Canary in the Coal Mine: Bank Liquidity Shortages and Local Economic Activity

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Motivation

- **Aggregate US economy is a collection of different regional economies**
- Gradual build-up of risk across regions in an economy $\Rightarrow$ national downturns or financial crises

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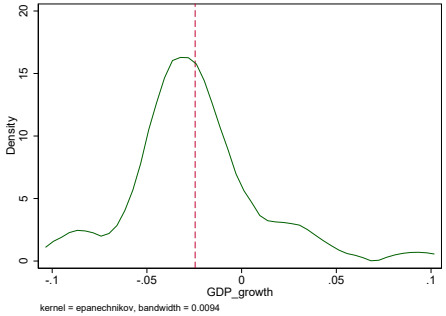
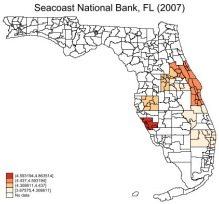
  - 35 out of 51 states experienced a GDP drop $> 2\%$ during GFC; other states experienced less severe declines or positive growth



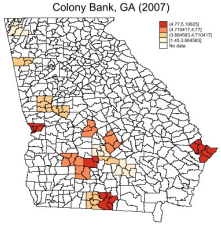
Density of Annual State GDP Growth in 2009

State Recessions State Recessions

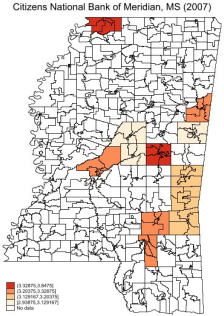
Single-State Banks' Deposit Rates in 2007



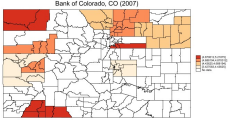
(a) Seacoast Bank



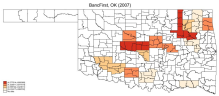
(b) Colony Bank



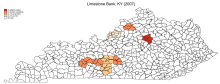
(c) Citizens Nat. Bank of Meridian



(d) Bank of Colorado



(e) BancFirst

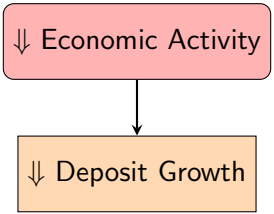


(f) Limestone Bank

Liquidity Conditions and Business Cycles

⇓ Economic Activity

Liquidity Conditions and Business Cycles



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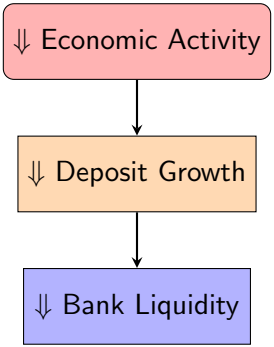

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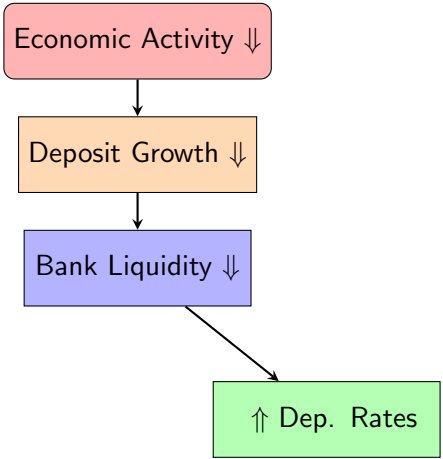

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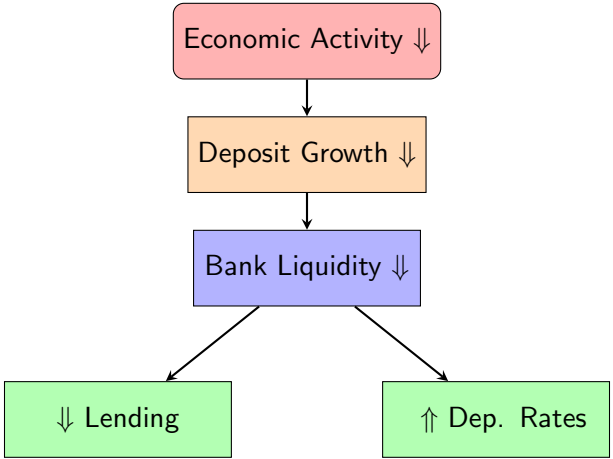

