Mortgage Seasonality, Capacity Constraints, and Lender Responses

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Consumer Financial Protection Bureau

Disclaimer

- The views expressed are those of the authors and do not necessarily reflect those of the Consumer Financial Protection Bureau or the United States.

Introduction

- Housing market is highly seasonal.
  - Weather patterns and school calendar effects
  - Construction
  - Moving peaks in the summer months and slows in the winter.
  - Home sales
- Seasonality in housing transactions implies seasonality in the number of mortgage applications.
- Using this natural experiment, we explore how lenders may ration credits during mortgage demand high seasons, and whether lenders may be more prone to making mistakes in underwriting when overworked.

Introduction

- Intuition:
  - With lenders and loan officers overworked, can they underwrite and deal with customers differently?
  - Vice versa, when loan officers sit idle, can they loosen the underwriting standards to generate more business?

- Formally: Do lenders ration credits when their operational capacity is constrained during high seasons?
  - Source of lenders' capacity constraint is a mortgage seasonality
  - Seasonality as an exogenous demand shifter

- How do the loans originated in high seasons perform differently than the loans originated in low seasons?

Related Literature

- Recent studies show that lenders may ration credits when faced with capacity constraints
  - Balance sheet constraints (Bernanke and Gertler, 1987; Bernanke, 2007)
  - Operational constraints from demand shocks for refi loans
    - low interest environment (Sharpe & Sherlund, 2016; Ma, 2023)
    - policy interventions (Choi et al., 2022; Fuster et al., 2021)
- Soft information and lender discretion
  - Agarwal et al., 2011; Agarwal and Ben-David, 2018; Ambrose et al., 2021; Jiang et al., 2022
- Literature on job performance and decision making under time constraints
  - Huang, 2011; Fitch and Shivdasani 2006; Coviello et al., 2014; Yang, 2016; Iverson 2019

Preview of the Main Findings

- An increase in demand for home purchase loans during high seasons
  ➡ lender capacity constraint ➡ higher denial rates for refinance apps
  - Independent mortgage companies are more likely to ration credits than large banks
  - Black and Hispanic applicants are more likely to be affected by credit rationing than non-Hispanic White applicants
- Soft information and/or lender discretion likely play a role in lenders' credit rationing
- Loans originated during mortgage demand high seasons are more likely to default than loans originated during low seasons, implying the quality of underwriting deteriorates when loan officers are overworked.

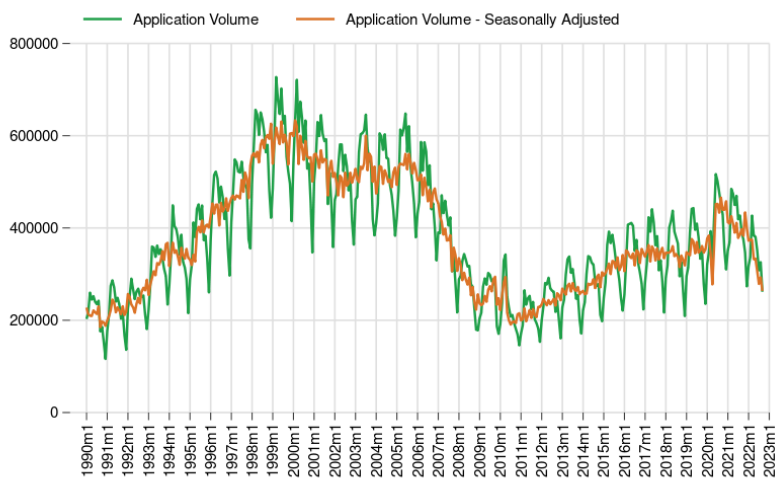
Data

- Confidential Home Mortgage Disclosure Act (HMDA) data
  - Main sample
    - 2018-2022 HMDA
    - Restricted to closed-end, not reverse mortgages, secured by site built, single-family, first-lien, principal residence
  - Additional sample for estimating seasonality
    - 1990-2022 HMDA

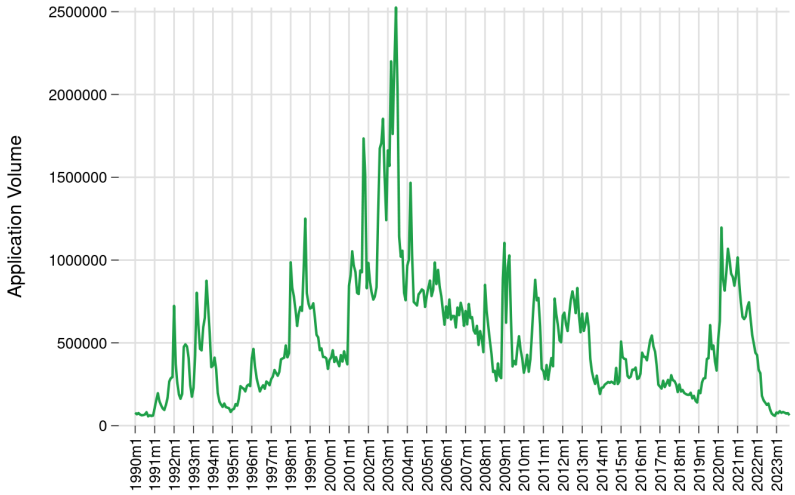
- National Mortgage Database (NMDB)
  - A nationally representative five percent sample of closed-end first-lien residential mortgages in the United States
  - Only nationally representative mortgage data that contains both the information at origination and mortgage performance information
  - Jointly funded by FHFA and CFPB

