Economics 742 Bonus (Old) Lecture: Regional Shocks and Evolutions

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Outline for Today

- Sources of regional variation and facts about regional change relevant to using regional variation to think about macro.

1. Regional Shocks
   - 1.1 Share-Shift ("Bartik") Shocks
   - 1.2 Housing Supply Elasticity, Saiz (2010), and Related Shocks
2. Regional Evolutions
   - 2.1 Blanchard and Katz (1992)
   - 2.2 Howard (2020): Blanchard and Katz revisited.
   - 2.3 Yagan (2019) on regional experiences in Great Recession

Regional Shocks

- Lots of macro-relevant data is reported regionally!
- Regional equilibria and shocks to regions are endogenous.
- For identification of macro-relevant responses to shocks, need *exogenous shocks*.
- Begin with frequently-used regional shocks / instruments:
  1. Share-Shift "Bartik" Shocks
  2. Saiz Housing Supply Elasticity

Share-Shift ("Bartik") Shocks: Idea

- National-level shocks affect some regions more than others because they have a greater share of responsive agents.
- So consider a shock that interacts
  - Initial *share* of responsive agents.
  - With the national shock, measured as the average shock across regions using a leave-out mean to prevent endogeneity.
- Often called a "Bartik Shock" because Blanchard and Katz (1992) cite Bartik (1991) as giving intuition.
- Used both as a shock and an instrument.
  - How are these different?

Share-Shift ("Bartik") Shocks: Examples We Will See

- "Classic" Bartik Shock to local employment is sum of local industry share $\times$ national industry shock.
  - Intuitively, if steel nationally outside of Pittsburgh does badly, then Pittsburgh should do badly.
- Other "Industry" Share-Shift Shocks
  - Local wage shocks by worker skill (Diamond, 2016)
  - Decline of manufacturing (Charles et al., 2018)
  - Penetration of Chinese imports (Autor-Dorn-Hanson, 2013) or robots (Acemoglu and Restrepo, 2019)
  - Military spending shocks (Nakamura and Steinsson, 2014)
- Bank Share-Shift Shocks
  - Foreign bank shock (Peek and Rosengren, 2000)
  - Bank health in Great Recession x bank locations prior to recession (Greenstone et al., 2020; Mondragon, 2020)

Share-Shift ("Bartik") Shocks: Formalism

- Define the Bartik shock to location j at time t as

$$\Delta \log \hat{X}_{j,t} = \sum_{ind} \left(\log X_{ind,-j,t} - \log X_{ind,-j,t-1} \right) \frac{X_{ind,j,t_{base}}}{X_{j,t_{base}}}$$

  - $-j$ is all locations but j.
  - Can do over any horizon.
  - t_{base} can be $t-1$ but can also be a longer lag.
  - Need not be in logs

- "Classic" Bartik shock uses employment for X and is interpreted as labor demand shock.

Example: Autor, Dorn, and Hanson (2013) "China Shock"

- What is the effect of import competition on labor markets?
  - Large increase in imports from China after it joined WTO.
  - Simultaneous decline in manufacturing in U.S.
  - Are these related?
- Approach: Look at local labor markets (commuting zones).
  - Shares: Industrial specialization within manufacturing.
  - Shift: Increase in Chinese imports by sub-industry due to differential Chinese comparative advantage.
- Change in Chinese import exposure per worker:

$$\Delta IPW_{uit} = \sum_j \frac{L_{ijt}}{L_{ujt}} \frac{\Delta M_{ucjt}}{L_{it}}$$

where u is U.S., c is China, i is CZ, and j industry.

- Control for manufacturing share in regressions.

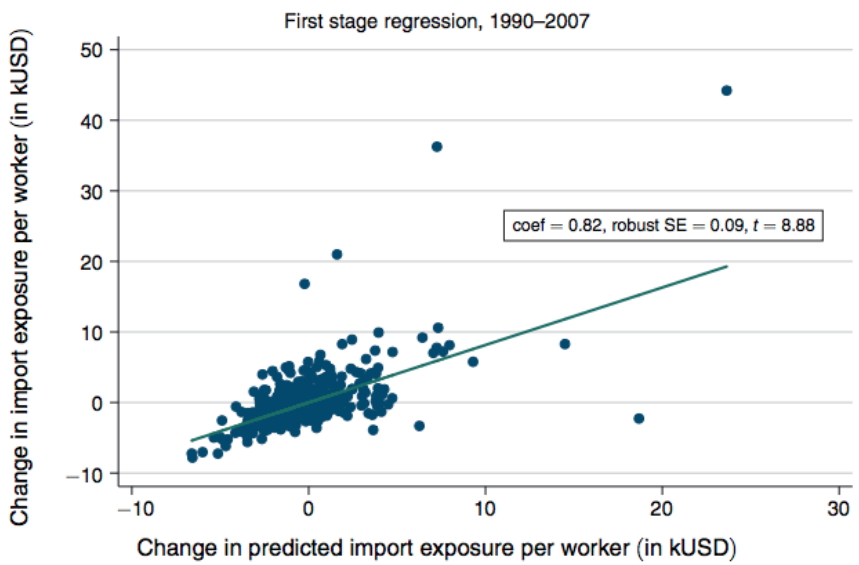
Example: Autor, Dorn, and Hanson (2013) "China Shock"

- Chinese comparative advantage with U.S. is endogenous!
  - Instrument for U.S. import growth by industry with growth in imports by other high-income markets

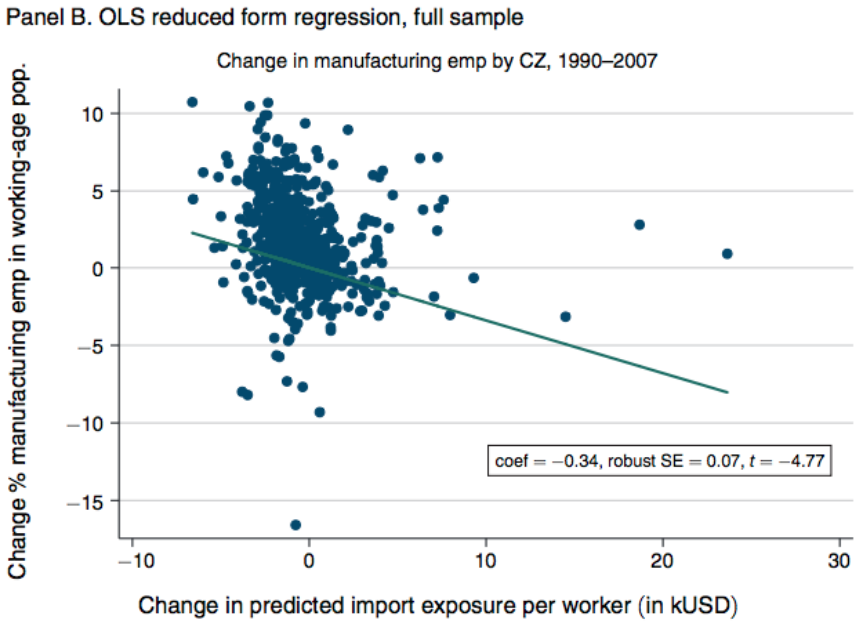
$$\Delta IPW_{oit} = \sum_j \frac{L_{ijt-1}}{L_{ujt-1}}$$

  - 10 year lags to limit expectations of future trade.
  - Turns out not to matter much.

Panel A. 2SLS first stage regression, full sample



Example: Autor, Dorn, and Hanson (2013) "China Shock"



- Relative to 25th percentile of exposure, 75th percentile has:
  - 4.5% fall in manufacturing employees.
  - 0.8 pp larger reduction in employment/population
  - 0.8% larger decline in wages.
  - 2-3.5% Increases in unemployment, disability, and transfer programs.

Share-Shift ("Bartik") Shocks: Concerns

1. Pre-Shock Shares Correlated With Outcome
   - 1.1 If time lag is short and shocks are serially correlated.
   - 1.2 Endogeneity of shares.
     - Usually argue shares based on historical accidents.
     - Never clear to me if this is the dominant source of variation.

2. Shock is Correlated With Other Shocks
   - 2.1 For instance, bad banks go into worse areas, make worse loans, and then have worse national shocks.
   - 2.2 In "classic" Bartik, concern is corr with "labor supply shocks."
     - Works if national growth rates are not correlated with the supply shock $\Rightarrow$ industries are not too concentrated.
     - In reality, picks up mixture of supply and demand shocks.
     - E.g., If female labor supply expands nationally, Bartik shows it as demand shock to female-dominated industries.

Three Recent Formalizations of Issues With Bartik

1. Adao, Kolesar, and Morales (2019): Inference, thinking of *shifts* as randomly assigned.
   - Cities have similar industrial shares; creates clustering problem.
   - Monte Carlos: Rejection rate for 5% CIs is 45-55%!
   - Novel standard errors to fix.
2. Borusyak, Hull, Jaravel (2021): Identification, thinking of *shifts* as randomly assigned.
   - Re-frame as coefficients from share-weighted *shock-level* IV.
   - Valid when *shocks* idiosyncratic, many, and dispersed.
   - Placebos and first stage F statistics at level of shocks.
3. Goldsmith-Pinkham, Sorkin, and Swift (2020): Identification, thinking of *shares* as randomly assigned.
   - Reframe as coefficients from shock-weighted *share-level* IV.
   - Diff-in-diff exposure design with exposure based on *shares*.
   - Tests based on diff-in-diff interpretation, over ID, exog of shares. Provide weights so you can see what industries matter.

- Depends on setting, but my view is random shifts typically makes most sense.

Housing Shocks

- House price variation is also frequently used.
  - Either housing market matters directly (Mian and Sufi).
  - Or as instrument for elasticity of supply of labor to an MSA.
    - More in labor/urban than macro. e.g., Diamond (2016).
- Shocks Used:
  - Saiz (2010) Housing Supply Elasticity / Land Unavailability.
  - Palmer (2015) – historical volatility.
  - See also Favara and Imbs (2015) who use bank branching deregulations to instrument for credit expansion.

Saiz (2010): Summary

- Housing supply elasticity is key parameter:
  - If perfectly elastic, demand shocks affect q not p.
  - If perfectly inelastic, demand shocks affect p not q.
- Idea: elasticity is related to *land availability.*
  - Featureless plain where can easily build outward (e.g. Tulsa).
    - Prices pinned at structure costs (roughly constant).
  - Island (e.g. Manhattan).
    - Once fill in can only build up (expensive) or purchase land.
    - Upward-sloping marginal cost $\Rightarrow$ inelastic supply.
- Saiz creates measure of land unavailability, shows it is positively related to endogenous supply elasticity.
  - Good instrument because exogenous to "modern" shocks.

Saiz (2010): Unavailability Measure

- Get location of "center city" (determined in early 20th Cent)
- "Unavailability" is fraction of land in 50km radius that is:
  1. Water.
  2. Too steep to build on.
- High unavailability $\Rightarrow$ volatile house prices, constrained supply.
  - LA, Miami, San Francisco, New York.
- Low unavailability $\Rightarrow$ stable prices, unconstrained supply.
  - Wichita, Omaha, Tulsa, Dallas.
- But in 2000s, fairly elastic MSAs had strongest boom-bust.
  - Las Vegas, Phoenix (see Nathanson and Zwick, 2018).

Saiz Elasticities (Table 3, Column 6 Predicted Values)

$$\Delta \ln P = \psi_{region} + \sigma_k \Delta \ln CC + \beta^{Reg} \ln WRI + \left[\beta^{Land} + \beta^{Land,Pop} \ln\left(Pop_{t-1}\right)\right] Unaval \times \Delta \ln H + \varepsilon$$

Unavailable land $\times \Delta\log(Q)$	−5.329
	(0.904)***
Log(1970 population) $\times$	0.481
unavailable land $\times \Delta\log(Q)$	(0.117)***
log(WRI)$\times \Delta\log(Q)$	0.301
	(0.066)***

- Calibrated intercept related to structure share of value, change in construction costs.
- Demand shocks instrumented with Bartik, immigration shock, Jan temperature
- Wharton Land-Use Regulation Index treated as exogenous.

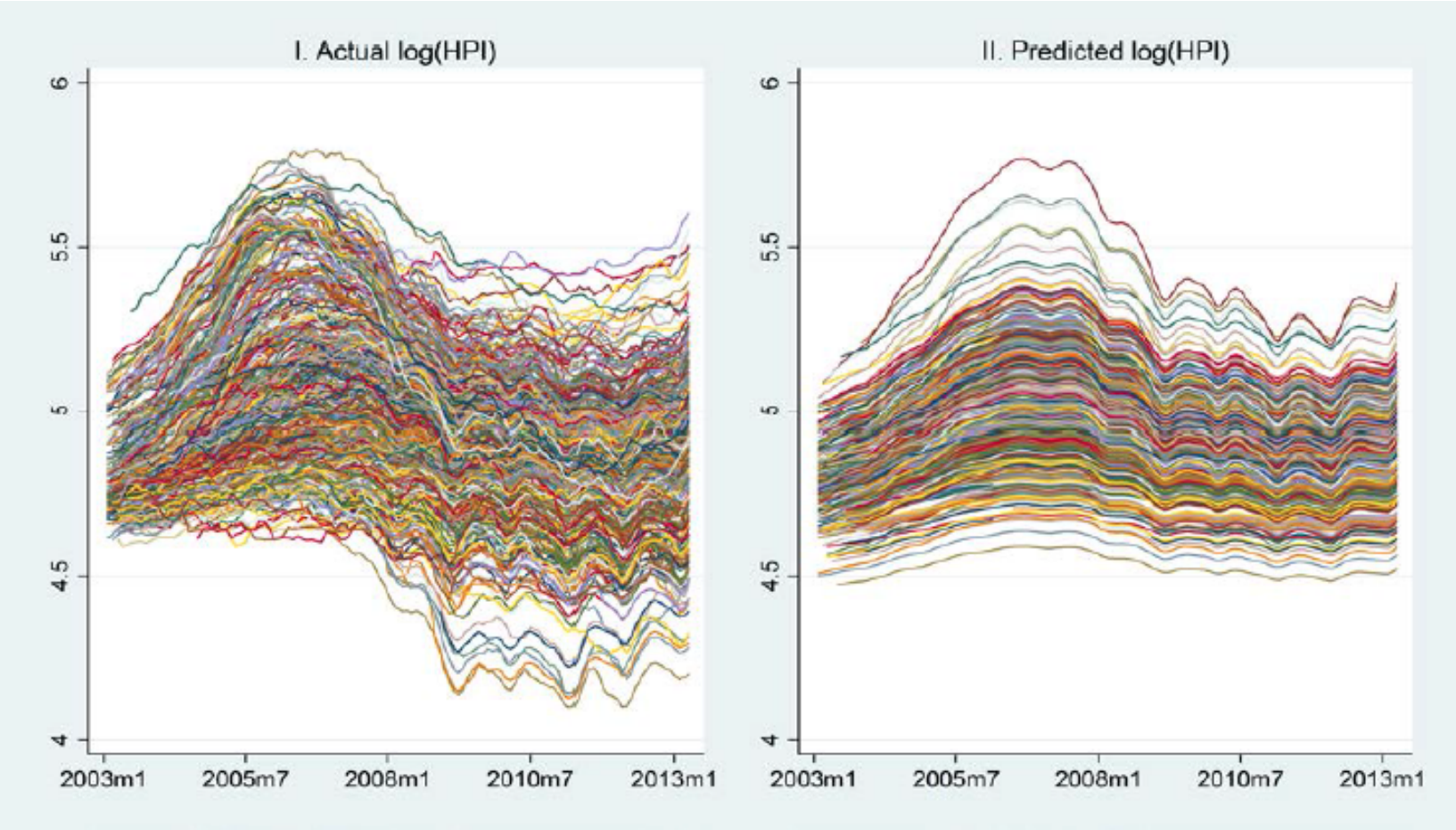
Saiz (2010): Notes on Use and Concerns

- Saiz data set includes Wharton Land-Use Regulation Index
  - Positively correlated with house price elasticity.
  - He shows it is endogenous!
- Saiz data set has elasticities, which are predicted values from regression with WRI.
  - Should instrument with land unavailability.
- Primary concern is that land unavailability is correlated with "modern" outcomes in other ways.
  - Davidoff (2013) criticizes using Saiz for 2000s cycle.
    - Most of variation simply explained by "sand state" dummies (AZ, CA, FL, NV). This could be corr with other things.
    - Argues residual variation is not corr with supply elasticity. Driven by long-term demand trends for coasts.
  - Quantity also goes against supply elasticity story.
- Only available at MSA level for 269 MSAs (but see recent working paper by Lutz and Sand)

Palmer (2015): Historical Volatility

- Related instrument that has benefit that can be constructed only from price data (more MSAs).
- Persistence of price cycles $\Rightarrow$ shock based on past volatilities.
  - Estimate standard deviation of house prices from 1980-1995.
  - Instrument is $\hat{\sigma}_{MSA} \times 1\,[month]$ in regression with month FE.
  - Does for 900 MSAs with CoreLogic data, could do for ZIPs.
- Intuitively, creating "predicted price change" by interacting national changes with local volatilities – like Bartik shock.
  - Exclusion restriction: Historical volatility independent of "modern" outcomes (testable).
    - He shows it is uncorrelated with subprime share, for instance.
  - Drawback: Less clear why this is exogenous relative to Saiz.