State of the Art in Predicting Economic Contractions

- **We introduce a granular, real-time, forward-looking vulnerability index:** local deposit rates

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  - Can predict local economic activity
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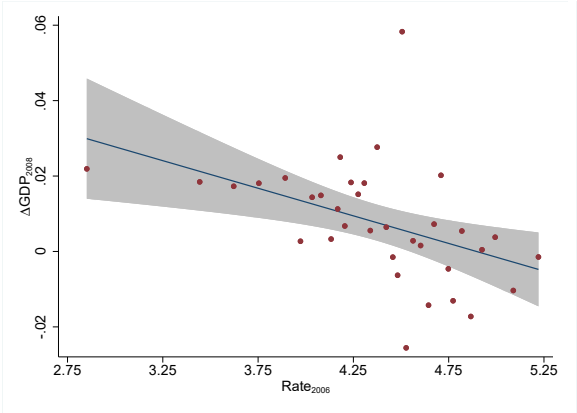
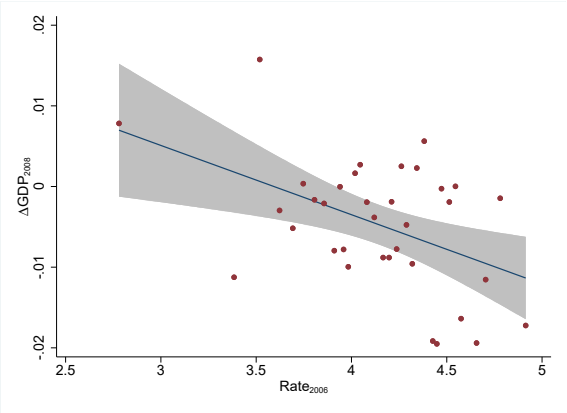
- **We highlight how banks change composition of deposits and rely more on insured deposits.**
  - Movement of insured and uninsured deposits at the onset of an economic contraction
  - Riskier banks substitute more to insured deposits
  - Raises concerns of moral hazard arising from deposit insurance

Deposit Rates and Economic Activity

2006 Deposit Rates Predict 2008 GDP Growth

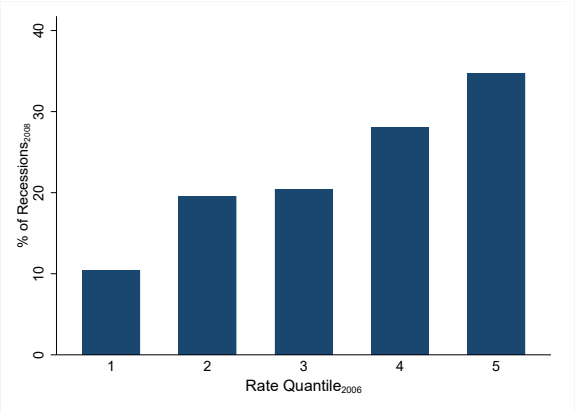


(a) County



(b) State

2006 Deposit Rates Predict Large Drops in GDP in 2008



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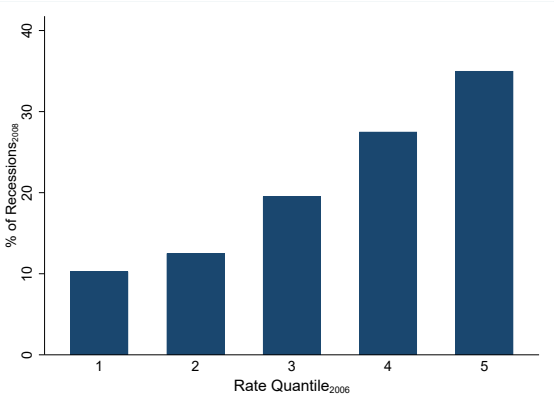


