Technology and Asset Liquidations: Evidence from Real Estate Collateral

Francesco Mazzola[1]

[1]Rotterdam School of Management - Erasmus University

March, 2023

10th SUERF/UniCredit Foundation Research Prize

Introduction

- Illiquid asset: demand frictions (participation costs) $\rightarrow$ poor matching and suffocate prices;
  - Best-suited buyer is unlikely to bid readily, especially in forced asset sales (e.g., *fire-sales*, Shleifer and Vishny, 1992);

Introduction

- Illiquid asset: demand frictions (participation costs) $\rightarrow$ poor matching and suffocate prices;
  - Best-suited buyer is unlikely to bid readily, especially in forced asset sales (e.g., *fire-sales*, Shleifer and Vishny, 1992);
  - may amplify negative price spillovers and feedback loops (Kiyotaki-Moore, 1997; Asquith et al., 1994;);

Introduction

- Illiquid asset: demand frictions (participation costs) $\rightarrow$ poor matching and suffocate prices;
  - Best-suited buyer is unlikely to bid readily, especially in forced asset sales (e.g., *fire-sales*, Shleifer and Vishny, 1992);
  - may amplify negative price spillovers and feedback loops (Kiyotaki-Moore, 1997; Asquith et al., 1994;);

RQ: How does technology affect forced asset sales?

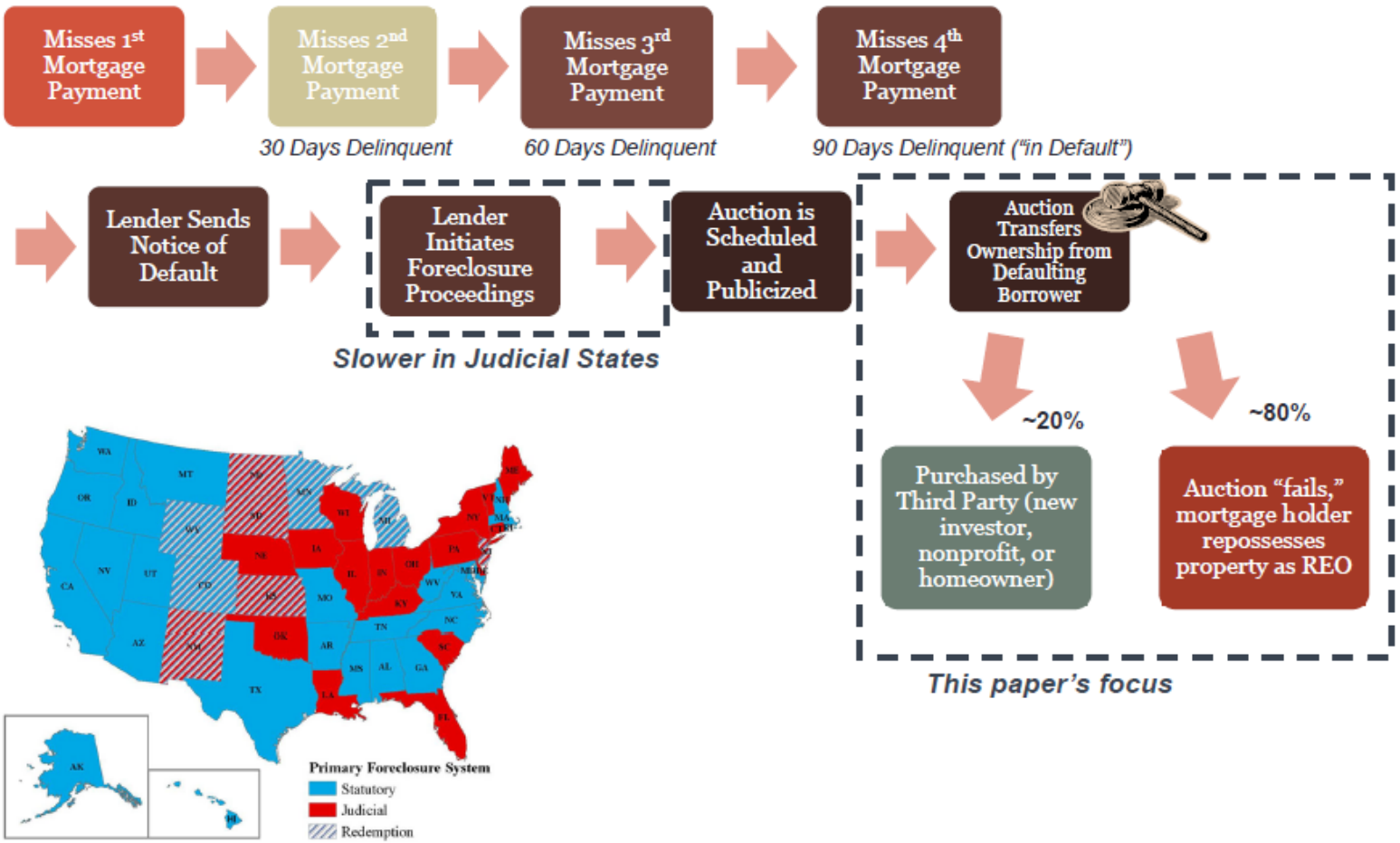
This paper: exploits legal reform in U.S. mortgage (foreclosure) collateral liquidations;

