The Deposits Channel of Aggregate Fluctuations

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Motivation

Simplified Bank Balance Sheet

Assets	**Liabilities**
Loans	**Deposits (80%)**
Securities	Equity & Regulatory Capital
Other Assets	Other Liabilities

- **A new dimension:** The geography of bank deposits

Research Objective

Can local deposit shocks account for aggregate fluctuations?

1. **Fat Tails:** Idiosyncratic shocks to fat tails may potentially account for aggregate fluctuations (Gabaix 2011)
   - Banks' source of deposits are geographically concentrated

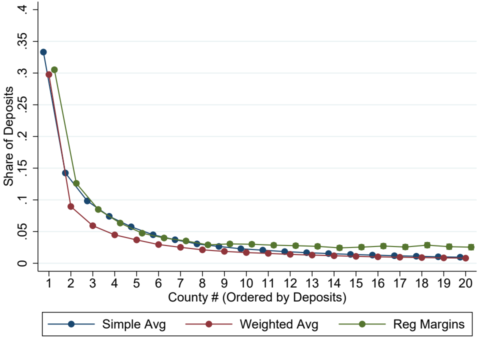
2. **Network Cascades:** Transmission of shocks through network (Acemoglu, Carvalho, Ozdaglar, Tahbaz-Salehi 2012)
   - **Internal Capital Markets:** Local shocks to a single geography (source of deposits) can spread to other geographies

Paper in a Nutshell

1. **Fact:** Bank deposits are geographically concentrated
   - On average, $\approx$ 30% of bank deposits come from a single county
2. **Methodology:** Construction of *novel* bank-specific shocks using GIV
   - Natural disasters result in a permanent deposit shock
   - Banks have different exposures to shocks
3. **Key Result:**
   - Local deposit shocks can explain aggregate fluctuations
   - Disaster Shocks $\Rightarrow$ Deposits $\downarrow$ $\Rightarrow$ Lending $\downarrow$ $\Rightarrow$ Economic Growth $\downarrow$
4. **Mechanism:**
   - The decline in lending growth is more severe
     - for capital-constrained banks
     - in non-core markets where banks do not have a physical branch
     - for constrained borrowers relative to unconstrained borrowers.

Bank Deposits are Geographically Concentrated

Share of deposits in counties ordered by deposits



- Largest deposit county accounts for $\approx 30\%$ of bank deposits

Temporal Analysis | Size | Big 4 | Bank Characteristics | Geography

Effect of Disasters on Aggregate Deposit Growth

1. **Immediate effect**
   - 1 sd disaster shock is associated with a 0.1-0.3 pp decline in deposit growth – comparable with the 25th percentile of deposit growth
     Main Result | Placebo | Robustness

2. **Long-run Response:**
   - Permanent decline in deposits of banks, 10 years after the initial shock
     Jordà Projection

3. **Takeaway:** Local disaster shocks negatively affect local bank deposits and this effect is permanent Property Damage | Natural Disasters | Notable Disasters

Granular Deposit Shocks à la Gabiax & Koijen

- **Bank Level Shocks**: Disaster-induced property damage per capita weighted by county deposit share

$$\Gamma_{b,t} = \sum_{c} \left\{ \frac{D_{b,c,t-1}}{\sum_c D_{b,c,t-1}} \times \varepsilon_{c,t} \right\}$$

  - Shocks are idiosyncratic ▸ Result 1 ▸ Result 2
  - Shocks are important ▸ Results

- **Aggregate Shocks**: Bank-level shocks weighted by lending share ▸ Insurance Payout

$$\Gamma_{t} = \sum_{b} \left\{ \frac{L_{b,t-1}}{\sum_b L_{b,t-1}} \times \Gamma_{b,t} \right\}$$

- **Granular Shocks**: Aggregate shocks subtracted by equal-weighted shocks

$$\Gamma_t^* = \Gamma_t - \sum_b \frac{1}{N_b} \left\{ \sum_c \left\{ \frac{1}{N_c} \times \mathbb{1}_{b,c,t} \times \varepsilon_{c,t} \right\} \right\}$$

Granular Shocks Can Explain Aggregate Fluctuations

Dep Var: GDP Growth$_t$	(1)	(2)	(3)
Γ^*_{t-1}	-0.0631**	-0.0679**	-0.0491**
	(0.0279)	(0.0277)	(0.0218)
Constant	1.0836***		
	(0.0416)		
Quarter FE		✓	✓
Year FE			✓
# Obs	97	97	96
R^2	0.0237	0.0259	0.5178

- 1 sd of granular shock reduces economic growth by 0.06 pp
- The effect is rather immediate and wanes away gradually over time

▸ Jorda

Granular Shocks Explain Aggregate Fluctuations

Dep Var: GDP Growth$_t$	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Γ^*_t	-0.0068						-0.0109
	(0.0218)						(0.0191)
Γ^*_{t-1}		-0.0631**					-0.0622**
		(0.0279)					(0.0303)
Γ^*_{t-2}			0.0091				0.0065
			(0.0190)				(0.0195)
Γ^*_{t-3}				0.0374*			0.0347
				(0.0218)			(0.0214)
Γ^*_{t-4}					0.0077		0.0093
					(0.0192)		(0.0178)
Γ^*_{t-5}						-0.0102	-0.0112
						(0.0172)	(0.0166)
Constant	1.0874***	1.0836***	1.0837***	1.0866***	1.0849***	1.0844***	1.0844***
	(0.0418)	(0.0416)	(0.0425)	(0.0427)	(0.0433)	(0.0438)	(0.0443)
# Obs	98	97	96	95	94	93	93
R^2	0.0003	0.0237	0.0005	0.0084	0.0004	0.0006	0.0330