(b) State

Bank Deposit Rates and Economic Activity

Summary Statistics

County deposit rates provide a vulnerability index of economic activity:

1. GDP growth
2. Employment growth
3. New business formation
4. Early-stage delinquencies

$$Y_{c,t+k} = \beta_1 \cdot Rate_{c,t} + \alpha_c + \alpha_t + \epsilon_{c,t}$$

- Focus on metropolitan (metro) counties as these areas exhibit a competitive banking structure
- Metro counties comprise nearly 60% of the national GDP

Deposit Rates and GDP Growth

Higher deposit rates ⇒ lower economic activity

Δln(GDP)	1 Year Ahead	2 Years Ahead	3 Years Ahead	1 Year Ahead	2 Years Ahead	3 Years Ahead
Rate	-0.0012	-0.0044***	-0.0037***	-0.0031	-0.0073**	-0.0138***
	(0.0008)	(0.0007)	(0.0006)	(0.0032)	(0.0035)	(0.0040)
County FIPS FE	✓	✓	✓	✓	✓	✓
Year FE				✓	✓	✓
N	4,578	4,292	4,029	4,578	4,292	4,029
R^2	0.1069	0.1196	0.1183	0.2668	0.2757	0.2796

- 1 SD ↑ in deposit rate → 0.44-0.73 pp ↓ in GDP growth two years ahead
- 1 SD ↑ in deposit rate → 0.37-1.38 pp ↓ in GDP growth three years ahead

Deposit Rates and Employment Growth

Higher deposit rates ⇒ lower economic activity

Δln(Employment)	1 Year Ahead	2 Years Ahead	3 Years Ahead	1 Year Ahead	2 Years Ahead	3 Years Ahead
Rate	-0.0038***	-0.0085***	-0.0080***	-0.0026	-0.0057***	-0.0095***
	(0.0004)	(0.0004)	(0.0004)	(0.0017)	(0.0017)	(0.0018)
County FIPS FE	✓	✓	✓	✓	✓	✓
Year FE				✓	✓	✓
N	4,638	4,347	4,079	4,638	4,347	4,079
R^2	0.1681	0.2263	0.2127	0.6300	0.6469	0.6647

- 1 SD ↑ in deposit rate → 0.57-0.85 pp ↓ in employment growth two years ahead
- 1 SD ↑ in deposit rate → 0.80-0.95 pp ↓ in employment growth three years ahead

Deposit Rates and Business Formation

Higher deposit rates ⇒ lower new business formation

ln(Applications)	1 Year Ahead	2 Years Ahead	3 Years Ahead	1 Year Ahead	2 Years Ahead	3 Years Ahead
Rate	-0.0488***	-0.0541***	-0.0755***	0.0055	-0.0111	-0.0277
	(0.0033)	(0.0033)	(0.0036)	(0.0146)	(0.0169)	(0.0171)
County FIPS FE	✓	✓	✓	✓	✓	✓
Year FE				✓	✓	✓
N	3,923	3,640	3,378	3,923	3,640	3,378
R^2	0.9797	0.9795	0.9804	0.9933	0.9935	0.9935

- 1 SD ↑ in deposit rate → 4.89% ↓ in business formation one year ahead
- 1 SD ↑ in deposit rate → 5.41% ↓ in business formation two years ahead
- 1 SD ↑ in deposit rate → 7.55% ↓ in business formation three years ahead

Deposit Rates and Mortgage Delinquency Rate

Higher deposit rates ⇒ higher early-stage delinquency rate

Delinquency Rate (30-89 days)	1 Year Ahead	2 Years Ahead	3 Years Ahead	1 Year Ahead	2 Years Ahead	3 Years Ahead
Rate	0.4066***	0.3447***	0.2800***	0.0564*	0.0858**	0.0767*
	(0.0151)	(0.0149)	(0.0147)	(0.0339)	(0.0363)	(0.0424)
County FIPS FE	✓	✓	✓	✓	✓	✓
Year FE				✓	✓	✓
N	2,356	2,337	2,146	2,356	2,337	2,146
R^2	0.5594	0.5253	0.5321	0.9280	0.9263	0.9239