The Motivation

- Over 7.5 million foreclosures completed 2007-2017 (CoreLogic 2017);
- National crisis, but pain not spread evenly
  - Florida had highest peak foreclosure rate, persistently large shares of mortgages in foreclosure process;

- Not only probability of default increase, but so did loss given default: doubled to 40% of balances (An and Cordell, 2021);
  - Large reductions in home prices;
  - Foreclosure timelines nearly doubled (Cordell and Lambie-Hanson, 2016);

Foreclosure process



Source: Cordell and Lambie-Hanson (2016)

Foreclosure auctions

- Foreclosure sales: public auction of mortgaged property at the premises of county courthouse;

Policy

- Poor outcomes: typically no show, 80+% properties bought by lenders (REOs);
- Substantial holding costs (15-20% of market value) over a long time (up to 24 months);

Policy

- Poor outcomes: typically no show, 80+% properties bought by lenders (REOs);
- Substantial holding costs (15-20% of market value) over a long time (up to 24 months);
  - REOs create negative *physical* externalities on the value of neighboring properties (e.g., Campbell, Giglio, Pathak, 2011; Fisher, Lambie-Hanson, Willen, 2015). spillovers

Policy

- Poor outcomes: typically no show, 80+% properties bought by lenders (REOs);
- Substantial holding costs (15-20% of market value) over a long time (up to 24 months);
  - REOs create negative *physical* externalities on the value of neighboring properties (e.g., Campbell, Giglio, Pathak, 2011; Fisher, Lambie-Hanson, Willen, 2015). spillovers
- This paper assesses effects of technology;
  - Florida House Bill 773 (2008): **Electronic bidding**;
  - Staggered adoption (exogenous to poor foreclosure outcomes) $\rightarrow$ DiD design;

Preview of results

1. Foreclosed properties sold faster: auction success increases by 37%;
   - and at better prices: auction discount decreases by 45%;
   - Propensity Score Matching confirms;
   - Foreclosure spillovers mitigated;
   - (Back-of-the-envelope) welfare gains substantial;

   Ex-ante credit supply:
   - Lending increases by 43 basis points; effects more pronounced for risky borrowers;
   - mortgage loan rates decrease;
2. Mechanisms:
   - Auction Buyers: + Local (Informed), Loyal, NonProfessional, SoloProp holder;
     $\rightarrow$ crowd empowered at expense of specialized professionals;
   - Benefits $\uparrow$ + auctions, better properties, remote courthouse;

Preview of results

1. Foreclosed properties sold faster: auction success increases by 37%;
   - and at better prices: auction discount decreases by 45%;
   - Propensity Score Matching confirms;
   - Foreclosure spillovers mitigated;
   - (Back-of-the-envelope) welfare gains substantial;

   Ex-ante credit supply:
   - Lending increases by 43 basis points; effects more pronounced for risky borrowers;
   - mortgage loan rates decrease;
2. Mechanisms:
   - Auction Buyers: + Local (Informed), Loyal, NonProfessional, SoloProp holder;
     $\rightarrow$ crowd empowered at expense of specialized professionals;
   - Benefits $\uparrow$ + auctions, better properties, remote courthouse;

Preview of results

1. Foreclosed properties sold faster: auction success increases by 37%;
   - and at better prices: auction discount decreases by 45%;
   - Propensity Score Matching confirms;
   - Foreclosure spillovers mitigated;
   - (Back-of-the-envelope) welfare gains substantial;

   Ex-ante credit supply:
   - Lending increases by 43 basis points; effects more pronounced for risky borrowers;
   - mortgage loan rates decrease;
2. Mechanisms:
   - Auction Buyers: + Local (Informed), Loyal, NonProfessional, SoloProp holder;
     $\rightarrow$ crowd empowered at expense of specialized professionals;
   - Benefits $\uparrow$ + auctions, better properties, remote courthouse;

Literature Review

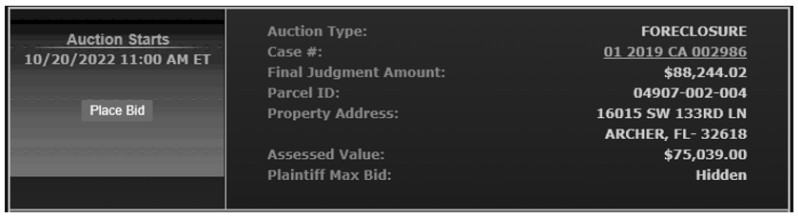
- **Costly liquidations**:
  - Real/financial assets (Pulvino, 1998; Coval and Stafford, 2007)
  - Foreclosures: **Discount** (Physical, Stigma, Buyer constraints) + **Price Spillovers** (Physical, Supply/Competition);
- **Information Technology (IT)**:
  1. improves information (Jensen 2007, Gao and Huang 2020)
     - price efficiency;
     - IT can benefit sophisticated investors if info processing matters (Hendershott et al., 2011; Menkveld, 2013)
  2. lowers participation costs (Bogan 2008, Jack and Suri 2014);
     - Current context: tech available equally to everyone;
- **Loan liquidity**:
  - Resale technology as securitization (Loutskina and Strahan, 2009) or FinTech 2ndary markets (Bollaert et al., 2021);
  - Foreclosure frictions (Pence, 2006; Dagher and Sun, 2016; Bongaerts et al., 2021)