Palmer (2015): Visual First Stage



Guren, McKay, Nakamura, and Steinsson (2021): Housing Wealth Effects: The Long View

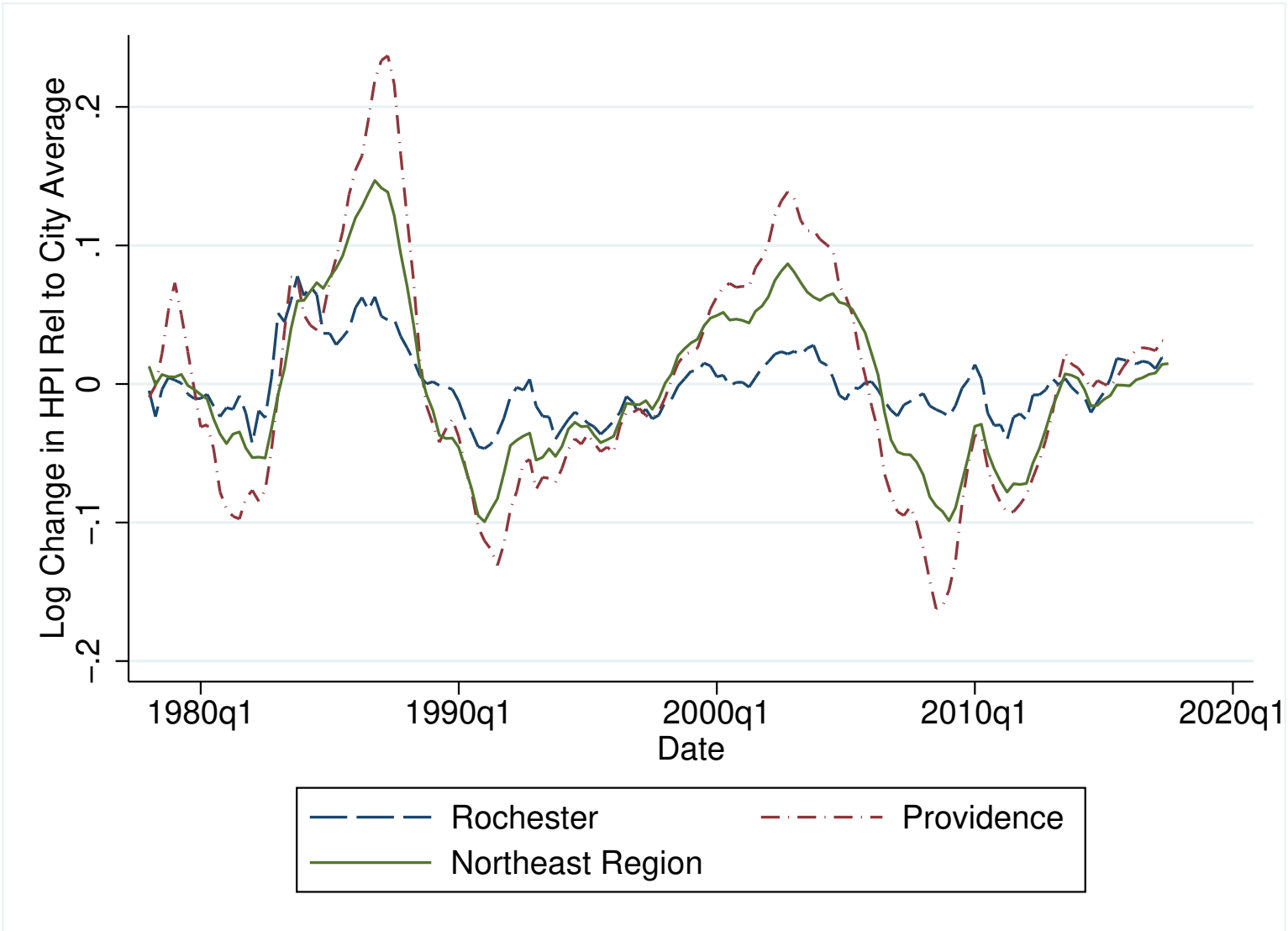
- Substantial evidence of "housing wealth effects" in the 2000s boom and Great Recession (Mian and Sufi)
- Where the 2000s boom-bust special?
  - Boom: Automated underwriting, subprime credit, HELOCs
  - Bust: House price and credit $\downarrow$ trigger deleveraging
- What We Do
  - Estimate housing wealth effect back to early 1980s using consistent methodology
    - Today: Novel cross-cities identification strategy building on Palmer (2015)
    - Next Class: Large housing wealth effect back to 1980s
  - Next class: Explain results using model "new canonical model" of housing wealth effects

Empirical Framework

$$\Delta y_{i,r,t} = \psi_i + \xi_{r,t} + \beta \Delta p_{i,r,t} + \Gamma X_{i,r,t} + \varepsilon_{i,r,t}$$

- i is CBSA (i.e., city), r is region, t is quarter, and Δ is annual difference.
- Goal is to estimate β
  - Effect of a foreign demand shock to housing in a structural model
- Exploit panel dimension: Control for fixed effects, industry shares, diff exposure to agg shocks.
  - Addresses Davidoff concerns, concerns about diff exposure to cycle.
- New approach to identification: "sensitivity instrument"
  - Exploit differential sensitivity of local house prices to regional housing cycles (Sinai 2012; Palmer 2015)
  - Compare to OLS and panel Saiz, which tell same story.

Sensitivity Example: Providence vs. Rochester



Sensitivity Instrument: First Pass

- Estimate:

$$\Delta p_{i,r,t} = \varphi_i + \gamma_i \Delta P_{r,t} + \nu_{i,r,t}.$$

  and use $\hat{\gamma}_i \Delta P_{r,t}$ as our instrument?

- Intuition: Differences in housing supply curves across locations lead to different response of house prices to aggregate shocks
- Concern: Heterogeneous $\hat{\gamma}_i$ could arise from reverse causation
  - Heterogeneous industrial structure $\rightarrow$ heterogenous business cycle volatility $\rightarrow$ heterogeneous house price volatility

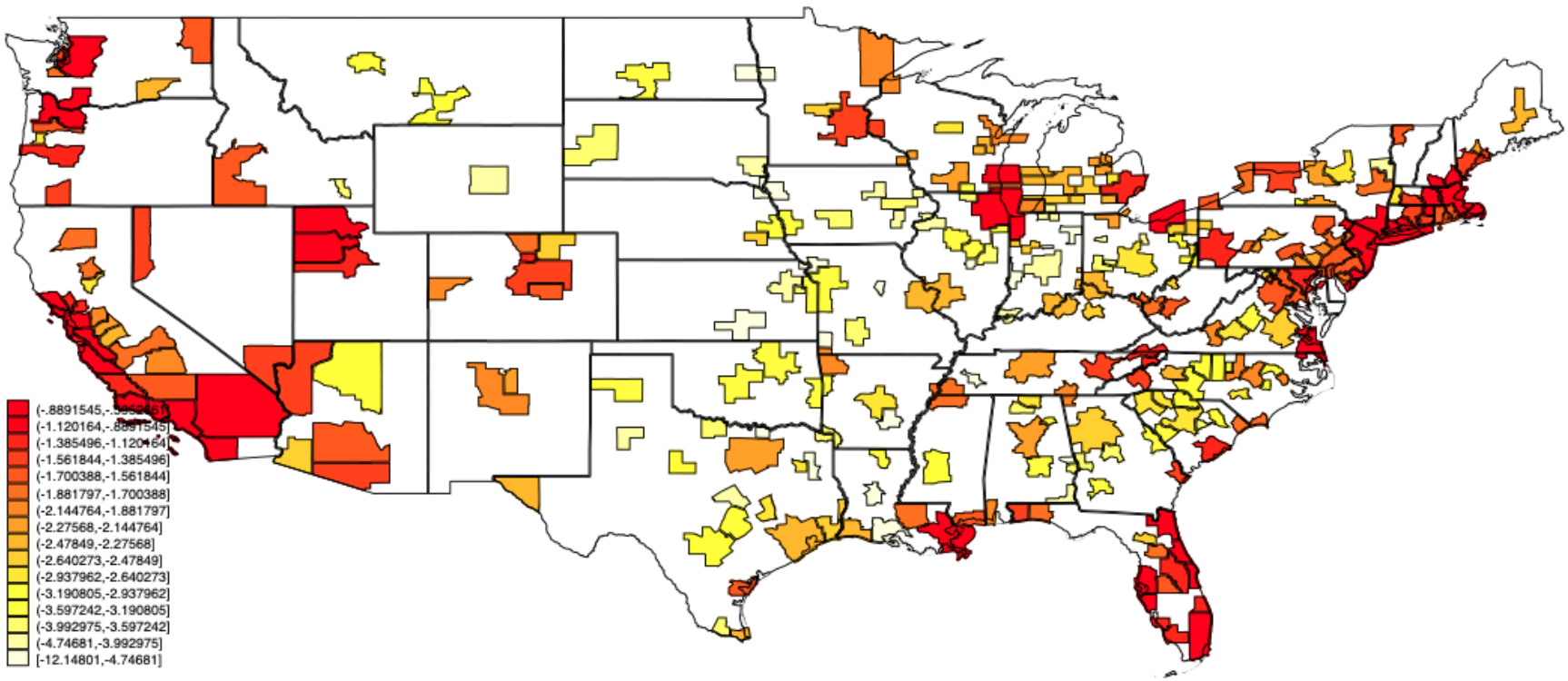
Sensitivity Instrument: Refined Version

- Control for local and agg change in y when estimating γ_i:

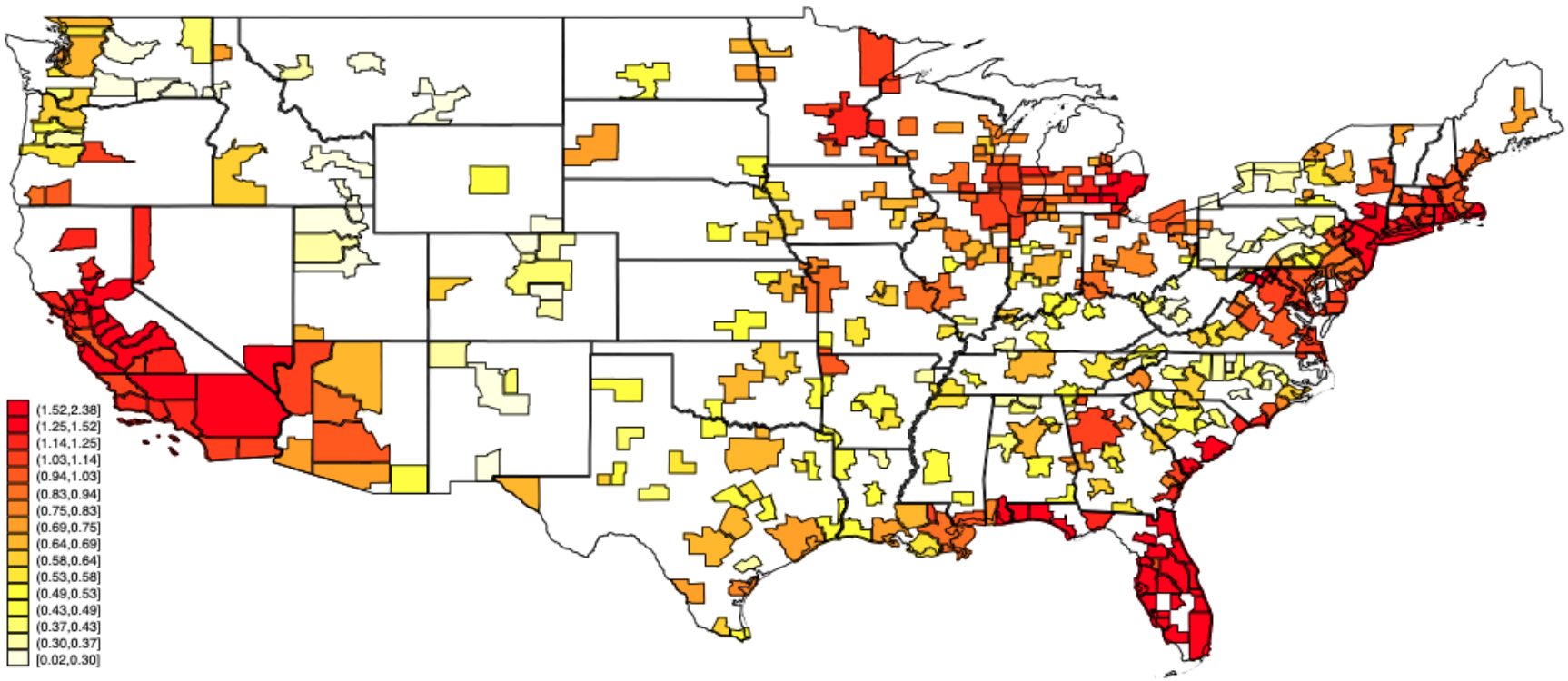
$$\Delta p_{i,r,t} = \varphi_i + \delta_i \Delta y_{i,r,t} + \mu_i \Delta Y_{r,t} + \gamma_i \Delta P_{r,t} + \nu_{i,r,t}$$

  and use $\hat{\gamma}_i \Delta P_{r,t}$ as our instrument.
  - R-squared without $\gamma_i \Delta P_{r,t}$ term: 0.24
  - Adding $\gamma_i \Delta P_{r,t}$ term raises R-squared to 0.71!
  - **Large part of housing cycles orthogonal to local employment cycles.**
- $\hat{\gamma}_i \Delta P_{r,t}$ correlated with Saiz and Wharton Land Use Regulation Index, but much more powerful.
  - Interpretation: Better measure of supply elasticity.
  - Concern: Including some "endogenous" variation. But Saiz also endogenous, so might as well use all the variation we have and purify it as best we can.

