The Impact of a Local Human Capital Shock: Evidence from World War II Veterans

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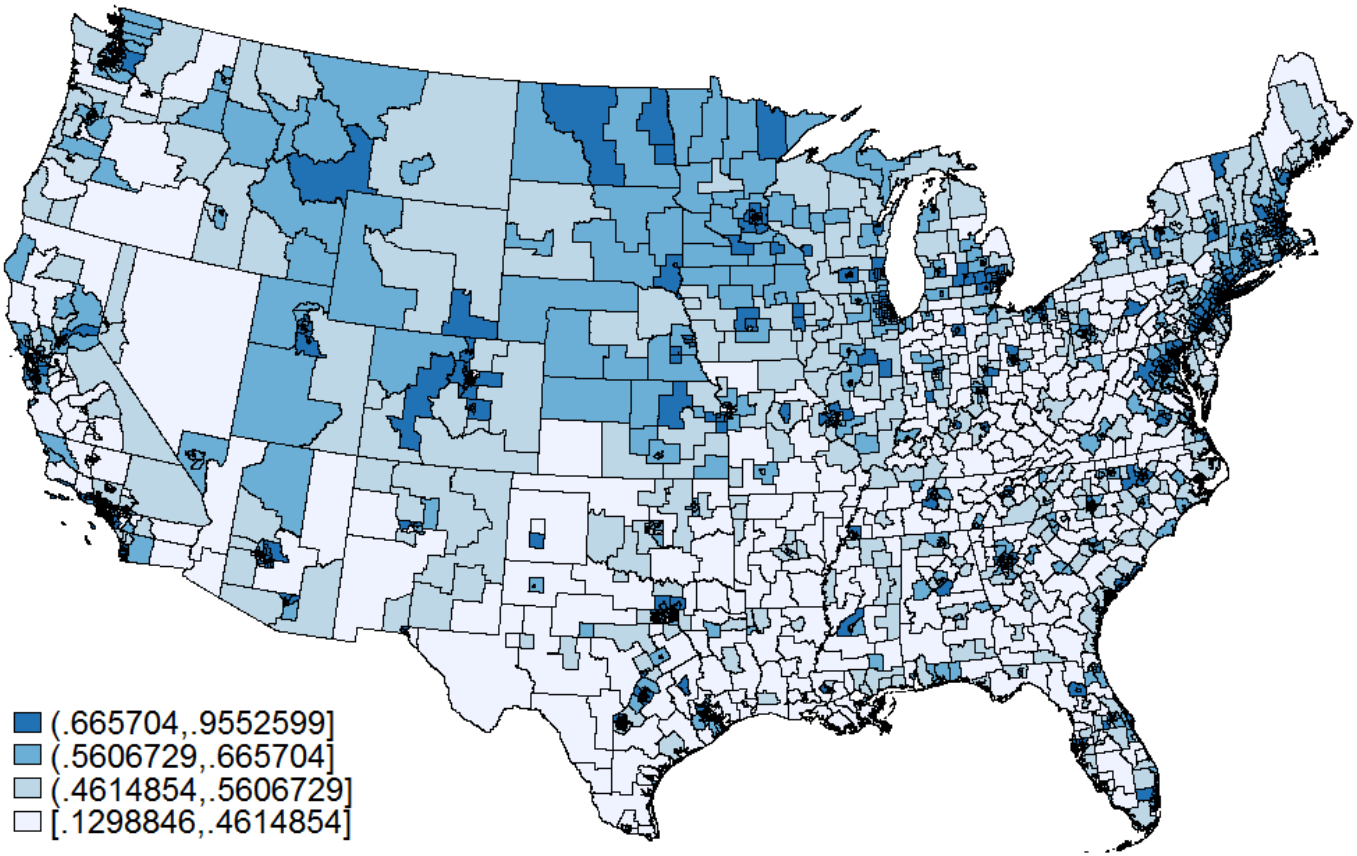
Motivation

- Local human capital is **unevenly** distributed across cities in the US.
- However, we know relatively **little** about **why** these differences arise.

Share of college-educated across the US in 2000



Note: Author's calculation from 2000 5% Census. Unit = PUMA. College-educated = Some college or higher.

Motivation

It is **important** to know the **causes** of this difference in local skill.

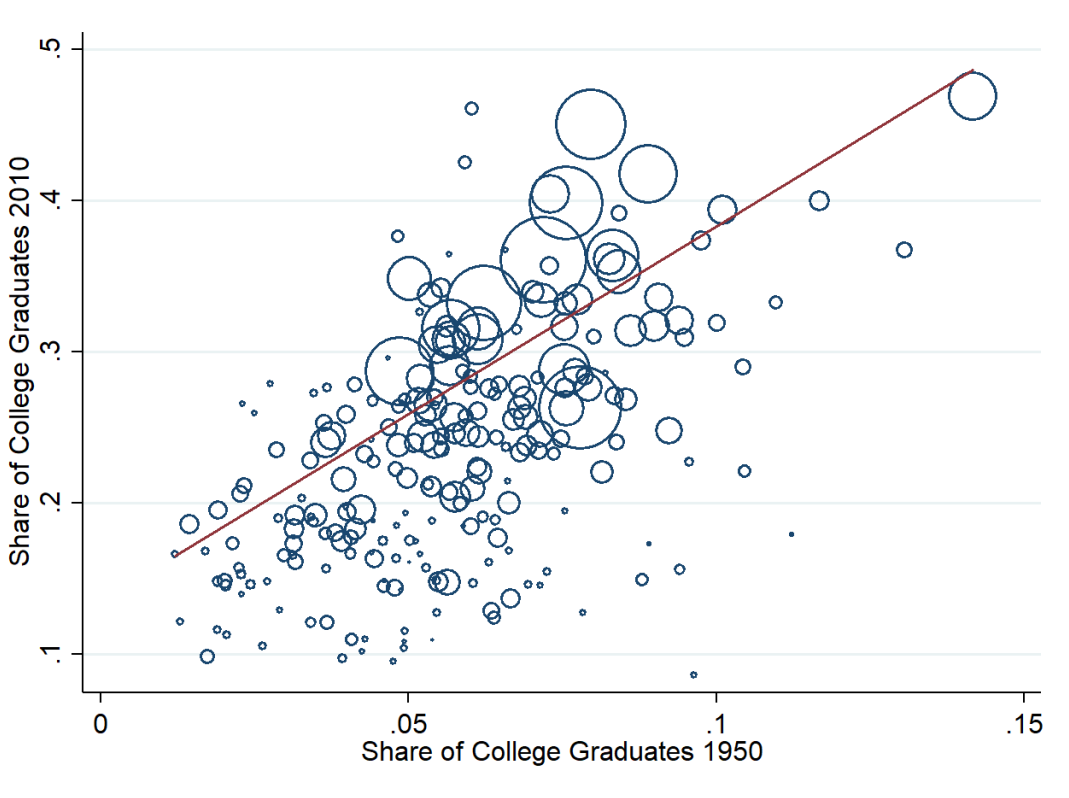
1. "Great Divergence" (*The New Geography of Jobs*, Moretti 2012)
   - Increasing split between regions that flourish and regions that fail (since 1980)
   - Main driver: innovation and spillover from well-educated workers
   - Cities with skilled workers attract more of the same

2. A strong predictor for local economic growth
   (Glaeser et al. 1995, Glaeser and Saiz 2004)
   - Skilled cities are good at adapting economic shocks
   - Skill-biased technical change (Acemoglu 2002, Beaudry et al. 2010)

Why did this significant difference in local human capital start?