- Granular shocks can explain 3.30% of variation in economic growth

Horse Race: Granular Shocks and Other Macro Shocks

Dep Var: GDP Growth$_t$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Γ^*_{t-1}	-0.0631**	-0.0717***	-0.0612**	-0.0621**	-0.0627**	-0.0753***	-0.0647**	-0.0848***
	(0.0279)	(0.0233)	(0.0282)	(0.0289)	(0.0280)	(0.0256)	(0.0282)	(0.0232)
Oil Shock$_{t-1}$		-0.0531						-0.0575
		(0.0638)						(0.0546)
Monetary Shock$_{t-1}$			0.0763*					0.0549
			(0.0394)					(0.0380)
Uncertainty Shock$_{t-1}$				-0.0573				-0.0485
				(0.0523)				(0.0468)
Term Spread$_{t-1}$					-0.0141			-0.0100
					(0.0349)			(0.0350)
Gvt Exp Shock$_{t-1}$						-0.1027		-0.0823
						(0.0661)		(0.0673)
Γ^{Gabaix}_{t-1}							0.0261	0.0142
							(0.0388)	(0.0369)
Constant	1.0836***	1.0845***	1.0841***	1.0828***	1.0837***	1.0832***	1.0836***	1.0841***
	(0.0416)	(0.0411)	(0.0410)	(0.0414)	(0.0417)	(0.0406)	(0.0417)	(0.0408)
# Obs	97	97	97	97	97	97	97	97
R^2	0.0237	0.0394	0.0581	0.0428	0.0248	0.0854	0.0277	0.1369

- Granular shocks can explain as much variation as other macro shocks
- Effect of granular shocks is robust to controlling for other macro shocks

How do Local Deposit Shocks ⇒ Economic Growth?

Mechanism

1. Reduction in bank lending – key mechanism through which shocks to banks affect economic growth
   - Small Business Lending ▸ Results
   - Mortgages ▸ Results
     - ★ Effect dominant for loans more likely to be funded by deposits ▸ Jumbo v Non-Jumbo

2. Importance of **frictions** in aggregation of idiosyncratic shocks
   - Banks are constrained ▸ Results
   - Banks lack information advantage in other areas ▸ Results - 1 ▸ Results - 2
   - Borrower financial constraints & reliance on relationship lending exacerbates real effects ▸ Results ▸ Results

3. Other results: ▸ Large Banks ▸ Geography matters ▸ Collateral Channel

Conclusion

1. **We document a new source of bank fragility** - the geography of bank deposits
   - **Fat Tails:** Bank deposits are geographically concentrated
   - **Network Cascades:** Role of internal capital markets

2. **Deposits Channel of Aggregate Fluctuations**
   - Shocks can explain 3.30% of variation in economic growth
   - **Primary Mechanism:** Local Disaster Shocks $\Rightarrow$ Deposits $\downarrow$ $\Rightarrow$ Lending $\downarrow$

3. **Frictions magnify the deposit channel:**
   - Bank capital constraints
   - Informational (dis)advantages
   - Sticky bank-borrower relationship

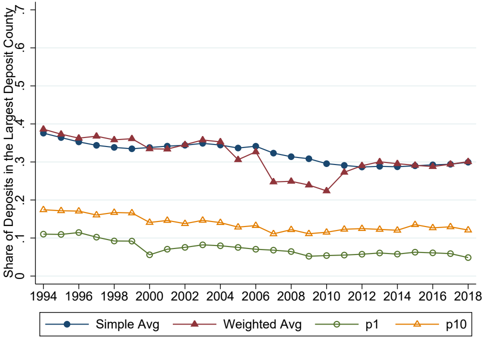
APPENDIX

Summary Statistics ▸ Back

	# Obs	Mean	SD	P25	P50	P75
Panel A: *Bank-County-Year Level Data*						
Small Business Lending Growth (%)	553,345	4.85	117.15	-43.63	0.00	49.72
Mortgage Origination Growth: All (%)	1,136,531	1.83	255.73	-50.72	0.00	57.72
Mortgage Origination Growth: Jumbo (%)	1,136,531	3.84	221.23	0.00	0.00	0.00
Mortgage Origination Growth: Non-Jumbo (%)	1,136,531	1.41	254.15	-49.43	0.00	55.34
Panel B: *County-Year Level Data*						
Deposit Growth (%)	76,755	4.48	9.20	0.17	3.37	7.12
Total Property Damage (2018 USD)	79,575	3,107,809	30,200,000	933	55,369	446,661
Total Property Damage per capita (2018 USD)	79,575	75.25	569.31	0.02	1.67	14.23
Panel C: *Bank-Year Data*						
Bank-Level Disaster Shock (Γ_{bt})	9,892	93.71	993.34	1.00	5.09	21.76
Ln(Assets)	9,892	14.00	1.74	12.72	13.64	15.00
Loan/Assets	9,892	0.63	0.13	0.56	0.65	0.73
Equity/Assets	9,892	0.10	0.03	0.08	0.09	0.11
Cash/Assets	9,892	0.05	0.04	0.03	0.04	0.06
Deposits/Assets	9,892	0.10	0.07	0.05	0.09	0.13
Hedge/Assets	9,892	-0.05	0.42	0.00	0.00	0.00
Dividend/Assets	9,892	0.00	0.00	0.00	0.00	0.00
Operating Income/Assets	9,892	0.02	0.01	0.01	0.02	0.02
Panel D: *Aggregate Data*						
GDP Growth	98	1.09	0.65	0.81	1.16	1.44
Γ_t	97	13.12	33.98	2.02	3.67	10.56
Oil Shock	97	0.00	1.01	-0.55	-0.03	0.72
Monetary Shock	97	-0.03	0.10	-0.03	-0.00	0.00
Political Uncertainty Shock	97	0.02	0.16	-0.10	0.02	0.12
Term Spread	97	1.10	0.74	0.60	1.08	1.55
Government Expenditure Shock	97	4.40	2.51	2.97	4.34	6.17
Γ_t^{Gabaix}	29	-0.00	0.01	-0.01	0.00	0.00
Deposit Growth	98	1.6402	0.5515	1.2337	1.6924	1.9896
C&I Lending Growth	98	1.3873	5.6219	-1.1126	3.0400	4.9582

