Lecture 6

Harvard Econ 2416
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Outline

1. Econometrics (Goldsmith-Pinkham, Sorkin, Swift, AER 2020; Borusyak, Hull, Jaravel, RESTUD forthcoming)
2. Regional fiscal policy (Nakamura and Steinsson, AER 2014)
3. Bank health (Chodorow-Reich, QJE 2014; Chodorow-Reich and Falato, JF forthcoming)
4. Regional stock market wealth (Chodorow-Reich, Simsek, Nenov, AER 2021)
5. Higher order shift-shares (Chodorow-Reich and Wieland, JPE, 2020)
6. Wrap-up

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Canonical example

- Structural equation:

$$y_\ell = \tau + \beta x_\ell + \epsilon_\ell.$$

  - y_ℓ: wage growth in area ℓ.
  - x_ℓ: employment growth in area ℓ.

- Identities:

$$x_\ell = \sum_k z_{\ell,k} g_{\ell,k},$$

$$g_{\ell,k} = g_k + \tilde{g}_{\ell,k}.$$

  - $z_{\ell,k}$: employment share in area ℓ in industry k.
  - $g_{\ell,k}$: employment growth in area ℓ in industry k.
  - g_k: national employment growth in industry k.
  - $\tilde{g}_{\ell,k}$: idiosyncratic component of employment growth rate.

- Bartik (1991) instrument to estimate inverse labor supply elasticity:

$$B_\ell = \sum_k z_{\ell,k} g_k.$$

General setup

Notation:

- $G_t \sim K \times 1$: vector of shifters $\{g_{k,t}\}_{k=1}^{K}$ in period $t = 1, \dots, T$.
- $Z_{k,t} \sim L \times 1$: vector of shares $\{z_{\ell,k,t}\}_{\ell=1}^{L}$ for shifter k in period t.
- $Z_t = \begin{pmatrix} Z_{1,t} & Z_{2,t} & \dots & Z_{K,t} \end{pmatrix} \sim L \times K$: matrix of shares in period t (rows of Z sum to 1).
- $B_t = Z_t G_t \sim L \times 1$: Bartik vector in period t.
- $X_t \sim L \times 1$: vector of endogenous variables $\{x_{\ell,t}\}_{\ell=1}^{L}$ in period t.
- $Y_t \sim L \times 1$: vector of outcomes $\{y_{\ell,t}\}_{\ell=1}^{L}$ in period t.
- Assume X_t, Y_t previously residualized with respect to any covariates.

General setup continued

- $B \sim LT \times 1$:

$$\underbrace{\begin{pmatrix} B_1 \\ B_2 \\ \vdots \\ B_T \end{pmatrix}}_{B} = \begin{pmatrix} Z_1 G_1 \\ Z_2 G_2 \\ \vdots \\ Z_T G_T \end{pmatrix} = \underbrace{\begin{pmatrix} Z_1 & 0 & \dots & 0 \\ 0 & Z_2 & \dots & 0 \\ \vdots & 0 & \ddots & \vdots \\ 0 & \dots & 0 & Z_T \end{pmatrix}}_{Z \sim LT \times KT} \underbrace{\begin{pmatrix} G_1 \\ G_2 \\ \vdots \\ G_T \end{pmatrix}}_{G \sim KT \times 1}.$$

- $X = \begin{pmatrix} X_1' & X_2' & \dots & X_T' \end{pmatrix}' \sim LT \times 1$: vector of endogenous variables (stacked X_t).
- $Y = \begin{pmatrix} Y_1' & Y_2' & \dots & Y_T' \end{pmatrix}' \sim LT \times 1$: vector of outcomes (stacked Y_t).
- $\hat{X} = B(B'B)^{-1} B'X$: fitted values using Bartik instrument.
- $\beta^B = \left(\hat{X}'\hat{X}\right)^{-1} \hat{X}'Y = (B'X)^{-1} B'Y$: IV coefficient.

Bartik is GMM (GPSS proposition 1.1)

- Claim:

$$\hat{\beta}^{B} = (B'X)^{-1} B'Y = (X'ZWZ'X)^{-1} X'ZWZ'Y = \hat{\beta}^{GMM},$$

where: $W = GG'$.

- Proof:

$$\begin{aligned} \text{Definition:} \quad & \hat{\beta}^{GMM} = (X'ZGG'Z'X)^{-1} X'ZGG'Z'Y \\ B = ZG: \quad & = (X'BB'X)^{-1} X'BB'Y \\ B'X \text{ is scalar:} \quad & = (B'X)^{-1} (X'B)^{-1} X'BB'Y \\ & = \hat{\beta}^{B}. \end{aligned}$$

- In words: Bartik IV is numerically equivalent in finite samples to an IV regression with KT excluded instruments corresponding to rows of Z and weight matrix GG'.

GMM intuition

- Exclusion restriction for Bartik instrument (T=1):

$$0 = E\left[B_\ell \epsilon_\ell\right] = E\left[\left(\sum_k z_{\ell,k} g_k\right)\epsilon_\ell\right] = \sum_k E\left[g_k z_{\ell,k}\epsilon_\ell\right].$$

- Sufficient condition:

$$0 = E\left[g_k z_{\ell,k}\epsilon_\ell\right] \ \forall \ell, k.$$

- This is $K \times L$ moment conditions for instrument $z_{\ell,k}$ with GMM weight g_k.

Rotemberg weights (GPSS proposition 3.1)

- Claim:

$$\hat{\beta}^B = \sum_{k,t} \alpha_{k,t} \hat{\beta}^{k,t},$$

where:

$$\begin{aligned}
\text{Weights:} \quad & \alpha_{k,t} = \left(B'X\right)^{-1} g_{k,t} Z'_{:kt} X, \\
\text{Just-identified coefficient:} \quad & \hat{\beta}^{k,t} = \left(Z'_{:kt} X\right)^{-1} Z'_{:kt} Y, \\
\text{Definition:} \quad & Z_{:kt} : kt \text{ column of } Z.
\end{aligned}$$

- Proof:

$$\begin{aligned}
\text{Substitute:} \quad \sum_{k,t} \alpha_{k,t} \hat{\beta}^{k,t} &= \sum_{k,t} \left(B'X\right)^{-1} g_{k,t} Z'_{:kt} X \left(Z'_{:kt} X\right)^{-1} Z'_{:kt} Y \\
\text{Rearrange:} \quad &= \left(B'X\right)^{-1} \sum_{k,t} g_{k,t} Z'_{:kt} Y \\
\text{Algebra:} \quad &= \left(B'X\right)^{-1} B'Y.
\end{aligned}$$

Rotemberg weights intuition

- $\hat{\beta}^{k,t} = (Z'_{:kt}X)^{-1} Z'_{:kt}Y$: just-identified IV coefficient from using only shares corresponding to shifter k in period t.

- $\alpha_{k,t} = (B'X)^{-1} g_{k,t} Z'_{:kt}X = \frac{g_{k,t}Z'_{:kt}X}{\sum_{k,t} g_{k,t}Z'_{:kt}X}$: ratio of Bartik first stage using only shifter k in period t to actual Bartik first stage.

- Rotemberg weights sum to one but can be negative.

- Weights measure sensitivity to each shifter-date as in Andrews, Gentzkow, and Shapiro (QJE, 2017).

- In practice, sometimes easier to interpret $\alpha_k = \sum_t \alpha_{k,t}$.

Shifter-level Bartik (BHJ eq. 4)

- Note for any conforming vector V:

$$B'V = \sum_t G_t' Z_t' V_t = \sum_t \sum_k g_{k,t} Z_{k,t}' V_t = \sum_t \sum_k g_{k,t} \sum_\ell z_{\ell,k,t} v_{\ell,t}$$

$$= L \sum_t \sum_k \hat{z}_{k,t} g_{k,t} \bar{v}_{k,t},$$

where: $$\underbrace{\hat{z}_{k,t} = \frac{1}{L} \sum_\ell z_{\ell,k,t}\,,}_{\text{Average exposure to } k} \qquad \underbrace{\bar{v}_{k,t} = \frac{\sum_\ell z_{\ell,k,t} v_{\ell,t}}{\sum_\ell z_{\ell,k,t}}}_{\text{Exposure-weighted average } v_{\ell,t}} \quad .$$

- Then:

Definition: $$\hat{\beta}^B = (B'X)^{-1} B'Y$$

Expand: $$= \left(\sum_t \sum_k \hat{z}_{k,t} g_{k,t} \bar{x}_{k,t} \right)^{-1} \sum_t \sum_k \hat{z}_{k,t} g_{k,t} \bar{y}_{k,t}.$$

- This is IV regression of $\bar{y}_{k,t}$ on $\bar{x}_{k,t}$ with excluded instrument $g_{k,t}$, weighted by $\hat{z}_{k,t}$.

