

Bank Competition amid Digital Disruption: Implications for Financial Inclusion

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- ▶ Common notion that technology can bring in new entrants, increase competition, and democratize access to financial services
 - E.g., Philippon (2016, 2019)
 - *“Between 2017 and 2019, the unbanked rate fell by 1.1 percentage points, corresponding to an increase of approximately 1.5 million banked consumers.” (FDIC, 2019)*

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 - *“Between 2017 and 2019, the unbanked rate fell by 1.1 percentage points, corresponding to an increase of approximately 1.5 million banked consumers.” (FDIC, 2019)*
- ▶ Digital divide: survey data reveals a sharp divergence in how consumers access banking services
 - The adoption of mobile banking rose by 40% among young consumers while only 10% among old ones from 2013 to 2019

- ▶ How does digital disruption change **bank competition** under digital divide?
- ▶ How does the changing landscape lead to **distributional effects**?

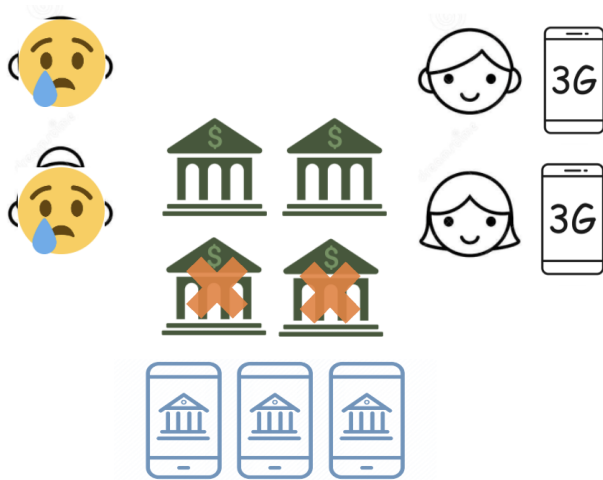
This Paper



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Empirical evidence using staggered expansion of 3G networks

- ▶ Digital disruption results in **segmented** banking markets
 - **Branching market becomes less competitive**
 - Branch closure + exit of branches → Branch HHI increases
 - Branching banks increase prices in both deposit and loan markets
 - **Digital market becomes more competitive**
 - Geographic expansion of non-branch-reliant banks → Lending market HHI decreases
 - non-branch-reliant banks lower prices in both deposit and loan markets

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 - non-branch-reliant banks lower prices in both deposit and loan markets
- ▶ Suggestive evidence for **distributional effects**
 - Older consumers: unbanked/underbanked ↑
 - Younger consumers: unbanked/underbanked ↓

- ▶ Data, Measure, and Design
- ▶ Banks' Responses to Digital Disruption
- ▶ Resulting Distributional Effects
- ▶ Structural Model of Bank Competition

Data, Measure, and Design

Digital Disruption Measure

- ▶ Staggered introduction of 3G network in the U.S.
 - digital maps of 3G network 2007-2018
 - 3G availability for each 1x1-km area

Digital Disruption Measure

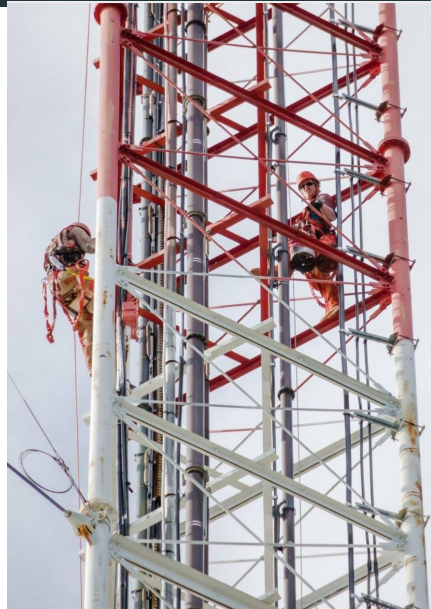
- ▶ Staggered introduction of 3G network in the U.S.
 - digital maps of 3G network 2007-2018
 - 3G availability for each 1x1-km area
- ▶ 3G expansion & Mobile banking adoption
 - Survey: FDIC Survey of Household Use of Banking and Financial Services
 - interviewed 33,000 consumers every other year since 2009

