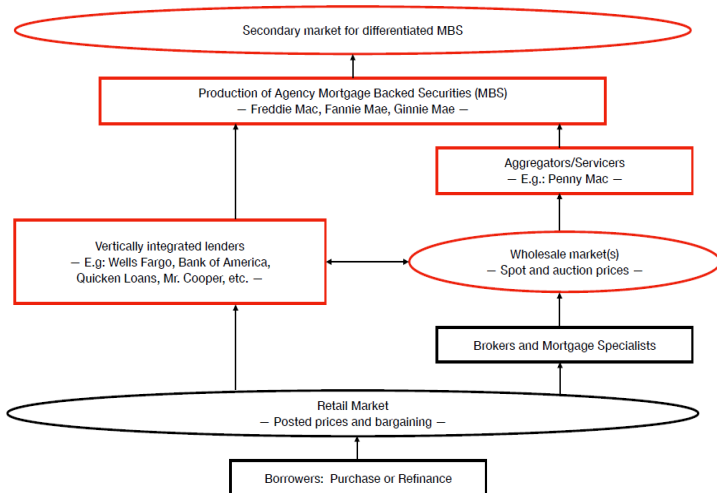


Asymmetric Information and the Supply Chain of Mortgages: The Case of Ginnie Mae Loans

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CRESSE, July 2023

Origin-to-Distribution Supply Chain of Mortgages



Loan Values for Servicers

- Sellers in MBS market sell pools of loans, but typically retain servicing rights
 - ▶ Collect monthly interest payment from borrower at note rate r
 - ▶ Pays the agency for insuring loan against default at rate g
 - ▶ Pays the MBS coupon (return) to investors at rate c
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 - ▶ Main source of risk: early prepayment (e.g., default, refi)
- Decisions by buyers in wholesale market (sellers in MBS mkt)
 - ▶ Acquisition prices: depends on resale price + service income
 - ▶ Security customization: (i) coupon, (ii) custom pool vs multi-issuer pool

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 - Lower loan prices and MBS prices
 - Auction design issues
 - ▶ Literature:
 - IO assumes loans are private value assets \Rightarrow banks have common beliefs about loan duration, idiosyncratic values.
 - Finance assumes loans are common value assets. \Rightarrow banks have private info about loan duration.

What We Do

Case Study: Wholesale/MBS markets for Ginnie Mae Mortgages

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- Security customization
 - ▶ Use coupon and pool choices to test for selection in the MBS market
 - ▶ Examine the impact of coupon choice on bids and markups in wholesale market.

Outline

- Market description and data
- Loan Valuation model
- Common value results
- Asymmetry in information quality
- Security choices and adverse selection
- Conclusion

Secondary (MBS) Market

- To-Be-Announced (TBA) forward market
 - ▶ Bank agrees to deliver a pool of agency-insured loans to a buyer at a specified price, par value, coupon, maturity, and delivery date.
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Wholesale Market: Two Segments

- *Posted price segment*: wholesale rate sheets or *Lock* prices
 - ▶ Lock price = Base(r , lock period) + Loan-level Price Adjustments
 - ▶ Base prices updated daily.
 - ▶ LLPA are based on a coarse partition of loan attributes
 - ▶ Attributes (X): Originator, Note-rate, Zip-code, Income, DTI, Loan Size, Home Value, LTV, FICO, Purchase/Refi

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- *Online auctions*: Flexible real-time pricing
 - ▶ Buyers submit *bulk* bids, BUT a seller can always sell its loan to a buyer at its lock price $\Rightarrow Bid_{ij} = \max\{Bulk_{ij}, Lock_{ij}\}$

Optimal Blue

- Optimal Blue (OB) loan exchange platform:
 - ▶ Active in both segments: 35% market-share (prior to 2021)
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 - ▶ 75% of loan exchanges done via auctions
- Auction design (since 2018):
 - ▶ Sellers invite buyers from fixed networks.
 - ▶ Loan-level, first-price sealed bid auction (1-2 hrs)

Data Sets

- **eMBS**: provides information on all agency MBSs and their component loans from September 2013 to present
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- **HDMA**: provides detailed information on all loans originated from September 2013 to present
 - ▶ Originator identity, loan attributes X plus borrower characteristics (e.g., race, first-time buyer, points/credits)
- Track OB loans from origination to securitization

Sample

- 30 year fixed-rate mortgages that benefit from Federal housing subsidies (FHA and VA) and insured by Ginnie Mae
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- Why Ginnie?
 - ▶ Riskier loans, higher default rates
 - ▶ Restrictions on coupon choice
 - ▶ Guarantee fee is fixed at 6 basis points for all lenders, not negotiated.
 - ▶ Sellers do *not* use the retail channel \Rightarrow loans are not adversely selected. Not true for GSEs.
- Ginnie Mae \simeq 25% of agency loan origination.

