

# Monetary Policy Transmission Through Online Banks

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April 2024

# Motivation

- Monetary policy transmission is imperfect
  - Market concentration in deposits (Drechsler et al., 2017))
  - Search costs (Duffie and Krishnamurthy, 2016)
  - Lender market power (Scharfstein and Sundarem, 2016)
  - Human frictions (D'Acunto et al., 2021)

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- FinTech has potential to impact monetary policy transmission

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  - Human frictions (D'Acunto et al., 2021)
- FinTech has potential to impact monetary policy transmission
- Online banks are different (in terms of technology) from traditional banks  $\Rightarrow$  offer higher deposit rates:
  - increase banking competition
  - lower search costs
  - compete also with money market mutual funds...
- How do online banks respond differently to monetary policy?

# Empirical Setting and Strategy

- **Empirical Setting:** Federal reserve rate hikes starting in March 2022
  - FFR went from zero in March 2022 to five percent in April 2023
- **Empirical Strategy:** Difference-in-differences, comparing online banks to brick-and-mortar banks on:
  - Deposit rates
  - Total deposits
  - Loan rates

# Findings

1. **Deposit Rates:** Online banks raise their rates more relative to traditional banks
  - A 100 BP increase in FFR leads to a 22 to 35 bp. larger increase in APY for online relative to traditional banks
2. **Total Deposits:** During rate hikes deposits flow out of traditional banks and into online banks
3. **Loan Rates:** Mortgage and auto loan rates of online banks are also more sensitive to changes in FFR

# Literature

- **Monetary Policy Transmission:** (Bernanke and Blinder (1988), Kashyap and Stein (1995), Brunnermeier and Sannikov (2016), Neuhierl and Weber (2019), Coibion et al. (2022), Cieslak and Schrimpf (2019), Bauer et al. (2022), Drechsler et al. (2017), Scharfstein and Sunderam (2016) ⇒ Channels of Pass-through: supply of bank loans, bank capital, communication, perceptions, deposit market power, loan market power.
  - See also Benetton and Fantino (2021) and Benetton et al. (2023) on the effect of targeted/unconventional monetary policies on bank lending.
- **FinTech in Banking:** Buchak et al. (2018), Fuster et al. (2019), Stulz (2019), Chernenko et al. (2022), DeFusco et al. (2022), Gopal and Schnabl (2022), Buchak and Jørring (2016), D'Acunto et al. (2019), Stein and Yannelis (2020), D'Acunto and Rossi (2023), Bartlett et al. (2022), Granja et al. (2022), Fuster et al. (2021), and Erel and Liebersohn (2022) ⇒ (i) Increased competition in direct lending to consumers and small businesses (ii) Expansion of financial access.

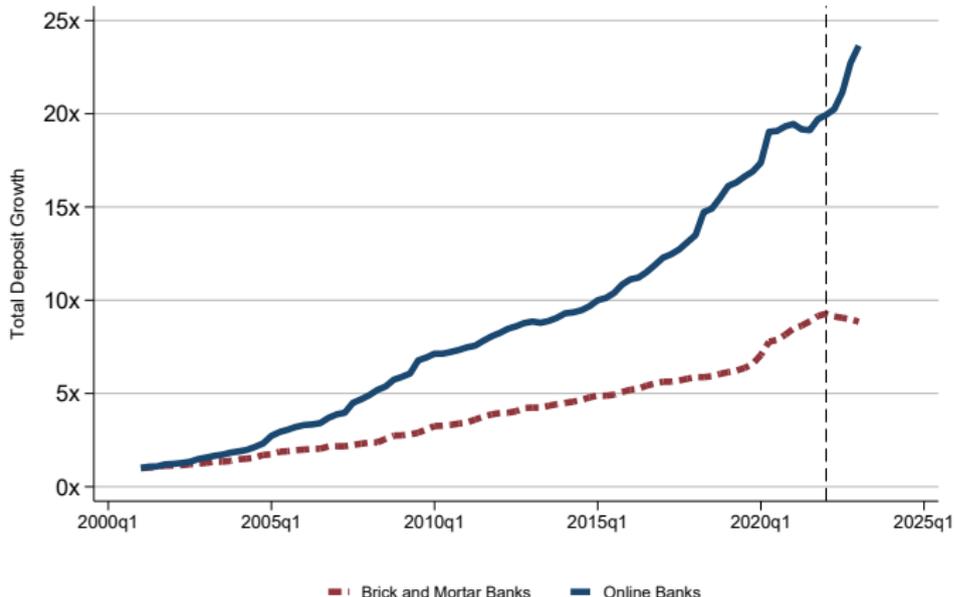
## Literature - Cont.

- Wang et al. (2022): Quantify the importance of each channel on the sensitivity of bank lending to changes in the FFR
- Xiao (2020): Monetary policy transmission through shadow banks
- Hannan and Berger (1991) and Neumark and Sharp (1992): Rigidity of bank deposit rates, especially in concentrated markets
- Begenau and Stafford (2022) and Granja and Paixao (2023): Uniform deposit pricing across markets, especially for large banks
- Koont et al. (2023): Introduction of digital platforms -mobile apps with at least 300 reviews- reduce franchise value of deposits.
- Greenwald, Kreiner and Paul (2023): Transmission of monetary policy through bank securities portfolios

# Institutional Background

- **Online Banking**

- Nearly 80% of households used online banking services in 2019 (Bhutta et al., 2020)
- Online banking has grown dramatically in importance:



# Institutional Background

MARKETS | FINANCE

## Online Banks Are Winning the Deposit War

Deposits rose quarter over quarter at Ally, Goldman Sachs's Marcus and Capital One

By *Gina Heeb* [Follow](#)

June 3, 2023 12:01 am ET



Deposits were up at Capital One, which has far fewer branches than the other big regional banks.  
PHOTO: ANDREW CABALLERO-REYNOLDS/AGENCE FRANCE-PRESSE/GETTY IMAGES

- **Deposit and Rate Data**
  - Match Call Reports (sample of all banks as of March 2021) to Ratewatch
  - Restrict to banks with monthly Ratewatch coverage 2021-2023
  - In Ratewatch we observe:
    - \$2,500 Savings
    - \$10,000 MM Savings
    - 6-Month \$10,000 CD
    - 24-Month \$10,000 CD
    - 12-Month IRAs
- Identify location of deposits using FDIC's Summary of Deposits and ZIP-code demographics using 2015-2019 American Community Survey (ACS)

## Identifying Online Banks

- We identify online banks in the data using three main sources:
  1. Ratewatch classification
  2. Abrams (2019)
  3. Nerdwallet.com (Drop any online banks with more than 30 branches)
- Final sample of 17 online banks

# Online Banks

Institution Name	Type	Branches	Total Deposits	Est. Date	Abrams 2019
Alliant Credit Union	Credit Union	2	11.69	January 01, 1935	No
Ally Bank	Internet Bank	1	141.94	August 02, 2004	Yes
American Express National Bank	Internet Bank	1	91.05	March 20, 1989	Yes
Axos Bank	Internet Bank	1	11.77	July 04, 2000	Yes
Bank5 Connect	Internet Bank	13	1.31	January 02, 1981	No
CIBC Bank USA	Bank	25	39.98	February 06, 1991	No
CIT Bank	Internet Bank	92	42.63	March 19, 2009	Yes
Capital One, National Association	Bank	446	306.69	January 01, 1934	Yes
Discover Bank	Bank	2	79.42	January 01, 1934	Yes
E*Trade Bank	Internet Bank	1	72.56	January 01, 1933	Yes
Farm Bureau Bank, FSB	Internet Bank	2	0.65	March 15, 1980	No
First Internet Bank of Indiana	Internet Bank	1	3.25	December 28, 1998	Yes
LendingClub Bank, National Association	Internet Bank	1	2.41	August 26, 1987	No
NBKC Bank	Bank	4	0.98	March 30, 1999	No
Quontic Bank	Savings and Loans	3	0.51	March 14, 2005	No
Synchrony Bank	Internet Bank	3	65.27	August 01, 1988	Yes
TIAA, FSB	Internet Bank	12	27.48	October 01, 1998	Yes

