Natural Disasters, Local Bank Market Share, and Economic Recovery

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Yellowstone Flooding

Redlodge, MT on June 14, 2022 (ABC News)

Banking and Economic Recovery - Bozeman, MT

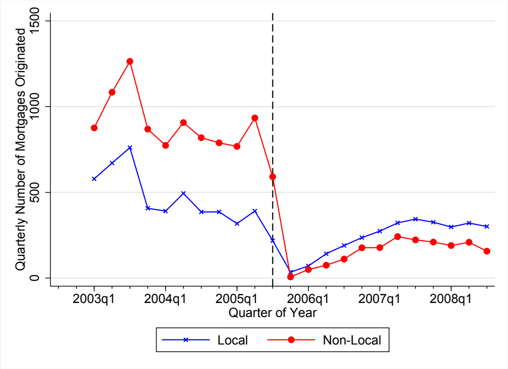
Does regional economic recovery following a disaster depend on the types of banks operating in the community?

- Founded in 1919 in Bozeman, MT
- Serves (only) Gallatin County, MT
- County's largest bank by deposit market share

- Founded 1852; Corporate headquarters in San Francisco
- 4th largest US bank by assets
- 70 million customers

Local and Non-local Lending following Hurricane Katrina

New quarterly mortgage originations by local and non-local banks to residents of New Orleans in areas that received the worst flooding from Hurricane Katrina



Gallagher and Hartley (2017); Data source: Home Mortgage Disclosure Act (HMDA)

Pre-Katrina: Non-local banks issued approx. 2/3 of new mortgages
Post-Katrina: Non-local bank mortgage originations dramatically lower
Local bank mortgage originations recover to pre-Katrina levels

Access to Credit is Important after an Economic Shock

- Many individuals rely on credit
  1. Only 46% of US adults could afford an unexpected $400 expense without borrowing or selling an asset (Federal Reserve, 2016)
  2. Just 55% of households have enough savings to cover a month of lost income (Pew Charitable Trusts, 2015)
- Credit could affect post-disaster regional economic recovery and growth
  1. Initial post-disaster reinvestment affects the path dependence of future economic growth (e.g. Kline and Moretti, 2014)
  2. Economies of agglomeration (e.g. Bleakley and Lin, 2012; Glaser, 2011)
  3. Social externalities: residents more likely to stay and rebuild in the disaster-impacted region if neighbors stay (e.g. Fu and Gregory, 2019; Paxon and Rouse, 2008)
- Hsiang and Jina (2014) summarize 4 potential development outcomes ranging from "no recovery" to "creative destruction"

Focus on Natural Disasters

1. Natural disasters are random, costly, and widespread shocks to local US economies
   - The US experienced $400 billion in damage from just the 14 most costly natural disasters in 2019 (NOAA, 2020)
   - FEMA declared 101 state-level disasters the same year (FEMA, 2019)
2. The economic cost of natural disasters is likely to increase in the coming decades
   - A better understanding of how local economies evolve following natural disasters is of independent interest (e.g. Roth Tran and Wilson, 2023).

Research Questions

1. **Do locations with a higher share of local banking at a time of a natural disaster have greater total lending post-disaster?**
   - Cortes and Strahan (2017), Gallagher and Hartley (2017) point to opposite conclusions
   - Neither study shows how total lending differs
   - Neither study accounts for endogenous bank development
   - Limitations to research designs in both papers
2. **Do (any) differences in post-disaster lending at the time of a disaster, attributable to the role of local banks, affect regional economic recovery and redevelopment?**
   - We are not aware of existing research that links the pre-disaster composition of local and non-local banking in a region (i.e. bank institutional development) with post-disaster outcomes

Project Overview

1. Economic theory provides contradictory predictions on how a greater concentration of non-local banking affects overall lending to a disaster region
2. Build a new database to test our 2 research questions
3. Estimate an event study model that instruments for bank market share in the year before a large natural disaster
4. Find that counties with higher concentrations of local banking at the time of a large natural disaster have:
    - (1) Less total post-disaster lending for approx. 6 years post-disaster
    - (2) Suggestive evidence of lower wage and population growth in the 8 years post-disaster