Seasonality of Mortgage Applications

Home Purchase Applications

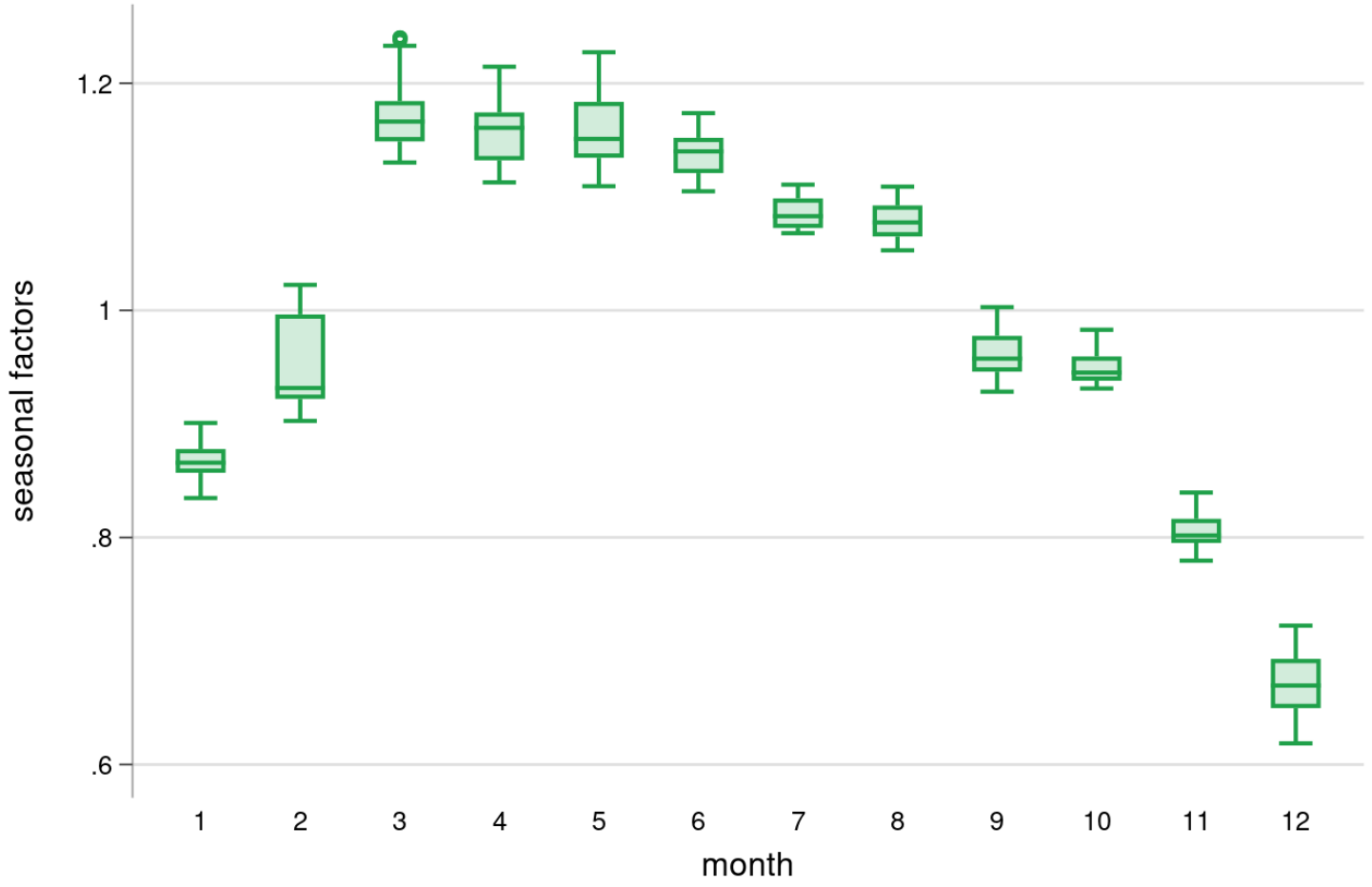


Refinance Applications



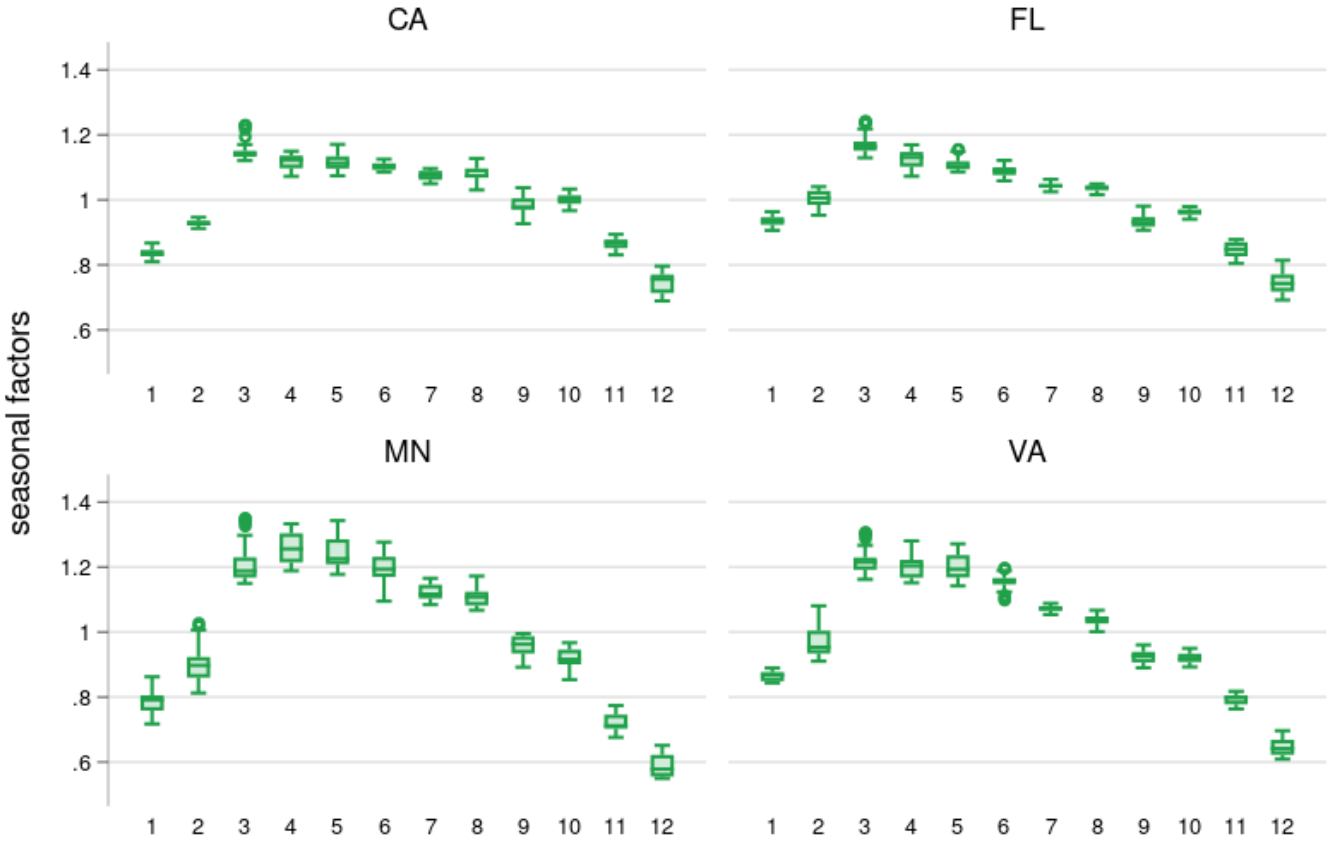
- To quantify seasonality, we use the Census Bureau's X-13ARIMA-SEATS (X13-A-S) method to compute numeric values called "seasonal adjustment factors (SF)"
  - SF > 1 : app vol greater than the yearly avg
  - SF < 1 : app vol less than the yearly avg

