The Effect of Large Investors on Asset Quality: Evidence from Subprime Mortgage Securities

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GSEs and Suprime MBS

August 23, 2016 1 / 36

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- Non-agency, subrime MBS market ("PLS" private-label securities) was at the root of the 2007–2008 global financial crisis.
- Issuance increased by an order of magnitude between 2000 and 2005 (\sim \$50 billion to almost \$500 billion).
- Numerous types of investors in the market commercial banks, investment banks, insurance companies, hedge funds, finance companies, mutual funds, pension funds, etc.
- Largest investors: Fannie Mae and Freddie Mac U.S. housing government sponsored enterprises ("GSEs").
 - Purchased about 30% of total issuance over this period (almost 40% of AAA issuance).
 - Held in their retained portfolio, not part of their traditional insurance or "credit guaranty business."

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	Subprime PLS Issuance	GSE Subprime PLS Purchases				
Year	(\$ billions)	Public Data (\$ billions)	Proprietary Data (\$ billions)	Market Share (%)		
2000	52.5					
2001	87.1		3.4	3.8		
2002	122.7		14.6	11.9		
2003	195.0		67.7	34.7		
2004	362.6	•	141.0	38.9		
2005	465.0		134.4	28.9		
2006	448.6	110.4	106.0	23.6		
2007	201.6	59.6	50.1	24.9		
2008	2.3	0.7				

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- This paper studies the effects of the GSEs, as the largest investors in the PLS market, on loan quality and pricing.
- Previous literature ⇒ large investors can have significant effects on the incentives of managers and large impacts on market outcomes.
- Evidence mostly from equities market "block-holder" literature.
- No evidence in arms-length, public debt markets.
 - Investors in highly rated public debt generally viewed as passive providers of capital (i.e., not relationship lenders).
 - A lack of information about investment in specific securities.

- Theoretical literature on block-holders:
 - Shleifer and Vishny (JPE,1986) Large shareholders can act as a powerful disciplinary mechanism on managers by improving monitoring.
 - Burkart (JF, 1995) Large shareholders can increase takeover premium by challenging outside raiders.
 - Burkart, Gromb, and Panunzi (QJE,1997) Reduced managerial discretion resulting from large shareholders can be costly because managerial discretion has benefits like more firm-specific investment.
 - Shleifer and Vishny (JF, 1997) Large shareholders can impose costs if they promote their own interest at the expense of other shareholders.

Previous Literature

- Mixed empirical evidence in equity markets:
 - Many studies have found large institutional investors (mutual and pension funds) do not yield significant benefits.
 - Brav, Jiang, Partnoy and Thomas (JF, 2008) "Activist" hedge funds do increase firm value.
 - Morse (2013) Large, "active" investors exert significant influence over portfolio decisions made by PE fund managers to the detriment of fund performance.
- Relationship banking literature banks make informational-sensitive loans based on long-term relationships.
 - Banks incur costs to acquire private information and reduce adverse selection and moral hazard concerns by engaging in a repeated game with borrowers (Boot, 2000).
 - May also exploit this informational advantage to "lock-in" borrowers and extract rents from them over time (e.g., Sharpe, 1990, Degryse and Van Cayseele, 2000 and Schenone, 2010)

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Summary of Results

- Loans backing GSE securities performed better relative to loans backing securities bought by other investors.
 - Setup allows comparison of loans backing GSE and non-GSE securities within the same PLS deals.
- Difference in performance driven primarily from sample of low documentation loans.
- Significantly larger differences for issuers that were heavily dependent on the GSEs as a source of business.
- Affiliation between mortgage originator and issuer also plays an important role.
- Consistent with private information story.

- Differences in ex-ante default risk between GSE and non-GSE loan pools appear to be reflected in PLS prices.
- Differences in ex-post default risk are not.
 - Yield spreads of AAA securities with claims on GSE are significantly **higher** than those with claims on non-GSE AAA securities.
 - Consistent with finding that GSE loan pools characterized by higher ex-ante default risk.
 - But suggests that ex-post performance differences not priced.
 - Most of the yield spread differences come from issuers that were heavily dependent on the GSEs as a source of business.
- Some evidence that non-GSE investors may have been hurt by the GSEs' presence:
 - Loans in non-GSE pools in deals without GSE participation performed better than loans in non-GSE pools in deals with GSE participation.

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Outline

- Identification of GSE pools
- 2 Empirical identification strategy
- Oata
- Results
- Sobustness
- Analysis of PLS yield spreads
- Concluding remarks

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Identification of GSE pools

- Typically difficult to link individual securities to specific investors.
- Exploit the fact that the GSEs are constrained by law to the conforming mortgage market ⇒ loans with balances
 \$417,000.
- Many PLS deals were structured with more than one collateral pool.
 - One with only conforming mortgages.
 - One (or more) with a mix of conforming and nonconforming loans.
- Individual pool cash flows first accrued to senior (AAA) securities. Remaining cash flows from all pools then accrued to junior securities.

Identification of GSE pools



Figure 1: Typical Subprime PLS Deal Structure with GSE Participation

This figure displays the structure of a typical subprime PLS deal purchased by the GSEs. These deals involved more than one mortgage pool: one consisting of only conforming loans ("CSE pool") and at least one other pool made up of both conforming and non-conforming (jumbo) loans ("Non-CSE Pool"). The lower rated securities derived their cash flows from all pools, while the triple-A securities purchased by the GSEs derived their cash flows exclusively from the conforming pool and the triple-A securities purchased by other investors derived their cash flows from the other pools.

August 23, 2016 11 / 36

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- Created a simple algorithm to identify conforming mortgage pools in the data.
 - Classify as "GSE pool" if at least 99% of the loans are below the conforming loan limit (CLL).
 - Allow a 1% margin for potential measurement error.
 - Also add a condition that the vast majority of loans in the pool cannot be second liens, since most second liens have initial balances below the CLL.