Theoretical Framework

- Asymmetric information and moral hazard have long been known to limit credit availability (e.g. Spence, 1973; Rothschild and Stiglitz, 1976)
- We outline a theoretical framework based on several previous contributions: Townsend, 1979; Holmstrom and Tirole, 1997; Morgan, Rime, and Strahan, 2004
- Our focus is on how the composition of local and non-local banking in the region at the time of the disaster affects available post-disaster credit

Theoretical Framework - State Verification Model

- In Townsend (1979) costly state verification model, lenders must pay a fixed cost to observe a borrower's return on a loan
- Model predicts:
  - (i) Some borrowers with a positive expected investment return will not receive a loan
  - (ii) Laws that restrict the activity of lenders (e.g. interstate banking restrictions) will reduce overall credit
- Model assumes banks are homogeneous
  - → Subsequent literature argues that community banks have an informational advantage that can lower the cost to screen and monitor borrowers (e.g. Berger and Udell, 2002; Hein, Koch, and MacDonald, 2005; Nguyen, 2019)

Theoretical Framework - Interstate Banking System

- Holmstrom and Tirole (1997) model how banks allocate credit when there is borrower moral hazard
- Costly monitoring by banks and/or borrower collateral can prevent moral hazard
- Model predicts that a natural disaster will lead to less credit in disaster region
- Morgan, Rime, and Strahan (2004) expand on Holmstrom and Tirole (1997) to include multiple bank lending locations ("interstate banking" system)
- We extend the intuition of the Morgan, Rime, and Strahan (2004) model in 2 ways:
  - (i) Bank lending to homeowners can be modeled similarly as lending to businesses
  - (ii) Characterize each bank (and by extension, each region) by the *degree* to which the bank operates outside the region

Theoretical Framework - Predictions

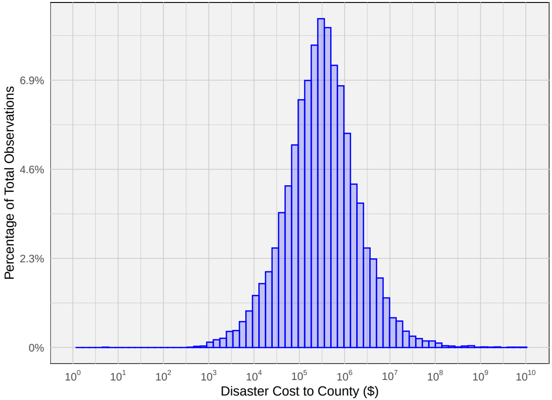
1. **Capacity**: local banks have *less capacity* to lend to a disaster region
    - Local banks are less geographically diversified and less able to import capital
    - The lower capacity to lend in regions with a higher share of local lending will, *all else equal*, decrease post-disaster lending
2. **Incentive**: local banks have a *greater incentive* to lend to a disaster region
    - A collateral shock to borrowers will make lending to the disaster impacted region more costly due to higher moral hazard
    - Non-local banks will shift lending to regions that now have a higher expected return
    - Local banks have fewer opportunities to lend outside the disaster impacted region, and have an interest in promoting the economic recovery of their lending area
    - The greater incentive to lend in regions with a higher share of local lending will, *all else equal*, increase post-disaster lending
3. **Information**: local banks may be able to better assess risk and to monitor borrowers at a lower cost
    - Monitoring rebuilding especially important after a natural disaster (Butler and Williams, 2011)
    - The informational advantage in regions with a higher share of local lending will, *all else equal*, increase post-disaster lending

Data Sources

Combine primary source data into a new annual county-level database (1981-2014):

1. **Natural Disaster Incidence and Cost**
   - FEMA Presidential Disaster Declarations for all natural disasters
   - Dollars of Public Assistance (i.e. federal disaster aid to repair infrastructure)
2. **Bank Deposits**: FDIC dollar deposits
3. **Bank Loans**
   - Home Loans (HMDA): number and dollar amount (1990-2014)
   - Business Loans (FFIEC): number and dollar amount (1997-2014)
   - SBA Disaster Loans: number and dollar amount (1991-2014)
4. **State Banking Deregulation**: Dates of intrastate and interstate bank deregulation (Morgan, Rime, and Strahan, 2004)
5. **Economic Information**: Employment (CBP); Wages (US BEA); Population (NBER)

Not All Disaster Counties Suffer Large Damage



Disaster counties 1990-2014. Data source: FEMA.