# Online Banks (Updated)

Institution Name	Type	Branches	Total Deposits	Est. Date	Abrams 2019
Alliant Credit Union	Credit Union	2	11.69	January 01, 1935	No
Ally Bank	Internet Bank	1	141.94	August 02, 2004	Yes
American Bank	Bank	1	0.60	June 05, 1997	No
American Express National Bank	Internet Bank	1	91.05	December 17, 2009	Yes
Axos Bank	Internet Bank	1	11.77	July 04, 2000	Yes
Bancorp Bank	Internet Bank	1	7.02	July 28, 2000	No
Barclays Bank Delaware	Internet Bank	1	22.12	May 23, 2001	No
CIT Bank	Internet Bank	92	42.63	October 20, 2000	Yes
Capital One, National Association	Bank	446	306.69	February 21, 1997	Yes
Colorado Federal Savings Bank	Internet Bank	1	1.71	June 29, 1990	No
Comenity Direct	Bank	1	6.56	December 01, 2003	No
Cross River Bank	Bank	2	4.73	June 23, 2008	No
Discover Bank	Bank	2	79.42	August 30, 1911	Yes
E*Trade Bank	Internet Bank	1	72.56	January 01, 1933	Yes
Farm Bureau Bank, FSB	Internet Bank	2	0.65	March 15, 1980	No
First Command Bank	Savings and Loans	1	0.93	April 21, 1997	No
First Internet Bank of Indiana	Internet Bank	1	3.25	December 28, 1998	Yes
LendingClub Bank, National Association	Internet Bank	1	2.41	August 26, 1987	No
Live Oak Banking Company	Bank	1	6.33	May 12, 2008	No
Marcus by Goldman Sachs	Bank	5	225.77	August 30, 1990	Yes
NBKC Bank	Bank	4	0.98	January 09, 2007	No
Nano Banc	Bank	2	1.08	October 25, 2018	No
NexBank	Bank	3	7.57	December 19, 2011	No
Quontic Bank	Savings and Loans	3	0.51	April 07, 2011	No
Sallie Mae Bank	Bank	1	23.77	November 28, 2005	No
Silvergate Bank	Savings and Loans	2	7.02	August 26, 1988	No
Synchrony Bank	Internet Bank	3	65.27	November 20, 2009	Yes
TAB Bank	Bank	1	0.80	October 01, 1998	No
TIAA, FSB	Savings and Loans	12	27.48	October 01, 1998	Yes
USAA Federal Savings Bank	Internet Bank	1	102.46	December 01, 1983	No

# Theoretical Framework

- Drechsler et al. (2017)

$$s_{trad} = \delta^{\frac{\varepsilon}{\varepsilon-1}} \left[ \frac{\mathcal{M} - \rho}{\varepsilon - \mathcal{M}} \right]^{\frac{1}{\varepsilon-1}} f$$

- $s_{trad}$  spread between FFR and deposit rates
- $\varepsilon$  elasticity of substitution between cash and deposits
- $\delta$  liquidity of deposits relative to cash
- $\mathcal{M}$  market power of bank
- $\rho$  elasticity of substitution between wealth and liquidity
- $f$  if the federal funds rate

# Theoretical Framework

$$s_{trad} = \delta^{\frac{\varepsilon}{\varepsilon-1}} \left[ \frac{\mathcal{M} - \rho}{\varepsilon - \mathcal{M}} \right]^{\frac{1}{\varepsilon-1}} f$$

- $\mathcal{M}$  is smaller for online banks
  - Frictionless to withdraw and transfer funds
  - Online bank deposits not sticky (no banking relationships)
- Thus online banks should adjust their deposit rates more than traditional banks do

## Empirical Strategy: Diff-in-Diff

- We compare how rates evolve differently between online and brick-and-mortar banks
- For bank  $i$  at month  $t$

$$APY_{it} = \alpha_i + \alpha_t + \beta 1[Online]_i \times 1[PostMarch2022]_t + \varepsilon_{it},$$

- $\beta$  captures the gap in annualized percentage yields (APY) following the increase in FFR
- $\alpha_t$  captures temporal shocks affecting all banks
- $\alpha_i$  captures time-invariant bank-specific factors
- Standard errors are corrected for clustering at the bank level

## Empirical Strategy - Cont.

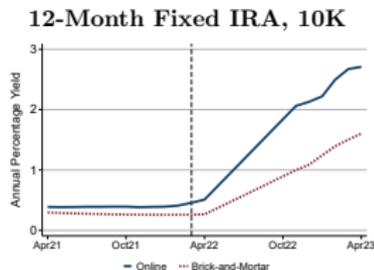
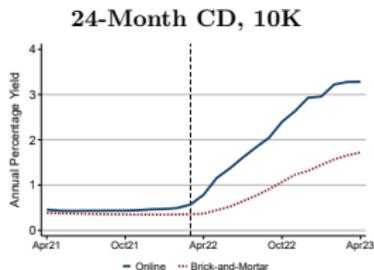
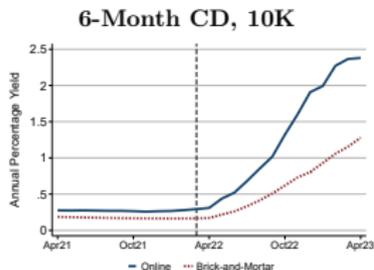
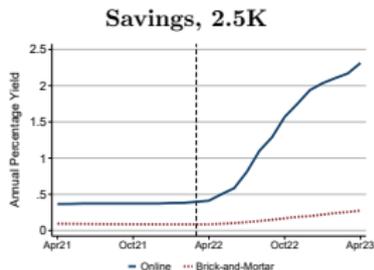
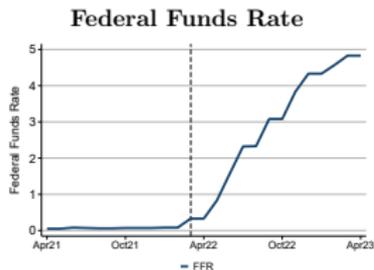
$$APY_{it} = \alpha_i + \alpha_t + \beta 1[Online]_i \times 1[PostMarch2022]_t + \varepsilon_{it},$$

- We also use outcomes such as total deposits and loan rates
- In some specifications we replace  $1[PostMarch2022]_t$  with FFR to capture relative spread increase for a one percentage point increase in FFR

## Online vs Brick-and-Mortar Summary Statistics

	Mean	SD	Max	Min	Median	Obs
<b>Bank Type: Brick and Mortar</b>						
6 Month CD	0.19	0.11	0.83	0.01	0.15	3851
12 Month Fixed IRA, 10K	0.30	0.17	1.91	0.01	0.25	3002
24 Month CD	0.39	0.18	1.26	0.01	0.35	3812
10K MM	0.11	0.09	0.80	0.01	0.10	3681
2.5K Savings	0.09	0.08	0.75	0.00	0.07	3920
Total Deposits	4.10	52.83	1986.41	0.00	0.30	4005
Total Assets	5.43	76.43	3207.52	0.01	0.35	4005
<b>Bank Type: Online</b>						
6 Month CD	0.28	0.15	0.60	0.10	0.25	13
12 Month Fixed IRA, 10K	0.39	0.18	0.65	0.15	0.50	11
24 Month CD	0.46	0.17	0.70	0.20	0.50	16
10K MM	0.33	0.17	0.60	0.03	0.35	11
2.5K Savings	0.37	0.18	0.61	0.03	0.40	15
Total Deposits	52.60	77.20	306.69	0.51	27.48	17
Total Assets	66.39	94.49	369.91	0.77	39.16	17

# Levels for Rates (Raw Means)



# Main Results

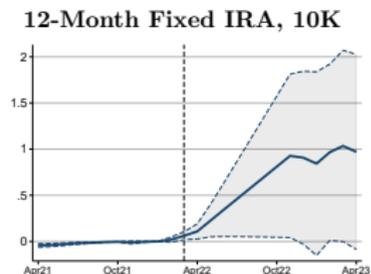
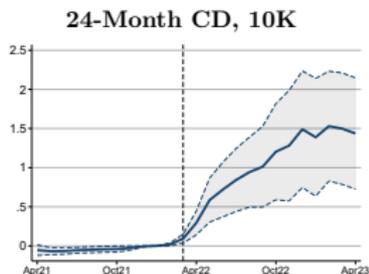
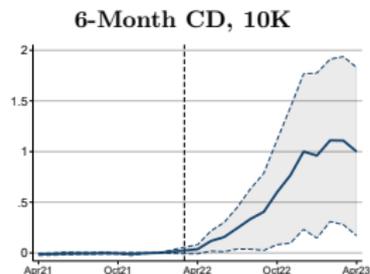
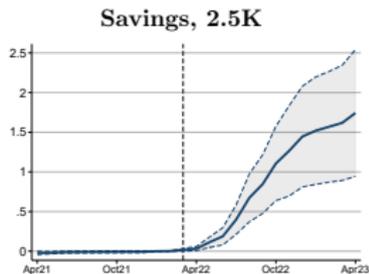
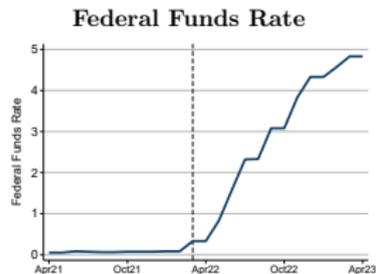
	(1)	(2)	(3)	(4)	(5)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K	12-Month Fixed IRA, 10K
<b>Panel A: Post Interaction</b>					
Online × Post March 2022	0.905*** (0.203)	0.663*** (0.214)	0.566** (0.223)	1.058*** (0.247)	0.652** (0.307)
<b>Panel B: FFR Interaction</b>					
Online × FFR	0.348*** (0.079)	0.255*** (0.083)	0.219** (0.086)	0.333*** (0.080)	0.219** (0.109)
Observations	98397	92456	96747	95723	75428
Bank FE	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓	✓