Heat Map: Saiz Elasticity



Heat Map: Sensitivity Instrument



Identifying Assumption

- Not some other unobserved aggregate factor that:
  1. Moves with house prices in time series.
  2. Differentially affects the same set of cities
- Similar to assumptions behind a Bartik instrument
  - Consider differential exposure to oil shocks (Texas vs Florida)
  - Not some other factor that happens to differentially affect Texas at the same time as oil price go up
- Panel data allows us to add controls:
  - We can estimate sensitivity to other observables and control
  - *E.g.*, cyclical sensitivity, industrial structure
  - Identification assumption *conditional on these controls*.

Cyclical Sensitivity Control

- Estimate:

$$\Delta y_{i,r,t} = \psi_i + \xi_{r,t} + \alpha_i \Delta Y_{r,t} + \varepsilon_{i,r,t}.$$

- In baseline include cyclical sensitivity control: $\hat{\alpha}_i \Delta Y_{r,\tau}$.
  - Captures differential cyclical sensitivity of retail employment
  - Has little impact on main results
- Other key controls: Bartik shocks or industry shares with time-specific coefficients.
  - Again, little impact on main results.

GMNS Identification Strategy Summary

- Estimate:

$$\Delta y_{i,r,t} = \psi_i + \xi_{r,t} + \beta \Delta p_{i,r,t} + \Gamma X_{i,r,t} + \varepsilon_{i,r,t}$$

  by IV with $z_{i,r,t} = \hat{\gamma}_i \Delta P_{r,t}$ where $\hat{\gamma}_i$ is obtained from

$$\Delta p_{i,r,t} = \varphi_i + \delta_i \Delta y_{i,r,t} + \mu_i \Delta Y_{r,t} + \gamma_i \Delta P_{r,t} + \nu_{i,r,t}$$

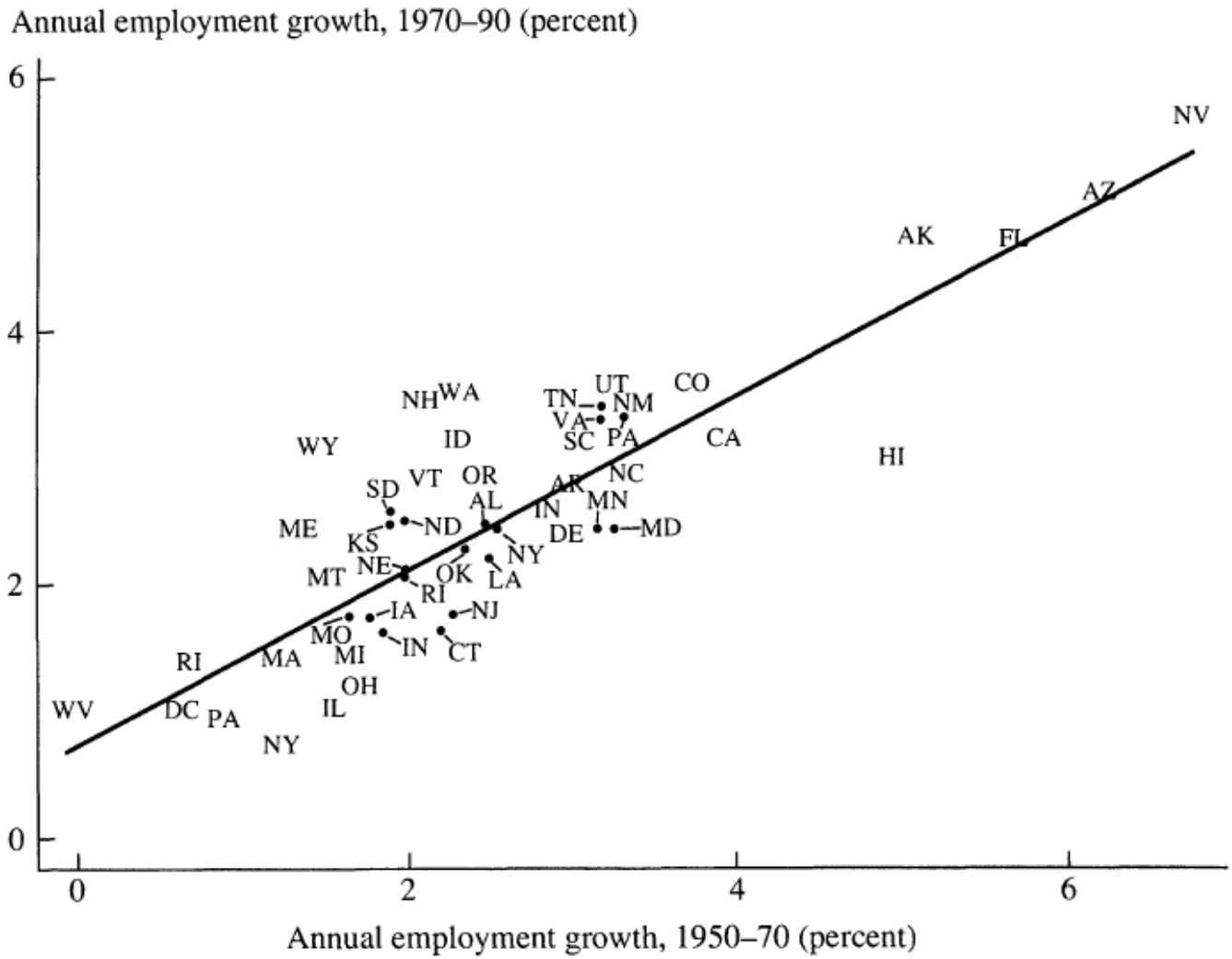
- Exploits systematic differences in sensitivity of local house prices to regional house price cycles
- Does not reflect systematic differences in local business cycles that induce systematic differences in local house prices
- Details:
  - 10 year rolling window estimation
  - Leave-one-out on time and city to avoid mechanical correlations in small sample

Regional Evolutions

Regional Evolutions (Blanchard and Katz, 1992)

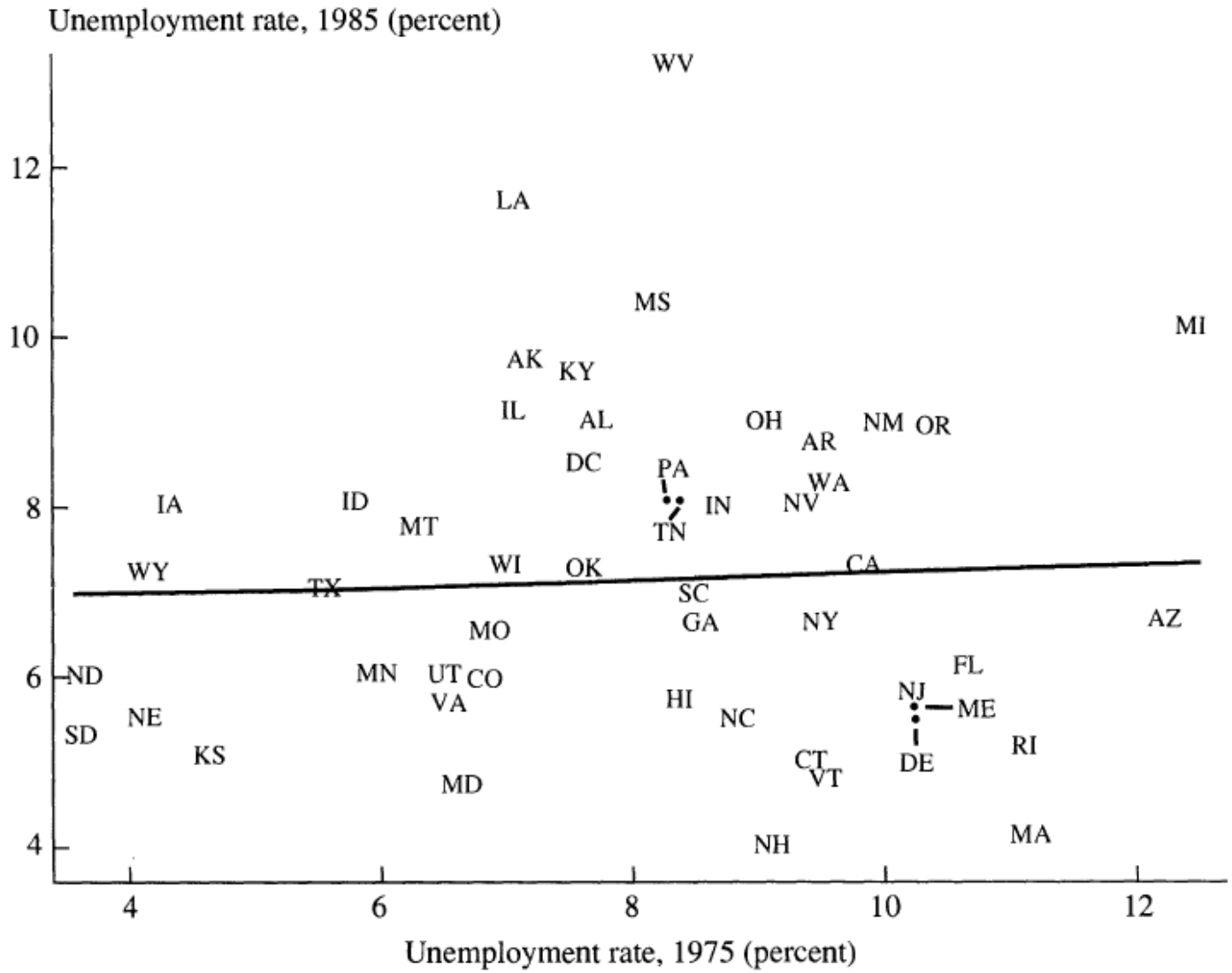
- How do regions re-equilibrate dynamically in response to local employment shocks?
  - Crucial if using regional shocks to study business cycle.
- Findings (about long-run declines not bus cycle):
  - Employment shocks have permanent effects on employment, temporary effect on employment rates (5-7 years).
  - Explanation: Migration is dominant adjustment margin ($> 3\%$ of Americans change MSA each year).
  - Wage and price level responses offset minimally at best.
- Approach:
  - Stylized facts (both time series and cross section).
  - 3-Variable VAR (employment, unemployment, participation) assuming demand shocks dominate. Check with Bartik IV.
  - VARs on wages and prices.

Employment Shocks Have Persistent Effects



Employment Rates Not Persistent

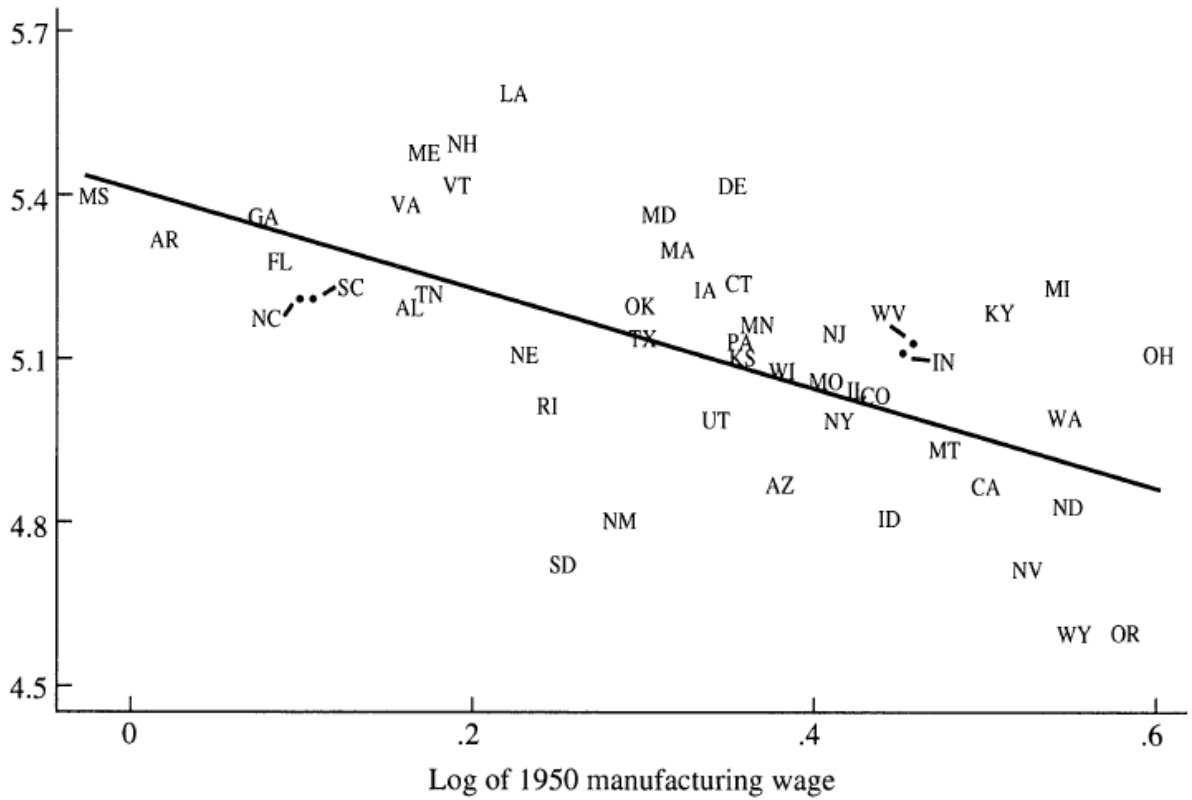
Figure 3. Persistence of Unemployment Rates across U.S. States, 1975–85



