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# Appraisal Inflation and Private Mortgage Securitization

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# Background

- From 2001 to 2006, non-agency originations increased from \$680 billion to \$1.480 trillion (118% increase) and non-agency MBS issuance increased from \$240 billion to \$1.033 trillion (330% increase).
- While private label mortgages constituted about 15% of all outstanding mortgages in 2009, they made up more than half of the foreclosure starts (Piskorski et al., 2010).
- The surge in private label mortgage securitization prior to the financial crisis fueled a large expansion in mortgage credit supply (Mian and Sufi, 2019).

# Question and Motivation

We investigate the relationship b/w appraisal inflation and securitization

- Inflated appraisal leads to insufficient collateral, underestimated LTV ratio, and higher loss severity in case of default.
- Growing body of evidence suggesting widespread appraisal inflation in the run-up to the housing market crash and directly linking it to the **foreclosure crisis** (Cho et al. 1996; Chinloy et al. 1997; Calem et al. 2015; Piskorski et al. 2015; Shi and Zhang 2015; Ding and Nakamura 2016; Kruger and Maturana 2016, 2019; Eriksen et al. 2019).
- Lenders may have strong incentives to press appraisers to inflate appraisals for loans intended for sale.
- Appraisal inflation is a major source of soft/private information that creates a potential for adverse selection problems in mortgage securitization

# Contribution

- Griffin and Maturana (2016) estimate that over 45 percent of privately securitized loans have inflated appraisals.
- Kruger and Maturana (2019) document that privately securitized mortgages with inflated appraisals are more likely to default and incur higher losses.
- Despite extensive evidence of appraisal inflation in securitized loans, it remains unclear what role securitization plays in appraisal inflation.
- We investigate the impact of securitization on appraisal inflation by examining and directly comparing the incidence of appraisal inflation in securitized vs portfolio loans
- We use refinance jumbo mortgages as a laboratory.
  - Jumbo Loans: to avoid endogeneity issues related to the securitization channel (GSEs versus private labels).
  - Refinance loans: because appraisal inflation is more critical for refinance loans than for purchase loans in LTV calculations.

# Broader Literature

## Securitization and Adverse Selection

- Ambrose et al. (2005) find that observably riskier loans are more likely to be retained by the lender
- Agarwal, Chang and Yavas (2012) find no significant difference between portfolio loans and sold loans with respect to default risk, but significant difference with respect to prepayment risk.
- Elul (2016) shows that privately securitized prime FRM loans are less likely to default while privately securitized prime ARM loans are more likely to default, compared to portfolio loans.

Role of securitization in the recent financial crisis (Mian and Sufi, 2009; Keys et al. ,2010; D Piskorski, Seru, and Vig, 2010; Agarwal et. al. 2010, 2011; Demyanyk and Van Hemert, 2011; Nadauld and Sherlund, 2013; Grin et al., 2020; Ding and Nakamura, 2016).

# Measuring Appraisal Bias

To measure appraisal quality or bias, the appraised value needs to be compared with the “fair” value of the property.

We use two approaches:

1. Use repeated transactions and require a subsequent property sale to be included in the sample. The HPI-adjusted later sale price of the same property is treated as a proxy for the “fair” value.
2. Use hedonic estimates of the “fair” value

# The Methodology

- We utilize two approaches. First, we conduct

## Ex-Ante Analysis of the Securitization Decision

$$\begin{aligned} Pr(Sec_i = 1) = & \alpha + \beta_1 \times AppraisInfl_i + \beta_2 \times LoanChars_i + \beta_3 \times PropChars_i \\ & + Lender + LocationTime_0 + \eta_i . \end{aligned}$$

# The Methodology

- Second, we recognize that properties securing sold loans and those securing portfolio loans might appreciate at different rates due to systematic differences in omitted loan/property characteristics between the two groups.