## Event Studies: Dynamic Diff-in-Diff

$$APY_{it} = \alpha_i + \alpha_t + \sum_t \beta_t Online_i + \nu_{it},$$

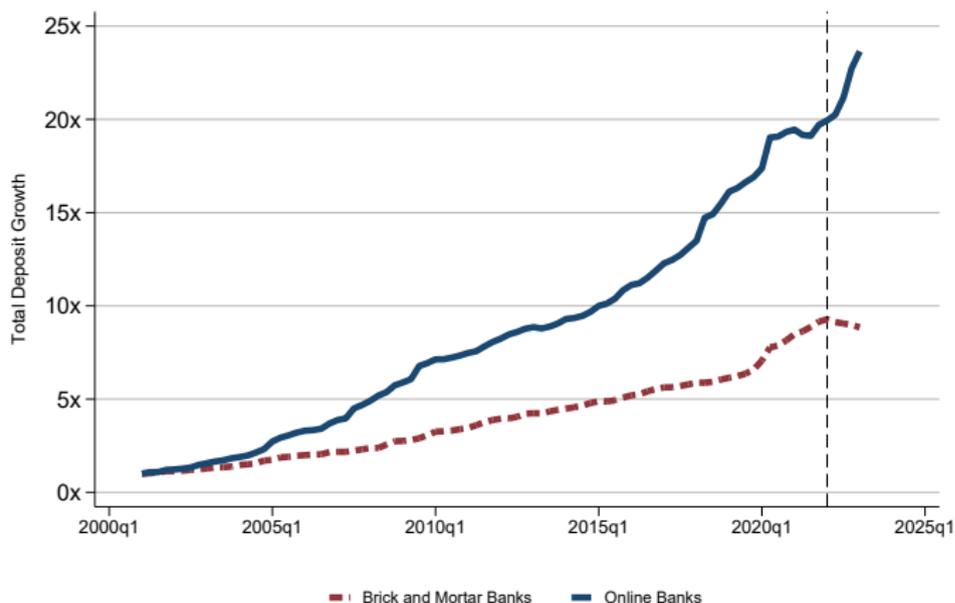
- To test for parallel trends and visualize effects over time...
- Created figures plotting  $\beta_t$  over time with 95% confidence interval

# Event Study Graphs using Rates

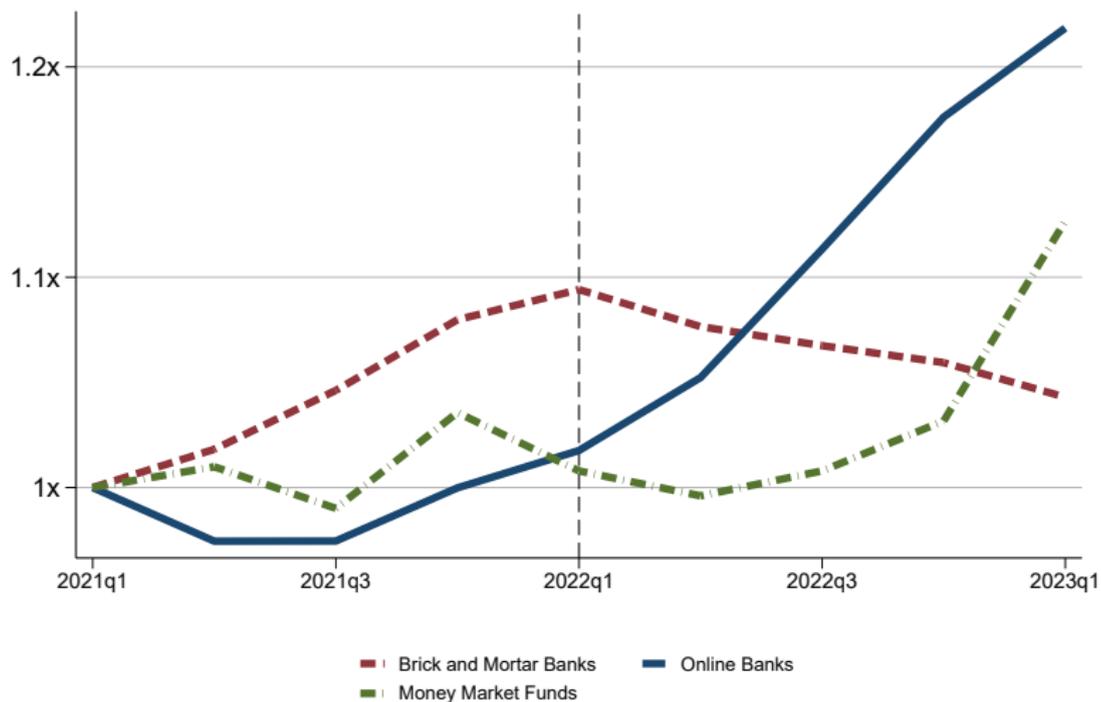


## What about Deposit Growth?

- An implication of our framework is that we should also see larger changes in deposit levels for online banks...

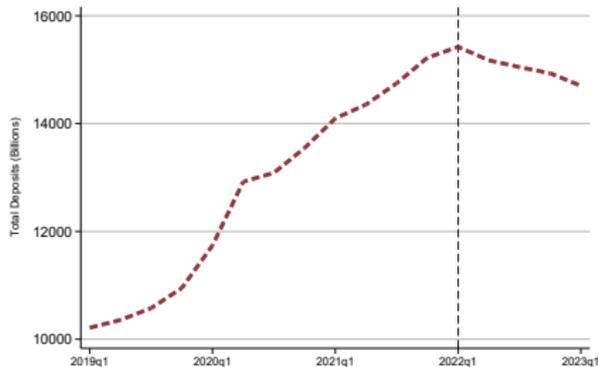


# Money Market Mutual Fund Growth

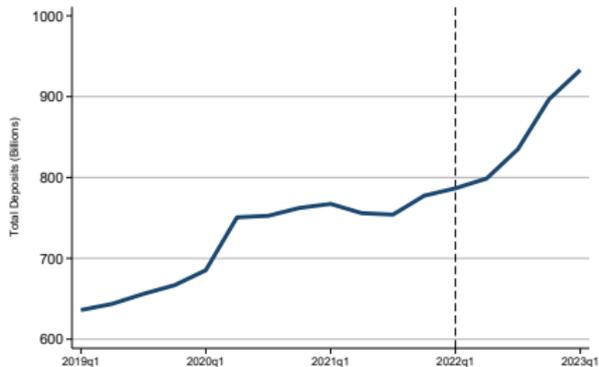


# Total Deposit Levels

## Brick-and-Mortar Banks



## Online Banks



# Deposit Results

	(1)	(2)	(3)
	Total Deposits	Interest Deposits	Non-Interest Deposits
<b>Panel A: Post Interaction - Level</b>			
Online $\times$ Post March 2022	5.978** (2.374)	6.034** (2.434)	-0.055 (0.131)
<b>Panel B: FFR Interaction - Level</b>			
Online $\times$ FFR	2.235** (0.886)	2.297** (0.931)	-0.062 (0.067)
Observations	34728	34728	34728
Bank FE	✓	✓	✓
Quarter FE	✓	✓	✓

# Mechanisms

- Online banks may behave like competitive B&M banks
- Less Sticky Depositors: Users of online banks may be more sensitive to changes in FFR
- Less Sticky Depositors: No banking relationships
- Online banks may experience better investment opportunities

# 1. Passthrough and Local Bank Competition

	(1)	(2)	(3)	(4)	(5)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K	12-Month Fixed IRA, 10K
<b>Panel A: Low Competition Branches</b>					
Online × Post March 2022	1.077*** (0.164)	0.706*** (0.213)	0.795*** (0.178)	1.327*** (0.205)	0.620** (0.303)
Observations	60795	56418	59781	59464	47439
<b>Panel B: High Competition Branches</b>					
Online × Post March 2022	1.100*** (0.164)	0.722*** (0.213)	0.885*** (0.178)	1.439*** (0.205)	0.683** (0.303)
Observations	60532	55979	59403	58814	47137
<b>Panel D: Low Competition Branches (In Advertised Zip Code)</b>					
Online × Post March 2022	1.088*** (0.164)	0.717*** (0.213)	0.811*** (0.178)	1.350*** (0.205)	0.621** (0.303)
Observations	44330	40957	43668	43195	34840
<b>Panel E: High Competition Branches (In Advertised Zip Code)</b>					
Online × Post March 2022	1.099*** (0.164)	0.720*** (0.213)	0.877*** (0.178)	1.427*** (0.205)	0.677** (0.303)
Observations	49896	46291	48944	48875	39338
Branch FE	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓	✓

Passthrough is different for online banks even in comparison with traditional banks in competitive markets