Temporal Analysis ▸ Back

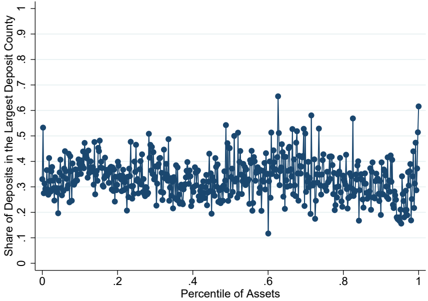
Bank deposits are geographically concentrated

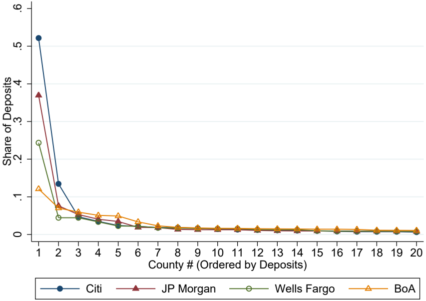


- Geographic concentration of bank deposits is not new

Is Deposit Concentration Driven by Small Banks? ▸ Back

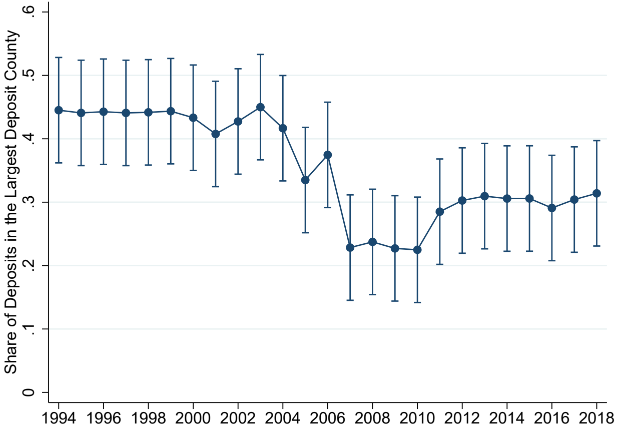
Not really!



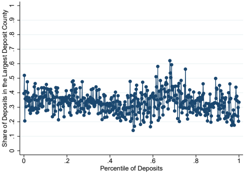


Time Series of Deposit Concentration for Big Four Banks

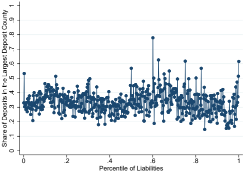
Back



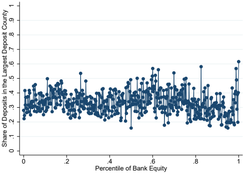
Geographic Concentration Across Bank Characteristics



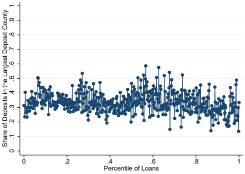
(a) Deposits



(b) Liabilities



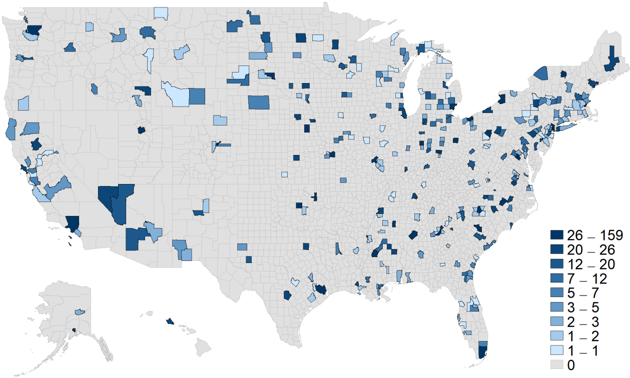
(c) Equity



(d) Loans

Geographic Description of Largest Deposit County

Back



Deposit Growth & Disaster Shock

Back

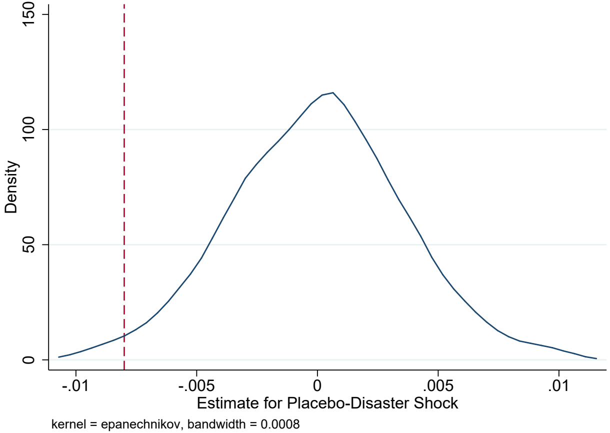
$$\Delta Ln(Dep)_{c,t} = \beta \text{Disaster Shock}_{c,t} + \theta_c + \theta_{s(c \in s),t} + \varepsilon_{c,t}$$

$\Delta Ln(Deposits)_{c,t}$	(1)	(2)	(3)	(4)	(5)	(6)
Disaster Shock$_{c,t-1}$	-0.0091***	-0.0121***	-0.0080***	-0.0111***	-0.0097***	-0.0080***
	(0.0028)	(0.0027)	(0.0030)	(0.0028)	(0.0028)	(0.0030)
Year FE		✓		✓		
County FE			✓	✓		✓
State-Year FE					✓	✓
# Obs	76,336	76,336	76,336	76,336	76,336	76,336
R^2	0.0001	0.0469	0.0523	0.0993	0.1348	0.1813

- 1 sd disaster shock is associated with a 0.1-0.3 pp decline in deposit growth – comparable with the 25th percentile of deposit growth
  - 1 sd disaster shock = Loss of \$570 per capita

Placebo Test: Randomization of Disaster Shock

Back



Min	p1	p5	p25	p50	p75	p95	p99	Max	Mean	St Dev
-0.0099	-0.0083	-0.0058	-0.0024	0.0001	0.0024	0.0059	0.0091	0.0107	0.0000	0.0036

