

The Credit Supply Channel of Monetary Policy Tightening and its Distributional Impacts

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Motivation

- ▶ Monetary policy tightening kicked off near start of 2022 in response to rising inflation
- ▶ Mortgage interest rates climbed from 3% to 7% in 2022
- ▶ Purchase mortgage originations contracted 13% from 2021 to 2022

Main questions

1. What channels drove the reduction in mortgage lending?
 - ▶ If demand: impact depends on EIS (e.g. used in conventional macro models like Smets and Wouters (2007))
 - ▶ If supply (i.e. binding DTI limits): impact depends on how much the constraint binds (Greenwald (2018))
2. Which borrowers were most impacted?
3. Local ramifications for house prices and consumption?

Main findings

Data: representative sample of U.S. purchase mortgages

1. What channels drove the reduction in mortgage lending?

- ▶ → Reduction concentrated in mortgages with *counterfactual DTI* $> 50\%$ (**credit supply** threshold)

2. Which borrowers were most impacted?

- ▶ → Reduction in lending concentrated in **minority** and **low- to middle-income** borrowers

3. Local ramifications for house prices and consumption?

- ▶ → MSAs with higher exposure to DTI limits also experienced relative reductions in **house prices** and **spending**

Literature

- ▶ **Transmission of monetary policy to housing and mortgage markets**, e.g. Berger et al (2021); Beraja et al (2018); Di Maggio, Kermani, and Palmer (2020); Larson (2022); Greenwald (2018); Greenwald and Guren (2021); Di Maggio et al (2017); Drechsler, Savov, and Schnabl (2017); Drechsler, Savov, and Schnabl (2023)
- ▶ **Credit accessibility in the U.S. mortgage market**, e.g. Bhutta and Ringo (2021); Ringo (2023); Bhutta, Hizmo, and Ringo (2021); Bartlett et al (2022); Giacoletti, Heimer, and Yu (2022); Fuster, Plosser, Vickery (2021); DeFusco, Johnson, and Mondragon (2020); Gete and Reher (2020); Favara and Imbs (2015); Di Maggio and Kermani (2017); Loutskina and Strahan (2015); Berger, Turner and Zwick (2020); Mian and Sufi (2021); Goodman (2017); Hurst et al (2016); Kulkarni (2016); Fuster, Lo, and Willen (2017); Bosshardt, Kakhbod, and Kermani (2023)
- ▶ **Bunching and missing mass techniques in mortgage markets**, e.g. DeFusco and Paciorek (2017); Best et al (2020); DeFusco, Johnson, and Mondragon (2020); Kleven and Best (2017); Anagol et al (2023)

Question 1

What channels drove the reduction in mortgage lending?

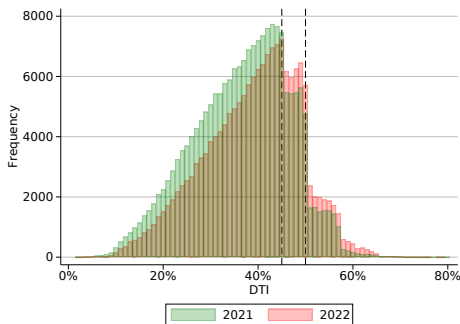
Data

- ▶ National Mortgage Database (NMDB): 5% representative sample of mortgages in the U.S.
- ▶ Focus on purchase loans for single-family (one-unit), owner-occupied, site-built properties in MSAs
- ▶ Compare loans in 2022/2023 to 2021/2020/2019

Hypothesis

Hypothesis:

- ▶ Interest rates increase
- ▶ → DTI more likely to exceed underwriting thresholds
- ▶ → reduced credit supply



How much of shift to higher DTI is due higher interest rates vs supply/demand response? → *counterfactual DTI* (3 constructions)