Empirical Identification Strategy

- Focus on credit risk as a proxy for loan quality.
 - Compare default rates of loans in GSE pools with loans in non-GSE pools *in the same* subprime PLS deals.
- Identify differences in loan performance due to factors that were likely *unobservable* to PLS investors at the time of contracting.
 - Block-holder literature is about *private* information.
- Compare ex-post default rates of loans in GSE and non-GSE pools while conditioning on information set available to investors (i.e. observable underwriting variables).
 - Also control for economic factors that might also cause differences in ex-post performance unrelated to private information.

Empirical Identification Strategy: Linear Probability Model

•
$$Def_{ijzt} = \alpha + \eta_j + \delta_t + \beta \cdot X_{ijzt} + \gamma \cdot GSE_{iz} + \varepsilon_{ijzt}$$

- *i* individual mortgage.
- *j* MBS deal.
- z mortgage pool (either GSE or non-GSE).
- t year in which MBS deal containing loan was issued.
- *Def_{ijz}* default indicator measured over specific horizon: Defined in calendar time (i.e. through 2008) or relative to period of issuance.
- GSE_{iz} indicator variable for mortgages in GSE pools.
- X_{ijzt} vector of underwriting variables and controls for economic factors
- δ_t issue year fixed effects
- η_j deal-level fixed effects

Empirical Identification Strategy

- Deal-level fixed effects play crucial role.
- Comparing ex-post performance of loans in GSE versus non-GSE mortgage pools *within the same deal*.
- Controls for factors that are typically difficult to account for directly:
 - Endogenous investor security matching.
 - Any unobserved deal-level characteristics, including:
 - Issuer, subordination levels, mortgage servicer, mortgage originator (in many cases).
 - Economic conditions at the time of issuance.
- Drawback: Inclusion of thousands of fixed effects limits focus to linear probability models (LPM).
 - Computationally demanding to estimate non-linear discrete choice models with many FEs.
 - Incidental parameters problem.

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Data

- CoreLogic Private Label Securities Database
- Loan-level data on mortgages that backed subprime PLS.
 - Publicly available data from the PLS trustees that CoreLogic cleans and organizes.
 - Coverage of the entire subprime PLS market before the crisis.
 - Extensive information on underwriting characteristics at origination.
 - Detailed information on loan performance after origination.
 - Used by many institutional PLS investors.
- Loans backing subprime deals issued between 2003 and 2007.
 - Over 10 million loans in approximately 1,800 deals.

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Data

- Additional information on attributes of subprime (triple-A) securities hand-collected from Bloomberg.
 - Face value, yield spreads, weighted average life.
 - Matched to CoreLogic by merging on individual security identifiers (CUSIPs).
- Identity of issuers from Bloomberg and SEC database on company filings (hand-collected from pooling and servicing agreements).
- House price indices from CoreLogic and unemployment rates from BLS.

Controls

- Underwriting variables:
 - Credit score, LTV ratio (cumulative), loan maturity, original balance, coupon at origination, # months seasoned, indicators for adjustable and fixed-rate loans, interest-only loans, negatively amortizing loans, occupancy status, low/no documentation, property type (condo, single-family), prepayment penalty, balloon mortgages, purchase/refi, jumbo loans, unemployment rate at origination (county), price index at origination (county), state fixed effects.
- Economic factors that impact loan performance:
 - Cumulative change in unemployment rate over horizon (measured at county-level).
 - Cumulative house price appreciation over horizon (measured at county-level)

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Assumptions and Sample Restrictions

- Consider three horizons measured from time of deal issuance: Through 2008, 2010, and 2012.
- Default defined as being *at least* 60 days delinquent at some point over horizon.
- Cluster standard errors by quarter of issuance.
- Sample restrictions:
 - Loans backing subprime deals only (no "alt-a" or "jumbo-prime")
 - First and second liens only.
 - Loans seasoned less than 12 months before appearing in CoreLogic database.

Data: Summary Stats

	Non-GSE Loans $(N = 6,324,311)$	$\begin{array}{l} \textbf{GSE Loans} \\ (N=4,\!140,\!711) \end{array}$
FICO (Points)	642	616
Balance (\$)	159,305	156,835
CLTV (P.Points)	88.8	84.4
Interest Rate (P. Points)	8.6	7.9
Term (months)	314	350
Trailing 12-month unemployment change	-6.5%	-5.3%
Unemployment change through 2012	54.7%	47.1%
Trailing 12-month HPA	12.1%	12.3%
HPA through 2012	-17.5%	-13.8%
UAG %	49.4%	52.4%
Low Documentation	0.41	0.35
Non-Owner Occupied	0.08	0.09
Purchase Loan	0.51	0.36
Cash-Out Refinance	0.42	0.56
Interest-Only	0.14	0.10
Balloon	0.22	0.09
ARM	0.49	0.74
Prepay Penalty	0.61	0.72
Default Rate through 2008Q4	0.34	0.31
Default Rate through 2010Q4	0.42	0.38
Default Rate through 2012Q4	0.44	0.39

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Results

• LPM of ex-post default indicator on GSE pool indicator.

• With and without controls for observable loan/borrower characteristics.

0	With	and	without	deal	FES.

Horizon		2008:Q4			2010:Q4			2012:Q4	
GSE (d)	0.016 ***	- 0.011 ***	- 0.019 ***	0.014**	- 0.008 ***	- 0.016 ***	0.012**	- 0.008 ***	- 0.015 ***
	(3.04)	(5.97)	(10.69)	(2.49)	(4.03)	(8.77)	(2.30)	(3.74)	(7.99)
Deal F.E. ? Covariates ? Issue Year F.E. ?	N N Y	N Y Y	Y Y	N N Y	N Y Y	Y Y	N N Y	N Y Y	Y Y
# Loans	10,465,022	10,465,022	10,464,165	10,465,022	10,465,022	10,464,165	10,465,022	10,465,022	10,464,165
# Deals	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
Adjusted R ²	0.04	0.14	0.16	0.09	0.19	0.20	0.11	0.20	0.21

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Results

- Mortgages in GSE pools default at higher *unconditional* rates relative to other securitized subprime loans.
 - GSEs purchased subprime PLS comprised of *observably* riskier mortgages.
- Results flip with the inclusion of controls for loan/borrower characteristics.
 - Conditional on observable underwriting variables, loans in GSE pools defaulted at lower rates.
- Inclusion of deal FEs widens the gap in performance
 - Loans in GSE pools default 1.5% 1.9% *less* (on average) than loans in non-GSE pools within same deal.
- $\bullet \Rightarrow$ GSE loans performed better due to unobservable factors.
 - Unobservable to other investors (private information) or unobservable to us (omitted variables)?