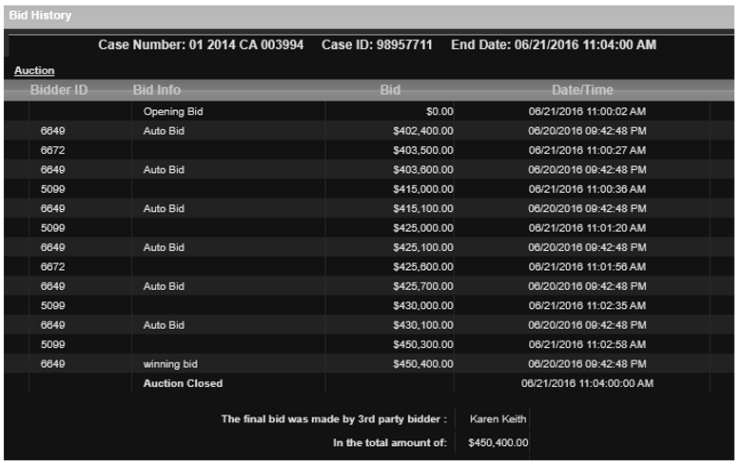
Technology Adoption

- 07/2008: FL counties can conduct **electronic bidding** auctions;
  - Lower hurdles for **everyone** to participate and bid;
    1. More competition;
    2. Higher max reservation price;
    3. $\rightarrow$ Higher success rate and lower discounts.

Technology Adoption

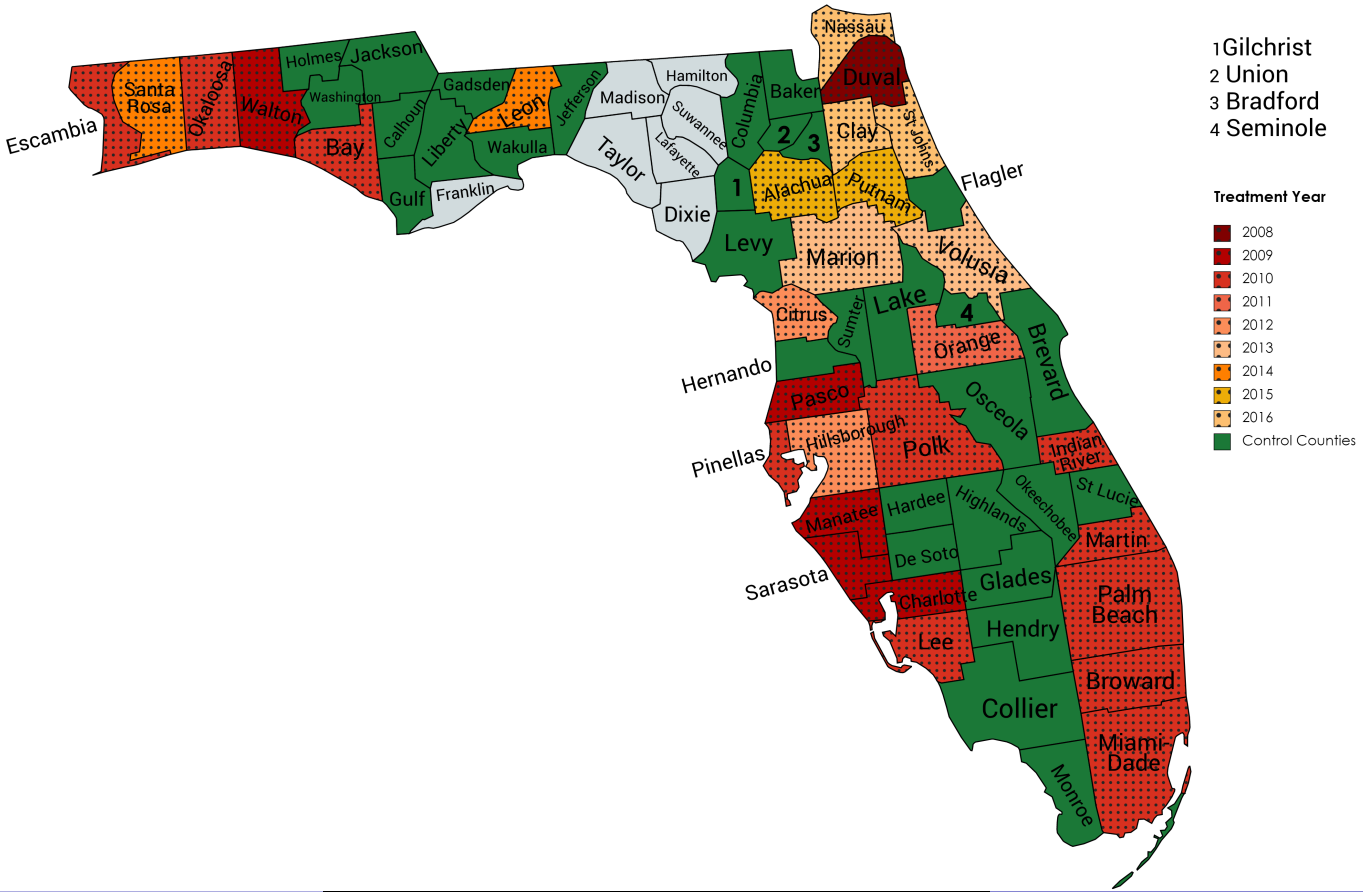
- 07/2008: FL counties can conduct **electronic bidding** auctions;
  - Lower hurdles for **everyone** to participate and bid;
    1. More competition;
    2. Higher max reservation price;
    3. $\rightarrow$ Higher success rate and lower discounts.