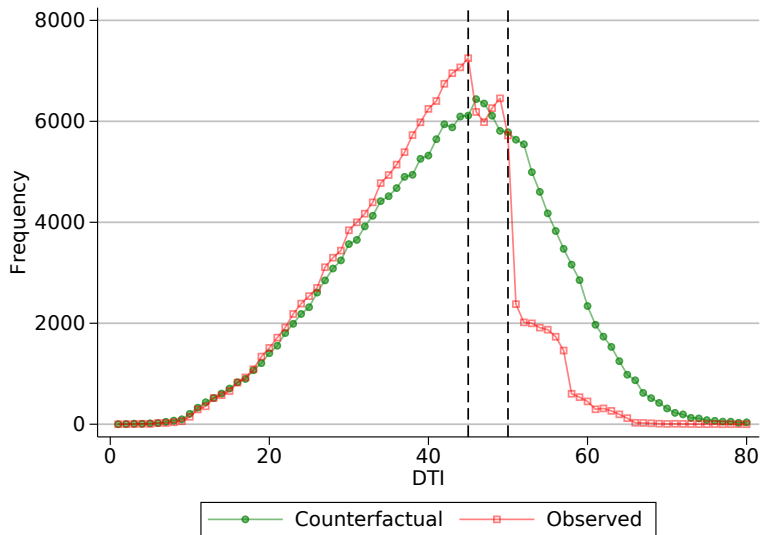
(Baseline) Counterfactual DTI: methodology

Construction 1: (baseline) counterfactual DTI

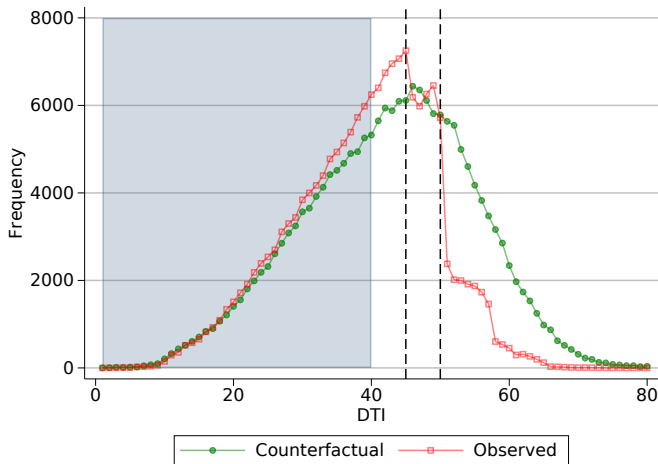
Compute (baseline) counterfactual DTI for 2021 originations as follows:

1. **Counterfactual interest rate** = observed interest rate + increase in the PMMS from origination month to same month in 2022
 - ▶ Average increase of 2.4 percentage points
 - ▶ Interest rate spike similarly affected borrowers with different levels of risk
2. **Counterfactual monthly P&I** = amortization formula (loan amount, number of payments, and counterfactual interest rate)
 - ▶ Average increase of \$487
3. **Counterfactual DTI** = observed DTI + (counterfactual P&I - observed P&I)/monthly income
 - ▶ Average increase of 5.8 percentage points

Counterfactual DTI: results

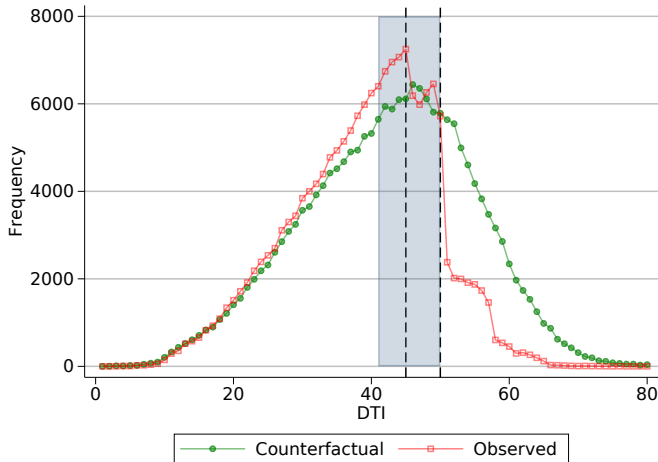


Counterfactual DTI: results (DTI well below thresholds)