- 1 SD ↑ in deposit rate → 0.41 pp ↑ in early-stage delinquency one year ahead
- 1 SD ↑ in deposit rate → 0.34 pp ↑ in early-stage delinquency two years ahead
- 1 SD ↑ in deposit rate → 0.28 pp ↑ in early-stage delinquency three years ahead

Robustness

Additional Findings:

- Higher deposit rates negatively affect the key sectors of counties, leading to slower employment and wage growth, as well as reduced business activity ▸ Industry
- Effects are magnified with higher-frequency measure of liquidity shortages ▸ GDP ▸ New Biz. ▸ Delin.
- Higher deposit rate ⇒ higher unemployment rate ▸ Unemployment
- Higher deposit rate ⇒ higher late-stage delinquency rate ▸ 90+ Delin.
- Higher deposit rate ⇒ higher CPI growth ▸ CPI Growth

Deposit Rates Predict in Cross-Section in 2006: ▸ GDP Growth ▸ CPI Growth

Deposit Rates Predict in Periods with no MP Changes: ▸ 2010-2015

Deposit Rates Predict after Accounting for Credit Growth: ▸ Credit Measures

Deposit Rates Predict Across Bank Sizes and Risk ▸ Large Banks ▸ All Counties ▸ Failed Banks

Predicting Annual County Recessions

$\mathbb{1}_{Recession}$	1 Year Ahead	2 Years Ahead	3 Years Ahead
Rate	0.0232***	0.0541***	0.0474***
	(0.0049)	(0.0053)	(0.0058)
County FIPS FE	✓	✓	✓
N	4,337	4,037	3,793
pseudo R^2	0.0780	0.1022	0.0949
AUC	0.7016	0.7302	0.7231
Overall test statistic, χ^2	284.8578	382.0780	313.1834
p-value	0.0492	0.0000	0.0009

Increases in deposit rate increase the likelihood of an impending recession

- 1 SD ↑ in deposit rate → 5.41 pp ↑ probability of recession two years ahead
- 1 SD ↑ in deposit rate → 4.74 pp ↑ probability of recession three years ahead
- 1 SD ↑ in deposit rate → 2.32 pp ↑ probability of recession one year ahead

Uninsured Rates

Validation from a Quasi-Natural Experiments: Natural Disasters

Natural Disasters and Deposit Rates

- Predictive power of deposit rates reflects the gradual build-up of liquidity shortages
- Therefore, deposit rates should have little or no predictive power when contractions in an economy arise due to sudden shocks
- Natural disasters identify the start of a downturn

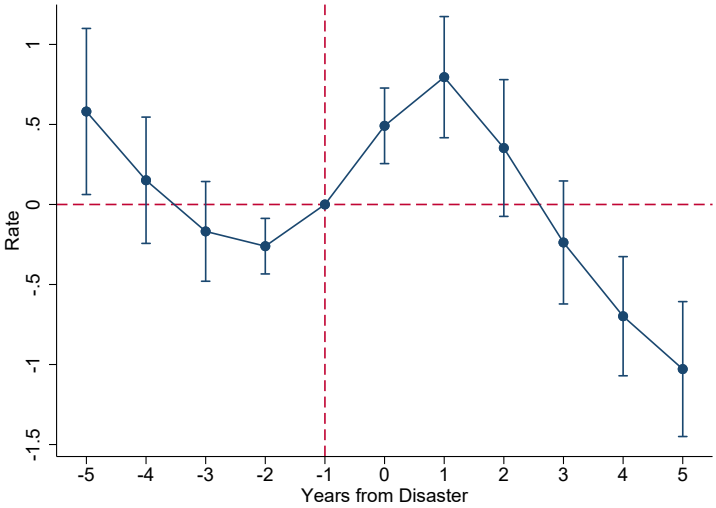
How do natural disasters impact deposit rates?