Two questions for causal interpretation

1. What is (conditionally) exogenous, shares or shifters?
   - Shares (Bartik as GMM): Sufficient for $E[z_{\ell,t}\epsilon_{\ell,t}] = 0 \ \forall z_{\ell,t}$.
     - ★ Interpret: ex ante exposure uncorrelated with unobserved determinants of outcome.
   - Shifter (shifter-level Bartik): $E[\hat{z}_{k,t} g_{k,t} \bar{\epsilon}_{k,t}] = 0$.
     - ★ Interpret: areas with ex ante larger exposure to shifters which take high value do not differ systematically along other dimensions.
2. What are asymptotics?
   - Need a law of large numbers along proper dimensions (L, K, or T) for sample moments to converge to expectations.

Technical aside: leave-one-out

- In practice shifter often constructed by aggregating from other areas.
- Avoids finite sample correlation of local component and local contribution to aggregate.
- In practice doesn't matter in applications where $L \to \infty$.

The usual specification checks apply

1. Estimated coefficients sensitive to inclusion of covariates?
2. Pre-trends?
3. Placebo tests?
4. Over-identification tests.
5. Subsample analysis: drop influential observations.
6. Others...

Standard errors

- Adão, Kolesár, Morales (QJE, 2019) point out potential issue with standard errors. Suppose true DGP is:

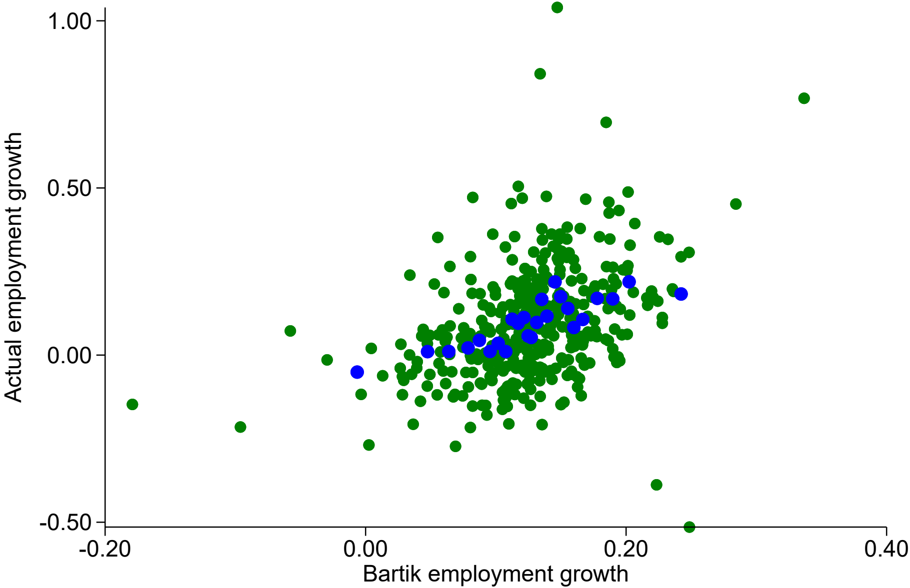
$$y_\ell = \beta x_\ell + \epsilon_\ell,\ x_\ell = \sum_k z_{\ell,k} g_k,\ g_k = g_k^1 + g_k^2,$$

  where g_k^1, g_k^2 are determined nationally.
- Let $x_\ell^n = \sum_k z_{\ell,k} g_k^n$, $n = 1, 2$, and consider the regression $y_\ell = b x_\ell^1 + e_\ell$.
- Why? Might be interested in effect of particular national shifter (e.g. stock market change, or China shock.)
- Endogeneity problem if $Cov(g_k^1, g_k^2) \neq 0$. E.g. sectors exposed to China also more exposed to automation.
- Suppose $Cov(g_k^1, g_k^2) = 0$, so $e_\ell = \beta x_\ell^2 + \epsilon_\ell$ and $plim b = \beta$.
- *Random effects*: areas with similar $z_{\ell,k}$s have correlated residuals.
- Limiting case of one industry per area: $z_{\ell,k} \in \{0, 1\}$ and x_ℓ^2 same for areas sharing an industry. Should cluster by industry, not geography.
- Adão, Kolesár, Morales provide more general clustering formula.

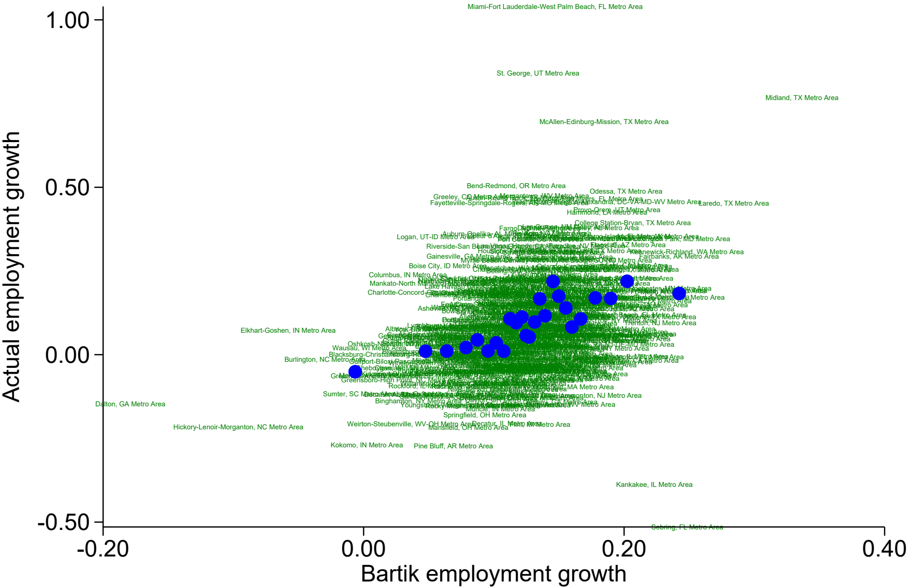
Example

- Shift-share employment growth, 2000-2016.
- County Business Patterns, NAICS 4 digit.
- NAICS cross-walk and missing data imputation from https://www.nber.org/papers/w26632.
- Leave-out growth rate.
- Actual $= 1.23 \times$ Bartik, $R^2 = 0.14$.

Scatter plot



Scatter plot



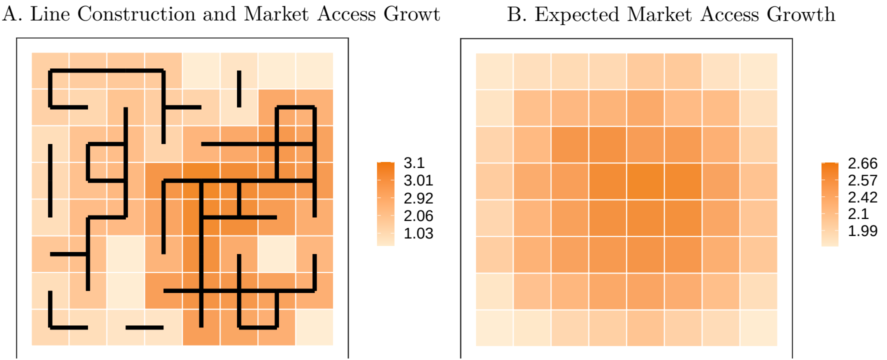
More general: exposure shocks (Borusyak, Hull, WP)

- Shift-shares are special case of exposure-based treatment.
- Setup:

$$y_\ell = \tau + \beta x_\ell + \epsilon_\ell,$$
$$z_\ell = f_\ell(g; w_\ell).$$

  - $f_\ell()$: known function.
  - g: vector of national shocks.
  - w_ℓ: exposure characteristics.
- Shift-share: $f_\ell(g; w_\ell) = \sum_n w_{\ell n} g_n$.
- Claim: Shock exogeneity $g \perp \epsilon, w$ not sufficient for z_ℓ to be valid instrument.
- Intuition: even if g random, some areas more likely to have high or low zs due to exposure.
- Linear shift-share special case where ex ante exposures all the same.

Example: transportation network



Notes: This figure illustrates the omitted variables bias problem and the recentering solution in the simple market access example discussed in Section 2. Panel A shows a random draw of the railroad construction experiment, with lines indicating connected regions and shading indicating corresponding market access growth (computed as described in the text). Panel B shows average market access growth over 1,000 such random draws. The shading in Panel C indicates the recentered market access measure which subtracts expected market access in Panel B from realized market access in Panel A, with the lines again indicating realized line construction.

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Nakamura and Steinsson (AER 2014) overview

- Two contributions:
  1. New measure of *regional* government spending shocks.
  2. Theoretical framework.
- Goal is to learn about impulse response to government spending.

Empirical specification

$$\frac{Y_{i,t} - Y_{i,t-2}}{Y_{i,t-2}} = \alpha_i + \gamma_t + \beta \frac{G_{i,t} - G_{i,t-2}}{Y_{i,t-2}} + \epsilon_{i,t}.$$

- $Y_{i,t}$: per capita output in region i and year t.
- $G_{i,t}$: per capita military procurement spending in region i and year t.
- Normalize by lagged output, so interpretation is per dollar.
- Two year differences instead of lags.
- γ_t: Time fixed effect restricts variation used to estimate β to coming from differences in spending shocks in the same period.
- Instrument 1: national military spending interacted with state FE: first stage coefficients are state-specific "loadings."
- Instrument 2: Bartik where shares are ratio of military spending to GDP in first five years of the sample.