Persistence in Local Human Capital

- Strong **persistence** in share of college-educated (correlation = 0.5209)



Note: Author's calculation from Census (Ruggles et al. 2010). Size of bubble = male population 1950.

One possibility: Persistent effects from a historical shock?

Post – WWII period

- The return of **WWII veterans**
  - **GI Bill**: Federal support for higher education to returning veterans (1944)
  - **Large** enrollments of returning veterans to colleges and universities
  - As a result, WWII veterans were relatively **highly educated**
- **Uneven** geographic distribution of college-educated WWII veterans
  - Local human capital $\uparrow$ in some places after the war
  - Can be viewed as a **local human capital shock**

This paper

- Presents the consequences of exogenous shock in local human capital
- Using cross-city variation in relative growth of college educated WWII veterans
- Method: Two Stage Least Squares (IV)
- Data: Census Microdata (IPUMS, Ruggles et al. 2015) from various years

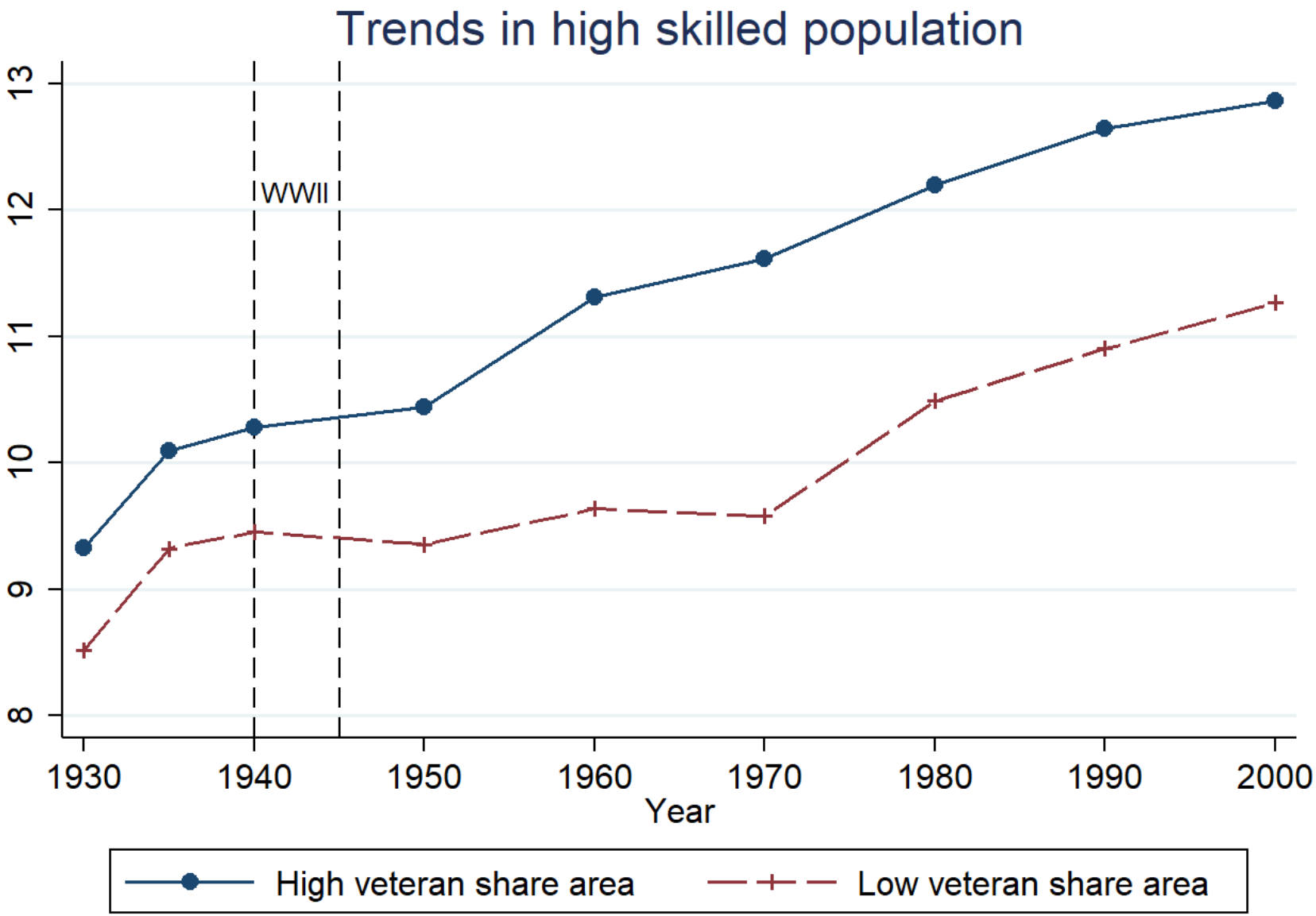
Research Questions:

1. Did the WWII veterans **reshuffle** the distribution of skills across cities? (Short-run: 1940-1950)
2. Did this post-WWII shock generate **persistent** trends in local human capital? (Long-run: 1940-2010)

Key Challenge

- **Key challenge**: This post-WWII shock could be a continuation of local trends.
  - due to the postwar migration of veterans (for colleges and jobs)
- I use the variation in **Pre-WW2 veteran communities** (1930)
  - a strong predictor for the locations of WWII veterans
  - not a continuation of pre-trends
  - **high** and **low** veteran share areas show **similar pre-trends**

Preview of findings



Outline

- Literature Review
- Historical Background
- Empirical Framework
  - First stage regression
  - Falsification test
- Results
  - Short-run effects
  - Robustness checks
  - Long-run effects
- Conclusion

Literature review

1. **Geographic sorting of skilled workers since 1980:**
   - Increasing divergence: Berry and Glaeser (2005), Moretti (2012), Diamond (2016)
   - Increase in skill premium: Acemoglu(1998, 2002), Beaudry et al. (2010)

   ⇒ The role of local human capital shock in earlier period, with long-run perspective

