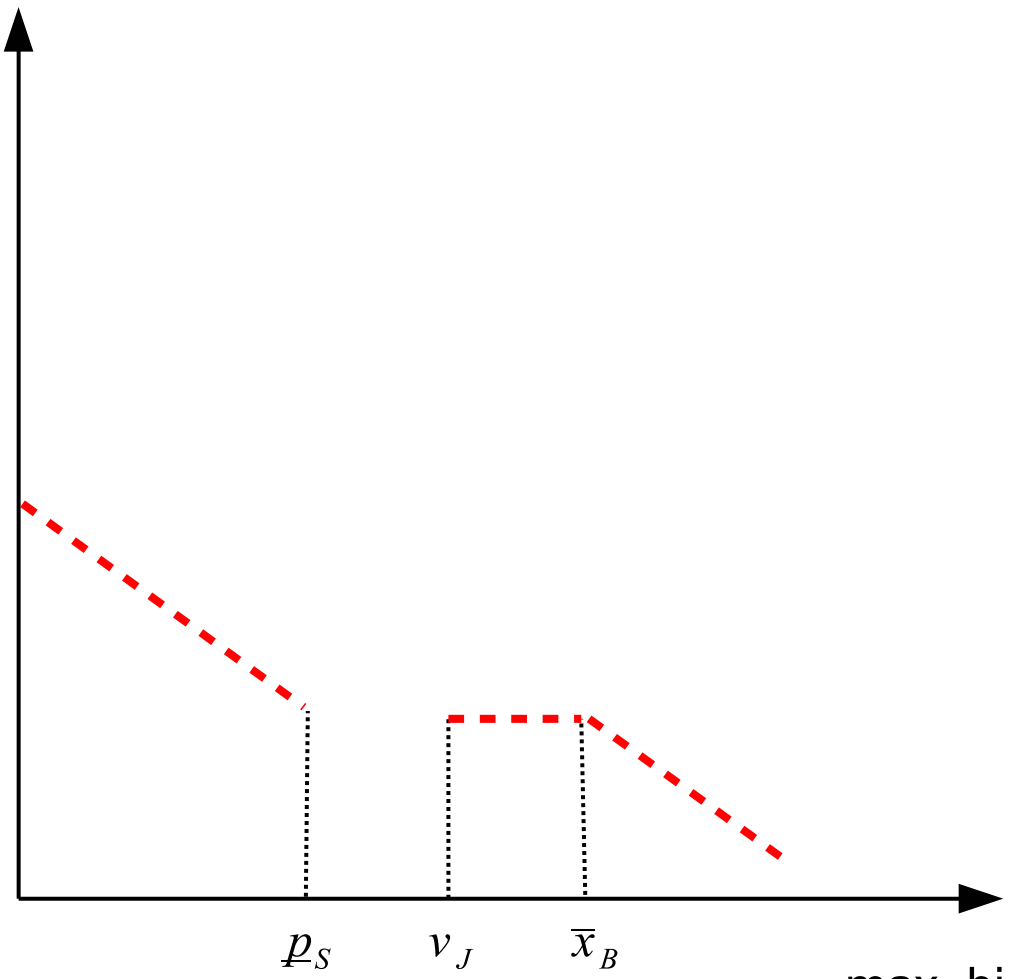
Asymmetric Information



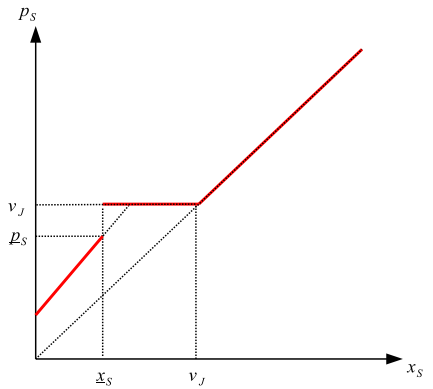
Empirical Predictions – Common Value Component

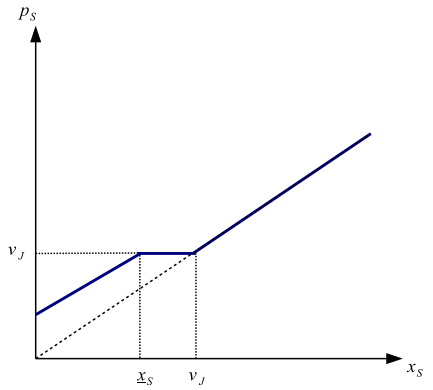
The Simple Version

probability of sale



max. bid bank





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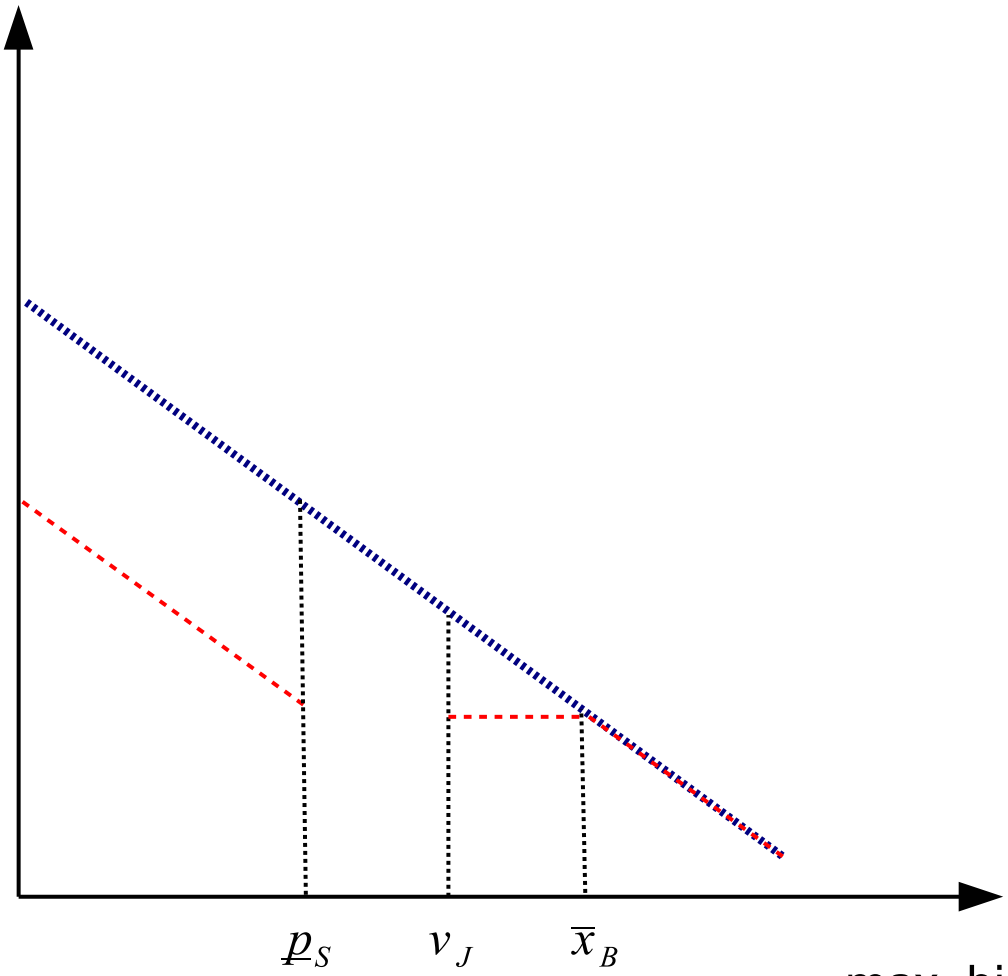

