# Polarization and Rising Wage Inequality
# Comparing the U.S. and Germany

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# Introduction

- Wage inequality has been increasing in many industrialized countries since the late 1970s (US: Autor et al., 2006, 2008, Lemieux, 2008; UK: Gosling et al., 2000; Germany: Dustmann et al., 2009, and others)
- One (most?) prominent explanation: Skill-biased technological change (SBTC)
- For SBTC to be "compelling explanation": Labor market trends across economies having access to the same technologies should be similar
- Therefore, we look at two such countries, which are arguably on the same technological level, using comparable data and a unified statistical approach
- Moreover, as SBTC may have a bias in the age/cohort dimension, our framework allows for potential cohort effects

# Literature Review

**Debate SBTC, Task-Based Approach, Polarization**

- Katz/Autor (1999, Handbook LE)
- Autor/Levy/Murnane (2003, QJE)
- Goos/Manning (2007, REStat)
- Autor/Katz/Kearney (2006, AER, 2008, REStat)

**...versus institutions and supply-side**

- DiNardo/Fortin/Lemieux (1996, Econometrica)
- Card/DiNardo (2002, JOLE)
- Lemieux (2006, AER, 2008, JPop)

**Some studies on Germany**

- Fitzenberger (1999), Fitzenberger/Hujer/MaCurdy/Schnabel (2001)
- Spitz-Oener (2006, JOLE)
- Dustmann/Ludst./Schönb. (2009, QJE), Gernandt/Pfeiffer (2007)

# Preview of Main Results

**U.S.**

- Polarization of employment
- And polarization of wages both across and within skill groups
- Small cohort effects

**Germany**

- Polarization of employment
- But polarization of wages only between skill groups
- Sizeable cohort effects: Recent cohorts hit most strongly

# Data

## U.S.

- Current Population Survey (CPS)
- Outgoing Rotation Group

## West Germany

- IAB Regional File (IABS)
- Top coding in earnings
- Truncation from below in earnings because of marginal employment
- Correction of structural break 1983/1984 in earnings (voluntary payments subject to social security taxation in 1984)
  $\longrightarrow$ Correct excess growth of wages above median
- Correction of missings and inconsistencies in education variables
  $\longrightarrow$ education level is not lost, correct by (higher) education level reported in the past (a couple of times)

# Data

**Choices**

- Large sample sizes, reliable information on wages
- Full-time working males, 25 to 55 years, only national citizens (Germany)
- 1979–2004
- Real log wage
- Construct cohort–year–skill cells

# Skill Groups

**U.S.**

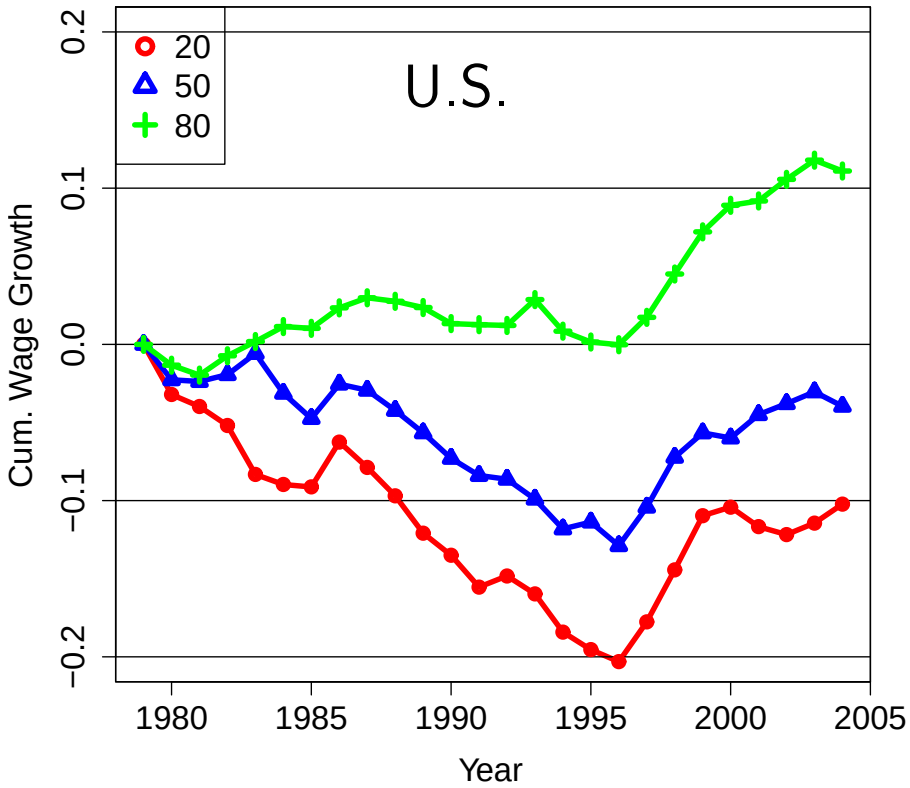
- Low-skilled: 12 years or less
- Medium-skilled: 13 to 15 years
- High-skilled: 16 years or more

