The Distributional Effects of GSE Pricing on Home Purchases

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Note: The analysis and conclusions set forth are those of the authors and not an official position of the Federal Reserve Board, the Federal Reserve System, the CFPB, or the United States.

Introduction

- Fannie Mae and Freddie Mac (government sponsored enterprises or GSEs) guarantee about **half** of residential mortgages in the United States
- GSE guarantee fee (g-fee) is often viewed as imperfectly adjusted to credit risk, providing a cross-subsidy to high-risk borrowers (Gerardi, 2017)
- This design is longstanding and controversial, yet its consequences for credit access and the distribution of homeownership remain poorly understood

This paper:

1. estimates distributional effects of g-fee pricing on home purchases
2. housing search model to understand our estimates and simulate counterfactual g-fee policies

Summary of findings

1. DID: home-purchase effects of g-fees, using differential g-fee changes across similar credit scores (CS) in 2023
   - High semi-elasticity: 100 bps decline in g-fee (25-30 bps of mortgage rates) $\Rightarrow$ 14% increase among borrowers receiving a g-fee reduction relative to others
   - Heterogeneous effects: cross-subsidy to lower-CS borrowers may be regressive
     - Lower-CS, higher-income borrowers are more responsive to g-fees
     - Higher-CS, higher-income borrowers were less responsive
2. Housing search model with entry of buyers with different financing costs
   - Calibration: model with inelastic sellers matches the estimated high elasticity
   - G-fee cross-subsidy will have significant distributional effects in tight housing markets

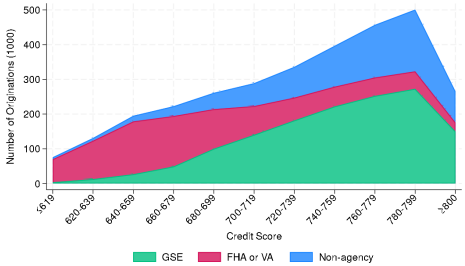
Literature

- GSE cross-subsidy: Hurst et al. (2016), Huh and Kim (2023), Berger et al. (2024), Zhang (2024), Ouazad and Kahn (2022), Sastry et al. (2023), Gete et al. (2024)
- Effects of interest rates on home purchases: Ringo and Bhutta (2021), Bosshardt et al. (2024b), Ringo (2024)
- Housing search models: Wheaton (1990), Krainer (2001), Novy-Marx (2009), Piazzesi and Schneider (2009), Genesove and Han (2012), Ngai and Tenreyro (2014), Buchak et al. (2024), Jiang et al. (2024), among others.

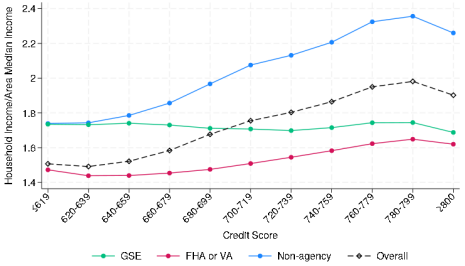
Data

- Confidential Home Mortgage Disclosure Act data from 2022 to 2023
- Credit scores, income, orig. date, loan type (conventional, FHA, VA), etc
- Information on whether a conventional loan was sold to GSEs
- Focus on **home purchase** mortgages, as refinances are rare in 2022 and 2023
- Low and moderate income (LMI) households are excluded
  - First-time buyers with LMI were exempted from upfront g-fees, staring in late 2022
  - HMDA does not have a first-time buyer flag

GSE market share varies with CS and incomes



(a) Number of originations by CS



(b) $E[\frac{\text{household income}}{\text{area median income}}|\text{loan type}]$ by CS

- lower CS + lower income → FHA/VA
- higher CS + higher-income → non-agency loans (balance sheet or PLS)

⇒ GSE pricing will have larger effects for low CS + higher inc/ high CS + lower inc

Lenders selling originations to GSEs pay g-fees

Our focus is on the upfront Loan-Level Price Adjustments (LLPAs): priced higher for loans with higher credit risk, ↓ CS and ↑ LTV