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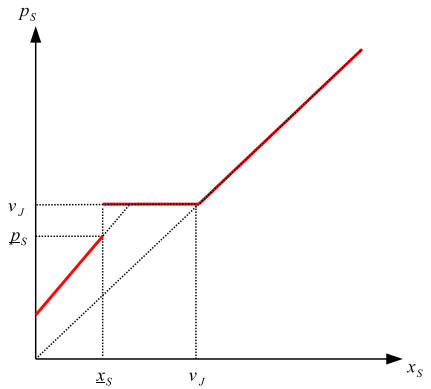

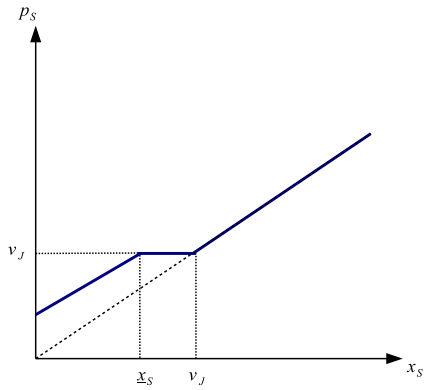

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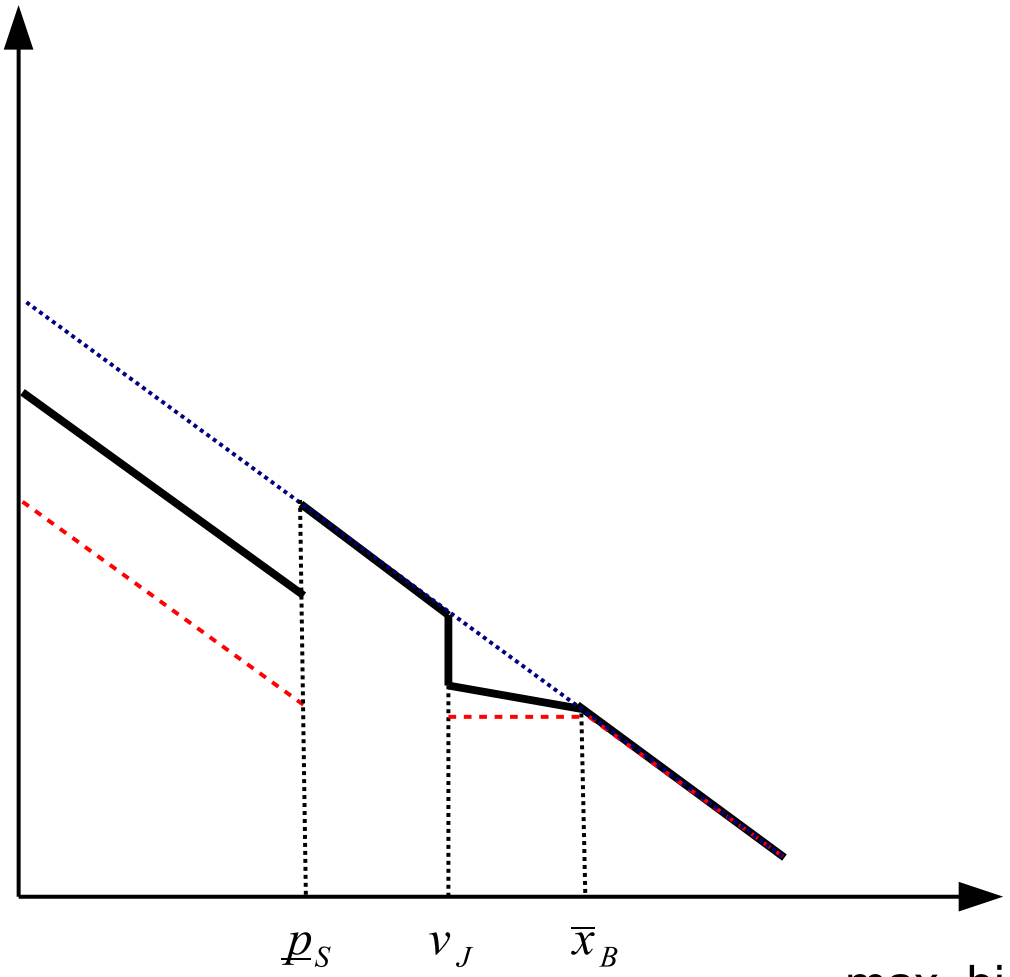

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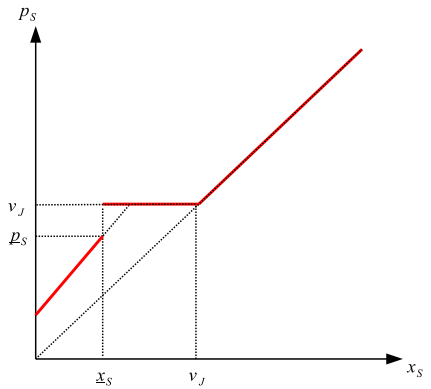
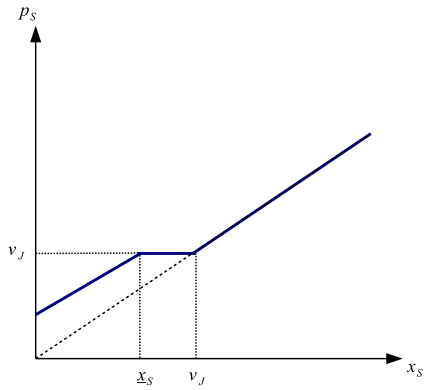
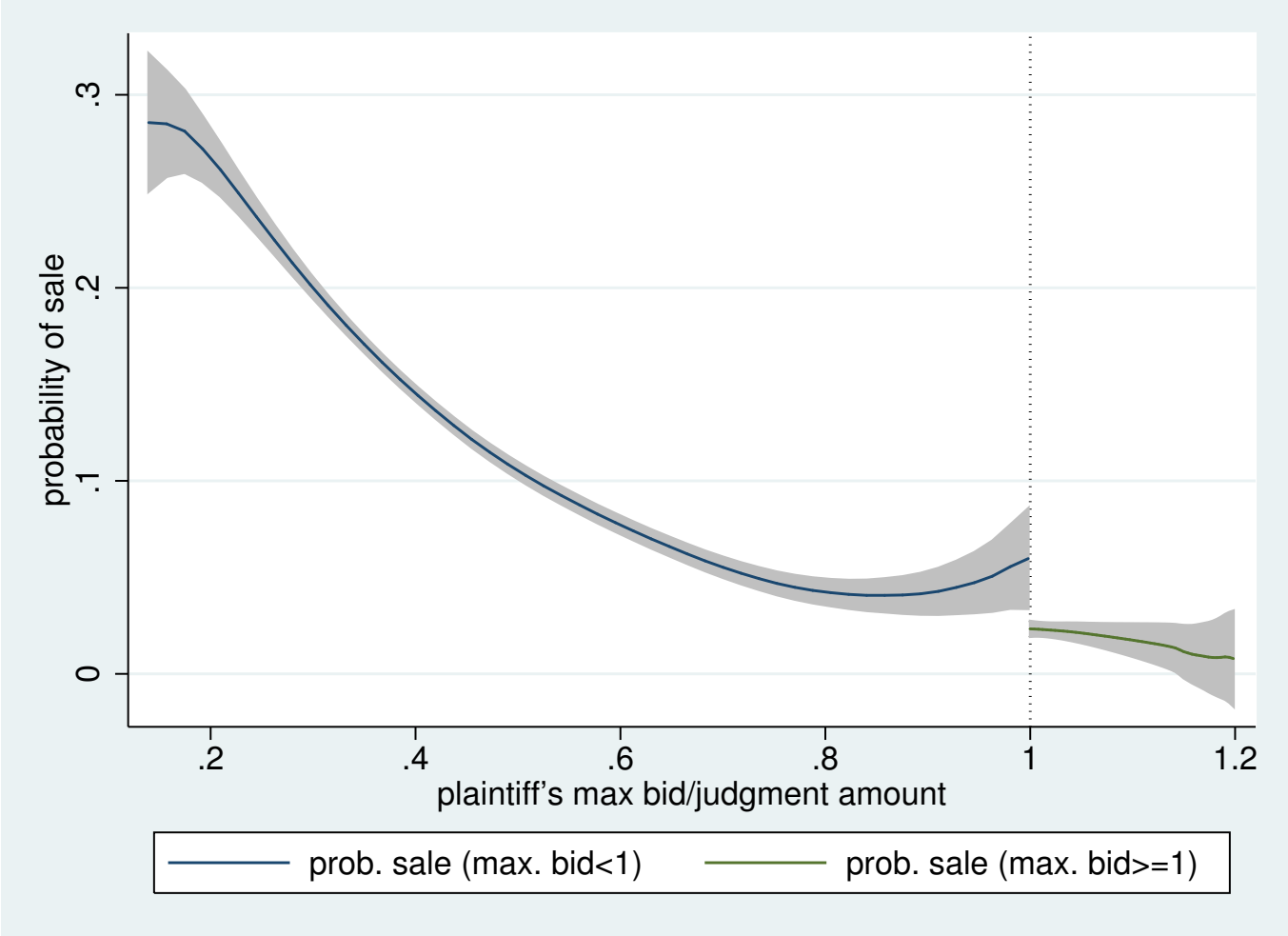




