Capital Market Integration and Growth Across the United States

Leonardo D'Amico Maxim Alekseev

Joint Center for Housing Studies

February 21, 2025

National Markets and American Development

American historical development characterized by:

(1) Rise of national financial markets: reallocate savings from areas with excess supply (Northeast) to areas with excess demand (booming South & West)

(2) Move of workers along the same geographical lines

Usually treated as parallel but distinct processes

National Markets and American Development

American historical development characterized by:

(1) Rise of national financial markets: reallocate savings from areas with excess supply (Northeast) to areas with excess demand (booming South & West)

(2) Move of workers along the same geographical lines

Usually treated as parallel but distinct processes

This paper. Did (1) cause part of (2)? Answer in two steps

Q1. What drives the geographic integration of financial markets?

Q2. How does this integration shape real economic activity?

National Markets and American Development

American historical development characterized by:

(1) Rise of national financial markets: reallocate savings from areas with excess supply (Northeast) to areas with excess demand (booming South & West)

(2) Move of workers along the same geographical lines

Usually treated as parallel but distinct processes

This paper. Did (1) cause part of (2)? Answer in two steps

Q1. What drives the geographic integration of financial markets?

Q2. How does this integration shape real economic activity?

Setting. Study US banking markets before branching deregulation (1953-82)

National Markets and American Development

American historical development characterized by:

(1) Rise of national financial markets: reallocate savings from areas with excess supply (Northeast) to areas with excess demand (booming South & West)

(2) Move of workers along the same geographical lines

Usually treated as parallel but distinct processes

This paper. Did (1) cause part of (2)? Answer in two steps

Q1. What drives the geographic integration of financial markets?

Q2. How does this integration shape real economic activity?

Setting. Study US banking markets before branching deregulation (1953-82)

Implications. Lessons for current context where capital markets are not integrated (developing countries, Eurozone) & current US place-based investment subsidies

The American Mid-Century Experience

Digitize new state-level bank data. Two main new facts:

- Substantial financial integration: narrowing of regional differences in interest rates
- GDP and population growth strongly correlated with initial capital-scarcity

Explain financial integration. Simple banking theory, tests and quantifications

Quantify real effects. Add banks to state-of-the-art dynamic spatial model:

- Endogenous regional diff. in bank loan rates + fwd. look. migration & investment
- **Fin. integr. explains 20% rise of capital-scarce South & West and North's decline**
- Aggregate effects (paper)

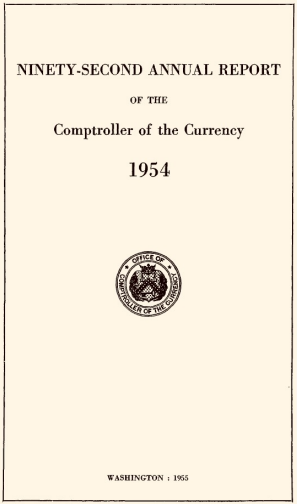
Implications. Policy counterfactuals on deregulation (paper)

- Effects of deregulation much larger than previously thought

Empirical Facts

Setting and Data

- American banking system pre-deregulation
  - Banks prohibited from branching out of state
  - Reg. Q capped rates offered on deposits
- Most commercial lending short term
  - 62% $\leqslant$ 6 months (Redenius 2006), for working capital


NINETY-SECOND ANNUAL REPORT

OF THE

Comptroller of the Currency

1954

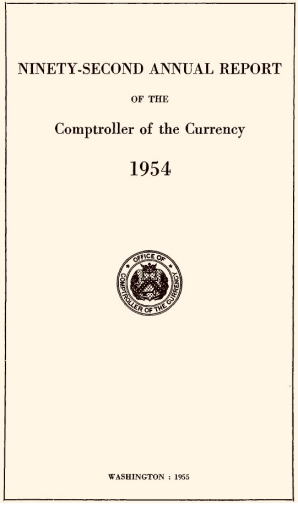
WASHINGTON : 1955

Setting and Data

- American banking system pre-deregulation
  - Banks prohibited from branching out of state
  - Reg. Q capped rates offered on deposits
- Most commercial lending short term
  - 62% $\leqslant$ 6 months (Redenius 2006), for working capital

Data.

- 1953-70: **digitize** *state-level* OCC reports (1953-70)
- 1960-83: *bank-level* call reports
  - FOIA before 1975 (Drechsler et al. 2020), public after
- Liabilities, assets, income, expenses, reserves


NINETY-SECOND ANNUAL REPORT
OF THE
Comptroller of the Currency
1954
WASHINGTON : 1955

More on Data Sources | More on Setting | Sample Table | Detailed List of Variables

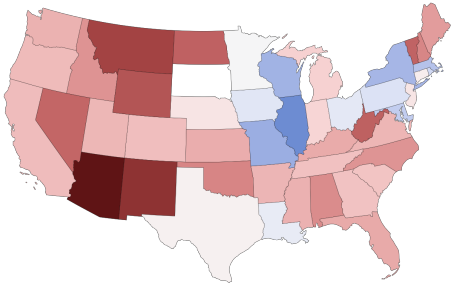
Fact 1. Segmentation and Convergence

$$r^{L}_{j,t} = \frac{\text{Interest \& Fees on Loans}_{j,t}}{\text{Total Loans}_{j,t-\frac{1}{2}}}$$

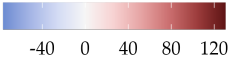
Fact 1. Segmentation and Convergence

Segmentation in 1953-58

$$r^L_{j,t} = \frac{\text{Interest \& Fees on Loans}_{j,t}}{\text{Total Loans}_{j,t-\frac{1}{2}}}$$



Deviation of lending rate from mean (bps)

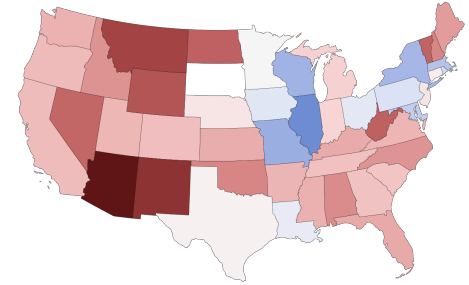


Correlates of Spreads | Correlation w. Mortgage Rates | Maps over Time | Time Series

Fact 1. Segmentation and Convergence

Segmentation in 1953-58

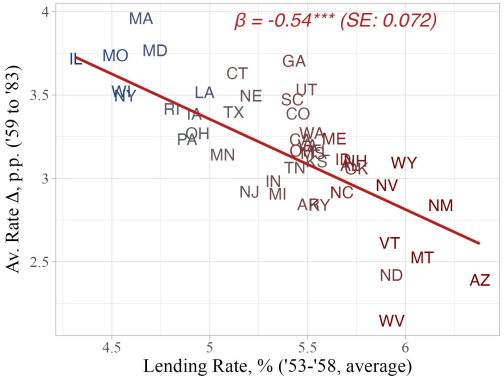
$$r^L_{j,t} = \frac{\text{Interest \& Fees on Loans}_{j,t}}{\text{Total Loans}_{j,t-\frac{1}{2}}}$$



Deviation of lending rate from mean (bps)

Convergence in 1959-1983

$$r^L_{j,\overline{59-83}} - r^L_{j,\overline{53-58}} = \alpha + \beta \cdot r^L_{j,\overline{53-58}} + \varepsilon_j$$



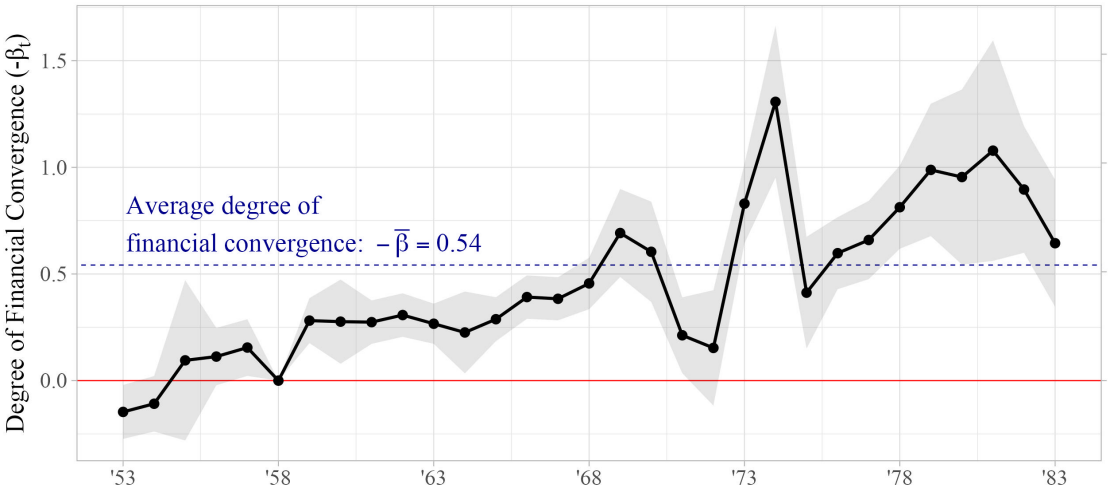
Correlates of Spreads | Correlation w. Mortgage Rates | Maps over Time | Time Series

Explaining the Drivers: Time-Varying Convergence

$$r^L_{j,t} - r^L_{j,\overline{53-58}} = \alpha_t + \boldsymbol{\beta_t} \cdot r^L_{j,\overline{53-58}} + \varepsilon_{jt}; \qquad -\boldsymbol{\beta_t} = \text{Degree of Fin. Convergence at } t$$

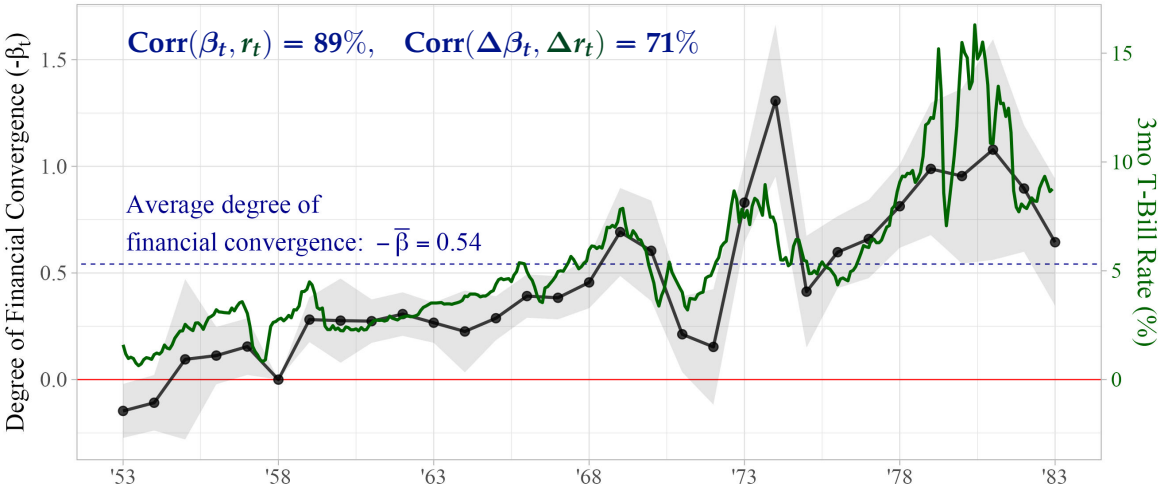
Explaining the Drivers: Time-Varying Convergence

$$r^L_{j,t} - r^L_{j,\overline{53-58}} = \alpha_t + \boldsymbol{\beta_t} \cdot r^L_{j,\overline{53-58}} + \varepsilon_{jt}; \qquad -\boldsymbol{\beta_t} = \text{Degree of Fin. Convergence at } t$$



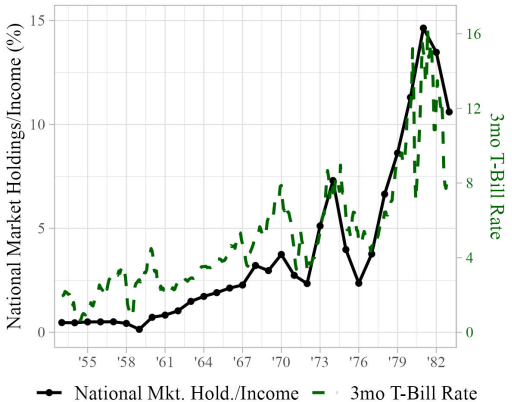
Explaining the Drivers: Time-Varying Convergence

$$r^L_{j,t} - r^L_{j,\overline{53-58}} = \alpha_t + \boldsymbol{\beta_t} \cdot r^L_{j,\overline{53-58}} + \varepsilon_{jt}; \qquad -\boldsymbol{\beta_t} = \text{Degree of Fin. Convergence at } t$$

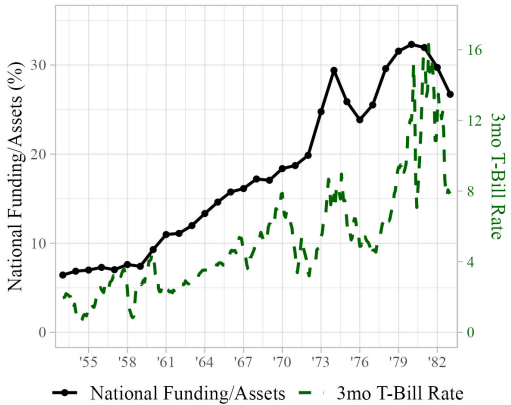


Aggregate Trends: Time-Varying Rise of Nat. Markets

Households' Money Market Holdings
(MMF shares, large time dep., commercial paper)

