Natural Disasters, Local Bank Market Share, and Economic Recovery

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NBER Summer Institute
July 25, 2022

Yellowstone Flooding

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

Banking and Economic Recovery - Bozeman, MT

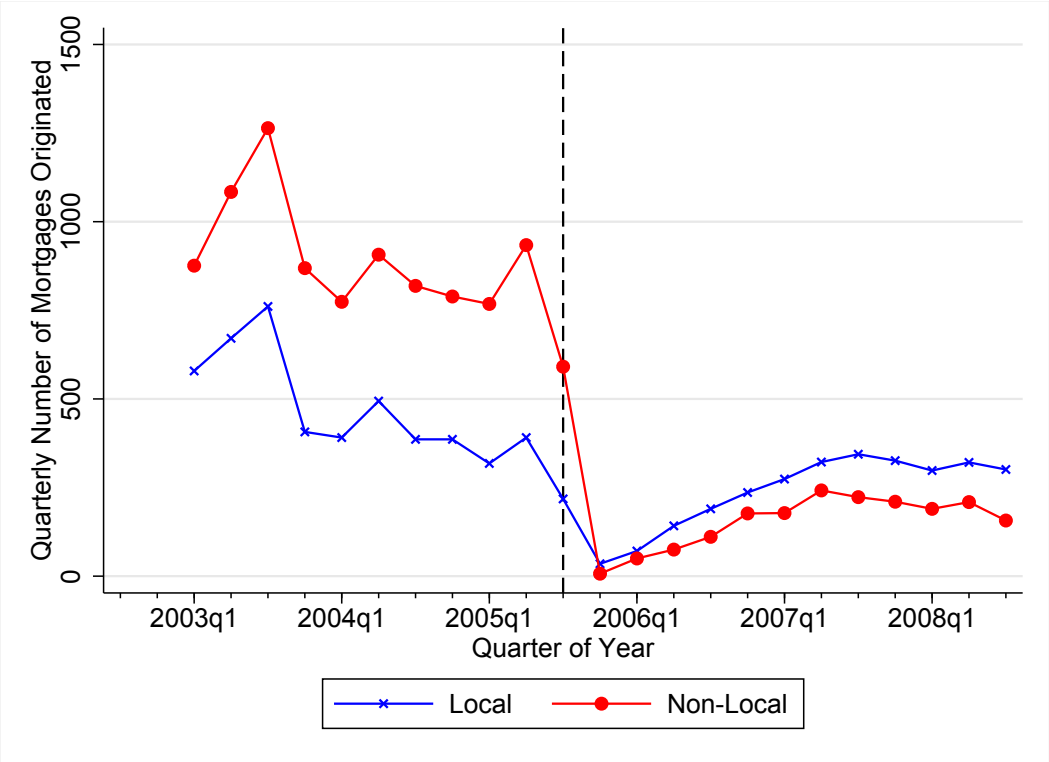
Does regional economic recovery following a disaster depend on the types of banks operating in the community?

- 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)

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, 2021).

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
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 lending 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) Greater total post-disaster lending (home loans)
   (2) (Surprisingly) No clear difference in post-disaster employment rates, wages, or population

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 (Cont.)

- 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 (Cont.)

- 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 (Cont.)

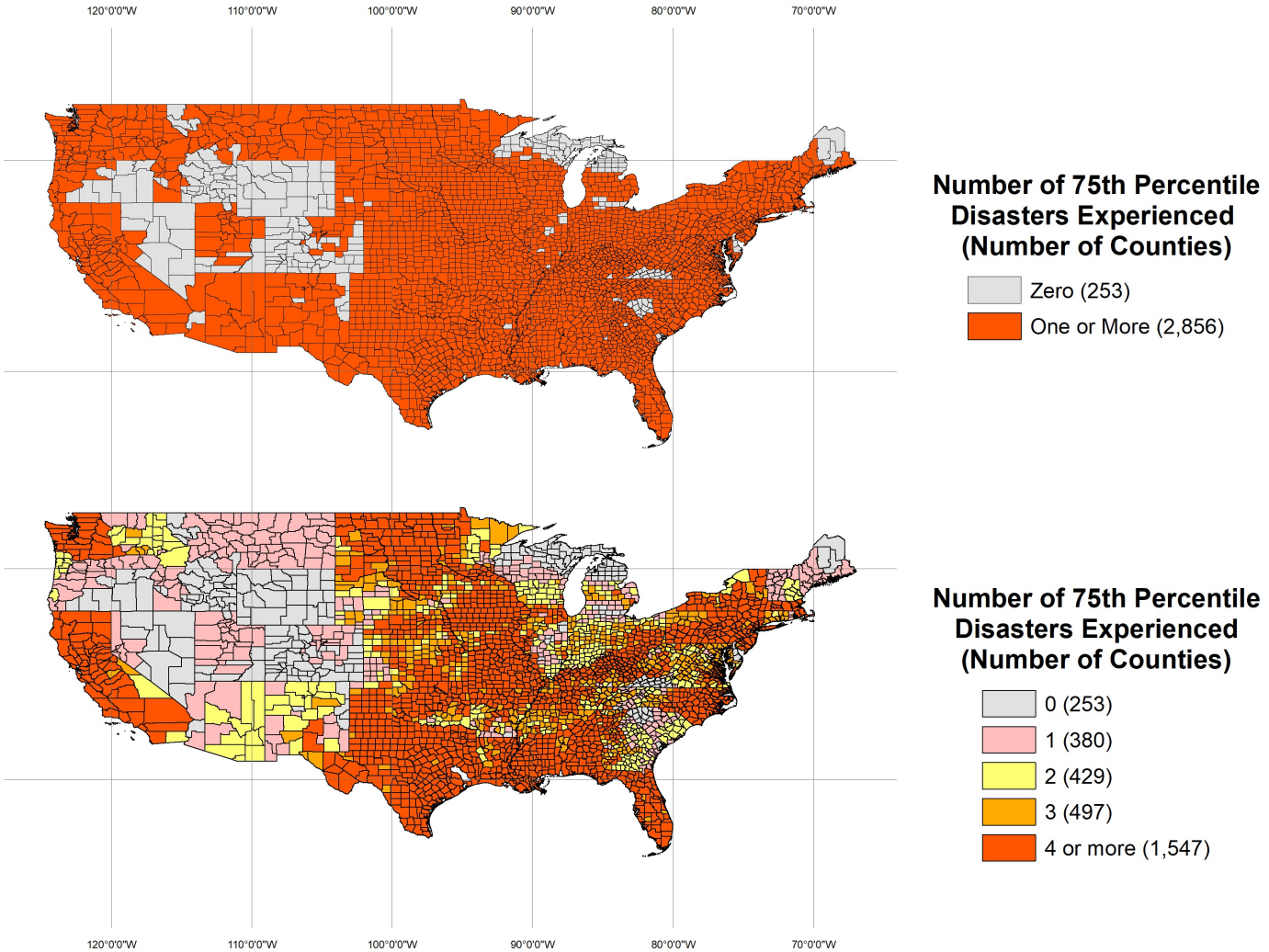
1. **Capacity**: local banks have *less capacity* to lend to a disaster region
   - Local banks are less geographically diversified and less able to import capital
   - The lower capacity to lend in regions with a higher share of local lending will, *all else equal*, decrease post-disaster lending
2. **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 may be especially important after a natural disaster
   - 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 panel database (1981-2014):