## 2a. Less Sticky Depositors: Online Banking Demographics (2015-19 American Community Survey)

	Mean	SD	Max	Min	Median	Obs
<b>SCF: Never Used Online Banking</b>						
Age 65+	0.46	0.50	1.00	0.00	0.00	5492
College Degree	0.14	0.35	1.00	0.00	0.00	5492
Minority	0.41	0.49	1.00	0.00	0.00	5492
Low Income	0.52	0.50	1.00	0.00	1.00	5492
<b>SCF: Used Online Banking</b>						
Age 65+	0.19	0.39	1.00	0.00	0.00	23393
College Degree	0.43	0.49	1.00	0.00	0.00	23393
Minority	0.29	0.46	1.00	0.00	0.00	23393
Low Income	0.17	0.37	1.00	0.00	0.00	23393
<b>Online Bank Sample</b>						
Age 65+	0.19	0.01	0.20	0.17	0.19	17
College Degree	0.35	0.08	0.44	0.21	0.37	17
Minority	0.24	0.07	0.32	0.09	0.26	17
Low Income	0.20	0.04	0.30	0.16	0.19	17
<b>Matched Brick-and-Mortar Branches</b>						
Age 65+	0.18	0.02	0.24	0.12	0.18	80
College Degree	0.31	0.08	0.48	0.19	0.30	80
Minority	0.22	0.08	0.35	0.08	0.23	80
Low Income	0.21	0.06	0.33	0.11	0.22	80

# Passthrough of Rates Controlling for Demographics

$$APY_{it} = \alpha_i + \alpha_t + \beta 1[Online]_i \times 1[PostMarch2022]_t + \sum_j \delta_j Demographic_{ji} \times 1[PostMarch2022] + \epsilon_{it}$$

	(1)	(2)	(3)	(4)	(5)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K	12-Month Fixed IRA, 10K
Online $\times$ Post March 2022	1.074*** (0.197)	0.714*** (0.213)	0.771*** (0.258)	1.299*** (0.300)	0.647* (0.357)
Observations	121378	112599	119332	118384	94476
$\times$ Has Computer	✓	✓	✓	✓	✓
$\times$ Internet Access	✓	✓	✓	✓	✓
$\times$ Age 65+	✓	✓	✓	✓	✓
$\times$ College Degree	✓	✓	✓	✓	✓
$\times$ Minority	✓	✓	✓	✓	✓
$\times$ Low Income	✓	✓	✓	✓	✓
Bank FE	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓	✓

Findings are similar, controlling for interactions with ZIP-code level demographics.

## ZIP Codes with Demographics Similar to Online Users

	(1)	(2)	(3)	(4)	(5)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K	12-Month Fixed IRA, 10K
Online × Post March 2022	1.090*** (0.167)	0.701*** (0.218)	0.857*** (0.188)	1.340*** (0.219)	0.659** (0.318)
Observations	2500	2175	2425	2500	1800
Branch FE	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓	✓

Findings are similar, using only traditional banks in ZIP codes of similar demographics.

## Placebo Online Banks

	(1)	(2)	(3)	(4)	(5)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K	12-Month Fixed IRA, 10K
Pseudo-Online × Post March 2022	-0.001 (0.017)	0.014 (0.030)	-0.012 (0.055)	0.050 (0.071)	0.000 (0.082)
Observations	120878	112324	118882	117859	94151
Branch FE	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓	✓

Traditional banks with demographics similar to online banks don't appear to be more sensitive.

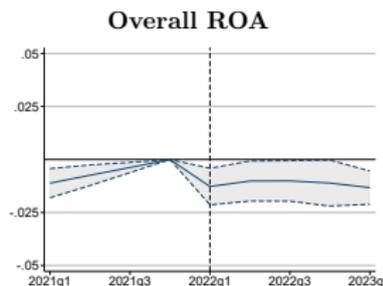
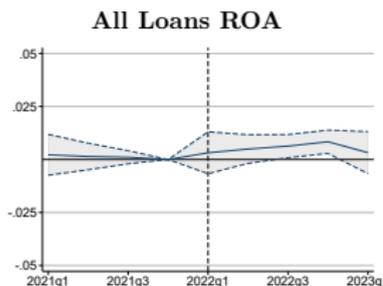
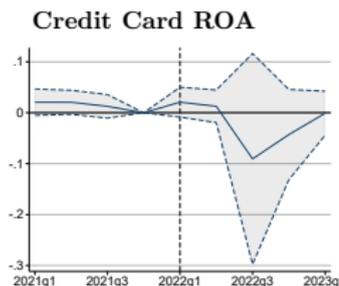
## 2b. Less Sticky Depositors: Relationships

	(1)	(2)	(3)	(4)	(5)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K	12-Month Fixed IRA, 10K
<b>Panel A: Specialized Online Lender</b>					
Online × Post March 2022	1.004*** (0.265)	0.840** (0.358)	0.986*** (0.210)	1.500*** (0.231)	1.041*** (0.357)
Observations	98222	92306	96572	95523	75303
<b>Panel B: General Online Lender</b>					
Online × Post March 2022	0.859*** (0.275)	0.515** (0.238)	0.206 (0.315)	0.757** (0.359)	0.469 (0.448)
Observations	98222	92331	96597	95548	75303
Bank FE	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓	✓

# Robustness Tests: Passthrough and Large Banks

	(1)	(2)	(3)	(4)	(5)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K	12-Month Fixed IRA, 10K
<b>Panel A: Large Banks Only</b>					
Online × Post March 2022	0.904*** (0.209)	0.729*** (0.219)	0.646*** (0.242)	1.180*** (0.274)	0.861** (0.328)
Observations	1750	1595	1675	1775	1425
<b>Panel B: Deposit Weighted</b>					
Online × Post March 2022	0.906*** (0.203)	0.626*** (0.216)	0.538** (0.218)	1.017*** (0.248)	0.615** (0.297)
Observations	97620	91729	95972	94868	74853
<b>Panel C: Specialized Online Lender</b>					
Online × Post March 2022	1.004*** (0.265)	0.840** (0.358)	0.986*** (0.210)	1.500*** (0.231)	1.041*** (0.357)
Observations	98222	92306	96572	95523	75303
<b>Panel D: General Online Lender</b>					
Online × Post March 2022	0.859*** (0.275)	0.515** (0.238)	0.206 (0.315)	0.757** (0.359)	0.469 (0.448)
Observations	98222	92331	96597	95548	75303
Bank FE	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓	✓

### 3. Any Difference in Investment Opportunities? ROA Event Studies



No evidence that investment opportunities are different between online and traditional banks.

# Robustness Test: Banks Matched on Rates and Other Characteristics

	(1)	(2)	(3)	(4)	(5)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K	12-Month Fixed IRA, 10K
<b>Panel A: Post Interaction</b>					
Online × Post March 2022	0.840*** (0.215)	0.625*** (0.223)	0.415 (0.253)	1.009*** (0.277)	0.537 (0.345)
<b>Panel B: FFR Interaction</b>					
Online × FFR	0.321*** (0.084)	0.244*** (0.087)	0.167* (0.097)	0.333*** (0.091)	0.187 (0.123)
Observations	1372	1070	1295	1475	1023
Bank FE	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓	✓

## Robustness Tests - Continued

- Drop one bank  $\Rightarrow$  results not driven by one online bank
- Young banks only  $\Rightarrow$  online banks are newer than most banks
- High rate banks only  $\Rightarrow$  online banks offer higher rates
- Abrams 2019 sample only  $\Rightarrow$  smaller sample with precedent

## Comparison to Loan Market

- Online banks are a growing presence in the retail loan market
- The effects of lowering search costs are **ambiguous**:
  - More competition will push **down** loan rates
  - Increased search for higher deposit yields may raise lender's costs, pushing **up** loan rates

# Comparison to Loan Market

	(1)	(2)	(3)	(4)
	5-Year Auto Loan, New	5-Year Auto Loan, 2-Year Used	15-Year Mortgage	30-Year Mortgage
<b>Panel A: Post Interaction</b>				
Online $\times$ Post March 2022	0.427** (0.202)	0.440** (0.176)	0.708 (0.594)	0.571 (0.567)
<b>Panel B: FFR Interaction</b>				
Online $\times$ FFR	0.224*** (0.063)	0.217*** (0.062)	0.176 (0.189)	0.149 (0.183)
Observations	46637	42572	22673	19759
Bank FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓

## Takeaways on Deposit and Loan Rate Passthrough

- We find monetary policy pass-through is greater among online banks for both loans and deposit rates
- Distributional consequences: savers benefit and borrowers suffer

# Loan Quantity Results

	(1)	(2)	(3)
	Total Assets	Total Loans	Credit Card Loans
<b>Panel A: Post Interaction - Level</b>			
Online $\times$ Post March 2022	6.977** (3.134)	9.805** (4.678)	5.494* (2.928)
<b>Panel B: FFR Interaction - Level</b>			
Online $\times$ FFR	2.652** (1.220)	3.432* (1.857)	2.222 (1.368)
<b>Panel C: Post Interaction - Log</b>			
Online $\times$ Post March 2022	0.047*** (0.018)	0.112*** (0.043)	0.332** (0.166)
<b>Panel D: FFR Interaction - Log</b>			
Online $\times$ FFR	0.025*** (0.006)	0.045** (0.020)	0.169* (0.089)
Observations	34728	34717	6654
Bank FE	✓	✓	✓
Quarter FE	✓	✓	✓

