Bank Competition amid Digital Disruption: Implications for Financial Inclusion

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Motivation

- 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 people while only 10% among old ones from 2013 to 2019

This Paper

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

This Paper

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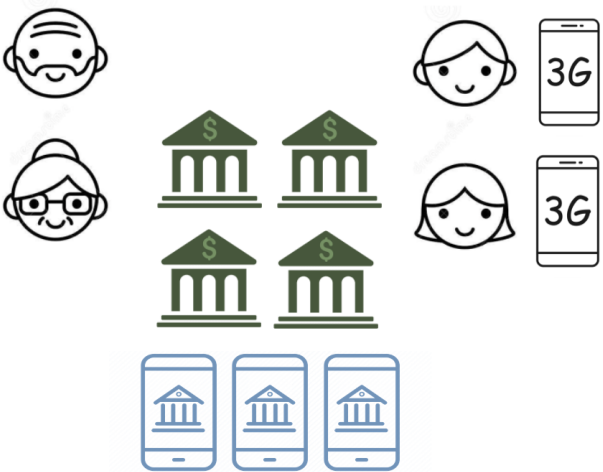

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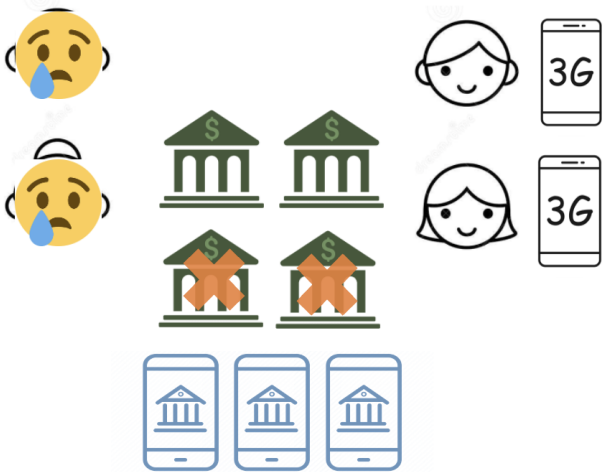

This Paper - Reduced Form

Empirical evidence using staggered expansion of 3G networks

- Digital disruption results in a segmented banking sector
  - Branching market becomes less competitive
    - Branch closure + exit of branches $\rightarrow$ Branch HHI increases
    - Branch-reliant banks increase prices in both deposit and loan markets
  - Digital market becomes more competitive
    - Expansion of non-branch-reliant banks $\rightarrow$ Product market HHI decreases
    - Non-branch-reliant banks lower prices in both deposit and loan markets

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- Suggestive evidence for distributional effects
  - Older consumers are more likely to be unbanked/underbanked
  - Younger consumers are less likely to be unbanked/underbanked

This Paper - Structural Model

- Reduced-form: causal evidence for mechanisms within each product market
- But...Banks face different demand systems across product markets
  - Depositor pool and borrower pool have different consumer age distributions
  - Deposit services may rely more (or less) on branch networks
- Separate pricing strategies but one branching decision because a branch serves both deposit and loan markets within a region

This Paper - Structural Model

- Model incorporates the economic mechanism in each market
- Two markets are connected through banks' branching decisions
- If only deposit market is disrupted, old depositors would not be worse off
- Disruption in lending market spill overs to deposit market through banks' branching decision
  - Marginal benefit of branch depends on demand from both markets

Road Map

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

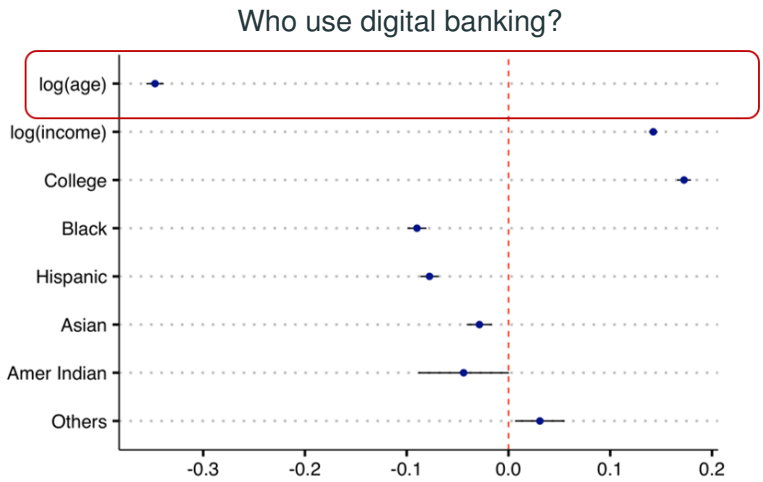
Data, Measure, and Design

Digital Disruption Measure

- Staggered introduction of 3G network in the U.S.
- 3G: Key infrastructure that popularized digital banking
  - digital maps of 3G network 2007-2018
  - 3G availability for each 1x1-km area
- Digital banking adoption & 3G expansion
  - Survey: FDIC Survey of Household Use of Banking and Financial Services
  - interviewed 33,000 consumers every other year since 2009
  - e.g., bank account ownership, primary methods to access bank accounts, reasons for being unbanked, a saturated set of demographics