Summary Stats: Loan Attributes

	mean	sd
Interest Rate	4.35	0.66
Loan Amount (100k)	2.37	1.02
Loan-to-Value	95.5	7.38
Credit Score (Min)	684.7	53.6
Debt-to-Income	39.8	14.4
1(DTI > 42)	0.53	0.50
1(VA-Backed)	0.35	0.48
1(Retail)	0.0024	0.049
1(Correspondent)	0.98	0.14
Loan Survival: 12-month	79.8	40.2
Loan Survival: 36-month	25.5	43.6
Observations	85,888	
Period	2018-2019	

Summary Stats: Auctions

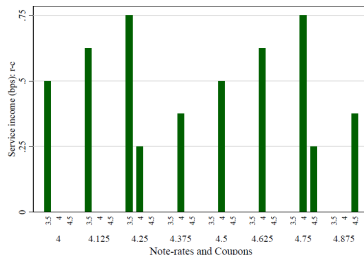
- Bids are for \$100 loan; resale price = TBA price

Table 2: Auction Attributes by Coupon Choice Status

	(1)		(2)	
	No Coupon mean	Choice sd	Coupon mean	Choice sd
Bid (\$)	103.4	1.07	103.6	1.12
Normalized Bid: $(\text{Bid}-\text{TBA})/(\text{r}-\text{c}-\text{g})$	1.45	0.89	0.82	0.90
Bulk Bid - TBA Price (\$)	0.74	0.46	0.36	0.43
Lock Bid - TBA Price (\$)	0.55	0.50	0.22	0.45
$1(\text{Bid} = \text{Bulk})$	0.71	0.45	0.72	0.45
Seller Network Size	14.1	4.15	14.0	4.31
Fraction Network Invited	0.79	0.20	0.81	0.20
TBA Price (\$) [2-Months Out]	102.8	1.09	103.2	1.07
Winning Bid (\$)	104.9	1.31	104.8	1.51
Fraction Bulk Bids	0.69	0.22	0.70	0.22
$1(\text{Winning Bid} = \text{Bulk})$	0.89	0.32	0.86	0.35
Winning Margin: $1^{\text{st}}-2^{\text{nd}}$ Bid (\$)	0.23	0.25	0.26	0.28
Gain: Winning Bid - Max Lock (\$)	0.72	0.85	0.76	0.89
$1(\text{Auction Has Lock Bid})$	0.90	0.30	0.90	0.30
Number of Bids	693310		259249	
Number of Auctions	64064		23927	

Coupon Choice

- r is quoted in $1/8$ increments, c in 0.5 increments.
- Regulation: $(r - c) \in \{0.25, 0.375, 0.5, 0.625, 0.75\}$



- ▶ Single c for loans with note rates ending in $0.375, 0.5, 0.625$
 - eg. $r = 4.5 \Rightarrow c = 4.0 \Rightarrow r - c = 0.5$
- ▶ Natural experiment: note rates ending in 0.25 and 0.75 can be pooled in either a low or a high coupon
 - Eg: $r = 4.25 \Rightarrow c_H = 4.0, c_L = 3.5 \Rightarrow r - c \in \{.25, .75\}$

Pricing Risk Attributes

- Hedonic regression: $Y_i = X_i\beta + \text{Auction Month} \times \text{Note Rate} + \text{State} + \text{Seller} + \varepsilon_i$ where $Y_i = 100 \times 1(T_i > T)$,

Table 1: Short- and Long-Term Survival Attributes (Pooled Sample)