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Low Doc Mortgages and Private Information

- Previous studies have found that private/soft information especially important among low documentation mortgages.
 - E.g. Keys, Seru, and Vig (2012); Begley and Purnanandum (2013); and Jiang, Nelson, and Vytlacil (2014).
- Test to see if performance differences larger in sample of low documentation loans.

Horizon	2008	3:Q4	2010):Q4	2012	2:Q4	
GSE (d)	-0.019***	-0.007***	-0.016***	-0.006**	-0.015***	-0.006**	
	(10.69)	(4.17)	(8.77)	(2.53)	(7.99)	(2.55)	
Low Doc (d)	0.057***	0.070***	0.060***	0.072***	0.058***	0.069***	
	(8.22)	(10.04)	(8.94)	(10.77)	(9.58)	(11.60)	
GSE*Low Doc		-0.032***		-0.029***		-0.026***	_
		(9.19)		(8.76)		(8.73)	(≫ li
Deal F.E. ?	Y	Y	Y	Y	Y	Y	
Covariates ?	Y	Y	Y	Y	Y	Y	
Issue Year F.E. ?							
# Loans	10,464,165	10,464,165	10,464,165	10,464,165	10,464,165	10,464,165	
# Deals	1,809	1,809	1,809	1,809	1,809	1,809	
Adjusted R ²	0.16	0.16	0.20	0.20	0.21	0.21	
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August 23, 2016 23 / 36

Low Doc Mortgages and Private Information

• Re-estimate regression separately by quarter (issuance) to see how ex-post performance difference evolved over time:



Private Information and Issuer Identity

- Significantly larger performance differences in low documentation sample consistent with importance of private information.
 - Issuers using private information to provide GSEs with higher quality loans.
 - Issuers possibly motivated by reputation concerns and desire to continue attracting the GSEs' business.
- Test by constructing a measure of the frequency of interaction between the GSEs and subprime PLS issuers.
 - Expect issuers that routinely transact with GSEs and may depend on GSE business to have the most incentive to provide high quality loans.

- For each issuer k and quarter t in our sample calculate two variables:
 - $TD_{kt} = \text{Total } \# \text{ of deals securitized by issuer } k \text{ before quarter } t.$
 - TD_{kt}^{GSE} = Number of deals securitized by issuer k before quarter t that contained a GSE mortgage pool.

• GSE Deal Fraction_{kt} =
$$\frac{TD_{kt}^{GSE}}{TD_{kt}}$$

Private Information and Issuer Identity

• Issuers with Highest "GSE Deal Fraction":

lssuer	Average	e value	of GSE	Deal Fr	raction	(%)	# Deals
ISSUEI	All Years	2003	2004	2005	2006	2007	(2003 - 2007)
Fremont	100	100	100	100	100		28
Fieldstone	98.3		100	100	94.1	91.7	13
Wells Fargo	94.4		100	100	87.4	63.6	11
Barclays	91.8		100	100	88.8	84.0	36
Washington Mutual	83.7	84.7	78.2	82.5	86.1	87.9	43
UBS	82.5	100	97.3	89.4	68.7	61.3	42
Morgan Stanley	80.4	75.3	79.5	83.5	81.8	78.6	111
National City	77.8	73.1	77.3	78.2	79.4		65
Goldman Sachs	77.3	100	91.3	78.0	70.9	69.0	65
Deutsche Bank	75.7	64.4	81.7	78.9	74.3	73.2	74
All Issuers	59.7	43.1	59.8	62.4	61.4	58.1	1,751

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Private Information and Issuer Identity

• Ex-post default regression including interaction term between GSE pool indicator and "GSE Deal Fraction"

Horizon	2008:Q4	2010:Q4	2012:Q4
GSE (d)	0.013***	0.012***	0.011***
	(3.59)	(4.03)	(4.21)
GSE*Low Doc	-0.032***	-0.029***	-0.026***
	(8.99)	(8.76)	(8.72)
GSE* "GSE Deal Fraction"	-0.033***	-0.027***	-0.026***
	(5.73)	(4.56)	(4.43)
Deal F.E. ?	Y	Y	Y
Covariates ?	Y	Y	Y
# Loans	10,156,202	10,156,202	10,156,202
# Deals	1,724	1,724	1,724
Adjusted R ²	0.16	0.20	0.21

Private Information and Issuer-Originator Affiliation

- Low documentation status and *GSE Deal Fraction* explains the entire ex-post performance differential between loans in GSE versus non-GSE pools within the same deal.
 - Consistent with reputation-based mechanism.
- But how could PLS issuers attain private information? The originator is more likely to obtain private information, since it interacts with mortgage borrowers.
 - Issuers and originators often affiliated entities and hence may be easier to transfer private information about loan quality.
 - Similar argument made by Demiroglu and James (2012), He, Qian, Strahan (2012), and Furfine (2014).
- Identify originator-issuer relationships and separately estimate regressions for affiliated and non-affiliated deals.

Private Information and Issuer-Originator Affiliation

• Separately estimate regression for loans in deals with and without an affiliation between originator and issuer.

• About 2/3 of loans contain info. on originator identity.