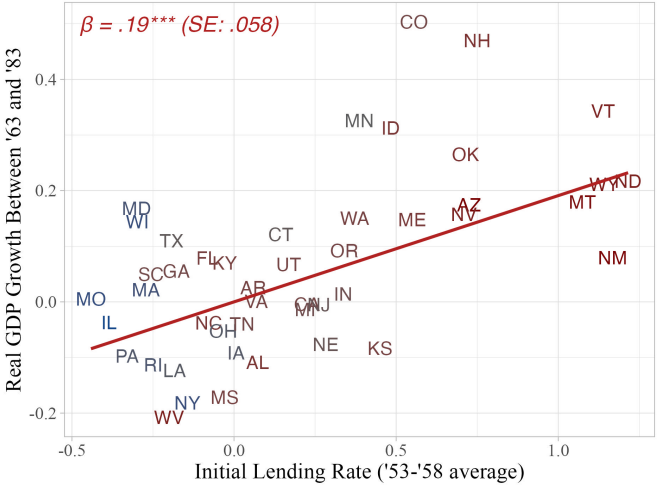


Banks' National Liabilities (large time dep., Fed Funds & Repos, foreign dep., comm. paper & bonds)



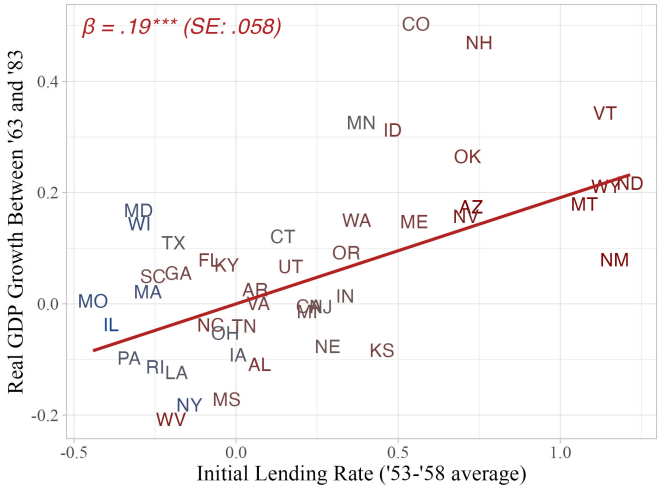
In changes | Local Holdings/Borrowings | Local Holdings/Borrowings in Changes

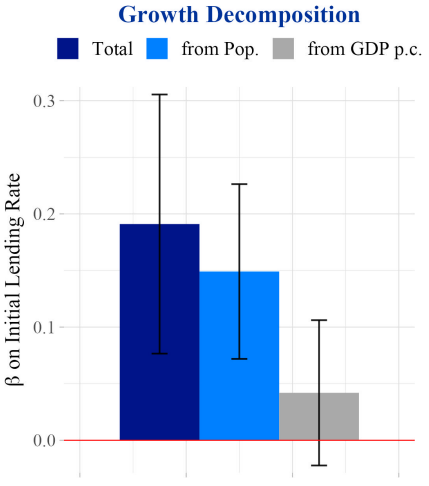
Fact 2. Higher GDP Growth in Initially High-Rate Areas



Controls: Jan. temp., Bartik sect. dem. shock, Bartik agricultural dem. shock, Right-to-Work state, % GDP in Oil in 1950

Fact 2. Higher GDP Growth in Initially High-Rate Areas





Controls: Jan. temp., Bartik sect. dem. shock, Bartik agricultural dem. shock, Right-to-Work state, % GDP in Oil in 1950

Robustness: holds also unconditionally & within region. Effects concentrated in sectors more dependent on financing

Table with Outcomes | Region FEs | Migration vs. Fertility | Sectors | Dependence on External Financing

Theory

Objectives and Ingredients

Objectives

- Role of r_t in driving financial integration
  - In paper, show other traditional stories (risk, competition) do not square w. data
- Role of financial integration in driving population growth
  - Conventional approach: fin. integration increases investment, no role for pop.
  - But here fin. integration within country! Labor is mobile & important in the data

Objectives and Ingredients

Objectives

- Role of r_t in driving financial integration
  - In paper, show other traditional stories (risk, competition) do not square w. data
- Role of financial integration in driving population growth
  - Conventional approach: fin. integration increases investment, no role for pop.
  - But here fin. integration within country! Labor is mobile & important in the data

Ingredients

- Many regions indexed by j with banks, firms, households; continuous time t
  - Lending markets are regional (branching prohibited/capital flows limited)
- Within period, households store liquidity, firms borrow to pay inputs
- Across periods, migration choices and investment choices

Static Choices

Timing. Firms pay inputs in the morning → produce → sell in the evening

Firms. Cobb-Douglas, finance share ξ_j of inputs w. bank loans

Households. Consume in the evening, hold liquidity in deposits or bonds that pay r_t:

- Have taste for liquidity of $\chi_j + \varepsilon$; $\varepsilon \sim \text{Exp}(\phi)$ random, χ_j regional shifter
- Choose dep. if $\chi_j + \varepsilon > r_t$, elasticity of deposit outflows ϕ

Banks. Intermediate: get liquidity from households, lend to firms

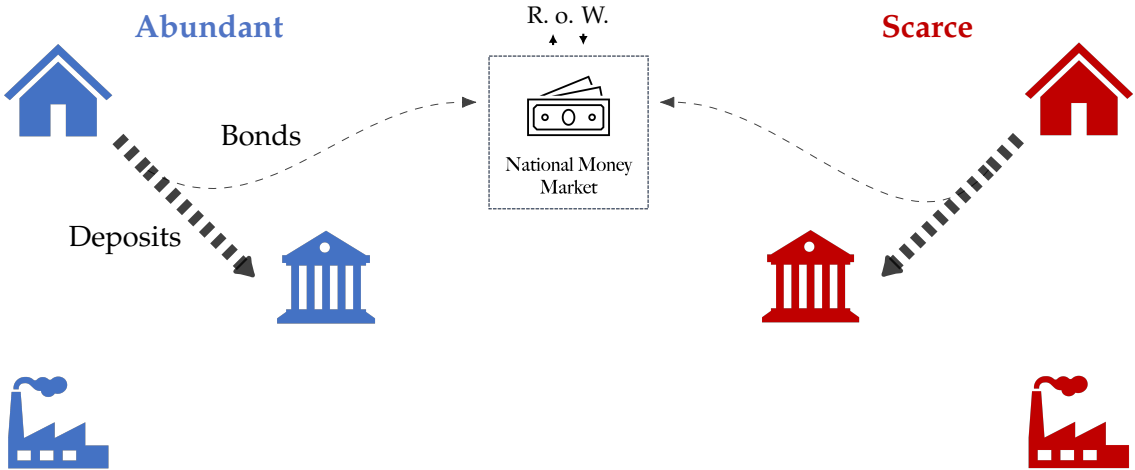
- Issue bonds if deposits $<$ loans, at frictions! Cost: $\underbrace{\theta_t}_{\text{Friction}} \left(1 - \frac{\text{Deposits}_{jt}}{\text{Loans}_{jt}}\right)^2 \cdot \text{Loans}_{jt}$

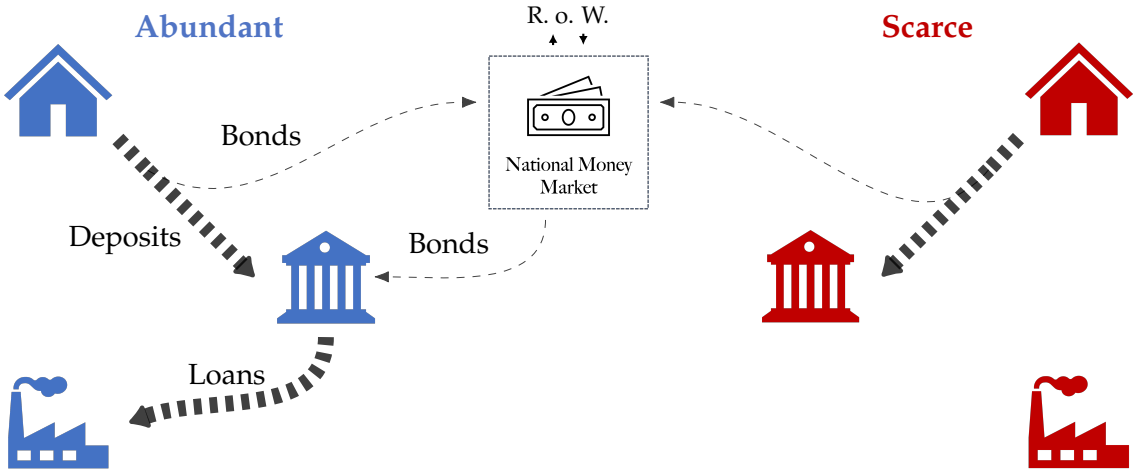
Abundant

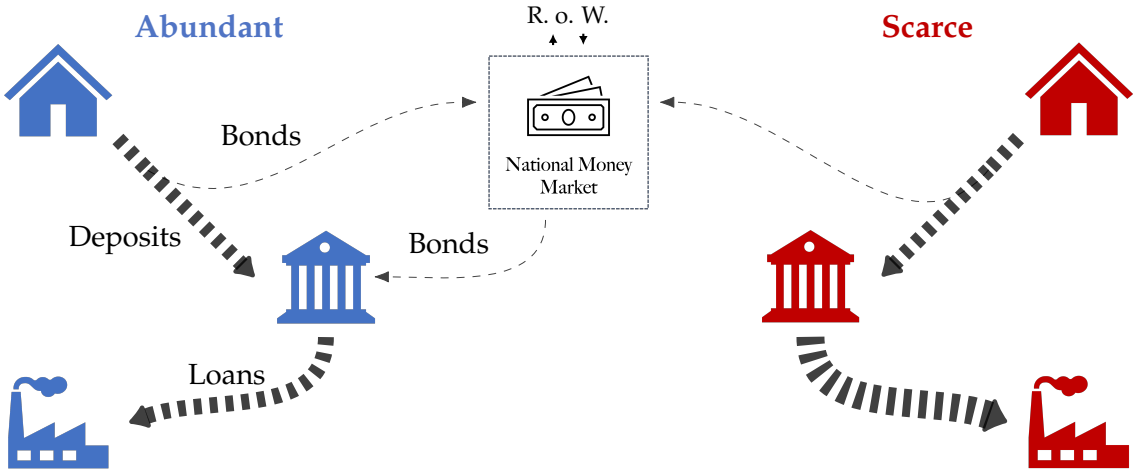
R. o. W.