2. **Economic impacts of exogenous local shocks:**
   - Demand: Katz and Murphy (1992), Moretti (2010), Notowidigdo (2011)
   - Supply: Moretti (2004), Kerr and Lincoln (2010), Peri et al. (2015)

   ⇒ Dynamic effects of high-skill supply shock, new IV

3. **War and labor market outcomes:**
   - State-level: Acemoglu et al. (2004), Malamud and Wozniak (2010)
   - WWII mobilization and education: Jaworski (2014)
   - GI Bill
     - ⋆ On veterans: Bound and Turner (2002, 2003), Stanley (2003), Fetter (2013)
     - ⋆ On family formation and children: Larsen et al. (2015), Page (2007)

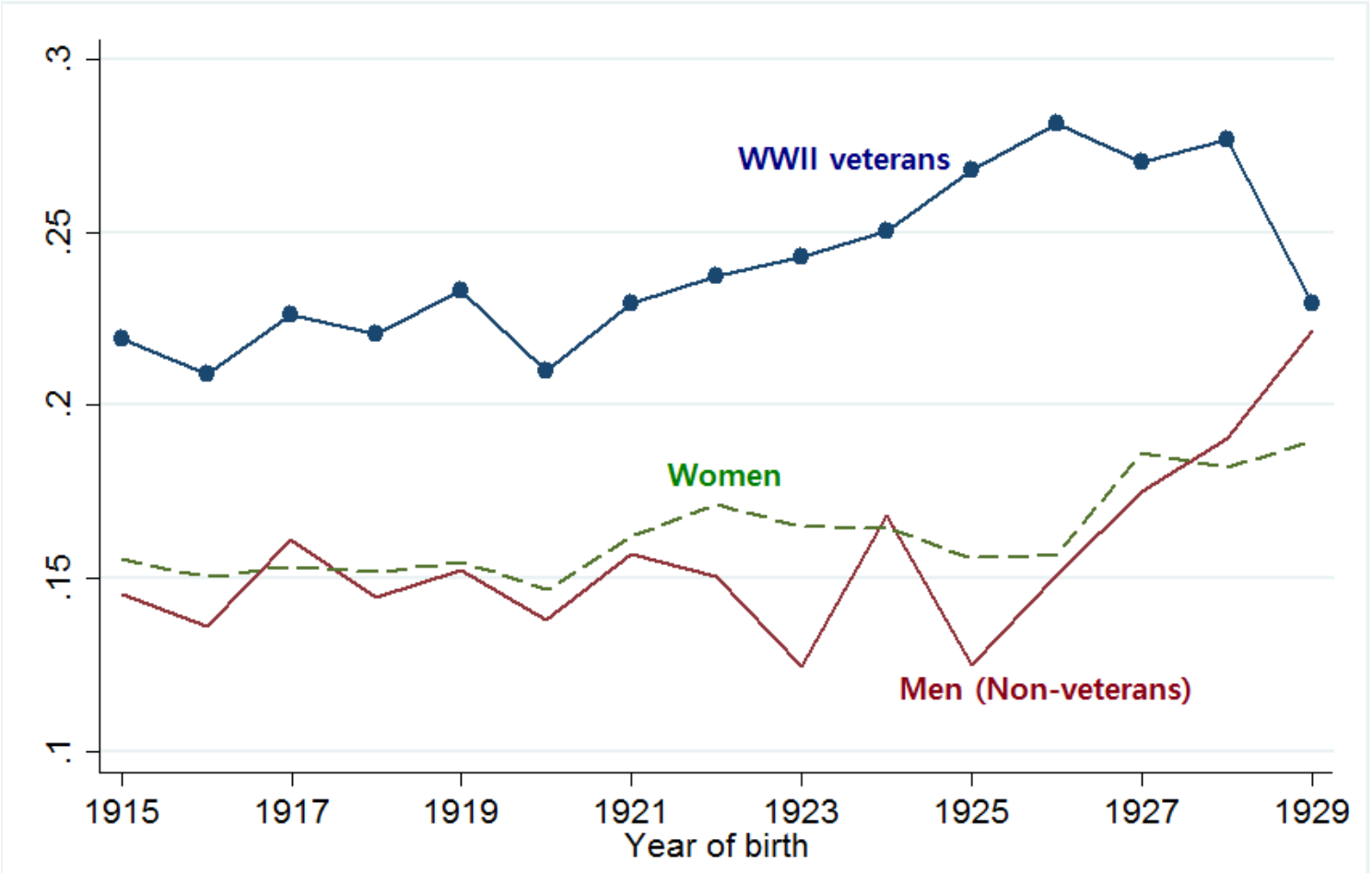
   ⇒ Impact on local labor markets

Historical background

- The Servicemens Readjustment Act of 1944
  - the G.I. Bill was created to help veterans of WWII
  - signed into law on June 22, 1944
- Most veterans were eligible for stipends covering tuition and living expenses
  - Any veteran who had served for at least 90 days
  - Or had been discharged because of disabilities
  - Veterans had to commence schooling by July 1951
- Total enrollment increased by more than 50%
  - from the prewar (1939) level of 1.3 million to over 2 million in 1946
  - over 2.2 million veterans received college education under the G.I Bill
- Other benefits
  - Vocational training
  - Home loans