Wage Convergence

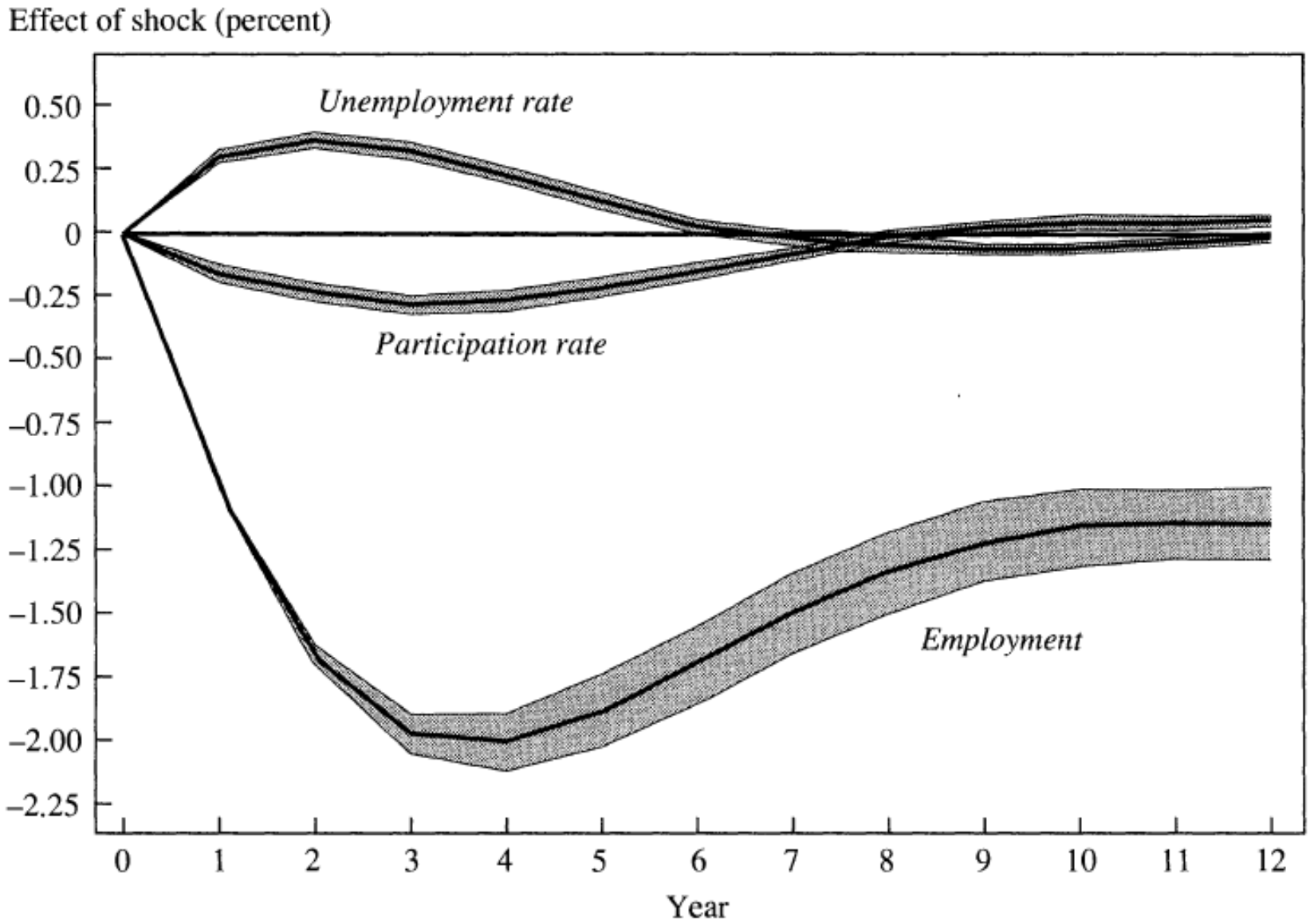
Figure 4. Convergence of Manufacturing Wages across U.S. States, 1950–90

Annual manufacturing wage growth, 1950–90 (percent)

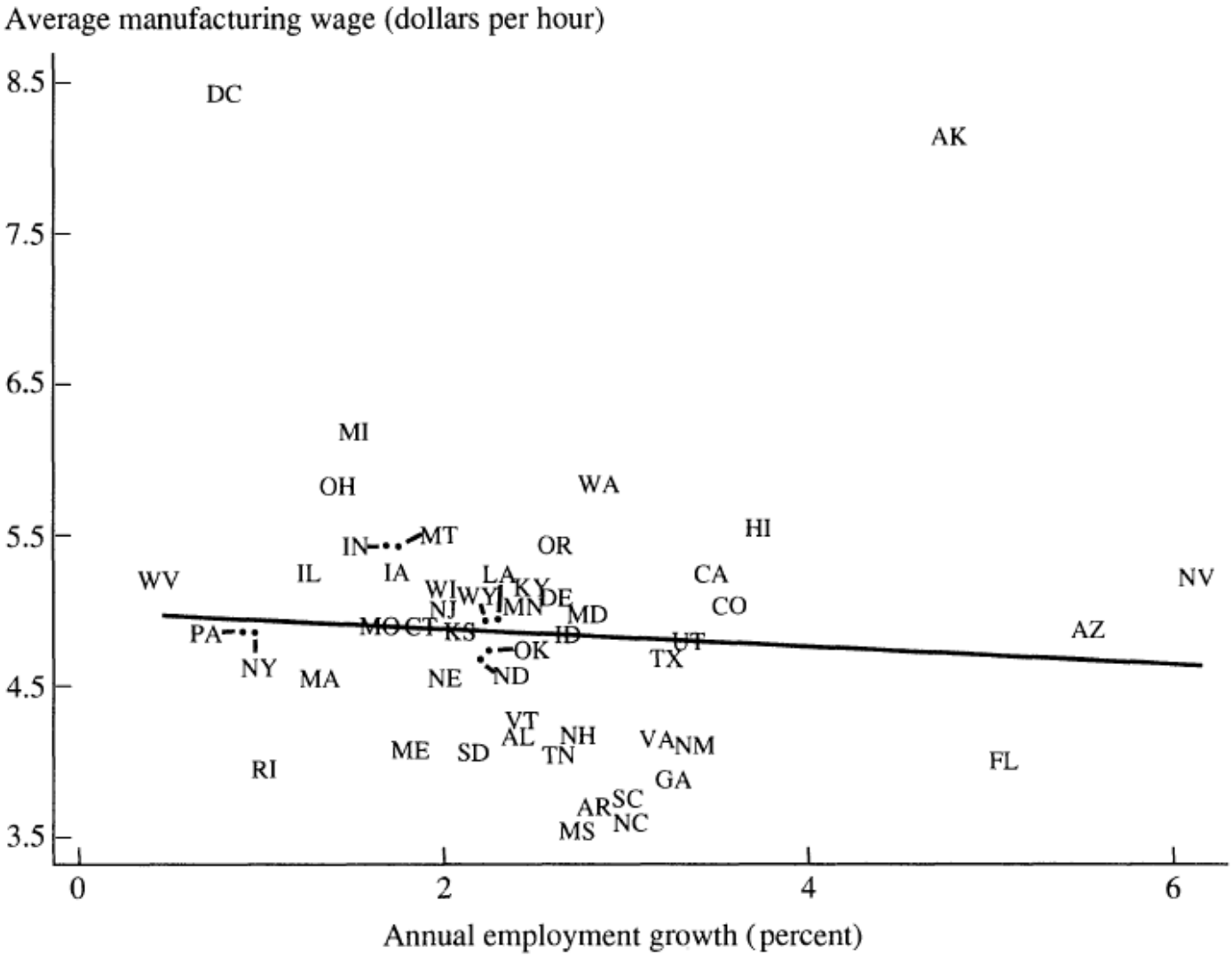


- Similar to Barro and Sala-i-Martin. Convergence rate has slowed (Ganong and Shoag; Giannone).

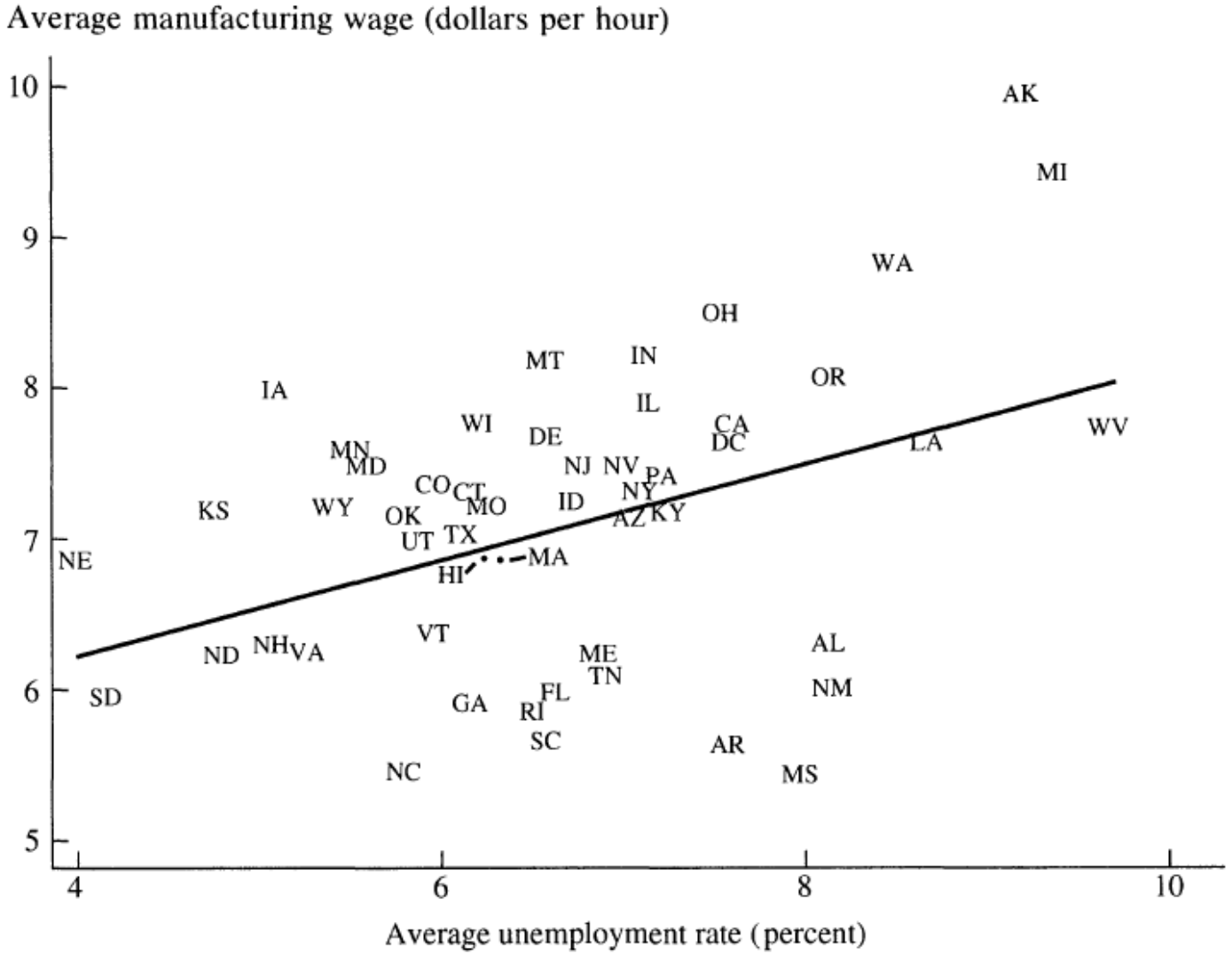
3 Variable VAR (Emp, Unemp Rate, Part Rate) IRFs



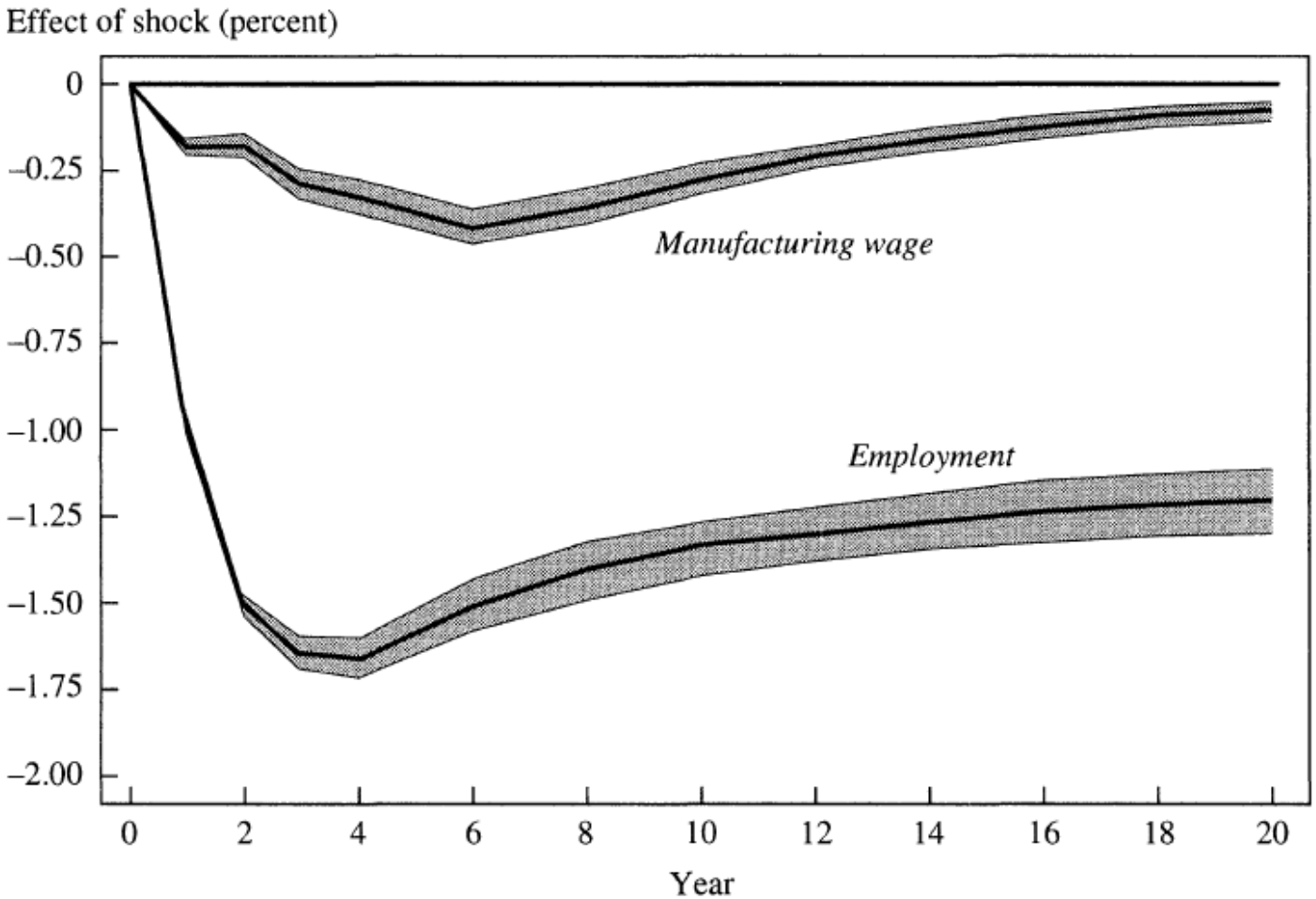
Wage Response Unrelated to Average Employment Growth