	Branch (1)	Mobile Banking (2)	Online Banking (3)	ATM (4)	Telephone Banking (5)
3G Coverage	-0.450*** (-3.654)	0.147** (2.470)	0.127 (0.947)	0.182* (1.938)	0.008 (0.383)
Year FE	✓	✓	✓	✓	✓
Adjusted R^2	0.010	0.090	0.018	0.003	0.001
Observations	93,801	93,801	93,801	93,801	93,801

- ▶ Staggered diff-in-diff: $Y_{b,c,t} = 3G \text{ Coverage}_{c,t} + FE_{b,s,t} + FE_{b,c} + Controls_{c,t}$
- ▶ Compare one bank's decision in a county with 3G expansion to those without in the same state

IV: Lightning Strikes

- ▶ Bartik IV: high vs low lightning areas within each state \times Year
- ▶ **Relevance: frequent lightning strikes \uparrow 3G maintenance costs** \rightarrow slower introduction of 3G networks
- ▶ **Exclusion: average weather condition is not correlated with banks' decisions to exit the market over time**



IV: Lightning Strikes

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	First stage 3G coverage (1)
$\mathbb{1}(\text{High Lightning}) \times \text{Year}$	-0.003** (-2.495)
Controls	✓
County FE	✓
State \times Year FE	✓
Observations	36,744

Cragg-Donald Wald F-statistic is 20.68

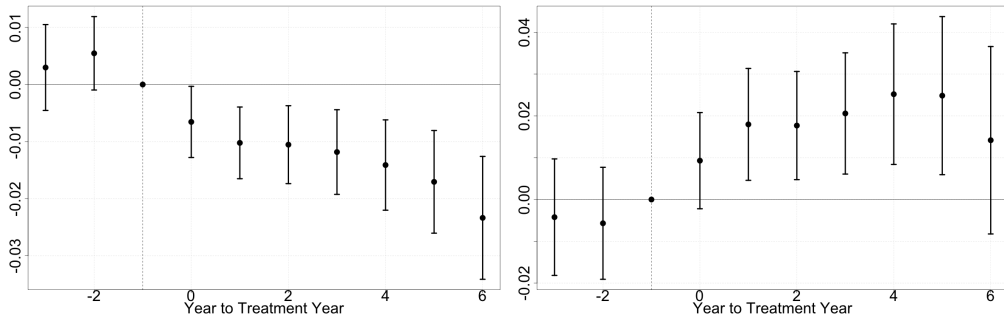
Reduced Form Evidence

Reduced Form Evidence

Banks' Endogenous Responses

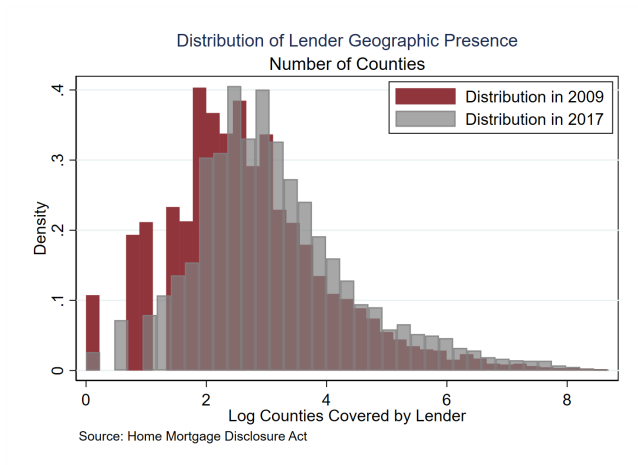
Branch Closure and Branch Competition

- ▶ Treatment year: the year when a county had more than 50% 3G expansion



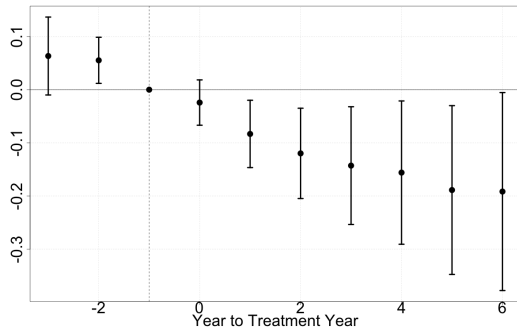
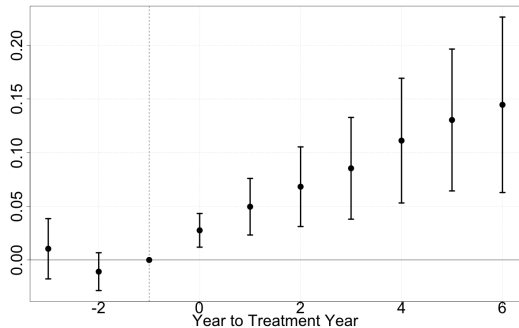
- ▶ After 3G expansion, the number of branches drop for the average county, and the branch concentration increases Bank Level Evidence