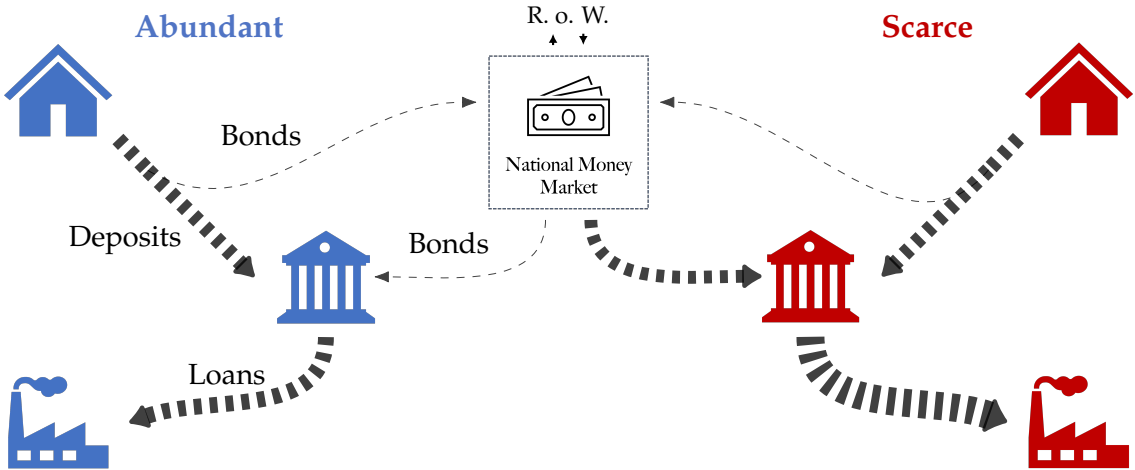
National Money Market

Scarce


Abundant
R. o. W.
Scarce
Bonds
National Money Market
Deposits

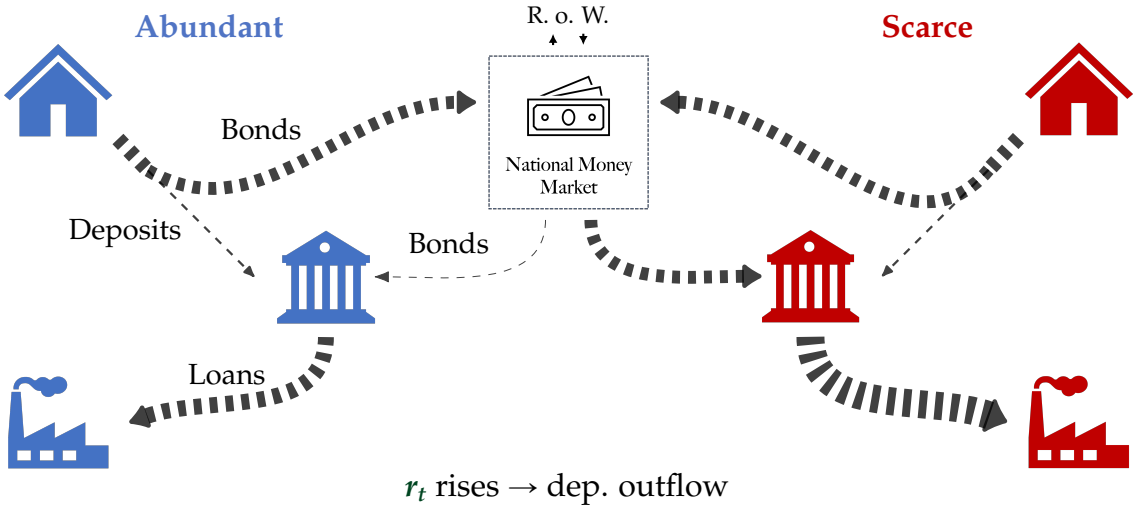

Abundant
R. o. W.
Scarce
Bonds
National Money Market
Deposits
Bonds
Loans


Abundant
R. o. W.
Scarce
Bonds
National Money Market
Deposits
Bonds
Loans

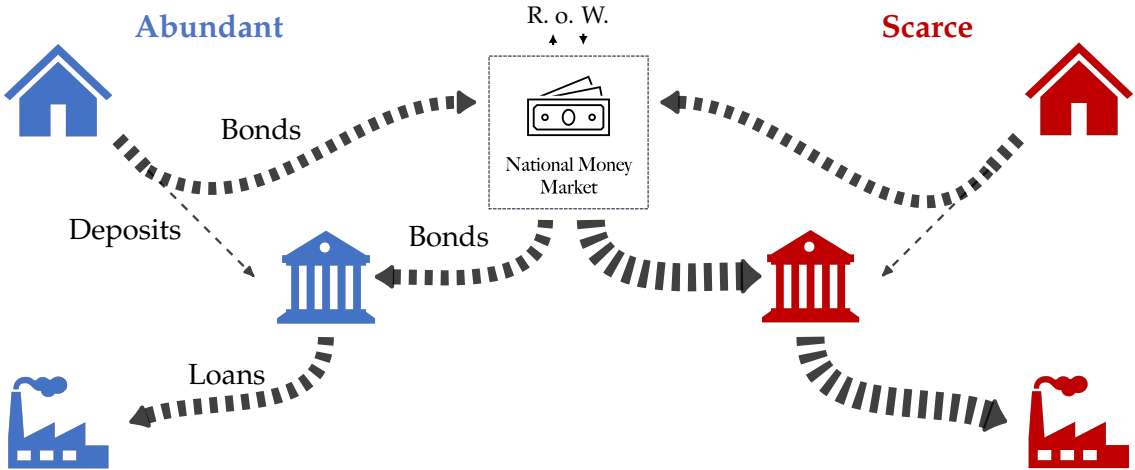


Fewer % dep. in scarce

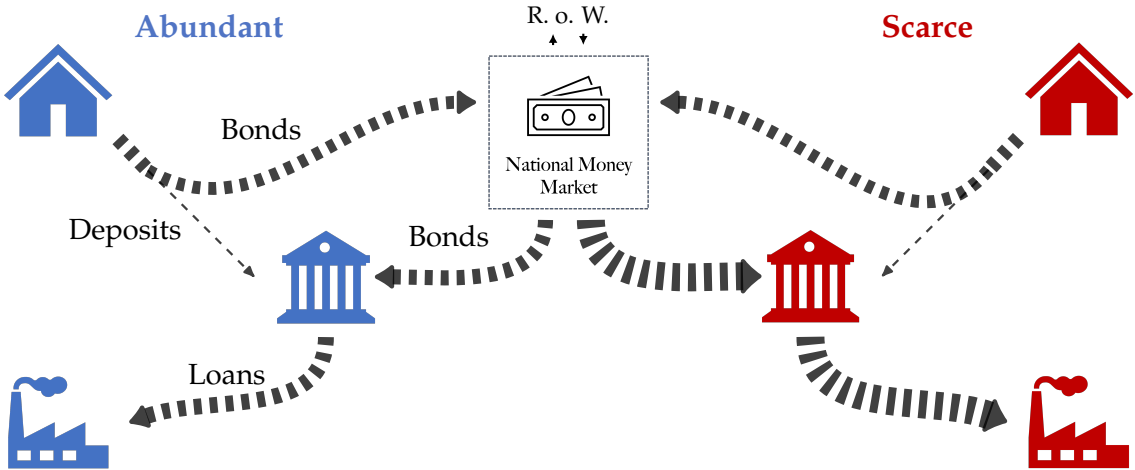
$\Longrightarrow$ rates are higher



r_t rises → dep. outflow

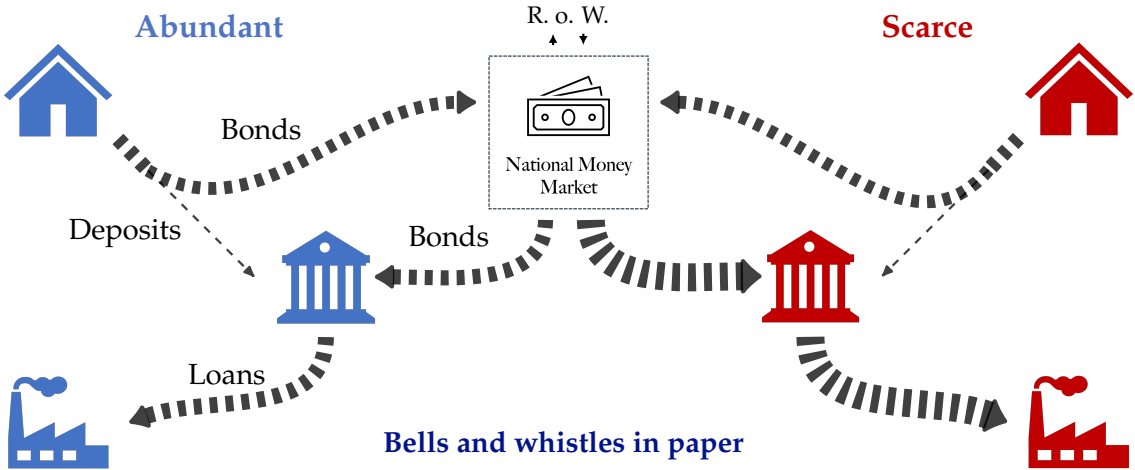


Abundant more exposed,
loses its advantage



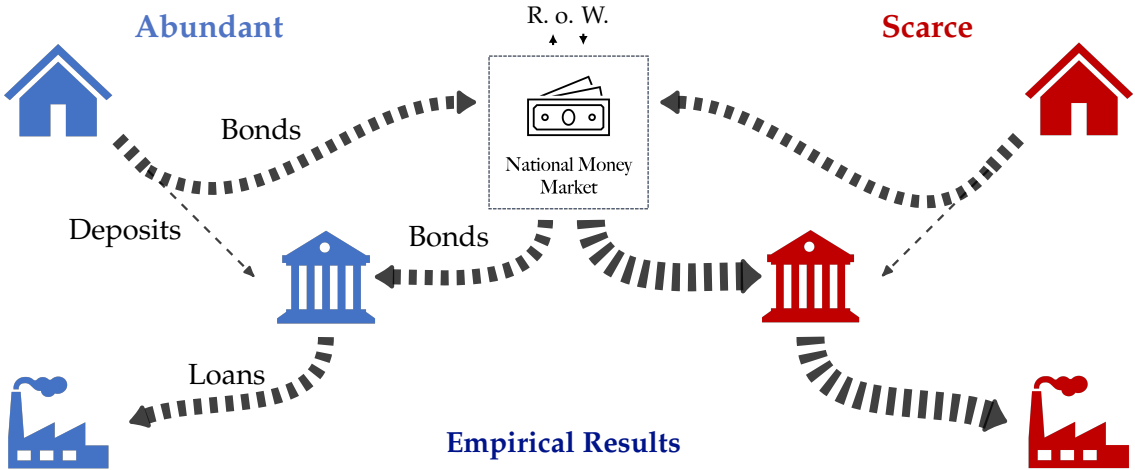
Funding Δ narrow

$\Longrightarrow$ regional spread $\downarrow$



Bells and whistles in paper

- ✓ Same intuition if differences were coming from household side
- ✓ Same with interbank market
- ✓ Can allow remunerated retail deposits, but need some inframarginal
- ✓ Cost of ext. financing not quadratic, up to cvxity not too extreme



Empirical Results

- ✓ Increase in r_t have larger effects in initially low-rate/high-dep. states
- Quantitatively: 51% of observed integration due to ↑ in r_t
  - Technological development (↓ θ_t) also important, together 89%

Real Effects and Dynamic Choices

Firms: borrow at spread $s^L_{jt} = r^L_{jt} - r_t$ from local bank, affects costs

- Hire N_{jt} and rent K_{jt}, costs: $\underbrace{\left(w_{jt}N_{jt} + r^K_{jt}K_{jt}\right)}_{\text{Real}} \cdot \underbrace{\left(1 + r_t + \xi_j \cdot s^L_{jt}\right)}_{\text{Financial}}$
- s^L_{jt} affects w_{jt}, r^K_{jt}, scale of pass-through depends on $\mathbb{E}[\xi_j] = .51$ (corp. loans/all debt)

Households (Caliendo et al. 2019): migration choices

- Enjoy amenities and consumption, pay housing
- Local spread → affects wages → migration, according to migration elasticity

Physical Capitalist (Kleinman et al. 2023): investment choices

- Immobile, make standard consumption-saving decisions
- Local spread → rental rate → investment

Assumptions and Quantitative Exercise

Two quantitatively important assumptions.

1. No household borrowing
   - Angelova and D'Amico (2024): very small regional differences in mortgage rates
2. Firm borrowing is short term
   - Firm loans mostly for working capital: 62% maturity $<$ 6 months (Redenius 2006)

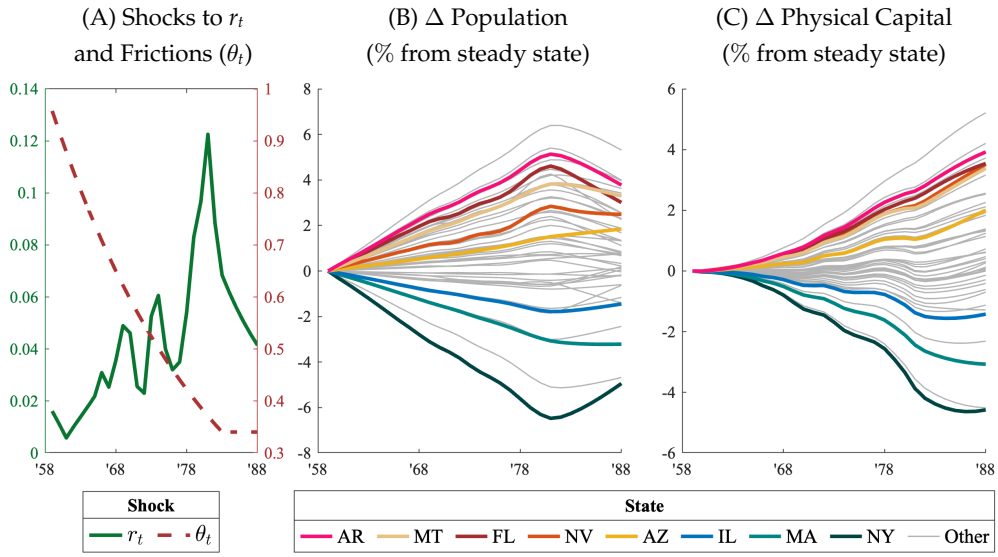
Quantitative exercise. States' response to fin. integration in 1958-83:

- Full transition dynamics to sources of integration estimated in paper:
  - $\uparrow$ in r_t, $\downarrow$ frictions in accessing markets (θ_t, tech. improvement)

Migration elasticity. Estimated from full transition dyn. ("Master Equation", Bilal 2023)

- Target most ΔGDP comes from Δpop., absolute ΔGDP untargeted

Regional Growth Generated by Financial Shocks



Aggregate Effects | Transition w. Uncertain χ_i | Model vs. Data (Maps) | Model vs. Data (Scatter) | Implications for Deregulation

Policy Implications

Taking stock.

- High nominal rates are a powerful driver of financial integration
- Financial integration can have important consequences on growth

Implications for policy today.

1. Cheap financing important for regional growth, sizable spatial consequences
   - Implications for current place-based investment policies
2. Removing barriers to capital mobility more effective in low rate environments
   - Deregulation allows banks to move deposits across space
   - More powerful in low rate environments: more deposits → more to reallocate
   - **US branching dereg. $2\times$ as powerful if it had happened in 1950s instead of 1980s**

Summary and Future Directions

This paper. Study mobility of financial capital jointly with mobility of labor

- Financial integr. of '59-'83 explains part of America's move to South & West
- Aggregate rates can be a powerful driver of financial integration
- Deregulation is more powerful in low-rate environments

Summary and Future Directions

This paper. Study mobility of financial capital jointly with mobility of labor

- Financial integr. of '59-'83 explains part of America's move to South & West
- Aggregate rates can be a powerful driver of financial integration
- Deregulation is more powerful in low-rate environments

Today. Eurozone comes out of a protracted low-rate environment

- % of money market holdings by EU households far lower than US in the 1980s

Summary and Future Directions

This paper. Study mobility of financial capital jointly with mobility of labor

- Financial integr. of '59-'83 explains part of America's move to South & West
- Aggregate rates can be a powerful driver of financial integration
- Deregulation is more powerful in low-rate environments

Today. Eurozone comes out of a protracted low-rate environment

- % of money market holdings by EU households far lower than US in the 1980s

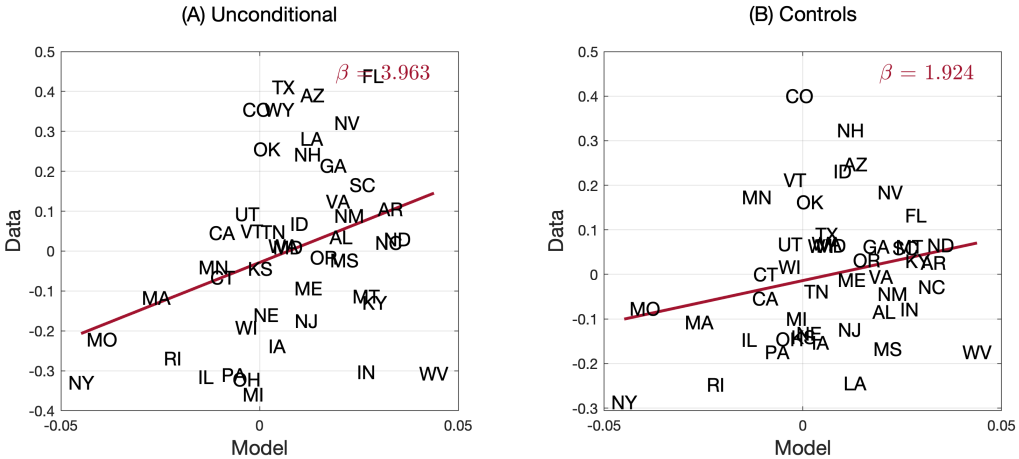
Agenda moving forward. Capital markets and local development

- US mortgage market integration and development (w. V. Angelova)
- Credit conditions and resilience of local labor mkts (w. G. Hanson and J. Katz)

Thank you!