- 1.11% of estimates with values to the left of the red-dashed line

Controlling for Lagged Shocks ▸ Back

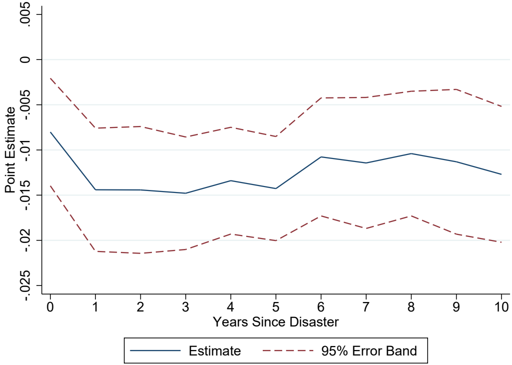
$$\Delta Ln(Dep)_{c,t} = \sum_{k=1}^{k=3} \beta_k \text{Disaster Shock}_{c,t-k} + \theta_c + \theta_{s(c\in s),t} + \varepsilon_{c,t}$$

$\Delta Ln(Deposits)_{c,t}$	(1)	(2)	(3)
Disaster Shock$_{c,t-1}$	-0.0080***	-0.0086***	-0.0089***
	(0.0030)	(0.0031)	(0.0032)
Disaster Shock$_{c,t-2}$		-0.0140***	-0.0143***
		(0.0028)	(0.0029)
Disaster Shock$_{c,t-3}$			-0.0070**
			(0.0032)
County FE	✓	✓	✓
State-Year FE	✓	✓	✓
# Obs	76,336	76,336	76,336
R^2	0.1813	0.1815	0.1815

Jordà Projection ▸ Back

Long-Run Response of Deposit Growth to Disaster Shocks

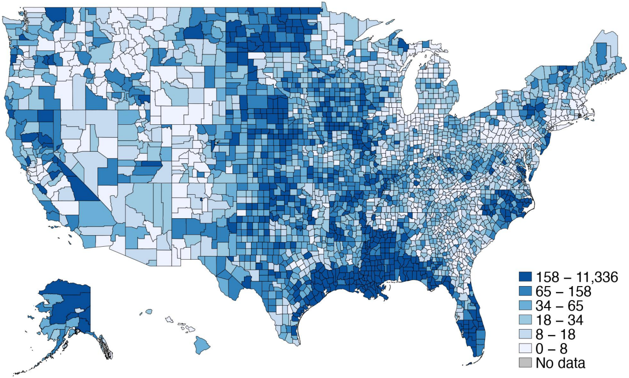
$$log(Y_{c,t+h}) - log(Y_{c,t-1}) = \beta_h \text{Disaster Shock}_{c,t} + \theta_c + \theta_{s(c\in s),t} + \varepsilon_{c,t}$$



- Effect of disaster shock on deposits is permanent even 10 years after the shock

Property Damage per Capita Across Counties from 1994 to 2018

Back



Property Damage from Natural Disaster ▸ Back

All hazards in the US between 1994 and 2018

Hazard Type	Number of Affected Counties	Total Damage (in 2018 Billion $)	Property Damage Distribution (in 2018 Million $) P25	P50	P75	P95	P99
Hurricane	3,044	240.13	0.04	0.55	4.71	223.46	1,379.27
Flooding	23,397	181.29	0.01	0.07	0.51	8.19	58.64
Tornado	11,691	39.66	0.02	0.09	0.42	5.76	53.90
Earthquake	30	38.16	0.66	18.19	22.32	945.26	33,887.58
Wildfire	1,652	33.73	0.00	0.06	0.81	11.16	151.38
Hail	11,538	33.20	0.00	0.02	0.08	1.81	33.92
Wind	49,493	19.00	0.01	0.02	0.07	0.55	3.53
Severe Storm	42,793	13.90	0.00	0.02	0.05	0.32	1.93
Winter Weather	16,327	12.88	0.00	0.03	0.19	2.51	13.96
Landslide	687	5.67	0.00	0.01	0.24	14.63	82.02
Drought	752	3.12	-	-	-	3.91	17.26
Coastal	309	1.85	-	-	0.00	1.68	72.97
Lightning	8,216	1.25	0.00	0.02	0.08	0.50	1.69
Tsunami/Seiche	47	0.11	0.02	0.03	0.10	15.85	42.36
Heat	691	0.05	-	-	-	0.08	0.17
Fog	345	0.05	0.00	0.03	0.09	0.43	1.48
Volcano	3	0.02	-	0.00	0.05	15.38	15.38
Avalanche	207	0.01	-	-	0.00	0.02	0.59
All Hazard Types	171,222	624.08	0.00	0.02	0.11	1.90	21.16

Notable Disasters

Quarter	Aggregate Bank Shock	Major Disaster #1	Affected States	Major Disaster #2	Affected States	Insurance Payout (in 2020 billion $)
1996q3	33.3705	Hurricane Fran	NC			2.63
1999q3	30.0705	Hurricane Floyd	NC			2.05
2001q1	22.8630	Nisqually earthquake	WA			0.44
2004q3	83.7900	Hurricane Ivan	FL, AL	Hurricane Jeanne	FL	14.40
2005q3	244.5543	Hurricane Katrina	LA, MS			87.96
2005q4	53.5566	Hurricane Wilma	FL			13.42
2008q2	27.7731	June 2008 Midwest floods	IN, IA, WI			0.60
2011q2	30.5780	Mississippi River floods	MS, MO	Super Outbreak (Tornado)	AL, MS, TN	7.60
2012q4	80.5528	Hurricane Sandy	NJ			28.88
2017q3	205.3722	Hurricane Harvey	TX	Hurricane Irma	FL	63.11
2018q4	30.4282	California wildfires	CA	Hurricane Michael	FL	19.84