Empirical Predictions – Common Value Component (Monte Carlo Simulation)

The General Version



50,000 random draws in Monte Carlo simulation

General Model

- bank has signal X_S drawn from distribution F_S
- n brokers, each has a signal X_i for $i = 1, ..., n$
- $(X_1, ..., X_n)$ are affiliated and their joint probability function is symmetric, continuously differentiable and positive on $\mathbb{R}^n_+$
- X_S and $(X_1, ..., X_n)$ are independent
- bank's utility from retaining property: $v_S(x_S, x_1, ..., x_n)$
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- define $v_{B,\alpha}(x_1, ..., x_n, x_S) = v_B(x_1, ..., x_n, \alpha x_S + (1 - \alpha)\mu)$, where μ is the mean of X_S
- $\alpha = 0$: uninformed bank case
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Conditions (Informal Version)

1. all utility functions increase weakly in all signals
2. single-crossing conditions hold:
   - bank's utility increases faster with bank's signal than broker's utility
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Conditions (Formal Version, Part 2)

- The functions $w(x_B, x_S)$, $v(x_B, x_S)$ and $u_S(x_S, x_B)$ are twice continuously differentiable, with $w(0,0) = v(0,0) = u_S(0,0) = 0$ and

$$\frac{\partial w(x_B, x_S)}{\partial x_B} \geq \theta, \quad \frac{\partial w(x_B, x_S)}{\partial x_S} \geq 0,$$
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  for some constant $\theta > 0$

- single-crossing conditions:

$$\frac{\partial w(x_B, x_S)}{\partial x_B} > \frac{\partial u_S(x_S, x_B)}{\partial x_B}, \quad \frac{\partial u_S(x_S, x_B)}{\partial x_S} > \frac{\partial w(x_B, x_S)}{\partial x_S}.$$

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General Results

Proposition

The bank's equilibrium bidding behavior below the judgment amount is $p_S^*(x_S) = w(m(x_S), x_S)$*, where* $m(x_S)$ *is given by the differential equation*

$$m'(x_S) = \frac{K(m(x_S), x_S)}{J(m(x_S), x_S)}$$

with initial condition $J(m(0), 0) = 0$*, where*

$$J(x, x_S) = w(x, x_S) - \frac{\partial w(x, x_S)}{\partial x} \frac{F_{(2)}(x) - F_{(1)}(x)}{f_{(1)}(x)} + (\min\{v_J, v(x, x_S)\} - w(x, x_S)) \frac{f_{(2)}(x)}{f_{(1)}(x)} - u_S(x_S, x), \tag{2}$$

and

$$K(x, x_S) \equiv \frac{\partial w(x, x_S)}{\partial x_S} \frac{F_{(2)}(x) - F_{(1)}(x)}{f_{(1)}(x)} + \int_x^1 \frac{\partial \min\{v_J, v(\tilde{x}, x_S)\}}{\partial x_S} \frac{f_{(2)}(\tilde{x})}{f_{(1)}(x)} d\tilde{x}. \tag{3}$$

General Results

Assume we observe data with heterogeneous α, where α has the distribution $\Lambda(\alpha)$. Denote the probability of sale given reserve price p as $\rho(p)$. Assume that the distributions are such that a bank with valuation $x_S = \mu$ would set a price higher than v_J.

Proposition

We have the following testable predictions concerning the probability of sale to the broker $\rho(p)$:

(a) *If all auctions in the data are uninformed seller auctions ($\Lambda(\alpha)$ puts mass 1 on $\alpha = 0$), then $\rho(p)$ is a continuous decreasing function.*

(b) *If all auctions in the data are informed seller auctions ($\Lambda(\alpha)$ puts mass 1 on some $\alpha > 0$), then there is a gap in the bid distributions on $(\underline{p}_\alpha, v_J) \cup (v_J, \overline{p}_\alpha)$ and $\rho(p)$ is not defined over the gap.*

(c) *There exists $\overline{\alpha} \in (0, 1]$ such that if the data exhibit a mixture of informed and uninformed seller auctions with the distribution $\Lambda(\alpha)$ supported on $[0, \overline{\alpha}]$, then the probability of sale will exhibit a downward discontinuity at v_J,*

$$\lim_{p \nearrow v_J} \rho(p) = \rho_0(v_J) < \rho(v_J).$$

Data

- foreclosure auctions Palm Beach county, FL, between January 21, 2010 and November 27, 2013
- data Clerk & Comptroller's auction website:
  - winning bid
  - whether winner is plaintiff (i.e. bank)
  - name of plaintiff
  - judgement amount
- 12,788 observations
- total judgment amount: $4.2 bn

