



# Disclaimer

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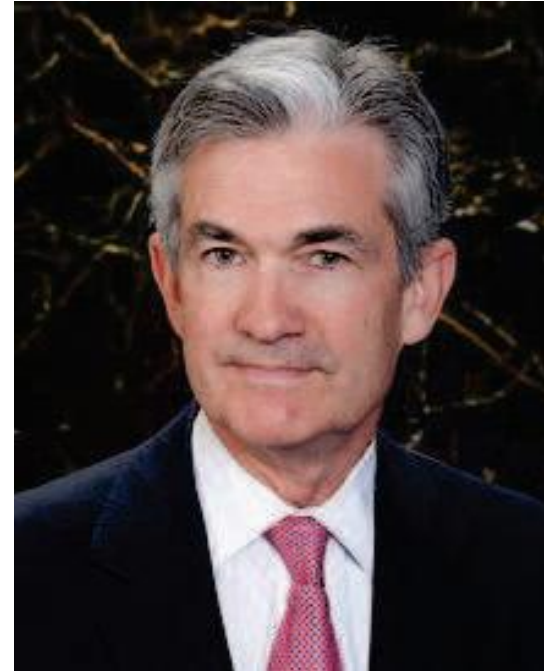
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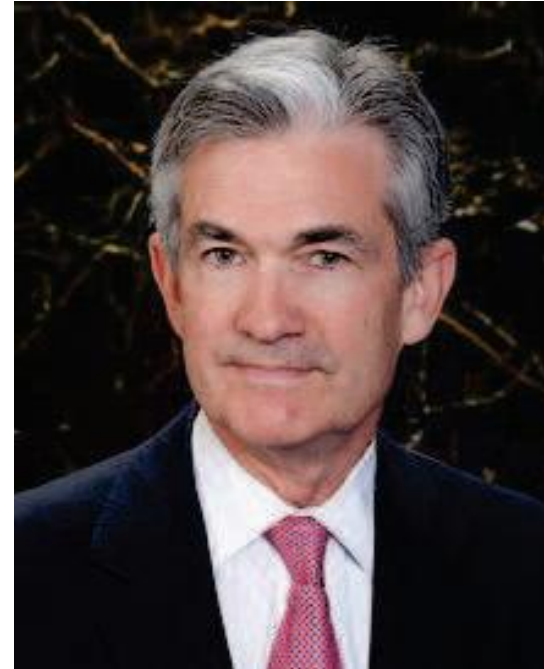
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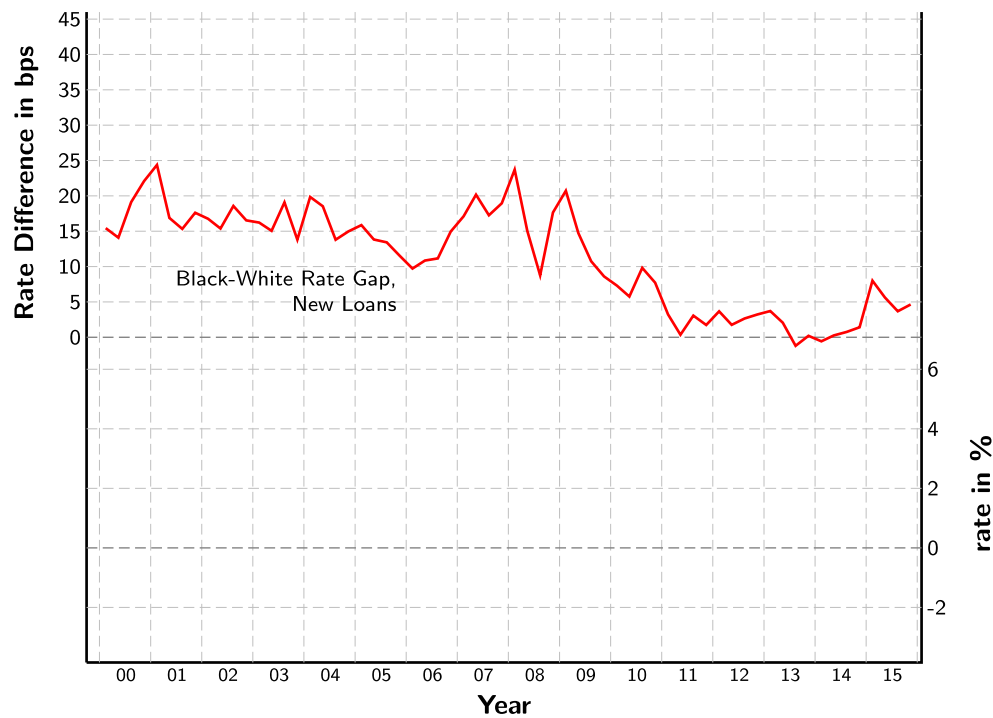
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# Introduction

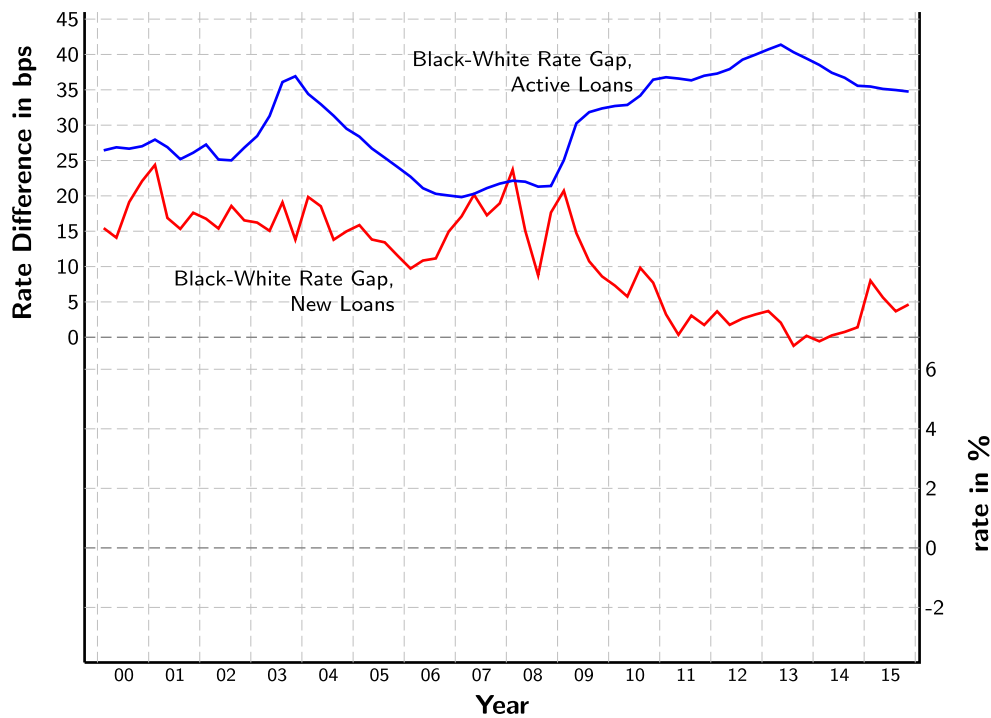
- Recently, attention on Black-White rate gap at origination

Bartlett, Morse, Stanton, and Wallace (2019), Bhutta and Hizmo (2020)