To enhance identification of the impact of securitization on appraisal inflation, we adopt a difference-in-difference approach by comparing

*differences in appraisal inflation between portfolio refinance and portfolio purchase mortgages*

vs

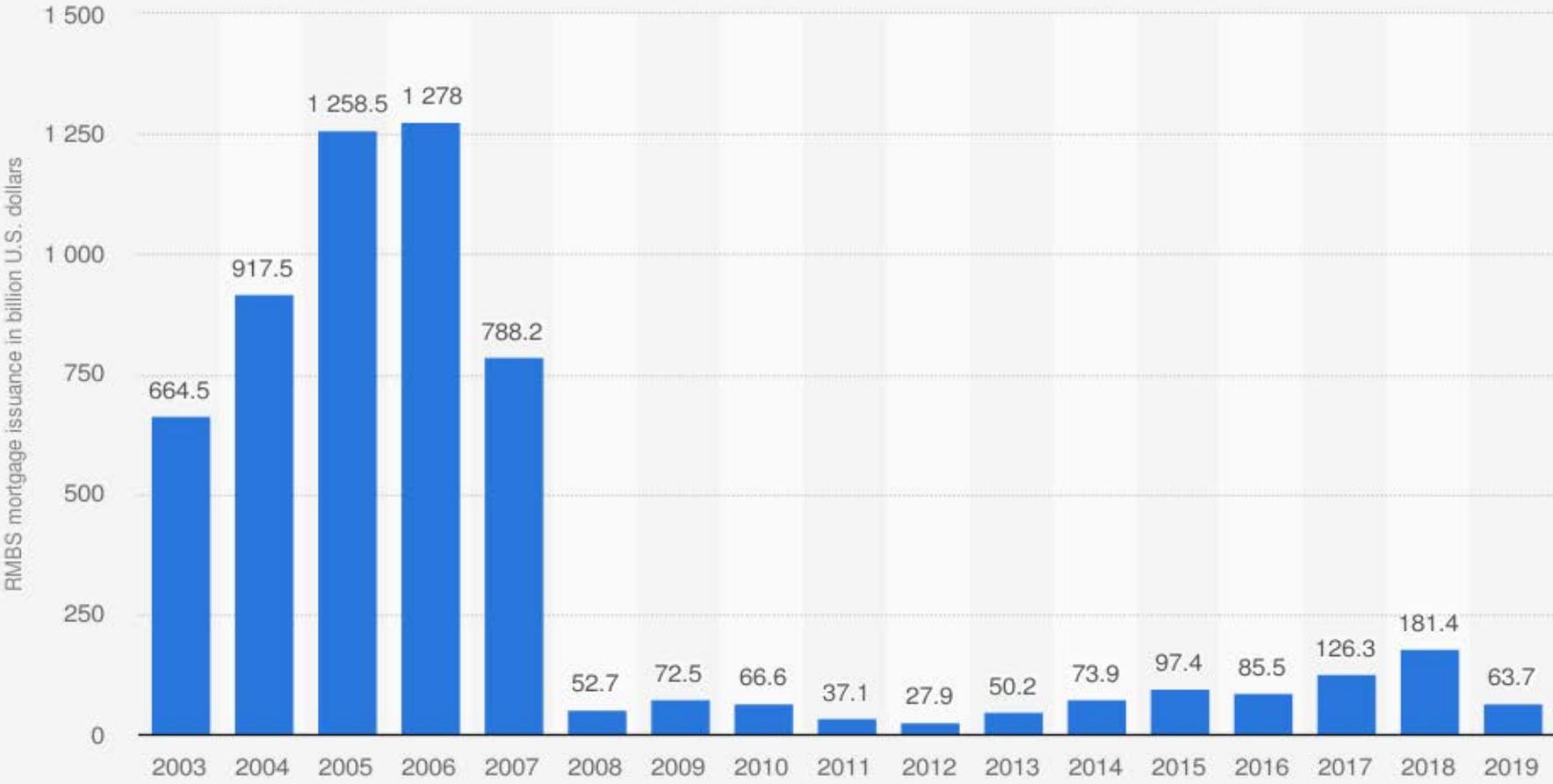
*differences in appraisal inflation between securitized refinance and securitized purchase mortgages*

- This allows us to attribute any significant difference in refinance-purchase appraisal inflation to whether the loan is securitized or not.

# LTV notches and Data

- Another important feature of our empirical design is our focus on appraisal bias at specific LTV notches, 80, 85, 90, 95, and 97% LTV ratios, where appraisal bias is likely to have the most impact on mortgage underwriting and pricing.
- We use mortgage origination and performance data from McDash, and property transaction and characteristics data from RealtyTrac.
- Mortgages originated between January 2005 and December 2006.