Trends in Seasonal Factors by Month

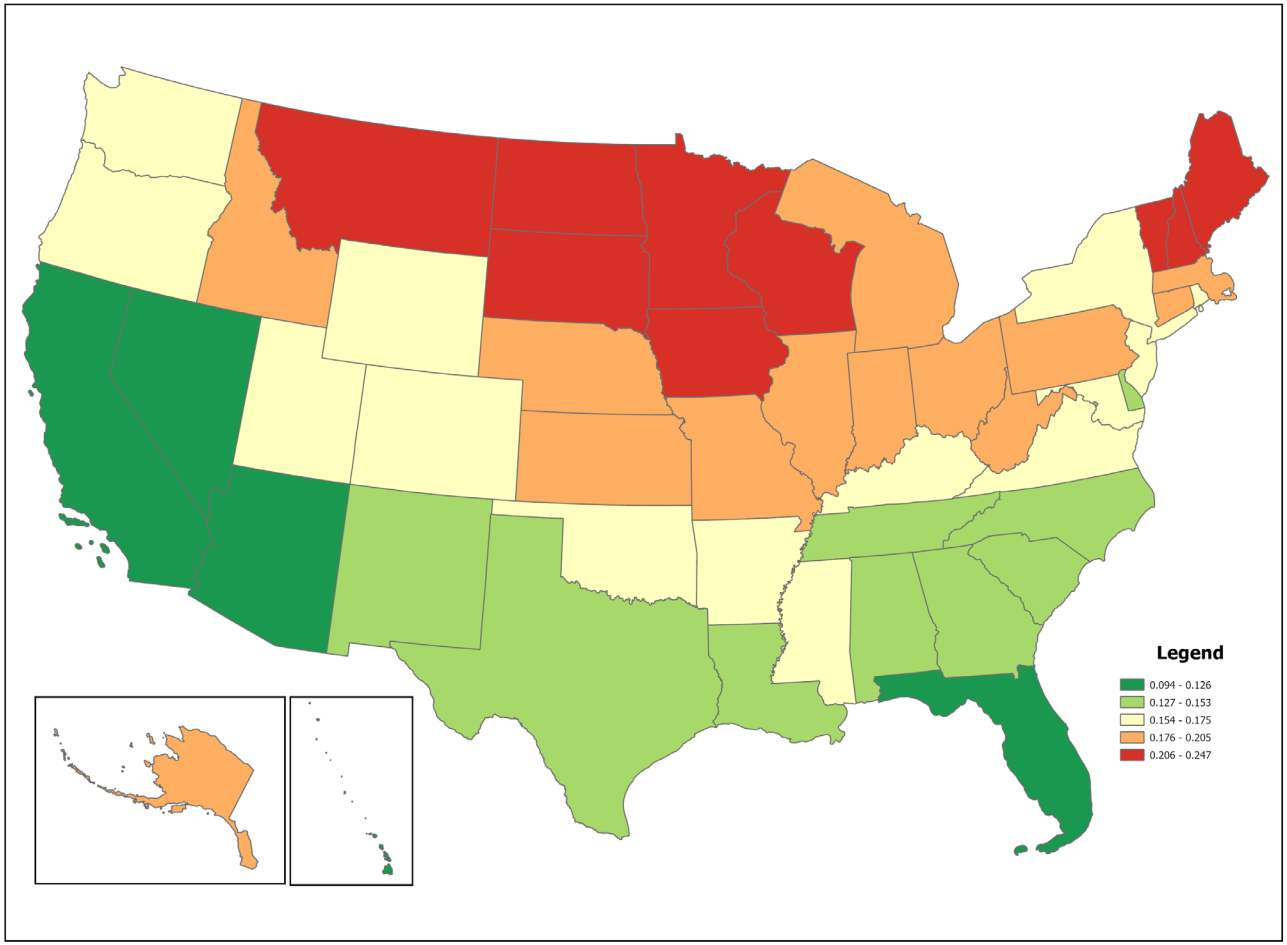


Seasonality by Month and State

- Not only mortgage seasonality varies by time, it also varies cross-sectionally.



Volatility of Monthly Number of Applications



Seasonality also varies by region.

States with temperate climates

➡ Less volatility in n of mortgage apps across months

Lender Capacity Constraints

Total mortgage industry employment trend

Source: BLS data

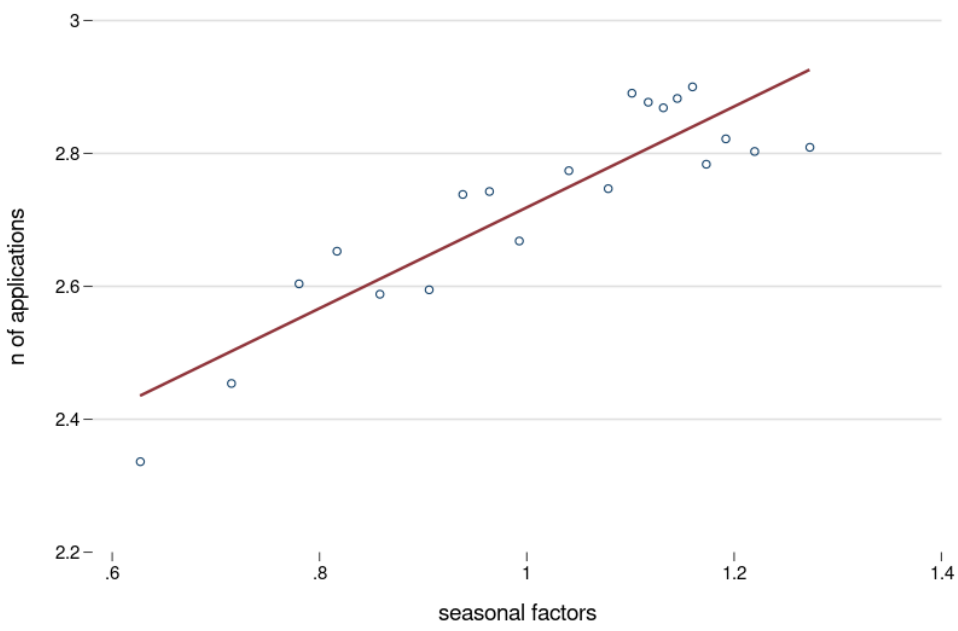
- Mortgage Loan Officers are high skilled workers
  - bachelor's degree
  - completion of prelicensure courses
  - Obtain a state license
  - Pass the Secure and Fair Enforcement Act (SAFE) test.
  - annually complete continuing education coursework and maintain active licenses

Can't flexibly adjust workforce

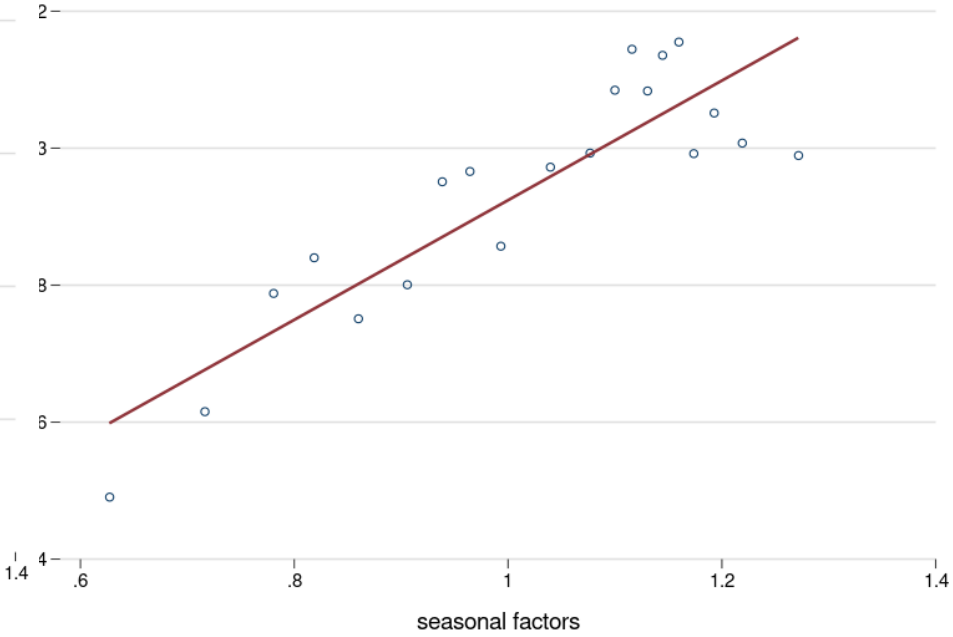
➡ operational capacity constraint

Lender Capacity Constraints

Avg max n of apps in LO's queue



Avg n of apps processed per LO



During home purchase high seasons, lenders are more likely to reach capacity constraints

Model for Denial Outcomes

$$Y_{ist} = \beta_{high}\, SF_{high} + \beta_{low}\, SF_{low} + X_{ist} + State + Lender + \varepsilon$$

Y_{ist} = denied

SF_{high} : seasonal factors > 1

SF_{low} : seasonal factors < 1

X_{ist} : factors that potentially influence the underwriting decisions (e.g. credit scores, Debt-to-Income (DTI), Loan-to-Value (LTV), income, AUS results, channels etc.)