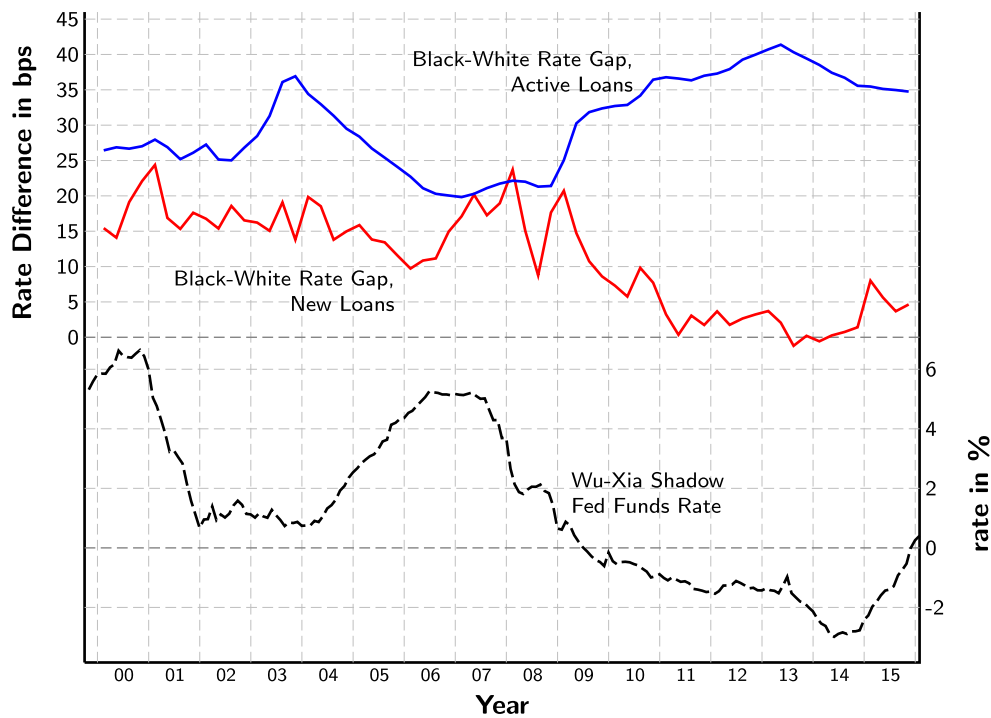


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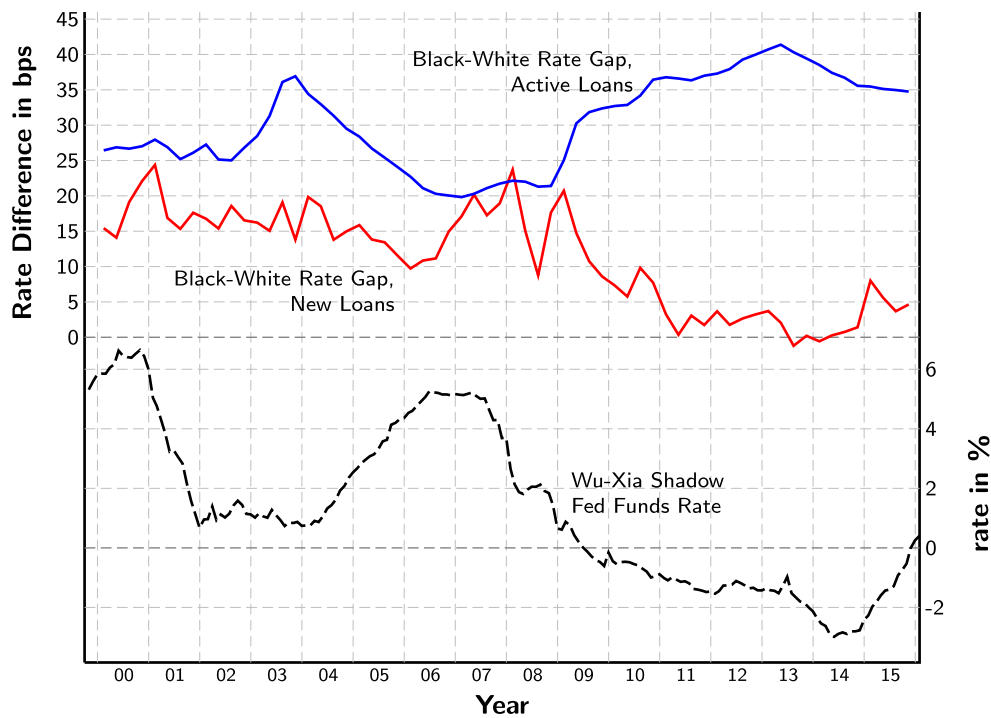
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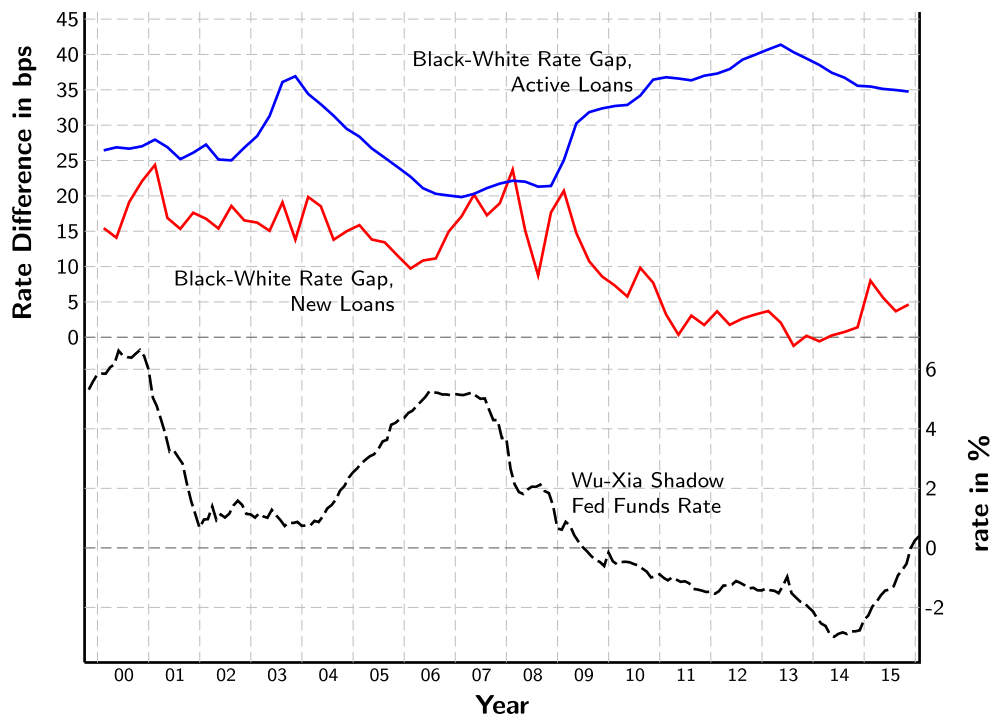
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- $\Rightarrow$  Differences in refinance speeds!

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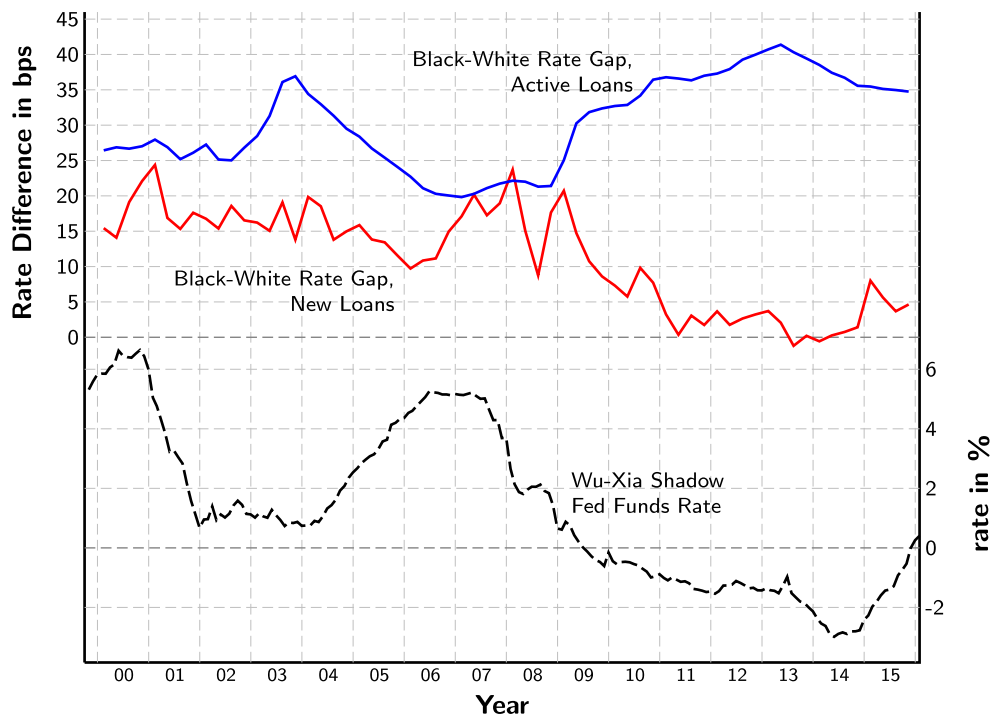
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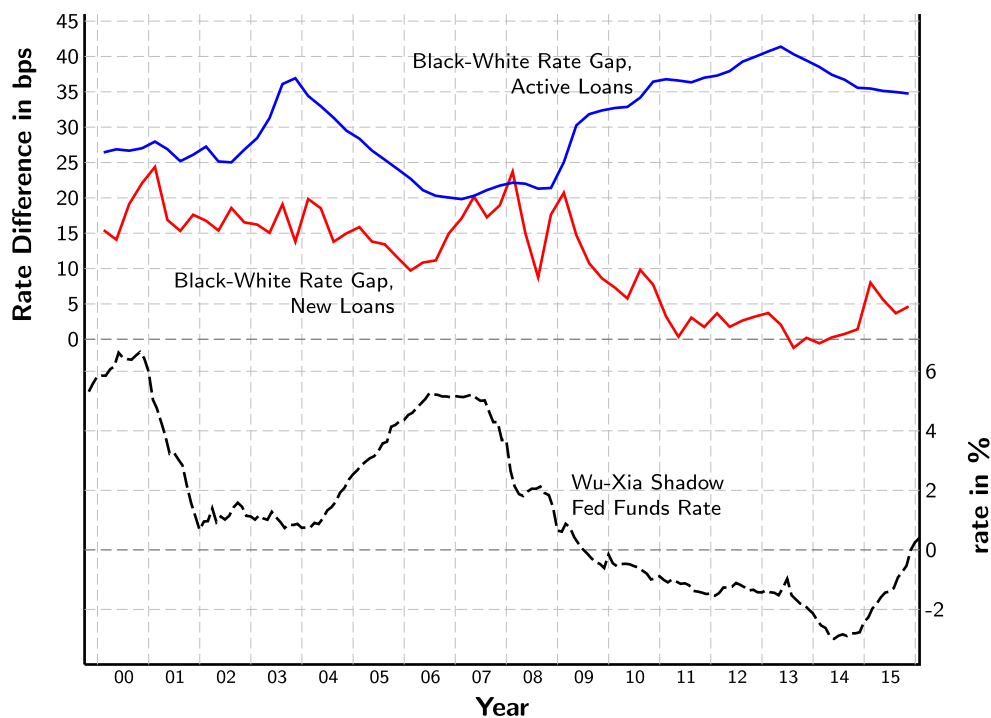
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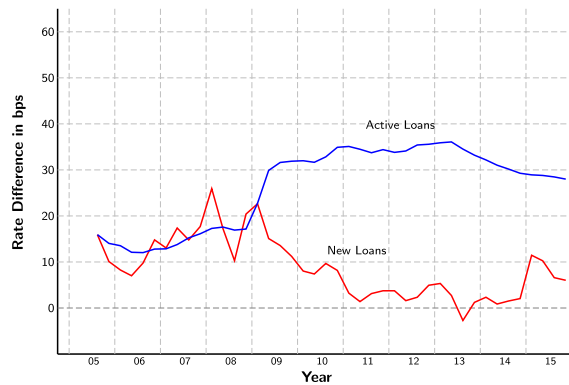
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- Monetary Policy (QE)
  - Disparate impact across races.