Representative Credit Score	LTV Range								
	Applicable for all mortgages with terms greater than 15 years								
	≤ 60.00%	60.01 – 70.00%	70.01 – 75.00%	75.01 – 80.00%	80.01 – 85.00%	85.01 – 90.00%	90.01 – 95.00%	95.01 – 97.00%	>97.00%
≥ 740	0.000%	0.250%	0.250%	0.500%	0.250%	0.250%	0.250%	0.750%	0.750%
720 – 739	0.000%	0.250%	0.500%	0.750%	0.500%	0.500%	0.500%	1.000%	1.000%
700 – 719	0.000%	0.500%	1.000%	1.250%	1.000%	1.000%	1.000%	1.500%	1.500%
680 – 699	0.000%	0.500%	1.250%	1.750%	1.500%	1.250%	1.250%	1.500%	1.500%
660 – 679	0.000%	1.000%	2.250%	2.750%	2.750%	2.250%	2.250%	2.250%	2.250%
640 – 659	0.500%	1.250%	2.750%	3.000%	3.250%	2.750%	2.750%	2.750%	2.750%
620 – 639	0.500%	1.500%	3.000%	3.000%	3.250%	3.250%	3.250%	3.500%	3.500%
< 620[1]	0.500%	1.500%	3.000%	3.000%	3.250%	3.250%	3.250%	3.750%	3.750%

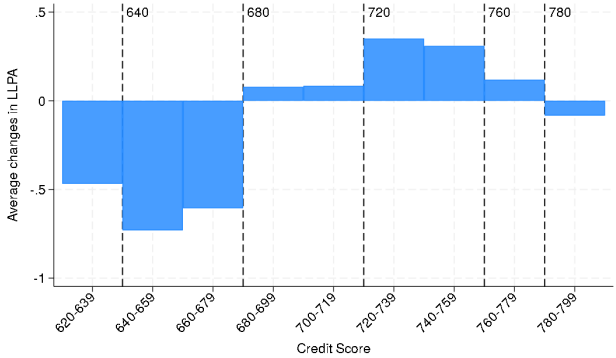
Unit = percentage of original loan balance

Identification: changes in LLPA in 2023

Credit Score	LTV Range								
	Applicable for all loans with terms greater than 15 years								
	≤ 30.00%	30.01 – 60.00%	60.01 – 70.00%	70.01 – 75.00%	75.01 – 80.00%	80.01 – 85.00%	85.01 – 90.00%	90.01 – 95.00%	>95.00%
≥ = 780	0.000%	0.000%	-0.250%	-0.250%	-0.125%	0.125%	0.000%	0.000%	-0.625%
760 – 779	0.000%	0.000%	-0.250%	0.000%	0.125%	0.375%	0.250%	0.250%	-0.500%
740 – 759	0.000%	0.000%	-0.125%	0.125%	0.375%	0.750%	0.500%	0.375%	-0.250%
720 – 739	0.000%	0.000%	0.000%	0.250%	0.500%	0.750%	0.500%	0.375%	-0.250%
700 – 719	0.000%	0.000%	-0.125%	-0.125%	0.125%	0.500%	0.250%	0.125%	-0.625%
680 – 699	0.000%	0.000%	0.125%	-0.125%	0.000%	0.375%	0.250%	0.125%	-0.375%
660 – 679	0.000%	0.000%	-0.250%	-0.875%	-0.875%	-0.625%	-0.500%	-0.625%	-1.000%
640 - 659	-0.500%	-0.500%	-0.125%	-1.250%	-0.750%	-0.750%	-0.750%	-0.875%	-1.250%
620 - 639	-0.500%	-0.375%	0.000%	-0.875%	-0.250%	-0.375%	-0.625%	-1.000%	-1.750%
≤ 619[1]	-0.500%	-0.375%	0.000%	-0.875%	-0.250%	-0.375%	-0.625%	-1.000%	-2.000%

- Identification: differential changes in g-fees across CS; LTVs are endogenous
- G-fee changes can be quite different for similar credit risk near CS cutoffs (e.g., 670–679 vs 680–689)