## Conclusion

1. **Deposit Rates:** Online banks raise their rates more relative to traditional banks
  - A 100 BP increase in FFR leads to a 22 to 35 bp larger increase in APY for online relative to traditional
2. **Total Deposits:** During rate hikes deposits flow out of traditional banks and into online banks
3. **Loan Rates:** Elasticity of auto and mortgage loan rates to FFR is also larger for online banks

# Conclusion

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  - A 100 BP increase in FFR leads to a 22 to 35 bp larger increase in APY for online relative to traditional
2. **Total Deposits:** During rate hikes deposits flow out of traditional banks and into online banks
3. **Loan Rates:** Elasticity of auto and mortgage loan rates to FFR is also larger for online banks
  - The increasing popularity of Fintech banking will change the efficiency of central bank policy
  - Old policy rules may have different effects on lending, growth, and employment than policymakers' expectations

# Updated Results

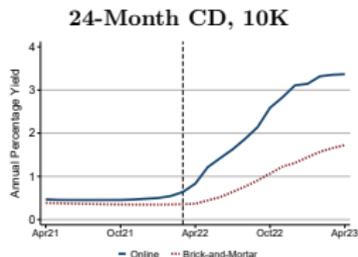
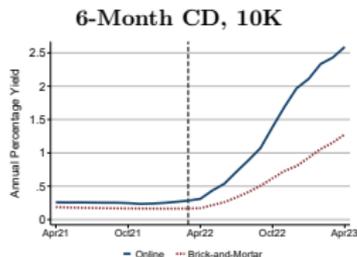
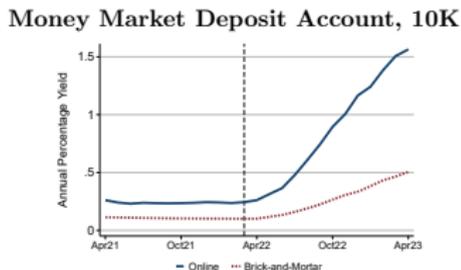
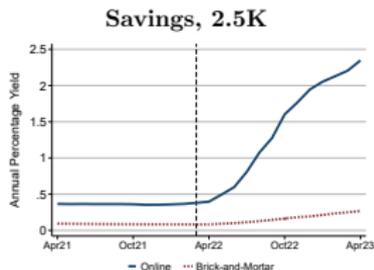
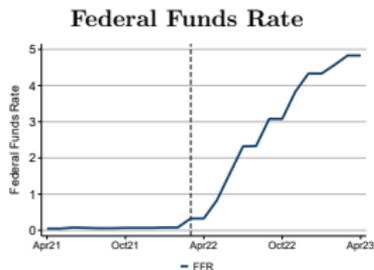
# Online Banks (Updated)

Institution Name	Type	Branches	Total Deposits	Est. Date	Abrams 2019
Alliant Credit Union	Credit Union	2	11.69	January 01, 1935	No
Ally Bank	Internet Bank	1	141.94	August 02, 2004	Yes
American Bank	Bank	1	0.60	June 05, 1997	No
American Express National Bank	Internet Bank	1	91.05	December 17, 2009	Yes
Axos Bank	Internet Bank	1	11.77	July 04, 2000	Yes
Bancorp Bank	Internet Bank	1	7.02	July 28, 2000	No
Barclays Bank Delaware	Internet Bank	1	22.12	May 23, 2001	No
CIT Bank	Internet Bank	92	42.63	October 20, 2000	Yes
Capital One, National Association	Bank	446	306.69	February 21, 1997	Yes
Colorado Federal Savings Bank	Internet Bank	1	1.71	June 29, 1990	No
Comenity Direct	Bank	1	6.56	December 01, 2003	No
Cross River Bank	Bank	2	4.73	June 23, 2008	No
Discover Bank	Bank	2	79.42	August 30, 1911	Yes
E*Trade Bank	Internet Bank	1	72.56	January 01, 1933	Yes
Farm Bureau Bank, FSB	Internet Bank	2	0.65	March 15, 1980	No
First Command Bank	Savings and Loans	1	0.93	April 21, 1997	No
First Internet Bank of Indiana	Internet Bank	1	3.25	December 28, 1998	Yes
LendingClub Bank, National Association	Internet Bank	1	2.41	August 26, 1987	No
Live Oak Banking Company	Bank	1	6.33	May 12, 2008	No
Marcus by Goldman Sachs	Bank	5	225.77	August 30, 1990	Yes
NBKC Bank	Bank	4	0.98	January 09, 2007	No
Nano Banc	Bank	2	1.08	October 25, 2018	No
NexBank	Bank	3	7.57	December 19, 2011	No
Quontic Bank	Savings and Loans	3	0.51	April 07, 2011	No
Sallie Mae Bank	Bank	1	23.77	November 28, 2005	No
Silvergate Bank	Savings and Loans	2	7.02	August 26, 1988	No
Synchrony Bank	Internet Bank	3	65.27	November 20, 2009	Yes
TAB Bank	Bank	1	0.80	October 01, 1998	No
TIAA, FSB	Savings and Loans	12	27.48	October 01, 1998	Yes
USAA Federal Savings Bank	Internet Bank	1	102.46	December 01, 1983	No

# Online vs Brick-and-Mortar Summary Statistics (Update)

	Mean	SD	Max	Min	Median	Obs
<b>Bank Type: Brick and Mortar</b>						
6 Month CD	0.19	0.11	0.83	0.01	0.15	3817
12 Month Fixed IRA, 10K	0.30	0.17	1.91	0.01	0.25	2990
24 Month CD	0.39	0.18	1.26	0.01	0.35	3776
10K MM	0.11	0.09	0.80	0.01	0.10	3653
2.5K Savings	0.09	0.08	0.75	0.00	0.07	3886
Total Deposits	3.90	52.84	1986.41	0.00	0.30	3961
Total Assets	5.19	76.56	3207.52	0.01	0.35	3961
<b>Bank Type: Online</b>						
6 Month CD	0.26	0.14	0.60	0.05	0.25	23
12 Month Fixed IRA, 10K	0.41	0.20	0.85	0.10	0.50	16
24 Month CD	0.47	0.19	0.75	0.10	0.50	26
10K MM	0.26	0.17	0.60	0.01	0.28	20
2.5K Savings	0.37	0.18	0.61	0.03	0.40	27
Total Deposits	42.56	71.83	306.69	0.51	7.30	30
Total Assets	53.83	88.94	369.91	0.77	11.04	30

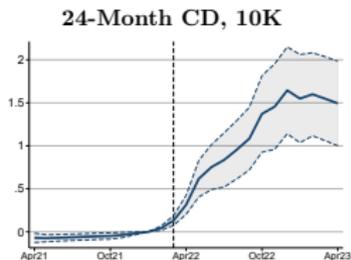
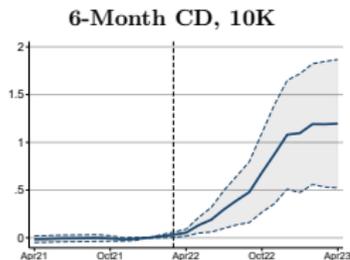
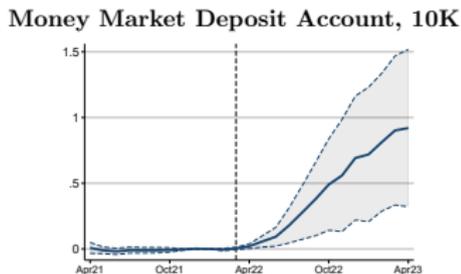
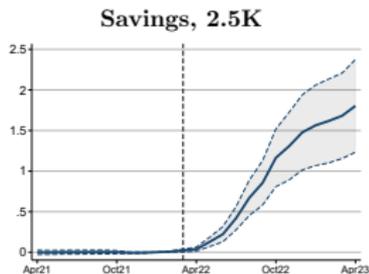
# Levels for Rates (Update)