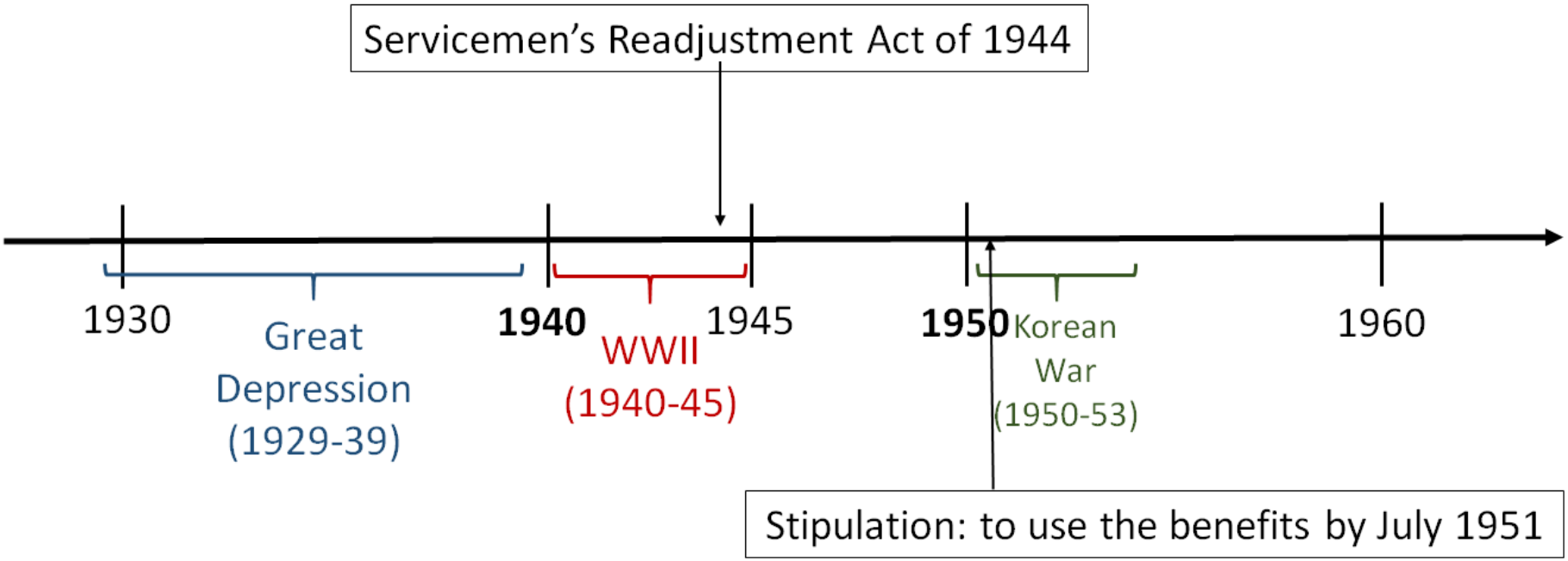
Historical background

Share of college-educated by year of birth



→ Significant increase in education due to the GI Bill (Bound and Turner 2002)

Historical background



- **Period measured for the shock: 1940-1950**
  - Stipulation to use the benefits by July 1951
  - Prevent confounding effects from Korean War (1950-1953) veterans

Data and geographical units

- **Data**
  - Census microdata from 1930 to 2010 (IPUMS, Ruggles et al. 2010)
  - Sample is restricted to aged 18 to 55
  - High skilled = some college or higher

- **Geographical Units**
  - For 1940-1950, State Economic Areas (SEAs)
    - ⋆ Either single county or groups of contiguous counties within the same state
    - ⋆ Defined to have similar economic characteristics in 1950 and cover entire U.S
  - For 1960 afterwards, Commuting Zones (CZs)
    - ⋆ In order to consistently identify the effects

Measuring the post-WW2 shock

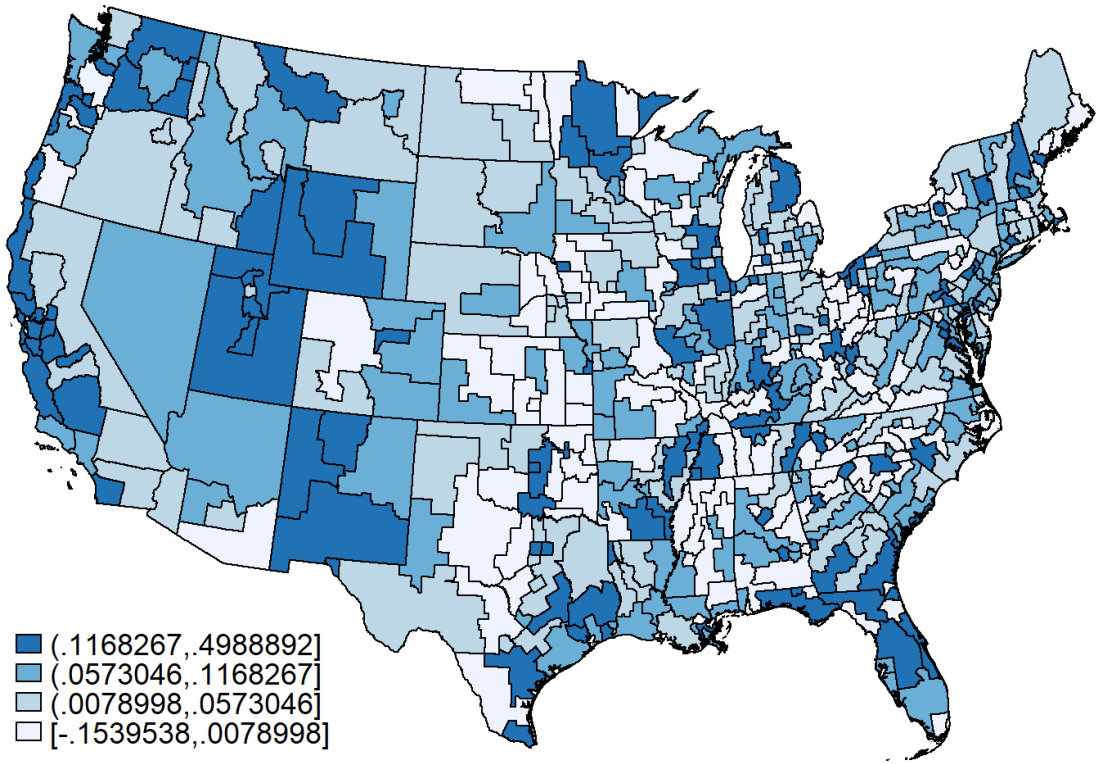
Following Card and Dinardo (2000),

$$shock_c = \left(\frac{V^H_{c,1950}}{P^H_{c,1940}} - \frac{V_{c,1950}}{P_{c,1940}} \right) = \left(\frac{\Delta V^H_c}{P^H_{c,1940}} - \frac{\Delta V_c}{P_{c,1940}} \right)$$

- Relative growth of college- and non-college-educted WW2 veterans

- $V^H_{c,1950}$: the number of college-educated WWII veterans in 1950
- $V_{c,1950}$: the number of WWII veterans in 1950
- $P^H_{c,1940}$: the number of college-educated population in 1940
- $P_{c,1940}$: the number of population in 1940

Geography of college-educated WWII veterans



Top 10			
	Commuting Zone	State	Shock
1	Columbus	GA	0.367
2	San Diego	CA	0.263
3	Savannah	GA	0.249
4	Atlanta	GA	0.241
5	Santa Barbara	CA	0.239
6	San Jose	CA	0.225
7	Sacramento	CA	0.221
8	Corsicana	TX	0.212
9	Carbondale	IL	0.206
10	Santa Rosa	CA	0.204

Empirical framework

Approximately, relative growth rate of skilled in city c is, $(P_c = N_c + V_c)$

$$\Delta log\left(\frac{P_c^H}{P_c}\right) = \left(\frac{\Delta N_c^H}{P_{c,1940}^H} - \frac{\Delta N_c}{P_{c,1940}}\right) + \left(\frac{\Delta V_c^H}{P_{c,1940}^H} - \frac{\Delta V_c}{P_{c,1940}}\right)$$

During 1940-1950, for a local labor market c,

$$\left(\frac{\Delta N_c^H}{P_{c,1940}^H} - \frac{\Delta N_c}{P_{c,1940}}\right) = \alpha_s + \beta\left(\frac{\Delta V_c^H}{P_{c,1940}^H} - \frac{\Delta V_c}{P_{c,1940}}\right) + \gamma X_c + \varepsilon_c$$