- Preferred model includes State and Lender FEs
- lenders likely behave differently when on the high-side vs low-side of SF
  - strong demand (SF > 1) : lender experience capacity constrained, may ration credits
  - weak demand (SF < 1) : excess capacity ➡ lenders may not easily lower lending standards

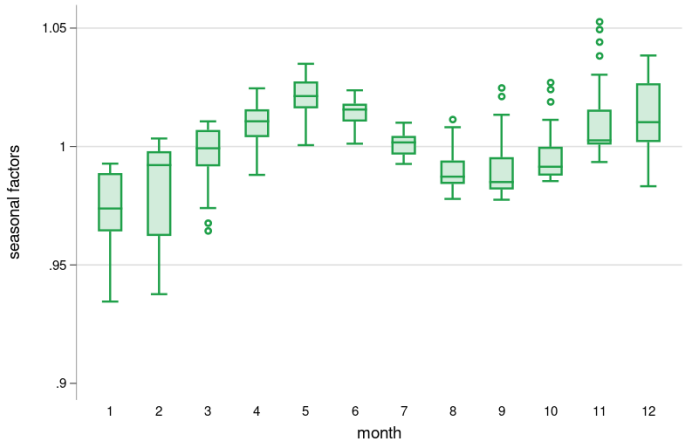
Mortgage Application Denial: Home Purchase Loans

	(1)	(2)	(3)	(4)	(5)
Seasonal factor high side (above 1)	-0.049***	-0.027***	-0.021***	-0.017***	0.001
	(0.001)	(0.001)	(0.001)	(0.003)	(0.004)
Seasonal factor low side (below 1)	0.021***	0.013***	0.009***	0.007***	-0.005*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Loan & credit characteristics	No	Yes	Yes	Yes	Yes
Channel	No	No	Yes	Yes	Yes
AUS	No	No	Yes	Yes	Yes
Lender FE	No	No	No	Yes	Yes
State FE	No	No	No	No	Yes
N. Obs.	20,956,270	19,277,912	19,277,912	19,277,836	19,277,836
Adj. R^2	0.00	0.21	0.28	0.31	0.31

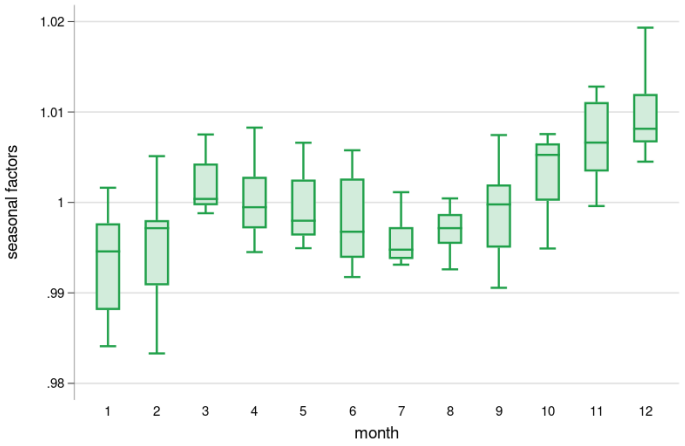
First lien closed-end home purchase originations secured by site-built, single family, owner-occupied properties