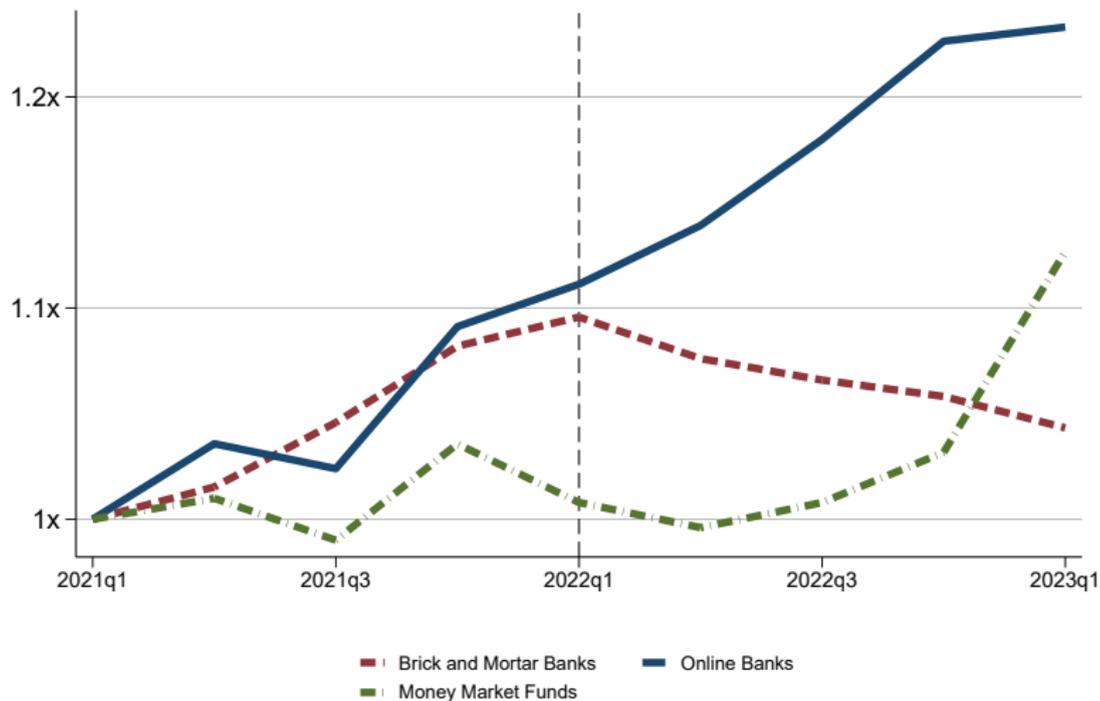
# Main Results (Update)

	(1)	(2)	(3)	(4)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K
<b>Panel A: Post Interaction</b>				
Online × Post March 2022	0.927*** (0.151)	0.442*** (0.154)	0.639*** (0.183)	1.137*** (0.172)
<b>Panel B: FFR Interaction</b>				
Online × FFR	0.357*** (0.058)	0.174*** (0.059)	0.245*** (0.069)	0.358*** (0.055)
Observations	98125	92209	96447	95373
Bank FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓

# Event Study Graphs using Rates (Update)

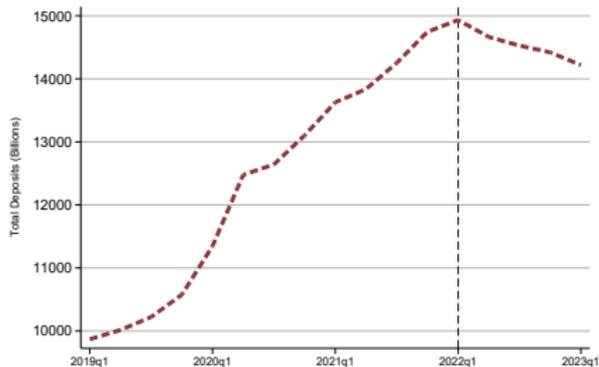


# Money Market Mutual Fund Growth (Update)

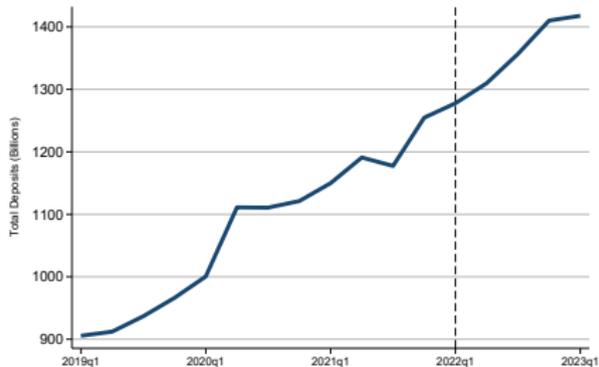


# Total Deposit Levels (Update)

## Brick-and-Mortar Banks



## Online Banks



# Deposit Results (Update)

	(1)	(2)	(3)
	Total Deposits	Interest Deposits	Non-Interest Deposits
<b>Panel A: Post Interaction - Level</b>			
Online $\times$ Post March 2022	5.809** (2.635)	5.960** (2.641)	-0.150 (0.145)
<b>Panel C: FFR Interaction - Level</b>			
Online $\times$ FFR	1.703** (0.686)	1.809*** (0.693)	-0.106 (0.078)
Bank FE	✓	✓	✓
Quarter FE	✓	✓	✓
Observations	36096	36096	36096

# Passthrough and Local Bank Competition (Update)

	(1)	(2)	(3)	(4)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K
<b>Panel A: Low Competition Branches</b>				
Online × Post March 2022	0.586*** (0.132)	0.408*** (0.123)	0.574*** (0.157)	0.894*** (0.157)
Observations	60545	56368	59406	59039
<b>Panel B: High Competition Branches</b>				
Online × Post March 2022	0.607*** (0.132)	0.424*** (0.123)	0.663*** (0.157)	1.004*** (0.157)
Observations	59984	55429	58979	58466
<b>Panel D: Low Competition Branches (In Advertised Zip Code)</b>				
Online × Post March 2022	0.596*** (0.132)	0.418*** (0.123)	0.587*** (0.157)	0.916*** (0.157)
Observations	44130	40932	43343	43095
<b>Panel E: High Competition Branches (In Advertised Zip Code)</b>				
Online × Post March 2022	0.606*** (0.132)	0.422*** (0.123)	0.655*** (0.157)	0.992*** (0.157)
Observations	49498	45841	48645	48352
Branch FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓

# ZIP Codes with Demographics Similar to Online Users (Update)

	(1)	(2)	(3)	(4)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K
Online × Post March 2022	0.615*** (0.134)	0.410*** (0.127)	0.650*** (0.170)	0.900*** (0.177)
Observations	2375	2175	2274	2350
Branch FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓

## Placebo Online Banks (Update)

	(1)	(2)	(3)	(4)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K
Pseudo-Online $\times$ Post March 2022	-0.018 (0.014)	0.007 (0.028)	-0.026 (0.060)	0.056 (0.080)
Observations	119309	110797	117416	116332
Branch FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓

# Robustness Tests: Passthrough and Large Banks (Update)

	(1)	(2)	(3)	(4)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K
<b>Panel A: Young Banks Only</b>				
Online × Post March 2022	0.906*** (0.152)	0.399** (0.155)	0.560*** (0.185)	1.032*** (0.174)
Observations	12447	12327	12291	12427
<b>Panel B: High Rate Banks Only</b>				
Online × Post March 2022	0.910*** (0.151)	0.382** (0.154)	0.439** (0.184)	0.927*** (0.173)
Observations	41461	24082	24394	24166
<b>Panel C: Low Consumer Loans to Assets</b>				
Online × Post March 2022	1.075*** (0.186)	0.649*** (0.213)	0.530** (0.233)	1.218*** (0.199)
Observations	97775	91959	96172	95098
<b>Panel D: High Consumer Loans to Assets</b>				
Online × Post March 2022	0.826*** (0.217)	0.235 (0.202)	0.757*** (0.282)	1.098*** (0.282)
Observations	97825	91959	96148	95023
Bank FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓

# Comparison to Loan Market (Update)

	(1)	(2)	(3)	(4)
	5-Year Auto Loan, New	5-Year Auto Loan, 2-Year Used	15-Year Mortgage	30-Year Mortgage
<b>Panel A: Post Interaction</b>				
Online × Post March 2022	0.464*** (0.138)	0.316** (0.156)	1.434*** (0.051)	1.260*** (0.104)
<b>Panel B: FFR Interaction</b>				
Online × FFR	0.171*** (0.060)	0.125 (0.086)	0.407*** (0.018)	0.368*** (0.055)
Observations	46637	42572	22673	19759
Bank FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓

# Backup Slides

## Hand Collected Rates

Bank	Website	Internet Archive Coverage
Affirm	<a href="http://www.affirm.com">www.affirm.com</a>	Yes
Bask Bank	<a href="http://www.baskbank.com">www.baskbank.com</a>	Yes
Barclays	<a href="http://www.banking.barclaysus.com">www.banking.barclaysus.com</a>	Yes
Bread Financial	<a href="http://savings.breadfinancial.com">savings.breadfinancial.com</a>	Yes
Charles Schwab Bank	<a href="http://www.schwab.com">www.schwab.com</a>	Yes
Chime	<a href="http://www.chime.com">www.chime.com</a>	Yes
Ever Bank	<a href="http://www.everbank.com">www.everbank.com</a>	No
Go2bank	<a href="http://www.go2bank.com">www.go2bank.com</a>	Yes
Marcus by Goldman Sachs	<a href="http://www.marcus.com">www.marcus.com</a>	Yes
One United Bank	<a href="http://www.oneunited.com">www.oneunited.com</a>	Yes
Popular Direct	<a href="http://www.populardirect.com">www.populardirect.com</a>	Yes
Revolut	<a href="http://www.revolut.com">www.revolut.com</a>	No
Scarlet	<a href="http://www.getscarlet.com">www.getscarlet.com</a>	No
SoFi	<a href="http://www.sofi.com">www.sofi.com</a>	No
Tab Bank	<a href="http://www.tabbank.com">www.tabbank.com</a>	Yes
UFB Direct	<a href="http://www.ufbdirect.com">www.ufbdirect.com</a>	No
Varo	<a href="http://www.varomoney.com">www.varomoney.com</a>	Yes
Vio Bank	<a href="http://www.viobank.com">www.viobank.com</a>	No
Upgrade	<a href="http://www.upgrade.com">www.upgrade.com</a>	No
Zynlo	<a href="http://www.zynlobank.com">www.zynlobank.com</a>	No