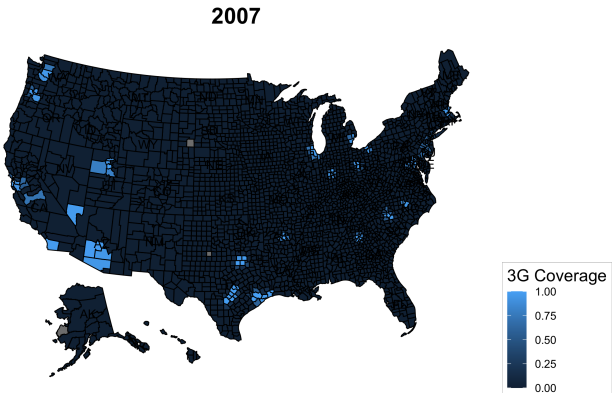
	Branch (1)	Mobile Banking (2)	Online Banking (3)	ATM (4)	Telephone Banking (5)
3G Coverage	-0.450***	0.147**	0.127	0.182*	0.008
	(-3.654)	(2.470)	(0.947)	(1.938)	(0.383)
Year FE	✓	✓	✓	✓	✓
Adjusted R^2	0.010	0.090	0.018	0.003	0.001
Observations	93,801	93,801	93,801	93,801	93,801

Premise: Digital Divide



- Age — compare to income, education, and race — is the most important determinant of using digital banking services

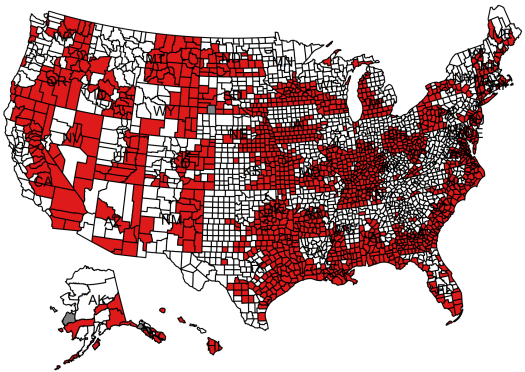
Empirical Design



- Staggered diff-in-diff: $Y_{b,c,t} = \text{3G Coverage}_{c,t} + FE_{b,s,t} + FE_{b,c} + Controls_{c,t}$
- 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



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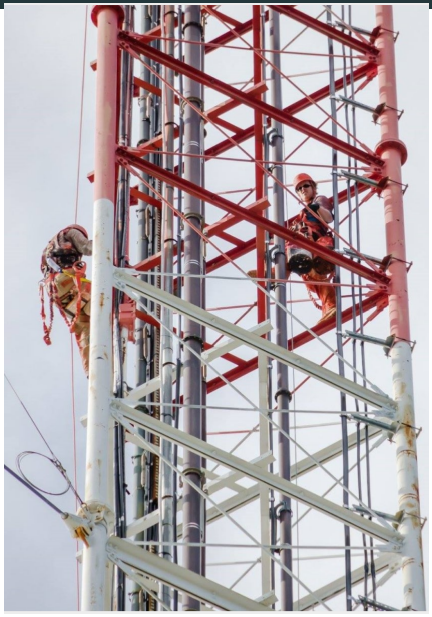

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	First stage 3G coverage
	(1)
$\mathbb{1}$(High Lightning) $\times$ *Year*	-0.003^{**}
	(-2.495)
Controls	✓
County FE	✓
State$\times$Year FE	✓
Observations	36,744