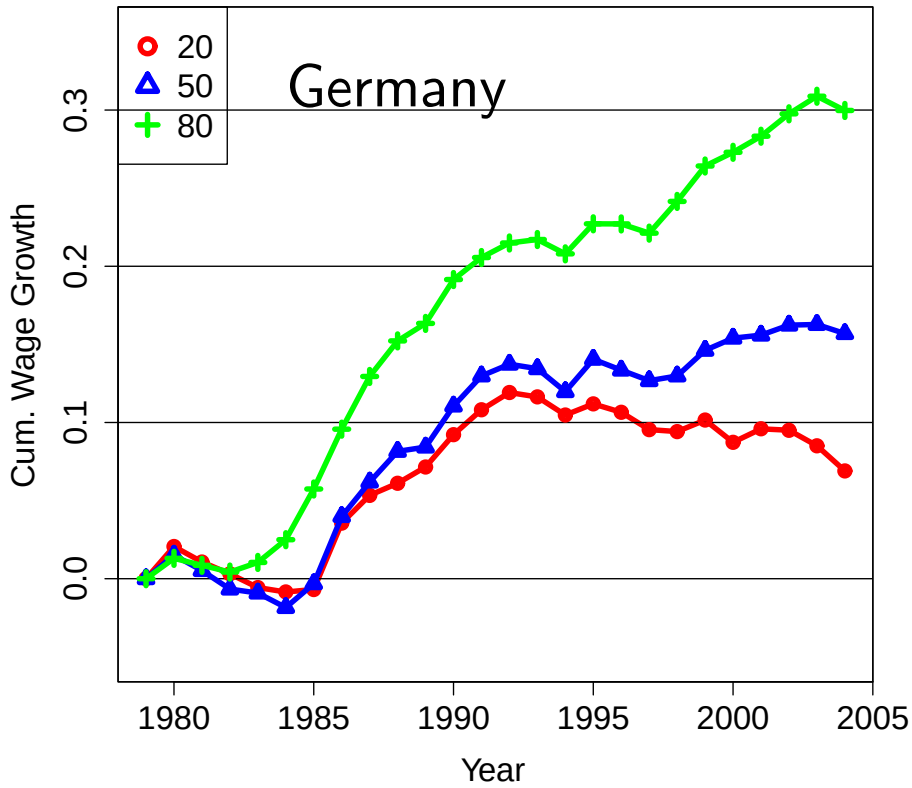
**Germany**

- Low-skilled: without a vocational training degree
- Medium-skilled: vocational training degree
- High-skilled: technical college/university degree

# Basic Facts

Unconditional cumulated wage growth at different quantiles 79–04:
Rising wage inequality in both countries, polarization restricted to the U.S.