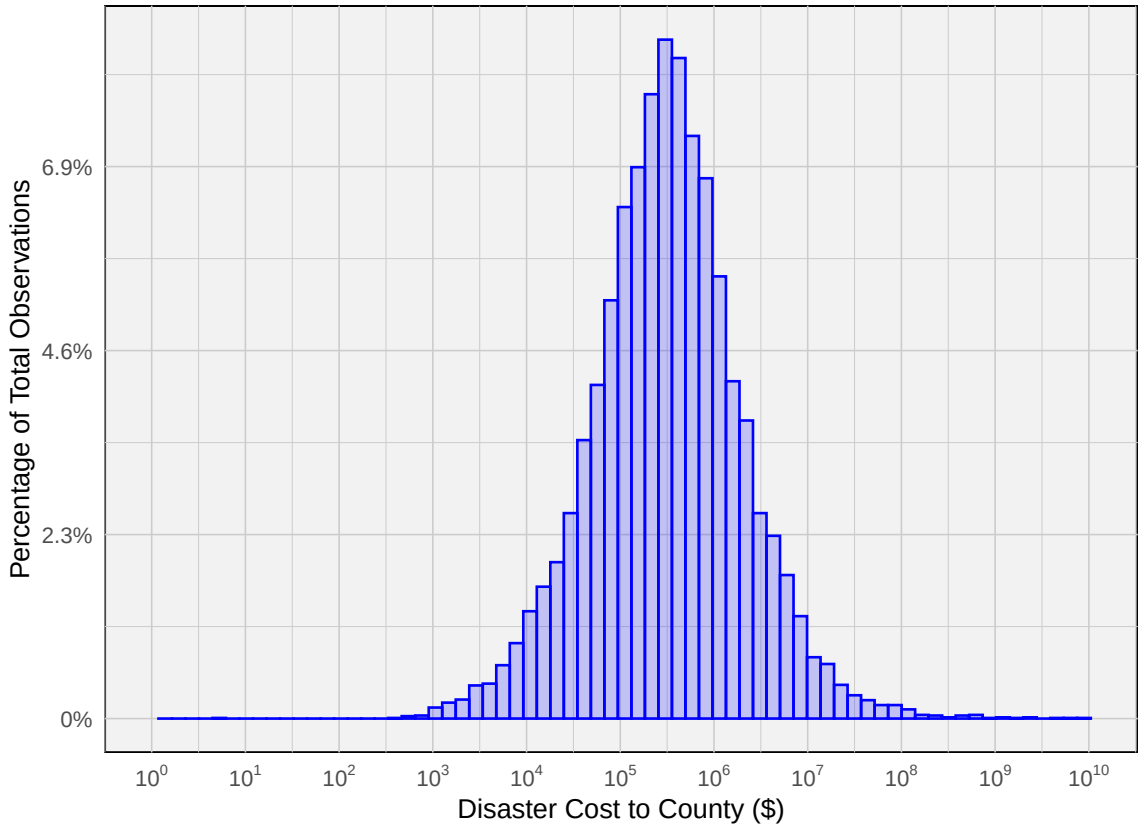
1. **Natural Disaster Incidence and Cost**
   - FEMA Presidential Disaster Declarations for all natural disasters
   - Dollars of Public Assistance (i.e. federal disaster aid to repair infrastructure)
     → Use disaster cost to define "large disasters"
2. **Bank Deposits**: FDIC dollar deposits
   → Use bank deposits to define local banking for a county
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); Property Values (Core Logic)

Location of 75th Percentile Cost County-level Natural Disasters



Presidential Disaster Declaration counties 1981-2014. Data source: FEMA.