Cragg-Donald Wald F-statistic is 20.68

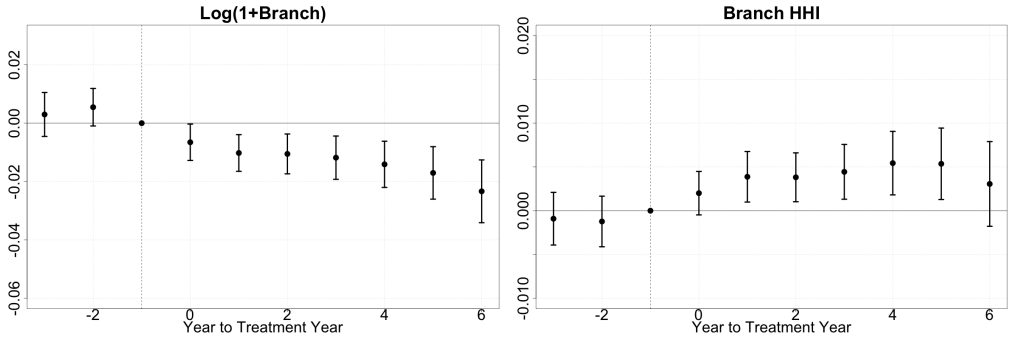
Reduced Form Evidence

Reduced Form Evidence

Banks' Endogenous Responses

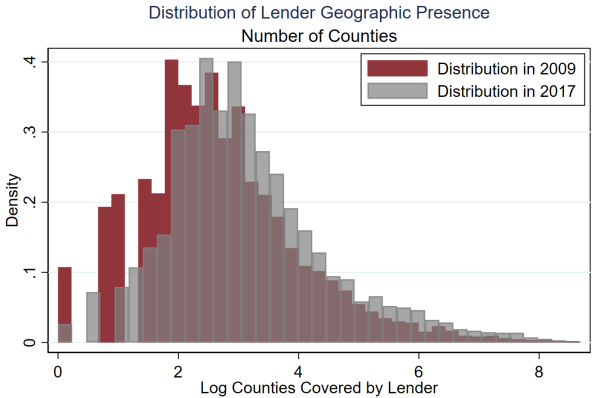
County-level Branch Competition

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



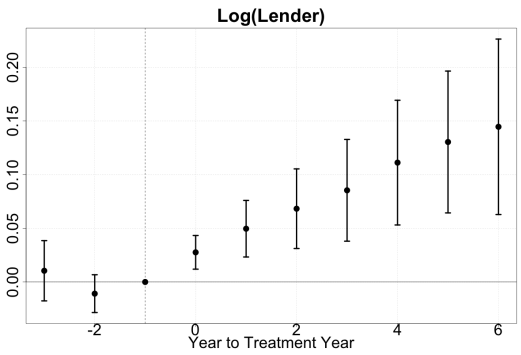
- After 3G expansion, the number of branches drop for the average county, and the branch concentration increases Bank Level Evidence

Geographic Expansion



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

Geographic Expansion



	(1) Product HHI	(2) Log(Lenders)
3G Coverage	-0.914**	0.408**
	(-1.968)	(2.360)
County Controls	✓	✓
County FE	✓	✓
State-Year FE	✓	✓
Observations	33,605	33,584
F-stats	22.249	22.156

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

Diverging Pricing Strategies - Deposit Market

Deposit Spread

	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
	F-Bank	T-Bank	Full Sample	F-Bank	T-Bank	Full Sample
3G Coverage	-0.019**	0.016*	-0.069***	-0.108	0.221**	-0.310*
	(-2.257)	(1.941)	(-5.516)	(-0.836)	(2.101)	(-1.843)
3G Coverage×Branch-Reliance			0.069***			0.289***
			(6.352)			(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*	-1.229***	-1.675***	0.915
	(-1.704)	(-5.469)	(-6.385)	(1.624)
3G Coverage×Branch-Reliance	0.059***	0.171***	0.227***	0.205***
	(3.739)	(10.341)	(11.807)	(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