# Econometric Approach / MaCurdy and Mroz (1995)

- Three effects: $t$: time, $\alpha$: age, $c$: year of birth
- Identification problem: $t - \alpha = c$
- "Age-earning profiles" are statistically indistinguishable from "cohort-earning profiles"
- Cohort-earning profile $ln[w(c, \alpha)] = g(c, \alpha) + u$
- $\frac{\partial g}{\partial t}|_c = \frac{\partial g}{\partial \alpha}|_c \equiv g_\alpha(c, \alpha) \equiv g_\alpha$
  Simultaneous change of $t$ and $\alpha$
- $H_{UI}$: Uniform insider wage growth hypothesis (*testable*)
  $g_\alpha = a(\alpha) + b(t) = a(\alpha) + b(c + \alpha)$
- Integrating back wrt $\alpha$

$$g(c, \alpha) = \underbrace{G + K(c)}_{\substack{\text{cohort specific con-} \\ \text{stant of integration}}} + A(\alpha) + B(c + \alpha)$$

# Estimated Model

$$
\begin{aligned}
g(c,\alpha) = {} & G + a_1\alpha + a_2\alpha^2 + a_3\alpha^3 \\
& + b_1 t + b_2 t^2 + b_3 t^3 + b_4 t^4 + b_5 t^5 \\
& + \gamma_{b2} c^2_{b(orth)} + \gamma_{b3} c^3_{b(orth)} + \gamma_{a2} c^2_{a(orth)} + \gamma_{a3} c^3_{a(orth)} \\
& + \sum_{i=1979}^{2004-N_b-1} \kappa_i YD_i
\end{aligned}
$$

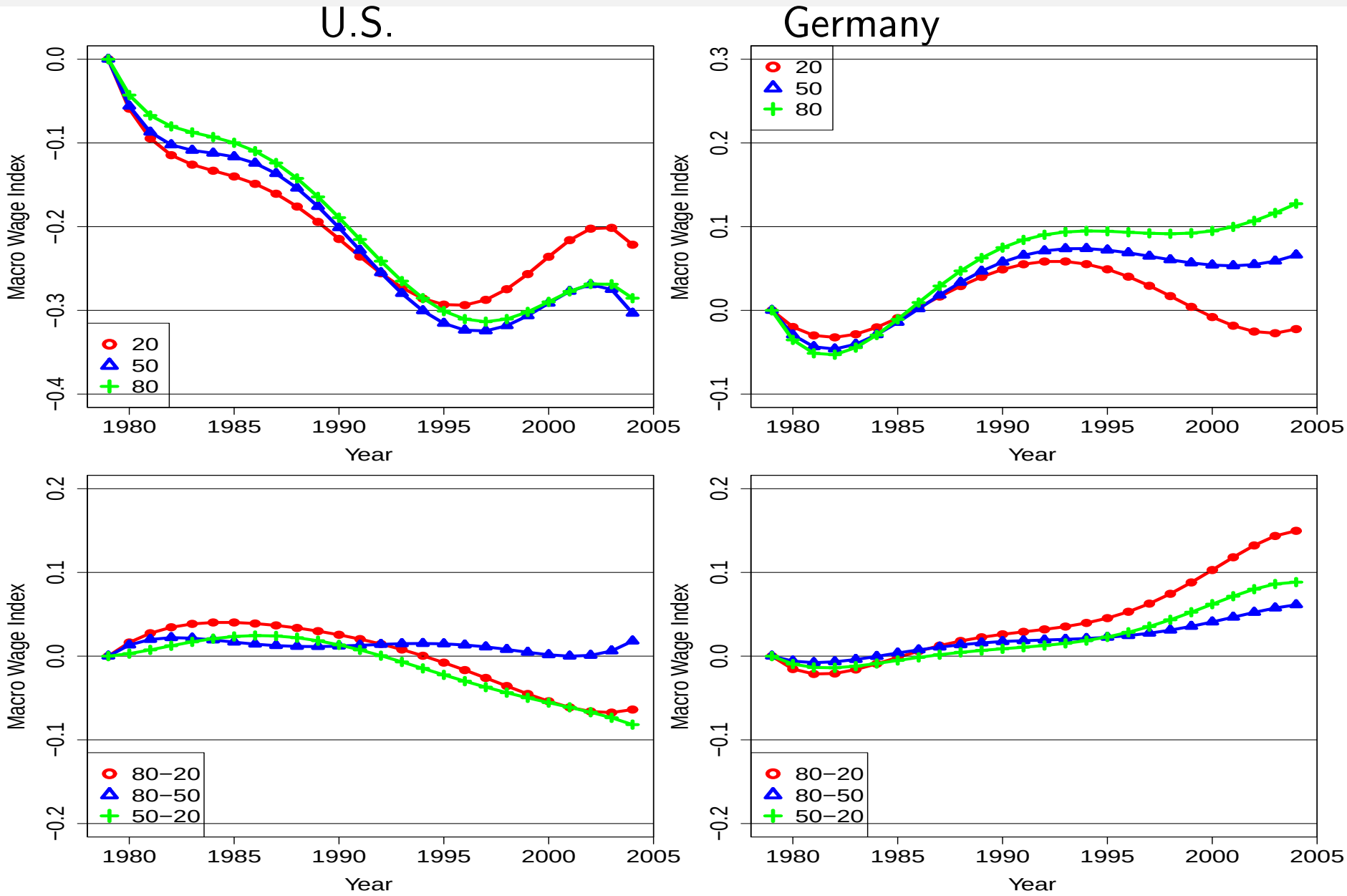
- $c^n_{b(orth)}$ are the quadratic and cubic cohort terms orthogonalized wrt c
- Identifying assumption: Linear cohort term equals zero
- $H_{UI}$ never rejected