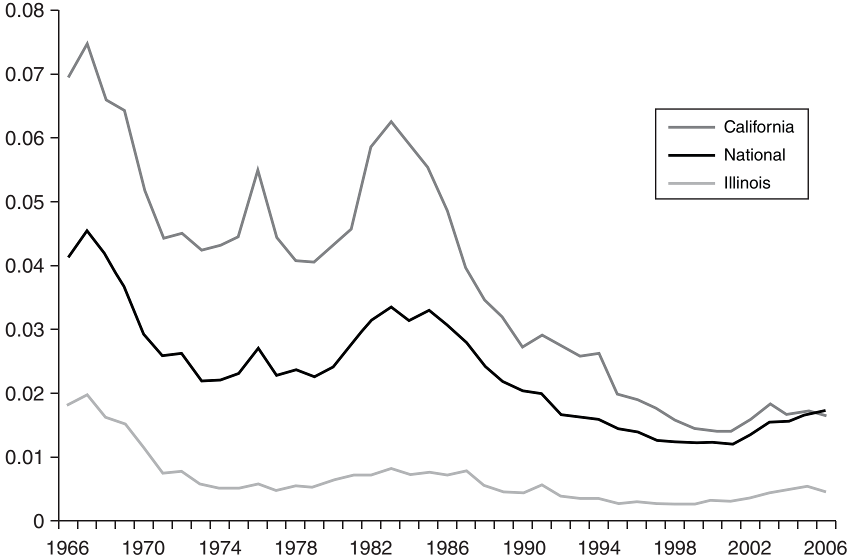

Figure 1. Prime Military Contract Spending as a Fraction of State GDP

What is exogenous and what are asymptotics?

What is exogenous and what are asymptotics?

- Exogenous (Nakamura and Steinsson, AER 2014, p. 755): *Our identifying assumption is that the United States does not embark on military buildups-such as those associated with the Vietnam War and the Soviet invasion of Afghanistan-because states that receive a disproportionate amount of military spending are doing poorly relative to other states.*

- Asymptotics: many states, many periods, one national defense series.

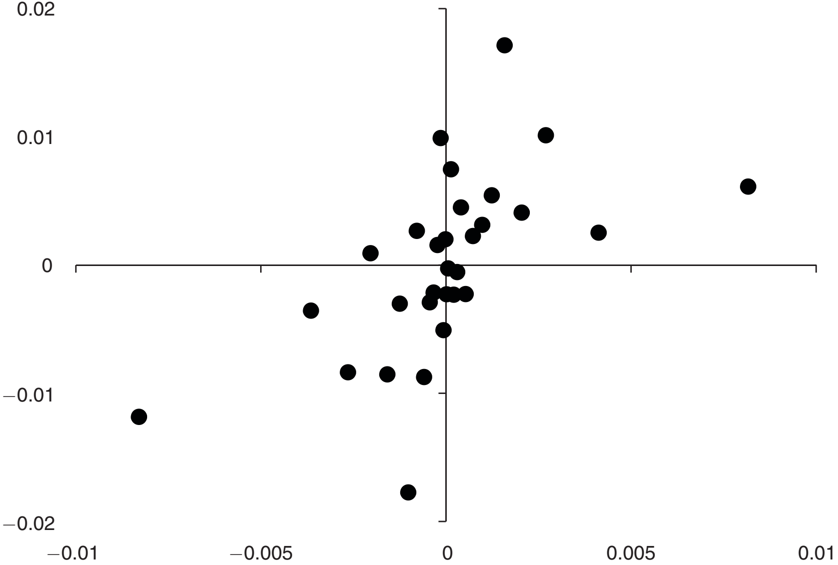

FIGURE 3. QUANTILES OF CHANGE IN OUTPUT VERSUS PREDICTED CHANGE IN MILITARY SPENDING

Table 2—The Effects of Military Spending

	Output		Output defl. state CPI		Employment		CPI	Population
	States	Regions	States	Regions	States	Regions	States	States
Prime military contracts	1.43	1.85	1.34	1.85	1.28	1.76	0.03	−0.12
	(0.36)	(0.58)	(0.36)	(0.71)	(0.29)	(0.62)	(0.18)	(0.17)
Prime contracts plus military compensation	1.62	1.62	1.36	1.44	1.39	1.51	0.19	0.07
	(0.40)	(0.84)	(0.39)	(0.96)	(0.32)	(0.91)	(0.16)	(0.21)
Observations	1,989	390	1,989	390	1,989	390	1,763	1,989

Notes: Each cell in the table reports results for a different regression with a shorthand for the main regressor of interest listed in the far left column. A shorthand for the dependent variable is stated at the top of each column. The dependent variable is a two-year change divided by the initial value in each case. Output and employment are per capita. The regressor is the two-year change divided by output. Military spending variables are per capita except in Population regression. Standard errors are in parentheses. All regressions include region and time fixed effects, and are estimated by two-stage least squares. The sample period is 1966–2006 for output, employment, and population, and 1969–2006 for the CPI. Output is state GDP, first deflated by the national CPI and then by our state CPI measures. Employment is from the BLS payroll survey. The CPI measure is described in the text. Standard errors are clustered by state or region.

Table 3—Alternative Specifications for Effects of Military Spending

	1. Output level instr.		2. Employment level instr.		3. Output per working age		4. Output OLS	
	States	Regions	States	Regions	States	Regions	States	Regions
Prime military contracts	2.48	2.75	1.81	2.51	1.46	1.94	0.16	0.56
	(0.94)	(0.69)	(0.41)	(0.31)	(0.58)	(1.21)	(0.14)	(0.32)
Prime contracts plus military compensation	4.79	2.60	2.07	1.97	1.79	1.74	0.19	0.64
	(2.65)	(1.18)	(0.67)	(0.98)	(0.60)	(1.00)	(0.19)	(0.31)
Observations	1,989	390	1,989	390	1,785	350	1,989	390

	5. Output with oil controls		6. Output with real int. controls		7. Output LIML		8. BEA employment	
	States	Regions	States	Regions	States	Regions	States	Regions
Prime military contracts	1.32	1.89	1.40	1.80	1.95	2.07	1.52	1.64
	(0.36)	(0.54)	(0.35)	(0.59)	(0.62)	(0.66)	(0.37)	(0.98)
Prime contracts plus military compensation	1.43	1.72	1.61	1.59	2.21	1.90	1.62	1.28
	(0.39)	(0.66)	(0.40)	(0.84)	(0.67)	(1.02)	(0.42)	(1.16)
Observations	1,989	390	1,989	390	1,989	390	1,836	360

Notes: Each cell in the table reports results for a different regression with a shorthand for the main regressor of interest listed in the far left column. A shorthand for the dependent variable plus some extra description is stated at the top of each column. The dependent variable is a two-year change divided by the initial value in each case. The dependent variables are in per capita terms. The main regressor is the two year change divided by output. Standard errors are in parentheses. Specifications: 1 and 2 use national military spending scaled by fraction of military spending in the state in 1966–1971 relative to the average fraction as the instrument for state spending; 3 constructs per capita output using the working age population, which is available starting in 1970; 4 presents OLS estimates of the benchmark specification; 5 adds the price of oil interacted with state dummies as controls; 6 adds the real interest rate interacted with state dummies as controls, where our measure of the real interest rate is the Federal Funds Rate

GPSS re-analysis of table 2 column 2 of NS

Panel A: Negative and positive weights

	Sum	Mean	Share
Negative	-0.933	-0.155	0.600
Positive	1.933	0.483	0.400

Panel B: Correlations of Aggregates

	α_k	g_k	β_k
α_k	1		
g_k	0.877	1	
β_k	0.081	0.111	1

Panel C: Top 5 Rotemberg weight (region times growth rates)

	$\hat{\alpha}_k$	g_k	$\hat{\beta}_k$	95 % CI
CT MA ME NH RI VT	1.001	1.825	1.739	(1.6,1.9)
TX OK LA AR	0.400	1.202	1.185	(.95,1.4)
CA WA OR AK HI	0.295	1.614	5.727	(5.25,6.25)
MO KS IA NE MN SD ND	0.237	0.964	-1.841	(-2.25,-1.45)
NC SC GA FL	-0.133	0.771	5.647	(5.05,6.3)

Panel D: Summary of $\hat{\beta}_k$

	Mean	Median	25th P	75th P	Share Negative
β_k	1.514	1.846	5.040	-2.016	0.400

Lead/lag exogeneity revisited

- Can view NS specification as LP-IV.
- They estimate contemporaneous response, but could trace out full IRF.
- Recall Stock and Watson's lead/lag exogeneity criteria: not sufficient for defense exposure $\times$ defense spending to be otherwise uncorrelated with output. Must also be serialy uncorrelated.
- Intuition: to identify impact of spending at date t, instrument must be uncorrelated with spending at date $t-1$.
- Likely to be true? Conditional on what?