- X_c: city-specific controls: Bartik, Land-grant university, Rural area
- α_s: State fixed effect

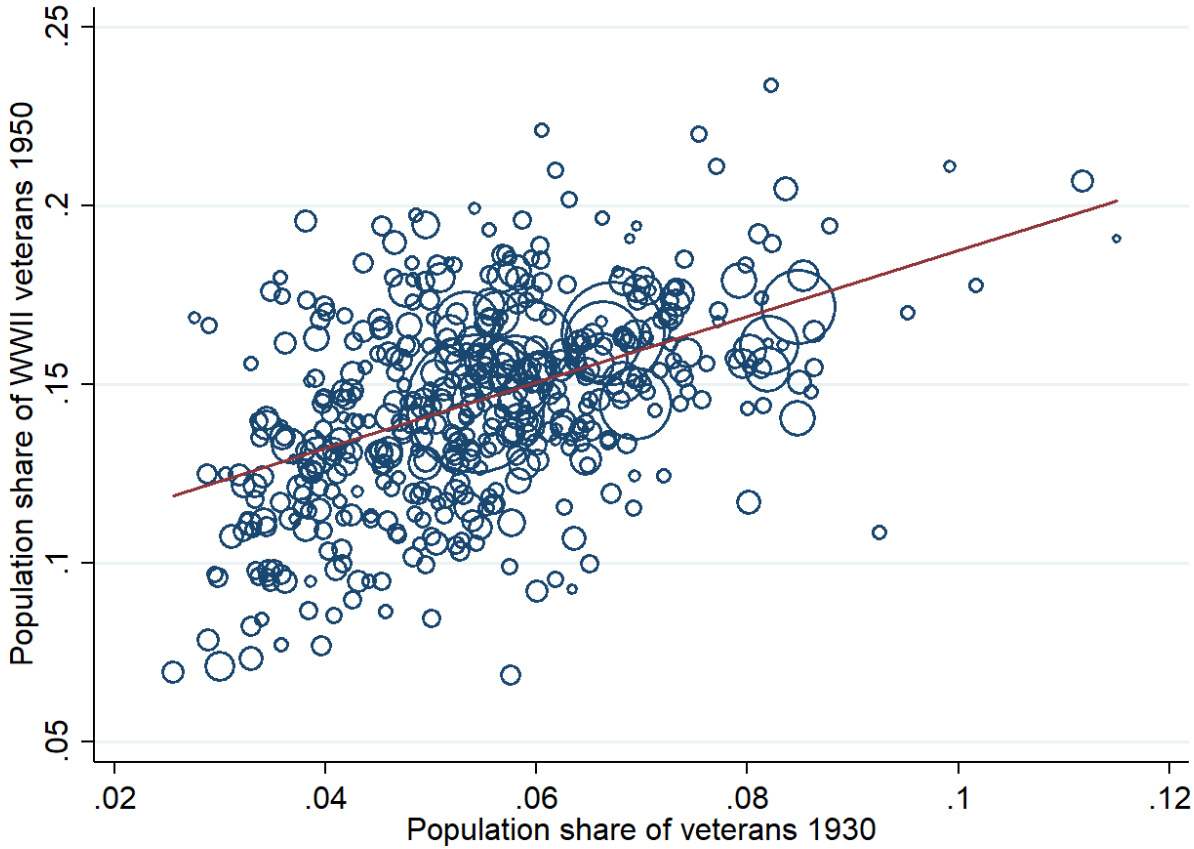
- If $\beta = -1$, non-veterans location decisions fully offset veteran inflows
- If $\beta = 0$, non-veterans are not differently affected by veteran inflows
- If $\beta > 0$, the shock attracts highly educated non-veterans more

- β could be **biased** due to the migration of veterans.

Instrumental variable: intuition

- Costa et al. (2018): Network of Civil War veterans
- Campante and Yanagizawa-Drott (2015): Intergenerational transimission of veteran status

⇒ **Prewar distribution of veterans → locations of WWII veterans?**



Instrumental variable

- To relieve the concerns, I use the variation in **prewar** veteran communities.

$$\widehat{V_c^j} = \left[V_{c,1930} \cdot \left(\frac{V_{1950}^{-s(c)}}{V_{1930}^{-s(c)}} \right) \cdot \tau_j^{-s(c)} \right]$$

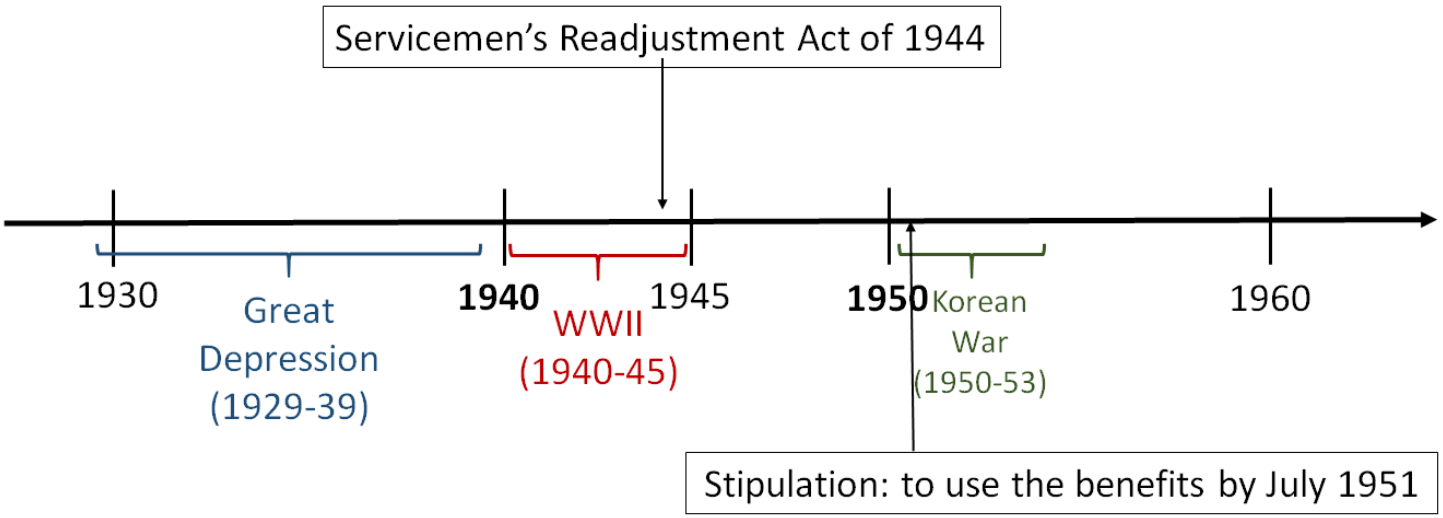
  - j: skill group (either H or L)
  - $V_{c,1930}$: the number of veterans in city c (with race r) in 1930
  - $\frac{V_{1950}^{-s(c)}}{V_{1930}^{-s(c)}}$: growth of veterans 1930-1950 (outside of state s where city c belongs to)
  - $\tau_j^{-s(c)}$: Fraction college-educated among WWII veterans