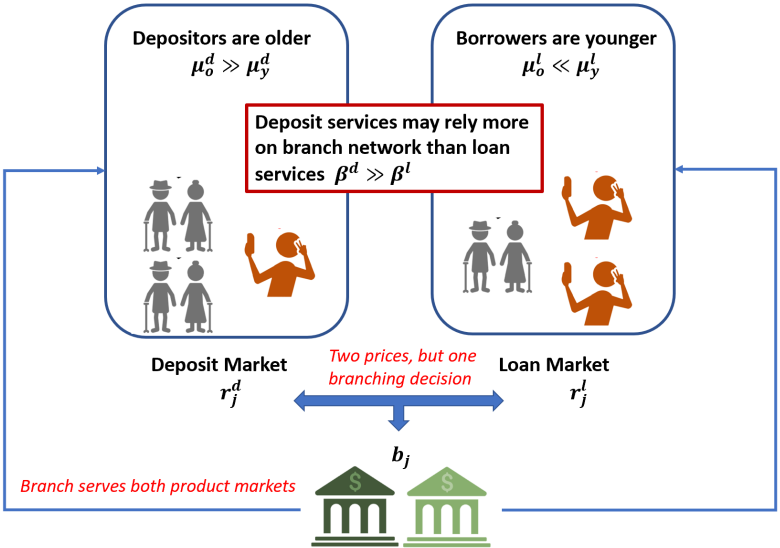
Distributional Effects

	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

Model Outline



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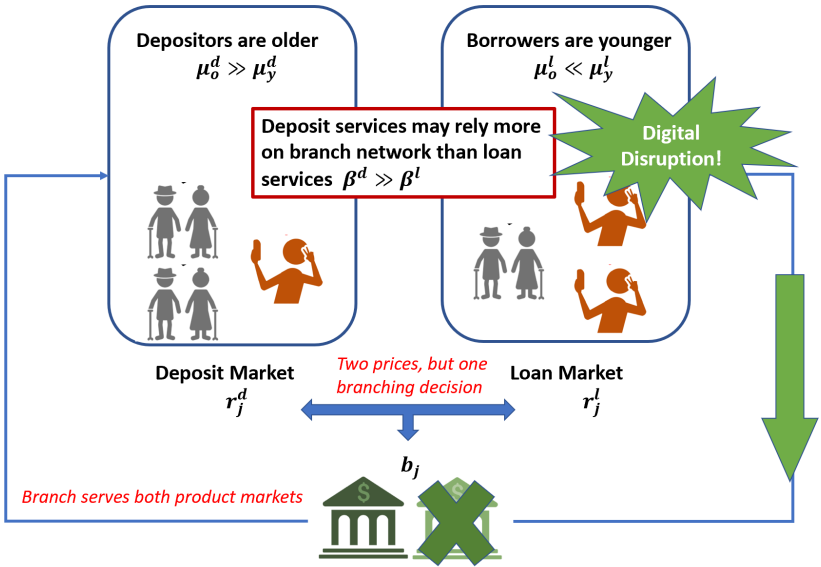

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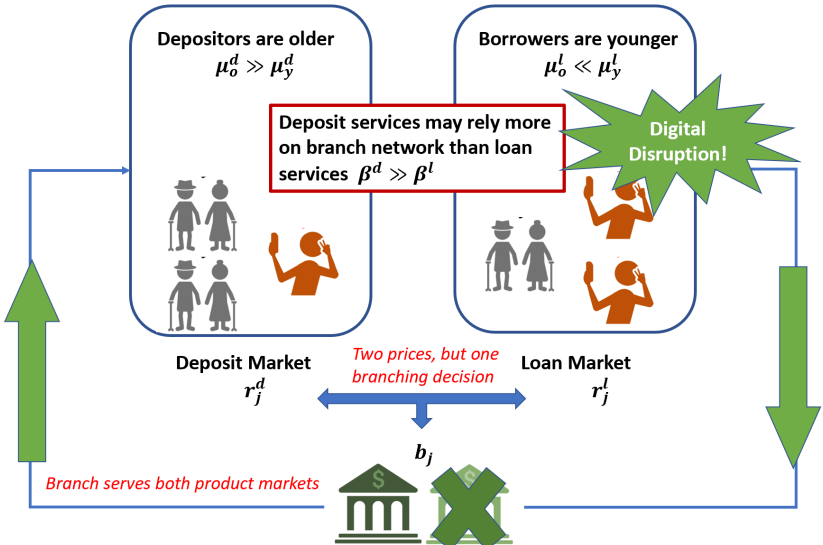