## Rates in the Stock and the Flow

- Main sample is a 3-way merge of fixed-rate mortgages originated 2005–2015: [▶▶ Details](#)

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All Loans



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- 2005: Stock = flow



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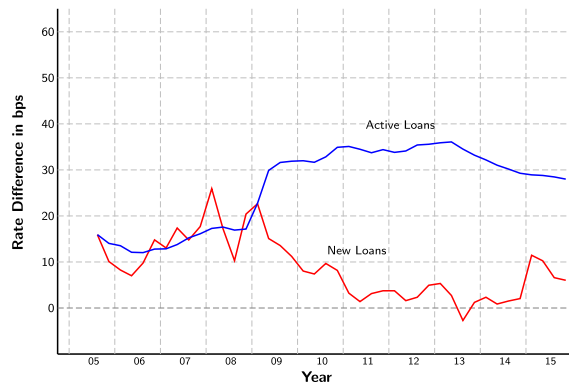
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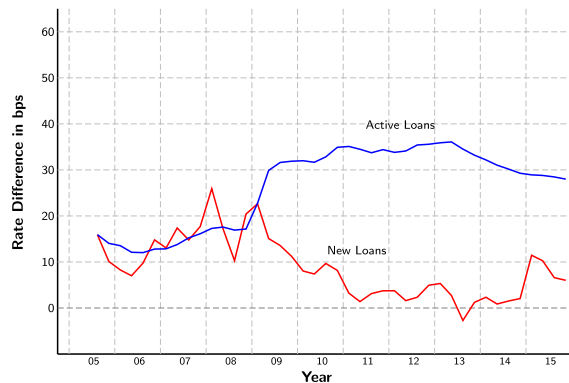
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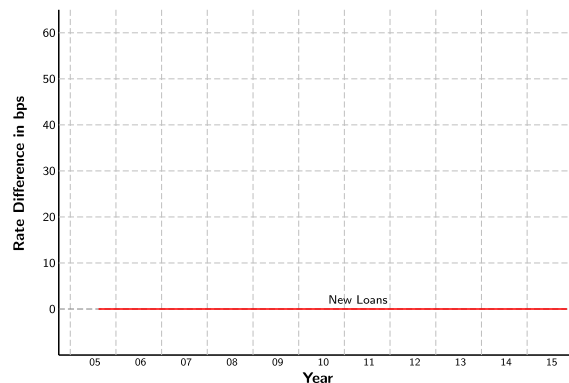
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Assuming all borrowers get same rate



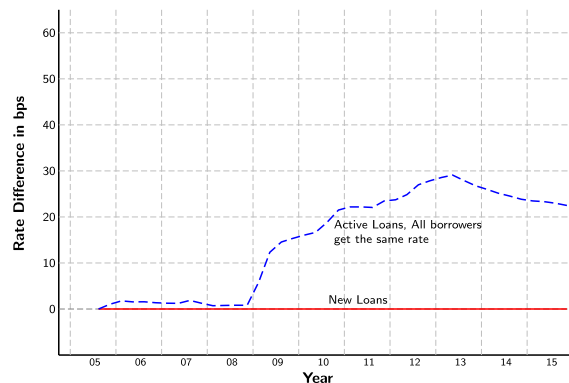
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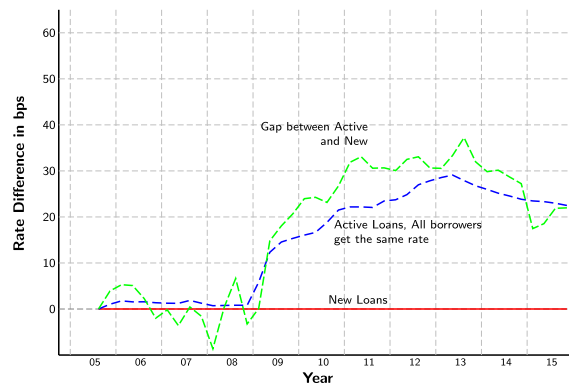
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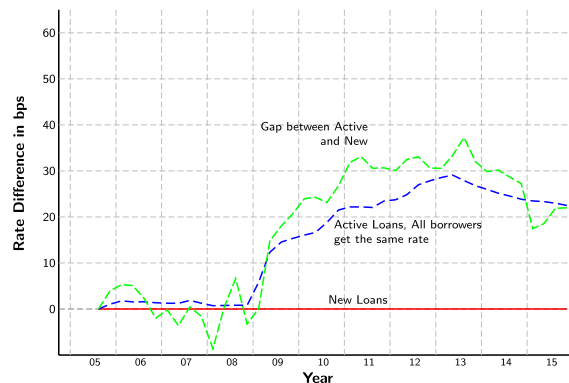
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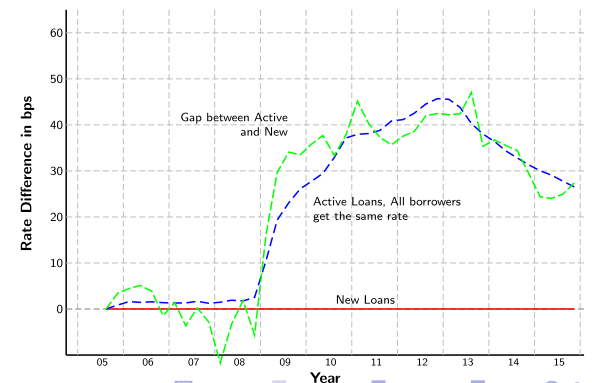
Gerardi, Willen and Zhang

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Fannie and Freddie Only



Assuming all borrowers get the same rate



Prepayment and Race

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# QE and Rates

- QE 1 furnishes test Beraja, Fuster, Hurst, and Vavra (2018)