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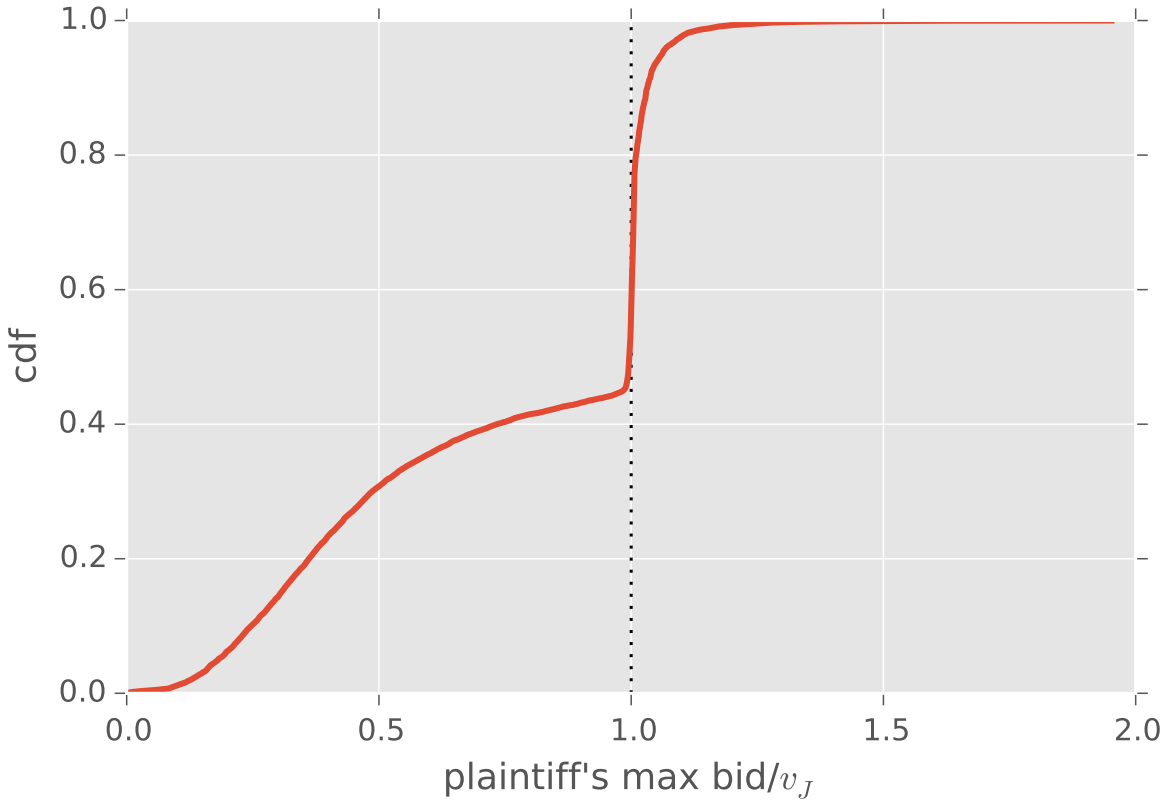
CDF of bids

Empirics



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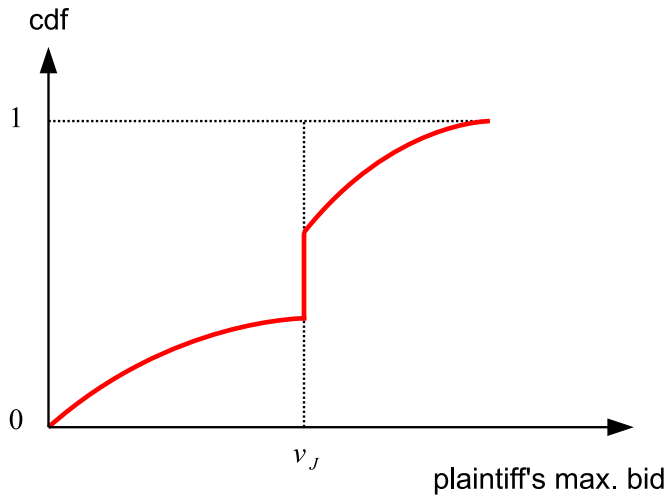
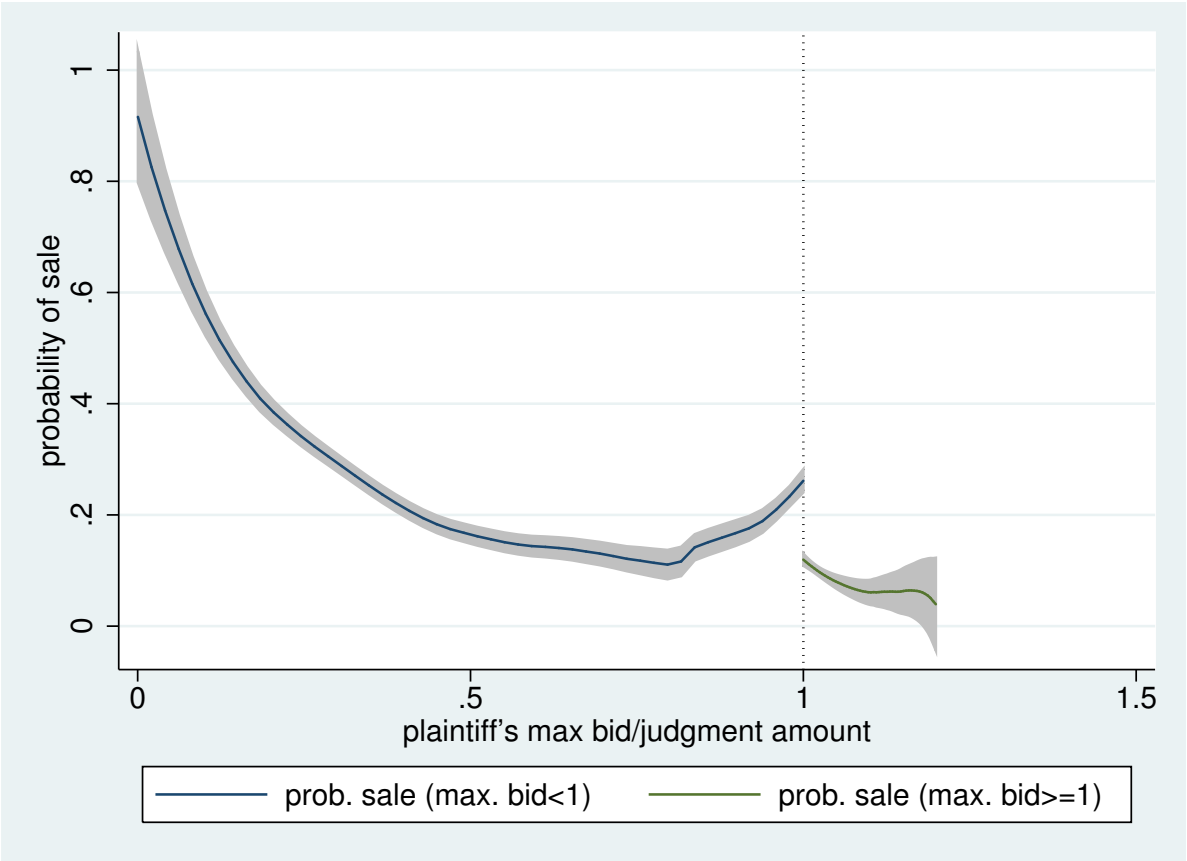
Theory