# RMBS issuance in the U.S.



Source  
SIFMA  
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Additional Information:  
United States; SIFMA; 2003 to 2019

# Summary Statistics

Table 1: Sample Summary Statistics

<i>Variable</i>	<i>Portfolio</i>		<i>Securitized</i>	
	<i>Mean</i>	<i>Std. Dev.</i>	<i>Mean</i>	<i>Std. Dev.</i>
Appraisal_0 (in \$1000)	784.675	238.644	753.711	228.381
Price_1 (in \$1000)	587.030	281.259	536.897	263.909
<u>Appraisal Inflation (Appraisal_0/Adj_Price_1)</u>	<u>1.173</u>	0.293	<u>1.181</u>	0.296
Notch	0.292	0.455	0.341	0.474
FICO (in 100)	7.039	0.554	6.969	0.595
CLTV (in %)	74.632	10.039	75.889	10.992
LowDoc	0.580	0.494	0.519	0.500
DTI (in %)	35.054	14.615	37.803	11.910
FRM	0.093	0.291	0.223	0.416

# Summary Statistics – Notch vs Non-notch

Table 2: Summary Statistics - Notch=0 versus Notch=1

<i>Variable</i>	<i>Sample</i>	<i>Portfolio</i>		<i>Securitized</i>	
		<i>Notch=0</i>	<i>Notch=1</i>	<i>Notch=0</i>	<i>Notch=1</i>
Appraisal_0/Adj_Price_1	Full Sample	<u>1.1581</u>	<u>1.2076</u>	<u>1.1512</u>	<u>1.2389</u>
Appraisal_0/Adj_Price_1	Distress=0	<u>1.0881</u>	<u>1.1085</u>	<u>1.0729</u>	<u>1.1406</u>

# Impact of Appraisal Inflation on Lender's Securitization Decision

Table 3: Securitization Decision and Appraisal Inflation

	Model (A)			Model (B)		
	(1)	(2)	(3)	(1')	(2')	(3')
<i>Dep. Var: Securitization Dummy</i>	<i>All Loans</i>	<i>Notch=0</i>	<i>Notch=1</i>	<i>All Loans</i>	<i>Notch=0</i>	<i>Notch=1</i>
Appraisal Inflation	0.0060 ( 0.0132)	-0.0125 ( 0.0167)	<u>0.0627***</u> ( 0.0230)	-0.0274 ( 0.0449)	-0.0089 ( 0.0523)	<u>0.1516**</u> ( 0.0695)
Control Variables	Y	Y	Y	Y	Y	Y
MSA*YYQQ Orig. FE	Y	Y	Y	Y	Y	Y
Lender FE	Y	Y	Y	Y	Y	Y
R-Square	0.1871	0.1904	0.2566	0.2049	0.2142	0.3133
N. Obs.	13,298	8,912	4,386	5,308	3,551	1,757
<b>Appraisal Inflation</b>	<b>AppraisInf – <math>\widehat{\text{Appreciation}}</math></b>			<b>AppraisInf – <math>\widehat{\text{Appreciation}}</math></b>		

# Securitization and Appr Infl - DID Analysis

Table 4: Securitization and Appraisal Inflation – DID Regression Overall Sample Results

<i>Variable</i>	Full Sample			Excluding Distress Sales		
	<i>(1)</i> <i>All loans</i>	<i>(2)</i> <i>Notch=0</i>	<i>(3)</i> <i>Notch=1</i>	<i>(1')</i> <i>All Loans</i>	<i>(2')</i> <i>Notch=0</i>	<i>(3')</i> <i>Notch=1</i>
Sec x Refi	0.0018 ( 0.0088)	-0.0076 ( 0.0113)	<u>0.0312**</u> ( 0.0158)	-0.0047 ( 0.0108)	-0.0140 ( 0.0133)	<u>0.0529**</u> ( 0.0224)
Sec	-0.0064 ( 0.0070)	0.0003 ( 0.0094)	-0.0248** ( 0.0119)	0.0009 ( 0.0087)	0.0082 ( 0.0112)	-0.0308* ( 0.0164)
Refi	0.0609*** ( 0.0079)	0.0853*** ( 0.0100)	0.0179 ( 0.0145)	0.0596*** ( 0.0095)	0.0763*** ( 0.0117)	0.0130 ( 0.0201)
Control Variables	Y	Y	Y	Y	Y	Y
MSA*YYQQ Orig FE	Y	Y	Y	Y	Y	Y
MSA*YYQQ LaterSale FE	Y	Y	Y	Y	Y	Y
R-Square	0.4036	0.4182	0.4896	0.3173	0.3444	0.5069
N. Obs.	21,072	13,182	7,890	12,978	9,000	3,978