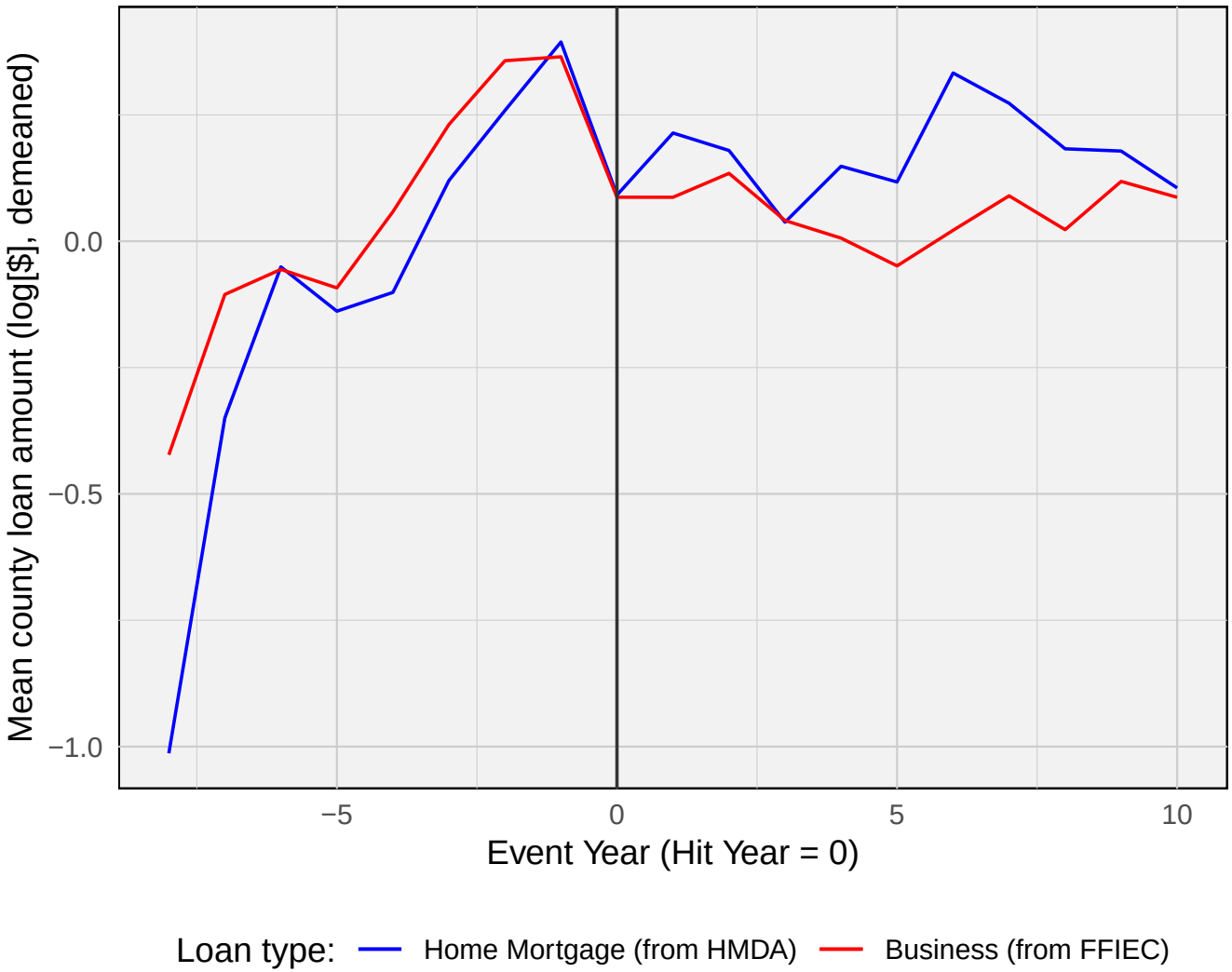
Disaster County Cost follows a Log Normal Distribution



Disaster counties 1981-2014. 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)



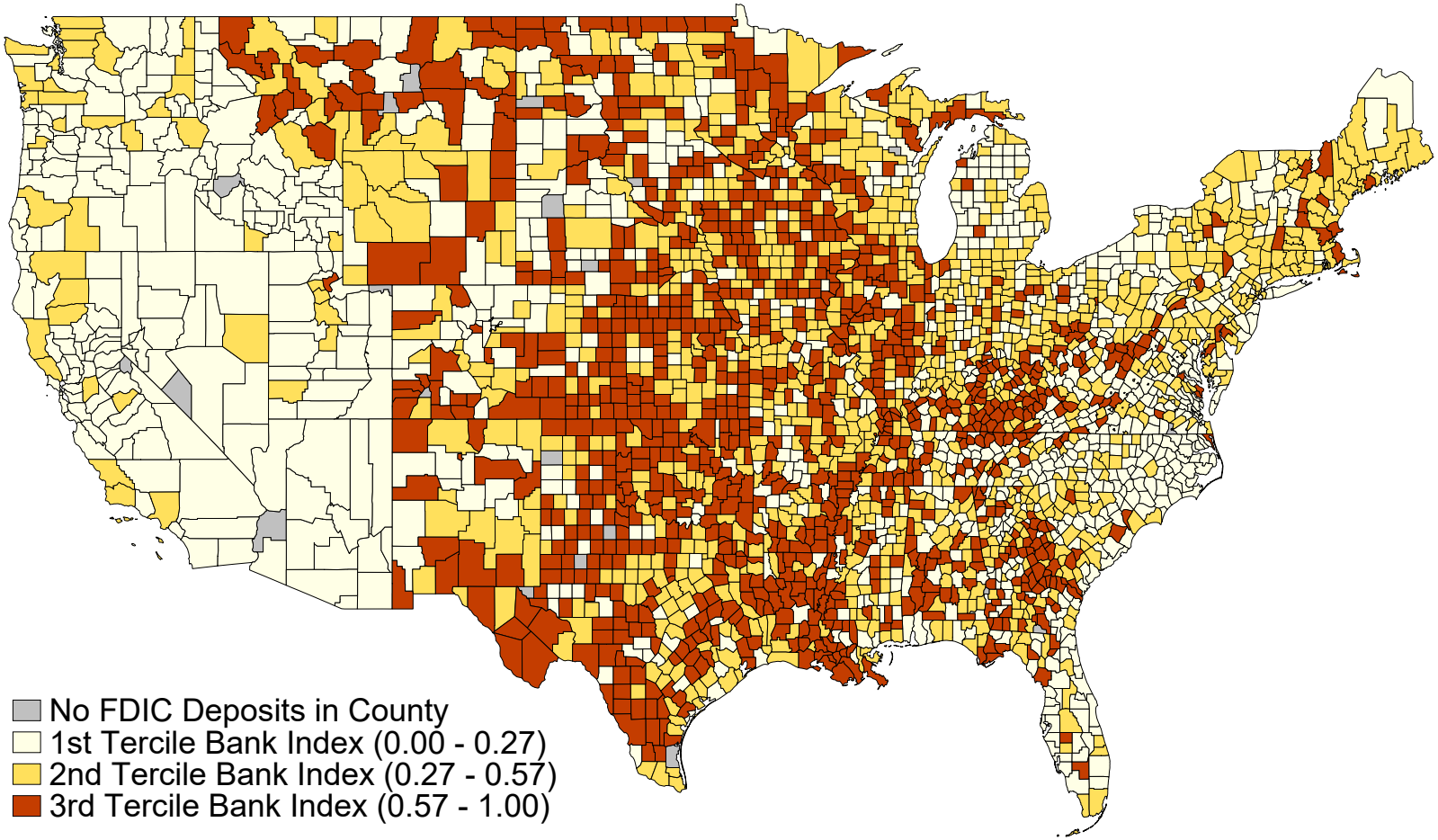
The figure plots the mean level of lending (across counties, after removing county fixed effects) for counties hit by a large disaster with respect to the timing of the disaster.