Growth: Model vs. Data

GDP Growth between 1963 and 1983



Implications for US Branching Deregulation

- From 1982 onwards: start of branching deregulation
- Banks could now locate freely in all states → full integration
  - Very large literature that studied its effects (Jayaratne and Strahan 1996)
  - Influential with policymakers (e.g. cited in Draghi 2018)

Implications for US Branching Deregulation

- From 1982 onwards: start of branching deregulation
- Banks could now locate freely in all states → full integration
  - Very large literature that studied its effects (Jayaratne and Strahan 1996)
  - Influential with policymakers (e.g. cited in Draghi 2018)
- Occurred after a very high rate environment
  - Markets already did part of the work, spreads much smaller than in the '50s
  - Liquidity moved to national market, less "reshuffling" of liquidity left to do

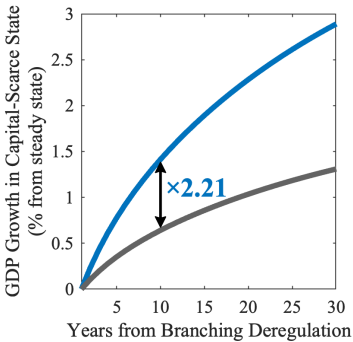
Implications for US Branching Deregulation

- From 1982 onwards: start of branching deregulation
- Banks could now locate freely in all states → full integration
  - Very large literature that studied its effects (Jayaratne and Strahan 1996)
  - Influential with policymakers (e.g. cited in Draghi 2018)
- Occurred after a very high rate environment
  - Markets already did part of the work, spreads much smaller than in the '50s
  - Liquidity moved to national market, less "reshuffling" of liquidity left to do
- US deregulation in low-rate environment would have been more powerful

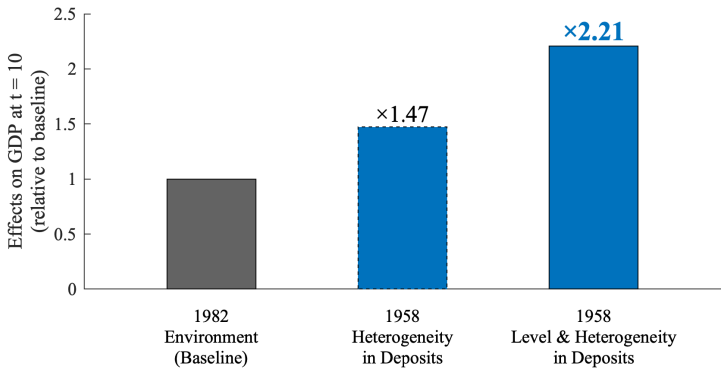
Conclude

Smaller Effects of Dereg. in High-Rate Environments

(A) Real Effects of Branching Deregulation in High and Low-Rate Environments



(B) Effects at t = 10, Relative to Deregulation in 1982, for Different Counterfactual Low-Rate Environments



Extra Slides

CONTRIBUTIONS

Full Related Literature

Bank Lending Channel of Monetary Policy (Bernanke and Gertler 1995; Kashyap and Stein 1995; 2000; Bernanke et al. 1999, ... and many more)

- $\uparrow r_t, \downarrow$ deposits as in Drechsler et al. (2017): here bites heterogeneously across space

CONTRIBUTIONS

Full Related Literature

Bank Lending Channel of Monetary Policy

- $\uparrow r_t, \downarrow$ deposits as in Drechsler et al. (2017): here bites heterogeneously across space

CONTRIBUTIONS

Full Related Literature

Bank Lending Channel of Monetary Policy

- $\uparrow r_t, \downarrow$ deposits as in Drechsler et al. (2017): here bites heterogeneously across space

Financial Convergence in 20^{th} Century America (Bogue 1955; Davis 1965; Schaaf 1966; Sylla 1969, 1972, 1975; Williamson 1974; James 1976a, 1976b; Rockoff 1977; Bodenhorn 1992, 1995; Gendreau 1999; Smiley 1975, 1981, 1985; Sushka and Barrett 1984, 1985; Ostas 1977; Eichengreen 1984, 1987; Snowden 1987; Redenius 2006; Angelova and D'Amico 2024)

- New channel of integration → **depends on r_t: time varying & not monotonic**

CONTRIBUTIONS

Full Related Literature

Bank Lending Channel of Monetary Policy

- $\uparrow r_t, \downarrow$ deposits as in Drechsler et al. (2017): here bites heterogeneously across space

Financial Convergence in 20^{th} Century America

- New channel of integration $\rightarrow$ **depends on r_t: time varying & not monotonic**

CONTRIBUTIONS

Full Related Literature

Bank Lending Channel of Monetary Policy

- $\uparrow r_t, \downarrow$ deposits as in Drechsler et al. (2017): here bites heterogeneously across space

Financial Convergence in 20^{th} Century America

- New channel of integration $\rightarrow$ **depends on r_t: time varying & not monotonic**

Economic Convergence in 20^{th} Century America (Steckel 1983; Greenwood and Hunt 1984; Long 1988; Barro and Martin 1992; Greenwood 1997; Holmes 1998; Haines 2000; Glaeser and Tobio 2008; Molloy et al. 2011; Zimran 2024)

- New explanation for **America's move to South & West**: financial integration

CONTRIBUTIONS

Full Related Literature

Bank Lending Channel of Monetary Policy

- $\uparrow r_t, \downarrow$ deposits as in Drechsler et al. (2017): here bites heterogeneously across space

Financial Convergence in 20^{th} Century America

- New channel of integration → **depends on r_t: time varying & not monotonic**

Economic Convergence in 20^{th} Century America

- New explanation for **America's move to South & West**: financial integration

CONTRIBUTIONS

Full Related Literature

Bank Lending Channel of Monetary Policy

- $\uparrow r_t, \downarrow$ deposits as in Drechsler et al. (2017): here bites heterogeneously across space

Financial Convergence in 20^{th} Century America

- New channel of integration → **depends on r_t: time varying & not monotonic**

Economic Convergence in 20^{th} Century America

- New explanation for **America's move to South & West**: financial integration

Dynamic Spatial Models (Caliendo et al. 2019; Ramos-Menchelli and Van Doornik 2022; Kleinman et al. 2023; Bilal and Rossi-Hansberg 2023)

- Introduce banks in spatial dynamic GE models (Bilal and Rossi-Hansberg 2023)

Full Related Literature and Contributions

Banks and local labor markets (Guiso et al. 2004; Becker 2007; Paravisini 2008; Nguyen 2019; Greenstone et al. 2020, 2020; Granja et al. 2022; Gilje et al. 2016; Cortés and Strahan 2017; Supera 2021; Maingi 2023): financial int. mattered for American development & can study shocks across markets in spatial equilibrium (Mian et al. 2022; Catherine et al. 2022; Herreño 2023)

Deposits Outflows and r_t (Berger and Hannan 1989; Diebold and Sharpe 1990; Hannan and Berger 1991; Driscoll and Judson 2013; Drechsler et al. 2017, 2021; Drechsler et al. 2023; Koont et al. 2023; Lu et al. 2024; Erel et al. 2024; Haendler 2022; Jiang et al. 2022; Koont 2023): gives rise to our channel

- Implications for e-banking: allows deposits to be sourced without physical (local) branch

Regionally Heterogeneous Passthrough of Monetary Policy (Fratantoni and Schuh 2003; Beraja et al. 2019; Alpanda and Zubairy 2019; Bellifemine et al. 2023; Rogers 2023): can come from frict. mobility of fin. capital

Finance in Spatial Models (Ramos-Menchelli and Van Doornik 2022; Maingi 2023; Morelli et al. 2024; Oberfield et al. 2024): first with endogenous lending differentials & real dynamics

1980s Branching Deregulation (Jayaratne and Strahan 1996; Kroszner and Strahan 1999, ... and many many others): occurred after exceptionally high r_t, mkts already quite integrated, smaller effects

- Implications for Eurozone today, coming out of protracted low rate environment

Historical Setting

"Ours is a country predominantly of independent local banks"

Thomas McCabe, the Chairman of the Fed, Commencement address of 1950

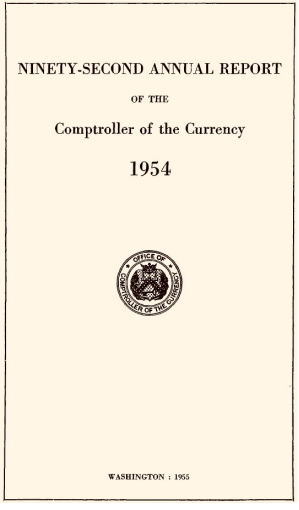
- 13,446 commercial banks, mostly local
- Tight regulation, creating frictions
  - Branching restricted both across and within states (Mengle, 1990)
  - Reg. Q caps deposit rates, esp. short maturities & demand (§19(i), Fed. Res. Act)
- Supervised by Office of the Comptroller of the Currency & state-level regs
  - OCC issued yearly reports, state-level aggr. of banking balance sheet items

Data

- Digitize *state-level* OCC reports (1942-70)
- FOIA *bank-level* call reports (1960-83)[a]
- Liabilities, assets, income, exp., reserves
- Construct, **local lending rates**

$$r^L_{jt} = \frac{\text{Interest \& Fees on Loans}_{jt}}{\text{Total Loans}_{jt}}$$

- Correlate w. mortgage spreads ($\rho = 55\%$)
  - Digitized from National Archives phys. reports


NINETY-SECOND ANNUAL REPORT
OF THE
Comptroller of the Currency
1954
WASHINGTON : 1955

a. Following Drechsler, Savov, and Schnabl, 2021, who also made available to us the data before our request was completed. Data after 1975 is public.

More | Sample Table | Other Vars

OCC Sample Table

TABLE B–25.—*Current operating revenue, and expenses, and dividends of national banks, by major categories and States, year ended Dec. 31, 1962*

[Dollar amounts in thousands]

Location	*Number of banks* [1]	*Current operating revenue*								
		Interest and dividends on securities		*Interest and discount on loans*	*Service charges and other fees on bank loans*	*Service charges on deposit accounts*	*Other service charges, commissions, fees and collection and exchange charges*	*Trust department*	*Other current operating revenue*	*Total current operating revenue*
		U.S. Government obligations	*Other securities*							
United States and possessions, total	4,503	$1,136,543	$414,878	$4,134,522	$74,305	$380,402	$108,978	$242,204	$104,571	$6,596,403
Maine	22	2,246	734	13,364	180	1,199	238	1,008	166	19,135
New Hampshire	51	2,489	659	11,851	117	1,801	302	436	168	17,823
Vermont	29	1,871	453	7,979	117	786	91	156	92	11,545
Massachusetts	94	29,642	6,748	130,897	2,210	12,241	9,017	10,525	4,582	205,862
Rhode Island	4	3,740	2,050	18,769	203	1,457	636	1,356	224	28,435
Connecticut	22	7,216	3,954	43,380	928	4,952	997	5,805	627	67,859
New England States, total	222	47,204	14,598	226,240	3,755	22,436	11,281	19,286	5,859	350,659
New York	224	100,835	48,217	405,951	6,100	28,513	9,630	26,873	35,505	661,624
New Jersey	149	38,940	21,066	133,951	1,739	14,327	2,434	6,677	1,975	221,109
Pennsylvania	423	82,226	39,630	272,831	2,974	16,238	4,229	22,572	5,541	446,241
Delaware	4	109	23	299	0	13	1	0	3	448
Maryland	48	13,381	3,251	38,859	1,347	3,684	895	1,987	524	63,928
District of Columbia	5	9,029	1,048	23,947	695	2,632	495	1,816	293	39,955
Eastern States, total	853	244,520	113,235	875,838	12,855	65,407	17,684	59,925	43,841	1,433,305

Data Sources

1. Annual Report of the Comptroller of the Currency

- OCC: regulating entity for national banks
- Annual report on condition of banks
- Series by state of balance sheet items, 1863–1980
  - Originally from "Call Reports"
- We digitized 1942 to 1970

2. Call Reports

- Bank-level balance sheet variables
- FOIA request to the FRB for 1960 to 1975 (as in Drechsler, Savov, Schnabl, 2021)

VARIABLES

OCC (1942–70). At the state level, for every year:

- **Assets**: loans, treasuries, securities, stocks, currency, balances w oth. bks
- **Liabilities**: deposits (demand vs. time/savings, by holder), borrowings, capital stock
- **Loans**: by type (C&I, financial, real estate, agricultural), reserves for losses
- **Earnings**: interest rates and charges on loans, ... on securities, fees on deposits
- **Expenditure**: operating exp., interest exp., losses on loans and los. on sec.

Call Reports (1960–75). Same as above, but at the bank level, with more detailed breakdowns.