Treatment: $E[\Delta LLPA|\text{cs bin}]$ (weighted by the pre-policy LTV distn)



- Identification exploits differential changes at 640, 680, 720, 760, and 780
- comparing similar CS on opposite sides of cutoff (f): $[f-10, f-1]$ vs $[f, f+9]$

Stacked DID Poisson regression for the number of originations

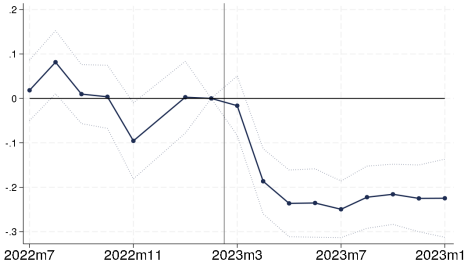
$$E[y_{cs,inc,t}] = \exp(\beta \times E[-\Delta LLPA|\text{cs bin}] \times \mathbf{1}[t > Feb2023] + \xi_{f,inc,t} + \xi_{cs})$$

- $y_{cs,inc,t}$ = num of originations for CS, income bin (inc), and year-month (t)
- $\xi_{f,inc,t}$ controls for differential trends for CS cutoff (f) $\times inc \times t$

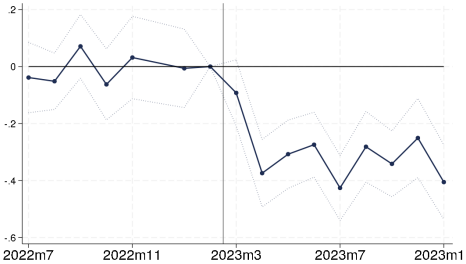
$\Rightarrow$ β is identified by comparing similar CS on opposite sides of CS cutoffs

- Interpretation of β: semi-elasticity of home purchase volumes for borrowers receiving a 100 bps g-fee reduction *relative* to borrowers who did not
  - different interpretation from interest-rate effects on home purchases as in Bhutta and Ringo (2021) and Bosshardt et al. (2024)
  - if house supply is limited/inelastic, borrowers with lower g-fees may crowd out others

Effects on borrowing costs of GSE loans per 100 bps decline in g-fees



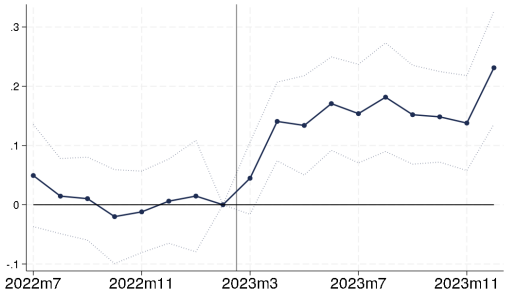
(a) Mortgage rates



(b) Net origination charges (points and fees net of lender credits, % of loan size)

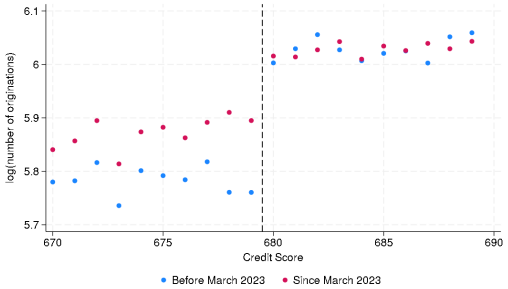
- Full or close-to-full pass-through; 30% of the g-fee change in terms of points/fees
- Other papers on pass through: Amornsiripanitch and Ricks (2024), Kalda et al. (2025)

Semi-elasticity of relative total home purchase volumes



- Average effects = 14% per 100 bps decline in g-fee (25–30 bps of mortgage rate)
  - larger than 14% increase in FHA-likely borrowers per 50 bps decline in FHA mortgage rates (Bhutta and Ringo, 2021)

log(number of total originations) around CS cutoffs at 680 and 720



(a) CS cutoff 680

(b) CS cutoff 720

- Identification is driven by sharp, discontinuous changes at the cutoffs
- CS manipulation does not seem to be behind these data patterns details

What explains the large semi-elasticity estimate?