- Finally, the instrument is

$$\widehat{shock_c} = \left(\frac{\widehat{V_{c,1950}^H}}{s^H \cdot P_{c,1930}} - \frac{\widehat{V_{c,1950}^H} + \widehat{V_{c,1950}^L}}{P_{c,1930}} \right) \approx \left(\frac{V_{c,1950}^H}{P_{c,1940}^H} - \frac{V_{c,1950}}{P_{c,1940}} \right)$$

Instrumental variable

- **Why 1930** geographic distribution of veterans?
  - 1930 veterans did not have GI Bill: unlikely capture trends in local schooling
  - Major historical events during 1930-1950: Great Depression, WWII
  - **Large, unexpected** national shock: WWII



First stage

	(1) Basic	(2) Baseline (SEA)	(3) Control: 1930 charact.	(4) Using Veteran share	(5) Baseline (CZ)
Predicted shock	0.880***	0.685***	0.685***		0.454***
	(0.163)	(0.182)	(0.200)		(0.132)
Veteran share 1930				2.198***	
				(0.548)	
1st-stage F	29.21	14.12	11.69	16.06	11.91
Geographical Unit	SEA	SEA	CZ	SEA	SEA
Weighted	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Observations	467	467	467	467	238
R-squared	0.310	0.324	0.359	0.329	0.570

Note: The dependent variable is the relative growth rate of college educated WWII veterans. The explanatory variable is the predicted relative growth rate of college educated WWII veterans. Standard errors in parenthesis are heteroskedasticity-robust and clustered by state. All the regressions are weighted by the population in 1940.

***p< 0.01, **p< 0.05, *p< 0.1

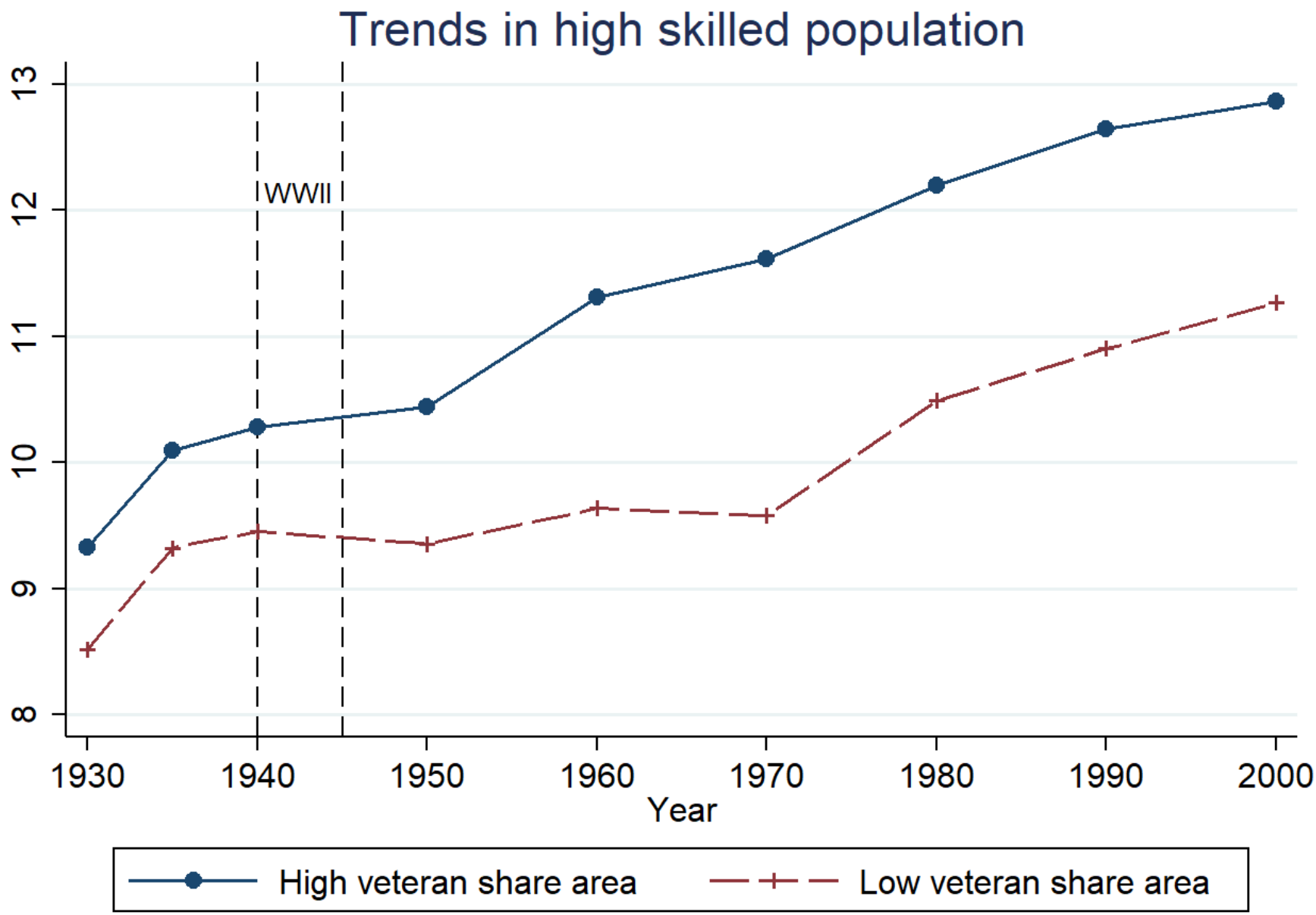
- Baseline controls: Bartik index, Land-grant university, rural area dummy
- 1930 characteristics: share of nonwhite, immigrants, and young (aged 18 to 40)