Outline

Overview

- What is importance of credit supply shocks in Great Recession in U.S.?
- Focus on acute period of financial panic: of 8.8m private sector jobs lost between peak (Jan-2008) and trough (Feb-2010), 49% occurred during panic period of Sep-2008 to Mar-2009.
- Approach: link employment outcomes of borrowers to health of their lenders.
- Shifter: health of lenders.
- Share: pre-crisis exposure to different lenders.

Syndicated loans

- Loan from multiple banks to single borrower.
- “Lead arranger” provides majority of financing and recruits “participant” lenders.
- All banks party to loan agreement.
- Half of total C&I lending with maturity 31-364 days; two-thirds of lending with maturity 365+ days.
- Only U.S. segment with matched bank and borrower information during crisis.

Example credit agreement

On October 31, 2006, Lifetime Brands, Inc. (the "Company") entered into a Second Amended and Restated Credit Agreement with HSBC Bank USA National Association, JP Morgan Chase Bank, N.A., Citibank, N.A. and Wachovia Bank, National Association. The amended agreement increases the amounts available to the Company under the facility from $100 million to $150 million and, under certain circumstances, to $200 million; and extends the maturity of the facility to April 2011.

Data: Dealscan

- Covers universe of syndicated loan deals at origination.
  - Close to half of all C&I lending is syndicated.
- 1-2 lead arrangers responsible for due diligence, paperwork, recruiting other participants (also retain largest share of loan).
- Sample restrictions:
  - Working capital or corporate purposes (7,885 of 11,740 unique borrowers).
  - Borrowers not in finance, insurance or real estate (6,569 of 7,885).
  - Not missing information on state, industry, or ownership status (4,791 of 6,569).
  - Loans made by 43 most active lenders and industries where at least one firm has a loan market event during the post-Lehman crisis (4,391 of 4,791).

Data: BLS Longitudinal Database (LDB)

- Monthly employment at all private sector establishments in the U.S.
- Administrative data, built up from Unemployment Insurance records.
- Microdata for the QCEW, benchmark for the BLS CES.
- IRS Employer Identification Number (EIN) used to group establishments into firms within each quarter.
- "Fuzzy" merge of Dealscan and LDB using geographic and industry identifiers plus bigram string comparator score of firm name as reported in each dataset.

Banking relationships

	At random benchmark	Actual share	
		2001 to Jun-07	Oct-08 to Jun-09
	Percent of loans in which borrower uses previous lead lender		
Private	9.0	75.0	84.5
Public (Unrated)	9.2	65.6	68.6
Public (Rated)	13.3	73.9	65.5
All	9.5	72.3	75.1

- Shares must be sticky.

Measuring credit supply

- *Bank change in lending*: Weighted average of the number of loans made by each member of the pre-crisis syndicate, Oct-08 to Jun-09 relative to 2005-07, excluding loans to borrower, with weights given by (imputed) loan commitment shares.

- *Lehman exposure*: Fraction of syndicated loan portfolio in credit lines where Lehman Brothers had a lead role.

- *ABX exposure*: Loading of bank's stock return on ABX index.

- *Bank statement items*: 2007 deposits/liabilities, 2007-08 trading net income, 2007-08 real estate charge-offs.

Weighted correlations

	Bank change in lending	Lehman exposure	ABX exposure
Lehman exposure	0.41**		
	[0.008]		
ABX exposure	0.39*	0.29+	
	[0.01]	[0.07]	
Bank statement items	0.52**	0.53**	0.33*
	[0.0004]	[0.0004]	[0.04]

- Shifters imperfectly correlated.

What is exogenous and what are asymptotics?

What is exogenous and what are asymptotics?

- Exogenous (Chodorow-Reich, QJE 2014, p. 16): *the health of banks must be uncorrelated with the unobserved characteristics of their borrowers that affect either loan market or employment outcomes. I sometimes refer to this assumption as "as good as random" matching of banks and borrowers conditional on observables.*

- Asymptotics: many firms, many banks, one crisis.

Observed characteristics

	Quartile of lender health		Standard
	1	4	deviation
Mean employment change, 2008:3-2009:3, in:			
Borrower's industry	-0.086	-0.089	0.083
Borrower's county	-0.056	-0.056	0.009
Share with bond market access	0.455	0.236	0.494
Share private, no bond market access	0.418	0.525	0.492
Share public, no bond market access	0.127	0.239	0.374
Mean all in drawn spread	266	199	133
Median sales at close ($2005 billions)	0.366	0.285	4.146
Mean year of last pre-crisis loan	2005.83	2006.05	1.50
Share with loan due during crisis	0.193	0.205	0.394

- Balancing on observables consistent with exogenous exposures.

Unobserved characteristics

$$
\begin{aligned}
&\left[\ln\left(1 + V_{b,i,crisis}\right) - \ln\left(V_{b,i,pre-crisis}\right)\right] \\
&= \delta\left[\%\Delta \text{ loans to other borrowers}\right] + FE_i + \nu_{i,b}
\end{aligned}
$$

- $V_{b,i,crisis}$: lending from bank b to borrower i between October 2008 and June 2009.
- $V_{b,i,pre-crisis}$: amount of i's last pre-crisis loan from bank b.
- Within estimator: compares change in lending by different banks to the *same* firm.
- Modified Khwaja and Mian exercise: whether including FE_i matters to δ is test of whether unobserved characteristics matter.

Testing for unobserved characteristics

	Δ log(lending in firm-bank pair)	
	(1)	(2)
%Δ loans to other borrowers	1.05**	1.07**
	(0.33)	(0.32)
1-digit industry FE	No	Yes
Year of last pre-crisis loan FE	No	Yes
Bond access/Public/Private FE	No	Yes
Additional controls	No	Yes
Borrower FE	Yes	No
R^2	0.423	0.088
Borrowers	432	432
Observations	2,005	2,005

Employment equation

$$g^{y}_{i,s,t-k,t} = \beta_0 + \beta_1 \Delta\tilde{L}_{i,s} + \gamma X_i + \epsilon_{i,s,t-k,t}$$

or

$$g^{y}_{i,s,t-k,t} = \beta_0 + \beta_1 \widehat{\Delta\tilde{L}_{i,s}} + \gamma X_i + \epsilon_{i,s,t-k,t}$$

$$\widehat{\Delta\tilde{L}_{i,s}} = \delta_0 + \delta_1 \left(other\ measure\right) + \gamma X_i$$

- $g^{y}_{i,t-k,t} = \frac{\sum_{e \in i_{t-k}} y_{e,i,t} - \sum_{e \in i_{t-k}} y_{e,i,t-k}}{0.5\left[\sum_{e \in i_{t-k}} y_{e,i,t} + \sum_{e \in i_{t-k}} y_{e,i,t-k}\right]}$.
- $y_{e,i,t}$: employment at establishment e of firm i in period t.
- Symmetric growth rate:
  - Bounded between [-2,2] and easily accommodates entry and exit.
  - Limits influence of outliers.
  - Second order approximation of log growth rate around zero.

The effect of credit supply on employment

	Employment growth rate 2008:3-2009:3		
	OLS		IV
	(1)	(2)	(3)
%Δ loans to other borrowers	1.17*	1.67**	2.38**
	(0.58)	(0.61)	(0.77)
Emp. change in firm's county		0.89*	0.89^{+}
		(0.43)	(0.46)
2-digit SIC, state, loan year FE	No	Yes	Yes
Firm size & age bin FE	No	Yes	Yes
Bond access/Public/Private FE	No	Yes	Yes
Additional Dealscan controls	No	Yes	Yes
$E[g_j^y]$	-9.2	-9.2	-9.3
Lead lender clusters	43	43	40
Observations	2,040	2,040	2,015

The effect of credit supply on employment

	Employment growth rate 2008:3-2009:3		
	$\Delta \tilde{L}_{i,s}$ instrumented using		
	Lehman exposure	ABX exposure	Bank statement
	(1)	(2)	(3)
%Δ loans to other borrowers	2.49*	3.17*	2.13*
	(1.00)	(1.35)	(0.88)
Emp. change in firm's county	0.85^{+}	0.86^{+}	0.87^{+}
	(0.46)	(0.48)	(0.45)
2-digit SIC, state, loan year FE	Yes	Yes	Yes
Firm size & age bin FE	Yes	Yes	Yes
Bond access/Public/Private FE	Yes	Yes	Yes
Additional Dealscan controls	Yes	Yes	Yes
$E[g_j^y]$	-9.2	-9.3	-9.2
Lead lender clusters	43	40	43
Observations	2,040	2,015	2,040