1. DTI constraint: larger semi-elasticity among borrowers close to DTI max ▸ details
   - consistent with Bhutta and Ringo (2021) and Bosshardt et al. (2024)

2. Elevated price sensitivity even for DTI-unconstrained borrowers:
   - they still have high semi-elasticity of 10%
   - 55% of them purchased discount point of 110 bps on avg, suggesting them targeting monthly payment levels

3. β reflects *relative* effects between borrowers receiving different g-fee changes
   - if house supply is limited/inelastic, there will be winners and losers, leading to large effects on housing allocation
   - we explore more with our housing search model

Heterogeneous effects on home purchases across CS and incomes

	(1) CS $<$ 700	(2) CS $\in$ [700, 740)	(3) CS $\geq$ 740
$1[t > Feb23] \times E[-\Delta LLPA]$	0.095***	0.177***	0.171***
	(0.019)	(0.054)	(0.043)
$1[t > Feb23] \times E[-\Delta LLPA] \times 1[\frac{\text{Income}}{AMI} \in (P_{33}, P_{66}]]$	0.054**	0.095*	-0.029
	(0.026)	(0.053)	(0.058)
$1[t > Feb23] \times E[-\Delta LLPA] \times 1[\frac{\text{Income}}{AMI} \in (P_{66}, P_{90}]]$	0.068**	-0.045	0.064
	(0.034)	(0.108)	(0.065)
$1[t > Feb23] \times E[-\Delta LLPA] \times 1[\frac{\text{Income}}{AMI} > P_{90}]$	0.149**	-0.093	-0.165***
	(0.068)	(0.130)	(0.052)
Cutoff $\times$ Income bin $\times$ Orig YM	Y	Y	Y
CS FE	Y	Y	Y
N. Obs.	1,440	720	1,440
Pseudo R^2	0.92	0.89	0.89

Note: P_n = the n-th percentile of $\frac{\text{income}}{\text{area median income}}$

- Larger effects for borrower types who typically rely more on GSE loans
  - low-CS ($<$700) + higher incomes; high-CS ($\geq$ 740) + incomes $< P_{90}$

$\Rightarrow$ Cross-subsidy toward lower CS may be regressive in the income dimension
  - Low-CS + higher-income: older and less likely to be first-time buyers ▸ NMDB

Housing Search Model

- We build and calibrate a housing search model to rationalize our large elasticities and simulate counterfactual g-fee policies

- Model is in two stages:
  1. Stage 1: buyers and sellers decide to enter the housing market based on the expected value of entry
     - Buyers choose loan type, if they decide to enter, which determines their financing cost
  2. Stage 2: standard housing search and match model, similar to Jiang et al (2024)

- Stage 1 leads to borrower heterogeneity in financing costs, which is novel
  - allows us to examine the effects of g-fees on housing allocation across buyers

Model Details: Buyers in Stage 1

- Buyers vary by CS (c) and income (k),
  choosing lender (j) $\times$ LTV (l) $\times$ loan type (f) to maximize:

$$\gamma^B \underbrace{V^B(r_{ckjlf})}_{\substack{\text{EV of entry with} \\ \text{mortgage rate } r_{ckjlf}}} + \underbrace{\xi_{cklfb(j)}}_{\substack{\text{loan char. other than} \\ \text{mortgage rate}}} + \epsilon_{ckjlft} \tag{1}$$

- Outside option: not searching for a home (payoff $= 0$)
- Inflow of buyers of type r_i (mortgage rate from optimal choice):

$$\mu^B(r_i) = \sum_{ck} w_{ck} \mathbb{1}(r_i = r_{ckjlf}) \frac{\exp\left(\gamma^B V^B(r_{ckjlf}) + \xi_{cklfb(j)}\right)}{1 + \sum_{jlf} \exp\left(\gamma^B V^B(r_{ckjlf}) + \xi_{cklfb(j)}\right)} \tag{2}$$

Model Details: Sellers in Stage 1

- Inflow of sellers:

$$\mu^S = \frac{\exp(\gamma_0^S + \gamma_1^S V^S)}{1 + \exp(\gamma_0^S + \gamma_1^S \underbrace{V^S}_{\text{EV of entry}})}, \tag{3}$$