# Quantile Regression, Life-cycle Index and Time Trend

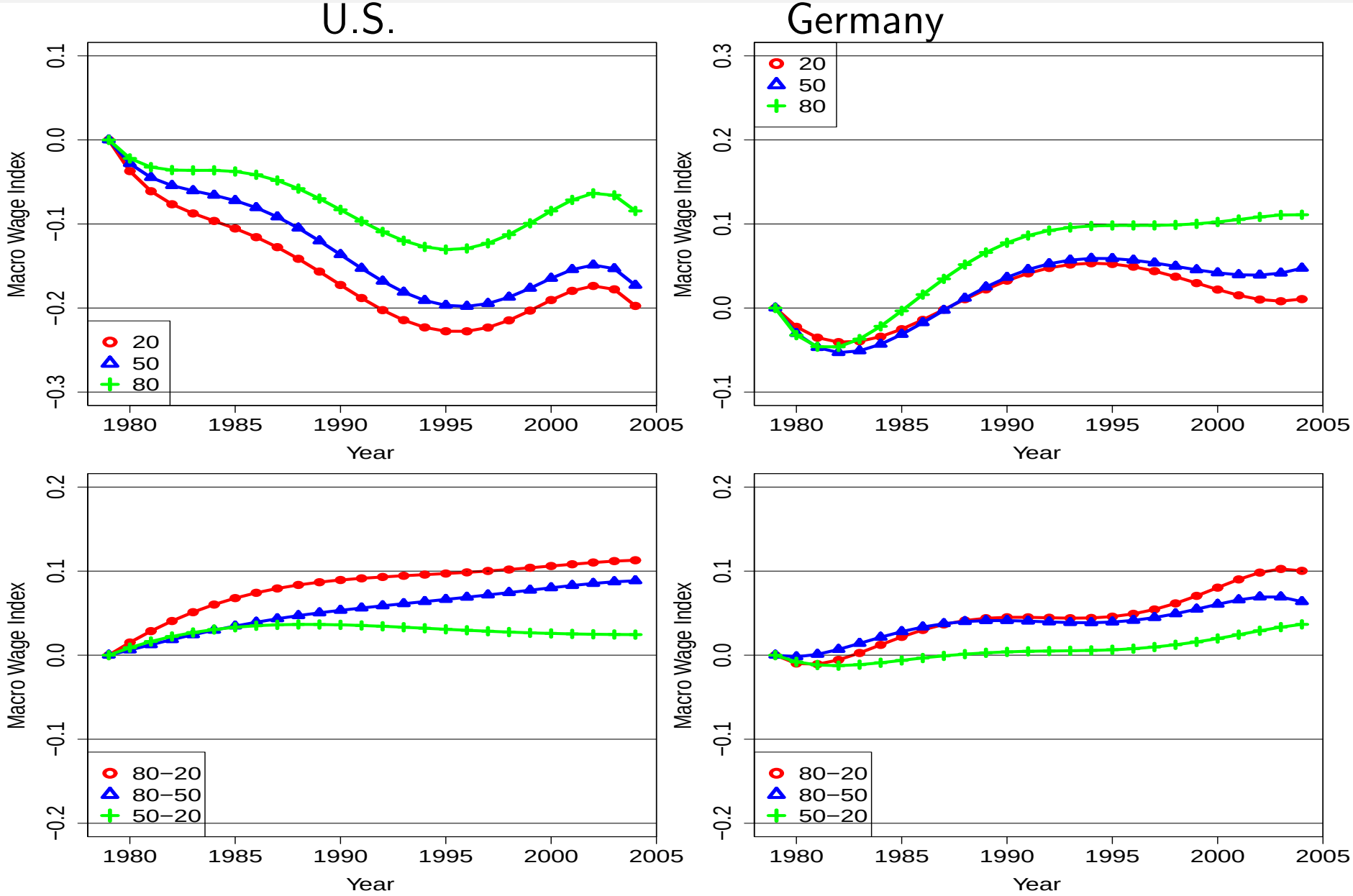
- Construct age-education cells for each year
- Calculate the quantiles in each cell, then regress using weighted OLS, where the weight is the employment size of a cell (Chamberlain 1994, MaCurdy/Mroz 1995)
- Life-cycle index
  $ln[w_L(\alpha)] = (A_1 - K_1)\alpha + A_{(2)}(\alpha) = (A_1 - K_1)\alpha + a_2\alpha^2 + a_3\alpha^3$
- Time trend
  $ln[w_m(\alpha)] = (B_1+K_1)t+B_{(2)}(t) = (B_1+K_1)t+b_2t^2+b_3t^3+b_4t^4+b_5t^5$