Treatment timing

- Treated: receives treatment + at least one control county;
- Control: never-treated (or not-yet-treated) + adjoining treated;
  - Matching with replacement;



Data

- Real Property Roll (2009-2019) from FL Department of Revenue;
  - All real estate transactions in Florida, including transfer type, ownership, price and date;
  - Property characteristics: exact location, size, age, quality, appraised value (counterfactual), etc.;

Data

- Real Property Roll (2009-2019) from FL Department of Revenue;
  - All real estate transactions in Florida, including transfer type, ownership, price and date;
  - Property characteristics: exact location, size, age, quality, appraised value (counterfactual), etc.;
- Electronic Auction data from *realauction.com*;
  - Non-winning bids unavailable (observable only for treated counties after shock);
    - Looking at (final) buyers, Courthouse accessibility, Property attractiveness;
- Court legal filings from Office of State Courts Administrator;
- HMDA: application-level, including lender's action taken;

Methodology

- Auction-level Linear Probability Model (LPM):

$$Fcl_{i,c,cb,t} = \beta Treated_{c,cb} \times Post_{t,cb} + \eta X_i + \gamma W_{c,cb,t-1} + \\ + FE_{cbt,g} + \varepsilon_{i,c,t,cb} \quad (1)$$

- foreclosed property i located in county c of border b auctioned in month t. Stats
- CountyBorder $\times$ time Fixed effects crucial;
  - When staggered rollout, negative weights in TWFE DD (Goodman-Bacon 2021)
    - "stacked diff-in-diff" (Baker et al., 2022, Cengiz et al., 2019)
  - Geography g can be either county, zip code or census tract.
- β: captures the electronic bidding effect;

Methodology

- Auction-level Linear Probability Model (LPM):

$$Fcl_{i,c,cb,t} = \beta Treated_{c,cb} \times Post_{t,cb} + \eta X_i + \gamma W_{c,cb,t-1} + \\ + FE_{cbt,g} + \varepsilon_{i,c,t,cb} \quad (1)$$

- foreclosed property i located in county c of border b auctioned in month t. Stats
- CountyBorder $\times$ time Fixed effects crucial;
  - When staggered rollout, negative weights in TWFE DD (Goodman-Bacon 2021)
    - "stacked diff-in-diff" (Baker et al., 2022, Cengiz et al., 2019)
  - Geography g can be either county, zip code or census tract.
- β: captures the electronic bidding effect;

Methodology

- Auction-level Linear Probability Model (LPM):

$$Fcl_{i,c,cb,t} = \beta Treated_{c,cb} \times Post_{t,cb} + \eta X_i + \gamma W_{c,cb,t-1} + \\ + FE_{cbt,g} + \varepsilon_{i,c,t,cb} \quad (1)$$

- foreclosed property i located in county c of border b auctioned in month t. Stats
- CountyBorder $\times$ time Fixed effects crucial;
  - When staggered rollout, negative weights in TWFE DD (Goodman-Bacon 2021)
    - "stacked diff-in-diff" (Baker et al., 2022, Cengiz et al., 2019)
  - Geography g can be either county, zip code or census tract.
- β: captures the electronic bidding effect;