Geographic Expansion



- ▶ The **scope of competition** shifts from local to (more) national

Geographic Expansion and Product Competition



► #total lenders serving a county increases, so does the market competition

Heterogeneous Responses in Branch Closure

	2SLS		
	Log(1+Branch)		
	(1)	(2)	(3)
	Low BR Bank	High BR Bank	Full Sample
3G Coverage	-1.592*** (-3.694)	-0.171 (-1.255)	-0.171 (-1.255)
3G Coverage×Low BR Bank			-1.421*** (-3.145)
County Controls	✓	✓	✓
Bank-County FE	✓	✓	✓
Bank-State-Year FE	✓	✓	✓
Observations	107,688	351,288	458,976

- ▶ Branch-reliance_b = $\frac{Branch_{2007}}{Deposits_{2007}(M)}$
- ▶ Low BR Bank: lowest quartile of branch-reliance

- ▶ Non-branch-reliant banks close more branches after 3G expansion

Diverging Pricing Strategies - Deposit Market

	Deposit Spread					
	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
	Low BR Bank	High BR Bank	Full Sample	Low BR Bank	High BR Bank	Full Sample
3G Coverage	-0.019** (-2.257)	0.016* (1.941)	-0.069*** (-5.516)	-0.108 (-0.836)	0.221** (2.101)	-0.310* (-1.843)
3G Coverage × Branch-Reliance			0.069*** (6.352)			0.289*** (2.665)
County Controls	✓	✓	✓	✓	✓	✓
Bank-County FE	✓	✓	✓	✓	✓	✓
Bank-Quarter FE	✓	✓	✓	✓	✓	✓

- ▶ Diverging pricing behavior after 3G
- ▶ Price increases for branch-reliant banks and decreases for non-branch reliant banks

Diverging Pricing Strategies - Loan Market (IV)

	2SLS			
	Mortgage	Auto New	Auto Used	Unsecured Credit
3G Coverage	-0.207* (-1.704)	-1.229*** (-5.469)	-1.675*** (-6.385)	0.915 (1.624)
3G Coverage × Branch-Reliance	0.059*** (3.739)	0.171*** (10.341)	0.227*** (11.807)	0.205*** (4.146)
County Controls	✓	✓	✓	✓
Bank-County FE	✓	✓	✓	✓
State-Quarter FE	✓	✓	✓	✓

- ▶ Diverging pricing behavior after 3G
- ▶ Price increases for branch-reliant banks and decreases for non-branch reliant banks

Reduced Form Evidence

Distributional Effects

Financial Inclusion

Distributional Effects (IV)

	2SLS			
	Unbank/Underbank		Nonbank Credit	
	Young & Poor Consumer	Old & Poor Consumer	Young & Poor Consumer	Old & Poor Consumer
3G Coverage	-4.368*	2.951*	-1.865	2.519*
	(-1.734)	(1.824)	(-0.914)	(1.882)
Controls	✓	✓	✓	✓
State × Year FE	✓	✓	✓	✓
MSA FE	✓	✓	✓	✓