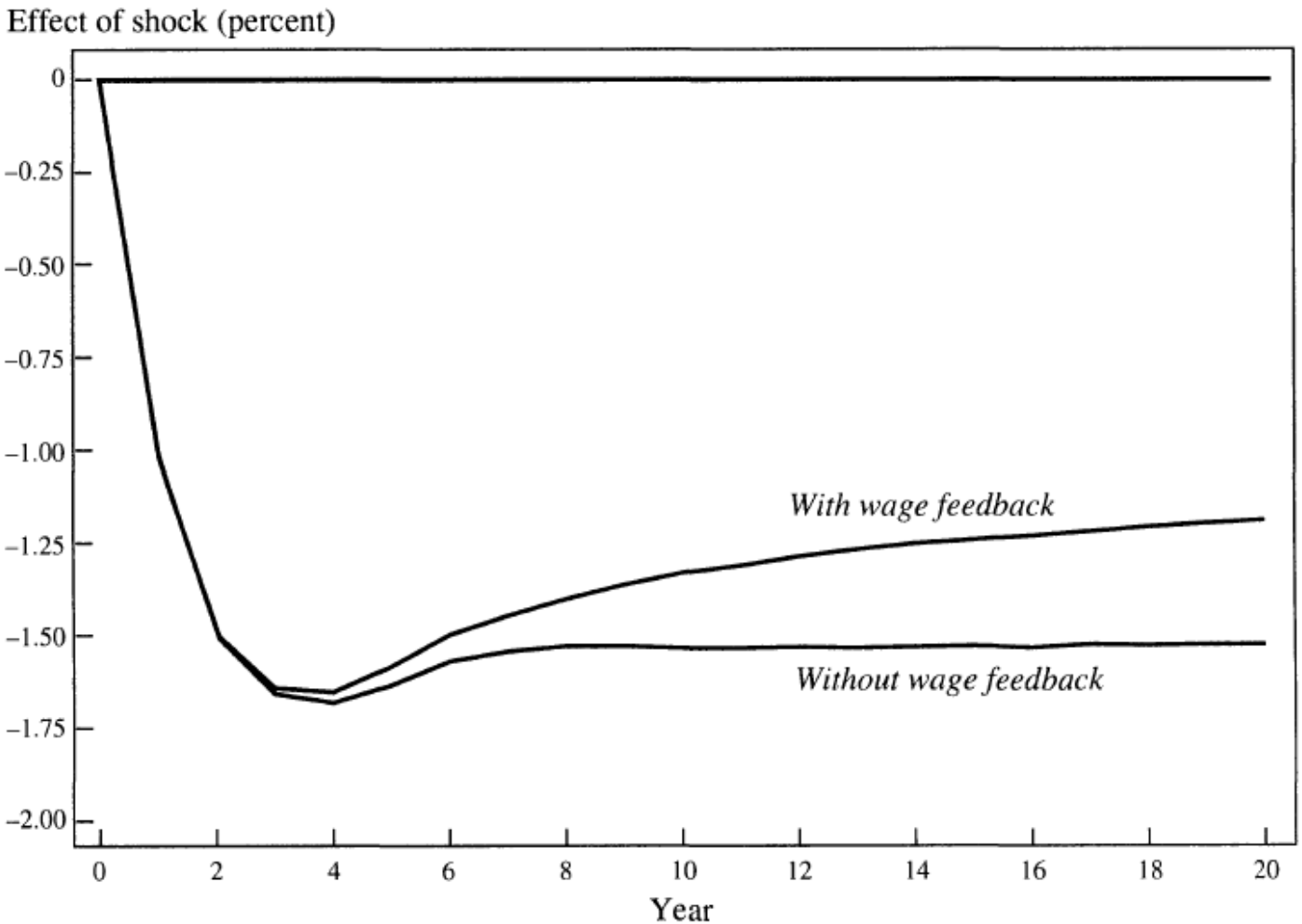
Wage Response Related to Average Employment Rate



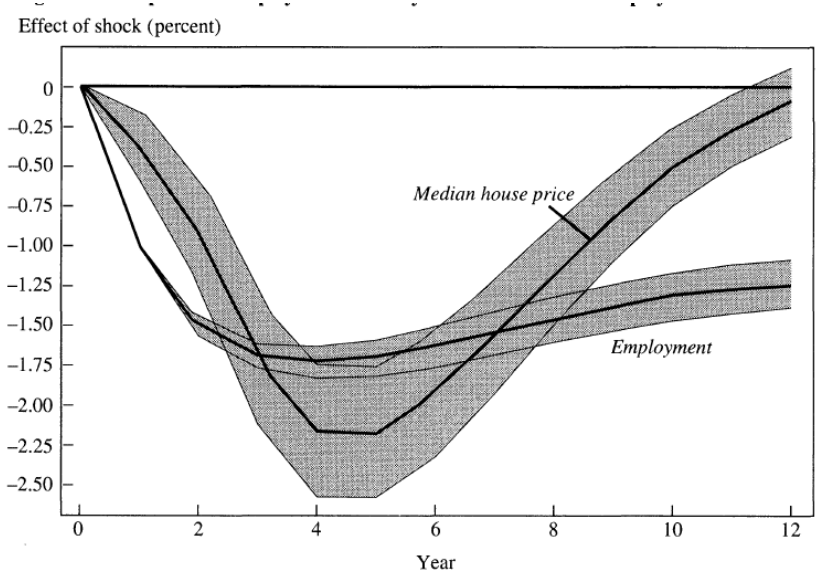
VAR (Emp, Wages) IRF: Partial Wage Adjustment

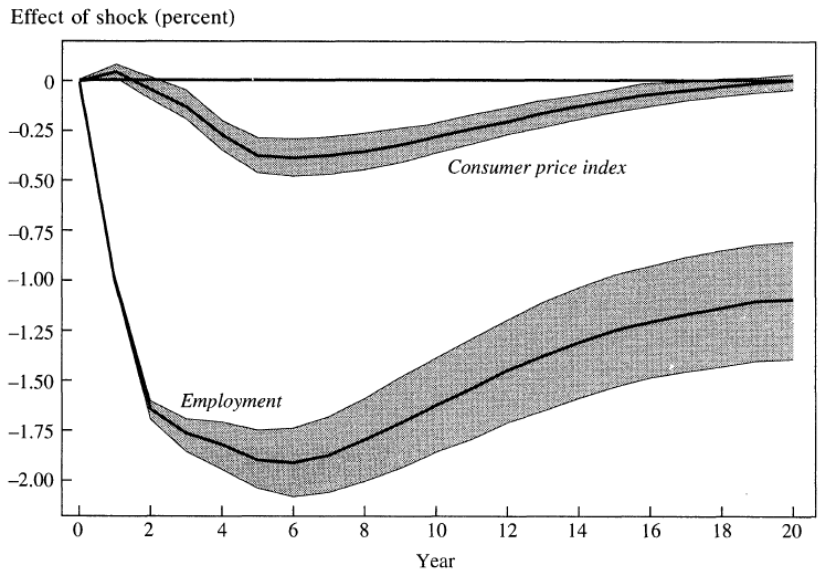


VAR IRF: Counterfactual Without Wage Response



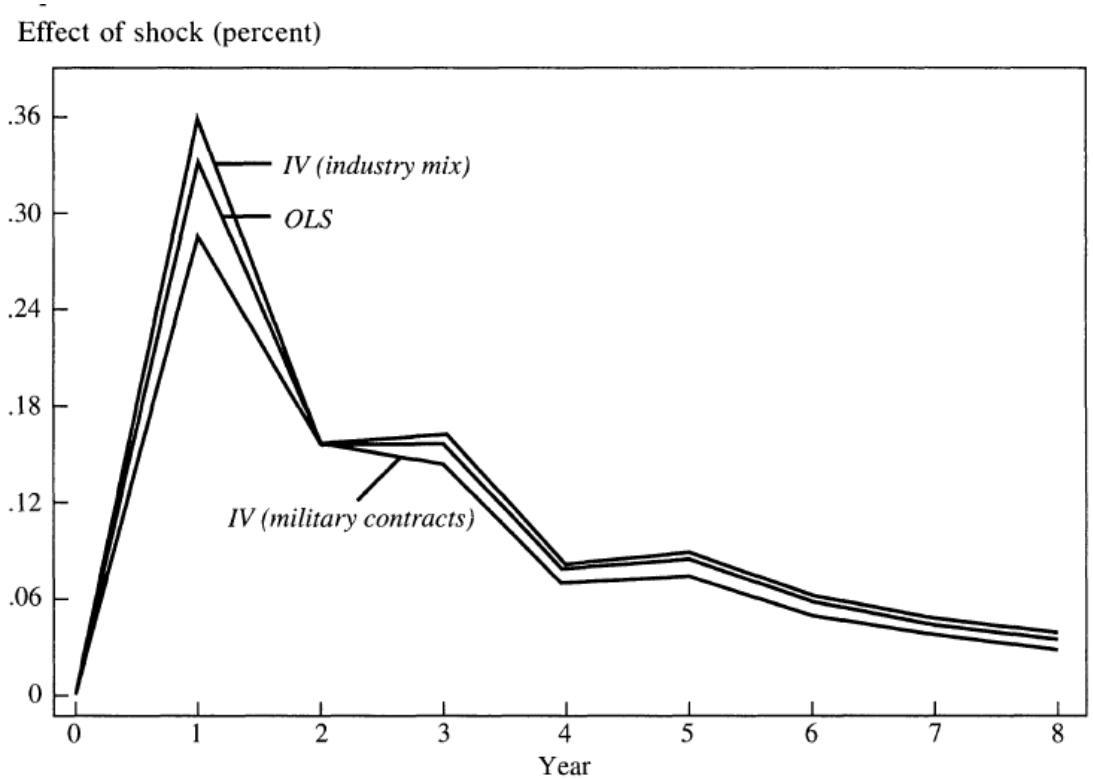
VAR IRF: House Price and CPI Responses





- Put together with some assumptions, wages adjusted for price levels decline 40% of decline in nominal wages.
- Prices thus have even smaller effect than looking at only nominal wages would suggest.

Testing Assumption that Short-Run Labor Responses are Demand Shocks



- Worry: autocorrelation of shocks creates endogeneity in Bartik shock because shares measured annually.

Regional Evolutions Revisited

- Regional economics has recently become a very hot topic.
- Dogma of Blanchard and Katz has been revisited.
  1. Howard (2020): Migration accelerator.
  2. Yagan (2019): Great Recession.

Howard (2020): Migration Accelerator

- Traditional view: Migration mitigates local shocks.
  - People move from struggling areas to booming areas.
  - Implicit assumption: Migration creates slack in receiving region, reduces slack in sending region, equilibrating system.
- Howard (2020) finds evidence of the *opposite*.
  - In migration *reduces* local unemployment rate, *amplifying* shocks!
  - Mechanisms: Housing boom in receiving city increases
    1. Employment in construction sector as build houses
    2. Employment in non-tradeables as house price rise stimulates consumption.
  - Quantitatively, migration amplifies shocks to unemployment rate by 20%.

Howard (2020): Empirical Strategy

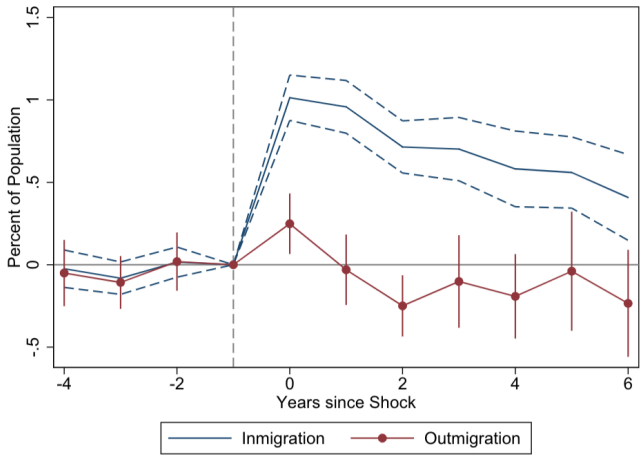
$$\Delta u_{n,t} = \sum_{s=-3}^{6} \beta_s \Delta z_{n,t} + \alpha_t + \varepsilon_{n,t}$$

- Instrument migration with Bartik-style predicted migration.

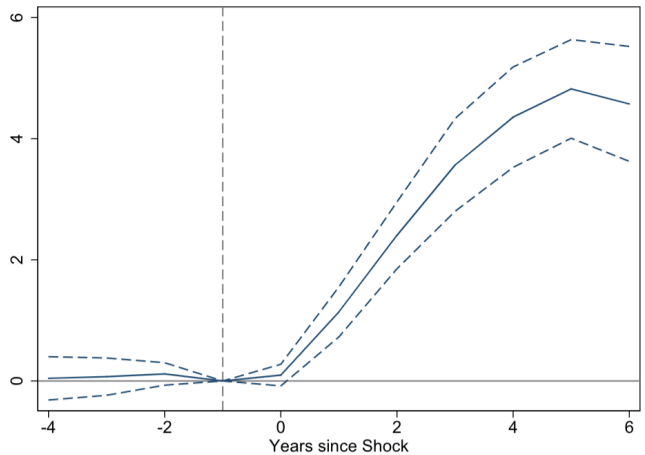
$$\tilde{z}_{n,t} = \sum_{c \in -n} \frac{m_{c \to n, t_0}}{m_{c \to -n, t_0}} m_{c \to -n, t}$$

  - t_0 is pre-period.
  - $-n$ is set of all counties sufficiently far from n
  - $m_{c \to n}$ is migration from c to n.
  - Normalize by population, isolate innovations from AR(2) to account for autocorrelation in migration.
- Identifying assumption: Out migration from historically-connected counties is unrelated to other factors that may affect unemployment rate.
  - Biggest concern: Correlated shocks (e.g. similar industries).
  - But this will bias results downward.

Howard (2020): Main Empirical Findings

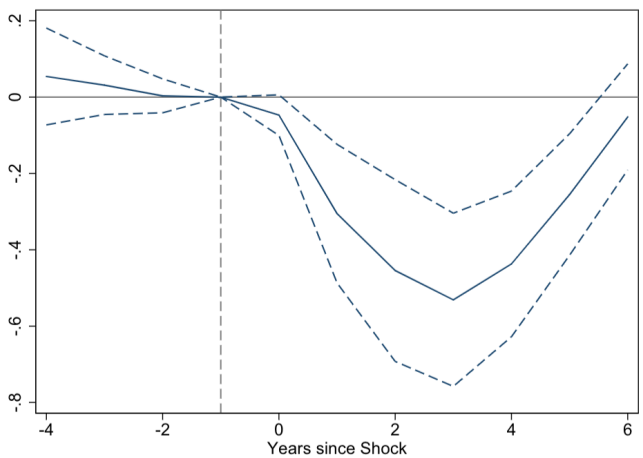


(a) Migration

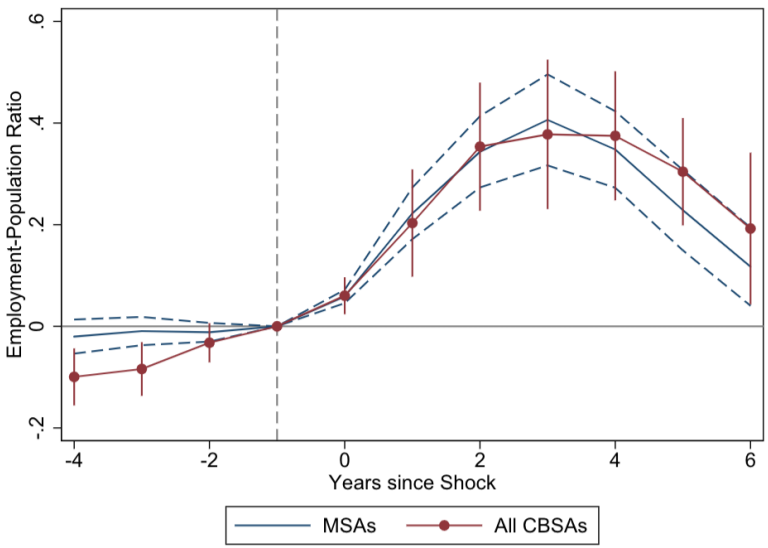


(b) Log Population

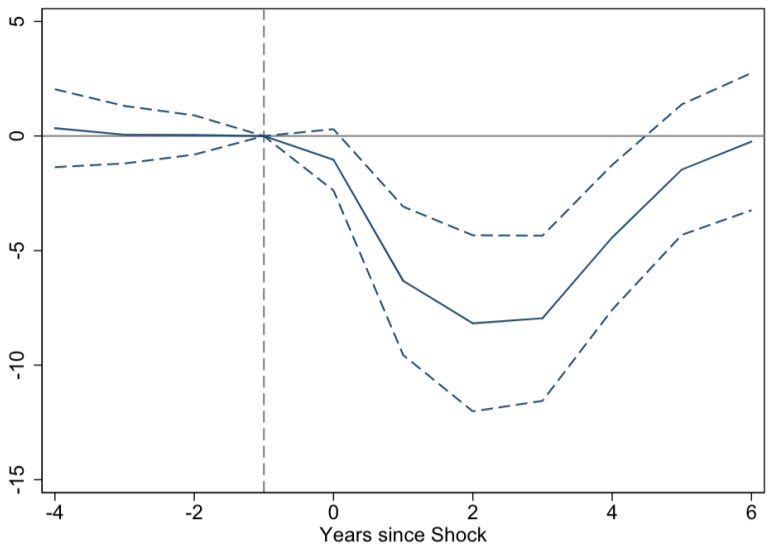
Unemp:



Howard (2020): Main Empirical Findings

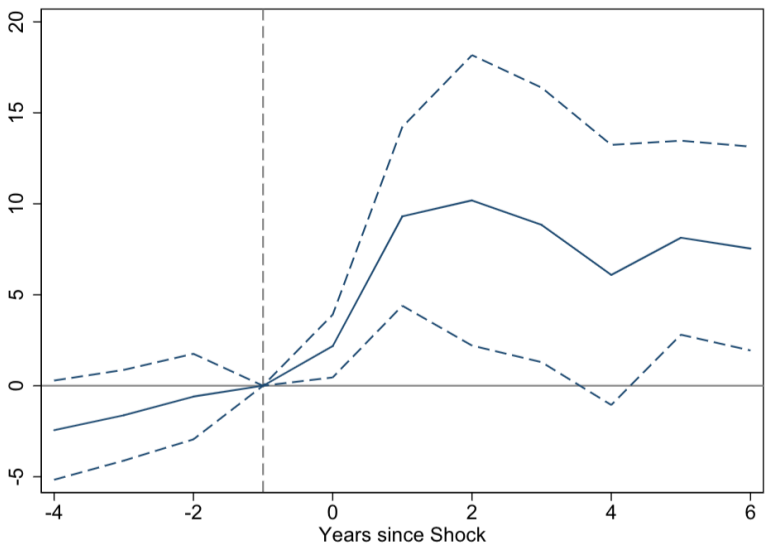


(a) Employment-Population Ratio

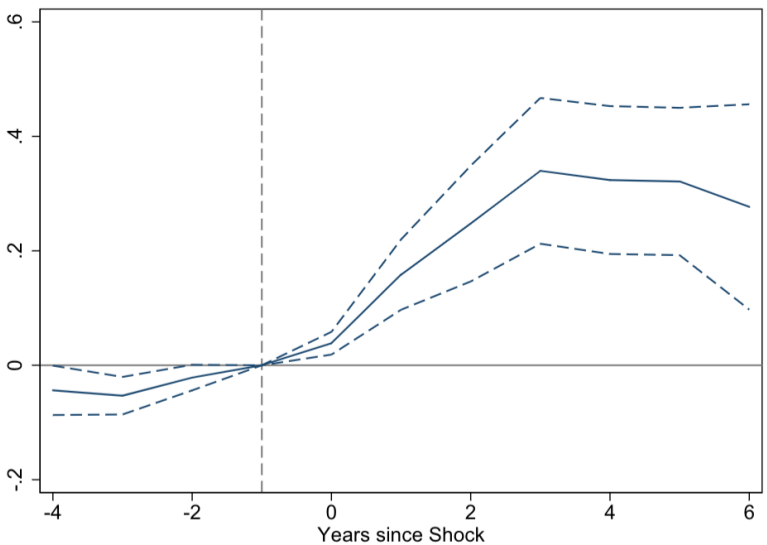


(b) Log Unemployment Benefits

Howard (2020): Construction Permits

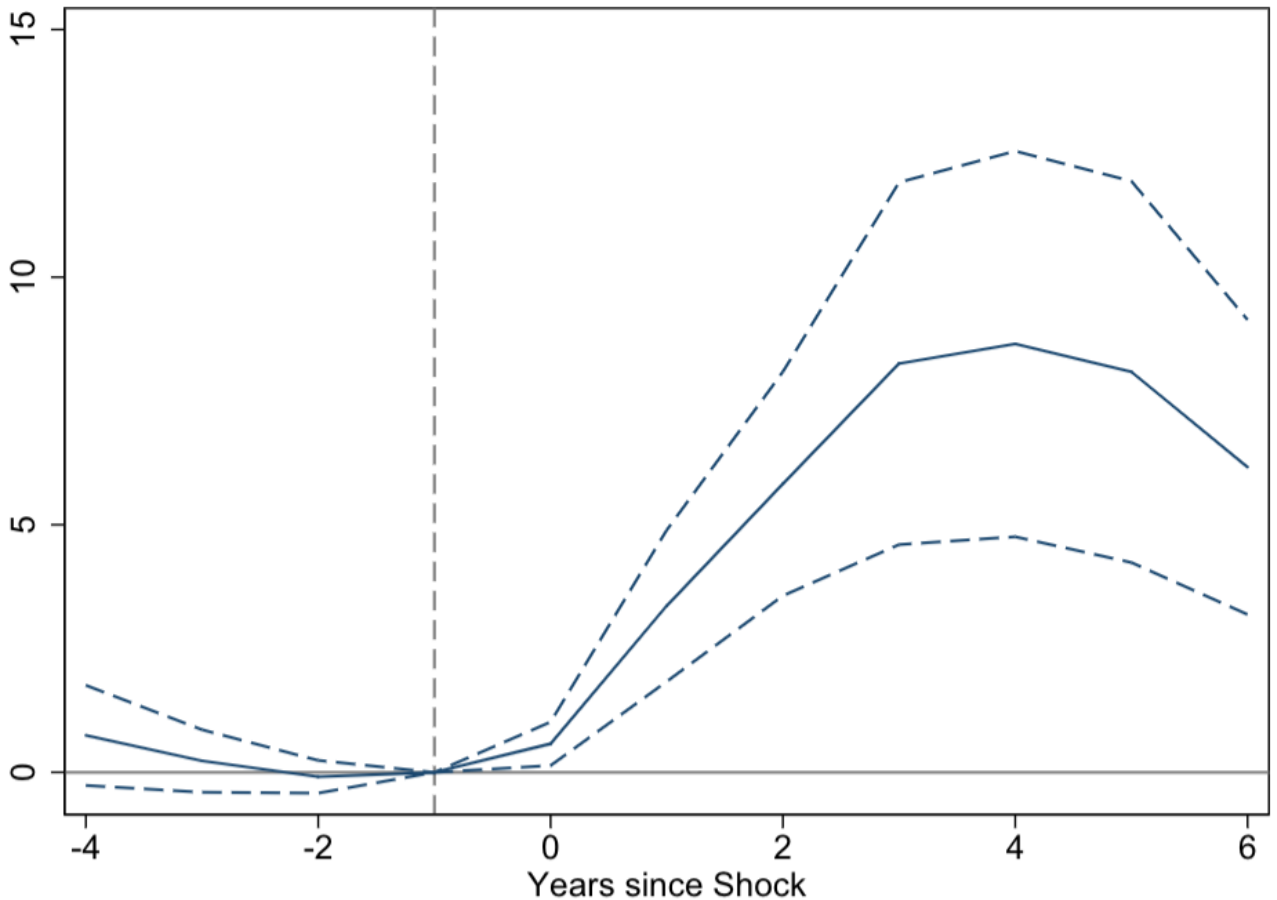


(a) Log Housing Permits

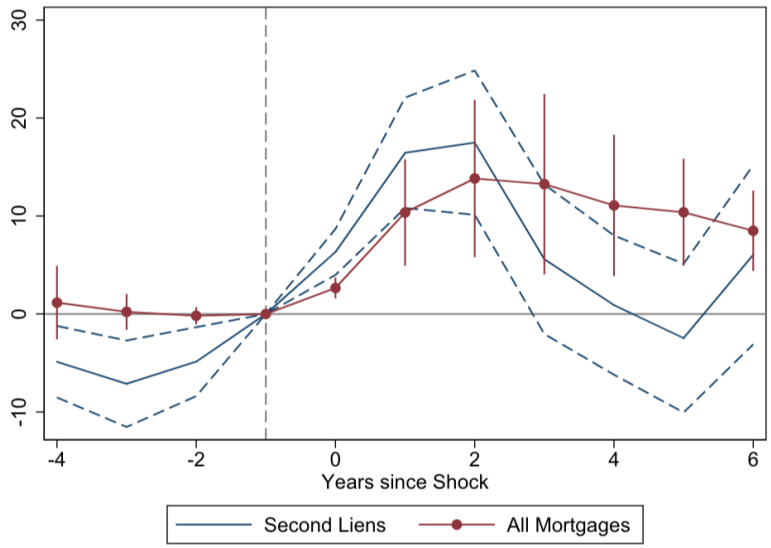


(b) Construction Employment per Capita

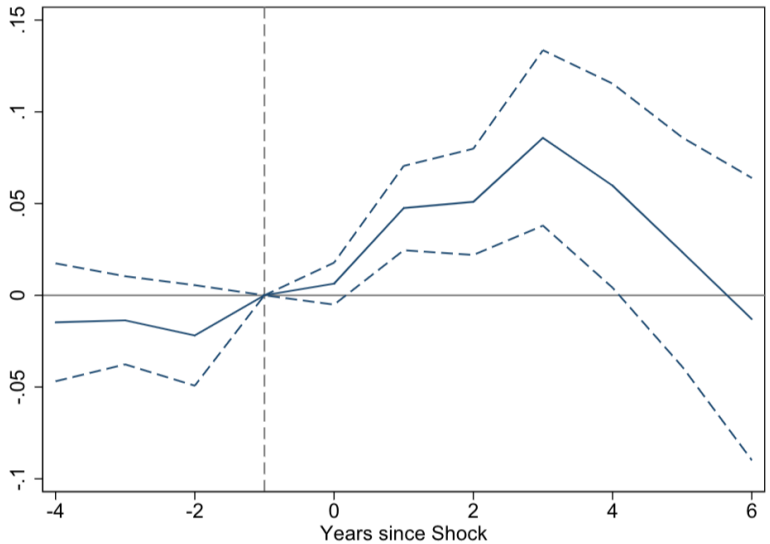
Howard (2020): House Prices



Howard (2020): Mortgage Refinancing and Non-Tradeable Employment



(a) Log Mortgage Originations (Dollars)

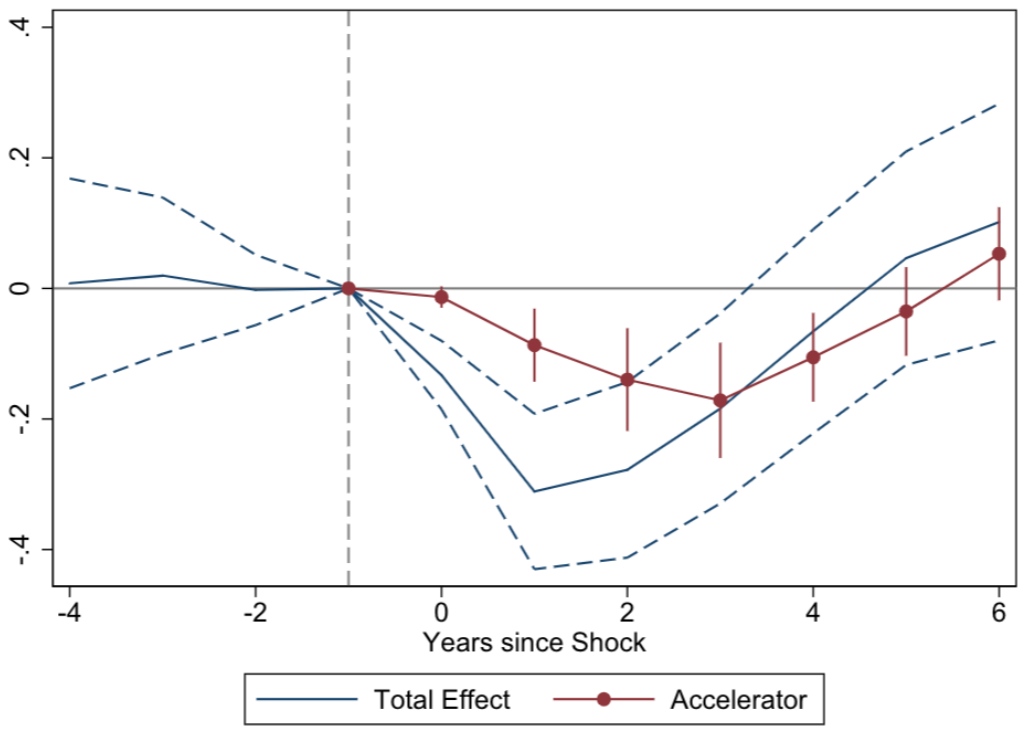


(b) Non-tradable Employment per Capita

- Heterogeneity by supply elasticity and population growth reacts as one would expect.

Howard (2020): How Strong Is the Accelerator?

- Estimate effect of labor demand on migration using traditional Bartik.
- Subtract from total effect of migration to calculate accelerator (see paper for details):



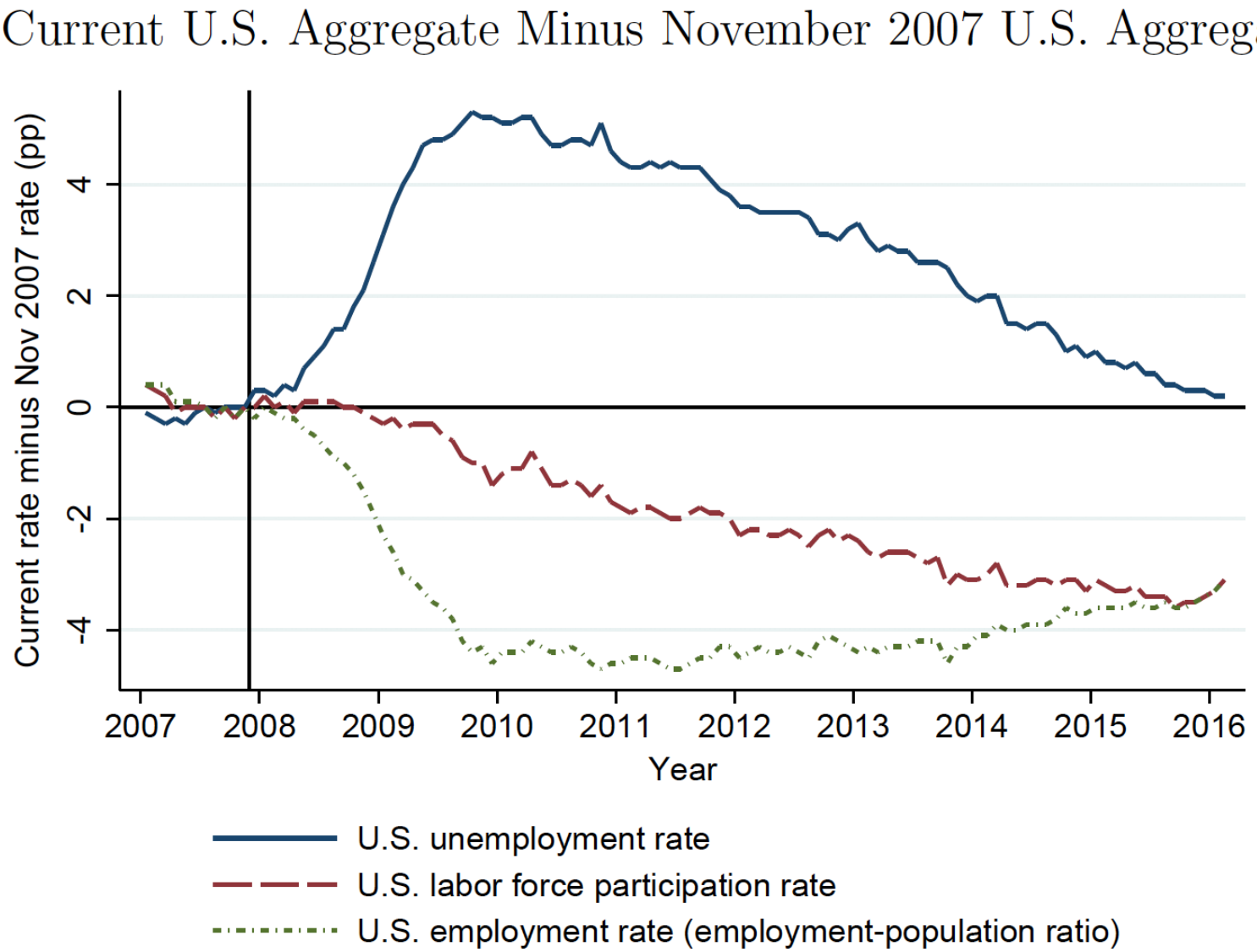
Howard (2020): Take Aways

- Very surprising results.
  - Important for currency unions, inter regional economics, etc.
  - Still consistent with Blanchard-Katz.
    - About short run amplification, which they did not analyze.
- LATE is for in-migration with no out-migration.
  - People presumably still leave places that are doing badly.
  - Need evidence on those regions, where my guess is labor supply effects dominate housing channels.
- Potential path dependence due to durability of housing.