Seasonality of Application Credit Characteristics

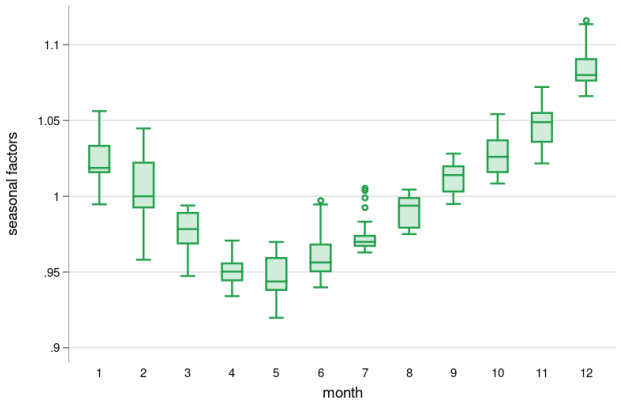
- (a)Average income



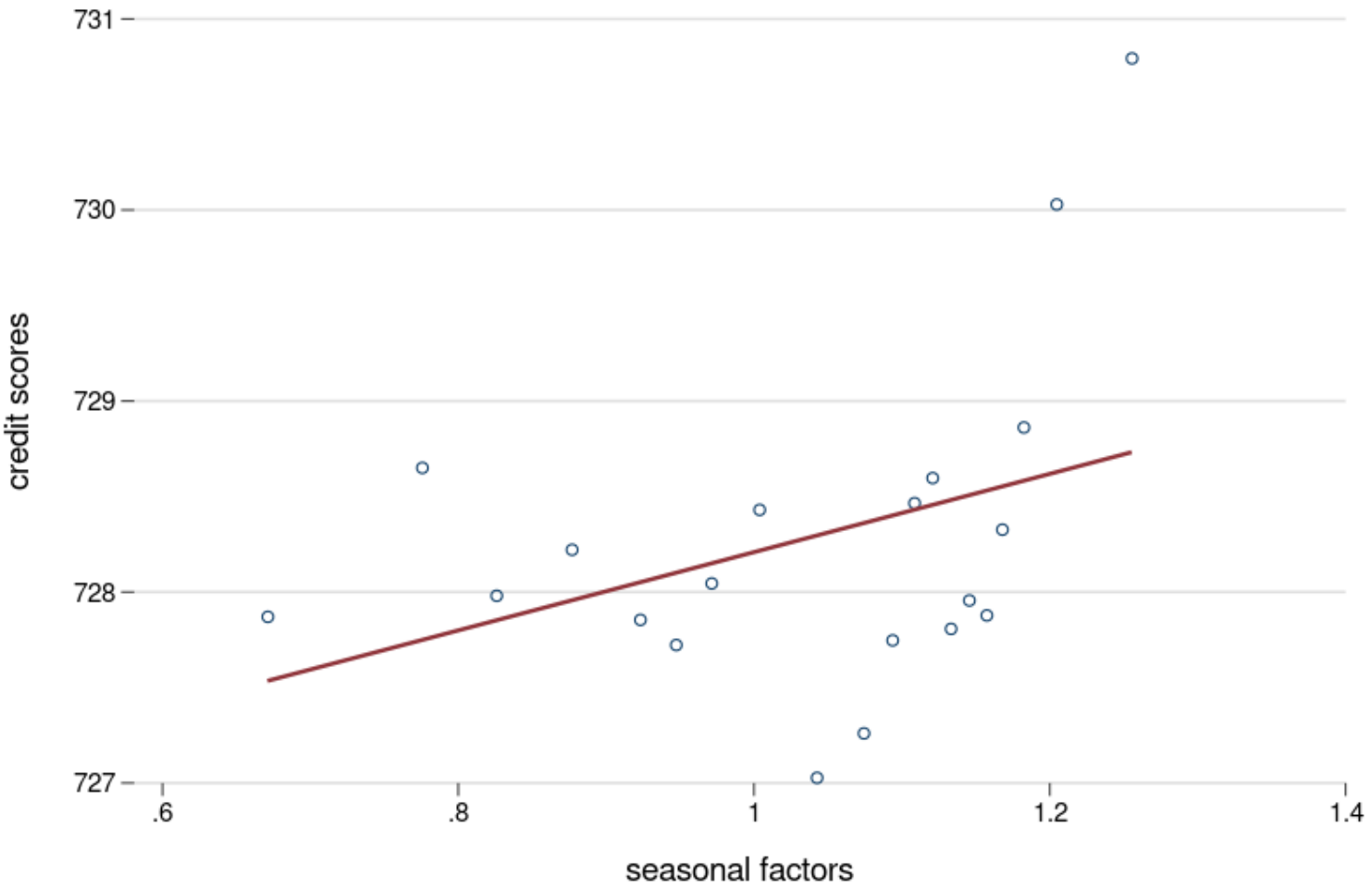
(b) Median loan amount to income ratio



(c) Minority share



Credit Characteristics of HP applicants



Key Identification Assumptions

1. There is a seasonal variation in home purchase application volumes.

2. Most lenders receive both home purchase applications and refinance applications and hence the change in home purchase application volume could spill over to the lenders' overall capacity, constraining lenders' capacity to deal with refinance applications.

3. Unlike the home purchase applications, the change in credit characteristics of refinance loan application pool is orthogonal to the home purchase seasonality.

Mortgage Application Denial: Refinance Loans

	(1)	(2)	(3)	(4)	(5)
Seasonal factor high side (above 1)	0.006***	-0.002**	-0.003***	0.037***	0.047***
	(0.001)	(0.001)	(0.001)	(0.014)	(0.015)
Seasonal factor low side (below 1)	0.020***	0.010***	0.009***	-0.004	-0.011
	(0.001)	(0.001)	(0.001)	(0.006)	(0.007)
Loan & credit characteristics	No	Yes	Yes	Yes	Yes
Channel	No	No	Yes	Yes	Yes
AUS	No	No	Yes	Yes	Yes
Lender FE	No	No	No	Yes	Yes
State FE	No	No	No	No	Yes
N. Obs.	27,177,303	22,073,047	22,073,047	22,072,981	22,072,981
Adj. R^2	0.00	0.31	0.38	0.43	0.43

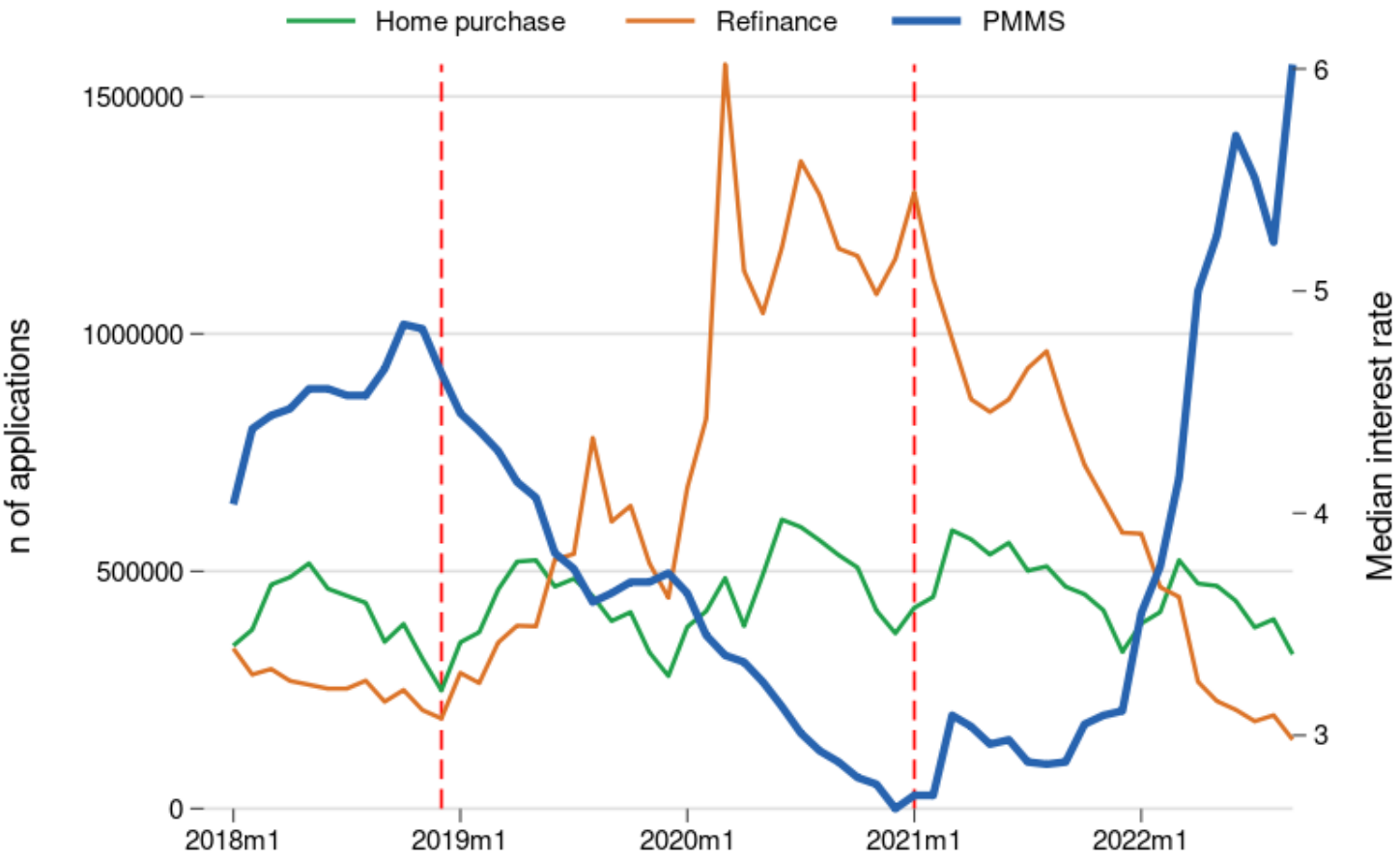
Robustness Checks

Our identification strategy relies on two key assumptions:

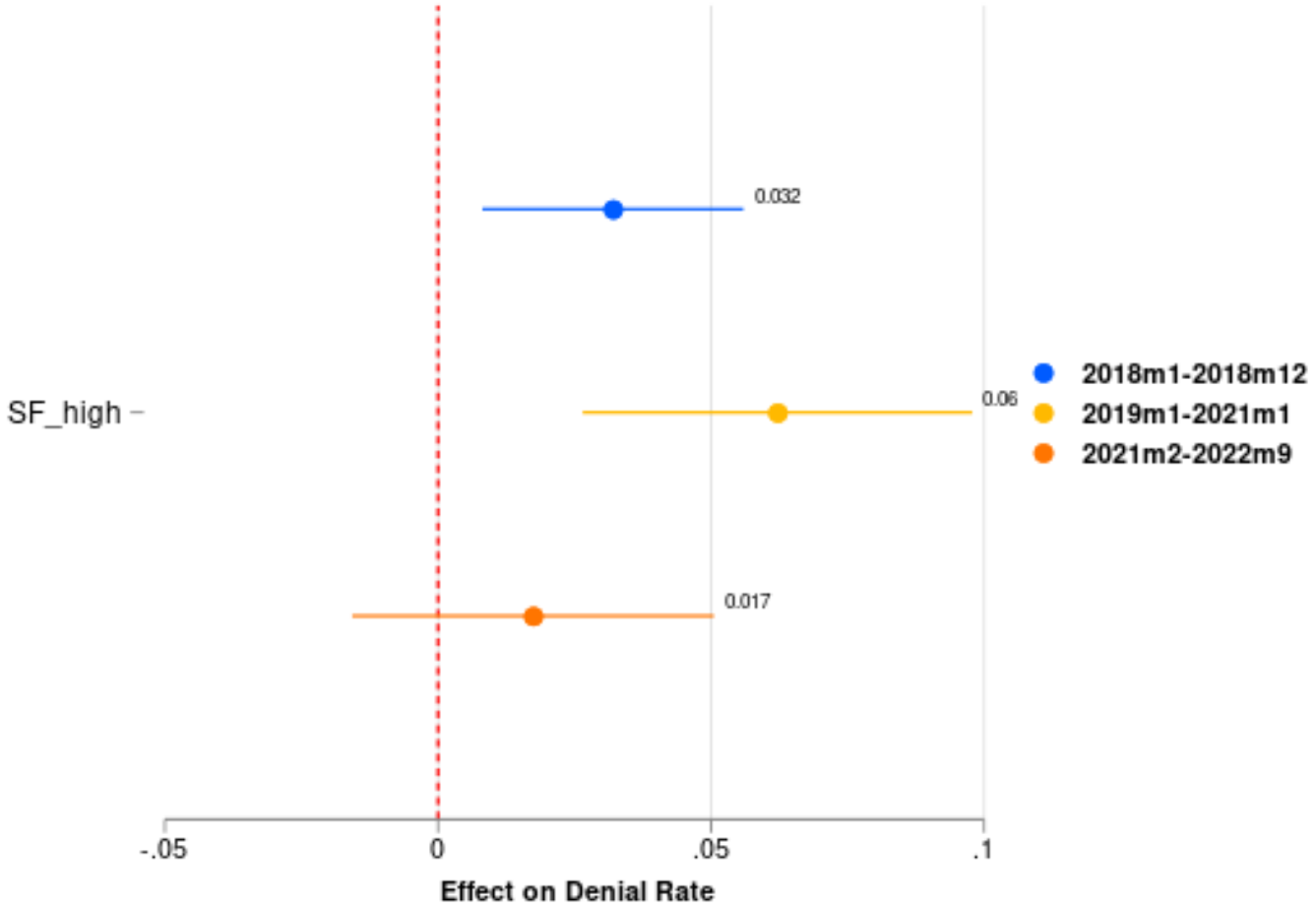
1. The change in credit characteristics of refinance loan application pool is orthogonal to the home purchase seasonality.
   - True in theory.
   - But could be confounded if the change in interest rate environment coincided with home purchase seasonality in our sample period.

2. Most lenders receive both home purchase and refinance applications and hence the change in home purchase application volume could spill over to the lenders' overall capacity, constraining lenders' capacity to deal with refinance applications.
   - Can be tested.

Market Trends



Robustness Check: by Time Periods



Robustness Check: by Lenders' Refi Shares

	(1) ≥ 99%	(2) ≥ 95%	(3) ≥ 90%	(4) ≥ 80%	(5) ≥ 50%	(6) < 50%
Seasonal factor high side (above 1)	0.033	0.021	0.054*	0.038**	0.053**	0.030***
	(0.031)	(0.034)	(0.028)	(0.015)	(0.021)	(0.005)
Seasonal factor low side (below 1)	-0.051	-0.048	-0.023*	-0.018**	-0.016*	0.002
	(0.032)	(0.046)	(0.013)	(0.007)	(0.009)	(0.002)
Loan & credit characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Channel	Yes	Yes	Yes	Yes	Yes	Yes
AUS	Yes	Yes	Yes	Yes	Yes	Yes
Lender FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
N. Obs.	73,025	435,745	1,803,710	6,433,227	15,973,405	6,098,273
Adj. R^2	0.58	0.53	0.51	0.40	0.42	0.45

- No statistically significant effects for lenders specializing in refi loans
  ➡ No spillover effect from home purchase loan seasonality to lenders' overall capacity to process mortgage applications

Heterogeneous Effects: Lender Types

	(1) Large Banks	(2) Medium Banks	(3) Small Banks	(4) Large Credit Unions	(5) Small Credit Unions	(6) Independent Mortgage Companies	(7) Others
			Panel A: Sample Period 2018m1 to 2022m9				
Seasonal factor high side (above 1)	0.126	0.057***	0.018***	0.061	0.007	0.036***	-0.008
	(0.081)	(0.021)	(0.006)	(0.041)	(0.005)	(0.008)	(0.037)
Seasonal factor low side (below 1)	-0.036	-0.009	0.002	0.013*	0.005	-0.007	-0.062*
	(0.038)	(0.006)	(0.003)	(0.007)	(0.003)	(0.006)	(0.035)
N. Obs.	3,125,562	1,133,851	1,748,087	430,780	1,512,106	13,255,105	867,490
Adj. R^2	0.52	0.43	0.47	0.52			
			Panel B: Sample Period 2018m1 to 2018m12				
Seasonal factor high side (above 1)	0.060	0.040*	-0.000	-0.040	0.020	0.030**	0.005
	(0.040)	(0.021)	(0.013)	(0.059)	(0.013)	(0.015)	(0.026)
Seasonal factor low side (below 1)	-0.012	-0.039**	-0.014	-0.032	0.001	-0.039	-0.042
	(0.021)	(0.016)	(0.014)	(0.025)	(0.013)	(0.034)	(0.028)
N. Obs.	304,817	118,373	150,376	32,782	145,091	1,100,230	85,374
Adj. R^2	0.52	0.43	0.49	0.48	0.47	0.40	0.45
			Panel C: Sample Period 2019m1 to 2021m1				
Seasonal factor high side (above 1)	0.166	0.071**	0.024***	0.121**	0.007	0.045***	-0.002
	(0.098)	(0.030)	(0.006)	(0.053)	(0.005)	(0.008)	(0.028)
Seasonal factor low side (below 1)	-0.027	-0.005	-0.004	-0.000	0.001	0.004	-0.008
	(0.051)	(0.007)	(0.005)	(0.011)	(0.004)	(0.004)	(0.007)
N. Obs.	1,765,677	695,367	1,111,253	227,003	902,516	7,375,440	493,535
Adj. R^2	0.49	0.42	0.45	0.53	0.48	0.40	0.48
			Panel D: Sample Period 2021m2 to 2022m9				
Seasonal factor high side (above 1)	0.083	0.033**	0.013	0.021	-0.001	0.008	-0.052
	(0.086)	(0.014)	(0.013)	(0.040)	(0.007)	(0.012)	(0.065)
Seasonal factor low side (below 1)	-0.055*	0.000	0.010	0.001	0.006	-0.022**	-0.037**
	(0.028)	(0.010)	(0.008)	(0.015)	(0.005)	(0.010)	(0.016)
N. Obs.	1,055,066	320,108	486,437	170,994	464,440	4,779,398	288,580
Adj. R^2	0.56	0.46	0.49	0.53	0.50	0.43	0.57