Electronic bidding and Auction Outcomes

Auction Success dynamics

Auction Success

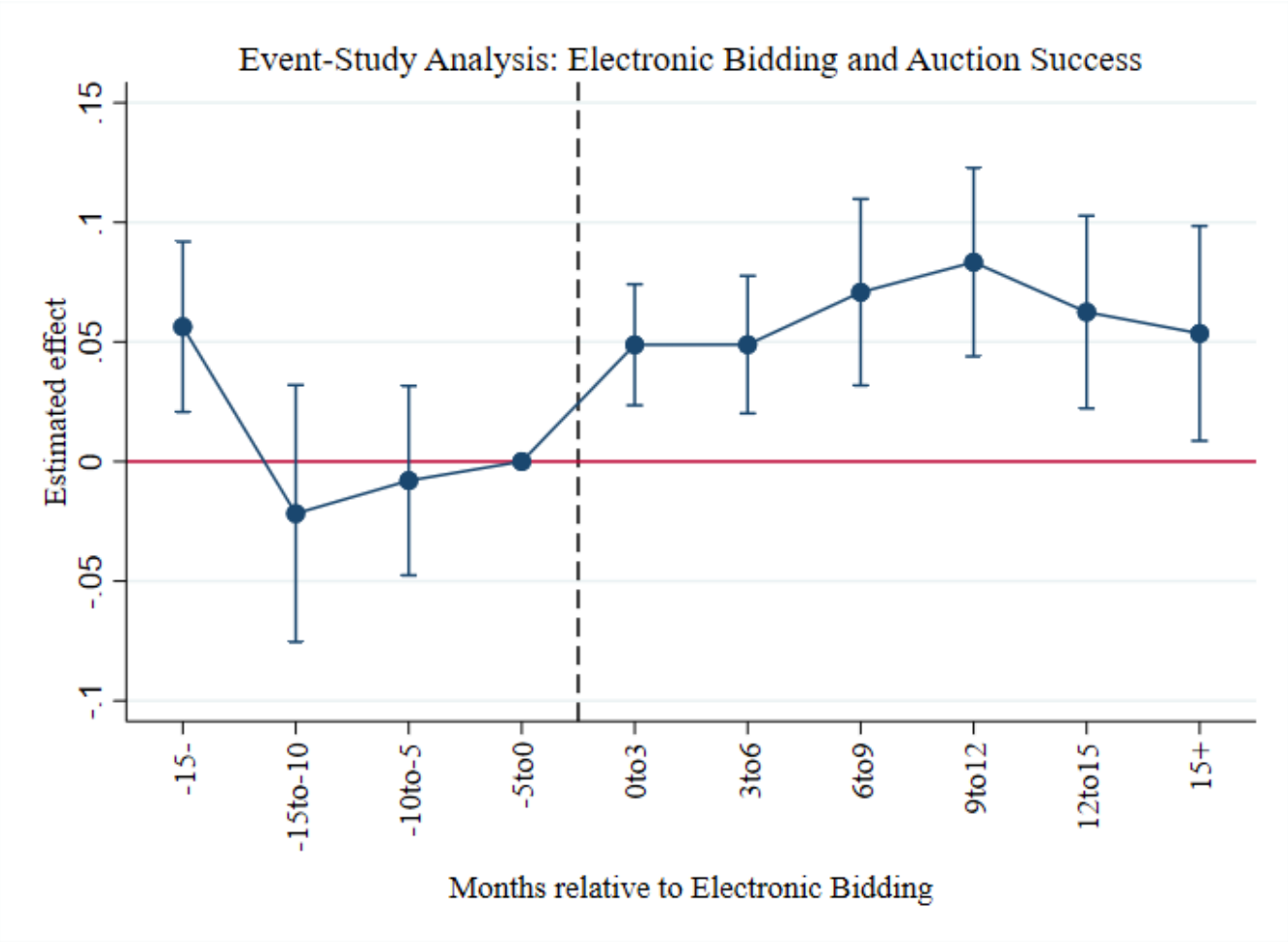
Dep. var.: $AucSucc_{i,c,t}$	(1)	(2)	(3)	(4)	(5)
$Treated_c \times Post_t$	.0408**	.0406**	.0432***	.0403**	.0653***
	(2.59)	(2.57)	(2.96)	(2.59)	(3.15)
$HouseAge_{i,c,t}$		-.00105***	-.00081***	-.00092***	-.0010***
		(-4.68)	(-5.48)	(-6.21)	(-5.64)
$ln(Size)_{i,c,t}$		-.0385***	-.0280***	-.0283***	-.0312***
		(-7.78)	(-7.94)	(-8.80)	(-8.22)
$NoResUnts_{i,c,t}$		.0027	.00027	-.00065	-.00053
		(.69)	(.11)	(.23)	(-.025)
$StrucQual_{i,c,t}$		-.00694**	-.00060	-.0040*	-.0044**
		(-2.14)	(-.32)	(-1.80)	(-1.99)
Border × Month FE	✓	✓	✓	✓	✓
County Controls	✓	✓	✓	✓	✓
Geog FE	c	c	z	n	n
# of Observations	411,423	411,423	331,233	411,234	292,066
R^2	.060	.063	.081	.087	.102
adj. R^2	.059	.061	.075	.074	.083

Auction Success

Dep. var.: $AucSucc_{i,c,t}$	(1)	(2)	(3)	(4)	(5)
$Treated_c \times Post_t$	.0408**	.0406**	.0432***	.0403**	.0653***
	(2.59)	(2.57)	(2.96)	(2.59)	(3.15)
$HouseAge_{i,c,t}$		-.00105***	-.00081***	-.00092***	-.0010***
		(-4.68)	(-5.48)	(-6.21)	(-5.64)
$ln(Size)_{i,c,t}$		-.0385***	-.0280***	-.0283***	-.0312***
		(-7.78)	(-7.94)	(-8.80)	(-8.22)
$NoResUnts_{i,c,t}$		.0027	.00027	-.00065	-.00053
		(.69)	(.11)	(.23)	(-.025)
$StrucQual_{i,c,t}$		-.00694**	-.00060	-.0040*	-.0044**
		(-2.14)	(-.32)	(-1.80)	(-1.99)
Border × Month FE	✓	✓	✓	✓	✓
County Controls	✓	✓	✓	✓	✓
Geog FE	c	c	z	n	n
# of Observations	411,423	411,423	331,233	411,234	292,066
R^2	.060	.063	.081	.087	.102
adj. R^2	.059	.061	.075	.074	.083