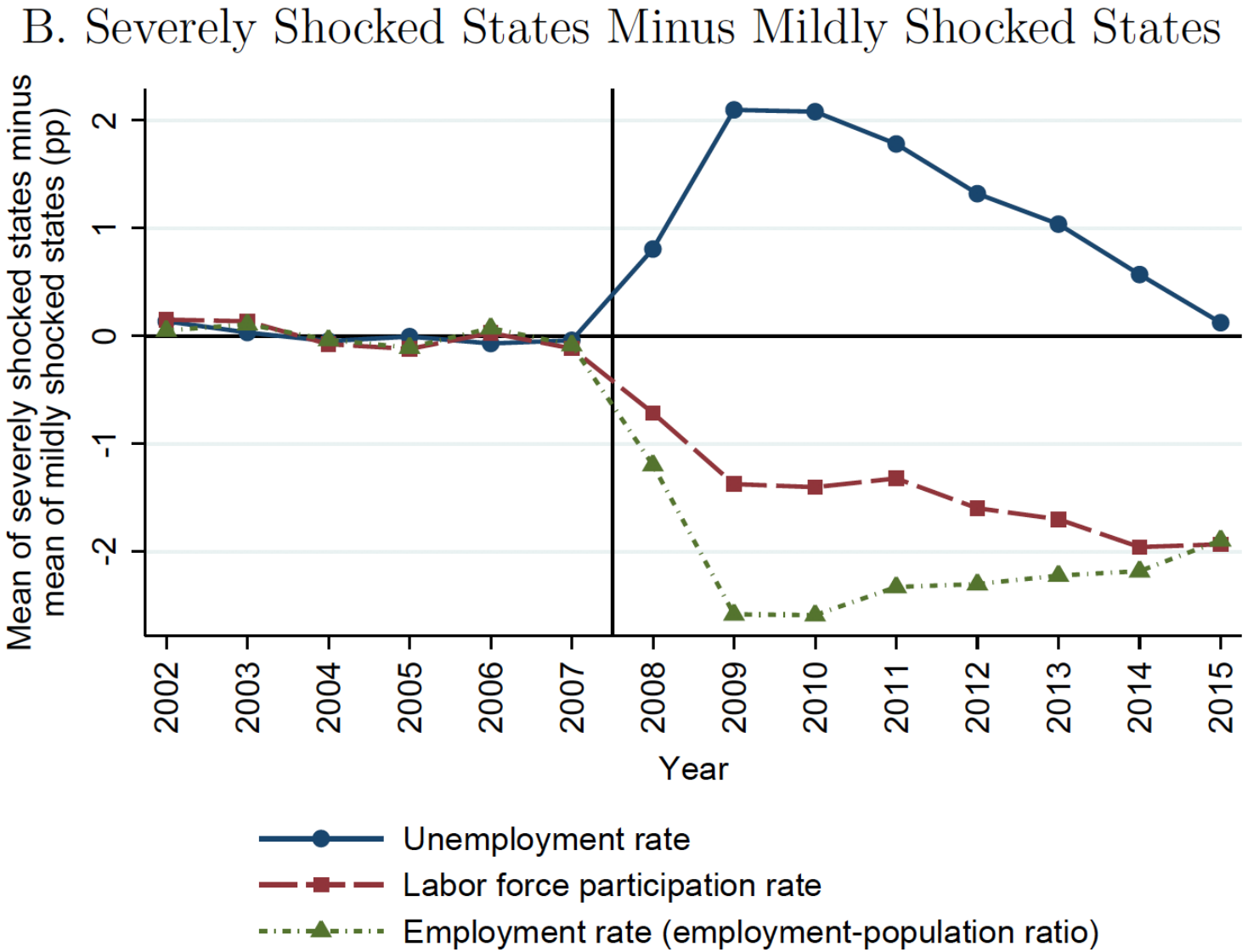
Yagan (2019): Blanchard and Katz in the Great Recession

- Yagan (2019) re-analyzes questions asked by Blanchard and Katz in the Great Recession.
  - Has the Great Recession has an enduring impact on the hardest-hit regions?
  - Blanchard and Katz say 5-7 years, so things should have equilibrated by 2015.
- Replicates Blanchard-Katz on Great Recession data.
  - Things look similar, except permanent impact on employment.
  - People living in locations hit hardest by Great Recession in 2007 had persistent place effects.
    - Leveraging amazing tax data.
- Uses amazing tax data to argue that this is not due to unobservables.
  - Baseline: Age-earnings-industry FE.
  - Crazy robustness test: People at big retail chains doing same job in different cities.
  - Identification assumption: Selection on observables.

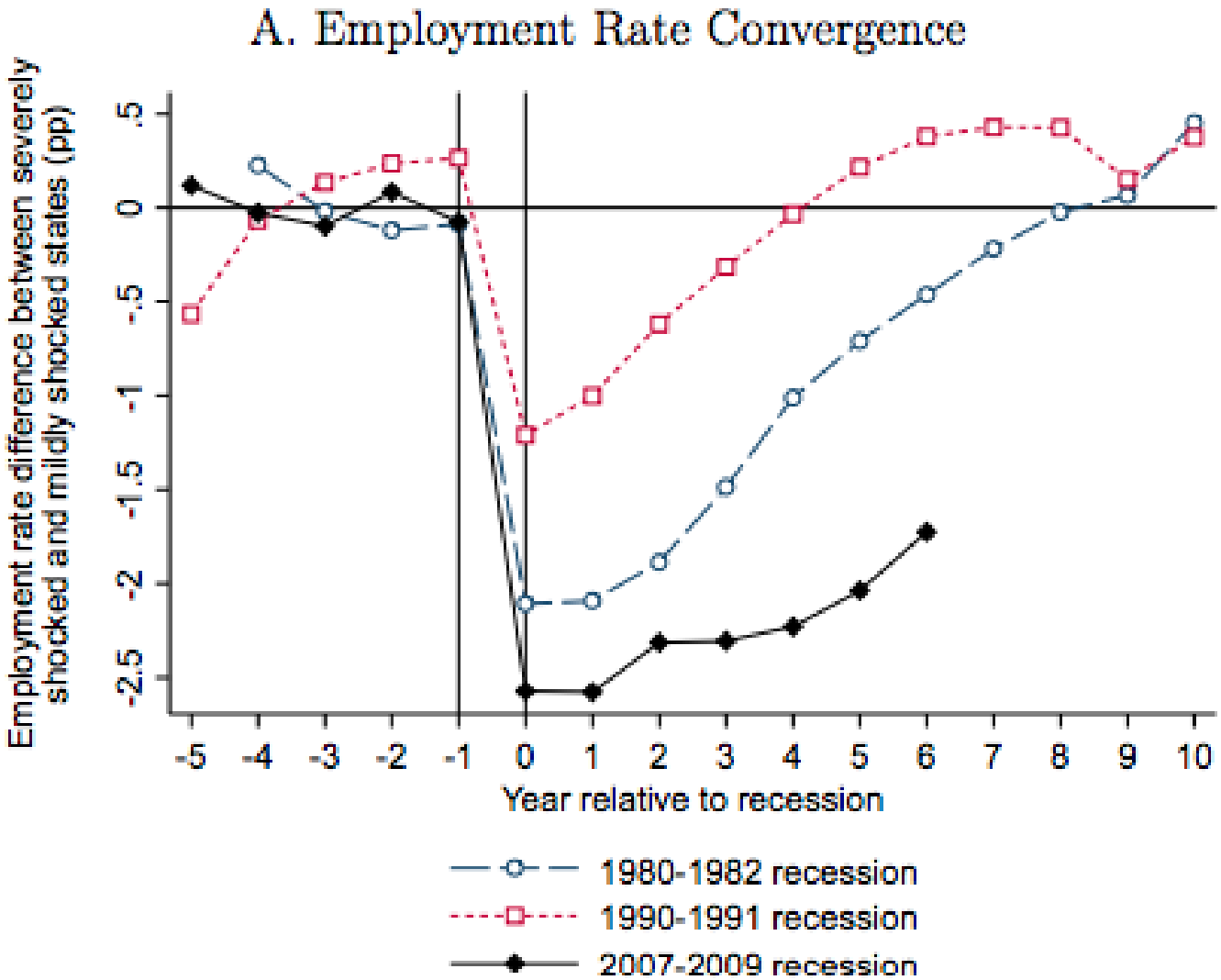
Yagan (2019): Unemp Converged by 2016, But Not LFP



Yagan (2019): Same Pattern Across States, A La B-K

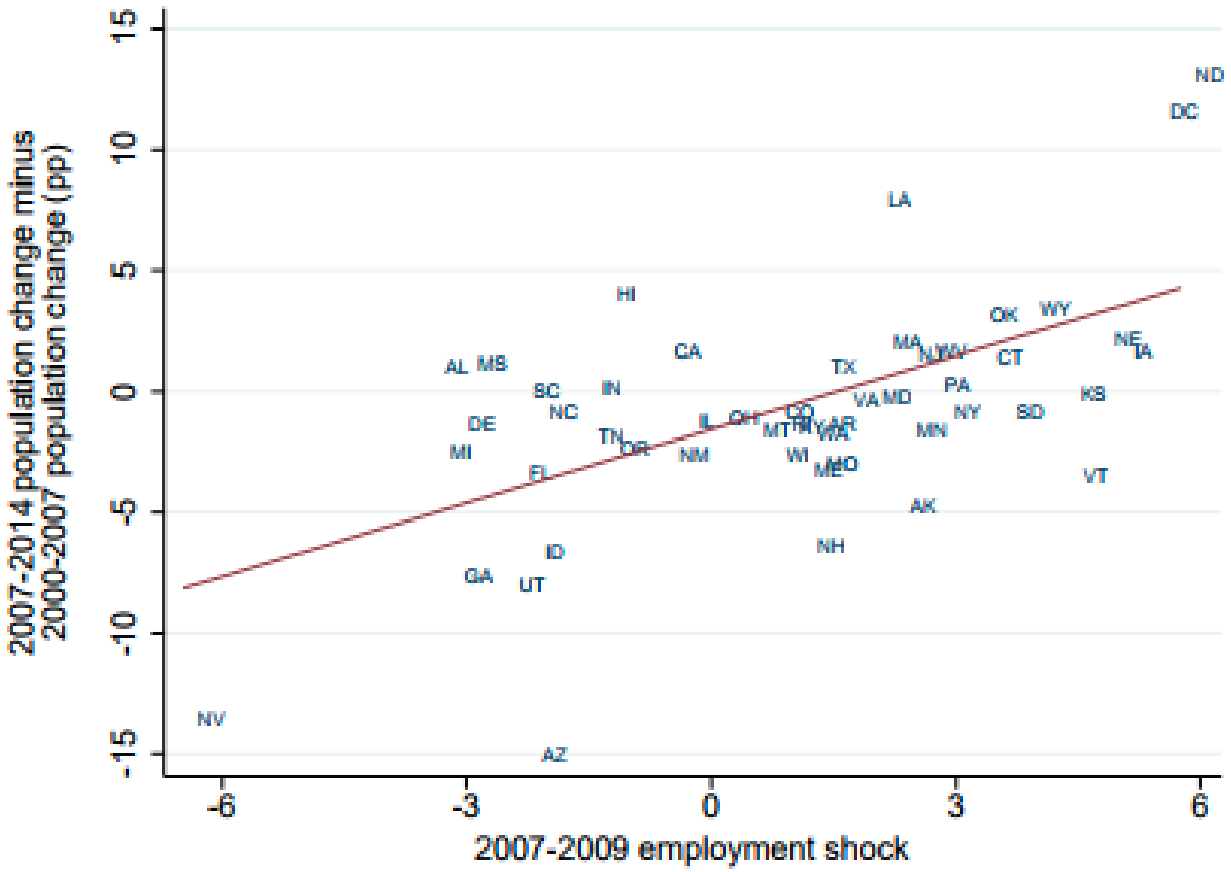


Yagan (2019): This Is Different From Before...