- Some disaster counties on periphery of natural disaster & receive little damage
- We use FEMA grants to repair public infrastructure as a damage proxy
- Focus on most-damaged counties

Home and Business Loan Time Trends (1997-2014)

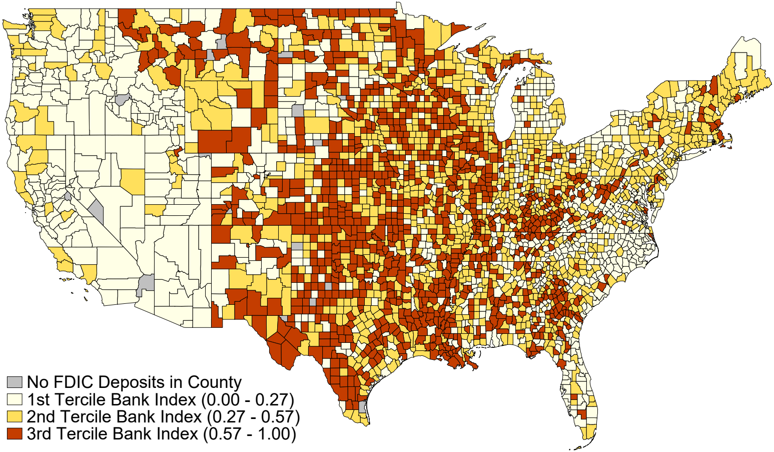
The figure plots the mean level of lending (across counties, after removing county fixed effects) for counties hit by a large disaster with respect to the timing of the disaster.

County Local Banking Index

- We use the FDIC bank deposits data to define a *lender localness* score for each lender l, in each county c, for each year t (similar to Cortes and Strahan, 2017)
- We then calculate a county local banking index by taking a weighted average of the lender localness scores for each lender operating in the county during the year
- We interpret the county local banking index, which ranges from 0 to 1, as the degree of local banking (or local banking market share) in each county each year

$$\text{Local Banking Index}_{ct} = \sum_{l=1}^{L} (\text{Lender Localness})_{lct} * (\text{Lender County Share})_{lct} \qquad (1)$$

US Map Shows County Local Banking Index is Correlated within State



1995 US Map. Data source: FEMA.

Bank Deregulation as Exogenous Variation in Local Banking Concentration

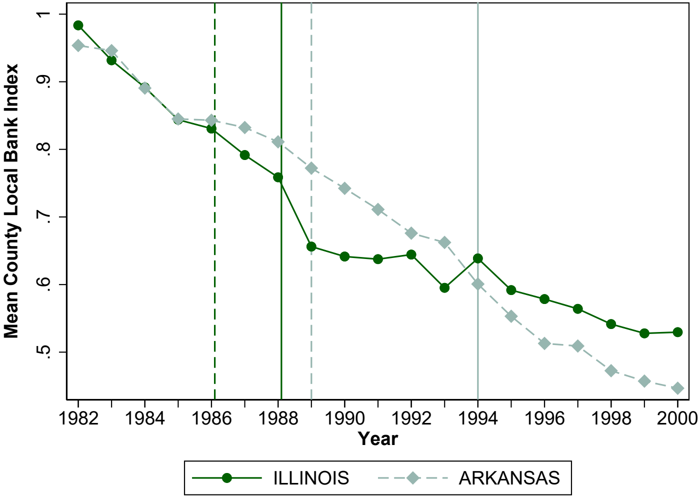
- Prior to 1978 every state prohibited banks from other states, and most prohibited branching to other counties in the same state
- Interstate Deregulation:
  - Beginning with Maine in 1978 states passed reciprocity laws that allowed banks to operate in states that signed similar laws
  - In 1994, Reigle-Neal Interstate Banking and Branching Efficiency Act formally established a national banking system
  - Post-1994, states still retained some ability to limit expansion of out-of-state banks (e.g Rice and Strahan, 2010)
- Intrastate Deregulation:
  - Most states didn't allow intrastate banking until the 1970's and 1980's
- The timing of state-level banking is uncorrelated with state economic conditions (e.g. Jayaratne and Strahan, 1996; Levine et al., 2020)

Interstate or Intrastate deregulation was passed for at least one state each year 1980-1994

Deregulation Year	States Passing Deregulation	
	Interstate	**Intrastate**
Pre-1980	1	16
1980	0	1
1981	0	3
1982	1	1
1983	2	1
1984	3	1
1985	9	4
1986	10	1
1987	9	5
1988	6	6
1989	2	1
1990	1	4
1991	2	2
1992	1	0
1993	1	1
1994	0	1

Data source: Morgan, Rime, and Strahan (2004).