- Ind Mortg Co ration credits during high seasons
- Large banks don't seem to ration credits
- ➢ Large banks are subject to more regulations and have a stronger compliance system

Heterogeneous Effects: Applicant Race

	(1) 2018m1-2022m9	(2) 2018m1-2018m12	(3) 2019m1-2021m1	(4) 2021m2-2022m9
Seasonal factor high side (above 1)	0.036**	0.031**	0.051**	0.006
	(0.017)	(0.012)	(0.019)	(0.018)
Seasonal factor low side (below 1)	-0.008	-0.018	-0.003	-0.015*
	(0.007)	(0.011)	(0.009)	(0.009)
Asian	0.019***	0.026***	0.017***	0.020***
	(0.003)	(0.006)	(0.003)	(0.004)
Black	0.021***	0.023***	0.019***	0.023***
	(0.003)	(0.005)	(0.003)	(0.003)
Hispanic White	0.011***	0.014***	0.008***	0.013***
	(0.004)	(0.004)	(0.003)	(0.004)
Joint	-0.005***	-0.002	-0.004***	-0.005***
	(0.001)	(0.003)	(0.001)	(0.002)
Other	0.028***	0.040***	0.023***	0.029***
	(0.004)	(0.008)	(0.004)	(0.005)
Missing	0.017***	0.024***	0.016***	0.017***
	(0.004)	(0.007)	(0.004)	(0.004)
Asian $\times$ SF_{high}	0.020	0.042*	0.017	0.013
	(0.012)	(0.022)	(0.012)	(0.016)
Black $\times$ SF_{high}	0.025*	0.064***	0.030*	0.020
	(0.014)	(0.020)	(0.016)	(0.014)
Hispanic White $\times$ SF_{high}	0.020*	0.055***	0.030**	0.005
	(0.012)	(0.019)	(0.011)	(0.014)
Joint $\times$ SF_{high}	0.014	-0.008	0.018	0.013
	(0.009)	(0.024)	(0.011)	(0.011)
Other $\times$ SF_{high}	0.010	0.025	0.018	-0.011
	(0.019)	(0.033)	(0.025)	(0.024)
Missing $\times$ SF_{high}	0.004	-0.002	0.001	0.015
	(0.013)	(0.014)	(0.014)	(0.014)
Asian $\times$ SF_{low}	0.015**	-0.023	0.018***	0.010
	(0.006)	(0.020)	(0.006)	(0.014)
Black $\times$ SF_{low}	-0.020*	-0.028	-0.033***	-0.004
	(0.011)	(0.019)	(0.011)	(0.012)
Hispanic White $\times$ SF_{low}	-0.005	-0.054***	-0.003	-0.002
	(0.008)	(0.015)	(0.007)	(0.013)
Joint $\times$ SF_{low}	0.007	0.006	0.012*	-0.004
	(0.005)	(0.016)	(0.006)	(0.008)
Other $\times$ SF_{low}	-0.014	-0.040	-0.016	0.009
	(0.012)	(0.029)	(0.013)	(0.017)
Missing $\times$ SF_{low}	0.001	-0.020	0.005	-0.008
	(0.006)	(0.018)	(0.005)	(0.012)

Economic Magnitude of Race and Seasonal Factor Interaction

- Black and Hispanic borrowers are more likely to be affected by lenders credit rationing
  - 10% increase in home purchase loan applications lead to 0.64 pp increase in denial rates for Black and 0.55 pp for Hispanic applicants

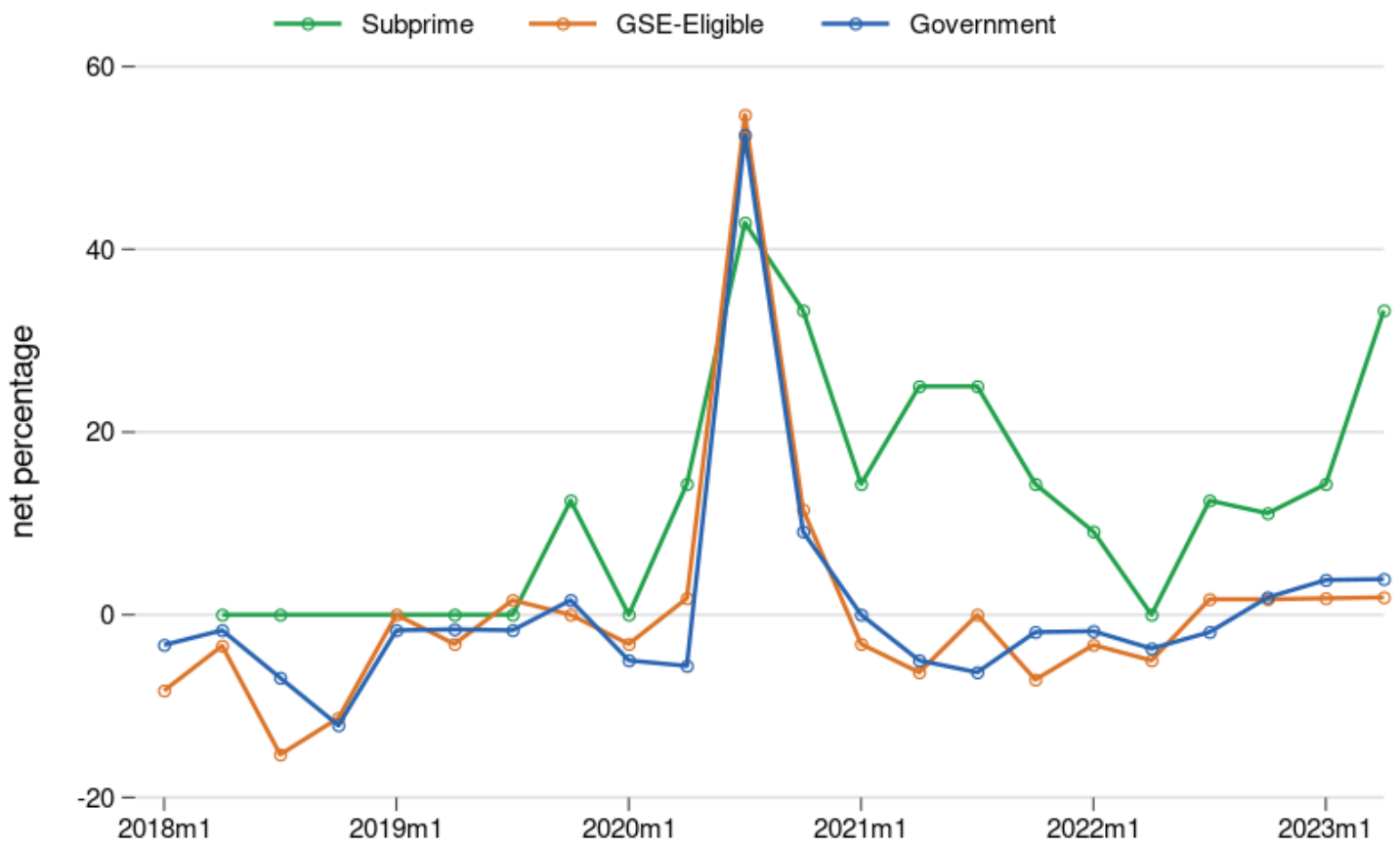
- Roughly 4,200 more Black applicants and 3,100 more Hispanic refinance applicants that were directly impacted by credit rationing due to seasonality-caused capacity constraint, relative to White applicants.