Heterogeneous treatment effects

	Employment growth rate 2008:3-2009:3	
	(1)	(2)
$\Delta\tilde{L}_{i,s}$ * Large	0.54	
	(0.97)	
$\Delta\tilde{L}_{i,s}$ * Medium	1.84^{+}	
	(0.97)	
$\Delta\tilde{L}_{i,s}$ * Small	2.16^{**}	
	(0.79)	
$\Delta\tilde{L}_{i,s}$ * Bond market access		1.04
		(1.00)
$\Delta\tilde{L}_{i,s}$ * No access		2.01^{**}
		(0.60)
Full controls	Yes	Yes
Lead lender clusters	43	43
Observations	2,040	2,040

Placebo periods

	Employment growth rate			
	2005:2-2007:2		2001:3-2002:3	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
%Δ loans to other borrowers	−0.67	0.92	−0.74	−0.72
	(1.63)	(1.15)	(1.44)	(0.85)
Full controls	Yes	Yes	Yes	Yes
Lead lender clusters	43	40	43	40
Observations	1,879	1,854	1,675	1,653

Data: Share National Credit program (SNC)

- Joint supervisory data set of Federal Reserve, FDIC, and OCC.
- Information on all loans >\$20 million and shared by 3+ supervisees.
- Yearly snap shot on December 31st but information on amendments over course of year.
- \$1.2T outstanding in SNC in 2007 versus \$1.4T C&I loans at commercial banks. ▸ Call Reports comparison
- SNC covenant review sample: information on covenant compliance for subset of SNC universe.
  - We restrict to nonfinancial borrowers, term loans and credit lines, remaining maturity of 1+ years.
- *Bind*: loan breaches covenant regardless of whether waiver granted.

Loan covenants

Section 7.12 Leverage Ratio

The Borrower will not permit the Leverage Ratio at any time to be greater than (a) 3.00 to 1.00 or (b) upon the written request of the Borrower to the Administrative Agent not later than ten (10) Business Days after the consummation by the Borrower or any Subsidiary of a Permitted Acquisition, 3.50 to 1.00 for the period of four fiscal quarters immediately succeeding the consummation of such Permitted Acquisition; *provided* that (i) at the time of such request, no Event of Default shall have occurred and be continuing and (ii) the Borrower shall not have requested an adjustment of the Leverage Ratio pursuant to this Section 7.12 at any time during the four fiscal quarters immediately preceding such request.

Section 7.13 Interest Coverage Ratio

The Borrower shall not permit the Interest Coverage Ratio as of the last of any fiscal quarter to be less than 4.00 to 1.00.

ARTICLE 8. EVENTS OF DEFAULT

Section 8.01 Events of Default

Each of the following events shall constitute an "*Event of Default*":

(a) the Borrower shall fail (i) to pay any principal of any Loan or in respect of any Reimbursement Obligation when and as the same shall become due and payable, whether at the due date thereof or at a date fixed for prepayment thereof or otherwise or (ii) make any deposit into the Cash Collateral Account when required hereby; or

(b) the Borrower shall fail to pay any interest on any Extension of Credit or any fee, commission or any other amount (other than an amount referred to in clause (a) of this Section 8.01) payable under any Loan Document, when and as the same shall become due and payable, and such failure shall continue unremedied for a period of three Business Days; or

(c) any representation or warranty made or deemed made by or on behalf of any Loan Party in or in connection with any Loan Document or any amendment or modification thereof or waiver thereunder, or in any report, certificate, financial statement or other document furnished pursuant to or in connection with any Loan Document or any amendment or modification thereof or waiver thereunder, shall prove to have been incorrect in any material respect when made or deemed made; or

(d) the Borrower shall fail to observe or perform any covenant, condition or agreement contained in Sections 6.02, 6.03, 6.08, 6.11, 6.12, 6.13 or 6.14 or in Article 7; or

Section 8.02 Contract Remedies

Upon the occurrence of an Event of Default or at any tVime thereafter during the continuance thereof,

(a) in the case of an Event of Default specified in Section 8.01(h) or 8.01(i), without declaration or notice to the Borrower, the Revolving Commitments (including the Letter of Credit Commitment) shall immediately and automatically terminate, and the Loans, all accrued and unpaid interest thereon and all other amounts owing under the Loan Documents shall immediately become due and payable, and

(b) in all other cases, upon the direction of the Required Lenders, the Administrative Agent shall, by notice to the Borrower, declare all of the Revolving Commitments (including the Letter of Credit Commitment) to be terminated forthwith, whereupon such Revolving Commitments (including the Letter of Credit Commitment) shall immediately terminate, or declare the Loans, all accrued and unpaid interest thereon and all other amounts owing under the Loan Documents to be due and payable forthwith, whereupon the same shall immediately become due and payable.

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(c) any representation or warranty made or deemed made by or on behalf of any Loan Party in or in connection with any Loan Document or any amendment or modification thereof or waiver thereunder, or in any report, certificate, financial statement or other document furnished pursuant to or in connection with any Loan Document or any amendment or modification thereof or waiver thereunder, shall prove to have been incorrect in any material respect when made or deemed made; or

(d) the Borrower shall fail to observe or perform any covenant, condition or agreement contained in Sections 6.02, 6.03, 6.08, 6.11, 6.12, 6.13 or 6.14 or in Article 7; or

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Section 1.01 Defined Terms

"*Required Lenders*" means, at any time, (i) Lenders having Revolving Exposures and unused Revolving Commitments representing not less than 51% of the sum of the total Revolving Exposures and unused Revolving Commitments at such time and (ii) in any event not less than two Lenders.

Results (C-R and Falato, JF forth.)

Dependent variable:	%ΔTotal committed		Credit Util.	%Δ Drawn
Aggregation:	Loan all margins	Firm	Firm	Firm
Bad Lender	6.3	6.2	0.3	7.4
	(14.0)	(13.4)	(5.7)	(6.9)
Bind	-8.5^{**}	-6.3^{**}	-1.5	2.3
	(3.7)	(3.1)	(2.6)	(3.1)
Bad Lender × *Bind*	-24.4^{***}	-30.1^{***}	7.3^{***}	-19.1^{**}
	(14.0)	(10.3)	(1.5)	(8.0)
Year, Industry FE	Yes	Yes	Yes	Yes
Borrower controls	Yes	Yes	Yes	Yes
Loan controls	Yes	No	No	No
Controls×*Bad Lender*	Yes	Yes	Yes	Yes
Observations	3,420	1,803	1,803	1,803

Outline

1. Econometrics (Goldsmith-Pinkham, Sorkin, Swift, AER 2020; Borusyak, Hull, Jaravel, RESTUD forthcoming)
2. Regional fiscal policy (Nakamura and Steinsson, AER 2014)
3. Bank health (Chodorow-Reich, QJE 2014; Chodorow-Reich and Falato, JF forthcoming)
4. Regional stock market wealth (Chodorow-Reich, Simsek, Nenov, AER 2021)
5. Higher order shift-shares (Chodorow-Reich and Wieland, JPE, 2020)
6. Wrap-up

Introduction

> *We care about financial conditions not for themselves, but instead for how they can affect economic activity and ultimately our ability to achieve the statutory objectives of the Federal Reserve... A rise in equity prices can boost household wealth, which is one factor that underpins consumer spending.*
> *—William Dudley, President of Federal Reserve Bank of New York, March 30, 2017*

- Representative of FOMC views (Cieslak and Vissing-Jorgensen, WP).
- Limited direct evidence due to two confounders:
    1. Leading indicator channel.
    2. Cost of capital channel.

Stock market wealth and return

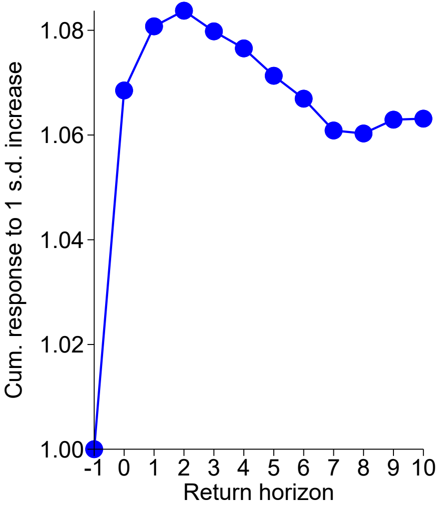
- Main regressor is (approximately) $S_{a,t-1}R_t$ where:

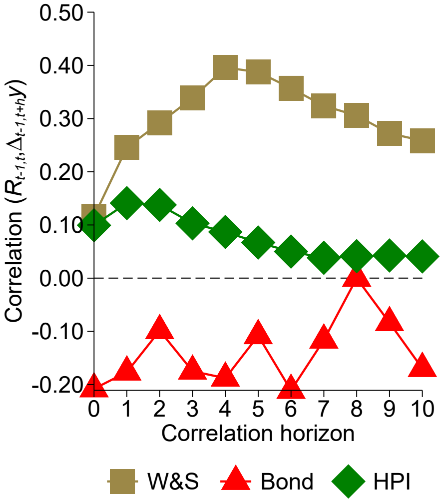
$$S_{a,t} = \underbrace{D_{a,t}}_{\text{dividend income}} \times \overbrace{\frac{Q_t}{D_t}}^{\text{Price-dividend ratio}} \times \frac{1}{\underbrace{W_{a,t}L_{a,t}}_{\text{labor income}}}$$

R_t : Market return between quarter $t-1$ and quarter t.