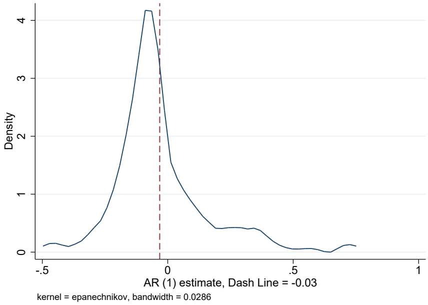
Back

Can Bank-Characteristics Predict Bank Shocks? ▸ Back

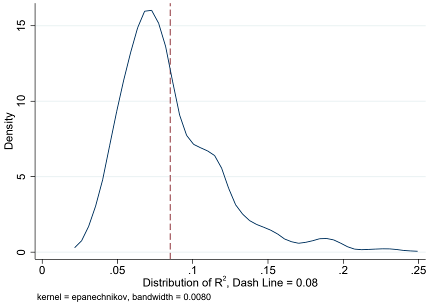
Dep Var: $\Gamma_{b,t}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln(Assets)$_{b,t-1}$	-0.0199**								-0.0149	-0.0681
	(0.0087)								(0.0093)	(0.0538)
Loan/Assets$_{b,t-1}$		-0.0137							-0.0154	0.0249
		(0.0092)							(0.0108)	(0.0164)
Equity/Assets$_{b,t-1}$			0.0051						0.0060	-0.0109
			(0.0090)						(0.0090)	(0.0155)
Cash/Assets$_{b,t-1}$				-0.0080					-0.0213***	-0.0075
				(0.0050)					(0.0066)	(0.0109)
Deposits/Assets$_{b,t-1}$					0.0283**				0.0302**	0.0205
					(0.0123)				(0.0140)	(0.0210)
Hedge/Assets$_{b,t-1}$						0.0063***			0.0013	-0.0029
						(0.0017)			(0.0032)	(0.0028)
Div/Assets$_{b,t-1}$							-0.0074		-0.0092	-0.0171*
							(0.0054)		(0.0059)	(0.0092)
Income/Assets$_{b,t-1}$								-0.0042	-0.0050	0.0135
								(0.0059)	(0.0060)	(0.0117)
Bank FE										✓
Year FE										✓
# Obs	9,892	9,892	9,892	9,892	9,892	9,892	9,892	9,892	9,892	9,892
R^2	0.0004	0.0002	0.0000	0.0001	0.0008	0.0000	0.0001	0.0000	0.0017	0.0737

- Bank characteristic cannot predict bank-level shocks in any robust statistical and quantitative sense

Spatial and Temporal Properties of Bank Shocks ▸ Back



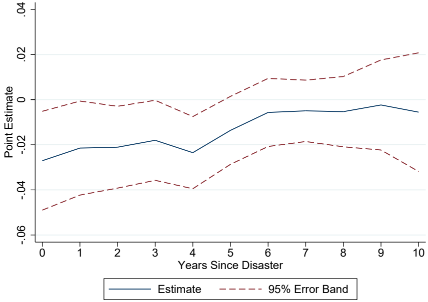
(a) AR(1) estimate for Bank Shocks



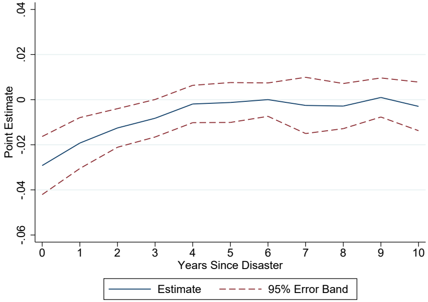
(b) Pairwise R^2 for Bank Shocks

Long-Run Bank Response to Deposit Shocks ‣ Back

$$y_{b,t+h} - y_{b,t-1} = \beta_h \times \Gamma_{b,t-1} + \theta_b + \theta_t + \varepsilon_t.$$

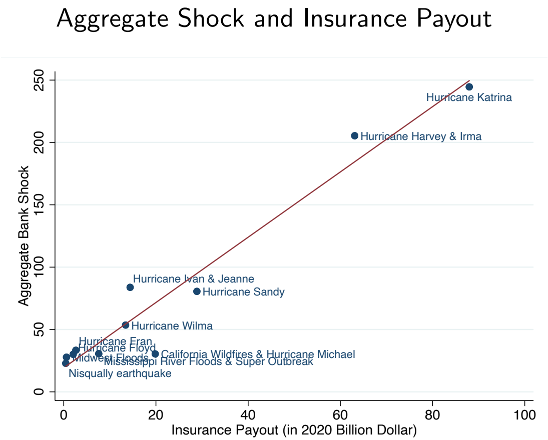


(a) Deposit



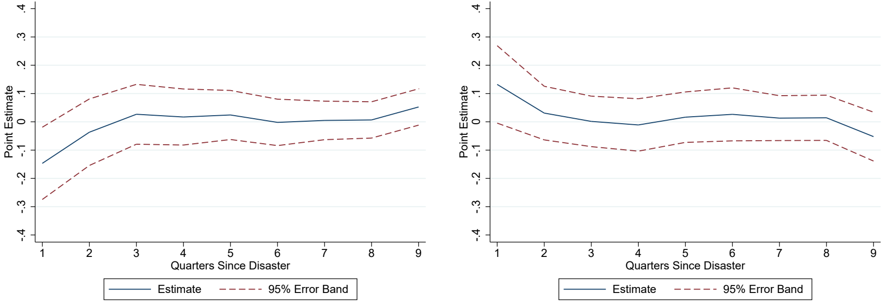
(b) Liquidity Creation

Aggregate Shocks and Insurance Payout ▸ Back



Long-Run Response: Jordà Projection ▸ Back

$$log(GDP_{t+h}) - log(GDP_{t-1}) = \alpha_h + \beta_h \Gamma^*_{t-1} + \varepsilon_t$$



(a) Granular Shock (b) Disaster Shock

- Granular effect is immediate and wanes gradually. No direct effect of disasters on economic growth
- Deposit elasticity of economic growth ▸ IV Regression

Instrumental Variables Regression

Back

	(1)	(2)	(3)	(4)	(5)	(6)
	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
	Δ GDP	Δ Deposits	Δ GDP	Δ Loans	Δ Loans	Δ Deposits
Deposits Growth	0.8755**				6.0853**	
	(0.3978)				(2.7785)	
C&I Lending Growth			0.1438*			
			(0.0822)			
Γ^*_{t-1}		-0.0016***		-0.0099**		-0.0016***
		(0.0005)		(0.0042)		(0.0005)
# Obs	97	97	97	97	97	97
R^2	0.0256	0.0187	0.0256	0.0066	0.0066	0.0187
KP LM Statistic		1.182		0.942		1.182
KP Wald F Statistic		11.137		5.511		11.137

- A 1% decrease in the loan supply results in a decline of economic growth by 0.14 pp.
- Magnitude is similar to Kundu & Vats (2020) and Herreno (2020).