Ranking of CZs

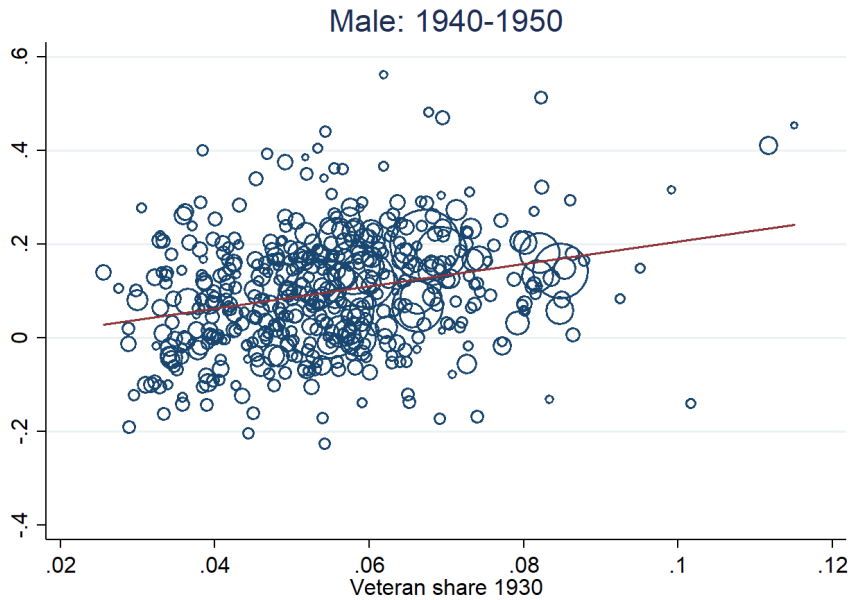
Top 10			
	Commuting Zone	State	Shock
1	Columbus	GA	0.367
2	San Diego	CA	0.263
3	Savannah	GA	0.249
4	Atlanta	GA	0.241
5	Santa Barbara	CA	0.239
6	San Jose	CA	0.225
7	Sacramento	CA	0.221
8	Corsicana	TX	0.212
9	Carbondale	IL	0.206
10	Santa Rosa	CA	0.204

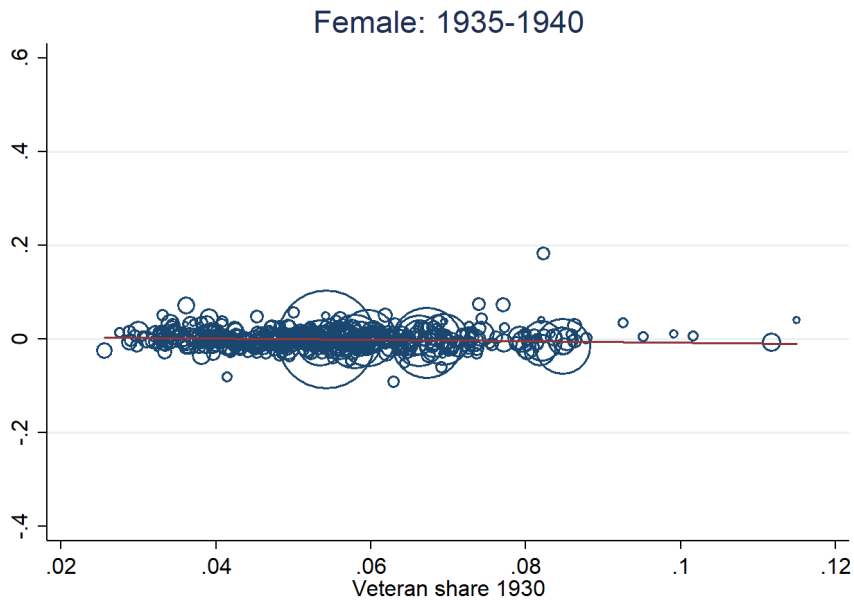
Top 10				
	Commuting Zone	State	Actual	Predicted
1	Washington DC	DC	0.184	0.710
2	Bridgeport	CT	0.085	0.572
3	San Diego	CA	0.263	0.533
4	Newport News	VA	0.081	0.506
5	Rock Springs	WY	0.027	0.464
6	Providence	RI	0.018	0.463
7	Newport	OR	0.024	0.429
8	Portland	OR	0.138	0.424
9	Roseburg	OR	-0.133	0.416
10	Minneapolis	MN	0.113	0.410

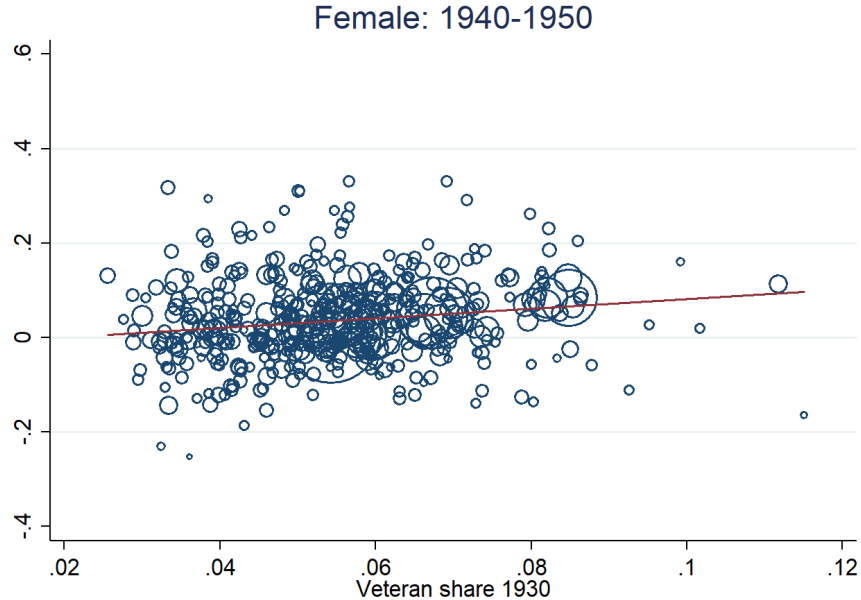
Falsification: Pre-trends check



Falsification: Pre-trends check







Falsification: Pre-trends check

	(1) Male relative growth (1935–40)	(2) Female relative growth (1935–40)	(3) Population growth (1930–40)	(4) Employment growth (1930–40)	(5) Manufacturing growth (1930–40)
Predicted shock	0.064 (0.072)	0.061 (0.052)	0.670 (0.427)	0.635 (0.530)	0.236 (0.798)
Weighted	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Observations	467	467	467	467	467
R-squared	0.211	0.178	0.368	0.402	0.511

Note: The explanatory variable is the predicted relative growth rate of college educated WWII veterans. Standard errors in parenthesis are heteroskedasticity-robust and clustered by state. All the regressions are weighted by the local population aged 18 to 55 in 1940. Baseline controls include Bartik shocks, the indicator for Land-grant universities, and the indicator for rural areas. People with some years of college education or higher are counted as college educated.