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

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

US Map Shows County Local Banking Index is Correlated within State

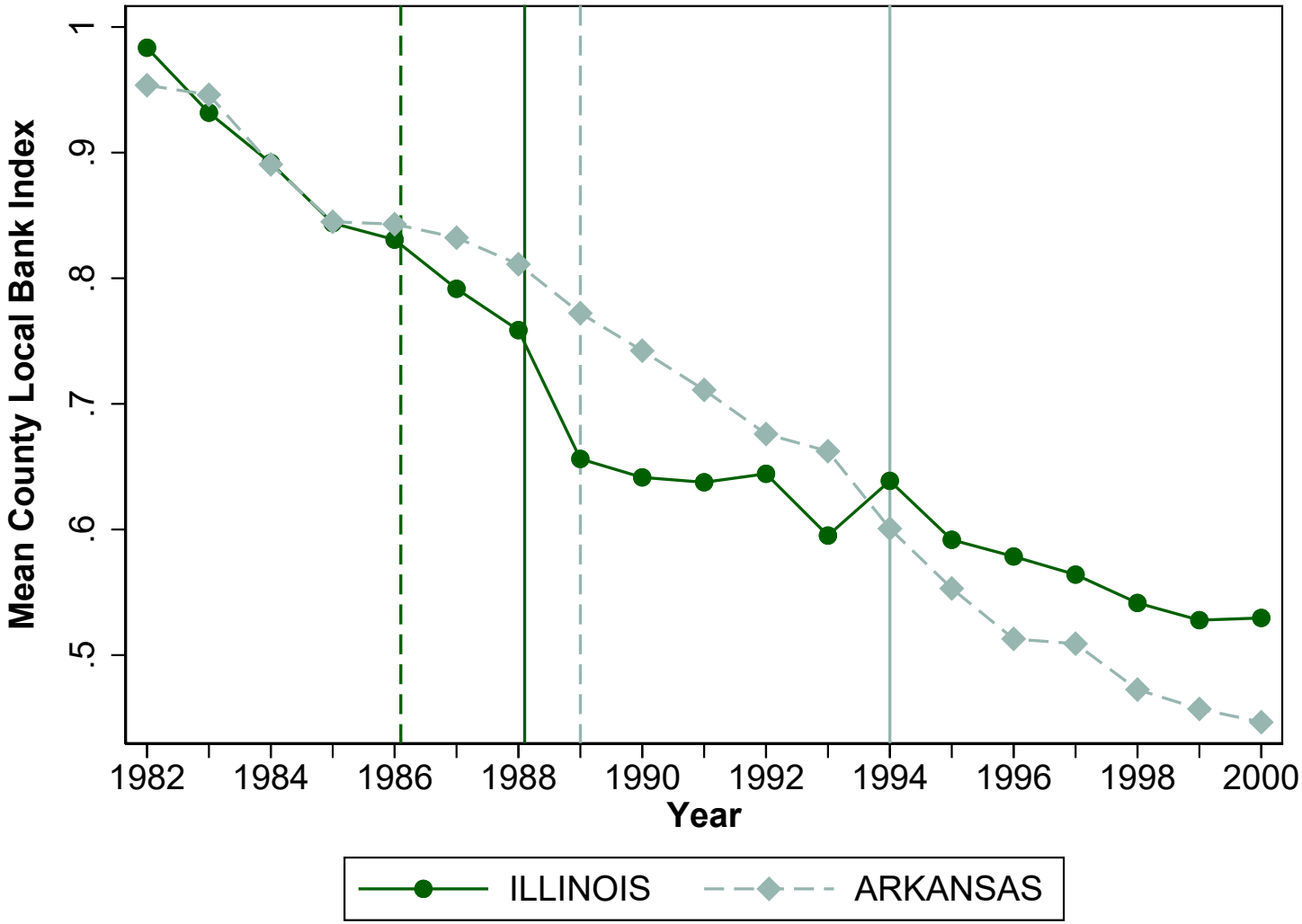


1995 US Map. Data source: FEMA.

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)

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



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

Statistical Model

Event study model estimates a heterogeneous treatment effect based on a continuous pre-treatment characteristic (e.g. Card, 1992)

$$y_{ct} = \sum_{\tau=-a}^{b} \alpha_\tau 1[LargeDisaster_{c\tau}] + \sum_{\tau=-a}^{b} \delta_\tau 1[LargeDisaster_{c\tau}] * LocalBanking_{c\tau=-1} + \sum_{\tau=-a}^{b} \beta_\tau 1[OtherDisaster_{c\tau}] + X_{ct}\beta + \lambda_c + \eta_{dt} + \epsilon_{ct} \quad (2)$$

Notes:

- y_{ct} is an economic outcome (e.g. new loans) for county c in year t
- δ_τ impact of large disaster based on local banking in county in year before disaster
- Baseline model controls for smaller disasters, fixed county characteristics, and year time trends (either year or Census District-by-year FE)
- Some model specifications include X_{ct}: SBA loans, flood insurance coverage
- Cluster standard errors by state

We estimate the model using two approaches

1. The continuous model (Equation 2) using OLS
   - Advantage: Use all the variation in county banking index
2. Imputation approach following Borusyak, Jaravel, and Spiess (2021)
   - Advantage: Avoids potential problems when using OLS, shown in the recent event study literature (e.g. Sun and Abraham, 2021)
   - Disadvantage: Imputation-based approach doesn't allow for a continuous treatment
   - We estimate a binary damage version of Equation 2, where we split the sample at median value of $LocalBanking_{ct}$ in the year before a large disaster