- SOI: income tax returns (1040s) filed from addresses in county.
  - Dividend income includes any distribution from C-corporation.
  - Labor income includes wages and salaries, bonuses, tips, etc.

Properties of stock returns





Outcome variables

Main outcomes: log change in employment/payroll in QCEW.

- QCEW: total employment and payroll at establishments in county covered by UI program ($> 95\%$ of total employment). Manual adjustments for transcription errors in data and seasonal adjustment using X-11 moving average.

- Nontradable (44-45, 72): Retail Trade, Accommodation and Food Services.

- Construction (23).

- Tradable (11, 21, 31-33): Agriculture, Forestry, Fishing and Hunting, Mining, Quarrying, and Oil and Gas Extraction, Manufacturing.

What is exogenous and what are asymptotics?

$$\overbrace{\Delta_{a,t-1,t+h}y}^{\text{change in area between } t-1 \text{ and } t+h} = \beta_h[S_{a,t-1}R_t] + \overbrace{\Gamma_h' X_{a,t-1}}^{\text{covariates}} + \epsilon_{a,t-1,t+h}.$$

- Local projection : Estimate separately for each h (Jorda (2005)).

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- Local projection : Estimate separately for each h (Jorda (2005)).
- Consistent when $E[R_t \mu_t] = 0$ where $\mu_t \equiv E[S_{a,t-1}\epsilon_{a,t-1,t+h}]$. details
  - "When R_t high, high-wealth areas don't grow faster for other reasons."

What is exogenous and what are asymptotics?

$$\overbrace{\Delta_{a,t-1,t+h} y}^{\text{change in area between } t-1 \text{ and } t+h} = \beta_h [S_{a,t-1} R_t] + \overbrace{\Gamma'_h X_{a,t-1}}^{\text{covariates}} + \epsilon_{a,t-1,t+h}.$$

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  - "When R_t high, high-wealth areas don't grow faster for other reasons."
- Baseline specification: $X_{a,t-1}$ includes county FE, stateXquarter FE, Bartik employment growth at horizon h, $S_{a,t-1} \times R_t^{\text{labor, business, bonds, housing}}$, lags of $S_{a,t}$. ▸ details

What is exogenous and what are asymptotics?

$$\overbrace{\Delta_{a,t-1,t+h}y}^{\text{change in area between } t-1 \text{ and } t+h} = \beta_h[S_{a,t-1}R_t] + \overbrace{\Gamma_h' X_{a,t-1}}^{\text{covariates}} + \epsilon_{a,t-1,t+h}.$$

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- Counties weighted by 2010 population.
- Standard errors two-way clustered by time and county.

Identifying assumption

- Matrix version:

$$\boldsymbol{Y} = \beta_h \boldsymbol{S}\boldsymbol{R} + \boldsymbol{X}\Gamma + \boldsymbol{\epsilon}.$$

  - $\boldsymbol{Y}$: $AT \times 1$ vector of $\Delta_{a,t-1,t+h}y$ stacked over A areas and T periods.
  - $\boldsymbol{S}$: $AT \times T$ matrix containing $\begin{pmatrix} S_{1,t-1} & \dots & S_{A,t-1} \end{pmatrix}'$ in rows $A(t-1)+1$ to At of column t and zeros elsewhere.
  - $\boldsymbol{R}$: $T \times 1$ vector of stock market returns.
  - $\boldsymbol{X}$: $AT \times K$: matrix of K covariates stacked over areas and time.
  - $\boldsymbol{\epsilon}$: $AT \times 1$ stacked vector of $\epsilon_{a,t-1,t+h}$.
- Identifying assumption:

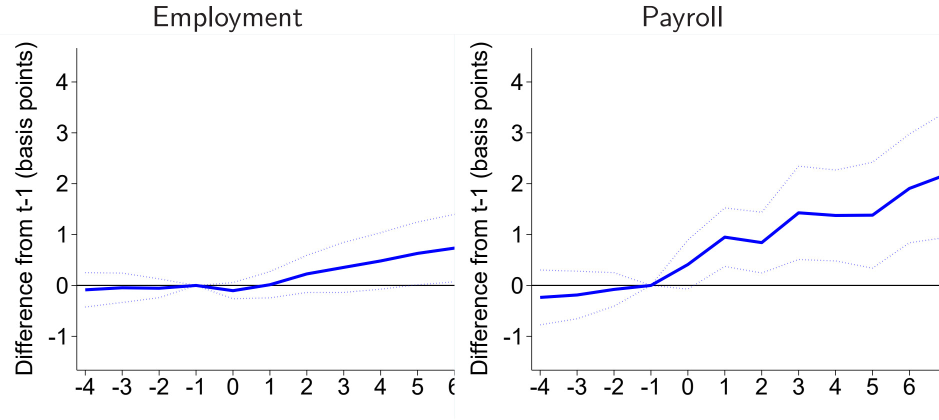
$$0 = \lim_{a,t\to\infty} (\boldsymbol{S}\boldsymbol{R})' \boldsymbol{\epsilon} = \lim_{a,t\to\infty} \boldsymbol{R}'\boldsymbol{S}'\boldsymbol{\epsilon} = \lim_{a,t\to\infty} \sum_t R_{t-1,t} \sum_a S_{a,t-1}\epsilon_{a,t-1,t+h}$$

$$= E\left[R_{t-1,t}\mu_t\right],$$

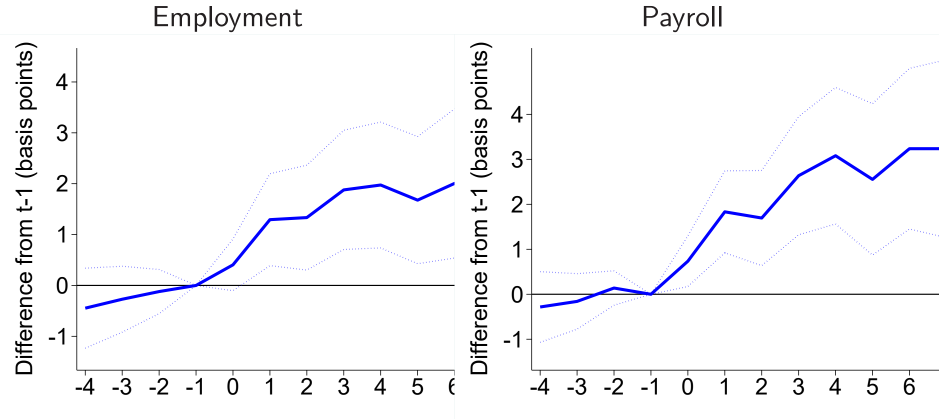
$\mu_t \equiv E\left[S_{a,t-1}\epsilon_{a,t-1,t+h}\right]$: time t weighted residual.