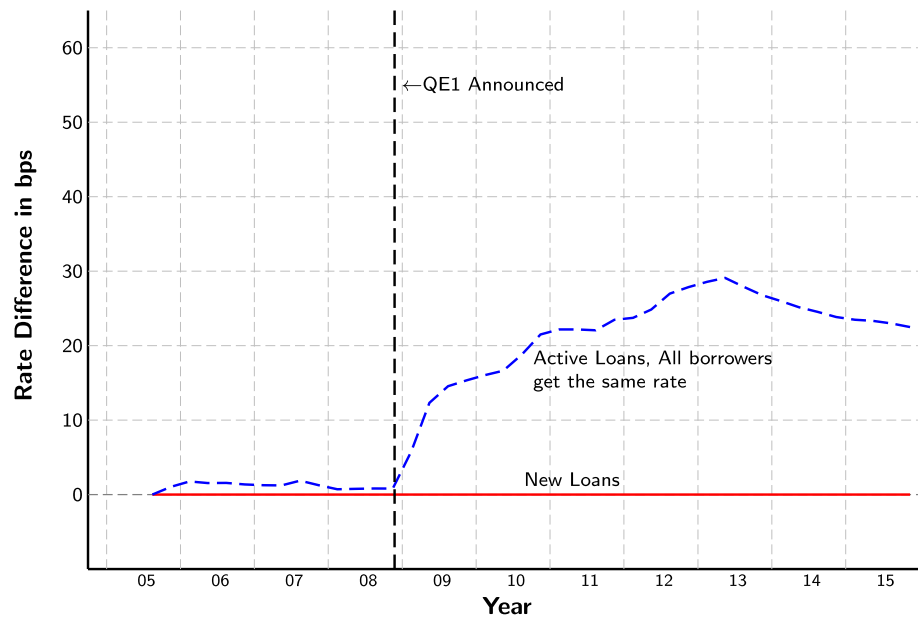
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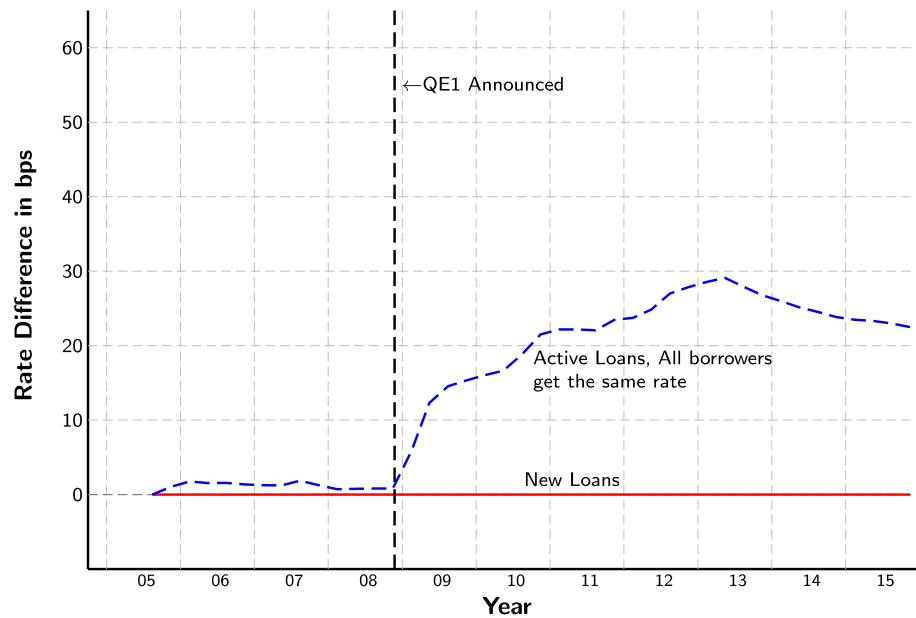
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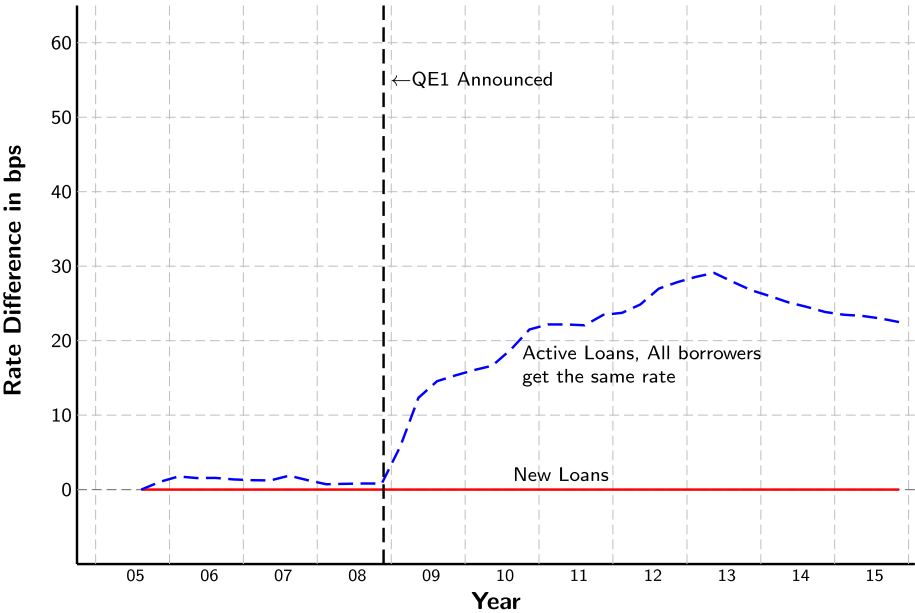
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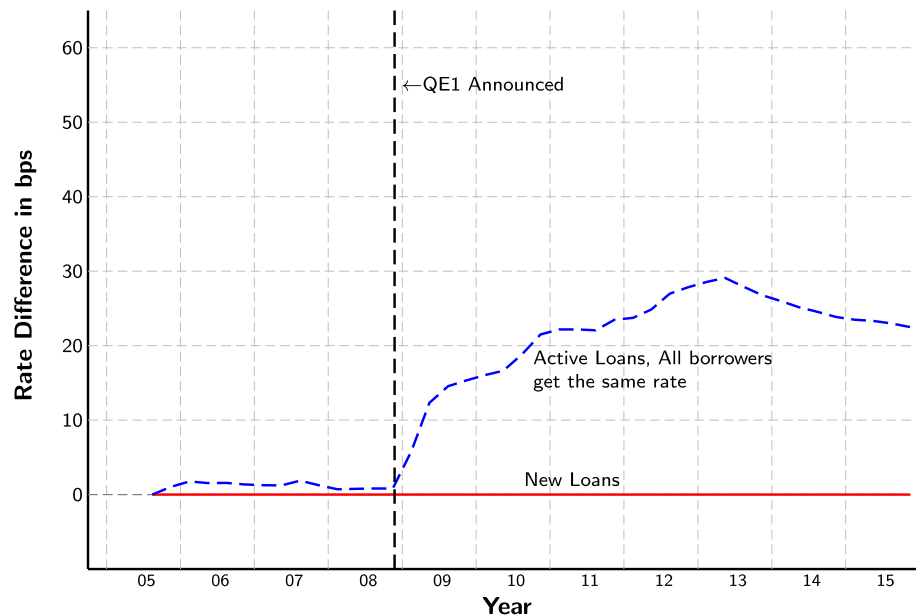
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- Event study framework: ▶▶ Details
  - 6 months before QE 1 announcement vs. 6 months after.



	(1)	(2)
Black (d)	0.232*** (0.016)	0.202*** (0.015)
Hispanic White (d)	0.134*** (0.019)	0.110*** (0.016)
postQE1 (d)	-0.220*** (0.004)	-0.002*** (0.000)
Black * postQE1	0.120*** (0.004)	-0.007*** (0.001)
Hispanic White * postQE1	0.118*** (0.005)	0.003** (0.002)
Constant	6.239*** (0.004)	6.135*** (0.004)
Vintage Year-Qtr FE		X

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  - Borrowers who got mortgages after QE got the same rates

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## Differences in Refinancing Behavior

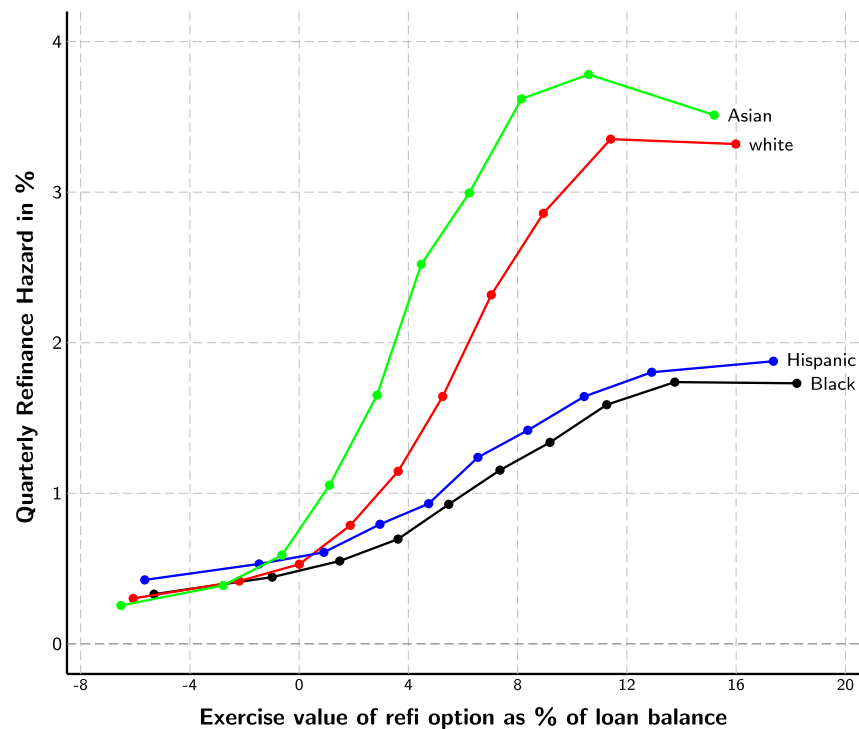
Dependent Variable: Prepay Refinance (d)						
	GSE Loans					
	(1)	(2)	(3)	(4)	(5)	(6)
Black (d)	<b>-0.746***</b> (0.086)	<b>-0.376***</b> (0.048)	<b>-0.308***</b> (0.036)	<b>-0.237***</b> (0.032)	<b>-0.232***</b> (0.032)	<b>-0.142***</b> (0.026)
Hispanic White (d)	<b>-0.687***</b> (0.118)	<b>-0.447***</b> (0.064)	<b>-0.448***</b> (0.060)	<b>-0.409***</b> (0.055)	<b>-0.401***</b> (0.060)	<b>-0.266***</b> (0.040)
Asian (d)	<b>0.436***</b> (0.143)	<b>0.261***</b> (0.092)	<b>0.277***</b> (0.097)	<b>0.265***</b> (0.097)	<b>0.309***</b> (0.100)	<b>0.221***</b> (0.068)
LTV Change		-0.002 (0.004)	<b>-0.045***</b> (0.004)	<b>-0.042***</b> (0.003)	<b>-0.022***</b> (0.004)	<b>-0.021***</b> (0.004)
Female (d)			<b>-0.063***</b> (0.012)	<b>-0.062***</b> (0.012)	<b>-0.062***</b> (0.012)	<b>-0.084***</b> (0.013)
Call Option			<b>0.232***</b> (0.016)	<b>0.237***</b> (0.016)		
Call Option V2					<b>0.232***</b> (0.017)	<b>0.234***</b> (0.017)
SATO			<b>-1.492***</b> (0.119)	<b>-1.444***</b> (0.113)	<b>-1.310***</b> (0.104)	<b>-1.293***</b> (0.107)
Risk Score Change				<b>0.769***</b> (0.084)	<b>0.348***</b> (0.067)	<b>0.336***</b> (0.067)
Loan Age	X	X	X	X	X	X
Underwriting Vars		X	X	X	X	X
HMDA Vars			X	X	X	X
Vintage Year-Qtr FE	X	X	X	X	X	X
State FE		X	X	X	X	
Zip Code FE						X
# Observations	15,460,588	12,572,069	12,114,409	12,032,408	10,960,104	10,960,090
# Loans	792,823	652,106	629,224	629,154	600,792	600,792
R <sup>2</sup>	0.007	0.012	0.018	0.019	0.020	0.023

- Underwriting controls explain  $\sim 50\%$ .
- Controlling for socio-demographics, risk score change, refi incentive, ZIP code FEs explains additional  $\sim 30\%$ .
- Altogether explain about 80% of difference between Black and White borrowers.
- Can explain about 60% of difference between Hispanic and White borrowers.