- Ec. sign: .0653/.1766=37%

Event Study - Auction Success



Auction Discount

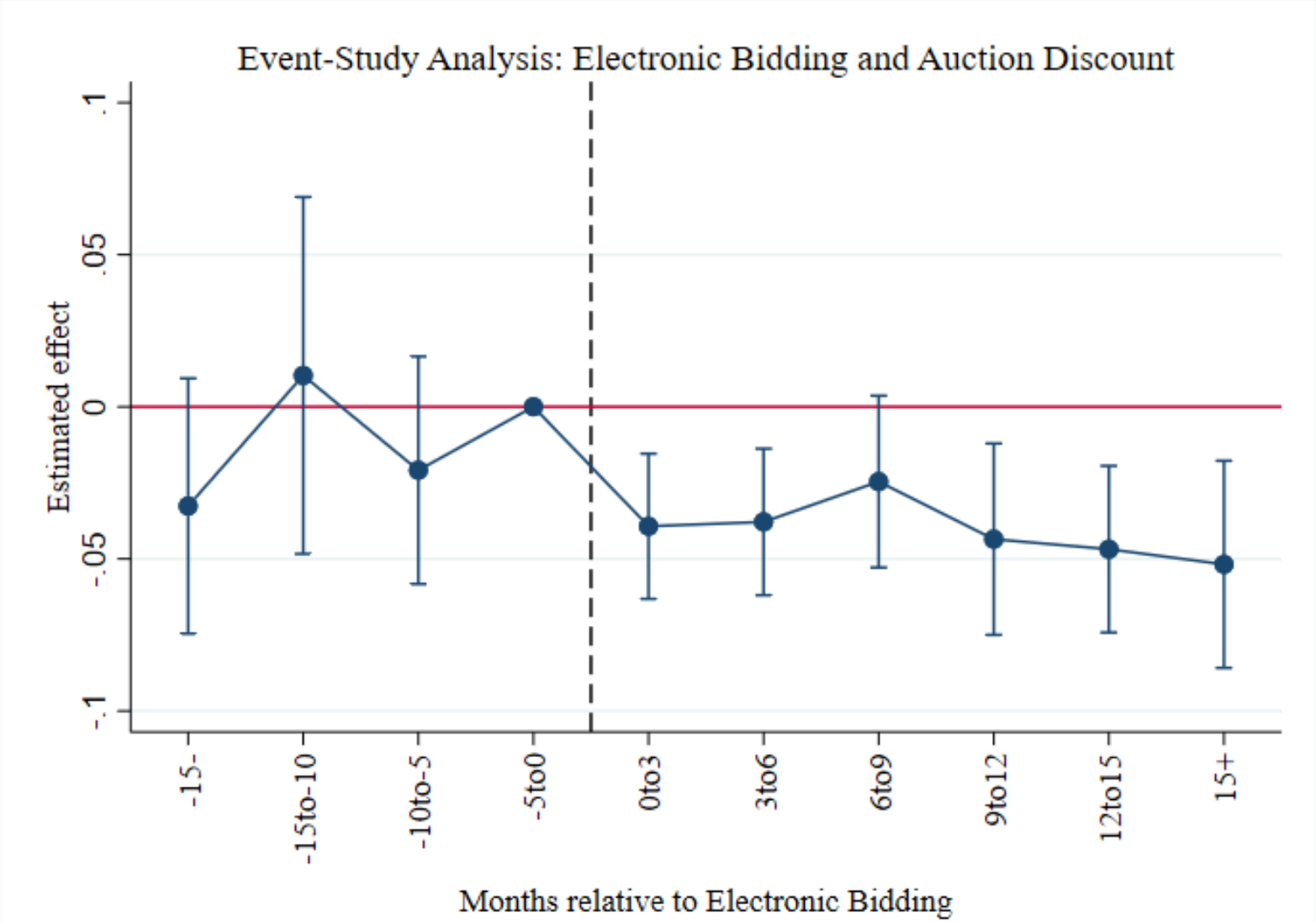
Dep. var.: $AucDisc_{i,c,t}$	(1)	(2)	(3)	(4)	(5)
$Treated_c \times Post_t$	-.0240***	-.0208***	-.0153*	-.0254***	-.0323***
	(-3.14)	(-2.67)	(-1.81)	(-3.01)	(-2.72)
$HouseAge_{i,c,t}$		.00193***	.00192***	.00192***	.00190***
		(13.89)	(10.34)	(13.56)	(13.42)
$ln(Size)_{i,c,t}$		-.0299***	-.0210***	-.0187***	-.0157**
		(-5.97)	(-4.44)	(-3.36)	(-2.53)
$NoResUnts_{i,c,t}$		.0495***	.0403***	.0527***	.0480***
		(4.46)	(3.89)	(4.85)	(5.19)
$StructQual_{i,c,t}$		-.0012	.0025	.0037	.0038
		(-.60)	(.80)	(1.59)	(1.63)
Border × Month FE	✓	✓	✓	✓	✓
County Controls	✓	✓	✓	✓	✓
Geog FE	c	c	z	n	n
# of Observations	58,917	58,917	50,334	58,113	41,547
R^2	.132	.169	.222	.266	.285
adj. R^2	.120	.158	.194	.209	.213