	Δ	filiated Dea	ls	Unaffiliated Deals			
Horizon	2008:Q4	2010:Q4	2012:Q4	2008:Q4	2010:Q4	2012:Q4	
GSE (d)	0.026**	0.025***	0.024***	-0.005	-0.014**	-0.015**	
	(2.43)	(2.91)	(3.01)	(0.78)	(2.24)	(2.45)	
GSE*Low Doc	-0.034***	-0.025***	-0.022***	-0.032***	-0.009	-0.008	
	(6.29)	(6.26)	(6.19)	(7.08)	(0.80)	(0.80)	
GSE* "GSE Deal Fraction"	-0.052***	-0.051***	-0.050***	-0.005	0.009	0.010	
	(3.21)	(3.58)	(3.70)	(0.58)	(1.00)	(1.14)	
Deal F.E. ?	Y	Y	Y	Y	Y	Y	
Covariates ?	Y	Y	Y	Y	Y	Y	
# Loans	2,668,773	2,668,773	2,668,773	3,374,320	3,374,320	3,374,320	
# Deals	396	396	396	695	695	695	
Adjusted R ²	0.15	0.19	0.21	0.15	0.19	0.21	

- Matched sample. Ink
- Better geographic controls. Ink
- Low documentation sample only. Ink
- Exclusion of non-conforming (jumbo) mortgages.
- Exclusion of second liens. •• link
- Exclusion of fixed-rate mortgages.
- Different default thresholds and horizons. •• link
- Non-linear models (logit, multinomial logit).
- Servicer heterogeneity.
- Ex-ante default analysis. •• link

Pricing Analysis

- If performance differences between loans in GSE and non-GSE pools were forecastable by PLS investors, they should be priced into the securities.
 - Expect higher prices/lower yields on the triple-A GSE securities compared to the triple-A non-GSE securities within the same subprime deal.
- Test for differences in yield spreads of triple-A securities with claims on GSE and non-GSE loan pools.
 - Focus on floating rate tranches (or inverse floaters) to eliminate pricing differentials caused by prepayment behavior.
 - Construct pool-level yields by aggregating across securities using weights based on original \$ amount.
 - Control for pool size and weighted average expected life, and include deal FEs.
 - Note: Yield spreads only good proxy for transaction prices if securities purchased at par.

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Pricing Analysis: Summary Stats

Year		Non-GSE	GSE	Difference
	# Pools Pool Size (\$ millions)	312 19 34	172 19.83	140 0 49***
2003	Spread (bps)	36.96	38.83	1.87
	Average Life (years)	2.91	2.85	-0.07
	# Pools	419	297	122
2004	Pool Size (\$ millions)	19.59	20.11	0.52***
2004	Spread (bps)	30.16	33.17	3.01***
	Average Life (years)	2.66	2.76	0.10*
	# Pools	511	316	195
2005	Pool Size (\$ millions)	19.92	20.02	0.11**
2005	Spread (bps)	20.02	25.88	5.86***
	Average Life (years)	2.31	2.51	0.19***
	# Pools	537	314	223
2006	Pool Size (\$ millions)	20.05	19.72	-0.32***
2000	Spread (bps)	13.46	16.44	2.98***
	Average Life (years)	2.15	2.30	0.15***
	# Pools	241	171	70
2007	Pool Size (\$ millions)	19.90	19.58	-0.32***
2007	Spread (bps)	23.47	25.27	1.80
	Average Life (years)	2.20	2.18	-0.02
	# Pools	2,020	1,270	750
A 11	Pool Size (\$ millions)	19.79	19.88	0.09***
All	Spread (bps)	23.41	26.92	3.51***
	Average Life (years)	2.42	2.51	0.09***

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Pricing Analysis: Results

	(1)	(2)	(3)	(4)	(5)	(6)
GSE (d)	2.71***	3.55***	-2.41	4.68***	6.36***	2.75
	(4.59)	(3.99)	(1.28)	(7.20)	(3.88)	(1.26)
Average Life	5.41***	6.99***	6.99***	4.52***	5.49***	5.50***
	(6.53)	(6.66)	(7.66)	(4.73)	(4.78)	
GSE * "GSE Deal Fraction"			9.61***			6.57**
			(3.29)			(2.03)
Pool Characteristics?	Ν	Ν	Ν	Y	Υ	Y
Issue Quarter FE?	Y			Y		
Deal FE?	Ν	Y	Y	Ν	Y	Y
# Pools	3,290	3,290	3,290	3,290	3,290	3,290
R ²	0.56	0.79	0.79	0.62	0.84	0.84

- Yield spreads on GSE-purchased securities are three to six basis points higher than those purchased by non-GSE investors *in same deal*.
- GSEs received particularly good deals from issuers that frequently included GSE pools in their deals.

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GSEs and Suprime MBS

Were Non-GSE Investors Negatively Affected?

- Focus on only non-GSE loan pools.
- Compare non-GSE loan performance in deals with GSE participation to non-GSE loans in deals without GSE participation.
- Not a completely clean exercise since we cannot control for selection into GSE deals.

Panel A: Differences in Default Propensities						
	(1)	(2)	(3)	(4)	(5)	(6)
GSE Deal	0.026*** (4.49)	0.022*** (4.26)	-0.012 (1.52)	0.029*** (6.14)	0.024*** (5.54)	0.007 0.58
GSE Deal * Low Doc		0.014*** (3.57)	0.013*** (3.61)		0.013*** (2.92)	0.012*** (2.86)
GSE Deal * Deal Fraction			0.065*** (4.51)			0.030 (1.63)
Covariates ?	Y	Y	Y	Y	Y	Y
Issuer FEs ?	Ν	Ν	Ν	Y	Y	Y
# Loans Adjusted R ²	6,209,878 0.16	6,209,878 0.16	6,132,891 0.17	6,209,878 0.17	6,209,878 0.17	6,132,891 0.17

Concluding Remarks

- We use a unique feature of the structure of subprime PLS deals to identify those securities purchased by Fannie Mae and Freddie Mac.
- Controlling for deal-level fixed effects, we find that mortgages backing subprime PLS purchased by the GSEs had similar ex ante risk characteristics, but better ex post performance.
- Results are principally driven by low documentation mortgages specifically those in deals sold by GSE-dependent issuers affiliated with the loan originators.
 - Consistent with reputation-building by issuers.
 - Also consistent with concerns about put-back risk.
- Suggestive evidence that other investors may have been negatively impacted by GSEs' presence.