[▶▶ FHA Results](#)
[▶▶ Logit Results](#)

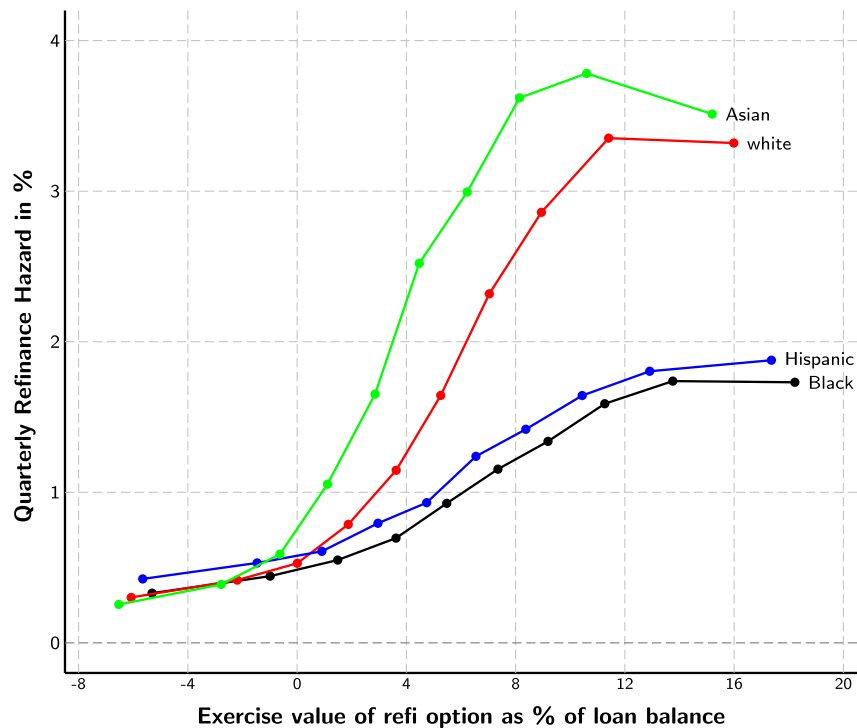
## Refi Incentive

- Bin scatter plot of *Call Option* and refi propensity by race/ethnicity: [▶ Defn](#)



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Dependent Variable: Prepay Refi (d)

	GSE Loans		
	(1)	(2)	(3)
Black (d)	-0.170*** (0.027)	0.339*** (0.075)	0.337*** (0.076)
Hispanic White (d)	-0.280*** (0.040)	0.172*** (0.062)	0.166** (0.064)
Call Option	0.231*** (0.017)	0.239*** (0.018)	0.239*** (0.018)
Risk Score Change	0.329*** (0.067)	0.330*** (0.067)	0.315*** (0.070)
Black * Call Option		-0.083*** (0.007)	-0.083*** (0.007)
Hispanic White * Call Option		-0.078*** (0.007)	-0.079*** (0.007)
Black * Risk Score Change			0.109** (0.043)
Hispanic White * Risk Score Change			0.089** (0.037)
Loan Age	X	X	X
Underwriting Vars	X	X	X
HMDA Vars	X	X	X
Vintage Year-Qtr FE	X	X	X
Zip Code FE	X	X	X
# Observations	10,354,221	10,354,221	10,354,221
# Loans	563,995	563,995	563,995
R <sup>2</sup>	0.023	0.023	0.023

▶ FHA

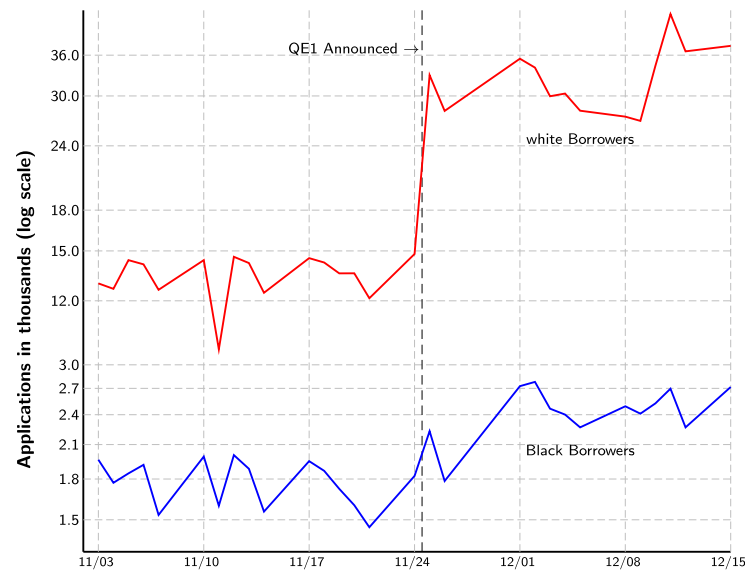


## QE 1 and Refinance Disparities

- Event Study
  - QE 1 Announced on 11/25/2008

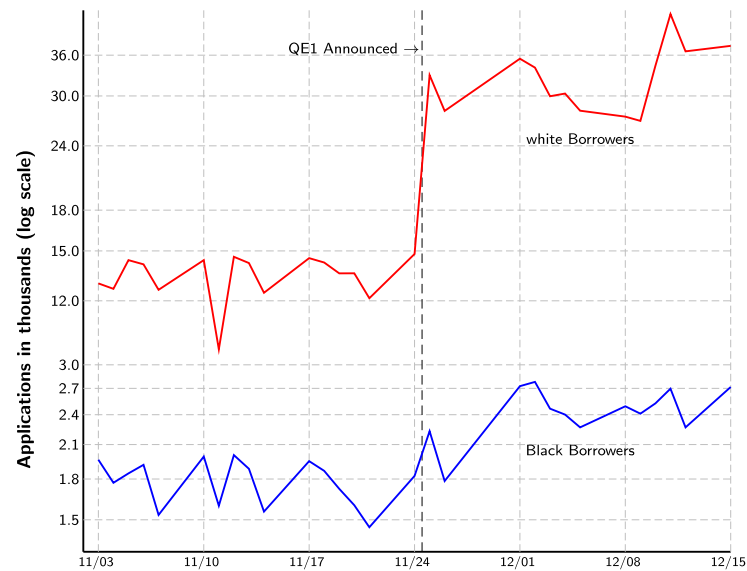
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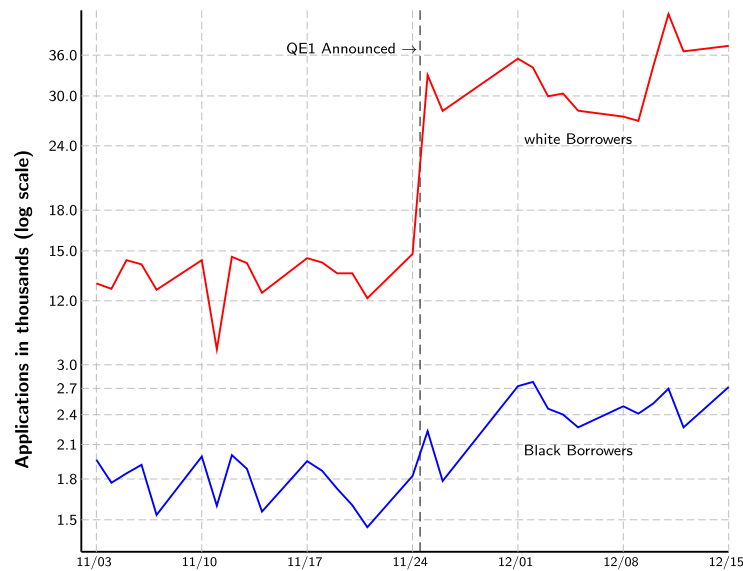
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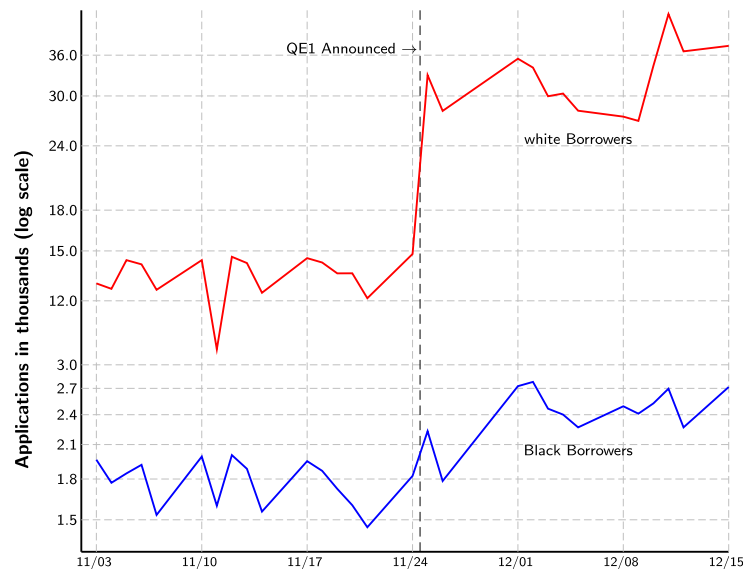
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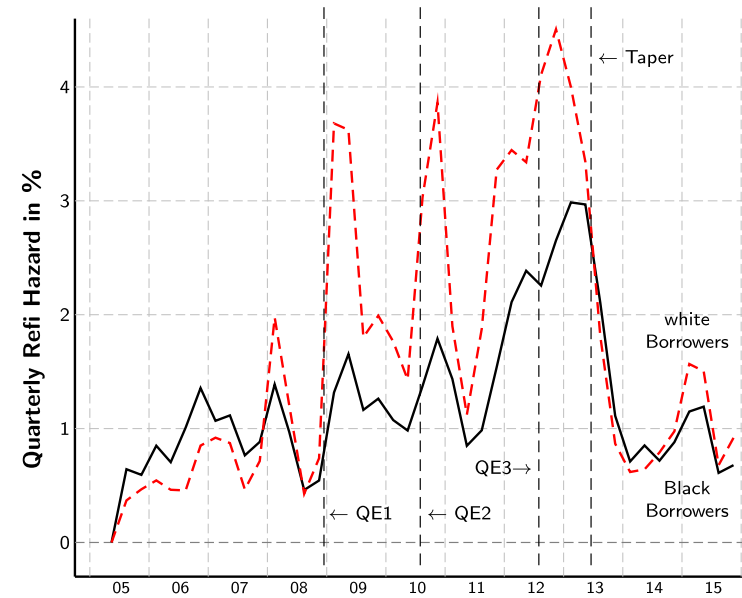