Auction Discount

Dep. var.: $AucDisc_{i,c,t}$	(1)	(2)	(3)	(4)	(5)
$Treated_c \times Post_t$	-.0240***	-.0208***	-.0153*	-.0254***	-.0323***
	(-3.14)	(-2.67)	(-1.81)	(-3.01)	(-2.72)
$HouseAge_{i,c,t}$		.00193***	.00192***	.00192***	.00190***
		(13.89)	(10.34)	(13.56)	(13.42)
$ln(Size)_{i,c,t}$		-.0299***	-.0210***	-.0187***	-.0157**
		(-5.97)	(-4.44)	(-3.36)	(-2.53)
$NoResUnts_{i,c,t}$		.0495***	.0403***	.0527***	.0480***
		(4.46)	(3.89)	(4.85)	(5.19)
$StructQual_{i,c,t}$		-.0012	.0025	.0037	.0038
		(-.60)	(.80)	(1.59)	(1.63)
Border × Month FE	✓	✓	✓	✓	✓
County Controls	✓	✓	✓	✓	✓
Geog FE	c	c	z	n	n
# of Observations	58,917	58,917	50,334	58,113	41,547
R^2	.132	.169	.222	.266	.285
adj. R^2	.120	.158	.194	.209	.213

- Ec. sign: -.0323/.0716=-45%

Event Study - Auction Discount



Foreclosure Spillovers

Dep. var.: $\ln(\text{nonFclP})_{i,c,t}$	(1)	(2)	(3)	(4)
$\text{Treated}_c \times Post_{t+12}$	-.0416	-.114**	-.108**	-.127**
	(-.95)	(-2.20)	(-2.22)	(-2.45)
$\text{NoAuct}_{n,t\in(t,t-12)}$	-.00394***	-.00279***	-.00272***	-.00285***
	(-6.05)	(-3.91)	(-3.74)	(-3.69)
$\text{Tr}_c \times Post_{t+12} \times NoAuct_{n,t\in(t,t-12)}$		.0029**	.00274**	.00298**
		(2.24)	(2.27)	(2.38)
CrossInteractions	x	✓	✓	✓
Border × Month FE	✓	✓	✓	✓
County Controls	x	x	✓	✓
Geog FE	n	n	n	n
# of Observations	601,856	601,856	601,782	538,230
R^2	.092	.092	.092	.142
adj. R^2	.082	.082	.082	.132

Real Effects: Ex-ante Lending

Lending

Table: Ex-ante Credit

Dep. var.:	$Accept_{i,c,t}$		$HPrice_{i,c,t}$	$Secz_{i,c,t}$	$Modify_{i,c,t}$	
	(1)	(2)	(3)	(4)	(5)	(6)
$Tr_c \times P_t$	.00309***	-.0164***	-.0107***	-.0027*	-.406	.914
	(2.65)	(-9.72)	(-3.50)	(-1.71)	(-1.08)	(-.12)
$Tr_c \times P_t \times Risk_{i,c,t}$		.0916***				
		(8.31)				
Border×Mnth FE	✓	✓	✓	✓	✓	✓
Applicant Controls	✓	✓	✓	✓	✓	✓Geog FE
n	n	n	n	z	z	
# of Obs.	3,276,855	3,276,855	2,320,682	2,320,666	13,880	13,880
R^2	.060	.064	.0122	.081	X	X
adj. R^2	.058	.062	.119	.078	X	X

Electronic Foreclosures: Mechanisms

Auction Buyers

	Type			Distance		
Dep. var.:	$\text{Profsl}_{i,c,t}$	$\text{MulProp}_{i,c,t}$	$\text{Flip}_{i,c,t}$	$\text{OutState}_{i,c,t}$	$\text{b-iDist}_{i,c,t}$	$\text{b-cDist}_{i,c,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\text{Treated}_c \times \textit{Post}_t$	-.0463***	-.0379**	-.0249**	-.0482**	-.108***	-.114***
	(-3.18)	(-2.41)	(-2.28)	(-2.03)	(-2.99)	(-2.93)
Border×Mnth FE	✓	✓	✓	✓	✓	✓
Geog FE	n	n	n	n	n	n
County Controls	✓	✓	✓	✓	✓	✓
Property Controls	✓	✓	✓	✓	✓	✓
# of Observations	62,598	62,598	62,598	25,161	21,201	20,267
R^2	.239	.258	.147	.212	.301	.304
adj. R^2	.179	.200	.080	.212	.301	.188

Channels

Dep. var.:	$AuctSucc_{i,c,t}$				
DDD Channel:	$Remote_c$	c-$iDist_i$	$Young_{c,t}$	$NoAuct_{c,t}$	$Quality_i$
	(1)	(2)	(3)	(4)	(5)
$Treated_c \times Post_t \times Ch$	.809***	.513*	.0652**	.876*	.0442***
	(3.12)	(1.91)	(2.41)	(1.68)	(3.61)
$Treated_c \times Post_t$	-.012	.0371*	.0302**	-.0196	.031**
	(-.89)	(1.95)	(2.37)	(-1.18)	(2.14)
CrossInteractions	✓	✓	✓	✓	✓
Border×Mnth FE	✓	✓	✓	✓	✓
County Controls	✓	✓	✓	✓	✓
Geog FE	n	n	n	n	n
Property Controls	✓	✓	✓	✓	✓
# of Observations	349,977	306,841	349,977	349,977	349,977
R^2	.093	.093	.093	.093	.093
adj. R^2	.077	.076	.077	.077	.077