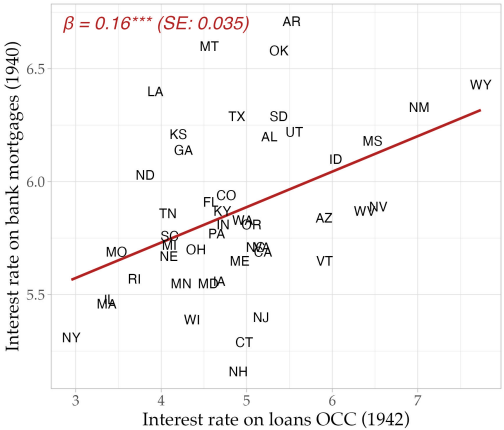
Correlates of Initial Spreads

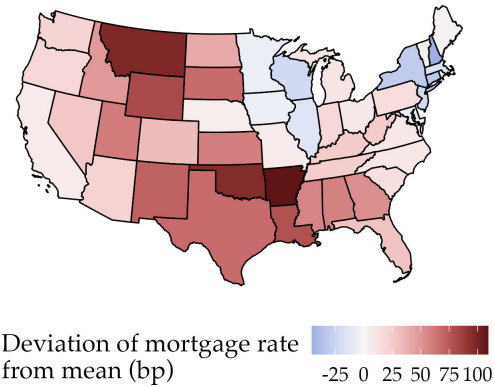
Table: Correlates of Average State-Level Lending Rates in 1953–58 and Controls in Dynamic DiD Regressions

	Correlation Coefficient with $r^L_{j,53-58}$	
	Unconditional	Multivariate
Bank Assets HHI_{61}	0.16 (0.16)	0.03 (0.13)
Share of farm $pop._{50}$	0.31 (0.11)	-0.2 (0.2)
Share employed in $mfg._{50}$	-0.53 (0.12)	-0.02 (0.15)
Share pop. aged $65+_{50}$	-0.37 (0.15)	-0.19 (0.11)
Share of GDP from Oil_{50}	0.4 (0.14)	0.14 (0.06)
$Population\ density_{53}$	-0.5 (0.12)	-0.28 (0.17)
$log(population)_{53}$	-0.64 (0.11)	-0.5 (0.12)
$log(income\ p.c.)_{53}$	-0.37 (0.13)	-0.25 (0.19)

Correlation with Mortgage Rates

Our Rates vs. Housing Census Mortgage Rates (from Angelova and D'Amico 2024)

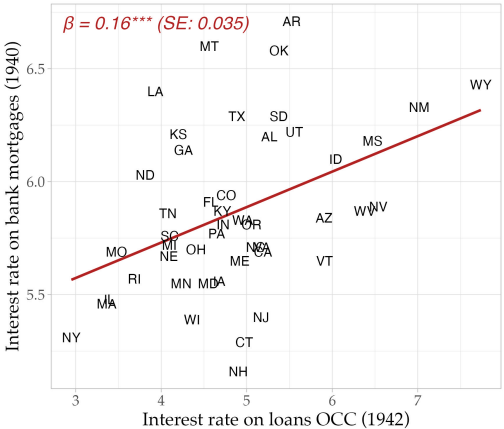


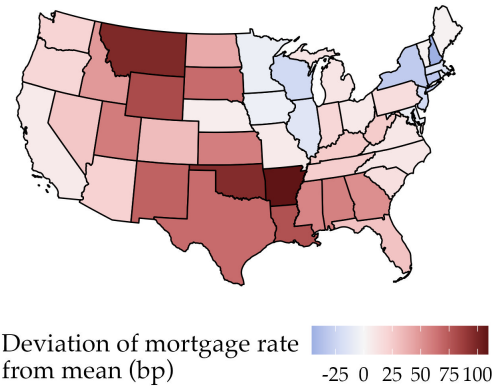


1962 Savings and Loans Data

Correlation with Mortgage Rates

Our Rates vs. Housing Census Mortgage Rates (from Angelova and D'Amico 2024)





1962 Savings and Loans Data

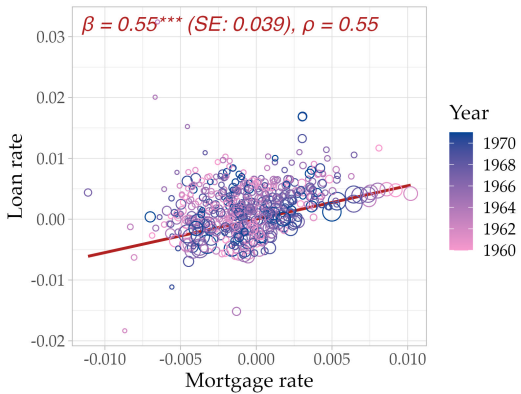
Mortgage Spreads, 1960-1970

Federal Home Loan Bank Board Records

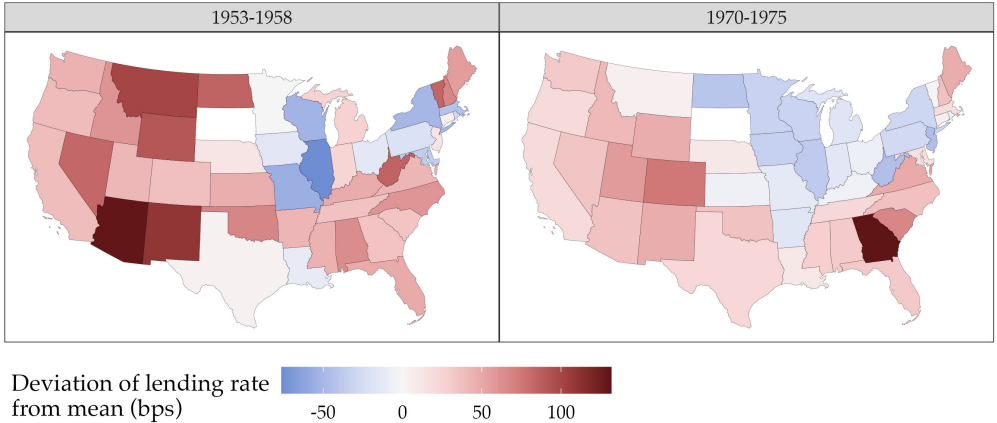
- Semiannual Financial Reports of Savings and Loan Institutions
- Operations and Conditions Books
  - Income, costs, assets, & liabilities
- For 1960-1972, physical copies hosted at National Archives
  - Aggregate at state and MSA level

$$\text{Mortgage Rate}_{jt} = \frac{\text{Interest on Mortgages}_{jt}}{\text{Total Mortgages}_{jt}}$$

Correlation with Mortgage Rates
(in deviations from yearly means)

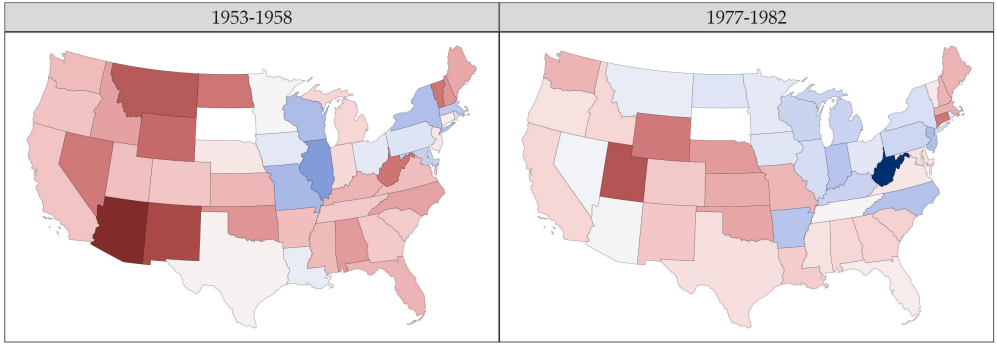


Convergence in Interest Rates

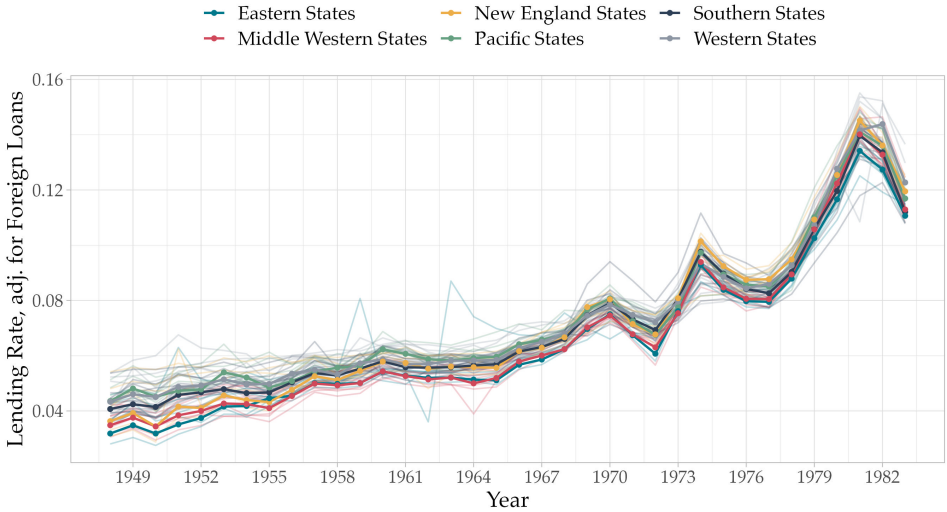


1982

Convergence in Interest Rates

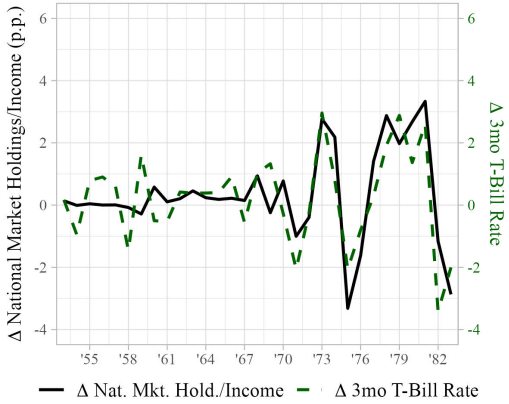


Convergence in Interest Rates

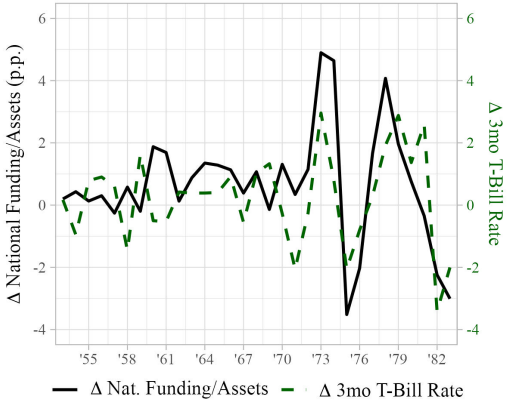


Time-Varying Rise of National Markets

Households' Money Market Holdings
(MMF shares, large time dep., commercial paper)

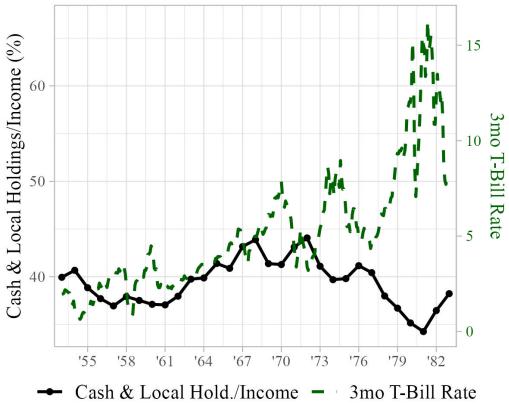


Banks' National Liabilities
(large time dep., Fed Funds & Repos, comm. paper)

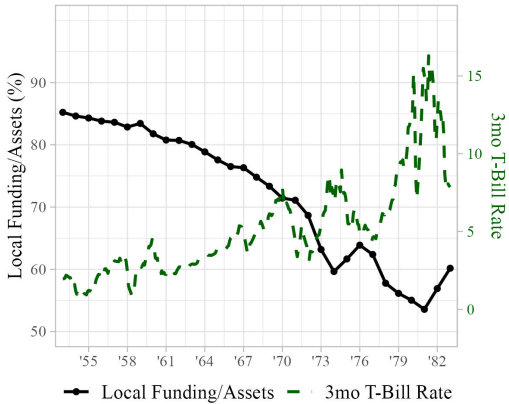


Time-Varying Rise of National Markets

Households' Local Holdings
(cash and checking acc., small time and savings dep.)



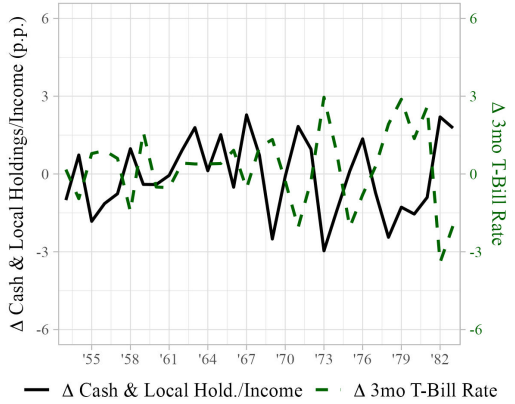
Banks' Local Liabilities
(checking accounts, small time and savings deposits)



Time-Varying Rise of National Markets

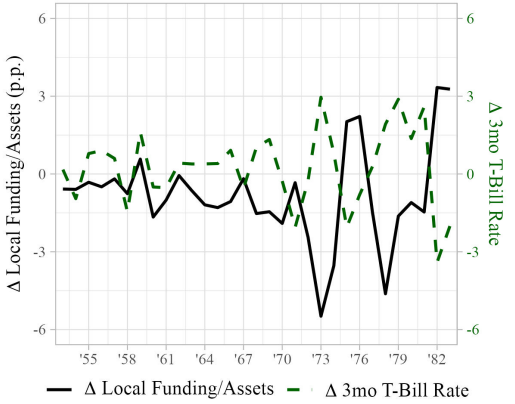
Households' Local Holdings

(cash and checking acc., small time and savings dep.)