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- Regression estimates. Refinance hazard increased
  - 5× for Black



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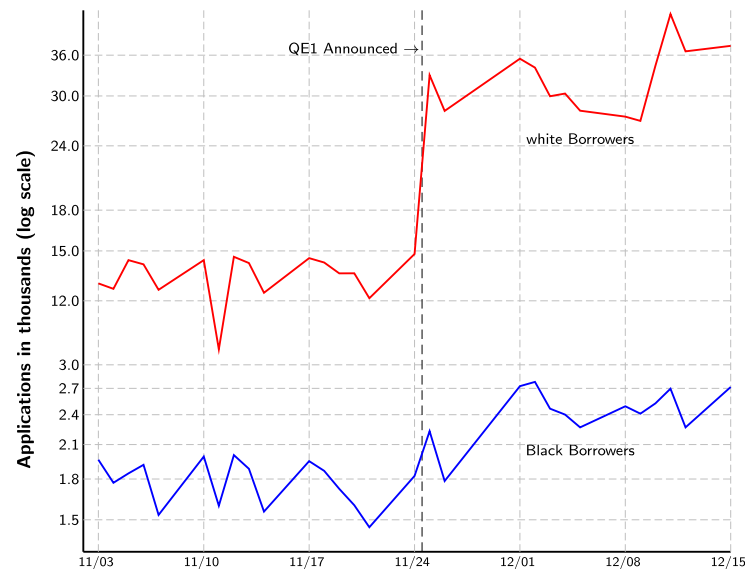


Prepayment and Race

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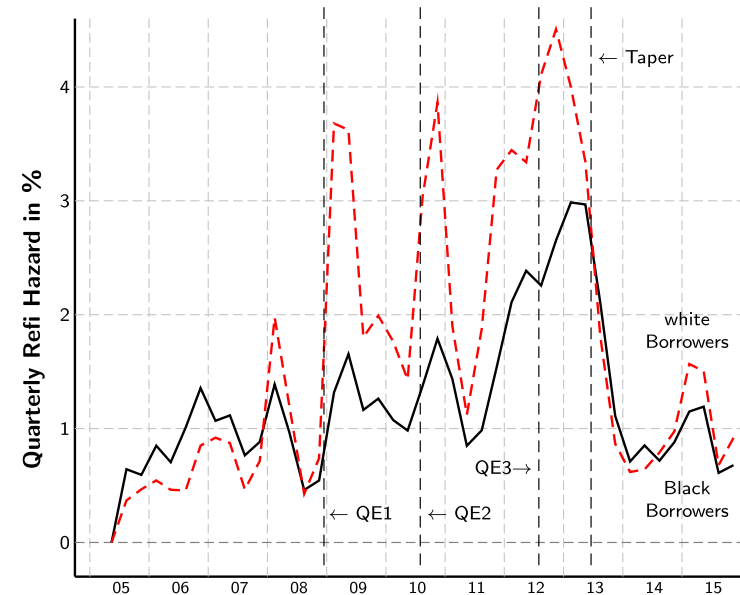
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Gerardi, Willen and Zhang

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- 5× for Black
- 2× for Non-Hisp. White



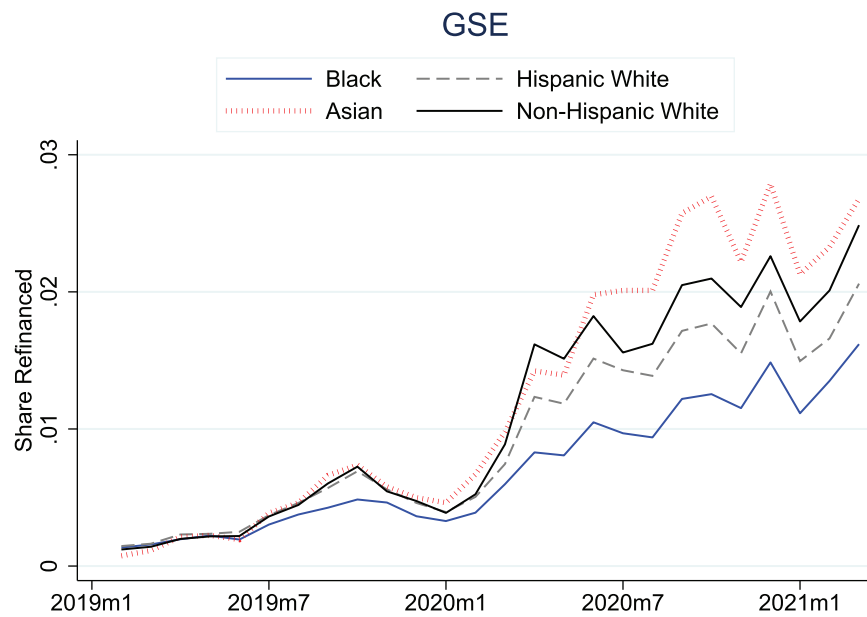
Prepayment and Race

## COVID Experience

- Another huge refinance wave.
- Similar pattern emerges

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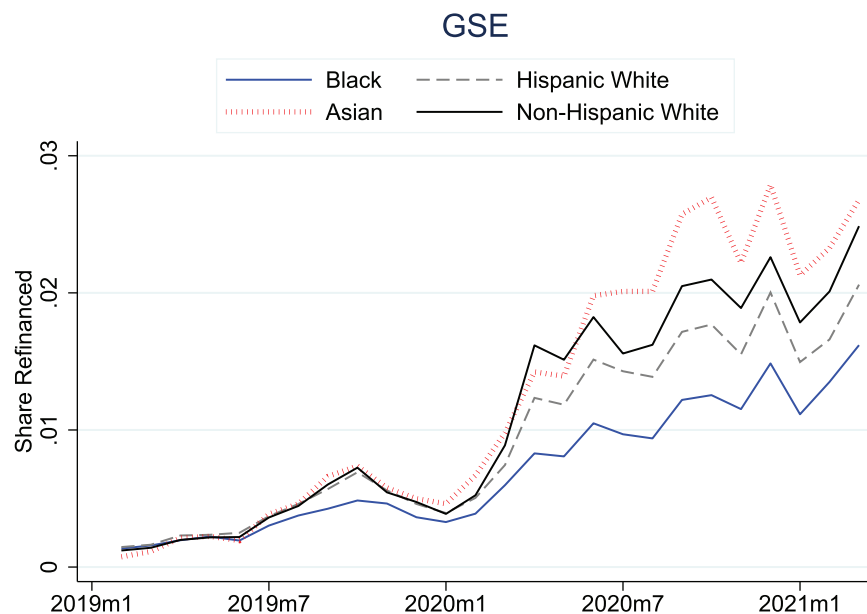
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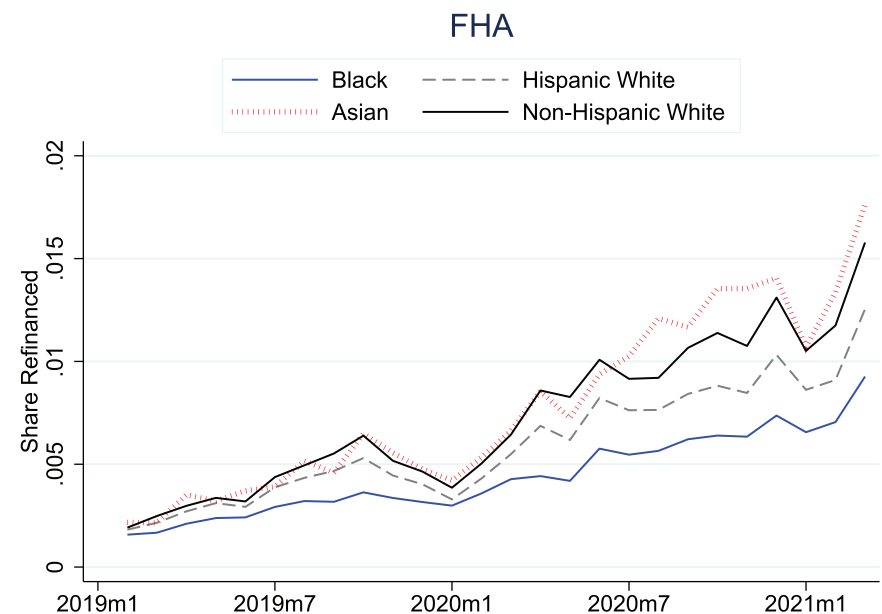


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- Gerardi, Kristopher, Lauren Lambie-Hanson, and Paul Willen. 2021. “Racial Differences in Mortgage Refinancing, Distress, and Housing Wealth Accumulation during COVID-19.” Boston Fed Current Policy Perspectives.