▸ back

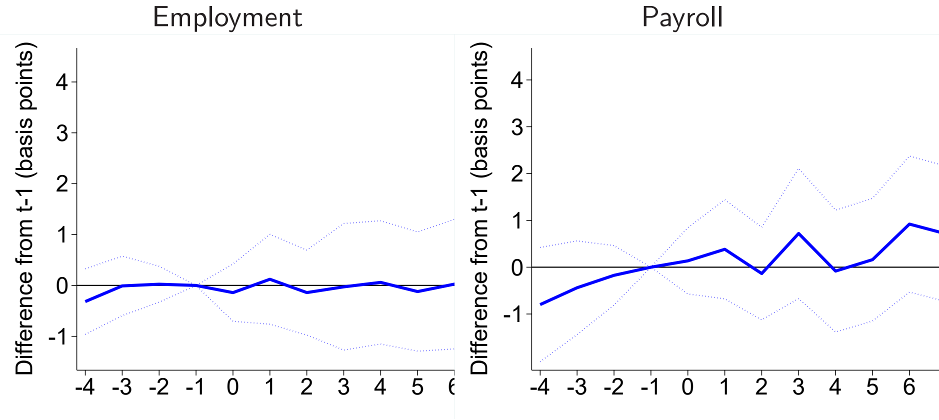
All Industries IRF



Nontradable Industries IRF



Tradable Industries IRF



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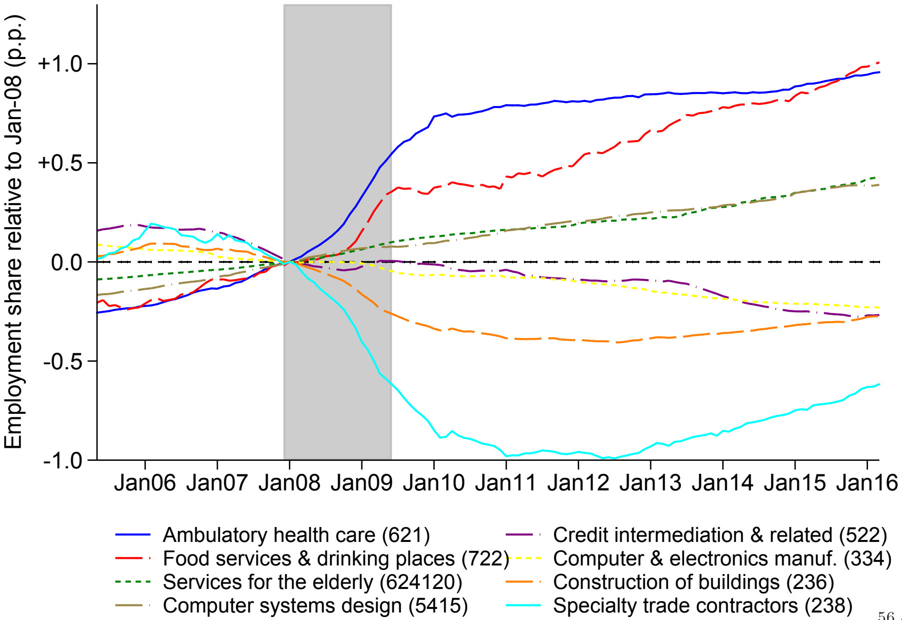
Reallocation around the great recession



Questions

- How easily do labor markets absorb industry specific shocks – e.g. to productivity, tastes, import competition, etc? Do these shocks affect business cycles?
  - Lilien (1982): Yes. Abraham and Katz (1986), Murphy and Topel (1987): No. Recent literature: divided.

- Our paper:
  - Reallocation occurs all the time, but response of economy depends on state of business cycle.
  - Empirical: study response of local labor markets to reallocation, separately by business cycle state.
  - Model: show how wage rigidity can account for results.

Reallocation index

$$R_{a,t,t+j} = \frac{12}{j}\frac{1}{2}\sum_{i}^{I} s_{a,i,t}\left|\frac{1+g_{a,i,t,t+j}}{1+g_{a,t,t+j}} - 1\right|. \tag{1}$$

- $e_{a,i,t}$: employment in industry i in area a at time t.
- $e_{a,t} = \sum_i e_{a,i,t}$: aggregate employment in area a.
- $s_{a,i,t} = \frac{e_{a,i,t}}{e_{a,t}}$: i employment share in period t.

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- $s_{a,i,t} = \frac{e_{a,i,t}}{e_{a,t}}$: i employment share in period t.
- $\frac{1}{2}\sum_i^I s_{a,i,t}\left|\frac{1+g_{a,i,t,t+j}}{1+g_{a,t,t+j}} - 1\right|$:
  - 0 if employment grows at identical rate in every industry.
  - 1 if all industries with positive employment in t disappear by $t+j$.
  - If $g_{a,t,t+j} = 0$, minimum fraction of employment which changes industry between t and $t+j$.

Reallocation index

$$R_{a,t,t+j} = \frac{12}{j}\frac{1}{2}\sum_{i}^{I} s_{a,i,t}\left|\frac{1+g_{a,i,t,t+j}}{1+g_{a,t,t+j}} - 1\right|. \tag{1}$$

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- $\frac{12}{j}$: convert total reallocation to monthly flow at annual rate.

Reallocation index

$$R_{a,t,t+j} = \frac{12}{j}\frac{1}{2}\sum_{i}^{I} s_{a,i,t}\left|\frac{1+g_{a,i,t,t+j}}{1+g_{a,t,t+j}} - 1\right|. \quad (1)$$

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- $s_{a,i,t} = \frac{e_{a,i,t}}{e_{a,t}}$: i employment share in period t.
- $\frac{1}{2}\sum_i^I s_{a,i,t}\left|\frac{1+g_{a,i,t,t+j}}{1+g_{a,t,t+j}} - 1\right|$:
  - 0 if employment grows at identical rate in every industry.
  - 1 if all industries with positive employment in t disappear by $t+j$.
  - If $g_{a,t,t+j} = 0$, minimum fraction of employment which changes industry between t and $t+j$.
- $\frac{12}{j}$: convert total reallocation to monthly flow at annual rate.
- Equivalent representation: $R_{a,t,t+j} = \left(\frac{12}{j}\right)\left(\frac{1}{2}\sum_{i=1}^{I}\left|s_{a,i,t+j} - s_{a,i,t}\right|\right)$.

Empirical framework

- Simultaneous system:

$$\Delta u_{a,t,t+j} = \beta_j R_{a,t,t+k} + \mathcal{G}\left(\{s_{a,i,t}\};\{\eta_{i,t,t+j}\}\right) + \Gamma^{u\prime} X_{a,t} + \epsilon_{a,t,t+j},$$
$$R_{a,t,t+k} = \mathcal{C}\left(u_{a,t},\ldots,u_{a,t+k}\right) + \mathcal{R}\left(\{s_{a,i,t}\};\{\eta_{i,t,t+k}\}\right) + \Gamma^{R\prime} X_{a,t} + \nu_{a,t,t+k}$$

  - $u_{a,t}$: labor market variable, e.g. unemployment rate.
  - $\eta_{i,t,t+j}$: industry-shock.
  - Assumption: $\mathcal{G}$ and $\mathcal{R}$ not collinear.

Empirical framework

- Simultaneous system:

$$\Delta u_{a,t,t+j} = \beta_j R_{a,t,t+k} + \mathcal{G}\left(\{s_{a,i,t}\};\{\eta_{i,t,t+j}\}\right) + \Gamma^{u\prime} X_{a,t} + \epsilon_{a,t,t+j},$$
$$R_{a,t,t+k} = \mathcal{C}\left(u_{a,t},\ldots,u_{a,t+k}\right) + \mathcal{R}\left(\{s_{a,i,t}\};\{\eta_{i,t,t+k}\}\right) + \Gamma^{R\prime} X_{a,t} + \nu_{a,t,t+k}$$

  - $u_{a,t}$: labor market variable, e.g. unemployment rate.
  - $\eta_{i,t,t+j}$: industry-shock.
  - Assumption: $\mathcal{G}$ and $\mathcal{R}$ not collinear.
- Reasons $u_{a,t+h} \Rightarrow R_{a,t,t+k}$:
  1. Lower opportunity cost of restructuring when demand is low (Schumpeter, 1942; Berger, 2014.)
  2. Reallocation from more to less cyclically sensitive industries when unemployment rises.

Empirical framework

- Simultaneous system:

$$\Delta u_{a,t,t+j} = \beta_j R_{a,t,t+k} + \mathcal{G}(\{s_{a,i,t}\};\{\eta_{i,t,t+j}\}) + \Gamma^{u\prime} X_{a,t} + \epsilon_{a,t,t+j},$$
$$R_{a,t,t+k} = \mathcal{C}(u_{a,t},\ldots,u_{a,t+k}) + \mathcal{R}(\{s_{a,i,t}\};\{\eta_{i,t,t+k}\}) + \Gamma^{R\prime} X_{a,t} + \nu_{a,t,t+k}$$

  - $u_{a,t}$: labor market variable, e.g. unemployment rate.
  - $\eta_{i,t,t+j}$: industry-shock.
  - Assumption: $\mathcal{G}$ and $\mathcal{R}$ not collinear.
- Reasons $u_{a,t+h} \Rightarrow R_{a,t,t+k}$:
  1. Lower opportunity cost of restructuring when demand is low (Schumpeter, 1942; Berger, 2014.)
  2. Reallocation from more to less cyclically sensitive industries when unemployment rises.
- General problem: shocks that affect R may also directly affect u (e.g. manufacturing decline.)

Double Bartik approach

- Define:

$$\text{Leave-out:} \quad g_{-a,i,t,t+j} \equiv \frac{e_{-a,i,t+j}}{e_{-a,i,t}} - 1,$$

$$\text{Bartik growth:} \quad g^b_{a,t,t+j} = \frac{12}{j} \sum_{i=1}^{I} s_{a,i,t} g_{-a,i,t,t+j},$$

$$\text{Bartik reallocation:} \quad R^b_{a,t,t+j} = \left(\frac{12}{j}\right) \left(\frac{1}{2} \sum_{i=1}^{I} s_{a,i,t} \left| \frac{1 + g_{-a,i,t,t+j}}{1 + g^b_{a,t,t+j}} - 1 \right| \right)$$

- Bartik reallocation as excluded instrument: determined as of period t so no feedback from local demand to Bartik reallocation.
- Bartik growth as included instrument: controls for cyclical sensitivity of industry mix and other industry-level shocks.

What is exogenous and what are asymptotics?