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

$\rightarrow$ 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 (in the year before the disaster)

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
- 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)

Predicted Local Bank Index

We replace $LocalBanking_{ct}$ with $\widehat{LocalBanking}_{ct}$ which is estimated by:

$$LocalBanking_{ct} = \gamma_1 1[\mathbf{Interstate_{ct}}] + \gamma_2 1[\mathbf{Intrastate_{ct}}] + \gamma_3 \mathbf{InterLag_{ct}} + \gamma_4 \mathbf{IntraLag_{ct}}$$
$$+ \sum_{\tau=-a}^{b} \alpha_\tau 1[LargeDisaster_{c\tau}] + \sum_{\tau=-a}^{b} \beta_\tau 1[OtherDisaster_{c\tau}] + X_{ct}\beta + \sigma_c + \phi_{dt} + \nu_{ct} \quad (3)$$

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.
- Control for disaster indicators, fixed county characteristics, and year time trends
- Cluster standard errors by state

Main Sample

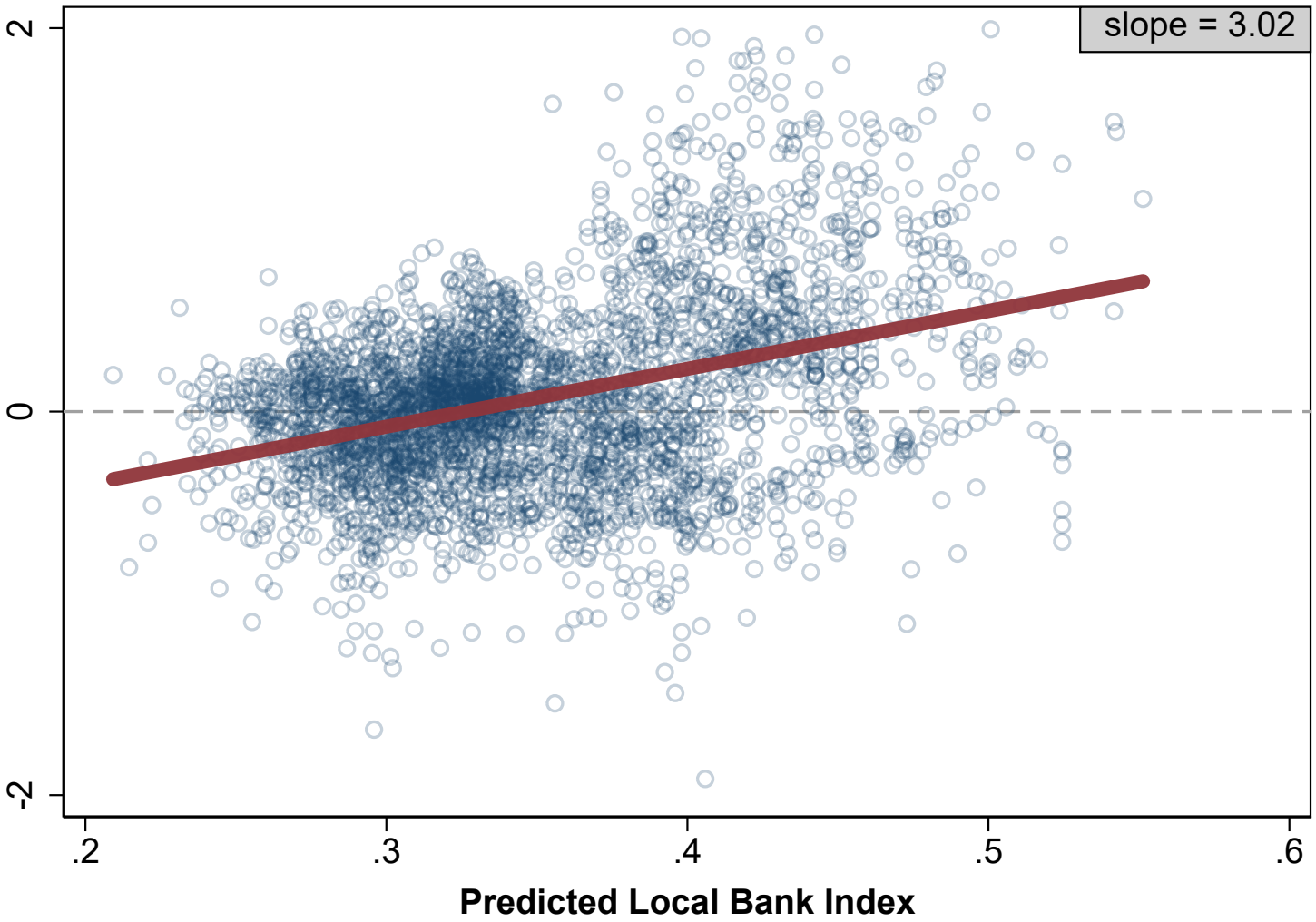
- Our objective is to leverage the deregulation instrument, given data availability
- Main Sample
  - **Data window**: 1990-2010
  - **Treated counties**: only 1 large disaster '90-'00, which occurs '93-'00
    - → Treated counties have 14 obs: 3 pre-treatment, yr large disaster, 10 post-treatment
    - → Allow treated counties to have large disaster after 2000 (control for these)
  - **Control counties**: all counties never hit by a large disaster '90-'10
  - **Cost data**: county-level FEMA cost, large disaster $>$ 75 percentile
- Notes on Main Sample
  - Allows us to estimate the same sample using OLS and BJS (2021)
  - Uses county-specific FEMA cost data (not available pre-1990)
  - Can observe home loans, an important measure of credit (not available pre-1990)