  $K_1$: coefficient of linear cohort term

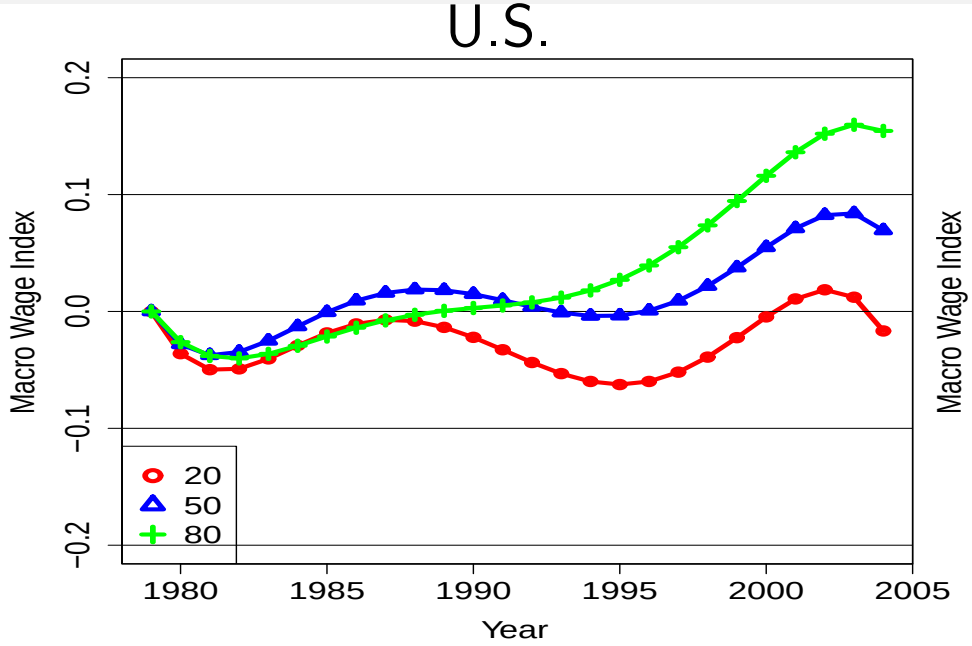
# Time Trends and Wage Dispersion, 79–04, Low-skilled