	(1) Survival (12mo)	(2) Survival (36mo)
LogLoanAmount	-17.3* (0.36)	-23.2* (0.40)
1(Purchase Loan)	3.83* (0.41)	4.90* (0.45)
FICO Score (/1000)	-51.0* (2.92)	-28.2* (3.19)
Loan-to-Value (/100)	18.7* (2.12)	7.42* (2.32)
1(VA-Backed)	-11.9* (0.34)	-6.42* (0.37)
1(Debt-to-Income \geq 50)	-0.47 (0.31)	-0.12 (0.33)
Observations	87918	86572
R^2	0.153	0.130

Standard errors in parentheses

* $n < 0.05$

- ▶ Loan attributes predict survival
- ▶ Short-run survival is good proxy for longer run survival

Pricing Prepayment Risk

	(1)	(2)	(3)
	Bulk Bid	Lock Price	Winning Bid
PredictedSurvival	0.224*	0.156*	0.282*
	(0.00119)	(0.00202)	(0.00265)
<i>N</i>	653834	259386	81030
<i>R</i> ²	0.309	0.314	0.477
BidSD	0.937	0.937	0.937
SurvivalSD	0.156	0.156	0.156

- Banks price predicted survival but more so in auctions than in posted price segment.

Bid Dispersion

- Sample: no coupon choice
 - ▶ Baseline: linear regression of net bids (lock and bulk) on X plus fixed effects (auction date \times rate, county, and seller).

	(1)	(2)	(3)	(4)
Baseline	✓	✓	✓	✓
Buyer FE		✓	✓	✓
Buyer-specific slopes			✓	✓
Buyer-seller FE				✓
R-squared	0.27	0.42	0.57	0.61
Standard-deviation residual	0.71	0.64	0.54	0.52

- Bidder asymmetries: 30 point increase from bidder-specific intercepts and slopes
- Within and across auction dispersion are similar \approx 60 cents

Loan Valuations

- *Realized monthly cash flows* for \$100 loan i :

$$R_i(c) = P_i + \underbrace{\sum_{\tau=1}^T \delta^\tau L_{\tau,i}}_{\text{service multiple } (M_i)} \times \underbrace{\frac{r_i - g - c}{1200}}_{\text{service income}}$$

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 - ▶ T is the (random) duration of the loan.
- Security price:
 - ▶ TBA price depends only (increasing) on c , but not on (x, r) .
 - ▶ Custom pool price depends on c AND (x, r) of every loan in the pool.

Two Models of Expected Loan Duration

- PV model:

- ▶ Common beliefs about loan duration: $\overline{M}_{ij} = E[M_i|Z_i]$
- ▶ Plus idiosyncratic match value shock S_{ij}

$$\text{Match Value} = Z_i\gamma_j + S_{ij}$$

- Z is X with fixed effects for interactions (e.g. note rate x loan size).
- ▶ Dispersion in bids reflect differences in match values.

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 - ▶ Dispersion reflect different expectations of loan duration
- Assume existence of an equilibrium in monotone increasing strategies.

Common Value Tests

- Sample: loans with no coupon choice (i.e., drop loans with note rates that end in 0.25 and 0.75)
 - ▶ Regression:

$$Y_i = \lambda_{\text{own}}[\text{Own Bids}] + \lambda_{\text{rival}}[\text{Rival Bids}] + FE_i + \gamma Z_i + \epsilon_i$$

where $Y_i = 100 \times 1(T_i > 12)$ and FE_i includes month \times note rate, state, seller.

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- We use the following measures:
 - ▶ Own Bids: indicator for bulk bid, bulk bid
 - ▶ Rival Bids: fraction of rival bulk bids, max rival bid
- Common value tests (Hendricks, Pinkse and Porter):
 - ▶ Affiliation of survival and signals \Rightarrow positive correlation between survival and bids
 - ▶ CV: $\lambda_{\text{own}} > 0$ and $\lambda_{\text{rival}} > 0$

Results

VARIABLES	(1)	(2)
Net bid (bulk)	-0.0568 (0.0928)	-0.0301 (0.0768)
Max rival bid		-0.183 (0.383)
1(Bulk bid)	0.383* (0.194)	0.275 (0.153)
Fraction bulk bids (rivals)		2.183* (0.910)
Observations	686,983	686,983
R-squared	0.158	0.158
Sample	Bids	Bids