Small Business Lending Growth & Deposit Shock ▸ Back

- Estimation:

$$\Delta Ln(Lending)_{b,c,t} = \beta \cdot \Gamma_{b,t-1} + \theta_{c,t} + \theta_{b,c} + \varepsilon_{b,c,t}$$

- Identification:
  - β is a within-county estimator
  - **Assumption:** banks face identical investment opportunities within a county
  - **Weaker Assumption:** any friction that creates a wedge between available investment opportunities to different banks within a county is unrelated to the idiosyncratic shock elsewhere
  - County-Bank FE controls for time-invariant importance of the bank in the county

- A 1 sd deposit shock is associated with a decline of 1.09-1.85 pp in lending growth
  ▸ Result ▸ Robustness ▸ Jordà

- Moreover, the effect of bank deposit shock on lending growth is persistent ▸ Jordà

Small Business Lending Growth & Deposit Shock

▸ Back

$\Delta ln(Lending)_{b,c,t}$	(1)	(2)	(3)	(4)	(5)	(6)
$\Gamma_{b,t-1}$	-0.0111***	-0.0131***	-0.0112***	-0.0160***	-0.0093***	-0.0148***
	(0.0022)	(0.0023)	(0.0023)	(0.0027)	(0.0023)	(0.0028)
County FE		✓	✓			
Year FE		✓	✓			
County-Year FE				✓		✓
County-Bank FE					✓	✓
Bank FE			✓			
# Obs	553,345	553,345	553,345	553,345	553,345	553,345
R^2	0.0001	0.0104	0.0163	0.1245	0.0747	0.1985

- 1 sd deposit shock is associated with a decline of 1.09-1.85 pp in lending growth

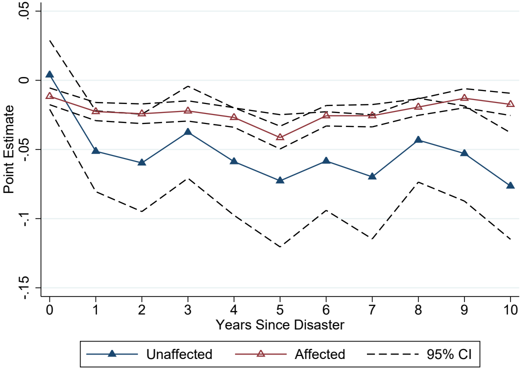
Small Business Lending Growth & Deposit Shock ▸ Back

Dep Var: $\Delta ln(Lending)_{b,c,t}$	(1) Unaffected	(2) Affected
$\Gamma_{b,t-1}$	-0.0382***	-0.0134***
	(0.0131)	(0.0030)
County × Year FE	✓	✓
Bank × County FE	✓	✓
# Obs	96,259	436,349
R^2	0.3222	0.2089

- 1 sd deposit shock is associated with a decline of 4.47 pp in lending growth in non-affected counties
- 1 sd deposit shock is associated with a decline of 1.57 pp in lending growth in affected counties

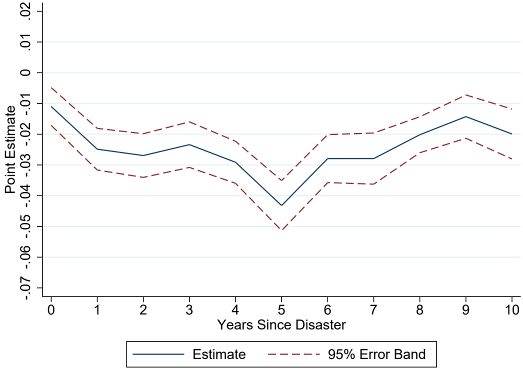
Disaster Affected and Unaffected Counties ▸ Back

$$ln(Lending)_{b,c,t+h} - ln(Lending)_{b,c,t-1} = \beta^h \times \Gamma_{b,t-1} + \theta^h_{c,t} + \theta^h_{b,c} + \varepsilon_{b,c,t}$$



Long-Run Response: Jordà Projection ▸ Back

$$log(Lending_{b,c,t+h}) - log(Lending_{b,c,t-1}) = \beta_h \cdot \Gamma_{b,t} + \theta_{c,t} + \theta_{b,c} + \varepsilon_{b,c,t}$$



- Effect of bank deposit shock on lending growth is persistent
- Effect increases until 5 years after the shock and shows slow reversion thereafter

Deposit Shocks and Mortgage Lending ▸ Back

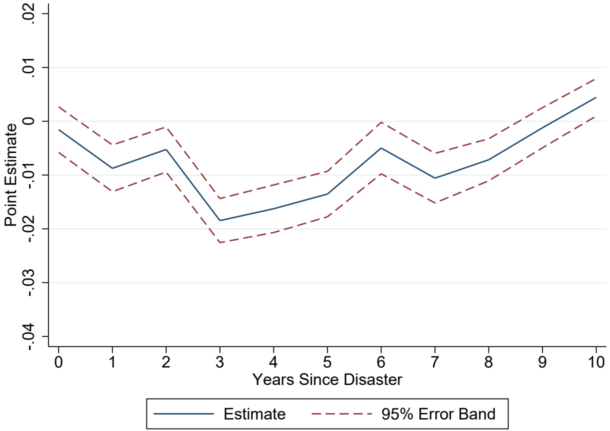
Dep Var: $\Delta ln(Lending)_{b,c,t}$	(1) Purchase	(2) Refinancing	(3) Improvement
$\Gamma_{b,t-1}$	-0.0073***	-0.0047***	-0.0032*
	(0.0020)	(0.0017)	(0.0018)
County $\times$ Year FE	✓	✓	✓
County $\times$ Bank FE	✓	✓	✓
# Obs	1,136,531	1,136,531	1,136,531
R^2	0.1302	0.1821	0.1166

- Effect is muted with mortgages
- Long-run response of mortgage lending to deposit shocks ▸ Jordà