Predicted Bank Index

Dependent Variable: County Local Banking Index		
Sample:	1981-2014 Full Panel	1993-2000 Event Time
	(1)	(2)
Intrastate Indicator	-0.131***	-0.070**
	(0.011)	(0.031)
Interstate Indicator	-0.026	-0.111**
	(0.017)	(0.045)
Intrastate Lag	0.003***	0.009***
	(0.001)	(0.002)
Interstate Lag	0.020***	-0.020
	(0.000)	(0.027)
Disaster Indicators	X	X
Census Div by Year FE	X	X
R^2	0.751	0.812
Observations	99,106	52,838
F-Stat, Regulation	56.4	11.2

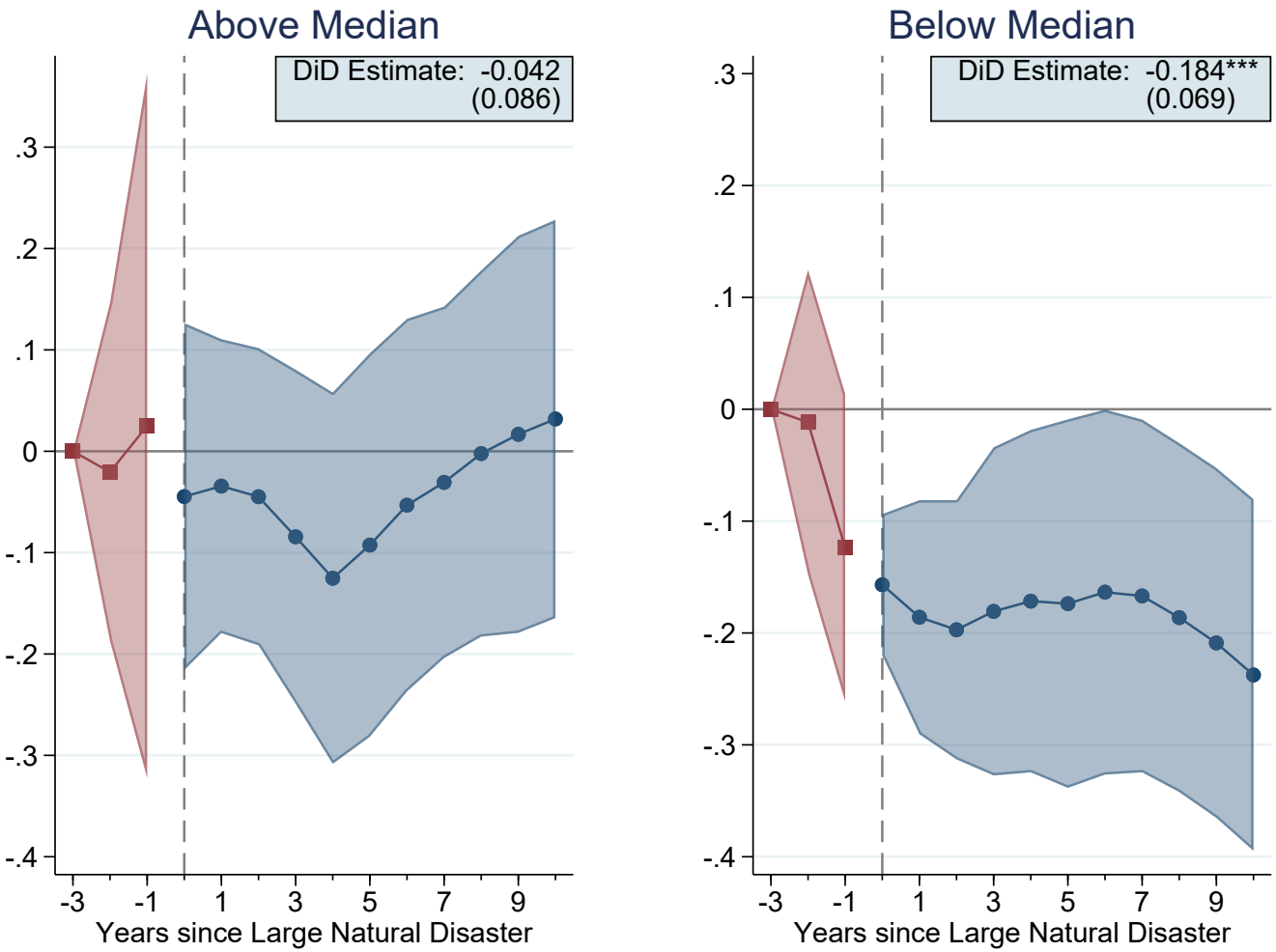
Data Sources: FDIC; FEMA; Morgan, Rime, and Strahan (2004).
Significance level: *** 1%, ** 5%, * 10%.