Bank deregulation can isolate exogenous variation in the intensity of local banking



Solid (dashed) vertical line is year of interstate (intrastate) deregulation.

Statistical Model

Linear projections difference-in-differences model (Dube et al., 2023; Roth Tran and Wilson, 2023) for a county-by-year panel

$$y_{c,t+h} - y_{c,t-1} = \sum_{\substack{\tau=-p \\ \tau\neq-1}}^{h} \beta_\tau^h 1[LargeDisaster_{c,t+\tau}] + \sum_{\substack{\tau=-p \\ \tau\neq-1}}^{h} \alpha_\tau^h 1[OtherDisaster_{c,t+\tau}] + \sum_{k=1}^{K} \rho_k^h (y_{c,t-1} - y_{c,t-k}) + \lambda_c^h + \eta_t^h + \epsilon_{c,t}^h \quad (2)$$

Notes:

- Dependent variable is the h period ahead lead of the logged outcome variable (e.g. new loans) minus the logged outcome variable in $t-1$, the reference period.
- β_τ^h: estimated impact of a large disaster on a local economic outcome h years after the disaster, relative to how the local economy would have evolved in the absence of a large disaster, and conditional on the other variables in the model
- Controls: smaller disasters, pre-period trends in DV, county FE, year FE
- Cluster SEs at State-by-Year level

Statistical Model that Includes Local Banking

Model estimates a heterogeneous treatment effect using a continuous pre-treatment characteristic (e.g. Card, 1992)

$$y_{c,t+h} - y_{c,t-1} = \delta^h 1[LargeDisaster_{c,t}] * LocalBanking_c + \gamma^h LocalBanking_c + \sum_{\substack{\tau=-p \\ \tau\neq-1}}^{h} \beta_\tau^h 1[LargeDisaster_{c,t+\tau}] + \sum_{\substack{\tau=-p \\ \tau\neq-1}}^{h} \alpha_\tau^h 1[OtherDisaster_{c,t+\tau}] + \sum_{k=1}^{K} \rho_k^h (y_{c,t-1} - y_{c,t-k}) + \lambda_c^h + \eta_t^h + \epsilon_{c,t}^h \quad (3)$$

Notes:

- δ^h: measures how the impact of a large disaster varies post-disaster based on a region's banking institutions in the year before the large disaster
- $LocalBanking_c$ is our County Local Banking Index

Continuous Treatment Identification Assumption

- Continuous treatment models require a stronger parallel trends identification assumption (Callaway, Goodman-Bacon, Sant'Anna, 2021)

- In our setting:

  We must assume that the average potential outcomes for disaster counties are the same for counties with each level of the (predicted) local bank index

Predict Bank Index to Account for Endogeneity of Bank Development

- Local bank development is endogenous (e.g. to size, wealth of local population)
- Locations with a larger/wealthier population (likely) more able to cope with disaster
- We want to identify the causal effect of banking institutions on credit provision and local economic recovery
- The model will likely lead to biased estimates unless we account for the geographic endogeneity of the banking institutions
- We predict level of local banking using the timing of state banking deregulation (e.g. Morgan, Rime, and Strahan, 2004; Kroszner and Strahan, 2014)

We Instrument for the Local Banking Index

We replace $LocalBanking_c$ with $\widehat{LocalBanking}_c$ which is estimated by:

$$
\begin{aligned}
LocalBanking_{ct} = & \gamma_1 1[\mathbf{Interstate_{ct}}] + \gamma_2 1[\mathbf{Intrastate_{ct}}] + \\
& \gamma_3 \mathbf{InterstateLag_{ct}} + \gamma_4 \mathbf{IntrastateLag_{ct}} + \\
& \sum_{\tau=-a}^{b} \beta_\tau 1[LargeDisaster_{c\tau}] + \sum_{\tau=-a}^{b} \alpha_\tau 1[OtherDisaster_{c\tau}] + \sigma_c + \phi_t + \nu_{ct}
\end{aligned}
\tag{4}
$$