# Extended Sample Results

	(1)	(2)	(3)
	Savings, 2.5K	6-Month CD, 10K	24-Month CD, 10K
<b>Panel A: Post Interaction</b>			
Online $\times$ Post March 2022	1.038*** (0.167)	0.889*** (0.247)	1.024*** (0.227)
<b>Panel B: FFR Interaction</b>			
Online $\times$ FFR	0.386*** (0.061)	0.319*** (0.088)	0.315*** (0.073)
Observations	98672	96872	95873
Bank FE	✓	✓	✓
Month FE	✓	✓	✓

# Drop One Robustness Check (Part 1)

	(1)	(2)	(3)	(4)	(5)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K	12-Month Fixed IRA, 10K
<b>Alliant Credit Union</b>					
Online × Post March 2022	0.875*** (0.215)	0.663*** (0.214)	0.566** (0.223)	1.003*** (0.257)	0.528* (0.311)
Observations	98372	92456	96747	95698	75403
<b>Ally Bank</b>					
Online × Post March 2022	0.863*** (0.213)	0.584*** (0.221)	0.513** (0.235)	1.047*** (0.263)	0.547* (0.319)
Observations	98372	92431	96722	95698	75403
<b>American Express National Bank</b>					
Online × Post March 2022	0.858*** (0.212)	0.663*** (0.214)	0.566** (0.223)	1.005*** (0.257)	0.652** (0.307)
Observations	98372	92456	96747	95698	75428
<b>Axos Bank</b>					
Online × Post March 2022	0.975*** (0.205)	0.749*** (0.217)	0.651*** (0.225)	1.171*** (0.235)	0.777** (0.311)
Observations	98372	92431	96722	95698	75403
<b>Bank5 Connect</b>					
Online × Post March 2022	0.975*** (0.205)	0.663*** (0.214)	0.651*** (0.225)	1.171*** (0.235)	0.652** (0.307)
Observations	98372	92456	96722	95698	75428
<b>CIBC Bank USA</b>					
Online × Post March 2022	0.972*** (0.206)	0.741*** (0.220)	0.567** (0.242)	1.076*** (0.262)	0.601* (0.333)
Observations	98372	92431	96722	95698	75403
<b>CIT Bank</b>					
Online × Post March 2022	0.975*** (0.205)	0.745*** (0.219)	0.651*** (0.225)	1.171*** (0.235)	0.652** (0.307)
Observations	98372	92431	96722	95698	75428
<b>Capital One, National Association</b>					
Online × Post March 2022	0.859*** (0.212)	0.663*** (0.214)	0.503** (0.233)	0.993*** (0.254)	0.758** (0.319)
Observations	98372	92456	96722	95698	75403
<b>Discover Bank</b>					
Online × Post March 2022	0.855*** (0.211)	0.578*** (0.218)	0.531** (0.239)	1.005*** (0.257)	0.541* (0.317)
Observations	98372	92431	96722	95698	75403
<b>E*Trade Bank</b>					
Online × Post March 2022	0.975*** (0.205)	0.663*** (0.214)	0.566** (0.223)	1.058*** (0.247)	0.652** (0.307)
Observations	98372	92456	96747	95723	75428

# Drop One Robustness Check (Part 2)

	(1)	(2)	(3)	(4)	(5)
	Savings, 2.5K	Money Market, 10K	6-Month CD, 10K	24-Month CD, 10K	12-Month Fixed IRA, 10K
<b>Farm Bureau Bank, FSB</b>					
Online × Post March 2022	0.905*** (0.203)	0.745*** (0.219)	0.602** (0.239)	1.116*** (0.256)	0.702** (0.333)
Observations	98397	92431	96722	95698	75403
<b>First Internet Bank of Indiana</b>					
Online × Post March 2022	0.950*** (0.213)	0.577*** (0.217)	0.471** (0.221)	0.999*** (0.256)	0.652** (0.307)
Observations	98372	92431	96722	95698	75428
<b>LendingClub Bank, National Association</b>					
Online × Post March 2022	0.836*** (0.205)	0.663*** (0.214)	0.566** (0.223)	0.989*** (0.253)	0.652** (0.307)
Observations	98372	92456	96747	95698	75428
<b>NBKC Bank</b>					
Online × Post March 2022	0.905*** (0.203)	0.661*** (0.235)	0.651*** (0.225)	1.073*** (0.262)	0.761** (0.317)
Observations	98397	92431	96722	95698	75403
<b>Quontic Bank</b>					
Online × Post March 2022	0.849*** (0.210)	0.584*** (0.220)	0.519** (0.237)	1.019*** (0.260)	0.777** (0.311)
Observations	98372	92431	96722	95698	75403
<b>Synchrony Bank</b>					
Online × Post March 2022	0.844*** (0.208)	0.638*** (0.234)	0.471** (0.220)	1.003*** (0.257)	0.528* (0.311)
Observations	98372	92431	96722	95698	75403
<b>TIAA, FSB</b>					
Online × Post March 2022	0.916*** (0.217)	0.688*** (0.234)	0.581** (0.241)	1.086*** (0.261)	0.649* (0.337)
Observations	98372	92431	96722	95698	75403
Bank FE	✓	✓	✓	✓	✓
Month FE	✓	✓	✓	✓	✓

# Loans (Deposit Lenders Only)

	(1)	(2)	(3)	(4)
	5-Year Auto Loan, New	5-Year Auto Loan, 2-Year Used	15-Year Mortgage	30-Year Mortgage
<b>Panel A: Post Interaction</b>				
Online × Post March 2022	0.427** (0.202)	0.440** (0.176)	1.433*** (0.051)	1.258*** (0.104)
<b>Panel B: FFR Interaction</b>				
Online × FFR	0.224*** (0.063)	0.217*** (0.062)	0.407*** (0.018)	0.367*** (0.055)
Observations	46637	42572	22648	19734
Bank FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓

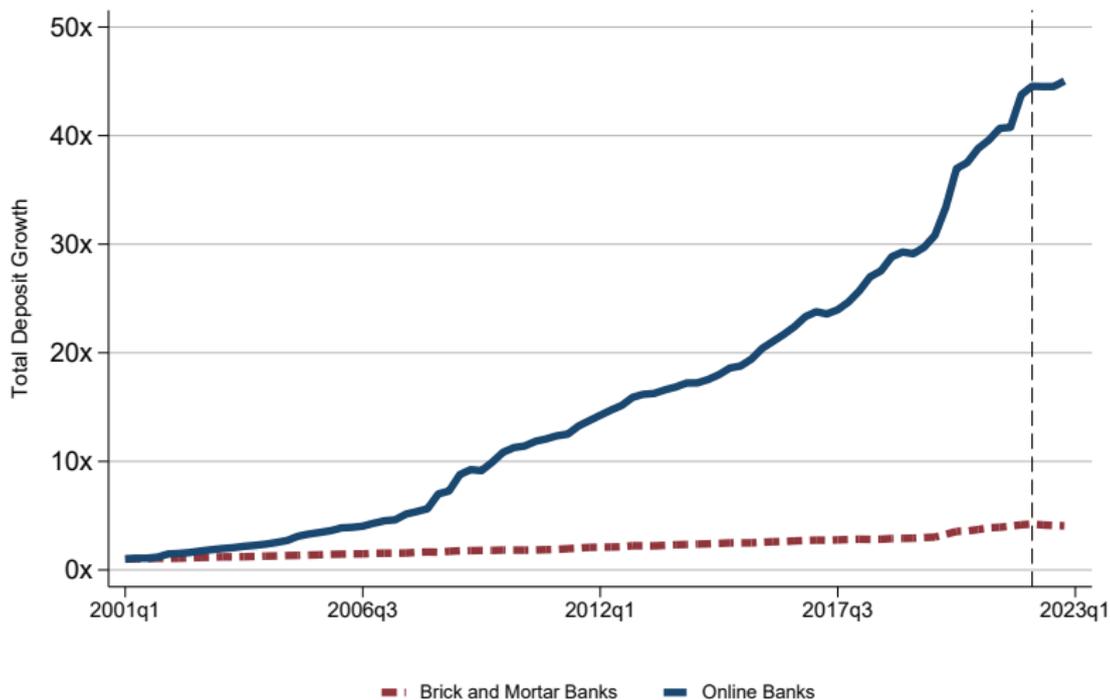
## Balance Sheet Summary Statistics (Online Banks Only)