Banks' Local Liabilities

(checking accounts, small time and savings deposits)



Initial Deposits, Initial Rates, and Deposits Outflows

	Dependent Variable: State-Level					
	Initial Lending Rate (bp)			Change between '59 and '83 in Dem. Dep./Tot. Liab. (pp)		
	(1)	(2)	(3)	(4)	(5)	(6)
Initial Demand Deposit/Tot. Liab. (%)	−.453	−1.690	−2.331	−.823	−.799	−.829
	(.673)	(.882)	(.690)	(.057)	(.069)	(.090)
Fract. of Large Banks in State (%)		−1.206	−.713		.023	.010
		(.431)	(.357)		(.020)	(.035)
Region FEs			✓			✓
E(Y)	538	538	538	-48	-48	-48
SD(Y)	47.5	47.5	47.5	8.88	8.88	8.88
Observations	46	46	46	46	46	46
R^2	.008	.2	.71	.86	.86	.87

All Outcomes, Levels

	Dependent variable:								
	Lending Rate (pp)			Bank Financing Rate (pp)			Demand Dep. Share (%)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Initial Lending Rate (pp), $r^L_{j,53-58}$	.999			.067			−1.142		
	(.063)			(.088)			(2.643)		
US 3mo T-Bill Rate (pp), r_t	1.320			.999			−5.194		
	(.013)			(.037)			(.463)		
$r^L_{j,53-58} \times r_t$	−.090	−.155	−.146	−.056	−.125	−.087	.235	.691	.934
	(.011)	(.024)	(.034)	(.009)	(.021)	(.032)	(.117)	(.235)	(.337)
Observations	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
R^2	.89	.99	.99	.88	.98	.99	.57	.98	.99
Within R^2	–	.27	.48	–	.25	.56	–	.14	.44
State & Region × Year FEs		✓	✓		✓	✓		✓	✓
Financial Controls		✓	✓		✓	✓		✓	✓
Macro Controls			✓			✓			✓

Changes | Deposits on RHS, Levels | Deposits on RHS, Changes

All Outcomes, Changes

	Dependent variable:								
	Lending Rate (pp)			Bank Financing Rate (pp)			Demand Dep. Share (%)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Initial Lending Rate (pp), $r^L_{j,53-58}$	.010			.039			.076		
	(.018)			(.029)			(.092)		
ΔUS 3mo T-Bill Rate (pp), Δr_t	1.101			1.195			−.745		
	(.152)			(.332)			(.178)		
$r^L_{j,53-58} \times \Delta r_t$	−.130	−.177	−.149	−.153	−.217	−.069	.118	.076	−.052
	(.027)	(.050)	(.050)	(.057)	(.061)	(.068)	(.052)	(.128)	(.184)
Observations	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
R^2	.62	.92	.94	.54	.86	.91	.017	.64	.75
Within R^2	–	.15	.41	–	.17	.5	–	.043	.33
State & Region × Year FEs		✓	✓		✓	✓		✓	✓
Financial Controls		✓	✓		✓	✓		✓	✓
Macro Controls			✓			✓			✓

All Outcomes, Levels

	Dependent variable:								
	Lending Rate (bp)			Bank Financing Rate (bp)			Demand Dep. Share (%)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Initial Dem. Dep. Share $(\%)_{53-58}$	−.817			−.490			1.029		
	(.448)			(.372)			(.054)		
US 3mo T-Bill Rate (pp), r_t	68.067			64.030			.928		
	(9.738)			(7.772)			(.691)		
Initial Dem. Dep. Share $\times r_t$	.245	.605	.452	.099	.415	.251	−.067	−.065	−.063
	(.171)	(.128)	(.175)	(.097)	(.135)	(.110)	(.011)	(.011)	(.016)
Observations	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
R^2	.88	.99	.99	.88	.98	.99	.7	.98	.99
Within R^2	–	.18	.44	–	.2	.55	–	.31	.54
State & Region × Year FEs		✓	✓		✓	✓		✓	✓
Financial Controls		✓	✓		✓	✓		✓	✓
Macro Controls			✓			✓			✓

All Outcomes, in Changes

	Dependent variable:								
	Lending Rate (bp)			Bank Financing Rate (bp)			Demand Dep. Share (%)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Initial Dem. Dep. Share $(\%)_{53-58}$	.073			−.018			−.035		
	(.148)			(.138)			(.003)		
ΔUS 3mo T-Bill Rate (pp), Δr_t	33.364			37.277			−.413		
	(.008)			(8.657)			(.00004)		
Initial Dem. Dep. Share $\times \Delta r_t$	.136	.709	.557	.055	.713	.455	.004	−.004	−.003
	(.129)	(.167)	(.297)	(.052)	(.307)	(.290)	(.003)	(.007)	(.010)
Observations	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
R^2	.61	.92	.94	.52	.85	.91	.042	.64	.75
Within R^2	–	.12	.41	–	.13	.5	–	.043	.33
State & Region × Year FEs		✓	✓		✓	✓		✓	✓
Financial Controls		✓	✓		✓	✓		✓	✓
Macro Controls			✓			✓			✓

	Dependent variable:							
	State-level Lending Rate (pp), $r^L_{j,t}$							
	In Levels				In Changes			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
US 3mo T-Bill Rate (pp), r_t	1.320							
	(.003)							
$r^L_{j,53-58} \times r_t$ (β)	−.090	−.099	−.155	−.146				
	(.011)	(.021)	(.024)	(.034)				
ΔUS 3mo T-Bill rate (pp), Δr_t					1.101			
					(.144)			
$r^L_{j,53-58} \times \Delta r_t$ (β^Δ)					−.130	−.138	−.177	−.149
					(.027)	(.045)	(.050)	(.050)
Observations	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
R^2	.89	.99	.99	.99	.62	.9	.92	.94
Within R^2	–	.19	.27	.48	–	.15	.15	.41
State FEs	✓	✓	✓	✓	✓	✓	✓	✓
Year FEs		✓	✓	✓		✓	✓	✓
Financial Controls		✓	✓	✓		✓	✓	✓
Region × Year FEs			✓	✓			✓	✓
Macro Controls				✓				✓

Financing Rates on LHS | Initial Deposits on RHS | Financing Rates on LHS, Initial Deposits on RHS

	Dependent variable:							
	State-level Bank Financing Rate (pp)							
	In Levels				In Changes			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
US 3mo T-Bill Rate (pp), r_t	.999							
	(.035)							
$r^L_{j,53-58} \times r_t$ (β)	−.056	−.069	−.125	−.087				
	(.007)	(.015)	(.021)	(.032)				
ΔUS 3mo T-Bill rate (pp), Δr_t					1.195			
					(.333)			
$r^L_{j,53-58} \times \Delta r_t$ (β^Δ)					−.153	−.171	−.217	−.069
					(.057)	(.076)	(.061)	(.068)
Observations	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
R^2	.9	.98	.98	.99	.54	.79	.86	.91
Within R^2	–	.17	.25	.56	–	.12	.17	.5
State FEs	✓	✓	✓	✓	✓	✓	✓	✓
Year FEs		✓	✓	✓		✓	✓	✓
Financial Controls		✓	✓	✓		✓	✓	✓
Region × Year FEs			✓	✓			✓	✓
Macro Controls				✓				✓

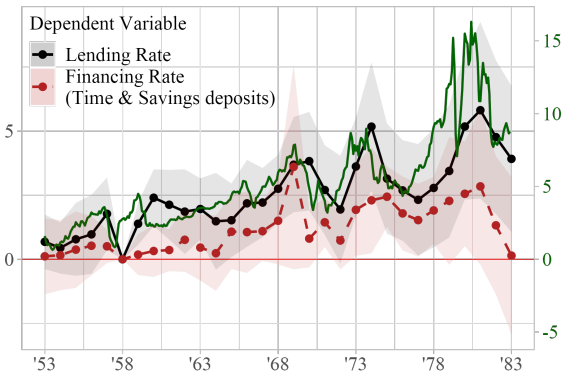
	Dependent variable:							
	State-level Lending Rate (pp), $r^L_{j,t}$							
	In Levels				In Changes			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
US 3mo T-Bill Rate (pp), r_t	.681							
	(.031)							
Initial Dem. Dep. Share (%)$_{53-58} \times r_t$ (β)	.245	.395	.605	.452				
	(.028)	(.111)	(.128)	(.121)				
ΔUS 3mo T-Bill rate (pp), Δr_t					.334			
					(.038)			
Initial Dem. Dep. Share (%)$_{53-58} \times \Delta r_t$ (β^{Δ})					.136	.230	.709	.557
					(.042)	(.166)	(.167)	(.183)
Observations	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
R^2	.89	.99	.99	.99	.61	.89	.92	.94
Within R^2	–	.11	.18	.44	–	.055	.12	.41
State FEs	✓	✓	✓	✓	✓	✓	✓	✓
Year FEs		✓	✓	✓		✓	✓	✓
Financial Controls		✓	✓	✓		✓	✓	✓
Region $\times$ Year FEs			✓	✓			✓	✓
Macro Controls				✓				✓

	Dependent variable:							
	State-level Bank Financing Rate (pp)							
	In Levels				In Changes			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
US 3mo T-Bill Rate (pp), r_t	.640							
	(.090)							
Initial Dem. Dep. Share (%)$_{53-58} \times r_t$ (β)	.099	.214	.415	.251				
	(.100)	(.135)	(.135)	(.091)				
ΔUS 3mo T-Bill rate (pp), Δr_t					.373			
					(.087)			
Initial Dem. Dep. Share (%)$_{53-58} \times \Delta r_t$ (β^{Δ})					.055	.332	.713	.455
					(.052)	(.180)	(.305)	(.223)
Observations	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
R^2	.9	.97	.98	.99	.52	.78	.85	.91
Within R^2	–	.14	.2	.55	–	.053	.13	.5
State FEs	✓	✓	✓	✓	✓	✓	✓	✓
Year FEs		✓	✓	✓		✓	✓	✓
Financial Controls		✓	✓	✓		✓	✓	✓
Region × Year FEs			✓	✓			✓	✓
Macro Controls				✓				✓

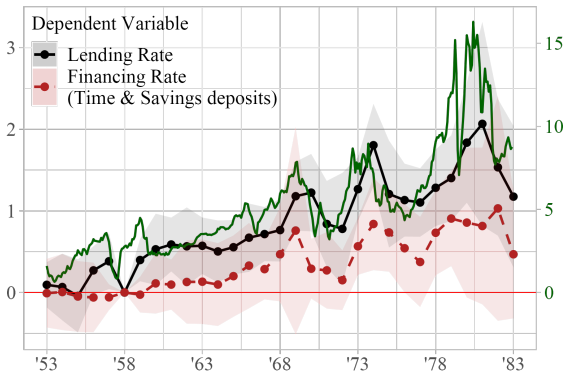
WITHIN REGION RESULTS

$$y_{j,t} = \underbrace{\alpha_j}_{\text{State FE}} + \underbrace{\psi_{t,R(j)}}_{\text{Region} \times \text{Year FE}} + \sum_{\tau \neq 1958} \beta_\tau \cdot X_{j,53-58} + \underbrace{\kappa_\tau \cdot \boldsymbol{C}_{jt}}_{\text{Macro \& Fin. Controls}} + \varepsilon_{jt}$$

$$X_{j,53-58} = \frac{\text{Demand Deposits}_{53-58}}{\text{Liabilities}_{53-58}} \text{ (\%)}$$



$$X_{j,1953-58} = -r^L_{j,53-58} \text{ (bps)}$$



Spreads and GDP Growth (Placebo)

	Dependent variable:							
	State-level Bank Lending Rate (pp)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
US GDP Growth Rate (pp), g_t	.402				.046			
	(.010)				(.003)			
$r^L_{j,53-58} \times g_t$	−.027	−.025	−.037	−.047	−.003	−.004	.005	−.014
	(.041)	(.019)	(.032)	(.036)	(.014)	(.011)	(.012)	(.018)
US 3mo T-Bill Rate (pp), r_t					1.308			
					(.005)			
$r^L_{j,53-58} \times r_t$					−.089	−.099	−.156	−.142
					(.014)	(.021)	(.024)	(.034)
Observations	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
R^2	.089	.99	.99	.99	.89	.99	.99	.99
Within R^2	.077	.041	.047	.39	–	.19	.27	.49
State FEs	✓	✓	✓	✓	✓	✓	✓	✓
Year FEs & Financial Conts.		✓	✓	✓		✓	✓	✓
Region × Year FEs			✓	✓			✓	✓
Macro Controls				✓				✓

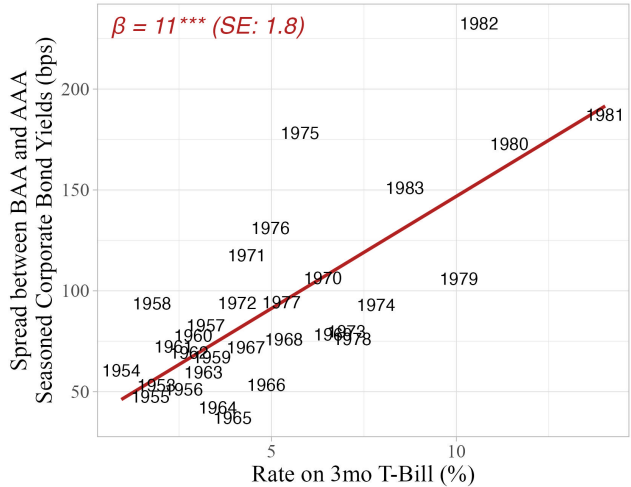
Real Rates

Spreads and Real Rates (Placebo)

	Dependent variable:							
	State-level Bank Lending Rate (pp)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
US Short Real Rate (pp), ρ_t^s	−.010				−.125			
	(.018)				(.029)			
$r_{j,53-58}^L \times \rho_t^s$	.036	.042	.028	.035	.044	.054	.039	.043
	(.067)	(.038)	(.062)	(.063)	(.014)	(.013)	(.026)	(.027)
US 3mo T-Bill Rate (pp), r_t					1.327			
					(.051)			
$r_{j,53-58}^L \times r_t$					−.092	−.104	−.156	−.147
					(.010)	(.020)	(.025)	(.034)
Observations	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
R^2	.038	.99	.99	.99	.9	.99	.99	.99
Within R^2	.026	.052	.04	.38	–	.22	.28	.49
State FEs	✓	✓	✓	✓	✓	✓	✓	✓
Year FEs & Financial Conts.		✓	✓	✓		✓	✓	✓
Region × Year FEs			✓	✓			✓	✓
Macro Controls				✓				✓