Long-Run Response of Mortgage Lending to Deposit Shocks

Back

$$ln(Lending)_{b,c,t+h} - ln(Lending)_{b,c,t-1} = \beta^h \times \Gamma_{b,t-1} + \theta^h_{c,t} + \theta^h_{b,c} + \varepsilon_{b,c,t}$$



Jumbo vs Non-Jumbo Mortgage Loans

Back

Dep Var: $\Delta ln(Lending)_{b,c,t,j}$	(1)	(2)	(3)	(4)
$Jumbo_j \times \Gamma_{b,t-1}$	-0.0125***	-0.0125***	-0.0125***	-0.0140***
	(0.0022)	(0.0022)	(0.0022)	(0.0024)
$Jumbo_j$	0.0099***	0.0099***	0.0099***	
	(0.0006)	(0.0006)	(0.0006)	
$\Gamma_{b,t-1}$	0.0091***	0.0006		
	(0.0016)	(0.0018)		
County × Year FE		✓		
County × Bank FE		✓		
County × Bank × Year FE			✓	✓
County × Bank × Jumbo FE				✓
# Obs	2,276,662	2,276,662	2,276,662	2,276,662
R^2	0.0000	0.0626	0.5322	0.5513

Mechanism: Constrained Banks Magnify Transmission

Back

$$\Delta Ln(Lending)_{b,c,t} = \beta_1 \cdot \lambda_{b,t-1} \cdot \Gamma_{b,t-1} + \beta_2 \cdot \lambda_{b,t-1} + \beta_3 \cdot \Gamma_{b,t-1} + \theta_{c,t} + \theta_{b,c} + \varepsilon_{b,c,t}$$

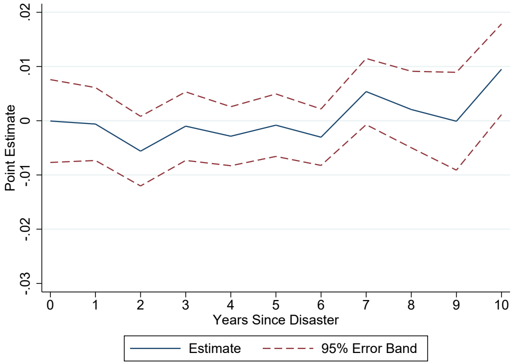
$\Delta ln(Lending)_{b,c,t}$	(1)	(2)	(3)	(4)	(5)	(6)
Low Tier 1 Ratio$_{b,t-1} \times \Gamma_{b,t-1}$	-0.1784***	-0.2045***	-0.1978***	-0.2161***	-0.1815***	-0.2196***
	(0.0113)	(0.0118)	(0.0125)	(0.0124)	(0.0124)	(0.0137)
Low Tier 1 Ratio$_{b,t-1}$	-0.0056***	-0.0031	-0.0281***	-0.0033	-0.0305***	-0.0277***
	(0.0021)	(0.0021)	(0.0038)	(0.0022)	(0.0042)	(0.0044)
$\Gamma_{b,t-1}$	-0.0036*	-0.0053**	-0.0046**	-0.0076***	-0.0023	-0.0067**
	(0.0022)	(0.0022)	(0.0023)	(0.0026)	(0.0023)	(0.0027)
County FE		✓	✓			
Year FE		✓	✓			
County-Year FE				✓		✓
County-Bank FE					✓	✓
Bank FE			✓			
# Obs	547,031	547,031	547,031	547,031	547,031	547,031
R^2	0.0006	0.0113	0.0172	0.1267	0.0746	0.2002

- The decline in lending growth is driven by constrained banks
- Constraint is measured using Tier 1 Capital Ratio of Banks

Jordà Projection ▸ Back

Long-Run Response of Lending Growth to Disaster Shocks

$$log(Y_{c,t+h}) - log(Y_{c,t-1}) = \beta_h \text{Disaster Shock}_{c,t} + \theta_c + \theta_{s(c \in s),t} + \varepsilon_{c,t}$$



- Effect of disaster shock on lending is transient (Cortés and Strahan 2017)

Mechanism: Banks Transmit Shocks to Non-Core Markets

Back

$$\Delta Ln(Lending)_{b,c,t} = \beta_1 \cdot NC_{b,c,t-1} \cdot \Gamma_{b,t-1} + \beta_2 \cdot NC_{b,c,t-1} + \beta_3 \cdot \Gamma_{b,t-1} + \theta_{c,t} + \theta_{b,c} + \varepsilon_{b,c,t}$$

$\Delta ln(Lending)_{b,c,t}$	(1)	(2)	(3)	(4)	(5)	(6)
$NC_{b,c,t-1} \times \Gamma_{b,t-1}$	-0.0145***	-0.0155***	-0.0166***	-0.0151***	-0.0131***	-0.0147***
	(0.0037)	(0.0037)	(0.0037)	(0.0044)	(0.0039)	(0.0045)
$NC_{b,c,t-1}$	0.0823***	0.0902***	0.0965***	0.0873***	0.3792***	0.3570***
	(0.0016)	(0.0018)	(0.0020)	(0.0019)	(0.0074)	(0.0080)
$\Gamma_{b,t-1}$	-0.0004	-0.0014	0.0009	-0.0044	0.0002	-0.0036
	(0.0022)	(0.0022)	(0.0022)	(0.0032)	(0.0022)	(0.0031)
County FE		✓	✓			
Year FE		✓	✓			
Bank FE			✓			
County-Year FE				✓		✓
County-Bank FE					✓	✓
# Obs	553,345	553,345	553,345	553,345	553,345	553,345
R^2	0.0015	0.0119	0.0178	0.1259	0.0792	0.2017

- *Core* defined by presence of branch; *Non-core* otherwise
- Affected banks reduce lending in non-core areas where they lack informational advantage

Mechanism: Banks Transmit Shocks to Non-Core Markets

Back

$$\Delta Ln(Lending)_{b,c,t} = \beta_1 \cdot NC_{b,c,t-1} \cdot \Gamma_{b,t-1} + \beta_2 \cdot NC_{b,c,t-1} + \beta_3 \cdot \Gamma_{b,t-1} + \theta_{c,t} + \theta_{b,c} + \varepsilon_{b,c,t}$$