1. No increase in deposit rates prior to natural disasters – only after
2. Deposit rates cannot predict recessions arising from unanticipated shocks

Hence, deposit rates effectively capture the liquidity stress of banks during economic contractions

Deposit Rates around Natural Disasters

Regressions Margins: Rate for Disaster Counties by Year from Event



Deposit Growth Declines after Natural Disasters

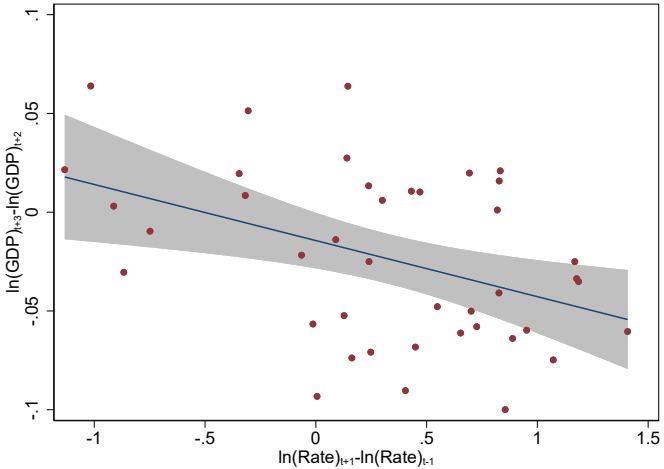
Δ ln(Dep Amt)	t-3	t-2	t-1	t	t+1	t+2	t+3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\mathbb{1}_{Disaster}$	0.0010	-0.0129	0.0031	0.0223	-0.0521***	-0.0084	-0.0035
	(0.0165)	(0.0167)	(0.0176)	(0.0213)	(0.0132)	(0.0116)	(0.0109)
Bank × County FE	✓	✓	✓	✓	✓	✓	✓
N	402,770	453,031	510,636	578,629	598,952	548,604	488,958
R^2	0.2202	0.2183	0.2110	0.2062	0.2072	0.1604	0.1478

- After natural disasters, deposit growth ↓ 5.21 pp

Ex Ante Deposit Rate Cannot Predict Disaster-Induced Recessions

$\mathbb{1}_{Recession}$	(1)	(2)	(3)
	1 Year Ahead	2 Years Ahead	3 Years Ahead
$\mathbb{1}_{Disaster} \times$ Rate $\times$ Shock	-0.1256	0.0173	0.0274
	(0.0869)	(0.0682)	(0.0739)
$\mathbb{1}_{Disaster} \times$ Rate	0.0963***	0.0806***	0.0520***
	(0.0157)	(0.0166)	(0.0165)
Rate	0.0250***	0.0133***	-0.0071***
	(0.0024)	(0.0025)	(0.0026)
Shock	-0.0500	0.0948	0.3429***
	(0.0729)	(0.0634)	(0.0626)
County FIPS FE	✓	✓	✓
N	32950	30743	28594
pseudo R^2	0.0836	0.0812	0.0795
AUC	0.6957	0.6921	0.6899
Overall test statistic, χ^2	2764.9614	2472.5013	2235.2807
p-value	0.0000	0.0000	0.0001

Ex Post Deposit Rate Change Predicts Future GDP Growth



- Deposit rate change after disaster predicts economic activity two years later

Bank Liquidity and Business Cycles

Summary of Mechanism

As a county approaches an economic downturn...

- Total deposit growth at the county level declines

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As a county approaches an economic downturn...

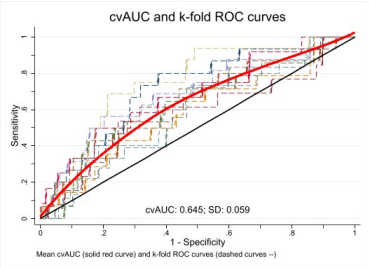
- Total deposit growth at the county level declines
  - Insured deposit growth decreases across all banks
  - Uninsured deposit growth decreases more for riskier banks

- To offset shortfall and support their balance sheet, banks raise rates to attract insured deposits
  - Magnitude depends on competition and balance sheet conditions