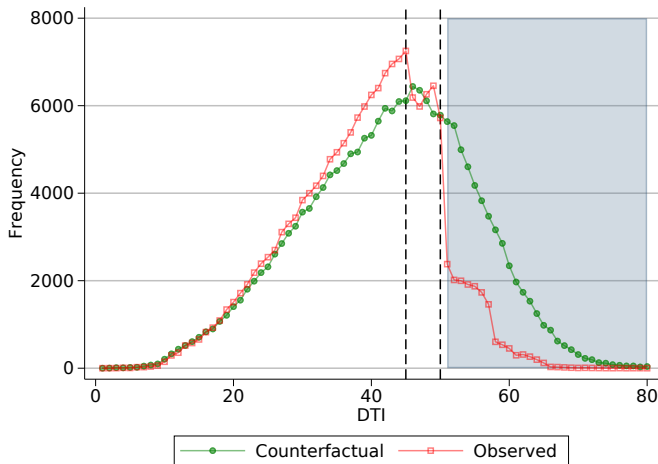
Interpretation: **intensive margin unrelated to DTI constraints** (e.g. demand) → net increase by 3.6% of 2021 observations

Counterfactual DTI: results (DTI just below thresholds)



Interpretation: **intensive margin plausibly related to DTI constraints** = “bunching” of observed distribution below thresholds → net increase by 2.5% of 2021 observations

Counterfactual DTI: results (DTI above thresholds)



Interpretation: **extensive margin plausibly related to DTI constraints** = “missing mass” above 50% threshold (18.7%) less intensive margin (2.5%) → net decrease by 16.2% of 2021 observations (among loans with $DTI \geq 41\%$)

Demand-adjusted counterfactual DTI: motivation

Construction 2: demand-adjusted counterfactual DTI

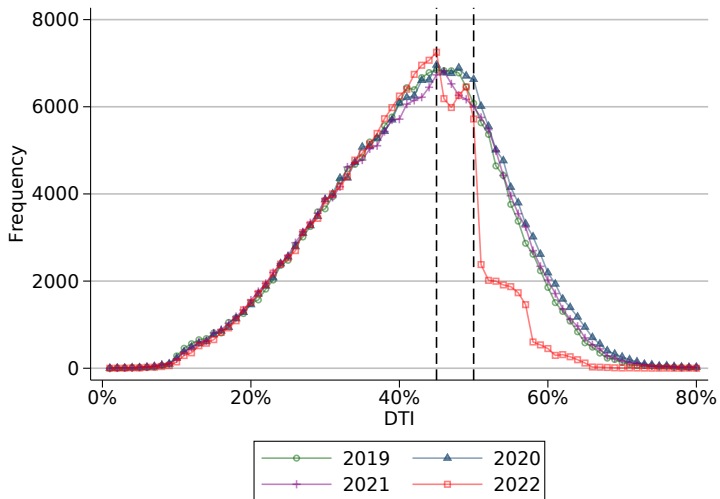
- ▶ Augment the counterfactual DTI methodology to incorporate intensive and extensive margin adjustments for demand
- ▶ Value added
 - ▶ Sharp changes at DTI thresholds already suggest supply channel
 - ▶ → Helps confirm magnitude of credit supply channel

Demand-adjusted counterfactual DTI: methodology

1. **Counterfactual interest rate** = observed interest rate + increase in the PMMS from origination month to same month in 2022
2. **Counterfactual loan amount** (intensive margin of demand)
 - ▶ Apply DeFusco and Paciorek (2017) semi-elasticity to interest rate
 - ▶ Apply **predicted changes** in loan amounts associated with changes in income and house prices
3. **Counterfactual monthly P&I** = amortization formula(**counterfactual loan amount**, number of payments, and counterfactual interest rate)
4. **Counterfactual DTI** = observed DTI + (counterfactual P&I - observed P&I)/monthly income
5. **Extensive margin of demand**: scale distribution to match the number of loans with $DTI \leq 40$