Difference in Loan Dollars in the Year following a Large Natural Disaster



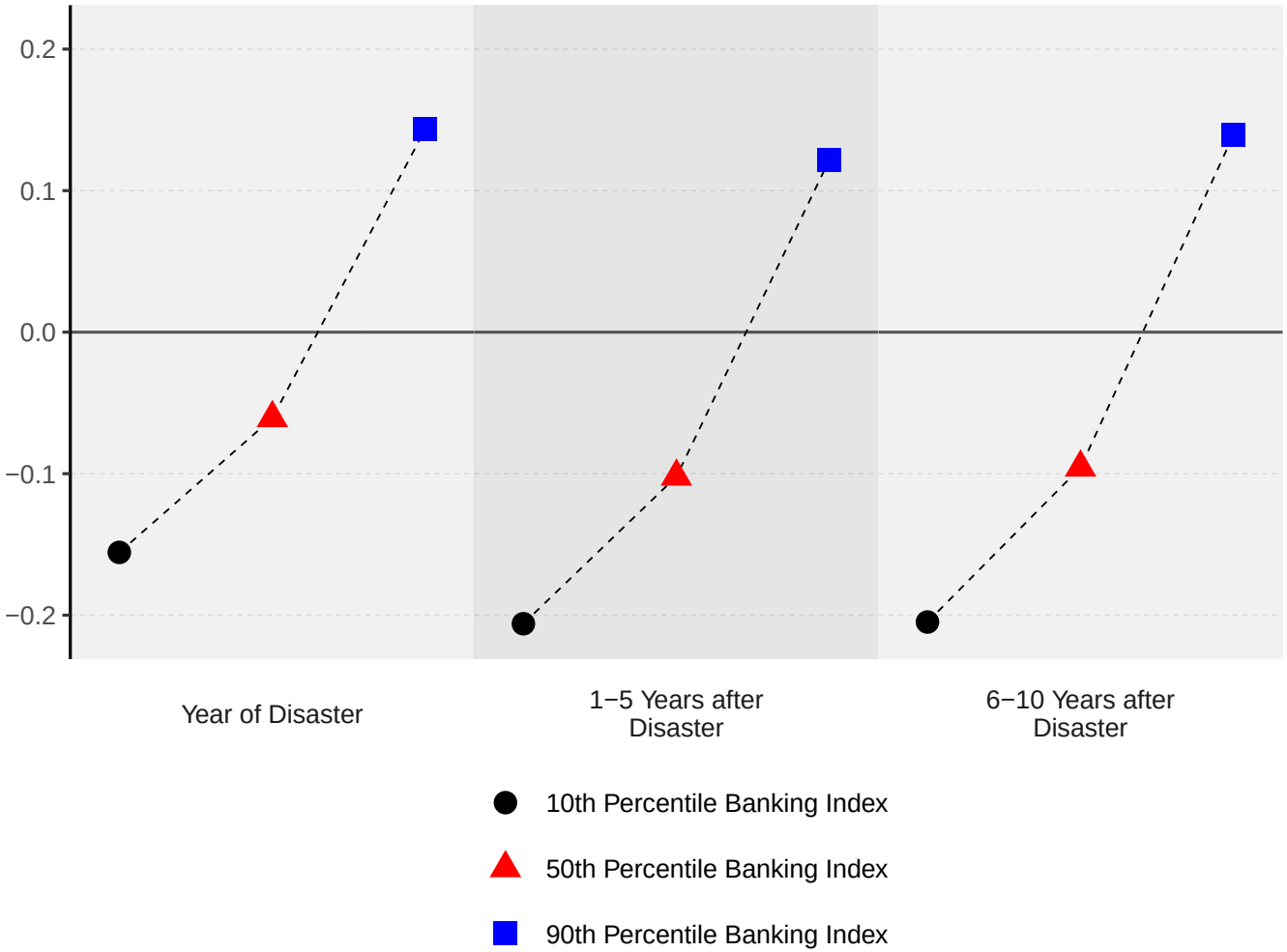
The figure plots the immediate change in ln loan dollars for new originations for all county years with a large disaster (1991-2013). Data sources: FDIC; FEMA; HMDA; Morgan, Rime, and Strahan (2004).

New Home Loans are Greater in Counties with Higher Predicted Local Bank Index



Dependent Variable: Ln Home Loan Dollars. Estimation using Borusyak, Jaravel, and Spiess (2021).
Data sources: FDIC; FEMA; HMDA; Morgan, Rime, and Strahan (2004).

New Home Loans are Greater in Counties with Higher Predicted Local Bank Index

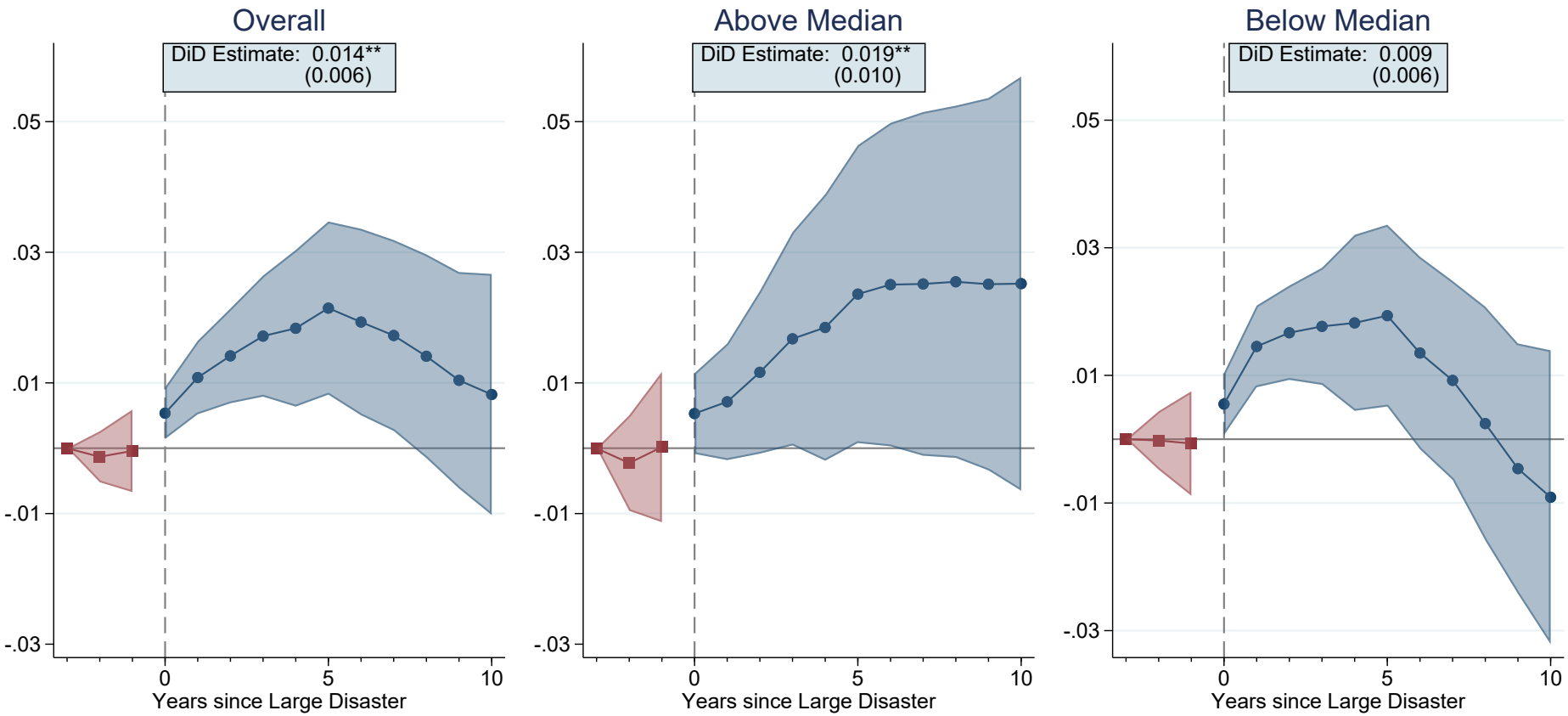


Dependent Variable: Ln Home Loan Dollars. Estimation using Equation 2 via OLS.
Data sources: FDIC; FEMA; HMDA; Morgan, Rime, and Strahan (2004).