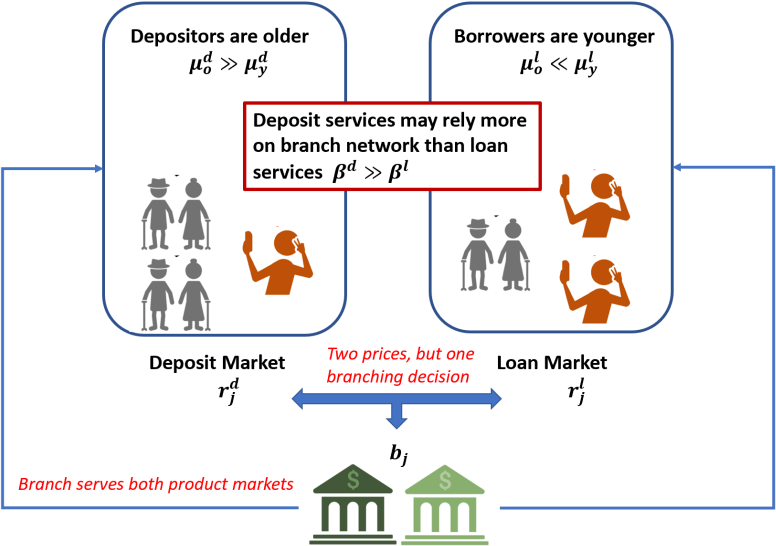
- ▶ Old (above 45 years old) & poor (under 30k annual income) consumers become more underbanked, and use more nonbank credit after 3G expansion

Structural Model

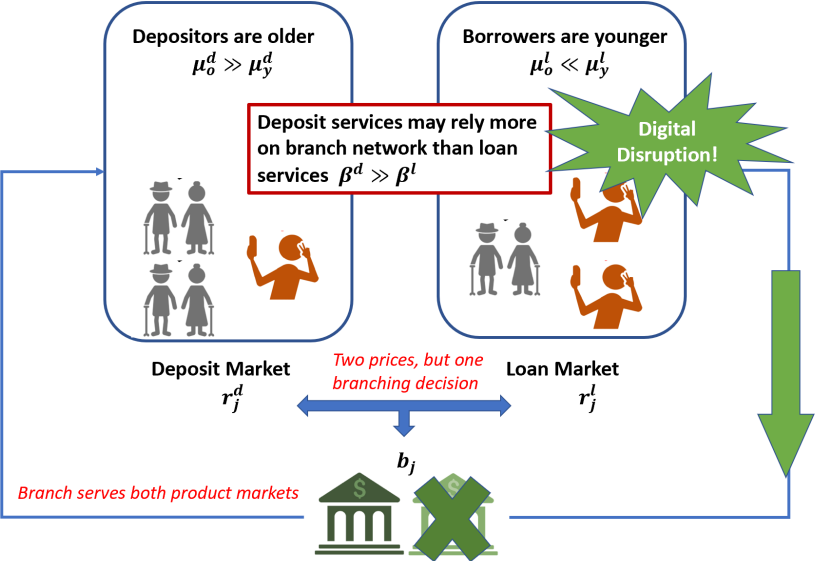
Why A Structural Model

- ▶ Reduced-form: causal evidence for mechanisms **within** deposit or loan market
- ▶ But..The two markets are connected as branches serve both markets
 - **Separate** pricing strategies but **one branching decision**
- ▶ **Question:** How does digital disruption in loan market affect consumers in deposit market?