Demand-adjusted counterfactual DTI: results

Demand-adjusted CDTI is similar for several reference years



Demand-adjusted counterfactual DTI: results

Change in number of loans from counterfactual to observed as a percentage of total number of loans in the counterfactual

	Baseline	Demand-adjusted		
	(1)	(2)	(3)	(4)
DTI \leq 40	3.583 (0.297)	0	0	0
41 \leq DTI \leq 45	2.474 (0.156)	1.433 (0.170)	0.872 (0.181)	0.657 (0.163)
46 \leq DTI \leq 50	0.055 (0.196)	-0.592 (0.193)	-1.558 (0.208)	-1.201 (0.220)
50 < DTI	-18.703 (0.369)	-15.532 (0.411)	-16.927 (0.639)	-14.150 (0.645)
41 \leq DTI	-16.174 (0.363)	-14.691 (0.525)	-17.612 (0.788)	-14.695 (0.829)
Observations	359,319	359,319	337,541	329,002
Bootstrap reps.	100	100	100	100
Comparison year	2021	2021	2020	2019

Compare to 2023

Further robustness and consumer responses

Variations of demand-adjusted counterfactual methodology

- ▶ Variation with respect to **interest rate semi-elasticity**
- ▶ Variation with respect to **extensive margin DTI cutoff**
- ▶ Much smaller association in a **placebo exercise**

VA-adjusted counterfactual: estimates changes in demand based on a “control” group without DTI thresholds (VA loans) – see paper for details

Consumer responses

- ▶ Little change in **loan amounts or house value**
- ▶ Limited evidence of **substitution to ARM or longer-term mortgages**

Question 2

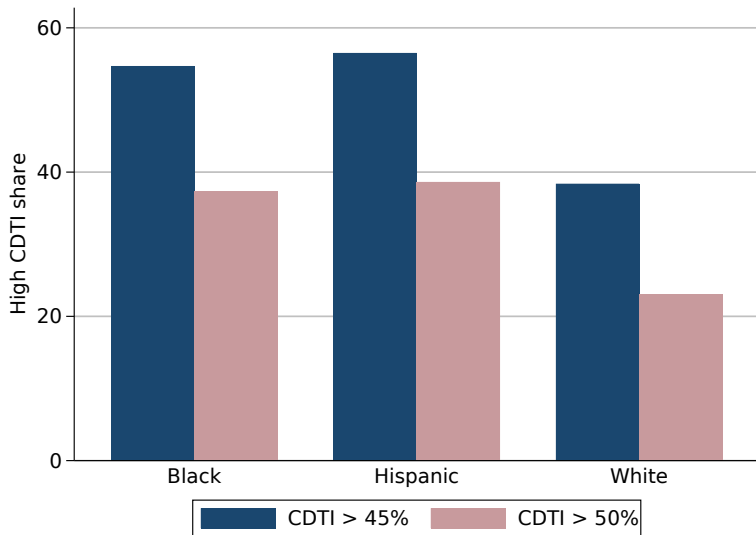
Which borrowers were most impacted?

Race and ethnicity: change in DTI distribution

Change in number of loans from counterfactual to observed as a percentage of total number of loans in the counterfactual