# Are Sold Loans More Likely to Default?

Table 6: Appraisal Inflation and Mortgage Performance – Are Sold Notch Loans More Likely to Default than Portfolio Notch Loans?

Variable	12-Month Default			24-Month Default		
	(1) All Loans	(2) Cash-Out Refi	(3) Term Refi	(1') All Loans	(2') Cash-Out Refi	(3') Term Refi
Sec * Notch	0.0230** ( 0.0101)	0.0272*** ( 0.0095)	-0.0028 ( 0.0164)	0.0413*** ( 0.0148)	0.0505*** ( 0.0146)	-0.0227 ( 0.0299)
Sec	0.0130*** ( 0.0042)	0.0128*** ( 0.0042)	0.0052 ( 0.0077)	0.0450*** ( 0.0048)	0.0453*** ( 0.0051)	0.0302** ( 0.0115)
Notch	-0.0066 ( 0.0082)	-0.0108 ( 0.0087)	0.0129 ( 0.0179)	0.0049 ( 0.0132)	-0.0082 ( 0.0131)	0.0762** ( 0.0311)
FICO	-0.0596*** ( 0.0045)	-0.0542*** ( 0.0044)	-0.0677*** ( 0.0076)	-0.1197*** ( 0.0059)	-0.1124*** ( 0.0062)	-0.1359*** ( 0.0115)
CLTV	0.0008*** ( 0.0002)	0.0007** ( 0.0003)	0.0004 ( 0.0003)	0.0044*** ( 0.0004)	0.0041*** ( 0.0004)	0.0029*** ( 0.0006)
LowDoc	-0.0035 ( 0.0038)	-0.0072* ( 0.0040)	0.0012 ( 0.0062)	0.0203*** ( 0.0062)	0.0079 ( 0.0056)	0.0198** ( 0.0098)
DTI	0.0003** ( 0.0001)	0.0003*** ( 0.0001)	-0.0001 ( 0.0002)	0.0004* ( 0.0002)	0.0004* ( 0.0002)	0.0001 ( 0.0005)
FRM	-0.0193***	-0.0211***	-0.0120	-0.0492***	-0.0486***	-0.0618***
R-Square	0.1270	0.1341	0.1759	0.2375	0.2349	0.2951
N Obs	13,275	11,361	3,987	13,275	11,361	3,987

# Is it Priced in?

Table 7: Appraisal Inflation and Mortgage Pricing – Are Sold Notch Loans Priced Higher than Portfolio Notch Loans?

<i>Variable</i>	Full Sample			FRM		
	(1) <i>All Loans</i>	(2) <i>Cash-Out Refi</i>	(3) <i>Term Refi</i>	(1') <i>All Loans</i>	(2') <i>Cash-Out Refi</i>	(3') <i>Term Refi</i>
Sec x Notch	0.0505 ( 0.1356)	0.0427 ( 0.1442)	0.0108 ( 0.1613)	-0.1235 ( 0.1316)	-0.1724 ( 0.1621)	-0.1634 ( 0.1231)
Sec	0.5616*** ( 0.0465)	0.4767*** ( 0.0463)	0.4477*** ( 0.0671)	0.0045 ( 0.0669)	0.0381 ( 0.0782)	0.0260 ( 0.0956)
Notch	-0.0485 ( 0.1332)	0.0078 ( 0.1410)	-0.1006 ( 0.1347)	0.1512 ( 0.1434)	0.1902 ( 0.1681)	0.1816 ( 0.1422)
FICO	-0.5492*** ( 0.0441)	-0.5839*** ( 0.0471)	-0.1000* ( 0.0534)	-0.2673*** ( 0.0238)	-0.2756*** ( 0.0240)	-0.1457*** ( 0.0434)
CLTV	0.0083*** ( 0.0023)	0.0106*** ( 0.0020)	0.0040 ( 0.0039)	0.0067*** ( 0.0013)	0.0068*** ( 0.0011)	0.0048 ( 0.0031)
LowDoc	-0.4029*** ( 0.0560)	-0.3508*** ( 0.0596)	-0.3933*** ( 0.0716)	0.0788** ( 0.0334)	0.0637* ( 0.0338)	0.0785 ( 0.0606)
DTI	0.0034 ( 0.0024)	0.0039 ( 0.0027)	0.0056** ( 0.0027)	-0.0005 ( 0.0015)	0.0000 ( 0.0018)	-0.0014 ( 0.0016)
FRM	0.7490***	0.6351***	0.9956***	0.0000***	0.0000***	0.0000***
R-Square	0.4440	0.4624	0.4433	0.5736	0.5859	0.6472
N. Obs.	13,275	11,361	3,987	2,565	2,311	847