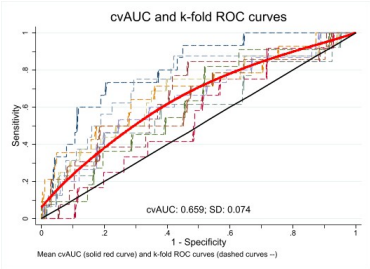
State Level Economic and Financial Risks

Out-of-Sample Findings

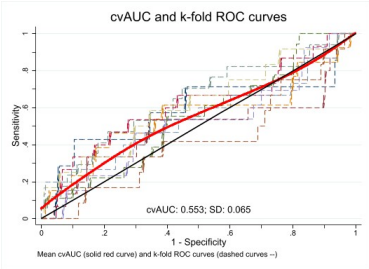
Predictive model generalizes well to independent datasets and reports high model prediction performance ▸ State ▸ Logit ▸ Forecasting 2022 GDP



(a) Recession in 4 Quarters: AUC = 0.65



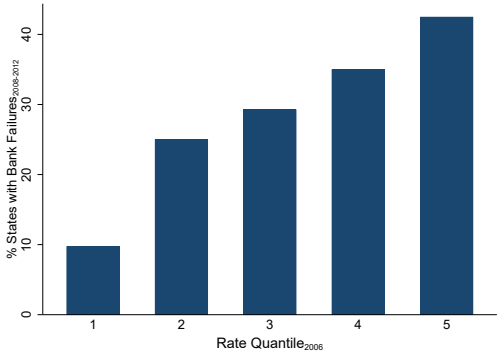
(b) Recession in 8 Quarters: AUC = 0.66



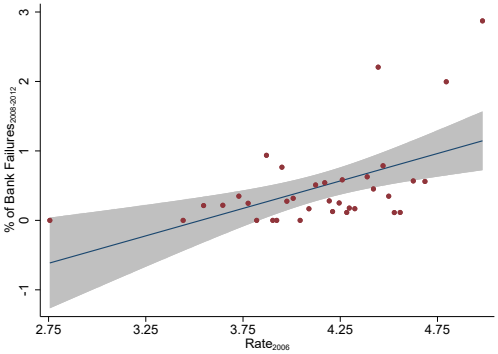
(c) Recession in 12 Quarters: AUC = 0.55

Vulnerability index can accurately predict recessions years in advance

2006 State Vulnerability Index Predicts Bank Failures (2008-2012)



(a) Extensive Margin



(b) Intensive Margin

- A 1 SD ↑ in state deposit rates in 2006 ⇒ 18.5 percentage points ↑ in the likelihood that a state experiences any bank failure during the crisis period
- A 1 SD ↑ in state deposit rates in 2006 ⇒ 0.66 pp (0.43 SD) ↑ in the share of failed banks in a state

Horse Race: Deposit Rates vs. Other Indicators

Deposit rates are forward-looking and exhibit better predictive power compared to other variables

- Credit growth and recessions ▸ SBL ▸ Mtg. ▸ Tot.
- Deposit rates, credit growth, and recessions ▸ SBL ▸ Mtg. ▸ Tot.
- Deposit growth and recessions ▸ Dep. Logit ▸ Dep. OLS
- Deposit rates, deposit growth, and recessions ▸ Dep. Logit ▸ Dep. OLS
- Deposit rates, auto sales, unemployment insurance claims and job openings ▸ Univariate ▸ Multivariate

Conclusion

1. **Bank liquidity conditions predict business cycles**
   - Predict recessions and depth of county and state using deposit rates on insured deposits across banks
   - Predicts changes in economic activity, reflecting liquidity shortages
   - Predicts changes in economic activity that are not accompanied by a credit boom

2. **Mechanism: liquidity squeezes**
   - As economic growth slows, deposit growth slows
   - In response, banks either increase deposit rates or reduce lending growth

3. **Granular vulnerability index with policy implications**
   - Allows for prediction of localized downturns
   - Market-based measure is easy to construct and is thus, a useful early warning signal of an impending recession
   - Riskier banks increase reliance on insured deposits as they approach a downturn, raising concerns of moral hazard arising from deposit insurance schemes