$\Delta ln(Lending)_{b,c,t}$	(1)	(2)	(3)	(4)	(5)	(6)
$NC_{b,c,t-1} \times \Gamma_{b,t-1}$	-0.0130***	-0.0160***	-0.0185***	-0.0148***	-0.0132**	-0.0165***
	(0.0048)	(0.0050)	(0.0049)	(0.0053)	(0.0051)	(0.0055)
$NC_{b,c,t-1}$	0.4846***	0.4873***	0.5563***	0.4861***	1.0018***	1.0610***
	(0.0029)	(0.0029)	(0.0033)	(0.0029)	(0.0051)	(0.0050)
$\Gamma_{b,t-1}$	-0.0035	-0.0050**	-0.0022	-0.0076***	-0.0040*	-0.0058**
	(0.0022)	(0.0023)	(0.0023)	(0.0028)	(0.0023)	(0.0028)
County FE		✓	✓			
Year FE		✓	✓			
Bank FE			✓			
County-Year FE				✓		✓
County-Bank FE					✓	✓
# Obs	553,345	553,345	553,345	553,345	553,345	553,345
R^2	0.0554	0.0660	0.0793	0.1777	0.1814	0.3045

- *Core* defined by above-median share of lending in a county-year; *Non-core* otherwise
- Affected banks reduce lending in non-core areas where they lack informational advantage

Small vs Large Recipients of Small Business Loans and Deposit Shocks ▸ Back

Dep Var: $\Delta ln(Lending)_{b,c,t,s}$	(1)	(2)	(3)	(4)
$Small_s \times \Gamma_{b,t-1}$	-0.0160***	-0.0160***	-0.0160***	-0.0130***
	(0.0042)	(0.0044)	(0.0042)	(0.0047)
$Small_s$	-0.0133***	-0.0133***	-0.0133***	
	(0.0014)	(0.0014)	(0.0014)	
$\Gamma_{b,t-1}$	0.0070**	0.0057		
	(0.0034)	(0.0036)		
County × Year FE		✓		
County × Bank FE		✓		
County × Bank × Year FE			✓	✓
Small × County × Bank FE				✓
# Obs	552,344	552,344	552,344	552,344
R^2	0.0001	0.1710	0.5345	0.5684

- Banks reduce lending more to firms that face greater financial constraints

Bank-Borrower Lending Relationship and Real Effects ▸ Back

$$ln(y_{f,t}) = \beta_1 \times Young_{f,t} \times \sum_b \Gamma_{b,t-1} + \beta_2 \times Young_{f,t} + \beta_3 \times \sum_b \Gamma_{b,t-1} + \theta_{i,t} + \theta_f + \varepsilon_{f,t}$$

	(1)	(2)	(3)	(4)
	Debt	Size	Employment	CapEx
$\text{Young}_f \times \sum_b \Gamma_{b,t-1}$	-0.1618**	-0.1313***	-0.0982**	-0.1513**
	(0.0640)	(0.0485)	(0.0402)	(0.0733)
Young_f	-0.2917***	-0.2358***	-0.1661***	-0.2690***
	(0.0595)	(0.0358)	(0.0256)	(0.0512)
$\sum_b \Gamma_{b,t-1}$	-0.0126*	-0.0049	-0.0015	-0.0012
	(0.0065)	(0.0039)	(0.0029)	(0.0043)
Firm FE	✓	✓	✓	✓
Industry × Year FE	✓	✓	✓	✓
# Obs	11,609	12,216	11,608	10,870
R^2	0.9253	0.9703	0.9696	0.9479

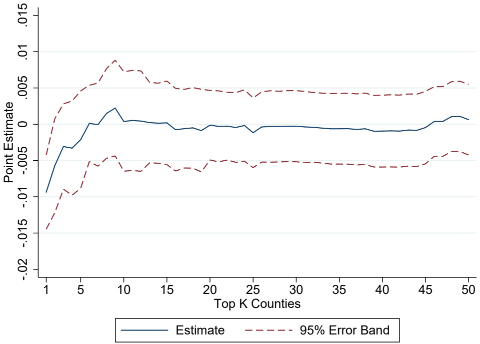
- Young firms are more likely to face relationship frictions
- Young firms experience greater real effects – lower debt, size, employment, and capital expenditure

Mechanism: Large Banks Magnify Transmission ▸ Back

Dep Var: $\Delta ln(Lending)_{b,c,t}$	(1) Small Banks	(2) Medium Banks	(3) Large Banks	(4) Top 20 Banks
$\Gamma_{b,t-1}$	-0.0061	-0.0128***	-0.0357***	-0.0251**
	(0.0308)	(0.0037)	(0.0087)	(0.0098)
County × Year FE	✓	✓	✓	✓
County × Bank FE	✓	✓	✓	✓
# Obs	35,632	165,547	298,355	235,454
R^2	0.4609	0.3254	0.2722	0.3133

Does the Geography of Bank Deposits Matter? Back

$$\Delta ln(Lending)_{b,c,t} = \beta^k \times \frac{1}{K} \cdot \sum_{j \in TopK} \text{Property Damage per capita}_{j,t-1} + \theta^h_{c,t} + \theta^h_{b,c} + \varepsilon_{b,c,t}$$



Collateral vs. Deposits Channel and Aggregate Fluctuation

▸ Back

Collateral shock computed by weighting the county-level disaster shocks by small business lending and mortgage lending

Dep Var: GDP Growth$_t$	(1)	(2)	(3)
Γ^*_{t-1}	-0.0645**		-0.0770***
	(0.0284)		(0.0285)
Γ^C_{t-1}		-0.0005	0.0605
		(0.1011)	(0.0856)
Constant	1.0588***	1.0596***	1.0587***
	(0.0470)	(0.0477)	(0.0472)
# Obs	83	83	83
R^2	0.0262	0.0000	0.0313

- Collateral channel does not drive the aggregate response in GDP growth
- Deposit channel explains aggregate fluctuations even after accounting for collateral channel – same estimate as baseline