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GSEs and Suprime MBS

August 23, 2016 36 / 36

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SUPPLEMENTARY SLIDES

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August 23, 2016 1 / 27

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- Compare aggregate security purchases generated from algorithm with information from Federal Crisis Inquiry Commission (FCIC) Report.
- Can use information from FCIC figure to impute Freddie Mac subprime PLS purchases during 2003–2005 period.
 - Don't have access to raw data, so can only obtain approximate numbers.
- Use imputed Freddie purchases from FCIC along with information from FHFA on Freddie purchases 2006-2007 and Fannie purchases 2003–2007 to generate total annual GSE subprime PLS purchases 2003–2007.

Validation of Algorithm

• GSE Subprime PLS Annual Purchases: 2003–2007 (\$ billions):

	FHFA Report to Congress Total Fannie Mae		FCIC Report Freddie Mac	FHFA + FCIC Reports Total	Algorithm Total
2003		25.8	[44-48]	[69.8-73.8]	67.7
2004		67.0	[70-74]	[137-141]	141.0
2005		24.4	[112-116]	[136.4-140.4]	134.4
2006	110.4	35.6	[72-76]	[107.6-111.6]	106.0
2007	59.6	16.0	[37-41]	[53-57]	50.1

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- FHFA announced lawsuits against PLS issuers in September of 2011.
 - Lawsuits focused on 718 securities purchased by the GSEs.
- Used associated tickers in the public documents to obtain information from Bloomberg regarding collateral type.
 - According to Bloomberg, 478 were subprime securities.
 - Face values of \$37.3 billion, \$80.7 billion, and \$38.3 billion in 2005, 2006, and 2007, respectively.
- Our algorithm identifies 476/478 as GSE securities.
 - Type I error rate = 0.4%

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Robustness: Conforming Loans Only

- Attempt to rule out alternative explanations of the results driven by institutional features of the GSEs.
- Biggest difference between GSE and non-GSE loan pools is the presence of jumbo loans.
 - Allows us to identify the two types of loans pools.
 - But, might worry that there is some (omitted) fundamental difference between jumbo and conforming loans, that is driving the results.
- Re-estimate all regressions excluding jumbo loans from sample.
 - Only compare *conforming* loans in GSE vs. non-GSE pools.

	Horizo	n through 20	008:Q4	Horizo	n through 20	010:Q4	Horizo	Horizon through 2012:Q4		
GSE (d)	-0.022*** (10.67)	-0.010*** (5.69)	0.011*** (2.87)	-0.019*** (8.81)	-0.007*** (3.07)	0.011*** (3.48)	-0.018*** (8.04)	-0.007*** (2.94)	0.011*** (3.66)	
GSE*Low Doc	()	-0.034*** (9.28)	-0.033*** (9.07)	. ,	-0.032*** (9.40)	-0.033*** (9.40)	. ,	-0.030*** (9.58)	-0.030*** (9.56)	
GSE* "GSE Deal Fraction"		. ,	-0.034*** (5.85)			-0.029*** (4.64)		. ,	-0.028*** (4.44)	
Deal F.E. ? Covariates ?	Y Y									
# Loans # Deals Adjusted R ²	9,783,310 1,809 0.15	9,783,310 1,809 0.15	9,495,412 1,724 0.15	9,783,310 1,809 0.20	9,783,310 1,809 0.20	9,495,412 1,724 0.20	9,783,310 1,809 0.21	9,783,310 1,809 0.21	9,495,412 1,724 0.21	

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Robustness: First Liens Only

- GSE pools include significantly fewer 2nd lien mortgages.
- Estimate on sample of first liens only.

	Horizo	n through 20	008:Q4	Horizo	n through 20	010:Q4	Horizon through 2012:Q4		
GSE (d)	-0.014***	-0.006***	0.013***	-0.013***	-0.006***	0.011***	-0.013***	-0.006***	0.010***
	(7.28)	(2.91)	(3.46)	(6.37)	(3.11)	(3.80)	(5.96)	(3.15)	(3.88)
GSE*Low Doc		-0.026***	-0.026***		-0.020***	-0.020***		-0.018***	-0.018***
		(9.48)	(8.99)		(8.11)	(7.89)		(7.47)	(7.30)
GSE* "GSE Deal Fraction"			-0.030***			-0.027***			-0.026***
			(4.83)			(4.53)			(4.50)
Deal F.E. ?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Covariates ?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Issue Year F.E. ?		·							
# Loans	7,743,382	7,743,382	7,530,399	7,743,382	7,743,382	7,530,399	7,743,382	7,743,382	7,530,399
# Deals	1,632	1,632	1,561	1,632	1,632	1,561	1,632	1,632	1,561
Adjusted R ²	0.14	0.14	0.14	0.19	0.19	0.18	0.19	0.19	0.19

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Robustness: Alternative Default Defn. and Horizons

• Define default threshold to be 90-days delinquent (instead of 60-days):

	Horizo	on through 20	08:Q4	Horizo	on through 20	10:Q4	Horizo	on through 20	12:Q4
GSE (d)	-0.019*** (10.43)	-0.007*** (4.66)	0.012*** (3.45)	-0.016*** (9.62)	-0.005*** (2.68)	0.009*** (3.18)	-0.015*** (8.75)	-0.006*** (2.65)	0.008*** (3.21)
GSE*Low Doc	. ,	-0.033*** (9.88)	-0.033*** (9.66)	· · /	-0.029*** (8.91)	-0.030*** (9.07)	()	-0.027*** (8.76)	-0.027*** (8.95)
GSE* "GSE Deal Fraction"			-0.031*** (5.41)			-0.023*** (3.84)			-0.021*** (3.66)
Deal F.E. ? Covariates ?	Y Y								
# Loans # Deals Adjusted R ²	10,464,165 1,809 0.15	10,464,165 1,809 0.15	10,156,202 1,724 0.15	10,464,165 1,809 0.21	10,464,165 1,809 0.21	10,156,202 1,724 0.21	10,464,165 1,809 0.22	10,464,165 1,809 0.22	10,156,202 1,724 0.22