Gerardi, Willen and Zhang



Prepayment and Race

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# COVID Experience

	A: 1/2020-10/2020					B: 1/2019-10/2019				
	Total	White	Black	Hispanic	Asian	Total	White	Black	Hispanic	Asian
(1) Total Paid Off/Terminated=	20.1	21.3	11.6	16.0	22.8	9.2	9.7	6.2	8.0	8.5
Refinanced +	11.0	11.6	6.2	8.9	13.6	3.2	3.2	2.5	3.2	3.2
Moved, new mortgage +	2.9	3.1	1.7	2.2	2.6	1.8	2.0	1.0	1.3	1.2
Paid off, no move, no refi +	3.6	3.8	2.0	3.0	4.6	2.0	2.1	1.2	1.7	2.3
Moved, no new mortgage +	2.5	2.7	1.6	1.9	2.1	2.2	2.3	1.4	1.7	1.7
Foreclosure completed	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0
(2) Still Active as of 10/20 =	79.9	78.7	88.4	84.0	77.2	90.8	90.3	93.8	92.0	91.5
60+ Days past due +	5.5	4.3	12.3	8.8	5.5	1.1	0.9	3.4	1.5	0.5
Current or < 60 DPD	74.4	74.5	76.0	75.2	71.6	89.7	89.4	90.4	90.5	91.1
<i>Forbearance as % of all 60+ DPD</i>	<i>81.5</i>	<i>80.8</i>	<i>80.1</i>	<i>83.5</i>	<i>87.6</i>					
(1)+(2)= All Outcomes	100	100	100	100	100	100	100	100	100	100
(3) <i>Refinance Detail</i>										
Refinanced "in the money"	9.0	9.5	5.2	7.4	10.3	0.9	0.9	0.8	0.9	0.9
Refinanced with cash-out	2.4	2.6	1.4	2.1	1.8	1.4	1.5	1.2	1.5	0.9
In-the-money at some point	84.0	83.6	85.1	86.4	81.2	25.1	24.6	26.3	27.9	21.8
<i>Refinanced as % of in-the-money</i>	<i>10.2</i>	<i>10.9</i>	<i>5.8</i>	<i>8.1</i>	<i>12.2</i>	<i>3.9</i>	<i>4.0</i>	<i>3.1</i>	<i>3.5</i>	<i>4.5</i>
(4) <i>Estimated Payment Reductions for In-the-Money Refinances</i>										
# of loans (thousands)	1,589	1,149	61	135	85	177	122	10	18	8
Monthly Payment Reduction	\$ 279	\$ 274	\$ 269	\$ 274	\$ 324	\$ 226	\$ 223	\$ 213	\$ 212	\$ 265
Total Annual Payment Reduction (millions)	\$5,312	\$3,776	\$198	\$443	\$331	\$478	\$328	\$25	\$46	\$25
as % of Total	100.0%	71.1%	3.7%	8.3%	6.2%	100.0%	68.6%	5.3%	9.6%	5.3%

# Additional Findings

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- Minority borrowers have higher default rates.
- Observable differences (Credit Score, etc.) explain most of the differences.
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### (3) Loan Pricing [▶ Details](#)

- Lower prepayment speeds imply that black borrowers should pay *lower* rates
- Do investors pay more for loans from black borrowers?

## Policy Implications/Future Work

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  1. FHA experiment:
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    - Did minority/white refi gaps widen?

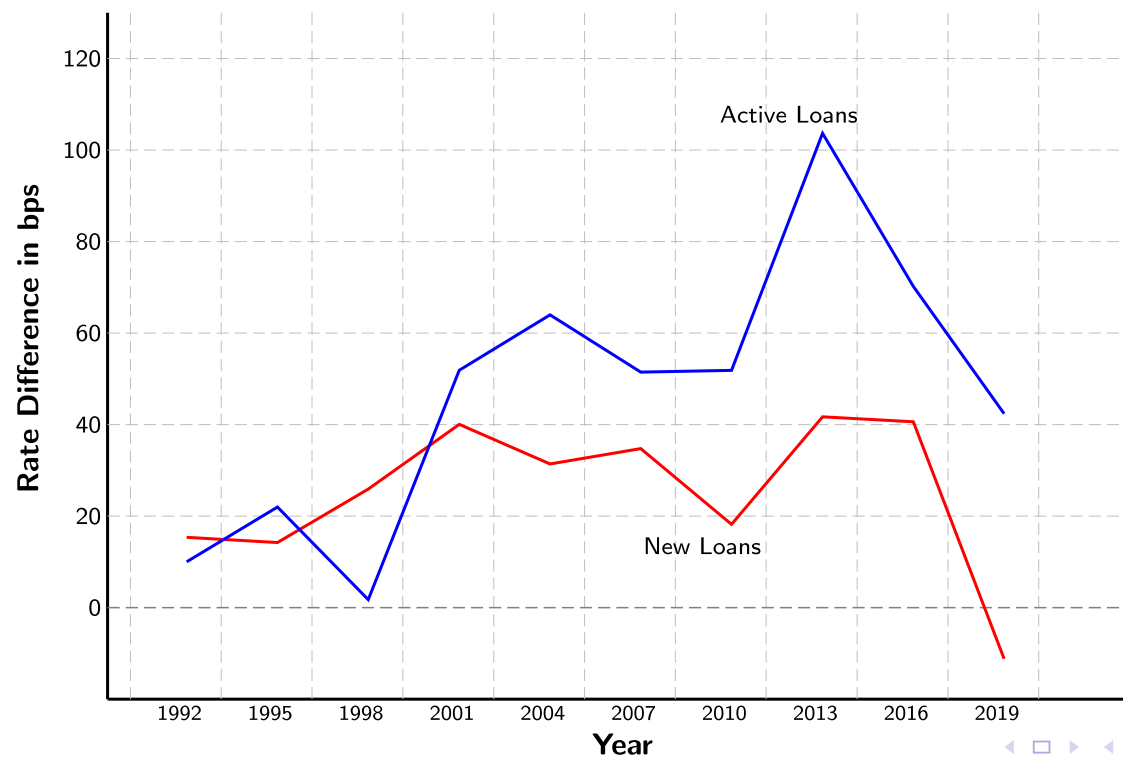
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  2. Structural model to determine if refinance disparities are due to time-varying vs. time-invariant factors.
    - Model from Anderson et al. (2020 - AER).
    - “Inattention” vs. fixed costs.

# SUPPLEMENTAL SLIDES

## Rate Gap in SCF

- Difference in average mortgage rates for Black and Non-Hispanic White borrowers based on data from the SCF (1992–2019).

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# Data

- Main sample is a three-way merge:
  1. McDash: Administrative loan-level monthly panel dataset:
    - Detailed info. on mortgage characteristics at origination (credit score, ltv, frm/arm, interest rates, property ZIP code, etc.).
    - Information on payment status over time.
    - 60-80% originations in most years after 2004.
  2. Equifax (CRISM):
    - Credit bureau data matched to each McDash mortgage (6 months prior to origination through 6 months after loan termination).
    - Covers ~ 90% of McDash loans.
    - **Allows us to distinguish between prepayments due to refinances versus property sales.**
    - Includes updated credit scores.
  3. Home Mortgage Disclosure Act (HMDA):
    - Race/ethnicity, Income, Gender.
- HMDA data matched (uniquely) to 60-80% of McDash loans in 2005–2015 period.

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## Data: Sample Details

- Loan originations between 2005–2015 (inclusive).
  - Performance through June 2020.
  - Can only distinguish between prepayments due to refinances and sales through December 2019  $\Rightarrow$  Nothing to say about disparities during the pandemic period.
- Main sample restrictions:
  - 30-year, fully amortizing FRMs.
  - GSE (Fannie and Freddie) and FHA loans.
  - Asian, Black, Hispanic White, and White borrowers.
- Analysis uses 7.5% random sample
  - $\sim$  800,000 GSE loans and 300,000 FHA loans.
  - $\sim$  15.5 million GSE loan-quarter obs. and 6.2 million FHA loan-quarter obs.