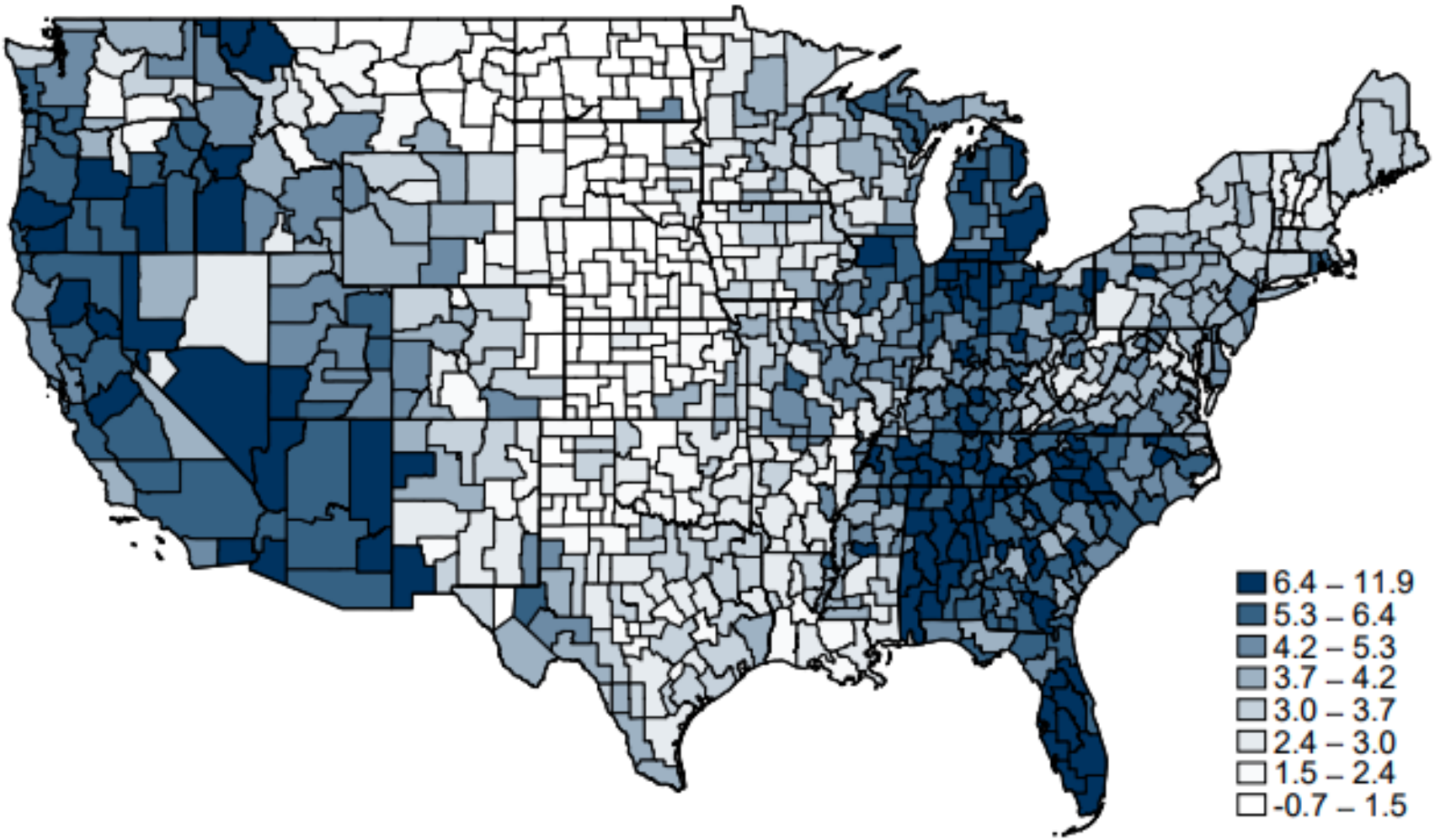
Yagan (2019): But Migration Looks The Same

B. State Population Changes vs. Great Recession State-Level Shocks



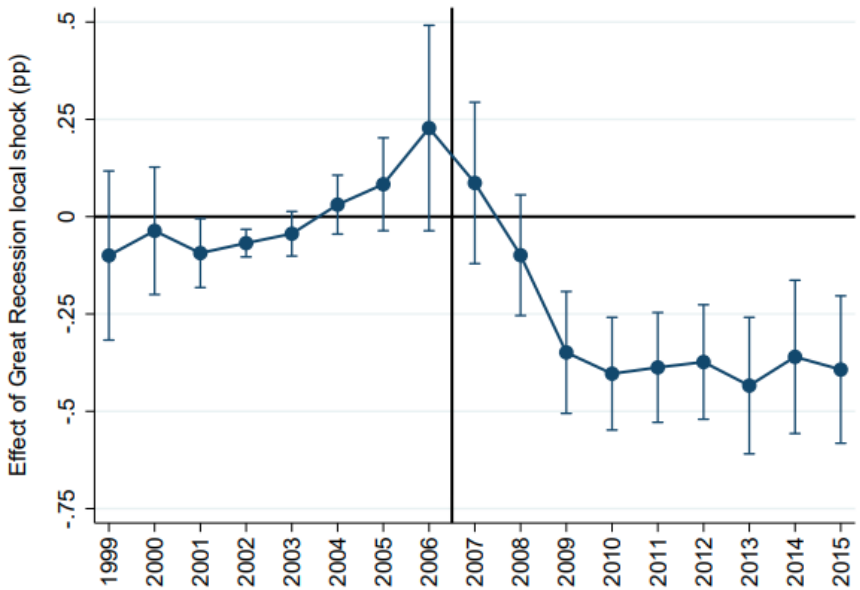
- BK: 1% pop change within 5-7 years after 1% emp shock.
- Great Recession: 1% shock, 1.016% pop change.

Yagan (2019): Commuting Zone Shocks

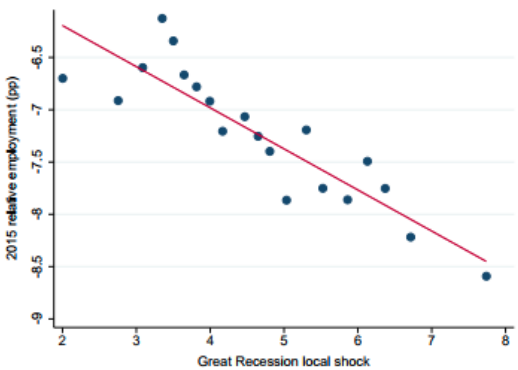


Yagan (2019): Effect of Living in Shocked CZ in 2007

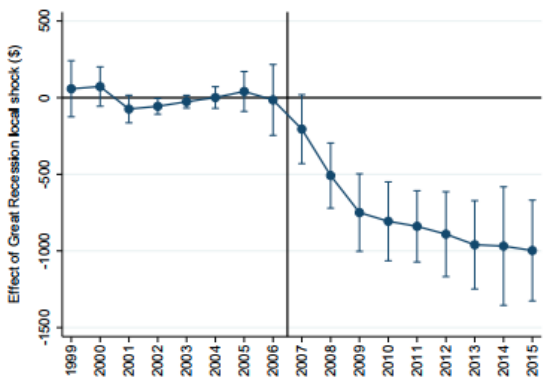
A. Employment Impact of Great Recession Local Shocks



B. 2015 Employment Impact by Shock Ventile

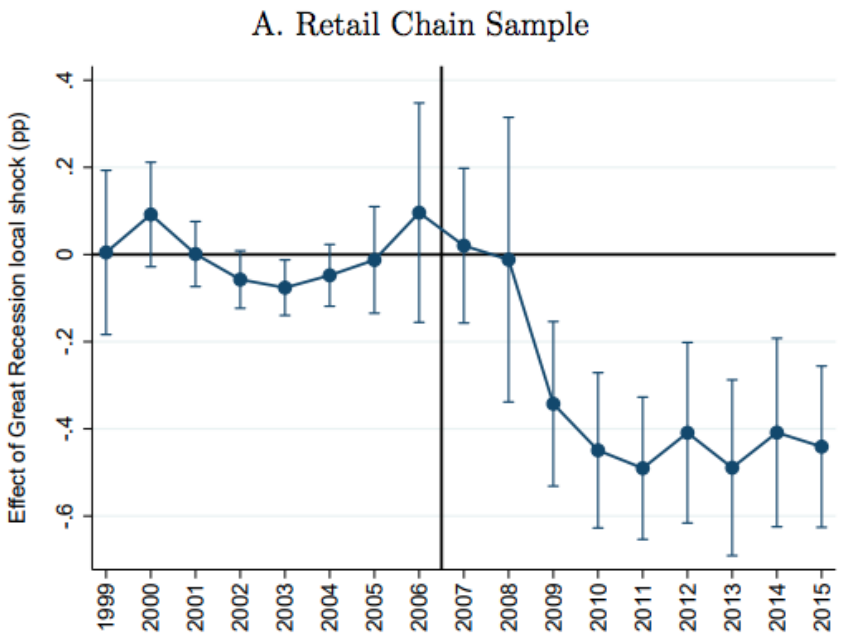


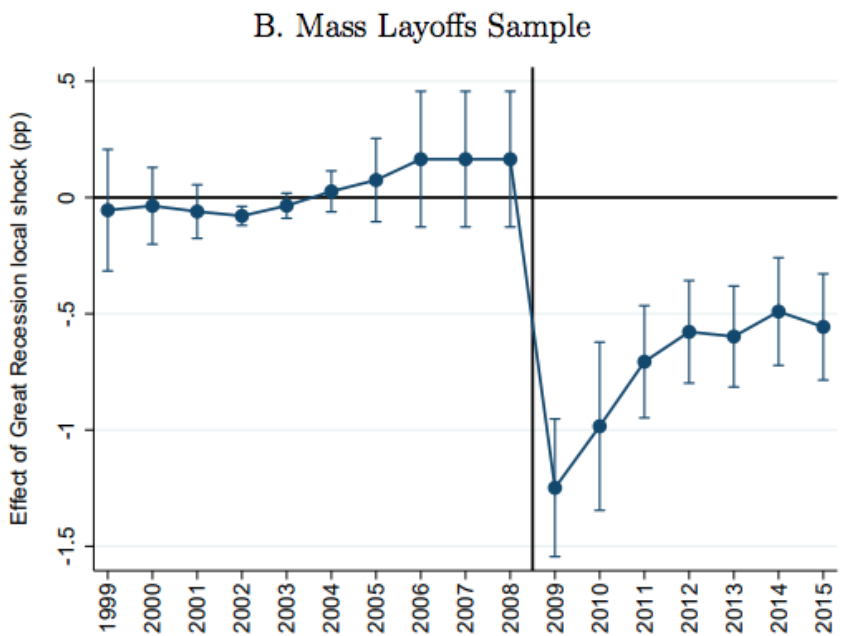
C. Earnings Impact of Great Recession Local Shocks



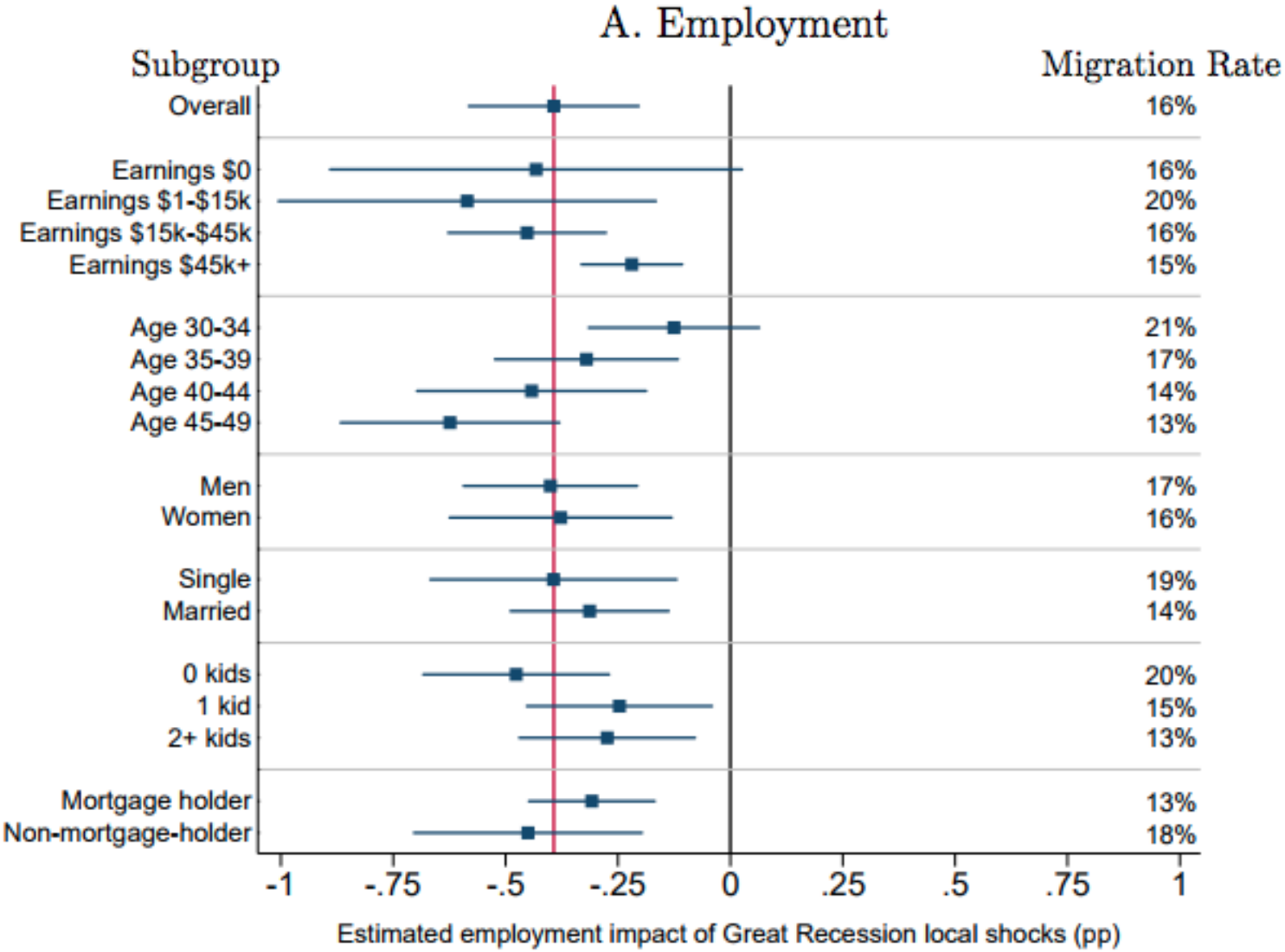
Yagan (2019): Crazy Robustness Checks

- Tax data, so can do truly remarkable robustness checks.
  - Look at all individuals employed in 2007 at national retail chains, run specification with age-earnings-*firm* FE
  - Mass layoffs to condition out quits.





Yagan (2019): Heterogeneity



Yagan (2019): Mechanisms and Take Aways

- Yagan shows that:
  1. Reduced migration cannot explain.
  2. Job specific rents / firm-specific human capital cannot explain.
  3. Disability insurance or unemployment insurance reducing labor supply.
- What does explain results?
  1. Human capital loss.
     - Most of incrementally laid off experienced persistent unemployment.
  2. Persistently low labor demand.
     - Local economies may have been scarred, and people stayed.
- More work needed on persistent LFP effects.
  - Scarring in the labor market in bonus slides

Regional Evolutions: Other Food For Thought

- US has very high mobility. How Does Europe adjust?
  - Participation equilibrates unemployment not migration (Decressin and Fatas, 1995).
- Booming literature in labor on "local labor markets."
  - Extensive use of "spatial equilibrium" Rosen-Roback-style models (see Moretti Handbook Chapter).
- Firm mobility
  - Firms thought to be very mobile relative to workers.
  - Implication: tax incidence falls on workers and land owners.
  - Suarez-Serrato and Zidar (2016) show local corporate tax incidence is 40% firms, 30-35% workers, 25-30% landowners.
  - Opens door to thinking about stickiness in firm mobility.

Regional Evolutions: Take Aways

- Migration is a key margin of regional adjustment to shocks.
  - Delayed response over 5-7 years.
  - Gradual migration is an important friction.
- I have seen very little serious thought put into migration in emerging macro literature on regional variation.
  - Typically a currency union model – small open economies linked by monetary authority (will discuss in lecture 4).
    - Exception: Farhi and Werning (2014) and Chen (2020).
- Potentially fruitful area for research and something to consider as we think about using regional variation in macro.
  - Migration complicates models very difficult, dynamics of migration are hard to capture correctly at high frequency.