- Takeaways:
 - ▶ Bidding the lock price is “bad news”, and more rivals bidding lock prices is even worse news. \Rightarrow *PCV*
 - ▶ But variation in bulk bids and max rival bulk not on average informative. \nRightarrow *PCV*

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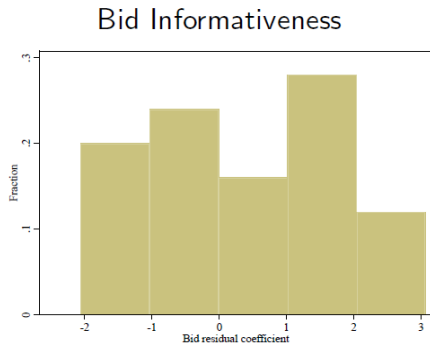
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- Signal quality ($\hat{\lambda}_j^s$): measure by estimating

$$Y_i = \lambda_j^s \hat{S}_{ij} + \lambda_j^b 1\{Bulk\} + FE_i + \gamma Z_i + \epsilon_i$$

Asymmetries in Signal Quality

- Sample: 29 bidders who won at least 100 loans

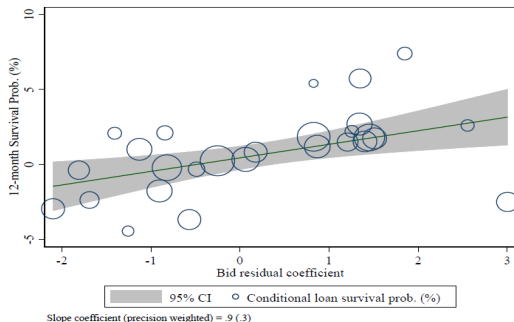


- Takeaway: roughly 9 bidders, mostly large bidders, have informative signals; most do not.

Do Bidders with Better Signals Win Better Loans?

- Survival FE conditional on Z : measure of bank “productivity”, centered at zero.

$$Y_i = \gamma Z_i + FE_i + \omega_j 1\{\text{Bank } j \text{ wins}\} + \epsilon_i$$

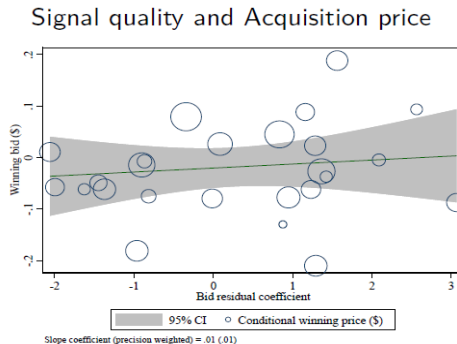


- Answer is yes.

Do Less Informed Bidders Pay Lower Bids?

- Let W_i denote the winning bid and regress

$$W_i = Z_i\beta + FE_i + \omega_j 1\{\text{Bank } j \text{ wins}\} + \epsilon_i$$



- The answer is no.

Summary

- A small group of bidders have private information about loan duration and win better loans
 - ▶ These are mostly the large bidders, including the two largest bidders who win 45% of the loans
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 - ▶ These are mostly the large bidders, including the two largest bidders who win 45% of the loans
 - ▶ Bidders in this group are also more likely to submit a bulk bid.
- Others are relatively uninformed, pay the same prices as more informed bidders but win on average shorter duration loans
 - ▶ Do these bidders suffer from the Winner's Curse? Lock price constraint?
 - ▶ Or do the loans fill pool-specific needs that cause these banks to value certain attributes more than cash flows?

Security Choices

- Coupon choice
 - ▶ For note rates that end in 0.25 or 0.75, bank can choose between a low c_L or a high coupon c_H .
 - ▶ Tradeoff: higher upfront payment $P(c_H)$ versus lower service markup $r - c_H$
 - ▶ Incentive: choose high coupon for shorter duration loans, low coupon for longer duration loans.

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 - ▶ Incentive: choose high coupon for shorter duration loans, low coupon for longer duration loans.
- Custom pool vs TBA choice:
 - ▶ Roughly 6 banks in our sample have the volume of loans to issue their own security
 - ▶ Incentivized to put better loans in custom pool where investors can price the lower prepayment risk.