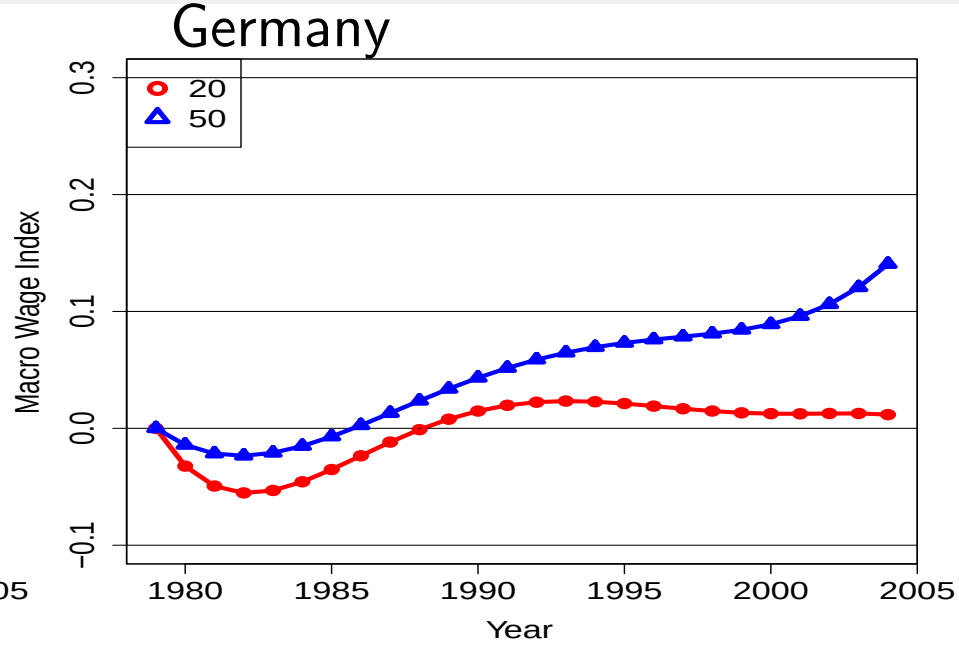


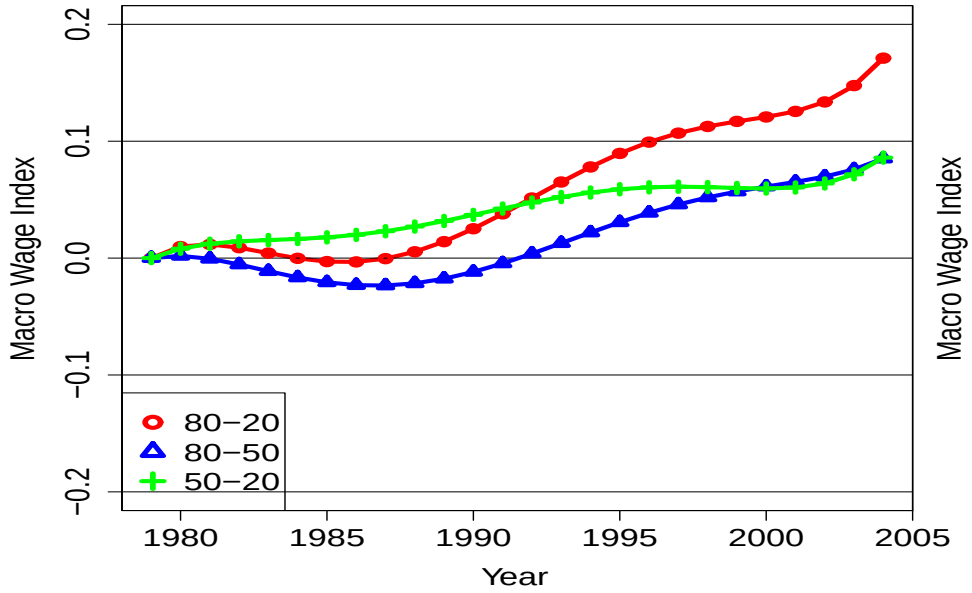
# Time Trends and Wage Dispersion, 79–04, Medium-skilled