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## QE 1 Diff-in-Diff

- QE 1 provides relatively clean test – Beraja et al. (2018 QJE).
  - Unanticipated policy that drove mortgages rates down.
  - Announced on November 25, 2008  $\Rightarrow$  up to \$500 billion in agency MBS purchases.
  - Expanded (March 2009) to an additional \$750 billion in MBS purchases.
  - Ended at end of first quarter of 2010.
  - Diff-in-diff specification comparing rate gaps before vs. after QE 1 announcement:

$$R_{it}^M = \beta * Black_i + \eta * postQE1_t + \delta * (Black_i * postQE1_t) + \epsilon_{it}$$

- $R_{it}^M$  – current mortgage interest rate paid by borrower  $i$ .
- $postQE1_t$  – indicator that equals 1 for the period after QE 1 and 0 for the period before QE 1 and quarter of announcement (2008:Q4).
- Consider three sample windows: 6 months, 1 year, 2 years.

# FHA Refinance Results

Dependent Variable: Prepay Refinance (d)			
	FHA Loans		
	(7)	(8)	(9)
Black (d)	-0.600*** (0.053)	-0.350*** (0.030)	-0.216*** (0.029)
Hispanic White (d) -0.401***	-0.372*** (0.076)	-0.385*** (0.040)	
Asian (d)	0.417*** (0.088)	-0.011 (0.059)	0.088 (0.072)
Equifax Risk Score		0.445*** (0.060)	
LTV Change		-0.013*** (0.003)	-0.030*** (0.002)
Female (d)			-0.077*** (0.016)
Call Option			0.139*** (0.014)
SATO			-0.196* (0.115)
Risk Score Change			0.835*** (0.084)
Loan Age	X	X	X
Underwriting Vars		X	X
HMDA Vars			X
Vintage Year-Qtr FE	X	X	X
State FE		X	
Zip Code FE			X
# Observations	6,184,502	4,563,659	3,953,353
# Loans	291,587	221,036	192,645
R <sup>2</sup>	0.004	0.011	0.017

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# Logit Refinance Results

- Average marginal effects:

Dependent Variable: Prepay Refinance (d)						
	GSE Loans				FHA Loans	
	(1)	(2)	(3)	(4)	(7)	(8)
Black (d)	-0.686*** (0.033)	-0.421*** (0.030)	-0.353*** (0.029)	-0.282*** (0.030)	-0.585*** (0.037)	-0.419*** (0.024)
Hispanic (d)	-0.654*** (0.057)	-0.475*** (0.024)	-0.489*** (0.030)	-0.449*** (0.031)	-0.405*** (0.059)	-0.389*** (0.028)
Asian (d)	0.466*** (0.132)	0.275*** (0.070)	0.259*** (0.070)	0.247*** (0.070)	0.455*** (0.088)	-0.030 (0.043)
Loan Age	X	X	X	X	X	X
Underwriting Vars		X	X	X		X
HMDA Vars			X	X		X
Vintage Year-Qtr FE	X	X	X	X	X	X
State FE		X	X	X		X
# Observations	15,460,588	11,983,398	11,547,035	11,469,141	6,184,502	4,316,733

## Option Value (Deng et al. 2000)

- Prepayment option value given by:

$$\text{Call Option}_{i,k} = \frac{V_{i,m} - V_{i,r}}{V_{i,m}}$$

where

$$V_{i,m} = \sum_{s=1}^{TM_i - k_i} \frac{P_i}{(1 + m_t)^s} \quad V_{i,r} = \sum_{s=1}^{TM_i - k_i} \frac{P_i}{(1 + r_i)^s}$$

- $r_i$  – borrower  $i$ 's mortgage rate
- $TM_i$  – mortgage term
- $k_i$  – age/seasoning of the mortgage
- $m_i$  – prevailing market rate (the FHLMC PMMS index)
- $P_i$  – mortgage payment
- The larger the value of  $\text{Call Option}_{i,k}$ , the more the borrower would benefit from refinancing into a new loan with a lower rate and payment.

## FHA Refi Sensitivity Results

Dependent Variable: Prepay Refinance (d)			
	FHA Loans		
	(4)	(5)	(6)
Black (d)	-0.160*** (0.026)	0.223** (0.098)	0.216** (0.098)
Hispanic White (d)	-0.297*** (0.039)	0.041 (0.076)	0.050 (0.077)
Call Option	0.139*** (0.015)	0.151*** (0.016)	0.151*** (0.016)
Risk Score Change	0.828*** (0.082)	0.825*** (0.082)	0.878*** (0.086)
Black * Call Option		-0.051*** (0.007)	-0.053*** (0.007)
Hispanic White * Call Option		-0.049*** (0.006)	-0.051*** (0.006)
Black * Risk Score Change			-0.202*** (0.025)
Hispanic White * Risk Score Change			-0.167*** (0.037)
Loan Age	X	X	X
Underwriting Vars	X	X	X
HMDA Vars	X	X	X
Vintage Year-Qtr FE	X	X	X
Zip Code FE	X	X	X
# Observations	3,856,796	3,856,796	3,856,796
# Loans	187,528	187,528	187,528
R <sup>2</sup>	0.023	0.024	0.024

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# Default Results

Dependent Variable: Default (d)							
	GSE Loans				FHA Loans		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Black (d)	0.443*** (0.076)	0.270*** (0.050)	0.147*** (0.024)	0.105*** (0.017)	0.733*** (0.057)	0.447*** (0.036)	0.401*** (0.031)
Hispanic White (d)	0.422*** (0.097)	0.268*** (0.063)	0.058*** (0.015)	0.054*** (0.015)	0.165*** (0.044)	0.148*** (0.044)	0.077* (0.043)
Asian (d)	0.026 (0.018)	0.026** (0.012)	0.021* (0.010)	0.010 (0.009)	-0.125*** (0.023)	-0.065*** (0.024)	-0.056** (0.026)
Equifax Risk Score		-0.452*** (0.062)				-0.903*** (0.076)	
LTV Origination		0.009*** (0.001)				0.014*** (0.001)	
LTV Change		0.031*** (0.003)	0.022*** (0.003)	0.024*** (0.003)		0.029*** (0.003)	0.031*** (0.004)
Female (d)			-0.013*** (0.004)	-0.013*** (0.004)			-0.028** (0.012)
Loan Age	X	X	X	X	X	X	X
Underwriting Vars		X	X	X		X	X
HMDA Vars			X	X			X
Vintage Year-Qtr FE	X	X	X	X	X	X	X
State FE		X	X			X	
Zip Code FE				X			X
# Observations	14,883,532	12,125,625	10,684,132	10,684,116	5,484,924	4,057,993	3,524,527
# Loans	792,823	652,106	600,795	600,795	291,587	221,036	192,655
R <sup>2</sup>	0.006	0.011	0.008	0.012	0.006	0.011	0.012

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# Sale Results

Dependent Variable: Prepay Sale (d)								
	GSE Loans				FHA Loans			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Black (d)	-0.524*** (0.019)	-0.413*** (0.018)	-0.397*** (0.019)	-0.373*** (0.022)	-0.644*** (0.030)	-0.536*** (0.036)	-0.431*** (0.035)	-0.413*** (0.032)
Hispanic White (d)	-0.430*** (0.028)	-0.333*** (0.019)	-0.330*** (0.022)	-0.280*** (0.020)	-0.515*** (0.029)	-0.550*** (0.036)	-0.514*** (0.035)	-0.472*** (0.035)
Asian (d)	-0.185*** (0.031)	-0.193*** (0.026)	-0.214*** (0.030)	-0.216*** (0.032)	-0.233*** (0.041)	-0.347*** (0.033)	-0.327*** (0.037)	-0.345*** (0.036)
LTV Change		-0.015*** (0.001)	-0.019*** (0.001)	-0.020*** (0.001)		-0.021*** (0.001)	-0.022*** (0.001)	-0.023*** (0.002)
Female (d)			0.027*** (0.008)	0.020** (0.009)			0.025** (0.011)	0.010 (0.010)
Risk Score Change			-0.065** (0.028)	-0.079*** (0.028)			0.278*** (0.014)	0.267*** (0.014)
Loan Age	X	X	X	X	X	X	X	X
Underwriting Vars		X	X	X		X	X	X
HMDA Vars			X	X			X	X
Vintage Year-Qtr FE	X	X	X	X	X	X	X	X
State FE		X	X			X	X	
Zip Code FE				X				X
# Observations	15,460,588	12,572,069	10,960,104	10,960,090	6,184,502	4,563,659	3,953,353	3,953,352
# Loans	792,823	652,106	600,792	600,792	291,587	221,036	192,645	192,645
R <sup>2</sup>	0.002	0.003	0.004	0.006	0.003	0.004	0.006	0.012

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# Pricing Implications

## 1. What if any pricing implications are there?

- Lower minority prepayment speeds (refi + sale)  $\Rightarrow$  Black/Hispanic loans are more valuable to lenders/investors.
  - $\Rightarrow$  Equilibrium interest rates should be lower at origination for minority borrowers (all else equal).
- Conduct a back-of-the-envelope calculation using low balance “spec pools” to try to determine how much more valuable securities with minority loans are to investors.
  - 50–100 bps increase in “gain-on-sale”.
  - Assuming full pass-through of MBS prices to borrowers  $\Rightarrow$  5–15 bps lower rates.

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