Model Limitation

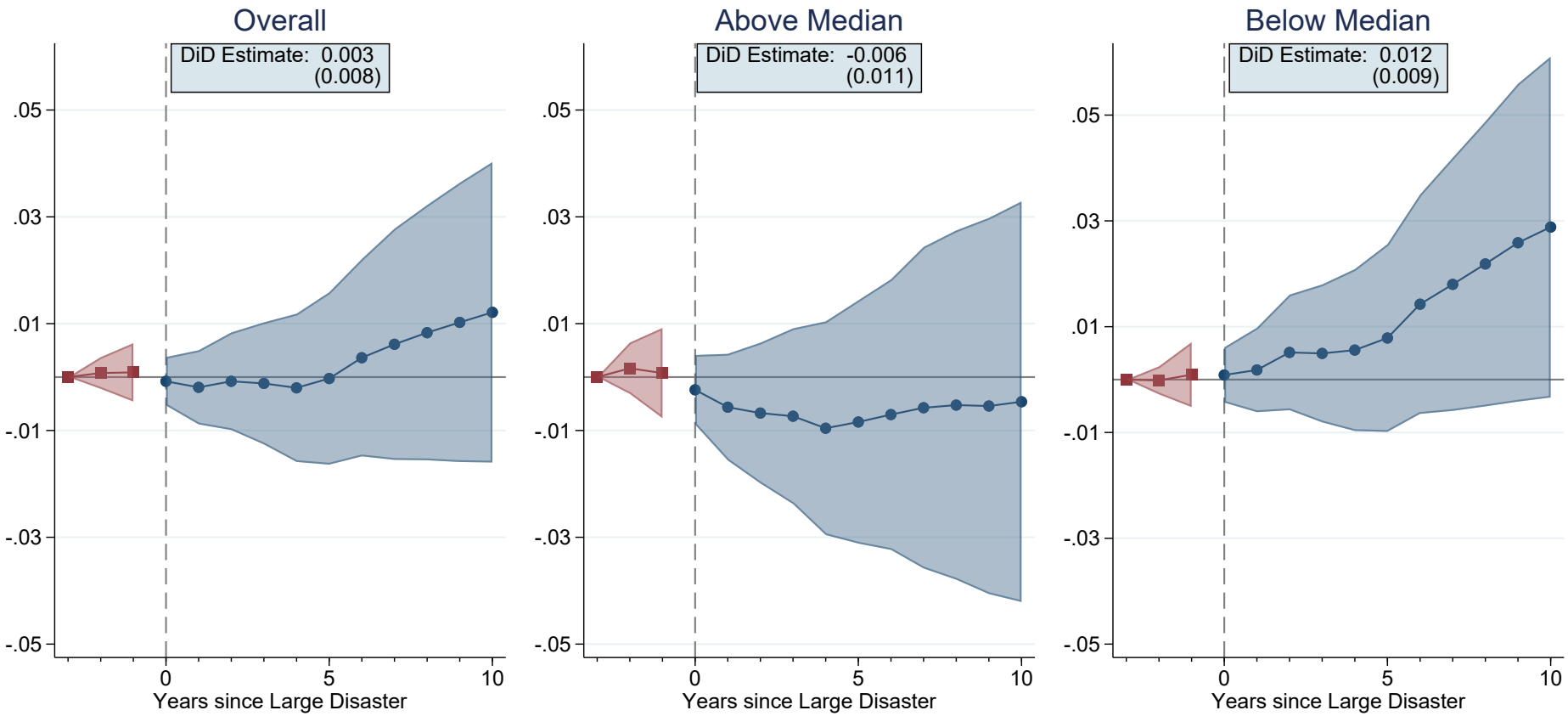
1. There is suggestive evidence that new home lending is already decreasing before a large disaster for counties with more non-local banking
   (1) Imputation (BJS, 2021) model: Drop in lending year before a large disaster (stat. sig. at 10% level)
   (2) OLS model: Pooled 2-3 year interaction variable is positive (stat. sig. at 10% level)
2. Thus, we are still cautious in interpreting our lending results
3. Work in progress includes an approach that uses a propensity score model to select control counties (rather than including all never-treated)
   → Preliminary results suggest that there is still less lending in counties with a higher level of non-local banking, but that the difference is a bit smaller

Change in Wages following a Large Disaster



Event study coefficients and 95% confidence intervals for the change in ln wage per capita following a large disaster using our event study model and sample 1. The box in each panel displays the DiD estimate and standard error. Data sources: FDIC; FEMA; Morgan, Rime, and Strahan (2004); US BEA.

Change in Population following a Large Disaster



Event study coefficients and 95% confidence intervals for the change in ln population following a large disaster using our event study model and sample 1. The box in each panel displays the DiD estimate and standard error. Data sources: FDIC; FEMA; Morgan, Rime, and Strahan (2004); NBER.

Conclusion

1. We build a new database to explore whether credit and local economic outcomes differ following a large natural disaster based on the level of local banking at the time of the disaster

2. Overall, there is around a 10% reduction in new home loans in US counties for the 10 years following a large natural disaster
   - The reduction in home loans is greater in counties where geographically diversified (non-local) lenders have a higher market share at the time of the disaster

3. Overall, there is a modest increase in average wages and the employment rate post-disaster
   - No difference by whether a county has more local banking at the time of a large disaster

4. A limitation to our current results is suggestive evidence that new lending is trending downward in counties with greater non-local lending pre-disaster
   - Preliminary results from a model that matches control counties supports our findings