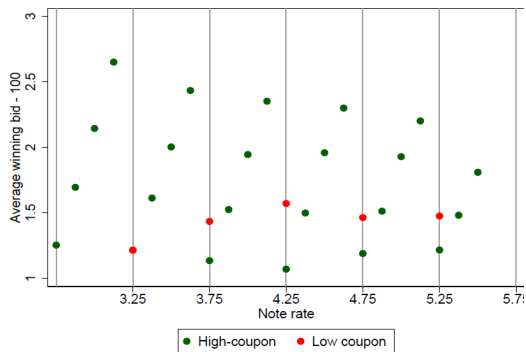
Adverse Selection

- Estimate correlation between survival and security choices.

VARIABLES	(1)	(2)	(3)
Single Coupon x TBA	-4.389*** (0.479)	-3.795*** (0.512)	-1.626*** (0.522)
Coupon Choice x TBA	-2.472*** (0.732)	-2.588*** (0.745)	-2.043** (0.809)
High-coupon x TBA	-4.283*** (0.979)	-2.514*** (0.955)	0.370 (1.000)
Constant	108.2*** (0.634)	137.6** (70.15)	99.52 (69.49)
Observations	76,510	76,499	76,499
R-squared	0.098	0.159	0.173
Fixed effects	Date x Rate	Full	Full+Winner
Characteristics	No	Full	Full

- ▶ Banks with custom pool option place better loans in their own security (Lemon's problem in TBA market).
- ▶ High coupon TBA loans are on average 4% less likely to survive than low coupon TBA loans but, surprisingly, the effect goes away after conditioning on Z and bidder fixed effects.

Bidding Behavior



- Focus on r between 3.375 and 5.25.
 - ▶ Average winning bid increases with markup $(r - c)$ for r ending in $\{.375, .5, .625\}$.
 - ▶ But falls sharply when r ends in $.75$ **even when coupon choice is low and markup is 0.75!**

Explanation

- Two types of banks:
 - ▶ Large banks with custom option are informed, place their lemons in TBA market, and always choose high coupon in both markets.
 - ▶ Banks without custom option are uninformed (conditional on Z), so their coupon choice is uncorrelated with loan survival.

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 - ▶ Banks without custom option are uninformed (conditional on Z), so their coupon choice is uncorrelated with loan survival.
- Impact on wholesale market:
 - ▶ Informed banks with custom option always bid for loans with coupon choice anticipating a markup of 0.25 \Rightarrow low bids.
 - ▶ Uninformed banks without custom option anticipate the low bids from large banks, lower their bids accordingly, and are more likely to choose the low coupon and higher service income.
 - ▶ Evidence: lower bid, lot more dispersion in bids for coupon choice loans.

Findings and Implication

- Main results:
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 - ▶ Auctions price pre-payment risk more efficiently than posted prices, increases loan prices, and lowers securitization costs
 - ▶ Reject the pure common-value model but common value and private info matters.
 - ▶ Lenders are asymmetrically informed (or act as if they are).

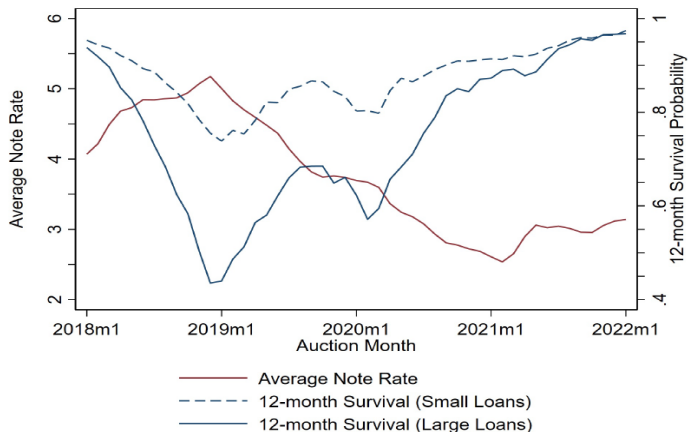
Findings and Implication

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- Implications: Market unraveling?
 - ▶ Ability to sell by auction undermines the value of the posted price segment of wholesale market
 - ▶ Ability to customize MBS undermines the value of "multi-issuer" pools in MBS market

PrePayment Risk in 2018 and 2019



- Lot of borrowers refinanced when interest rates fell in 2019 and 2020, especially ones with larger loans.