# Degree of Asymmetric Info and Adverse Selection – small vs big lenders

Table 8: Asymmetric Information and Adverse Selection Based on Appraisal Inflation – Small versus Big Lenders

<i>Variable</i>	Big Lenders		Small Lenders	
	(1)	(2)	(1')	(2')
	<i>Notch=0</i>	<i>Notch=1</i>	<i>Notch=0</i>	<i>Notch=1</i>
Sec * Refi	<u>0.0015</u> ( 0.0126)	<u>0.0266</u> ( 0.0180)	<u>-0.0308</u> ( 0.0349)	<u>0.1101**</u> ( 0.0505)
Sec	-0.0154 ( 0.0107)	-0.0361*** ( 0.0135)	0.0290 ( 0.0286)	-0.0133 ( 0.0389)
Refi	0.0802*** ( 0.0109)	0.0294* ( 0.0164)	0.0855*** ( 0.0317)	-0.0223 ( 0.0465)
Controls	Y	Y	Y	Y
MSA*YYQQ Orig FE	Y	Y	Y	Y
MSA*YYQQ LaterSale FE	Y	Y	Y	Y
Lender FE	Y	Y	Y	Y
R-Square	0.4493	0.5284	0.6207	0.6812
N. Obs.	10,682	6,327	2,520	1,577

# Lender-MBS Affiliation

Table 9: Lender-MBS Issuer Affiliation and Adverse Selection Based on Appraisal Inflation

<i>Variable</i>	Unaffiliated		Affiliated	
	(1)	(2)	(1')	(2')
	<i>Notch=0</i>	<i>Notch=1</i>	<i>Notch=0</i>	<i>Notch=1</i>
Sec * Refi	0.0040 ( 0.0147)	0.0469** ( 0.0199)	-0.0125 ( 0.0129)	0.0288 ( 0.0189)
Sec	-0.0134 ( 0.0140)	-0.0419** ( 0.0184)	0.0050 ( 0.0108)	-0.0257* ( 0.0139)
Refi	0.0703*** ( 0.0108)	0.0179 ( 0.0166)	0.0850*** ( 0.0106)	0.0257 ( 0.0162)
Controls	Y	Y	Y	Y
MSA*YYQQ Orig FE	Y	Y	Y	Y
MSA*YYQQ LaterSale FE	Y	Y	Y	Y
Lender FE	Y	Y	Y	Y
R-Square	0.5158	0.5524	0.4594	0.5586
N. Obs.	6,918	4,346	9,229	4,976

# More Results

- The results are robust after controlling the potential impact of servicer and lender effects.
- The results also remain when we infer appraisal inflation from hedonic price estimates instead of repeat sale transactions.
- ....We conclude that our findings represent strong evidence of adverse selection in securitization based on appraisal inflation.

# Conclusion

- One implication: private securitization contributed to lower loan origination quality prior to the recent financial crisis through adverse selection.
- It is possible that some of the deterioration in observable loan quality of prime loans is already captured in the pricing of mortgages and MBSs.
  - However, even if so, the ability of lenders to sell lower observable quality loans to investors will give them incentives to lessen the lending standards and originate lower quality loans that they would not have otherwise.
- This adverse effect on loan origination quality is a crucial concern for financial stability of the markets and for policy makers, regardless of whether the deterioration in loan quality is fully priced or not.