Robustness

- REO Market REO
- Placebo Robustness
- Cross-county Spillovers
- Excluding border groups with too-early treated;
- Excluding not-yet-treated counties from control;
- Weighted regression;
- No Foreclosure Supply effects;

Welfare

- Technology improved auction stage (6%) of foreclosure process$\rightarrow$ fewer REOs.
  1. Opp.Cost (Empty home): **6%** $\times\$947 \times 4,583 = \$260,000$
  2. Effort in vain (Broker Fees): **6%** $\times 5.5\%$ $\times\$196,000 \times 4,583 = \$2.9M$
  3. Opp.Cost (Bank Capital): **6%** $\times 4\%$ $\times\$196,000 \times 4,853 \times (1 + 8\%/12 months) = \$2.2M$.
- Total = $(\$260,000 + \$2.9M + \$2.2M) \times 7.5 months = \$40.2M$.
- Note: Lower bound as participation costs (time, effort, fuel) of participants in the auction are likely lower;

Conclusion

- I study the effect of relaxing demand frictions on foreclosure auctions;
- Exploit shock to bidding process in FL;
- Auction success increases by 37% and auction discount declines by 45%;
  - Propensity Score Matching, using property characteristics, confirms the results;
  - Driven by accessibility of the courthouse and by the entrance of local buyers;
- Reallocation of (risky distressed) assets from the bank sector to the household sector;
- Substantial welfare gains (important for other states);

Spillovers

Go back

Appendix - Summary Statistics

	Panel A: Full sample					
	Source	Mean	Std.Dev.	P5	P95	Observ.
$\text{AuctSucc}_{i,c,t}$	RPR	.1741	.3792	0	1	411,519
$\text{AuctDisc}_{i,c,t}$	RPR	.0774	.2044	-.2618	.4253	58,933
$\ln(\text{FclP})_{i,c,t}$	RPR	11.214	.983	9.547	12.560	71,661
$\text{AOoS}_{i,c,t}$	RPR	.110	.313	0	1	33,090
$\text{NoAuct}_{c,t}$	RPR	.452	.335	.057	1.133	411,519
$\text{Remoteness}_{c,t}$	FLCourts	.709	.454	0	1	411,519
$\text{Accept}_{i,c,t}$	HMDA	.7026	.4571	0	1	3,673,386
$\text{HPrice}_{i,c,t}$	HMDA	.0614	.2400	0	1	2,580,841
$\text{Sectz}_{i,c,t}$	HMDA	.5850	.4927	0	1	2,580,825
$\text{Modify}_{i,c,t}$	SFLL	.0027	.0517	0	0	14,192

	Panel B: Balance test				
	Treated		Control		
	Mean	SD	Mean	SD	T-C
$\text{HouseAge}_{i,c,t}$	29.19	7.03	26.78	8.33	2.408
$\ln(\text{Size})_{i,c,t}$	7.53	.15	7.51	.14	.024
$\text{NoResUnts}_{c,t}$	1.02	.02	1.02	.02	-.002
$\text{StrucQual}_{c,t}$	3.20	.41	3.08	.33	.117
$\text{Unempl}_{c,t}$	.06	.02	.07	.02	-.011
$\text{Income}_{c,t}$ ('000s)	16.92	17.24	9.88	11.44	7.03
$\text{White}_{c,t}$	.81	.09	.82	.07	-.007
$\text{Young}_{c,t}$	.47	.07	.46	.04	.003
$\text{TotPop}_{c,t}$	.44	.44	.25	.28	.187
$\text{NoAuct}_{c,t}$ (% of Mln Pop.)	.78	.25	.67	.20	.105

Go back

REO Market

Dep. var.:	$REODisc_{i,c,t}$	$OoS_{i,c,t}$	$Profssnal_{i,c,t}$	$T2Sell_{i,c,t}$	$T2Sell_{i,c,t}$
	(1)	(2)	(3)	(4)	(5)
$Treated_c \times Post_t$	.0094	.0304***	.0055	.0742***	.0420**
	(1.49)	(2.65)	(.30)	(5.52)	(2.35)
Border×Mnth FE	✓	✓	✓	✓	✓
Geog FE	n	n	n	X	z
County Controls	✓	✓	✓	✓	✓
Property Controls	✓	✓	✓	✓	✓
# of Observations	83,641	133,814	67,047	133,643	113,954
R^2	.329	.308	.172	.206	X
X					
adj. R^2	.297	.270	.137	.096	X
X					

Go back

Robustness tests

Dep. var.: $AuctSucc_{i,c,t}$	Placebo (1)	Donut (2)	LateTr (3)	NotYetTr (4)	wReg (5)	Supply (6)
$Treated_c \times Post_t$	-.0013	.0443***	.0380***	.0535***	.0353***	.0389**
	(-.05)	(3.11)	(2.90)	(3.24)	(2.65)	(2.30)
$Tr_c \times Post_t \times GovAg_{i,c,t}$						.0624
						(1.26)
Border×Mnth FE	✓	✓	✓	✓	✓	✓
County Controls	✓	✓	✓	✓	✓	✓
Property Controls	✓	✓	✓	✓	✓	✓
Geog FE	n	n	n	n	n	n
# of Observations	201,932	336,677	287,894	366,146	287,992	411,234
R^2	.078	.094	.085	.089	.078	.090
adj. R^2	.063	.077	.075	.076	.067	.076