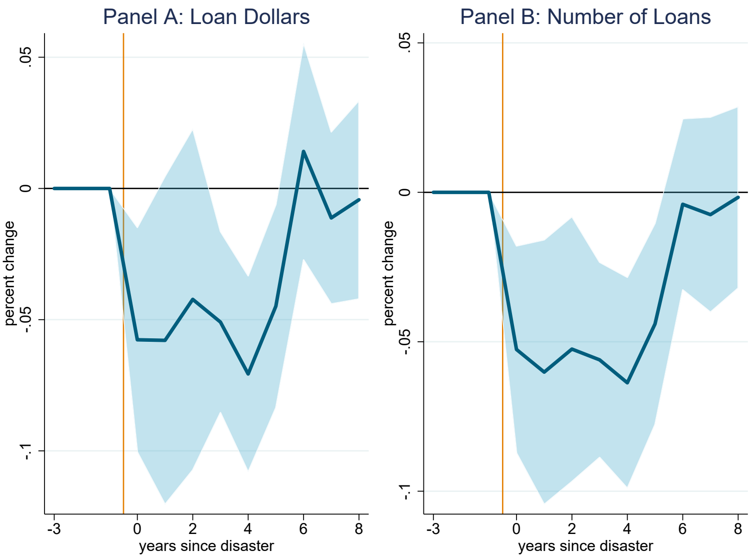
Equation Notes

- $\mathbf{Interstate}_{ct}$, $\mathbf{Intrastate}_{ct}$: indicators equal to 1 beginning in year of deregulation
- $\mathbf{InterLag}_{ct}$ and $\mathbf{IntraLag}_{ct}$: 0 before deregulation, 1 yr of deregulation, 2 yr after, etc.

Main Sample

- Our preferred panel is an unbalanced 1990-2006 sample
- Rationale for time period:
  1. HMDA loan and county-specific FEMA disaster cost (via a FOIA) available in 1990
  2. State deregulation occurs mostly mid-1980s to mid-1990s
  3. End panel before 2007 financial crisis
  4. Non-bank mortgage lending increased following Great Recession
- Reasons why unbalanced
  1. Small number county-years with no FDIC deposits data
  2. Drop county obs that have 2 large disasters in 5 years
- Baseline sample defines large disaster as $>$ 75% cost
- External validity: Examine flood-related disasters (hurricanes, coastal storms, severe storms, flooding), approx 80% of all disasters

There is Less Credit following a Large Natural Disaster

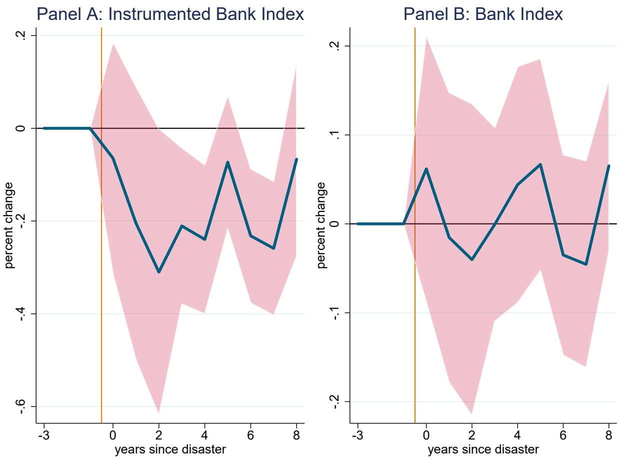


Predicted Bank Index

Dependent Variable: County Local Banking Index			
Panel length:	1981-2006	1990-2006	1990-2006
	(1)	(2)	(3)
Intrastate Indicator	-0.147***	-0.090***	-0.090***
	(0.012)	(0.031)	(0.030)
Interstate Indicator	-0.030**	-0.090*	-0.089*
	(0.015)	(0.050)	(0.050)
Intrastate Lag	0.005***	0.004***	0.005***
	(0.002)	(0.001)	(0.001)
Interstate Lag	0.006*	-0.057	-0.057
	(0.003)	(0.039)	(0.039)
Disaster Indicators	X	X	X
County FE	X	X	X
Year FE	X	X	X
Drop Repeat Disaster Obs			X
R^2	0.747	0.806	0.805
Observations	74,411	51,356	49,722
F-Statistic, Regulation	66.3	6.0	5.7

Data Sources: FDIC; FEMA; Morgan, Rime, and Strahan (2004).
Significance level: *** 1%, ** 5%, * 10%.