Robustness: Alternative Default Defn. and Horizons

• Measure default horizon relative to the month of issuance rather than a specific point in (calendar) time:

Horizon		24 Months			36 Months	
GSE (d)	-0.016***	-0.006***	0.008***	-0.016***	-0.005***	0.012***
	(6.89)	(3.26)	(1.77)	(8.50)	(2.42)	(3.27)
GSE*Low Doc		-0.027***	-0.028***		-0.031***	-0.031***
		(6.78)	(7.08)		(9.39)	(9.41)
GSE* "GSE Deal Fraction"			-0.021***			-0.027***
			(2.83)			(4.46)
Deal F.E. ?	Y	Y	Y	Y	Y	Y
Covariates ?	Y	Y	Y	Y	Y	Y
# Loans	10,464,165	10,464,165	10,156,202	10,464,165	10,464,165	10,156,202
# Deals	1,809	1,809	1,724	1,809	1,809	1,724
Adjusted R ²	0.16	0.16	0.16	0.20	0.20	0.20
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Robustness: Adjustable-Rate Mortgages Only

- Majority of subprime PLS loans were ARMs.
- Significantly larger fraction of ARMs in GSE pools compared to non-GSE pools.
 - 75% versus 49%.
- Might worry that there is some (omitted) fundamental difference between subprime ARMs and FRMs, that is driving the results.
- Re-estimate all regressions excluding FRMs from sample.
 - Only compare ARMs in GSE vs. non-GSE pools.
- Also addresses differences in prepayment behavior that might also drive performance results, since ARMs do not contain significant prepayment risk.

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Robustness: Adjustable-Rate Mortgages Only

	Horizo	n through 20	008:Q4	Horizo	n through 20)10:Q4	Horizo	Horizon through 2012:Q4		
GSE (d)	-0.015*** (7.23)	-0.005** (2.04)	0.019*** (5.19)	-0.015*** (6.76)	-0.007** (2.62)	0.015*** (4.72)	-0.015*** (6.61)	-0.007*** (2.90)	0.013*** (4.39)	
GSE*Low Doc		-0.028*** (8.92)	-0.028*** (8.54)		-0.023*** (7.87)	-0.023*** (7.69)		-0.021*** (7.51)	-0.021*** (7.32)	
GSE* "GSE Deal Fraction"			-0.037*** (6.06)			-0.033*** (5.59)			-0.032*** (5.43)	
Deal F.E. ?	Y	Y	Y	Y	Y	Υ	Y	Y	Y	
Covariates ?	Y	Y	Y	Y	Y	Y	Y	Y	Y	
# Loans # Deals Adjusted R ²	6,161,367 1,634 0.14	6,161,367 1,634 0.15	5,971,766 1,557 0.14	6,161,367 1,634 0.2	6,161,367 1,634 0.2	5,971,766 1,557 0.19	6,161,367 1,634 0.21	6,161,367 1,634 0.21	5,971,766 1,557 0.21	

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Robustness: Matched Sample Analysis

- Major concern is not adequately controlling for differences in observable mortgage and borrower characteristics between loans in GSE and non-GSE pools.
 - Summary statistics show some significant differences.
- Nearest-neighbor match based on propensity score (likelihood of loan being placed in GSE pool).
 - Estimate propensity score using fairly rich logit specification.
 - Match within deals, without replacement.
- Estimated propensity score distributions:



Robustness: Matched Sample Analysis

	Full s	ample	Full s	ample	Matcheo	l Sample
	(uncon	ditional)	(conditional	on deal F.E.)		
	Non-GSE	GSE	Non-GSE	GSE	Non-GSE	GSE
	N = 6,324,311	N = 4,140,711	N = 6,324,311	N = 4,140,711	N = 1,724,149	N = 1,724,149
Continuous Variables	Mean	Mean	Mean	Mean	Mean	Mean
FICO (Points)	642	616	635	626	618	624
Balance (\$)	159,224	156,907	183,399	119,987	163,977	156,558
CLTV (P.Points)	88.8	84.4	87.8	85.8	86.5	85.9
Orig. Rate (P. Points)	8.64	7.94	8.40	8.31	8.22	8.10
Term (months)	314	350	327	332	349	346
Unemployment (P. Points)	5.09	5.39	5.18	5.25	5.22	5.15
Trailing 12-month unemployment change	-6.5%	-5.3%	-6.2%	-5.8%	-6.3%	-6.1%
Unemployment change through 2012	54.7%	47.1%	63.1%	59.7%	62.7%	61.7%
Price Index	181	168	179	170	177	174
Trailing 12-month HPA	12.1%	12.3%	12.5%	11.6%	12.0%	11.9%
HPA through 2012	-17.5%	-13.8%	-16.4%	-15.6%	-17.0%	-16.5%
UAG %	49.4%	52.4%	49.4%	52.5%	53.2%	52.8%
Indicator Variables						
Low Documentation (share)	0.412	0.347	0.399	0.361	0.365	0.342
Non-Owner Occupied (share)	0.083	0.084	0.077	0.095	0.072	0.080
Purchase Loan (share)	0.508	0.356	0.499	0.366	0.495	0.439
Cash-Out Refinance (share)	0.422	0.563	0.432	0.548	0.442	0.482
Interest-Only (share)	0.137	0.096	0.138	0.090	0.114	0.122
Balloon (share)	0.225	0.094	0.175	0.167	0.134	0.126
ARM (share)	0.489	0.744	0.549	0.650	0.688	0.654
Prepay Penalty (share)	0.616	0.719	0.646	0.631	0.733	0.699
Default Rate through 2008:Q4	0.338	0.315	0.342	0.308	0.385	0.344
Default Rate through 2010:Q4	0.421	0.376	0.416	0.383	0.458	0.424
Default Rate through 2012:Q4	0.444	0.393	0.436	0.405	0.477	0.447

Robustness: Matched Sample Analysis

• Estimate same specification on matched sample.

• Include covariates since balance is not perfect.