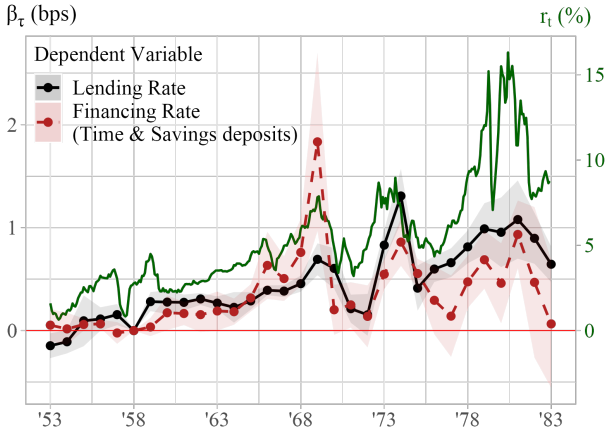
Risk Premia

Back to Intro | Back to Red. Form

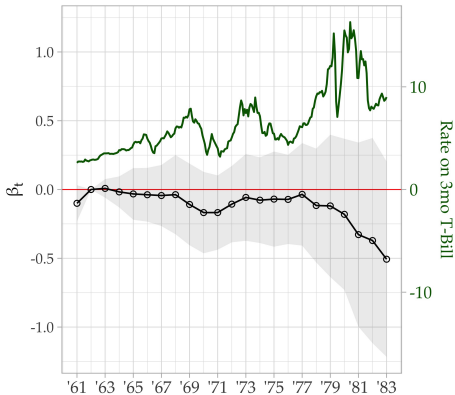


Market Power Unlikely to Explain β_t

Lending and Financing Rates



log(HHI) vs. Initial Rate



Triple-Difference (Changes)

	Dependent variable:					
	Bank-level Lending Rate			Bank-level Financing Rate		
	(1)	(2)	(3)	(4)	(5)	(6)
β on initial state lending rate $\times$ Δr_t:						
– Small banks, β_s	−.134	−.134	−.041	−.037	−.031	.027
	(.069)	(.060)	(.049)	(.035)	(.031)	(.037)
– Large banks, β_ℓ	−.368	−.368	−.174	−.218	−.211	−.044
	(.077)	(.076)	(.061)	(.100)	(.096)	(.152)
– Triple-diff, $\beta_\ell - \beta_s$	−.235	−.234	−.133	−.181	−.180	−.071
	(.070)	(.069)	(.082)	(.129)	(.110)	(.167)
Observations, small banks	238,395	238,395	238,395	236,484	236,484	236,484
Observations, large banks	12,851	12,851	12,851	12,851	12,851	12,851
Within R^2, small banks	.019	.022	.055	.011	.015	.032
Within R^2, large banks	.41	.41	.46	.12	.13	.19
Bank & Region $\times$ Year FEs	✓	✓	✓	✓	✓	✓
Ratio Domestic Loans Cont.	✓	✓	✓	✓	✓	✓
Loan Comp. Controls		✓	✓		✓	✓
Macro Controls			✓			✓

In Levels

Triple-Difference (Levels)

	Dependent variable:					
	Bank-level Lending Rate			Bank-level Financing Rate		
	(1)	(2)	(3)	(4)	(5)	(6)
β on initial state lending rate $\times$ r_t:						
– Small banks, β_s	−.100	−.103	−.056	−.027	−.026	−.008
	(.047)	(.059)	(.028)	(.026)	(.030)	(.035)
– Large banks, β_ℓ	−.197	−.202	−.110	−.147	−.147	−.069
	(.079)	(.097)	(.038)	(.073)	(.093)	(.065)
– Triple-diff, $\beta_\ell - \beta_s$	−.097	−.098	−.054	−.120	−.121	−.062
	(.063)	(.058)	(.042)	(.069)	(.076)	(.084)
Observations, small banks	249,668	249,668	249,668	247,749	247,749	247,749
Observations, large banks	13,450	13,450	13,450	13,450	13,450	13,450
Within R^2, small banks	.026	.035	.081	.0091	.015	.046
Within R^2, large banks	.46	.47	.51	.13	.15	.22
Bank & Region $\times$ Year FEs	✓	✓	✓	✓	✓	✓
Ratio Domestic Loans Cont.	✓	✓	✓	✓	✓	✓
Loan Comp. Controls		✓	✓		✓	✓
Macro Controls			✓			✓

In Changes

Growth and Initial Lending Rates

Migration vs. Fertility | By Sector

	Dependent variable: Growth Between 1963 and 1983 in								
	GDP			Population			GDP per capita		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Initial Lending Rate (pp), $r^L_{j,53-58}$	.284	.191	.139	.190	.149	.118	.094	.042	.021
	(.051)	(.058)	(.069)	(.041)	(.039)	(.042)	(.031)	(.033)	(.044)
Right-to-Work State		.190	.109		.012	.023		.178	.086
		(.044)	(.061)		(.033)	(.056)		(.020)	(.028)
% GDP from Oil_{50}		−.798	−1.155		−.657	−.500		−.141	−.654
		(.812)	(1.064)		(.433)	(.599)		(.451)	(.560)
January Temperature		.005	.004		.006	.005		−.001	−.001
		(.003)	(.004)		(.002)	(.003)		(.001)	(.003)
Bartik Demand Shock_{63-83}		.237	.253		.075	.112		.163	.141
		(.079)	(.105)		(.048)	(.063)		(.042)	(.057)
Bartik Agricultural Shock_{63-83}		.068	.246		−.748	.005		.815	.241
		(.571)	(.893)		(.362)	(.665)		(.301)	(.481)
Region FEs			✓			✓			✓
Observations	46	46	46	46	46	46	46	46	46
R^2	.29	.771	.815	.321	.666	.724	.115	.75	.826

2^{nd} Order Perturbation

$$s^L_{jt} = r^L_{jt} - r_t = \underbrace{\theta_t/2}_{\text{Friction}} \times \Big(1 - \big(\underbrace{\bar{\gamma}_j \exp(-\phi r_t)}_{\text{Local Funding}}\big)^2\Big) \tag{1}$$

$$\log s^L_{jt} \approxeq \upsilon_0 + \underbrace{\upsilon_j}_{\text{State FE}} + \underbrace{\upsilon_t}_{\text{Year FE}} + \underbrace{\eta(\phi) \cdot \log \bar{\gamma}_j \cdot r_t}_{\text{Regionally het. passthrough of } r_t} + \upsilon_{jt} \tag{2}$$

$$\text{w. frictions: } \log \theta_t = \log \bar{\bar{\theta}} \underbrace{- \boldsymbol{b}_\theta \cdot t}_{\text{Linear Trend}} + \tilde{\theta}_t \tag{3}$$

$J + 2$ parameters: $\{\bar{\gamma}_j\}_1^J, \phi, \boldsymbol{b}_\theta$

$J - 1$ Can run (2) in the data w. state-specific slopes, $J - 1$ coefficients inform $\{\bar{\gamma}_j\}_1^J, \phi$

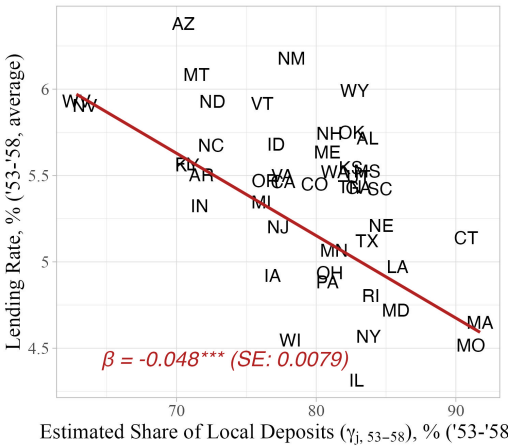
J Recover omitted state by matching aggr. share of retail dep. equal to data in 1958

$J + 1$ Match correlation over time of share of retail dep. in model and data

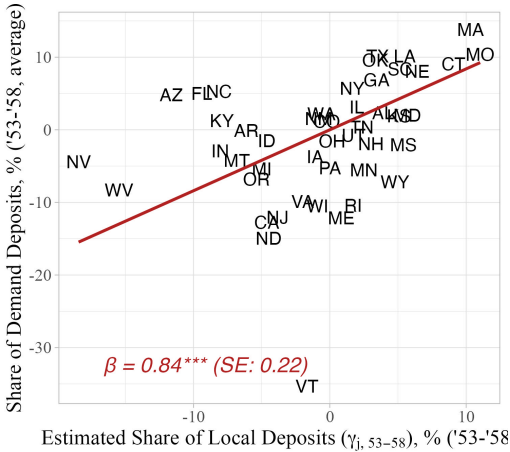
$J + 2$ Recover $\boldsymbol{b}_\theta$ from unexplained part in year FE