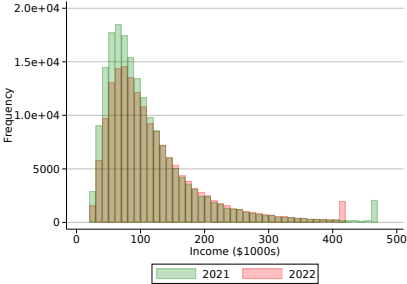
	(1)	(2)	(3)
DTI \leq 40	0.109 (0.648)	-1.850 (0.739)	0.122 (0.399)
41 \leq DTI \leq 45	0.442 (0.514)	0.821 (0.419)	0.748 (0.158)
46 \leq DTI \leq 50	-2.800 (0.671)	-2.511 (0.383)	-1.428 (0.194)
50 < DTI	-25.710 (0.672)	-29.156 (0.833)	-17.062 (0.394)
41 \leq DTI	-28.067 (1.105)	-30.846 (1.012)	-17.742 (0.501)
Observations	26,854	45,848	220,492
Bootstrap reps.	100	100	100
Subsample	Black	Hispanic	White

Race and ethnicity: high CDTI share

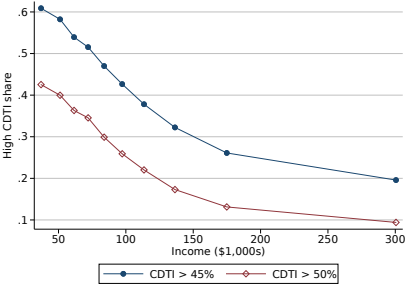


Income

Frequency



Correlation with high CDTI



Question 3

Local ramifications for house prices and consumption?

Specification

MSA-level cross-sectional specification:

$$\Delta Y_i = \beta_{DTI} highDTI_i + \gamma X_i + \varepsilon_i$$

where

- ▶ ΔY_i is change from 2021 to 2023 in MSA i (purchase mortgage volume, house prices, cash-out mortgage volume, spending)
- ▶ $highDTI_i$ is share with $CDTI > 50\%$ and $DTI \leq 50\%$ (pooling 2019-2021)
- ▶ X_i is controls: lagged dependent variable, growth in number of employees from 2020 to 2021, log of income per capita in 2021, housing supply elasticity (WRLURI from Gyourko et al (2021))

High-DTI share and purchase loan growth

Y = purchase loan volume growth 2021-2023 (NMDB)

	(1)	(2)	(3)	(4)
High-DTI share	-0.833 (0.128)	-0.787 (0.124)	-0.871 (0.138)	-1.031 (0.138)
Observations	381	381	302	302
R^2	0.115	0.159	0.198	0.424
DTI type	CDTI>50%	CDTI>50%	CDTI>50%	CDTI>50%
Base controls	No	Yes	Yes	Yes
Elasticity	No	No	WRLURI	WRLURI
Weighted	No	No	No	Yes

Consistency check with loan-level results

High-DTI share and house price growth

Y = house price growth 2021Q4-2023Q4 (FHFA all-transactions index)

	(1)	(2)	(3)	(4)
High-DTI share	-0.246 (0.037)	-0.387 (0.045)	-0.430 (0.052)	-0.289 (0.104)
Observations	381	381	302	302
R^2	0.100	0.190	0.234	0.178
DTI type	CDTI>50%	CDTI>50%	CDTI>50%	CDTI>50%
Base controls	No	Yes	Yes	Yes
Elasticity	No	No	WRLURI	WRLURI
Weighted	No	No	No	Yes

1 sd in high-DTI share \Rightarrow 0.17-0.3 sd in house prices

Consistent with existing studies relating house prices to transaction volume (DeFusco, Nathanson, Zwick (2022)) or interest rates (Larson (2022))

High-DTI share and cash-out refi growth

Y = cash-out refinance growth 2021-2023 (NMDB)

	(1)	(2)	(3)	(4)
High-DTI share	-0.903 (0.094)	-0.752 (0.094)	-0.818 (0.121)	-0.806 (0.078)
Observations	381	381	302	302
R^2	0.134	0.208	0.232	0.398
DTI type	CDTI>50%	CDTI>50%	CDTI>50%	CDTI>50%
Base controls	No	Yes	Yes	Yes
Elasticity	No	No	WRLURI	WRLURI
Weighted	No	No	No	Yes

Consistent with lower house price growth and DTI constraints

High-DTI share and spending growth

Y = percentage point difference in average daily credit/debt card spending relative to early 2020 ("Economic Tracker" associated with Chetty et al (2022))