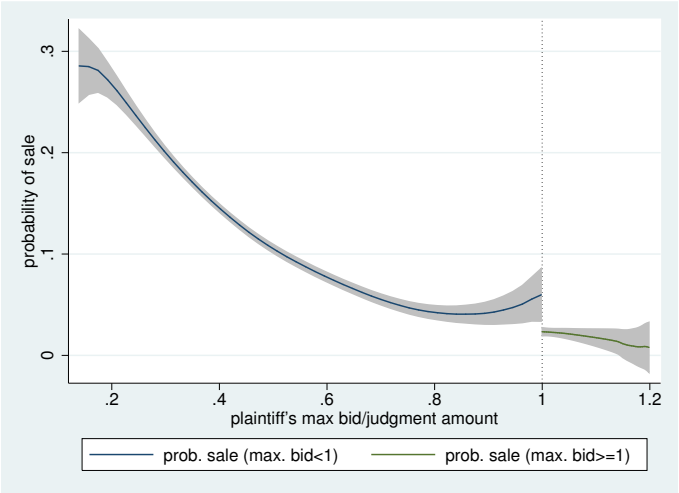


Probability of Selling – Auctions with Public Reserve

Empirics



Theory (Monte Carlo Simulation)

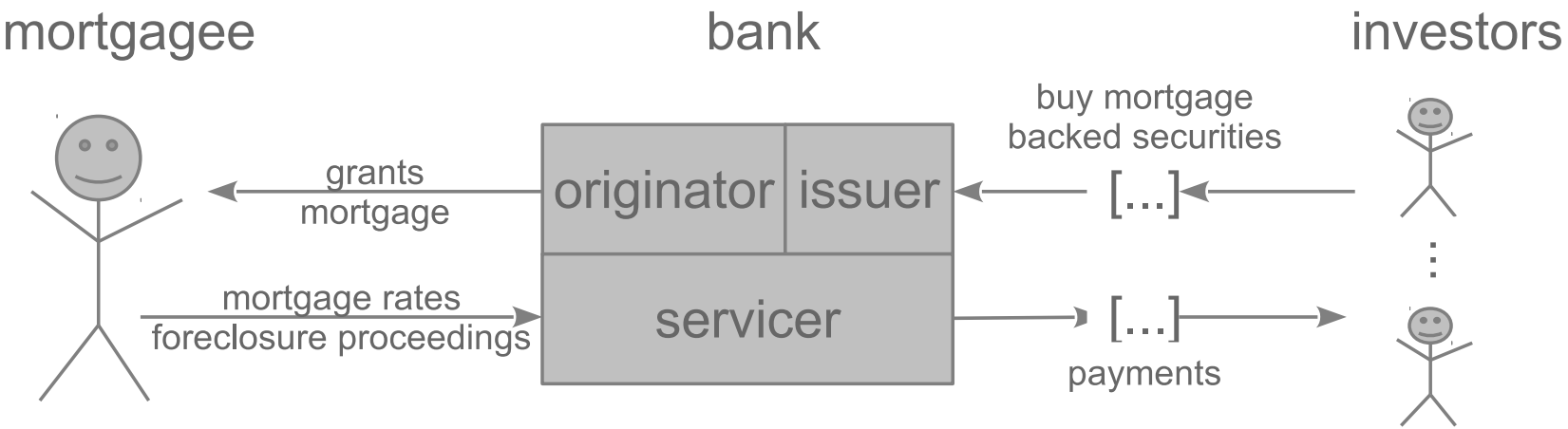


bank wins: 10,395 obs., broker wins: 2,218 obs.

▸ alternative estimator

Securitization

- short summary of aspects of securitization related to our analysis
- for more details see Key, Mukerjee, Sepu, Vig (2010), Tirole (2011), Brunnermeier (2009), Gorton, Metrick (forthcoming)



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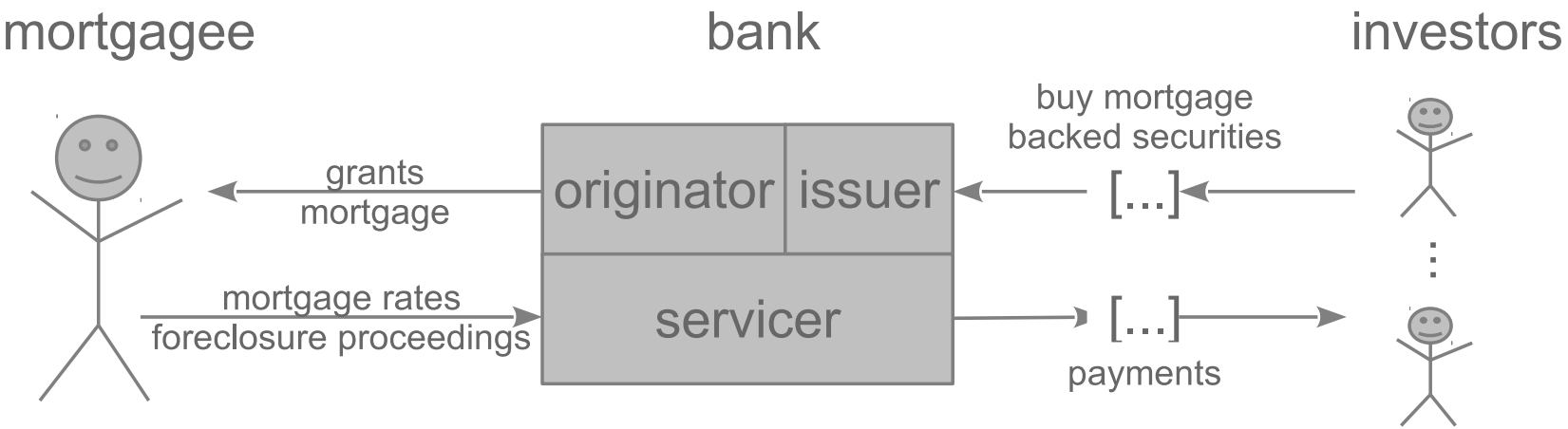

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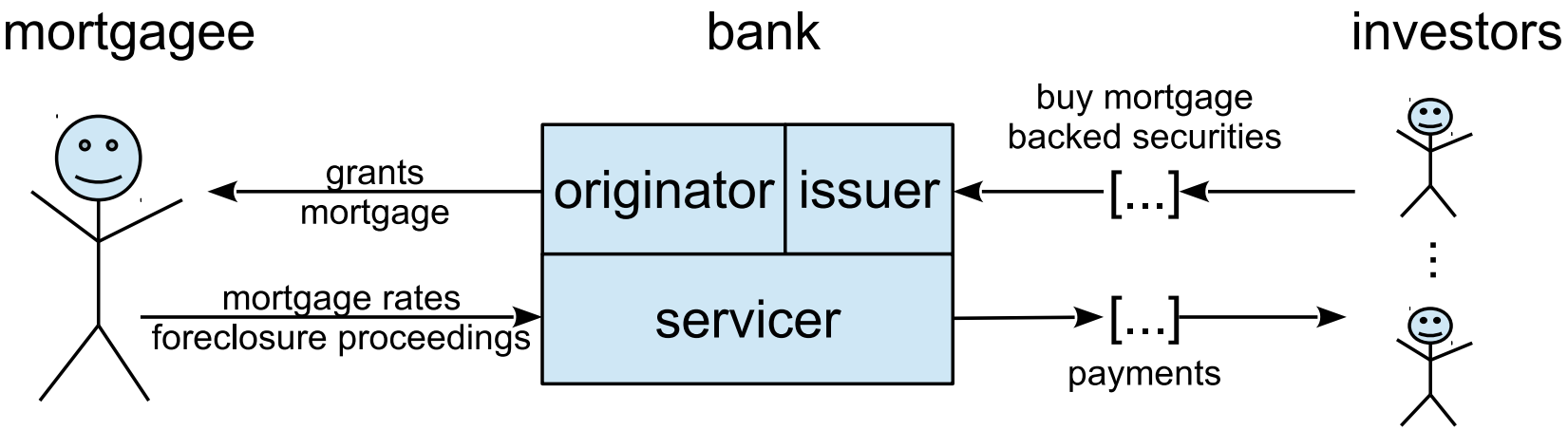