	Horizo	n through 20	008:Q4	Horizo	n through 20	010:Q4	Horizon through 2012:Q4		
GSE (d)	-0.018***	-0.011***	0.008***	-0.016***	-0.011***	0.005*	-0.015***	-0.011***	0.005
GSE * Low Doc	(8.05)	(5.43) -0.020***	(2.35) -0.019***	(6.19)	(4.93) -0.014***	(1.66) -0.014***	(5.78)	(4.72) -0.012***	(1.60) -0.012***
		(9.99)	(9.34)		(8.52)	(8.39)		(7.44)	(7.33)
GSE* "GSE Deal Fraction"			-0.031*** (5.39)			-0.026*** (4.34)			-0.024*** (4.34)
Deal F.E. ?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Covariates ?	Y	Y	Y	Y	Y	Y	Y	Y	Y
# Loans	3,448,298	3,448,298	3,448,298	3,448,298	3,448,298	3,448,298	3,448,298	3,448,298	3,448,298
# Deals	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130	1,130
Adjusted R ²	0.05	0.13	0.14	0.10	0.18	0.19	0.11	0.19	0.20
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Robustness: Better Geographic Controls

- Concerned that differences in highly localized economic factors (house prices, employment shocks) across loans in GSE and non-GSE pools could drive results.
- Also concerned that GSEs' had higher demand for loans in areas that qualified for the affordable housing goals.
 - May have created unobservable differences in the geographic concentration of GSE and non-GSE pools.
- Address concerns by estimating specification with zipcode fixed effects.
 - Comparing loans in GSE pools vs. non-GSE pools in the same subprime deal located in the same zipcode.

Robustness: Better Geographic Controls

	Horizo	n through 20	008:Q4	Horizo	n through 20	010:Q4	Horizon through 2012:Q4		
GSE (d)	-0.011***	-0.002	0.017***	-0.013***	-0.005*	0.007*	-0.014***	-0.007***	0.002
	(7.31)	(0.91)	(4.81)	(6.58)	(1.86)	(1.66)	(6.86)	(2.74)	(0.36)
GSE*Low Doc		-0.027***	-0.027***		-0.024***	-0.024***		-0.021***	-0.022***
		(8.13)	(8.04)		(8.05)	(8.37)		(8.16)	(8.61)
GSE* "GSE Deal Fraction"			-0.029***			-0.017***			-0.013*
			(5.21)			(2.45)			(1.82)
Deal F.E. ?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Covariates ?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Zip Code F.E.?	Y	Y	Y	Y	Y	Y	Y	Y	Y
# Loans	5,226,211	5,226,211	5,073,048	5,226,211	5,226,211	5,073,048	5,226,211	5,226,211	5,073,048
# Deals	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809	1,809
Adjusted R ²	0.19	0.19	0.19	0.23	0.23	0.23	0.24	0.24	0.24

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Robustness: Low Documentation Sample

- Concern that performance of low doc loans may be differentially sensitive to observable risk characteristics (particularly those in GSE pools).
- By pooling low doc and full doc loans together, differential sensitivity may confound the GSE effect.

	Horizo	Horizon through 2008:Q4 25*** 0.005 0.010*** .10) (1.35) (2.63) -0.046*** -0.044*** (7.08) (7.63)		Horizo	Horizon through 2010:Q4			Horizon through 2012:Q4		
GSE (d)	-0.025***	0.005	0.010***	-0.020***	0.003	-0.001	-0.020***	0.003	-0.006*	
GSE* "GSE Deal Fraction"	(11.10)	(1.35) -0.046*** (7.08)	(2.63) -0.044*** (7.63)	(9.26)	(1.12) -0.036*** (6.06)	(0.38) -0.026*** (4.88)	(8.65)	(1.04) -0.035*** (5.80)	(1.95) -0.021*** (5.03)	
Deal F.E. ?	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Covariates ?	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Zip Code F.E.?	N	N	Y	N	N	Y	N	N	Y	
# Loans	4,021,713	3,893,223	3,889,065	4,021,713	3,893,223	3,889,065	4,021,713	3,893,223	3,889,065	
# Deals	1,782	1,707	1,707	1,782	1,707	1,707	1,782	1,707	1,707	
Adjusted R ²	0.22	0.22	0.22	0.26	0.26	0.26	0.27	0.27	0.27	
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	Horizo	n through 20	08:Q4	Horizo	n through 20	10:Q4	Horizon through 2012:Q4		
GSE (d)	-0.015***	-0.004***	0.016***	-0.014***	-0.005***	0.013***	-0.014***	-0.005***	0.012***
	(10.70)	(2.56)	(4.56)	(9.09)	(2.53)	(4.15)	(8.91)	(2.87)	(3.81)
GSE*LOW DOC		-0.030	-0.030		-0.027	-0.027		-0.025	-0.025
GSE* "GSE Deal Fraction"		()	-0.032***		()	-0.027***		()	-0.026***
			(5.82)			(4.55)			(4.32)
Deal F.E. ?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Covariates ?	Y	Y	Y	Y	Y	Y	Y	Y	Y
# Loans	10,018,355	10,018,355	9,742,002	10,018,355	10,018,355	9,742,002	10,018,355	10,018,355	9,742,002
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Robustness: Servicer Heterogeneity

- Within-deal servicer heterogeneity is not accounted for with deal FEs.
- Not much within-deal heterogeneity:

	# Deals (2003-2007)	% of Deals
Servicer ID is Populated	1,455	80.43
Servicer ID is Missing for All Loans in Deal	318	17.58
Servicer ID is Missing for Some Loans in Deal	36	1.99
Total	1,809	100
	# Deals (2003-2007)	% of Deals
Same Servicer for All Loans in Deal	1,170	80.41
Different Servicers in Deal	285	19.59
Total	1,455	100

• Drop all loans that are in deals with more than one servicer:

	Horizo	n through 20	008:Q4	Horizo	n through 20	010:Q4	Horizo	orizon through 2012:Q4		
GSE (d)	-0.021***	-0.009***	0.007*	-0.017***	-0.008***	0.006	-0.017***	-0.009***	0.005	
	(10.74)	(4.50)	(1.70)	(7.23)	(3.17)	(1.62)	(6.63)	(3.23)	(1.43)	
GSE*Low Doc		-0.032***	-0.032***		-0.026***	-0.026***		-0.023***	-0.024***	
		(7.52)	(7.23)		(6.77)	(6.79)		(6.56)	(6.59)	
GSE* "GSE Deal Fraction"			-0.023***			-0.020***			-0.019***	
			(3.48)			(3.28)			(3.29)	
Deal F.E. ?	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Covariates ?	Y	Y	Y	Y	Y	Y	Y	Y	Y	
# Loans	6,413,780	6,413,780	6,161,913	6,413,780	6,413,780	6,161,913	6,413,780	6,413,780	6,161,913	
# Deals	1,169	1,169	1,106	1,169	1,169	1,106	1,169	1,169	1,106	
Adjusted R ²	0.15	0.15	0.15	0.20	0.20	0.19	0.21	0.21	0.21	

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- Forecast subprime mortgage default using only performance information available at the time of issuance (from past performance of loans in previous subprime deals).
- Idea is to see if there are significant differences in ex-ante credit risk between GSE and non-GSE loan pools that investors could have identified in real-time.
 - If there are and differences in same direction as the ex-post performance results, then sheds doubt on private information story.

Robustness: Ex-ante Default Analysis

- Follow basic methodology of Ashcraft, Goldsmith-Pinkham and Vickery (2010).
- Take all loans in pools that collateralized deals issued between 24 months and 12 months before issuance quarter, and track those loans over subsequent 12 months.
- Do the same for 24 and 36 month horizons.
- Identify defaulted loans.
- Estimate discrete choice model(s) of predicted default as function of observable underwriting characteristics for each quarter over 2003–2007 period.
- Use estimated parameters to construct predicted, cumulative default probabilities over 12, 24, and 36 month horizon for loans in both GSE and non-GSE pools.

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Robustness: Results: Ex-ante Default Analysis

- Ex-ante probabilities constructed using LPM, logit, multinomial logit, as well as competing risks, duration model.
- Regress predicted cumulative probabilities on GSE pool indicator with and without deal FEs.

Panel C: Multinomial Logit						
	12-mont	n Horizon	24-month Horizon		36-month Horizon	
GSE (d)	0.0042 (1.48)	-0.0016 (1.01)	0.0214*** (5.03)	0.0077*** (3.92)	0.0315*** (9.20)	0.0103*** (5.15)
Deal F.E.?	N	Y	N	Y	N	Y
# Loans # Deals Pseudo R ²	10,464,165 1,809 0.00	10,464,165 1,809 0.32	10,464,165 1,809 0.01	10,464,165 1,809 0.24	9,168,963 1,571 0.01	9,168,963 1,571 0.19

Panel D: Competing Risks Duration Model

	12-month Horizon		24-month Horizon		36-month Horizon	
GSE (d)	0.0019	-0.0019	0.0116***	0.007***	0.0084*	0.0106***
	(0.67)	(1.15)	(3.06)	(3.91)	(1.92)	(5.66)
Deal F.E.?	N	Y	N	Y	N	Y
# Loans	10,344,000	10,344,000	10,344,000	10,344,000	10,344,000	10,344,000
# Deals	1,804	1,804	1,804	1,804	1,804	1,804
Pseudo R ²	0.00	0.29	0.01	0.30	0.01	0.30

Robustness: Results: Ex-ante Default Analysis

- Ex-ante regressions show that:
 - GSEs purchased subprime PLS deals with observably riskier mortgages predicted default probability is 2%-3% higher over a 2-3 year horizon.
 - But the difference largely disappears once we include deal fixed effects.
- Robust to different underlying models, different default definition, separate estimation for first and second lien mortgages, conforming and jumbo loans, as well as ARMS and FRMS.
- Results support interpretation that ex-post performance differences do not reflect factors that were observable to MBS investors at time of contracting.



Other Covariates

	Horizon through 2008
GSE (d)	-0.007
	(4.17)
Low Doc (d)	0.070
	(10.04)
GSE*Low Doc	-0.032
	(9.19)
Owner Occupant (d)	-0.047
	(11.72)
Prepay Penalty (d)	0.047
	(9.47)
1-unit Single Family Prop. (d)	-0.004
	(3.03)
Condominium (d)	-0.024
	(10.71)
Balloon (d)	0.049
	(12.12)
# Months Seasoned	0.000
/	(0.00)
ARM (d)	-0.003
	(0.08)
Interest-Only (d)	0.046
	(10.31)
Negatively Amortizing (d)	0.046
	(1.73)
First Lien (d)	0.037
	(2.54)

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Other Covariates

Purchase Loan (d)	0.012
	(3.23)
Refinance Cash-Out (d)	-0.017
	(13.21)
LTV	0.002
	(8.53)
$70 \le LTV < 80$ (d)	0.023
	(5.04)
80 < LTV < 90 (d)	0.047
	(5.20)
$90 \leq LTV < 100 \; (d)$	0.074 5
	(6.37)
$LTV \ge 100 \; (d)$	0.130
	(8.24)
LTV = 80 (d)	0.026
	(6.78)
FICO	-0.001
	(25.93)
FICO < 580	0.025
	(7.05)
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Other Covariates

		_
$580 < FICO \leq 620$	0.022	
	(5.90)	
$620 < FICO \leq 660$	0.004	
	(1.24)	
$660 < FICO \leq 700$	-0.010	
	(4.32)	
Interest Rate	0.030	
	(17.04)	
Log (Loan Balance)	0.020	
	(2.27)	
Term	0.000	→ back
	(8.73)	
Jumbo (d)	0.023	
	(4.85)	
Unemp. Level at Origination	0.004	
	(6.17)	
Price Index Level at Origination	0.001	
	(7.90)	
Δ Unemp. through 2008	0.013	
	(2.76)	
HPA through 2008	-0.190	
	(4.30)	

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