	(1)	(2)	(3)	(4)
High-DTI share	-0.289 (0.039)	-0.316 (0.043)	-0.340 (0.049)	-0.371 (0.058)
Observations	342	340	273	273
R^2	0.132	0.154	0.169	0.271
DTI type	CDTI>50%	CDTI>50%	CDTI>50%	CDTI>50%
Base controls	No	Yes	Yes	Yes
Elasticity	No	No	WRLURI	WRLURI
Weighted	No	No	No	Yes

1 sd in high-DTI share \Rightarrow 0.20-0.26 sd in spending

Consistent with lower cash-out refi (Beraja et al (2018), Berger et al (2021), Di Maggio et al (2020))

Takeaways

1. Reduction in purchase loans during the 2022 and 2023 mortgage interest rate spike was concentrated in loans above DTI limit \Rightarrow **credit supply channel**
2. Reduction concentrated in minority and middle-income borrowers
3. High-DTI MSA also associated with lower house price and spending growth

Thank you!

Thank you!

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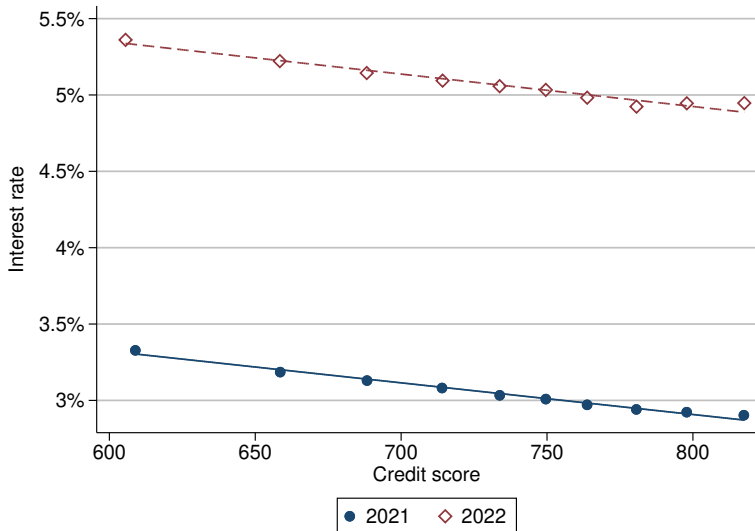
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Interest rate and credit score



Loan amount, income, and house prices

$Y = \log(\text{loan amount})$

	(1)	(2)	(3)
Log(house. income)	0.411 (0.005)	0.531 (0.006)	0.542 (0.006)
Log(tract HPI)	0.335 (0.034)		
Log(MSA HPI)		0.463 (0.055)	
Log(MSA med. val.)			0.345 (0.020)
Observations	331,932	405,171	537,877
R^2	0.676	0.522	0.568
Year FE	Yes	Yes	Yes
Geo. FE	Tract	MSA	MSA

Demand-adjusted counterfactual DTI: results with 2023

Change in number of loans from counterfactual to observed as a percentage of total number of loans in the counterfactual

	Baseline	Demand-adjusted		
	(1)	(2)	(3)	(4)
DTI \leq 40	-0.740 (0.384)	0	0	0
41 \leq DTI \leq 45	0.496 (0.203)	1.318 (0.190)	0.628 (0.225)	0.255 (0.210)
46 \leq DTI \leq 50	-0.942 (0.258)	0.271 (0.296)	-0.766 (0.276)	-1.026 (0.284)
50 < DTI	-29.926 (0.571)	-22.639 (0.577)	-23.698 (0.757)	-21.704 (0.786)
41 \leq DTI	-30.372 (0.599)	-21.051 (0.695)	-23.836 (0.864)	-22.475 (0.848)
Observations	309,130	242,261	220,058	220,803
Bootstrap reps.	100	100	100	100
Comparison year	2021	2021	2020	2019