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- securitization allows banks to sell their mortgages on the capital market as mortgage backed securities
- advantage: banks get liquidity
- disadvantage: banks don't have enough "skin in the game", they collect insufficient information about
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Securitization – Not Enough Skin in the Game

- "reverse-engineering" appraisal values was a wide-spread practice in the industry
- Ameriquest paid $325 million in a settlement "to end an investigation by 49 state attorneys general who alleged it had [...] pressured appraisers to overstate home values" in 2006 (Los Angeles Times)
- "[O]ne of the largest online mortgage lenders, has close to 12,000 appraisers on its 'ineligible appraiser list,' which was removed from the Atlanta-based company's website after the Center [for Public Integrity] made inquiries about it." (Center for Public Integrity, April 14, 2009)
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Securitization

Securitized

2014CA006340	$161,000.00	$100.00	10:14 AM	**Upcoming**

Case #:	2014CA006340
Final Judgment Book/Page:	28243/1293
Plaintiff:	DEUTSCHE BANK NATIONAL TRUST COMPANY AS TRUSTEE FOR MORGAN STANLEY MORTGAGE LOAN TRUST 2004-10AR MORTGAGE PASS-THROUGH CERTIFICATES SERIES 2004-10AR
Defendant:	ROSITA AVINERI; YORAM AVINERI; UNKNOWN TENANT(S)
Judgment Date:	4/19/2016
Final Judgment Amount:	$ 279,827.46
Address:	1516 North O St, Lake Worth, 33460
Legal:	LOT 4, BLOCK N, OF THE PALM BEACH FARMS CO. PLAT NO. 5, OF NORTH LAKE WORTH, ACCORDING TO THE PLAT THEREOF, AS RECORDED IN PLAT BOOK 5, PAGE 48, OF THE PUBLIC RECORDS OF PALM BEACH COUNTY, FLORIDA.
Links:	Docket | Property Appraiser

Non-Securitized

2016CA003604	$670,700.00	$100.00	10:29 AM	**Upcoming**

Case #:	2016CA003604
Final Judgment Book/Page:	28483/1603
Plaintiff:	HRB MORTGAGE HOLDINGS LLC
Defendant:	DEBORAH AUSTIN AKA DEBORAH J AUSTIN; OPTION ONE MORTGAGE CORPORATION; THE ANDOVER ASSOCIATION INC
Judgment Date:	8/2/2016
Final Judgment Amount:	$ 661,976.07
Address:	2705 Windham Ct, Delray Beach, FL 33445, Delray Beach, 33445
Legal:	LOT 63, OF ANDOVER SECTION II, ACCORDING TO THE PLAT THEREOF, AS RECORDED IN PLAT BOOK 54, AT PAGE 123, OF THE PUBLIC RECORDS OF PALM BEACH COUNTY, FLORIDA.
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- simple classification (false negatives, no false positives): mortgages securitized if one of the following keywords shows up: 'TRUST', 'ASSET BACKED', 'ASSET-BACKED', 'CERTIFICATE', 'SECURITY', 'SECURITIES', 'HOLDER'
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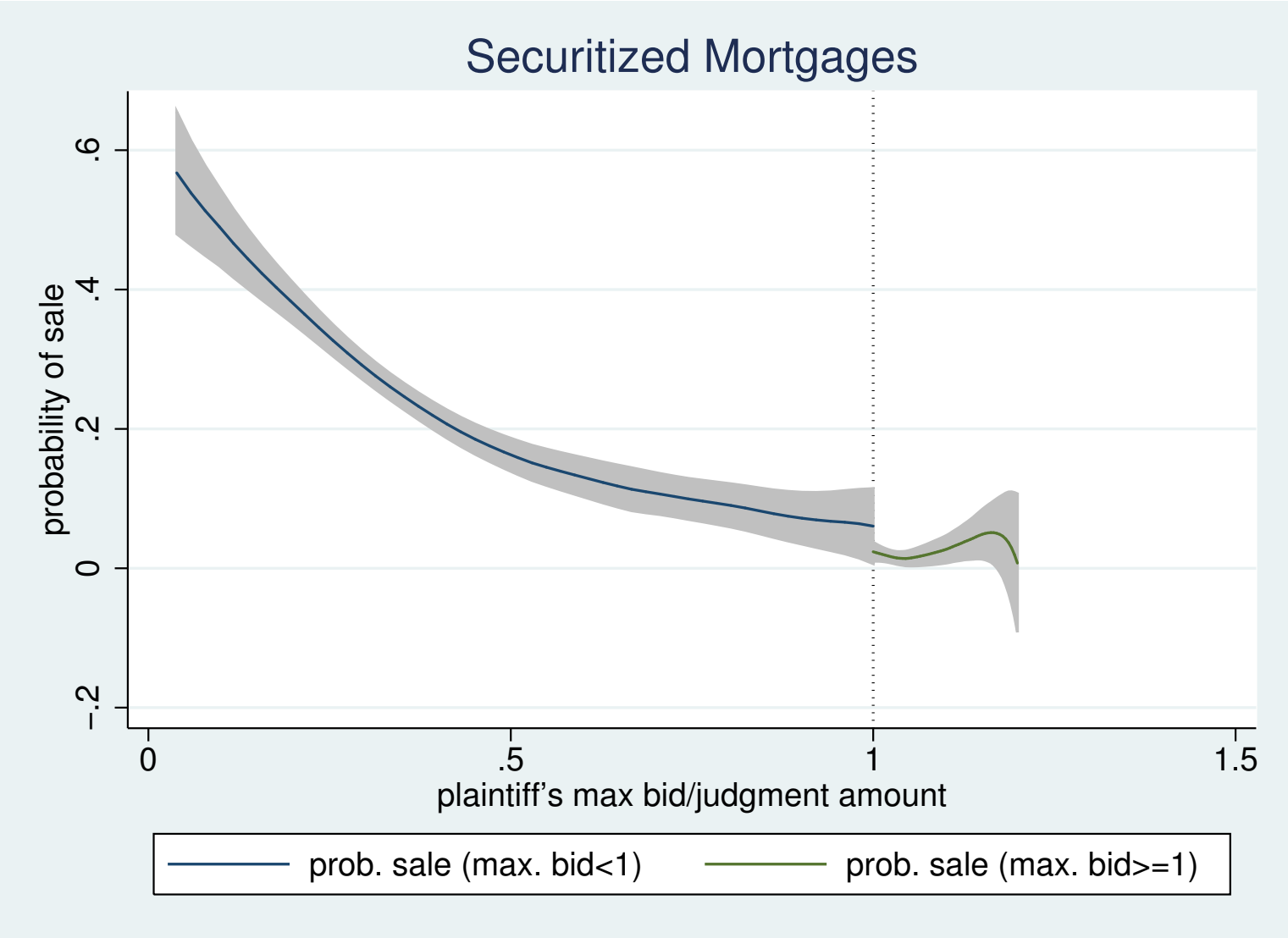
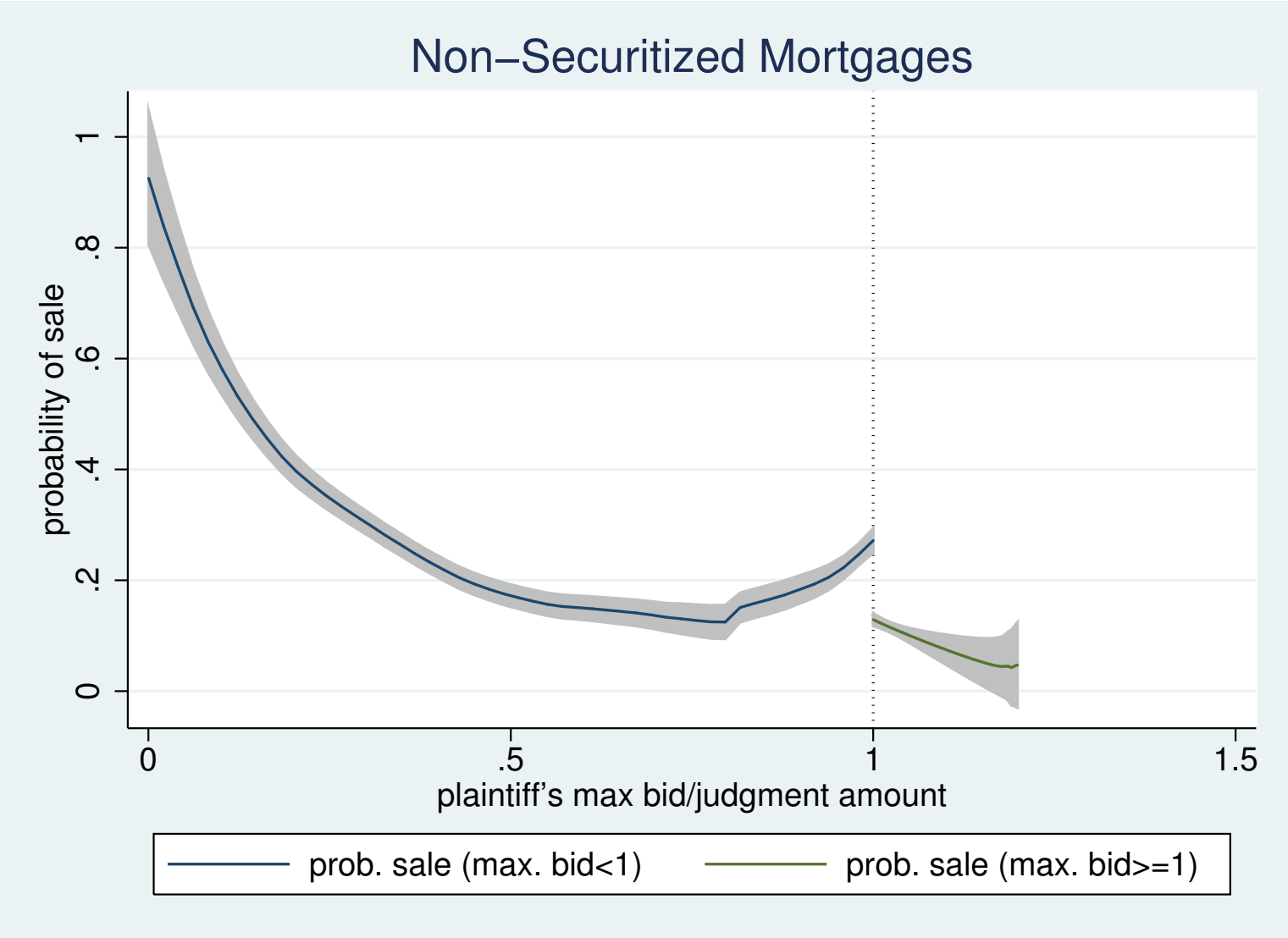
Probability of Selling – Securitized