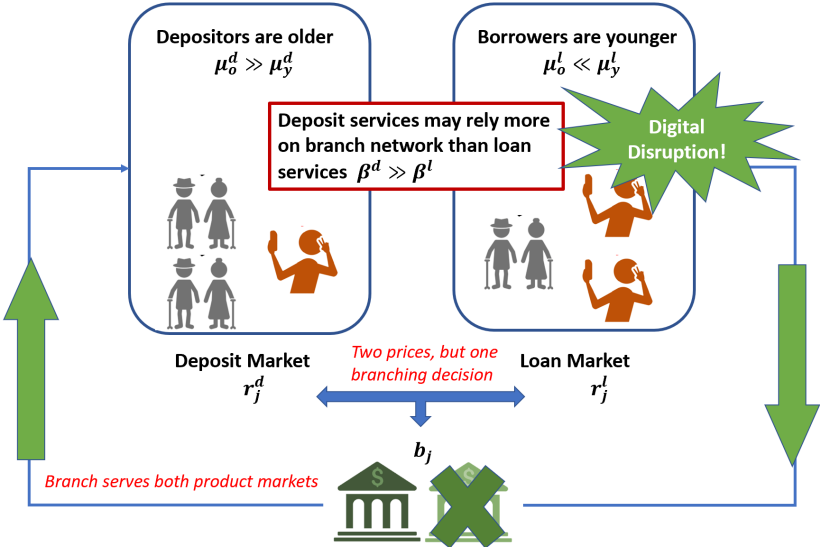
Model Outline



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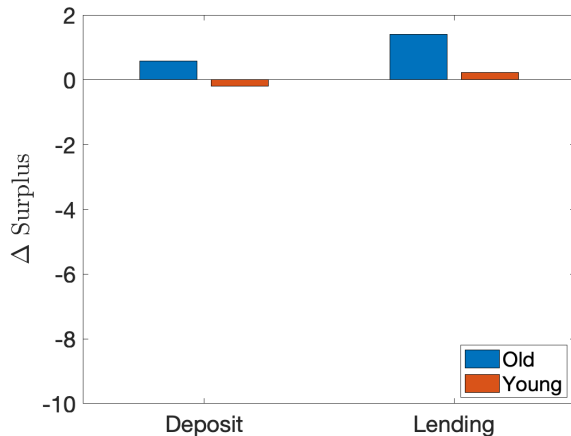
Model Outline



Structural model of bank competition with heterogeneous consumer preferences

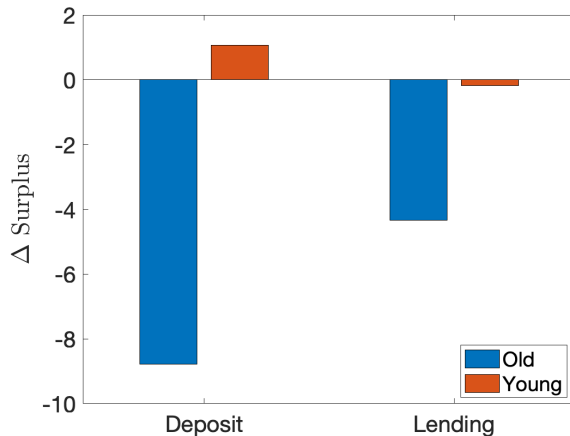
- ▶ Savers and borrowers with different level of tech-savviness
 - Different preferences over prices and how to access banking services (branch vs digital)
 - May stay unbanked if all options are too expensive or inconvenient
- ▶ Two type of banks: T-bank and F-bank, compete in deposit and lending markets
 - Offer differentiated services
 - Different level of substitutability (nested logit)
- ▶ Endogenous entry of each type of banks

Shock Spillover from Lending Market



- ▶ Only deposit market is shocked
- ▶ Old depositors will not be worse off when only deposit market experiences digital disruption
 - depositor pool contains more old consumers \rightarrow digital innovation isn't as disruptive

Shock Spillover from Lending Market



- ▶ Only lending market is shocked
- ▶ Depositors are affected even if there was no digital disruption in the deposit market
- ▶ Spillovers: borrower pool has more young consumers \rightarrow lowers marginal benefit of branch

Other Counterfactual Analysis

- ▶ Effects of digital disruption are mainly driven by service quality improvements rather than cost reduction
- ▶ Banks' branch adjustment outweigh rate responses in contributing to distributional effects
- ▶ Regulations restricting branch closures improve the overall consumer surplus

Conclusion and Discussion

Conclusion and Discussion

- ▶ Digital disruption results in a **segmented** banking sector with competitive digital market and less competitive branching market
- ▶ Old consumers can be strictly **worse off** because of **banks'** endogenous response to **stay competitive**
- ▶ Shocks to lending market **spill over to deposit market** because of banks' branching decisions

Conclusion and Discussion

- ⇒ Rising concerns from policy makers: *“The digital divide will become the new face of inequality” (United Nations, 2021)*
- ⇒ A framework of how technology reshapes the banking industry (AI, ChatGPT)
- ⇒ Importance of **supply-side adjustment**

Appendix

Banks' Structural Change

	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
	Log(1+Branch)	I(Branch)	Branch Exit	Log(1+Branch)	I(Branch)	Branch Exit
3G Coverage	-0.013*** (-4.304)	-1.378*** (-5.468)	1.701*** (8.565)	-0.386** (-2.171)	-32.035** (-2.127)	15.094* (1.735)
Adjusted R^2	0.894	0.843	0.931	-	-	-
Observations	458976	459000	262356	458976	459000	262356
County Controls	✓	✓	✓	✓	✓	✓
Bank-County FE	✓	✓	✓	✓	✓	✓
Bank-State-Year FE	✓	✓	✓	✓	✓	✓
Cragg-Donald Wald F-stats				141.209	141.240	85.025

- ▶ Banks shut down branches and even exit market in regions with higher 3G coverage