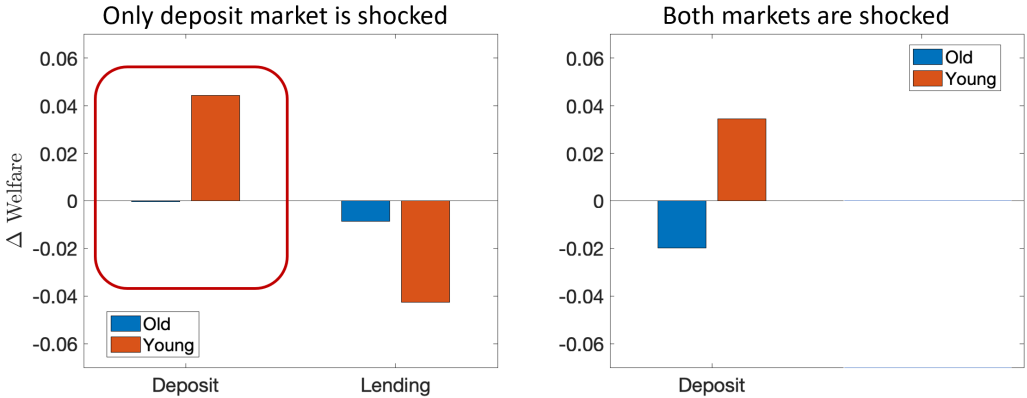
Key Ingredients

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

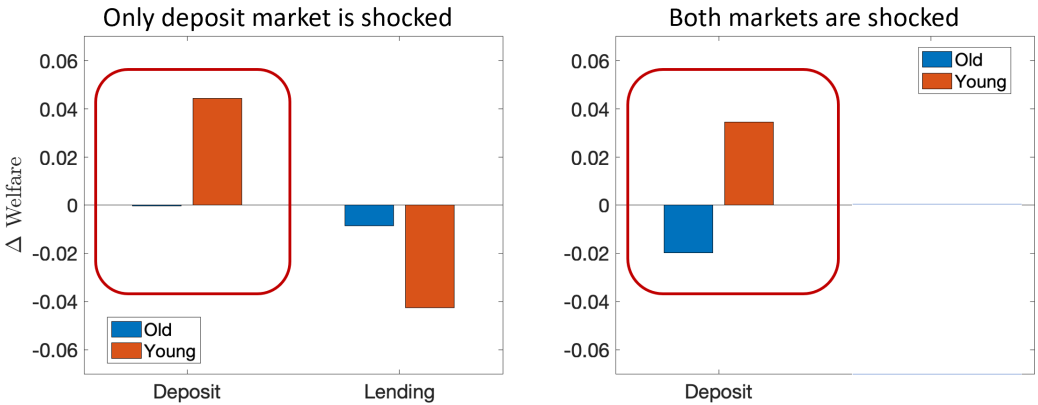
- Two type of banks: traditional banks (T-type) and FinTech banks (F-type), compete in deposit and lending markets
  - different level of substitutability (nested logit)
  - offer differentiated banking services
  - differ on two other dimensions
    - competitive advantage: marginal cost of branch operation and digital service quality
    - cost of entry

Decomposition: Shock Spillover from Lending Market



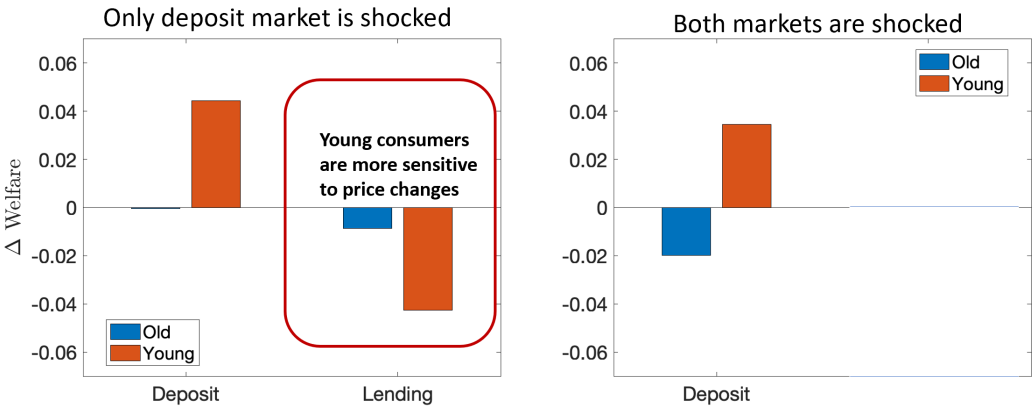
- Old depositors will not be worse off when only deposit market experiences digital disruption
  - depositor pool contains more old consumers → digital innovation isn't as disruptive

Decomposition: Shock Spillover from Lending Market



- Lending market digital disruption spills over to deposit market
  - borrower pool has more young consumers → lowers marginal benefit of branch

Decomposition: Shock Spillover from Lending Market



- Borrowers are affected even if there was no digital disruption in the lending market

Conclusion and Discussion

Conclusion and Discussion

- Digital disruption results in a segmented banking sector with competative digital market and less competative branching market
- Old consumers can be strictly worse off because of banks' endogenous response to stay competitive

$\Longrightarrow$ Rising concerns from policy makers: *"The digital divide will become the new face of inequality" (United Nations, 2021)*

$\Longrightarrow$ 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***	-1.378***	1.701***	-0.386**	-32.035**	15.094*
	(-4.304)	(-5.468)	(8.565)	(-2.171)	(-2.127)	(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

Heterogeneous Responses

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

FinTech banks close more branches after 3G expansion

- Branch-reliance$_b$ = $\frac{Branch_{2007}}{Deposits_{2006}(M)}$
- Fintech-bank: lowest quartile of branch-reliance