bank wins: 2,671 obs., broker wins: 577 obs.

Probability of Selling – Non-Securitized



bank wins: 7,724 obs., broker wins: 1,644 obs.

Robustness Check – Data on Resale Price

- the more informative a bank's signal x_S about the resale price, the more informative the auction price about the resale price (in the separating regions)
- we hand-collected additional data on resale prices for some of the auctions
- question: how informative is the resale price depending on
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  - lender integrated
  - covariates (single-family/condo/other; year of previous sale)

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Regression Results

Table: **Regression of Next Sale Prices**

	(1)	(2)	(3)	(4)
auction price	0.0590	0.0278	-0.281	0.753
	(0.0464)	(0.0462)	(0.205)	(0.860)
nonSE * auction price	0.0161	0.0430	0.167***	0.474*
	(0.0461)	(0.0459)	(0.0468)	(0.195)
IL * auction price	0.0610*	0.0824**	0.143***	0.511***
	(0.0288)	(0.0282)	(0.0396)	(0.0924)
CD * auction price	-0.0251	-0.0119	(dropped)	(dropped)
	(0.0235)	(0.0236)		
SF * auction price	0.0299	0.0553*	0.00401	-0.247**
	(0.0259)	(0.0259)	(0.0310)	(0.0885)
L80 * auction price			0.0729	-1.456
			(0.217)	(0.910)
L90 * auction price			0.188	-1.001
			(0.201)	(0.863)
L00 * auction price			0.170	-1.316
			(0.200)	(0.862)
quality index		0.0867***	1st step	1st step
		(0.0173)		
constant	0.0270	0.486	0.0228	0.0228
	(0.0143)	(0.917)	(0.0188)	(0.0188)
municipality fixed effect		Yes	1st step	1st step
last sale year fixed effect		Yes	1st step	1st step
auction price below judgment amount				Yes
adj. R^2	0.024	0.104		
F-stat (p-value)			6.857 (0.00)	9.31 (0.00)
N	2692	2661	1614	795
method	OLS	OLS	2SLS	2SLS

*: significant at 10%; **: significant at 5%; ***: significant at 1%. Standard errors are in parentheses.

Conclusions

- theory of foreclosure auctions
- prediction of bunching at judgment amount: shows up in data
- prediction of non-monotonicity and discontinuity of probability of sale in reserve: shows up in data
- data consistent with hypothesis that securitization leads to moral hazard: banks collect insufficient information about the value of the collateral

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Appendix: Details of Bank's Bid and Broker's Bid