- γ_1^S is related to GE responses to g-fees; if more buyers flow into the market in response to g-fees, γ_1^S determines the level of seller response
- γ_1^S is not identified in our data; $\gamma_1^S = 0$ for now, making seller listings inelastic
- Plan to examine the sensitivity of our results to different values of γ_1^S

Model Details: Matching in Stage 2

- Buyers and sellers play a continuous-time matching game
- In a stationary equilibrium, a mass of buyers M^B and sellers M^S are matched with this matching function:

$$m(M^B, M^S) = \alpha \left(\sum_i M^B(r_i) \right)^{\phi} \left(M^S \right)^{1-\phi} \tag{4}$$

Model Details: Nash Bargaining in Stage 2

- Upon matching and paying price P, buyer surplus:

$$v^B(r_i) = \underbrace{\rho^b}_{\text{house value}} - \underbrace{\psi r_i}_{\substack{\text{disutility from} \\ \text{financing cost}}} - P \tag{5}$$

  - ψ: allocative effects of g-fee changes, related to reduced-form semi-elasticity
  - holding fixed seller flows, larger $\psi \Rightarrow$ buyers with lower r_i win homes over others

- Seller surplus: $v^S = P + \epsilon_s$,
  where $\epsilon_s \sim N(0, \sigma)$ for each match, representing an idiosyncratic urgency to sell

- Nash bargaining determines the eqm price, with seller's bargaining power θ:

$$P(\epsilon_s, r_i) = V^S + \theta \underbrace{(\rho^b - \psi r_i + \epsilon_s - V^B(r_i) - V^S)}_{\text{match surplus}} \tag{6}$$

Calibration fit

Statistic	Model Output	Target	Difference
Relative home purchase semi-elasticity (100 bps g-fee)	0.140	0.139	0.001
Buyer weeks to success	11.803	12.000	-0.197
Seller days on market (DOM)	38.955	39.000	-0.045
Expected number of offers before success	2.486	2.500	-0.014
Expected price ($10,000s)	43.251	43.295	-0.044
Std. dev. of log price	0.092	0.093	-0.001
Nonbank share change (100 bps g-fee)	0.0178	0.019	-0.001

- The model fits the targeted moments well, in particular the reduced-form relative home purchase semi-elasticity of 14%
- Search frictions and limited, inelastic housing supply rationalize the large elasticity

Model implications for untargeted moments

Statistic	Model Output
Intensive margin elasticity (+100 bps interest rate)	-0.026
Growth in CS<680 share following 50 bps FHA MIP cut	0.210
Relative home purchase semi-elasticity (100 bps g-fee, constant flows)	0.092

1. Intensive margin elas of 2.6% in transaction price, similar to DeFusco and Paciorek (2017)
   - higher interest rates mainly reduces home purchases rather than transaction prices
2. Effects of FHA MIP cut still larger but similar to 14% in Bhutta and Ringo (2021)
   - tighter market conditions over our calibration period may explain this difference
3. Making buyer entry inelastic to mortgage rates reduces semi-elas from 14% to 9%
   - g-fee $\Rightarrow$ buyer endogenous entry v allocative effects during search
   - allocative effects accounts for two thirds of the relative home purchase elasticity

Conclusion

- G-fees have large, heterogeneous effects on home purchases
- G-fee pricing that is progressive in CS turned out to be regressive in income

$\Rightarrow$ Making g-fees less aligned with credit scores will be regressive in income and likely negatively affect GSE earnings and capital

- A housing search model with limited, inelastic housing supply can rationalize the large home-purchase effects through allocative effects
  - Distributional effects of g-fee pricing will be large in a tighter housing market

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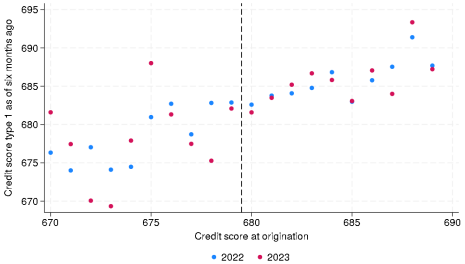
CS Manipulation: presence of co-borrowers