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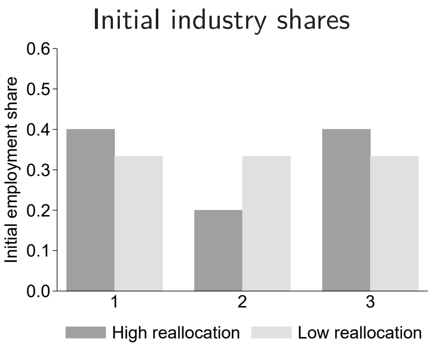
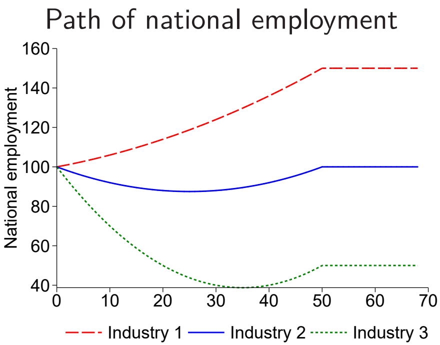
- Exogenous (Chodorow-Reich and Wieland, p. 6): *The exclusion restriction requires that Bartik growth absorb all direct effects of industry shocks on unemployment which occur through* $\mathcal{G}$. *Furthermore, specifying predicted reallocation as an excluded instrument solves the problem of feedback from local unemployment to reallocation because (with time fixed effects) predicted reallocation does not depend on local outcomes after time* t, *while including* $g^{b}_{a,t,t+k}$ *controls for both the area's industrial cyclical sensitivity and the possibility that predicted reallocation concentrates in areas also undergoing secular decline or expansion. Intuitively, the research design compares areas with the same predicted growth but different predicted reallocation.*

- Asymptotics: many areas, many industries, a few time periods.

3 INDUSTRY IDENTIFICATION EXAMPLE





- $g^b_{HR} = g^b_{LR} = 0$.
- $R^b_{HR} > R^b_{LR}$.

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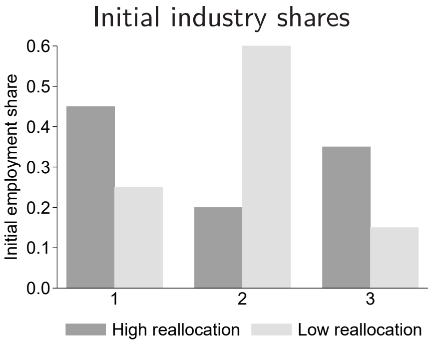
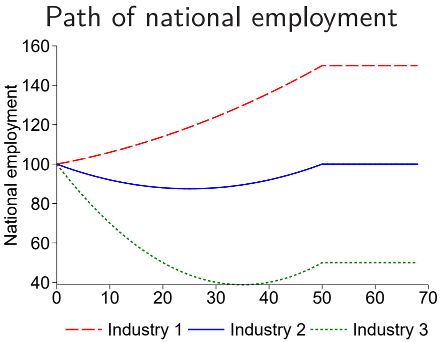




- $g^b_{HR} = g^b_{LR} > 0$.
- $R^b_{HR} > R^b_{LR}$.

First stage

	Dependent variable: actual reallocation			
	Recession-recoveries		Expansions	Pooled
	(1)	(2)	(3)	(4)
Predicted reallocation	0.98**	0.21	0.66**	0.80**
	(0.25)	(0.24)	(0.22)	(0.18)
Episodes	Ex. 1990-93	All	All	Ex. 1990-93
National cycle FE	Yes	Yes	Yes	Yes
Predicted growth	Yes	Yes	Yes	Yes
R^2	0.38	0.08	0.22	0.38
CSA-MSA clusters	217	218	218	220
Observations	534	748	557	1091

Notes: The dependent variable is actual reallocation, R_a. The variable predicted reallocation is the reallocation measure R_a^b. Standard errors in parentheses and clustered by CSA-MSA. $**$ indicates significance at the 1% level.

Pooled results, homogeneous treatment

	Dep. var.: change in unemployment rate		
	(1)	(2)	(3)
Reallocation	0.44^{+}	0.39^{*}	0.60^{**}
	(0.25)	(0.15)	(0.18)
National cycle FE	Yes	Yes	Yes
Predicted growth	Yes	Yes	Yes
Additional controls	No	Yes	No
Area FE	No	No	Yes
First stage coefficient	0.80	1.18	1.11
First stage F stat.	18.8	67.7	29.5
CSA-MSA clusters	220	220	220
First stage observations	1,091	1,091	1,091
Second stage observations	1,305	1,305	1,305

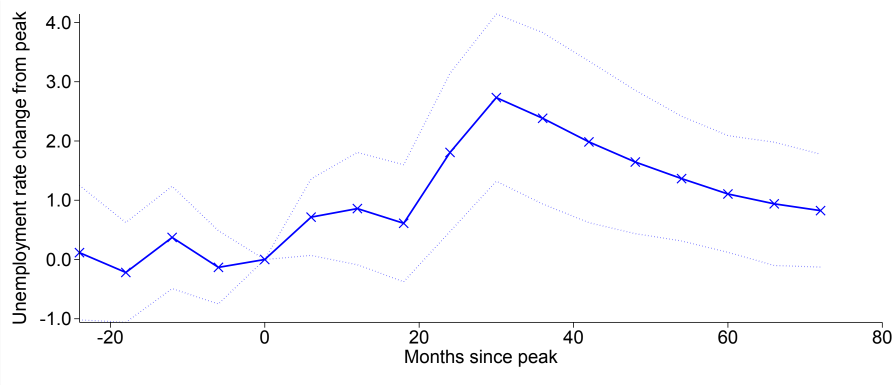
Notes: The table reports ts2sls regressions. The dependent variable is the change in the unemployment rate between the national recession peak and trough (recession-recovery episode) or during the first 30 months of the national expansion. Additional controls in column (2) are: lags of employment growth, population growth, and house price growth, each measured from 5 years to 1 year prior to the cycle start; area size, measured by

Heterogeneity over the business cycle

	Dep. var.: change in unemployment ra		
	(1)	(2)	(3)
Reallocation X Expansion	−0.40	−0.10	−0.32
	(0.35)	(0.16)	(0.34)
Reallocation X Recession-Recovery	0.87**	0.87**	0.91**
	(0.25)	(0.23)	(0.21)
P-value of equality	0.004	0.001	0.004
National cycle FE	Yes	Yes	Yes
Predicted growth	Yes	Yes	Yes
Additional controls	No	Yes	No
Area FE	No	No	Yes
First stage F-statistic, recession	16.7	20.2	13.3
First stage F-statistic, expansion	8.5	66.7	15.4
First stage observations	1,091	1,091	1,091
Second stage observations	1,305	1,305	1,305

- s.d.(predicted reallocation) $= 0.22 \Rightarrow$ 1 s.d. more reallocation $\rightarrow$ $0.22 \times 0.87 \times 2.5 = 0.5$ *p.p.* higher unemployment rate at trough.

Local projection



The figure plots the coefficients $\beta_{1,j}$ from the regression:

$$\Delta u_{a,peak(t),peak(t)+j} = \beta_j \hat{R}_{a,peak(t),lastpeak(t)} + \gamma_j g^b_{a,peak(t),lastpeak(t)} + \Gamma_j g^b_{a,peak(t),peak}$$
$$+ \alpha_{t,j} + \epsilon_{a,t,t+j}.$$

Borusyak, Hull (WP) revisited

- In exposure-based designs, random treatment not sufficient in general.
- In reallocation example, areas with high concentration of employment less likely to experience high reallocation (why?).
- If these areas different along other dimensions, then even if industry growth rates randomly assigned, treatment is not random.
- Solution: de-mean with respect to expected treatment.
- Or panel data with unit fixed effects.

Outline

1. Econometrics (Goldsmith-Pinkham, Sorkin, Swift, AER 2020; Borusyak, Hull, Jaravel, RESTUD forthcoming)
2. Regional fiscal policy (Nakamura and Steinsson, AER 2014)
3. Bank health (Chodorow-Reich, QJE 2014; Chodorow-Reich and Falato, JF forthcoming)
4. Regional stock market wealth (Chodorow-Reich, Simsek, Nenov, AER 2021)
5. Higher order shift-shares (Chodorow-Reich and Wieland, JPE, 2020)
6. Wrap-up

Conclusion

- What is exogenous?
- What are asymptotics?
- Next week: what do we do with these estimates?

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6. Be purposeful in topic selection, in specification, and in writing.
   - Don't do X just because ABC did X, unless point is contrast with ABC.

Miscellaneous presentation advice

1. Keep slides clean.
    - Ideally one line per bullet.
    - Text, figures, and tables legible from the back of the room.
    - Model yourself on other presentation slides, not teaching slides.
2. Adapt presentation to presentation slot:
    - Rule of thumb: two minutes per slide.
    - Explain everything or tell us what we can gloss over.
    - Lunch presentation different format and objective from job talk.
3. Practice: I have seen senior professors give a paper multiple times using *exactly* the same "script".