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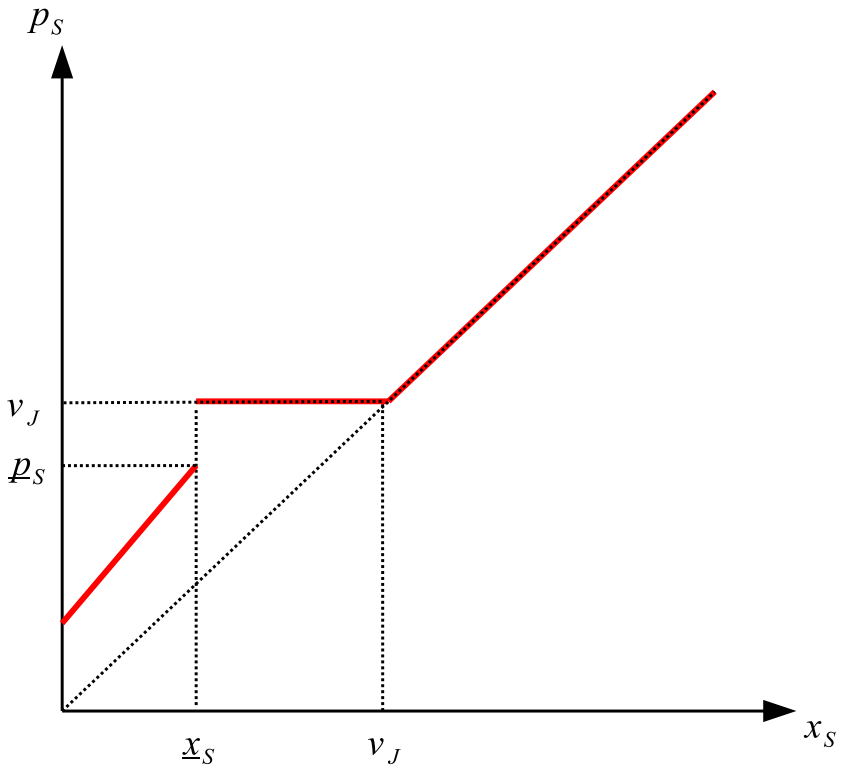
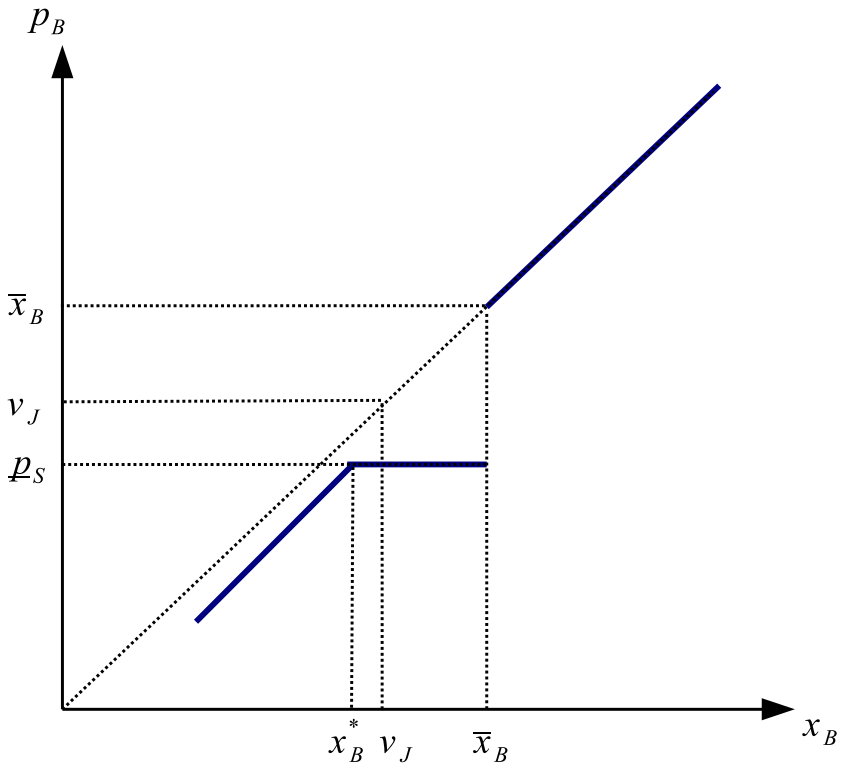


Broker



Further Results

- multiple buyers (in the paper, but not in presentation)
- nonlinear function $u_B(x_B, x_S)$ (in the paper)
- corner solutions for small v_J (in the paper)

return

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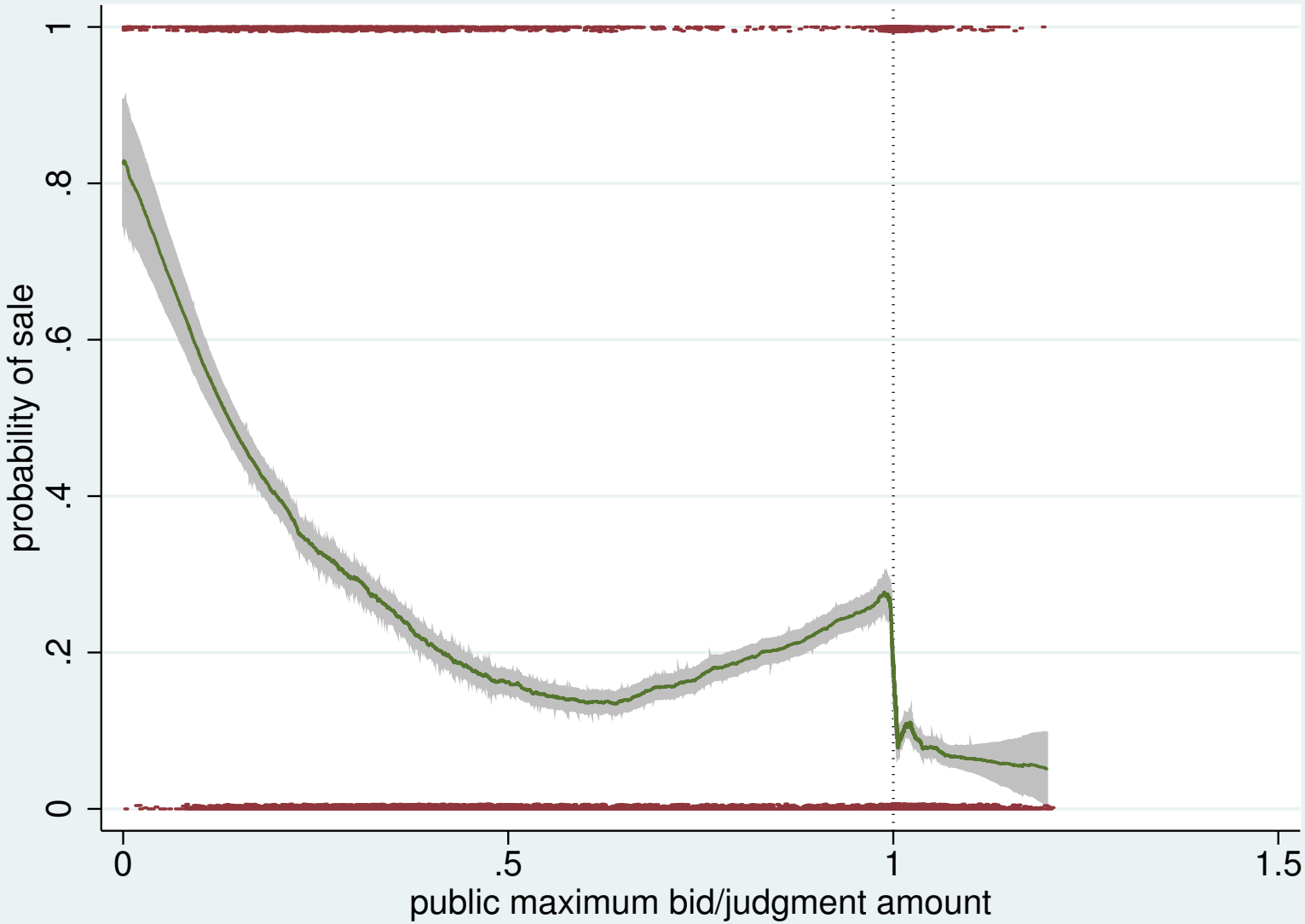
Appendix: Assuming Continuity Everywhere



return