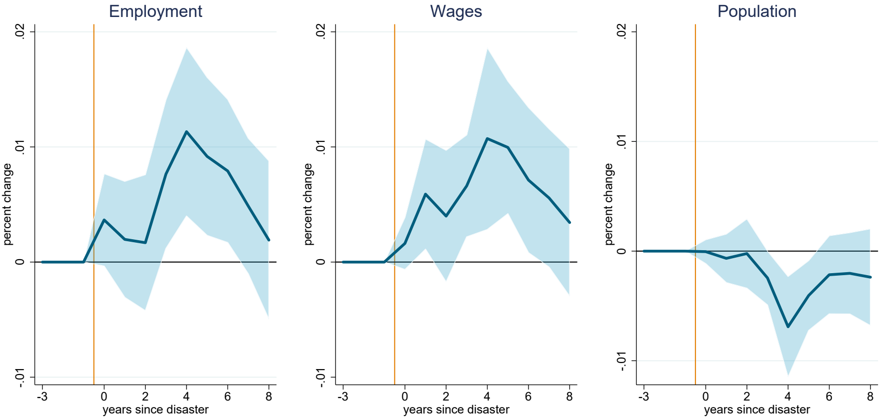
Reduced Lending in Regions with more Local Banking



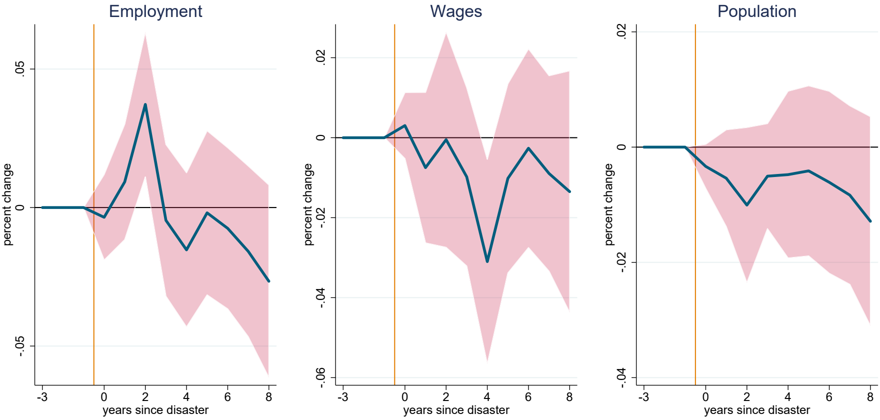
(1) Important to instrument for local banking

(2) Interpretation: 11 percentage points more lending in a county at 25th percentile of Local Banking Index vs. 75th percentile

Economic Recovery following a Large Disaster



Economic Recovery based on Local Banking Index



Discussion

1. There is lower total bank credit following a large natural disaster and the reduction in lending is larger in counties dominated by local banking
   - So far we have only examined overall lending
   - However, the literature also suggests that the type of lender may impact the distribution of credit
   - We plan to investigate the heterogeneity in lending by income
2. We plan to compare differences in socioeconomic and demographic differences between counties with high levels of actual and predicted local bank indices

Conclusion

1. We build a new database to examine whether the development of local banking institutions impacts local economic recovery following a natural disaster
2. We estimate a linear projections (event study) model for a 1990-2006 county-by-year panel
3. We use state banking deregulation to isolate the causal role of local banking following a large disaster on Credit Provision and Economic Development
4. We find:
   (1) Total credit (lending) is approx. 5% lower for 5 years
   (2) The reduction in lending is driven by locations with a higher share of local banking at the time of a disaster
   (3) There is an approx. 1% increase in wages and employment, and suggestive evidence of a small decrease in population
   (4) Regions with more local banking appear to have lower wages and population growth; the evidence is mixed for employment