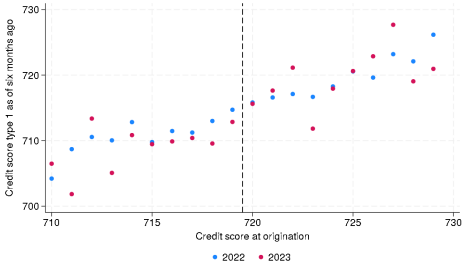
	subsample 1: CS cutoff $\in \{680, 720\}$			subsample 2: CS cutoff $\in \{640, 760, 780\}$		
	(1) Conventional conforming	(2) GSE	(3) Non-agency conforming	(4) Conventional conforming	(5) GSE	(6) Non-agency conforming
$1[t > Feb23] \times E[-\Delta LLPA]$	-0.002	0.010	-0.012	0.009	0.014	0.019
	(0.009)	(0.012)	(0.019)	(0.008)	(0.010)	(0.012)
CS cutoff × Income bin × Orig YM	Y	Y	Y	Y	Y	Y
CS FE	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
N. Obs.	197,428	125,164	71,927	733,246	542,382	404,942
Adj. R^2	0.03	0.02	0.05	0.03	0.03	0.03

- Adding a co-borrower can decrease the underwriting CS. But no evidence that this decision responds to g-fee changes

CS Manipulation: credit scores as of 6 months prior to origination



(a) 680 cutoff



(b) 720 cutoff

- No evidence supporting CS changed in different ways for loans with underwriting CS near CS cutoffs

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Home purchase semi-elasticities by DTI

	Total			GSE			Conventional conforming		
	(1) cDTI≤ 40	(2) cDTI> 40	(3) cDTI> 45	(4) cDTI≤ 40	(5) cDTI> 40	(6) cDTI> 45	(7) cDTI≤ 40	(8) cDTI> 40	(9) cDTI> 45
$1[t > Feb23] \times E[-\Delta LLPA]$	0.104*** (0.020)	0.181*** (0.017)	0.193*** (0.020)	0.261*** (0.031)	0.322*** (0.041)	0.393*** (0.058)	0.186*** (0.023)	0.270*** (0.035)	0.370*** (0.041)
Share of loan type	0.55	0.45	0.25	0.25	0.18	0.09	0.42	0.27	0.13
Cutoff × Income bin × Orig YM	Y	Y	Y	Y	Y	Y	Y	Y	Y
CS FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N. Obs.	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600
Pseudo R^2	0.85	0.73	0.71	0.83	0.77	0.72	0.85	0.77	0.73

- Consider counterfactual DTI (cDTI), in a scenario in the absence of discount points and g-fee changes on DTI

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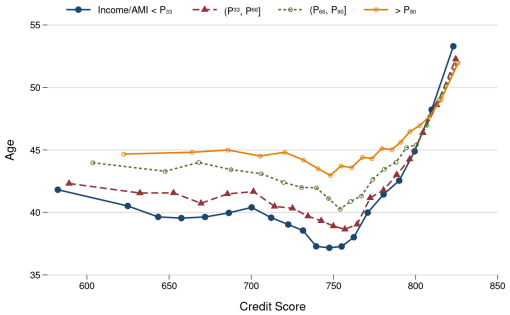
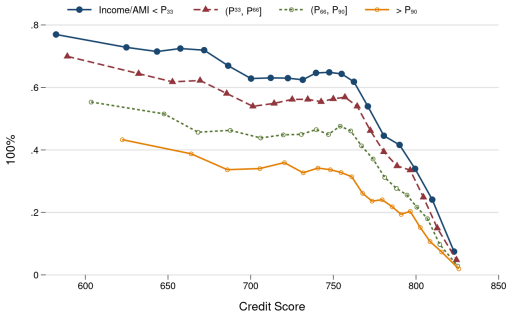
NMDB summary statistics



(a) Age



(b) Share of first-time home buyers

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