Mechanism: Soft Information or Lender Discretion?

- Soft info
  - Difficult to measure or quantify
  - Collected through personal interactions or based on an experience
  - E.g. LO's belief on whether docs are accurate and trustworthy

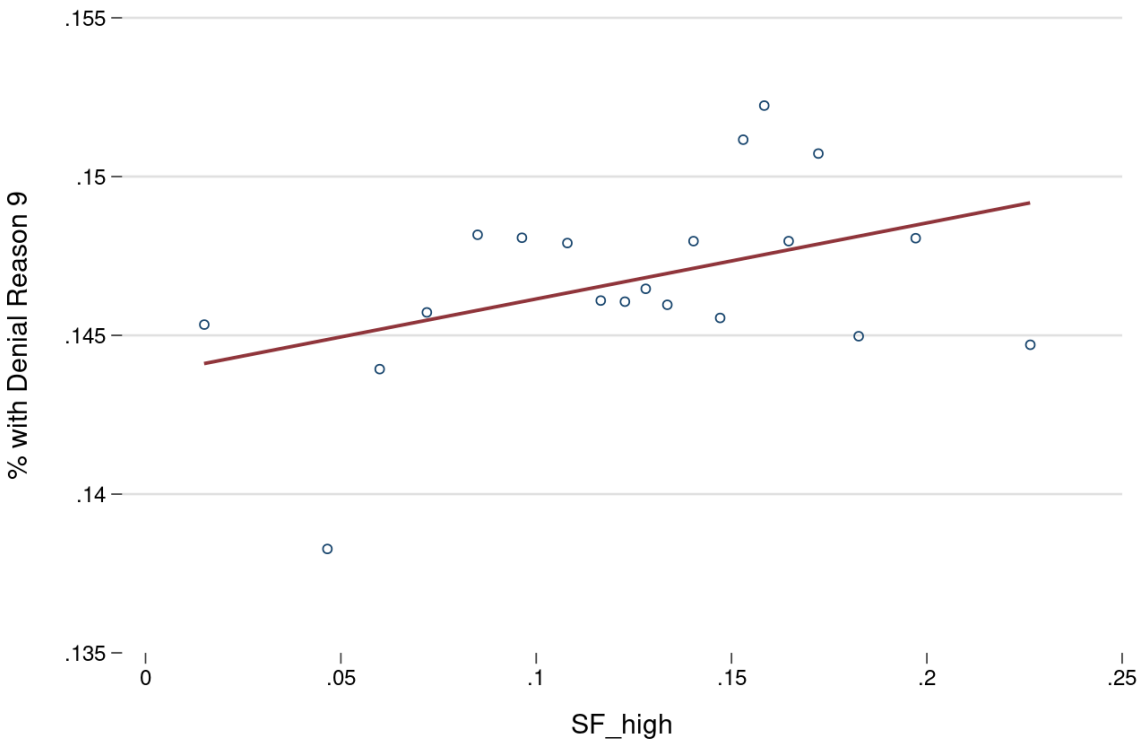
- Lender discretion?
  - Randomly reject applicants at the margin
  - Or reject additional applicants based on factors that may not be related to the risk.

Net Percentage of Domestic Banks Tightening Standards for Mortgage Loans



Federal Reserve's
Senior Loan Officer Opinion Survey on Bank Lending Practices (SLOOS)

Role of Soft Information / Lender Discretion



- Denial Reason Codes
  - 1: DTI
  - 2: Employment history
  - 3: Credit history
  - 4: Collateral
  - 5: Insufficient cash
  - 6: Unverifiable info
  - 7: Credit app incomplete
  - 8: Mortg insurance denied
  - **9: Other**

- Lenders more likely deny applicants using the denial reason "other" during high seasons

Mortgage Performance and Seasonality

- Do loans originated in different months and states perform differently post origination?

- Becker's Test (Becker 1957)
  - Difference in underwriting standards could be inferred by comparing the likelihood of mortgage defaults ex post.

- We build a 3-year default/prepayment competing risk model using NMDB.

Mortgage Performance and Seasonality

- Monthly outcomes: current, default, prepaid.
- Static variables: log of loan amount, credit scores, LTV, CLTV, DTI, loan terms, loan types, occupancy status, balloon loan status, prepayment flag, full documentation flag, negative amortization flag, cashout flag, county level unemployment rates at originations.
- Dynamic controls: county level house price change, underwater indicator, inflation, change in county level unemployment rate, interest rate spread.
- Variable of interest: seasonal factors at origination

Mortgage Performance and Seasonality

Table 9: Mortgage performance and seasonal factor at origination

	(1) 2018-2020	(2) 2011-2016	(3) 2017	(4) 2018	(5) 2019	(6) 2020
			Panel A: Delinquent			
Seasonal factor high side (above 1)	0.880***	0.371***	0.362***	0.459***	2.296***	-0.790***
	(9.97)	(9.75)	(3.37)	(3.38)	(14.47)	(-4.16)
Seasonal factor low side (below 1)	0.208**	-0.0304	-1.055***	0.184	0.111	0.210
	(3.23)	(-0.96)	(-12.27)	(1.70)	(0.95)	(1.80)
			Panel B: Prepaid			
Seasonal factor high side (above 1)	0.549***	-0.265***	-0.514***	-0.240***	0.414***	1.218***
	(18.11)	(-9.74)	(-7.05)	(-3.60)	(8.41)	(23.94)
Seasonal factor low side (below 1)	0.206***	0.262***	-0.601***	0.191***	0.127***	0.199***
	(9.28)	(11.99)	(-11.22)	(3.35)	(3.75)	(5.77)
N. Obs.	18,691,277	39,211,336	3,976,070	2,504,395	4,006,102	12,180,780

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The sample consists of originated refinance loans from NMDB. The reported parameters are log odds of mortgage becoming delinquent relative to account being current in Panel A and log odds of loan being prepaid relative to current in Panel B, within the first three years of origination.

Mortgage Performance and Seasonality of Vintage

- Loans originated during high seasons are more likely to be delinquent than loans originated during low seasons, after controlling for all observables at the time of origination and removing the effects of macroeconomic.

- Lenders are either less careful in performing their tasks screening out high risk applicants because they are overworked or resorting to criteria rejecting additional marginal applicants that are both opaque and uninformative to the real underlying credit risk.

- In other words, we observe that lenders' quality of underwriting during the high seasons worsens as their workload increases.

Conclusion

- Demand shocks during high seasons likely leads lenders to ration credits

- Black and Hispanic applicants are more likely to be affected
  - 4,200 additional Black and 3,100 additional Hispanic refinance applicants were denied between 2018 to 2022 due to lenders' credit rationing
  - Implications for fair and equal access to credits

- Loans originated during high seasons have a high default probability than loans originated during low seasons

Thank you!

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