***p< 0.01, **p< 0.05, *p< 0.1

Results

Mechanism: Distribution of Occupations

- Imperfect substitution between men and women

Occupation	WWII veterans	Men (Nonveteran)	Women
Professional and Technical	9.0%	6.5%	11.3%
Farm managers	4.9%	11.4%	0.6%
Managers, Officials, and Proprietors	9.6%	11.2%	4.0%
Clerical and Kindred	8.4%	5.5%	30.5%
Sales workers	7.6%	5.7%	8.4%
Craftsmen	22.6%	19.9%	1.7%
Operatives	23.1%	21.1%	21.1%
Service workers (household)	0.1%	0.2%	7.4%
Service workers (non-household)	4.7%	4.9%	11.5%
Farm laborers	2.6%	5.0%	2.8%
Laborers	7.4%	8.6%	0.8%

Short-run Effects

- β is statistically **NOT** different from 1.
- Negative effect on men, positive effect on women.

	OLS		2SLS			
	(1) Baseline	(2) Baseline (CZ) charact.	(3) Baseline	(4) Control: 1930 charact.	(5) IV: simple share	(6) Baseline (CZ)
Panel A: Nonveteran men						
Post-WWII shock	-0.010 (0.052)	0.072 (0.080)	-0.336** (0.162)	-0.265 (0.193)	-0.278* (0.168)	-0.116 (0.325)
Panel B: Women						
Post-WWII shock	0.115** (0.046)	0.181** (0.070)	0.199 (0.189)	0.147 (0.194)	0.179 (0.167)	0.283 (0.302)
Panel C: Relative skill growth						
Post-WWII shock	1.105*** (0.065)	1.253*** (0.119)	0.862*** (0.278)	0.882*** (0.291)	0.902*** (0.257)	1.167** (0.519)
1st-stage F	-	-	14.12	11.69	16.06	11.91
Geographical Unit	SEA	SEA	SEA	SEA	SEA	CZ
Weighted	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	467	238	467	467	467	238

Note: The units of observations are SEAs. Standard errors in parenthesis are heteroskedasticity-robust and clustered by state. All the regressions are weighted by total population in 1940.

Robustness Checks

- Female employment ↑ due to WWII mobilization (Acemoglu et al. 2004)
- Other benefits to WWII veterans

	(1) Control: ΔFemale employment	(2) Control: ΔVA-intensive jobs	(3) Control: ΔHome owners	(4) Dropping West regions
Panel A: Nonveteran men				
Post-WWII shock	-0.278*	-0.446**	-0.329*	-0.404**
	(0.167)	(0.213)	(0.180)	(0.162)
Panel B: Women				
Post-WWII	0.172	0.282	0.158	0.213
	(0.203)	(0.242)	(0.199)	(0.215)
Panel C: Relative skill growth				
Post-WWII	0.894***	0.836***	0.829***	0.808***
	(0.285)	(0.306)	(0.303)	(0.301)
1st-stage F	13.04	10.18	11.85	10.96
Weighted	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Observations	467	467	467	400

Note: The units of observations are SEAs. Standard errors in parenthesis are heteroskedasticity-robust and clustered by state. All the regressions are weighted by total population aged 18 to 55 in 1940. People with some years of college education or higher are counted as college-educated.

***p< 0.01, **p< 0.05, *p< 0.1

Wage Effects

	(1) High Skill Male	(2) High Skill Female	(3) Low Skill Male	(4) Low Skill Female
Post-WWII shock	0.235	-0.035	0.304	0.397*
	(0.129)	(0.097)	(0.210)	(0.228)
1st-stage F	13.62	14.33	14.12	14.12
Weighted	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Observations	455	464	467	467

Note: The units of observations are SEAs. Standard errors in parenthesis are heteroskedasticity-robust and clustered by state. All the regressions are weighted by total population aged 18 to 55 in 1940. People with some years of college education or higher are counted as college-educated.

***p< 0.01, **p< 0.05, *p< 0.1

Long-run Effects

- Test long-run **persistence** of the shock

	(1) 1940–50	(2) 1940–60	(3) 1940–70	(4) 1940–80	(5) 1940–90	(6) 1940–2000	(7) 1940–2010
Panel A: Men							
Post-WWII shock	0.884*** (0.325)	1.070*** (0.343)	1.983*** (0.611)	3.619*** (1.165)	5.335*** (1.267)	5.227*** (1.208)	4.528*** (1.049)
Panel B: Women							
Post-WWII shock	0.283 (0.302)	0.347*** (0.110)	1.040*** (0.292)	2.388*** (0.709)	4.603*** (1.044)	4.960*** (1.115)	4.481*** (1.030)
Panel C: Relative skill growth							
Post-WWII shock	1.167** (0.519)	1.417*** (0.442)	3.023*** (0.897)	6.007*** (1.871)	9.938*** (2.308)	10.187*** (2.318)	9.009*** (2.074)
1st-stage F	11.91	11.91	11.91	11.91	11.91	11.91	11.91
Weighted	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	238	238	238	238	238	238	238

Note: The units of observations are CZs. Standard errors in parenthesis are heteroskedasticity-robust and clustered by state. All the regressions are weighted by total population aged 18 to 55 in 1940. People with some years of college education or higher are counted as college-educated.

***p$<$ 0.01, **p$<$ 0.05, *p$<$ 0.1

Local Industrial Structure

	(1) 1940–50	(2) 1940–60	(3) 1940–70	(4) 1940–80	(5) 1940–90	(6) 1940–2000	(7) 1940–2010
Panel A: Manufacturing (High skilled)							
Post-WWII shock	0.251**	0.335**	0.357**	0.329**	0.258***	0.180***	0.150**
	(0.113)	(0.159)	(0.151)	(0.164)	(0.097)	(0.066)	(0.060)
Panel B: Manufacturing (Low skilled)							
Post-WWII shock	-0.083	0.126	0.368**	0.187	0.199**	0.145**	0.126***
	(0.113)	(0.128)	(0.161)	(0.116)	(0.091)	(0.059)	(0.046)
Panel C: Service (High skilled)							
Post-WWII shock	0.328***	0.399**	0.672***	0.802***	0.967***	0.998***	0.945***
	(0.109)	(0.162)	(0.231)	(0.248)	(0.252)	(0.253)	(0.248)
Panel D: Service (Low skilled)							
Post-WWII shock	1.345***	1.292***	1.697***	1.837***	2.023***	1.915***	1.645***
	(0.363)	(0.429)	(0.546)	(0.557)	(0.553)	(0.518)	(0.467)
1st-stage F	11.91	11.91	11.91	11.91	11.91	11.91	11.91
Weighted	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	238	238	238	238	238	238	238

Note: The units of observations are CZs. Standard errors in parenthesis are heteroskedasticity-robust and clustered by state. All the regressions are weighted by total population aged 18 to 55 in 1940. People with some years of college education or higher are counted as college-educated.

***p$<$ 0.01, **p$<$ 0.05, *p$<$ 0.1

Conclusion

- This paper discusses the **consequences** from a local human capital shock.
- The post-WW2 shock significantly **reshuffled** local human capital in 1940s.
- Th shock generated **lasting trends** of human capital.