Untargeted Moments

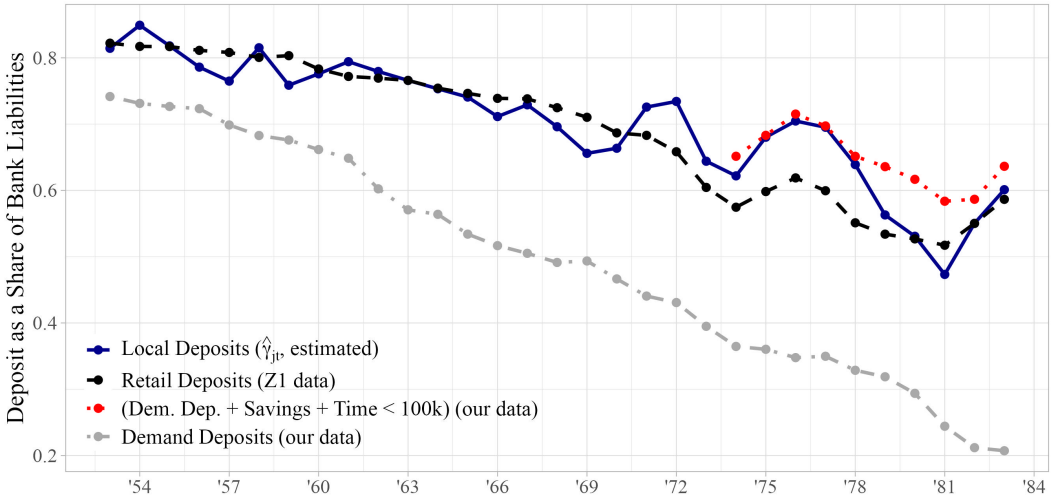
(a) Initial Lending Rates



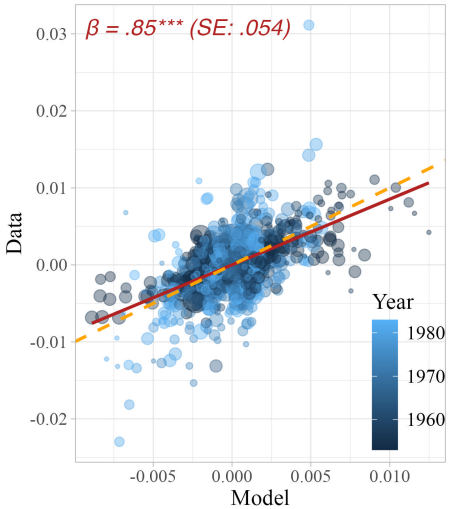
(b) Initial Demand Deposit Share

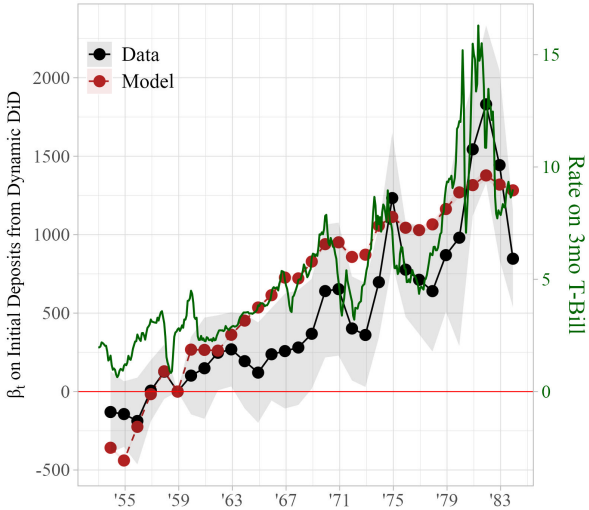


Targeted Time Series of Retail Deposits



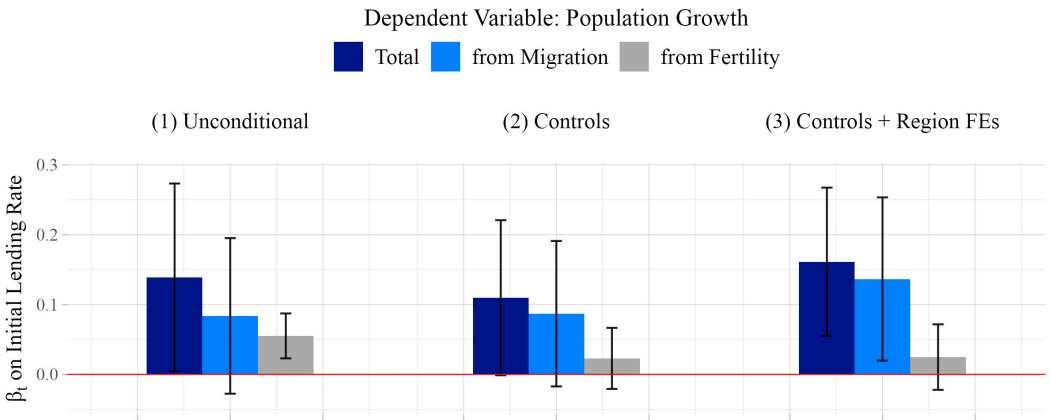
Targeted Changes in Spreads



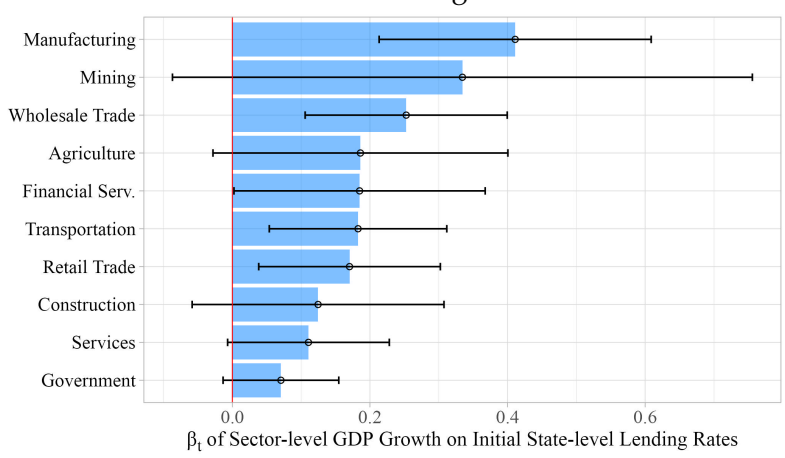


Population Growth is All Driven by Migration

Figure: Population Growth and Fin. Convergence: Migration vs. Fertility

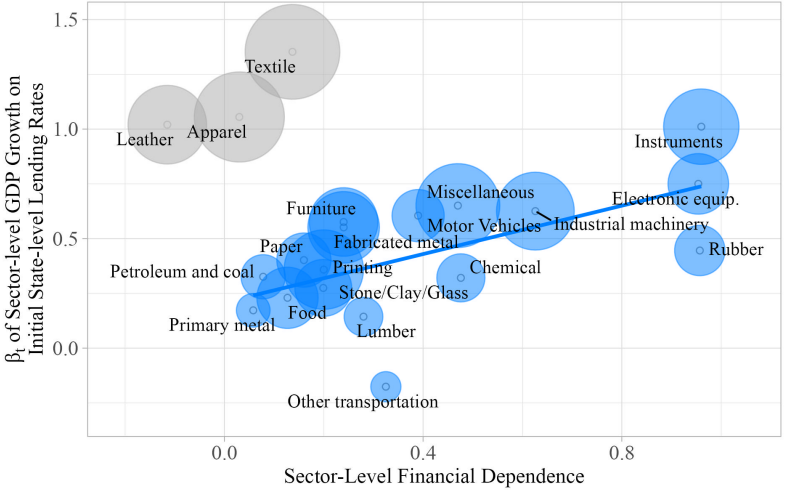


Higher Growth in Manufacturing



Higher Growth in Finance-Constrained Mfg. Sectors

Sector-level GDP Growth Against Initial Rates and Financial Dependence, w/in Mfg.



Households' Liquidity and Deposit Supply

Households earn wage w_{jt} in t^- and consume in t^+, can store liquidity in:

- Bonds pay rate of r_t, deposits, pay no rate but give liquidity premium $e_{ijt} \sim F_j$

$$\max_{m \in \{0,1\}} \underbrace{C_{jt}}_{\text{Real Consumption}} + \underbrace{(w_{jt}/p)(1-m)e_{ijt}}_{\text{Liquidity Services on Real Wage}}$$

$$\text{s.t.} \quad p_t C_{jt} = w_{jt}\left(1 + m r_t\right)$$

- Consumer i in j at time t holds start of period income w_{jt} in deposits iff $e_{ijt} \geqslant r_t$

Local Deposit Supply, fraction of local labor income

$$D_{jt} = \int \mathbf{1}\left(e \geqslant r_t\right) \times w_{jt}\, dF_j(e) = \underbrace{\bar{\varphi}_j}_{\substack{\text{Local Liquidity} \\ \text{Preference Shifter}}} \times \underbrace{\varphi\left(r_t\right)}_{\substack{\text{Sensitivity to } r_t \\ \varphi'(r_t)<0}} \times \underbrace{w_{jt} N_{jt}}_{\text{Labor Income}}$$

- If $e_{ijt} = \chi_j + \varepsilon_i$, $\varepsilon_i \sim \text{Exp}(\phi)$, then $\bar{\varphi}_j = \exp(\phi \chi_j)$ and $\varphi(r_t) = \exp(-\phi r_t)$

FIRMS

$$\max_{N,K} \quad p_t z_{jt} N^{\alpha_N} K^{\alpha_K} - R^F_{jt} \left(w_{jt} N + r^K_{jt} K \right)$$

Homogeneous good sold on national mkt at price p_t. Financing prod. at cost R^F_{jt}, two sources:

- Fraction $1 - \xi_j$ using internal capital or bond market, at cost r_t
- Fraction ξ_j using bank loans, at cost r^L_{jt}

$$R^F_{jt} = 1 + r_t + \xi_j \left(r^L_{jt} - r_t \right)$$

Loan Demand, fraction of input costs

$$L^D_{jt} = \xi_j \times \left(w_{jt} N_{jt} + r^K_{jt} K_{jt} \right)$$

Firms, Real Formulation

Firms solve:

$$\max_{N,K} (1 + \pi_t) F(N, K) + \left(1 + r_t + \xi_j s_{jt}(r_t)\right) \left(w_{jt} N + r_{jt}^K K\right)$$

where $s_{jt} = r_{jt}^L - r_t$. Equivalent to solving:

$$\max_{N,K} F(N, K) + \frac{1 + r_t + \xi_j s_{jt}(r_t)}{1 + \pi_t} \left(w_{jt} N + r_{jt}^K K\right)$$

Letting $r_t = \rho^s + \pi_t$ and approximating for a small π_t, yields:

$$\frac{1 + r_t + \xi_{jt} s_{jt}(r_t)}{1 + \pi_t} \approxeq 1 + \rho^s + \xi_j s_{jt}(r_t)$$

Proposition. (Neutrality) If $s_{jt} = 0 \; \forall j$, an increase in the nominal rate has no effects.

Households' Flow Utility

Static: $\max_{m\in\{0,1\}} C_{jt} + \frac{w_{jt}}{1+\pi_t}(1-m)e_{ijt} + B_{jt}$ s.t. $(1+\pi_t)\,C_{jt} + h_{jt} = w_{jt}\,(1+mr_t)$

Flow utility:

$$u_{jt}(\varepsilon) = w_{jt}\frac{1+\max\left\{r_t, \chi_j+\varepsilon\right\}}{1+\pi_t} - h_{jt} + B_{jt} \approxeq w_{jt}\left(1+\rho^s+\max\left\{0, \chi_j+\varepsilon-r_t\right\}\right) - h_{jt} + B_{jt}$$

Expected flow utility:

$$U_{jt} = \mathbb{E}\left[u_{jt}^N(\varepsilon)\right] = \int_{-\infty}^{\infty} u_{jt}^N(\varepsilon) f(\varepsilon) d\varepsilon = B_{jt} - h_{jt} + w_{jt}\left(1+\mathcal{R}_{jt}\right)$$

with $\mathcal{R}_{jt} = \rho^s + \frac{1}{\phi}\exp\left(-\phi(r_t-\chi_j)\right)$. If distribution of χ_j uncertain, substitute $\mathcal{R}_{jt} = \mathbb{E}_j\left[\mathcal{R}_{jt}\right]$, with priors equal to empirical distribution of χ_j ($\sim$ Normal)

Value Function

For small Δ:

$$v_{jt}(\varepsilon, \overrightarrow{\epsilon_t}) = \overbrace{\Delta u_{jt}^N(\varepsilon)}^{\text{Flow Utility}} + \rho(\Delta)\Big((1-\mu(\Delta)) \overbrace{\max_{\{m\}}\left[\beta \mathbb{E}_t v_{mt+\Delta}(e_{mt+1}, \overrightarrow{\epsilon}) - \tau_{jm} + \frac{\epsilon_{mt}}{\nu}\right]}^{\text{Continuation Value from Migration}} + \mu(\Delta) \underbrace{\mathbb{E}_t v_{jt+\Delta}}_{\text{Cnt. Value from Staying}}\Big)$$

Taking expectations $V_{jt} = \mathbb{E}\left[v_{jt}(\varepsilon_{ijt}, \overrightarrow{\epsilon}_t)\right]$ and $U_{jt} = \mathbb{E}\left[u_{jt}^N(\varepsilon)\right]$:

$$\rho V_{jt+\Delta} - \frac{V_{jt+\Delta} - V_{jt}}{\Delta} = U_{jt} + (1-\rho\Delta)\left[\mu\left(\mathbb{E}_{\overrightarrow{\epsilon}} \max_k \{e^{-\rho\Delta} V_{kt+\Delta} - \tau_{jk} + \epsilon_{kt}\} - V_{jt+\Delta}\right)\right]$$

Follow Caliendo et al. (2019):

$$\mathcal{M} = \mathbb{E}\max_k \{e^{-\rho\Delta} V_{kt+\Delta} - \tau_{jk} + \epsilon_{kt}\} = \frac{1}{\nu}\log\sum_k \exp\left(\nu\left(\beta V_{kt+\Delta} - \tau_{ik}\right)\right)$$

Law of Motions

$$\frac{dN_{jt}}{dt} = \mu \left(\sum_{i=1}^{N} m_{ijt}(V_t) N_{it} - N_{jt} \right); \quad \text{where} \quad m_{ij}(V_t) = \frac{\exp \nu \left(V_{jt} - \tau_{ij} \right)}{\sum_{m=1}^{J} \exp \nu \left(V_{mt} - \tau_{im} \right)}$$

Capital: guess-and-verify as in Moll (2014), $c_{jt}^K = \rho K_{jt}$, which pins down the KFE for capital as:

$$\frac{dK_{jt}}{dt} = \left(R_{jt}^K - \delta - \rho \right) K_{jt}$$

The value function of the capitalist is $\Pi_{jt} = (A_{jt} + \log K_{jt})/\rho$, with A_{jt} satisfying the Bellman equation:

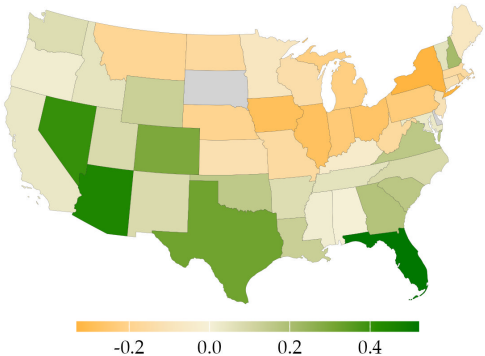
$$\rho A_{jt} - \frac{dA_{jt}}{dt} = \rho \log \rho + R_{jt}^K - \delta - \rho$$

Aggregate Effects

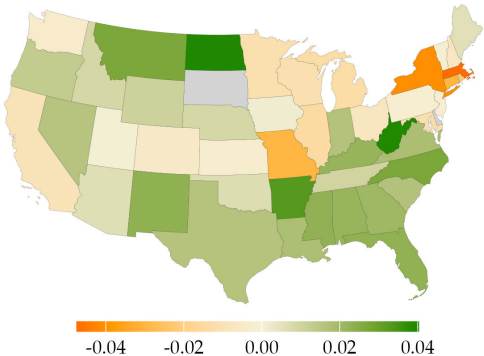
	Horizon (t)						
	1983	1993	2003	2013	2023	2083	$t \to \infty$
Changes relative to 1958							
US GDP	$-.66\%$	$-.15\%$	$.48\%$	$.97\%$	1.33%	2.07%	2.23%
US Physical Capital Stock	$-.75\%$	$.07\%$	1.24%	2.20%	2.87%	4.12%	4.33%
Path of shocks							
Nominal Rates, $r_t - r_{1958}$	6.84	2.52	.93	.34	.13	.00	.00
Frictions, θ_t/θ_{1958}	.34	.34	.34	.34	.34	.34	.34

Growth: Model vs. Data

Data, demeaned

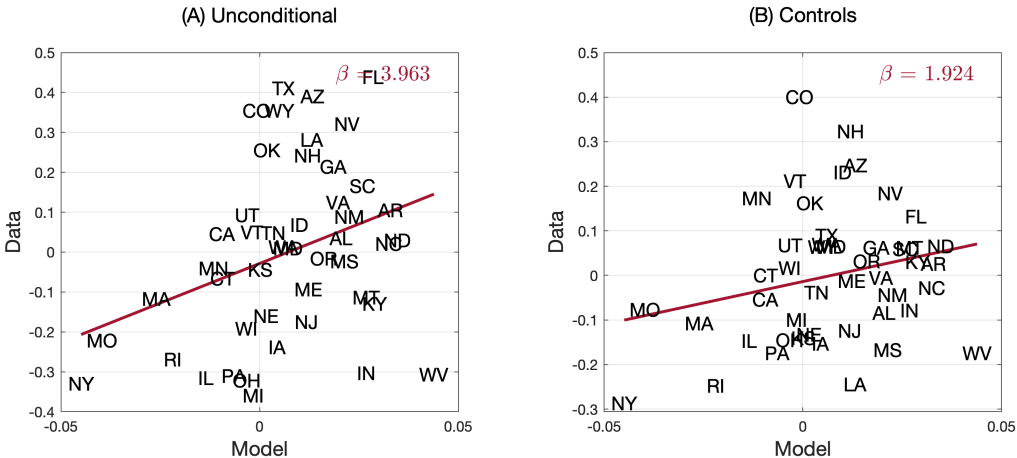


From Financial Integration



Growth: Model vs. Data

GDP Growth between 1963 and 1983



Uncertainty on χ_j