Variation with respect to interest rate semi-elasticity

Change in number of loans from counterfactual to observed as a percentage of total number of loans in the counterfactual

	(1)	(2)	(3)
DTI \leq 40	0	0	0
41 \leq DTI \leq 45	1.433 (0.170)	1.284 (0.161)	1.608 (0.180)
46 \leq DTI \leq 50	-0.592 (0.193)	-0.804 (0.184)	-0.084 (0.200)
50 < DTI	-15.532 (0.411)	-16.772 (0.420)	-13.072 (0.391)
41 \leq DTI	-14.691 (0.525)	-16.292 (0.519)	-11.549 (0.548)
Observations	359,319	359,319	359,319
Bootstrap reps.	100	100	100
IR semi-elasticity	2	1.5	3

Demand-adjusted counterfactual DTI with 35% threshold

Change in number of loans from counterfactual to observed as a percentage of total number of loans in the counterfactual

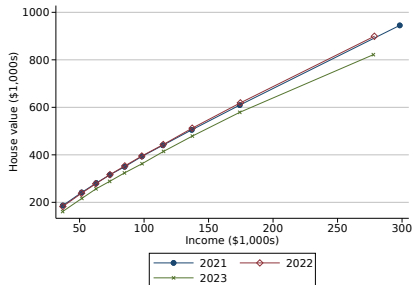
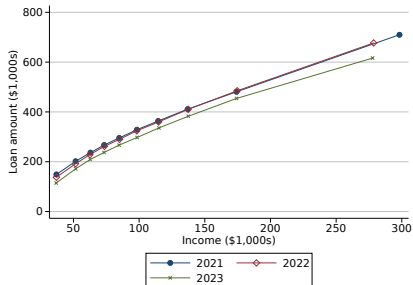
	Baseline	Demand-adjusted		
	(1)	(2)	(3)	(4)
DTI \leq 35	1.816 (0.220)	0	0	0
36 \leq DTI \leq 45	4.241 (0.252)	2.884 (0.288)	1.583 (0.251)	0.998 (0.278)
46 \leq DTI \leq 50	0.055 (0.196)	-0.221 (0.212)	-1.410 (0.216)	-1.174 (0.230)
50 < DTI	-18.703 (0.369)	-15.333 (0.414)	-16.894 (0.644)	-14.216 (0.644)
36 \leq DTI	-14.407 (0.441)	-12.670 (0.622)	-16.722 (0.840)	-14.393 (0.887)
Observations	359,319	359,319	337,503	328,990
Bootstrap reps.	100	100	100	100
Comparison year	2021	2021	2020	2019

Demand-adjusted counterfactual: placebo

Change in number of loans from counterfactual to observed as a percentage of total number of loans in the counterfactual

	(1)	(2)	(3)
DTI \leq 40	0	0	0
41 \leq DTI \leq 45	-0.706 (0.187)	0.125 (0.245)	1.582 (0.203)
46 \leq DTI \leq 50	-0.121 (0.251)	1.036 (0.263)	0.877 (0.174)
50 < DTI	-2.058 (0.223)	-0.719 (0.190)	0.386 (0.118)
41 \leq DTI	-2.885 (0.537)	0.443 (0.608)	2.845 (0.346)
Observations	361,682	353,143	331,365
Bootstrap reps.	100	100	100
Observed year	2021	2021	2020
Comparison year	2020	2019	2019

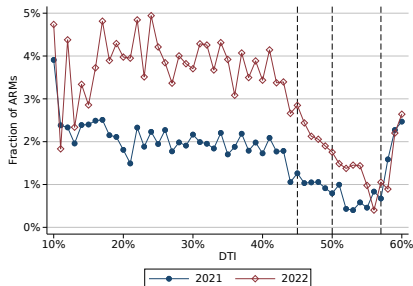
Loan amount and house value by income



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Fraction of ARM and shorter-term mortgages

Fraction of ARMs



Fraction of term < 30 years