	Mean	SD	Max	Min	Median	Obs
<b>Panel A: Liabilities</b>						
Deposits	0.77	0.11	0.91	0.43	0.79	16
Equity	0.11	0.03	0.16	0.06	0.10	16
<b>Panel B: Assets</b>						
Loans	0.69	0.18	0.91	0.23	0.74	16
Cash	0.13	0.08	0.35	0.03	0.12	16
Securities	0.14	0.15	0.66	0.00	0.09	16
<b>Panel C: Loans</b>						
Consumer Loans	0.49	0.29	0.98	0.07	0.46	16
Commercial Loans	0.26	0.24	0.71	0.00	0.19	16
Bank Loans	0.06	0.23	0.93	0.00	0.00	16
Commercial Real Estate Loans	0.11	0.12	0.38	0.00	0.09	16

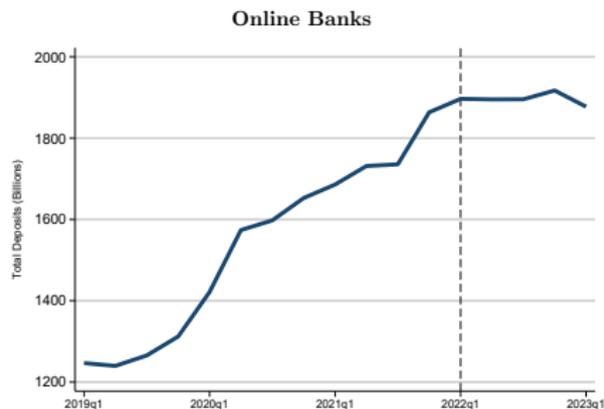
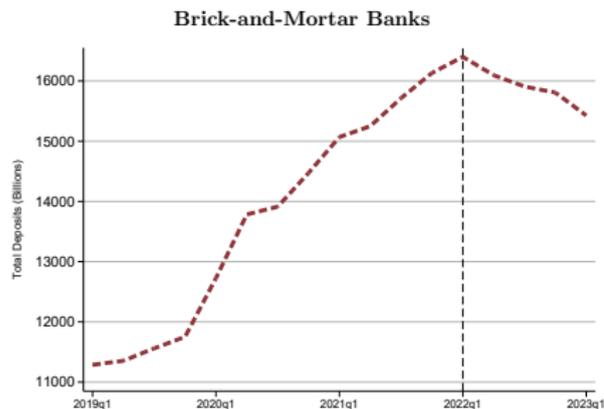
## Balance Sheet Summary Statistics (B&M Banks Only)

	Mean	SD	Max	Min	Median	Obs
<b>Panel A: Liabilities</b>						
Deposits	0.85	0.07	0.97	0.00	0.87	4005
Equity	0.11	0.03	0.93	0.00	0.10	4005
<b>Panel B: Assets</b>						
Loans	0.60	0.15	0.94	0.00	0.61	4005
Cash	0.13	0.10	0.74	0.00	0.11	4005
Securities	0.21	0.15	0.87	0.00	0.18	4005
<b>Panel C: Loans</b>						
Consumer Loans	0.29	0.20	1.00	0.00	0.25	4005
Commercial Loans	0.20	0.16	1.74	0.00	0.16	4005
Bank Loans	0.00	0.01	0.20	0.00	0.00	4005
Commercial Real Estate Loans	0.25	0.15	0.96	0.00	0.24	4005

# Total Deposit Growth (Out of Sample Banks)

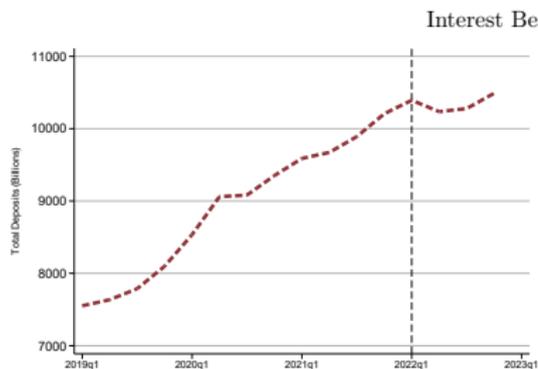


# Total Deposit Levels (Out of Sample Banks)

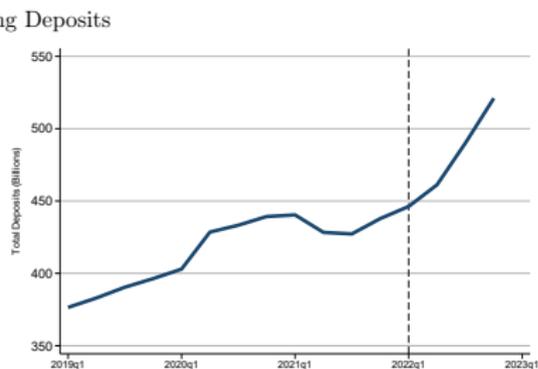


# Deposit Type Breakdown

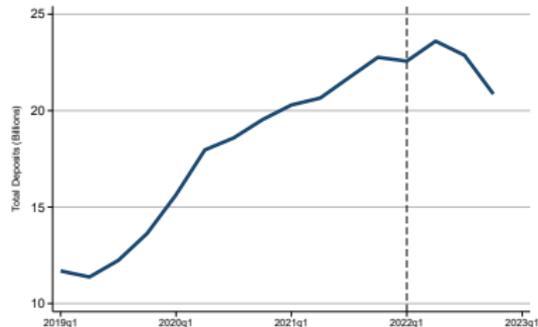
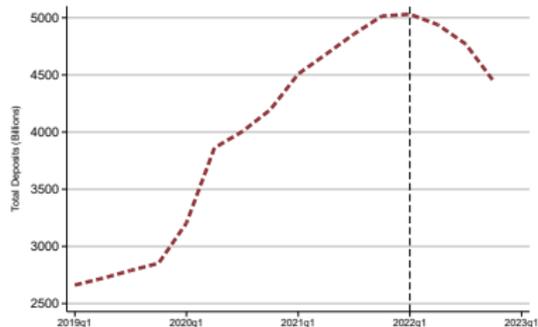
## Brick-and-Mortar Banks



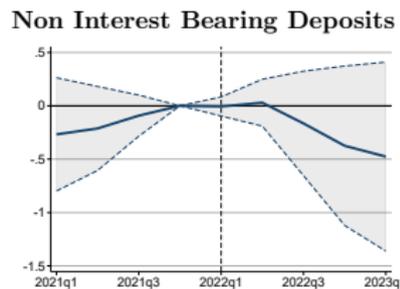
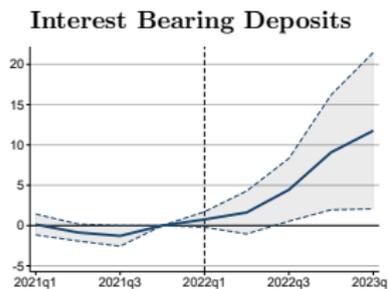
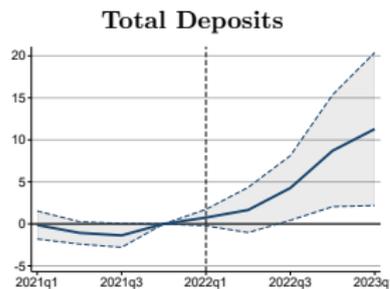
## Online Banks



## Non-Interest Bearing Deposits

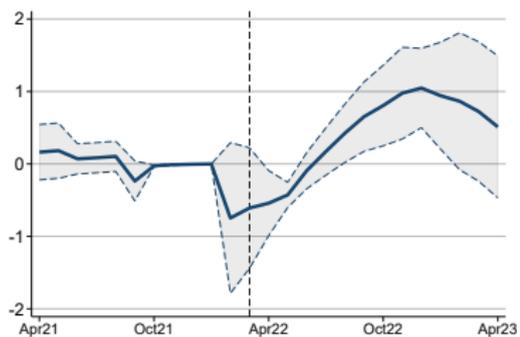


# Event Study Using Total Deposits

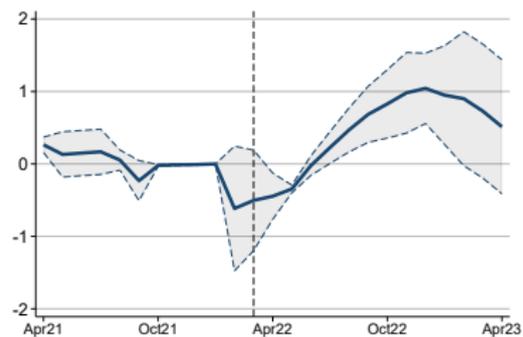


# Loan Event Studies

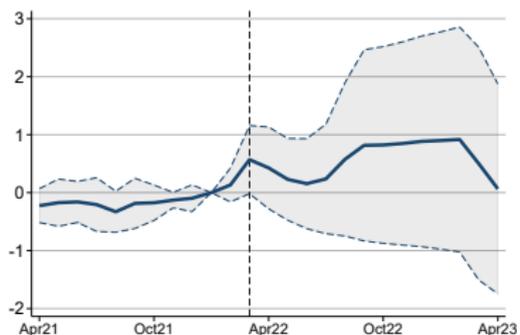
## 5-Year Auto Loan, New



## 5-Year Auto Loan, 2-Year Used



## 15-Year Mortgage



## 30-Year Mortgage