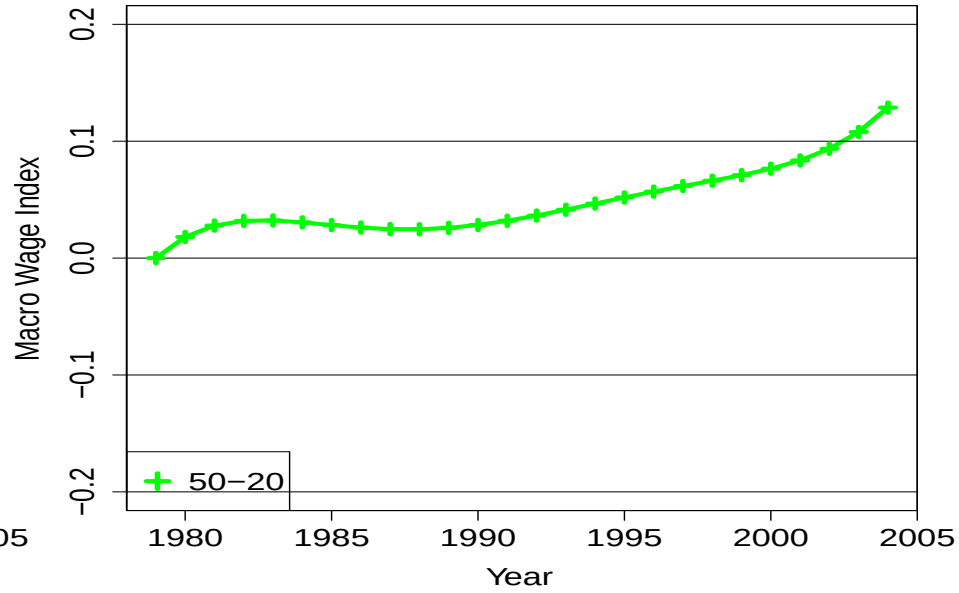


# Time Trends and Wage Dispersion, 79–04, High-skilled

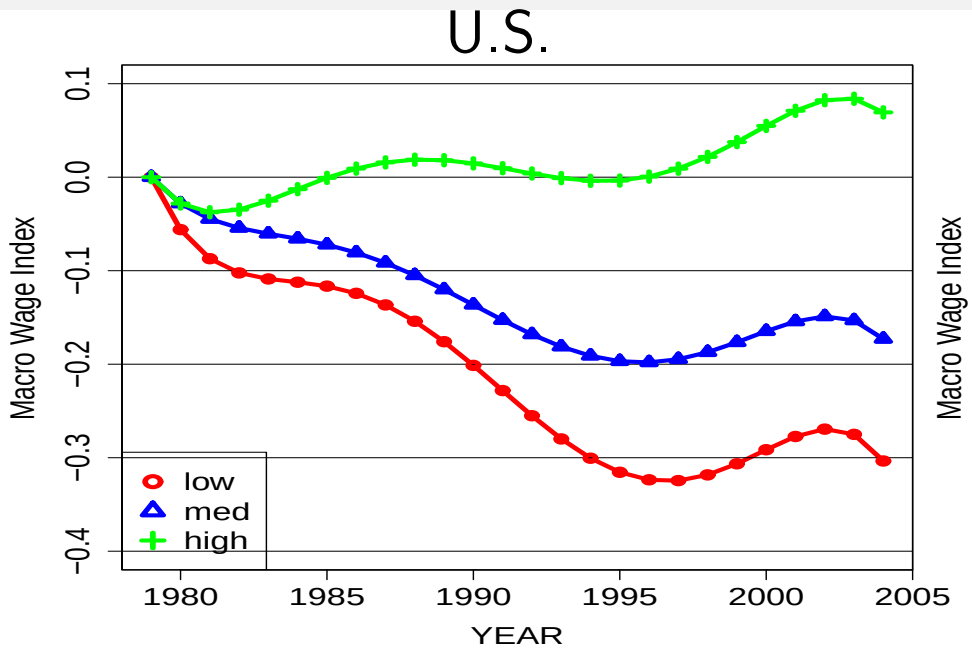


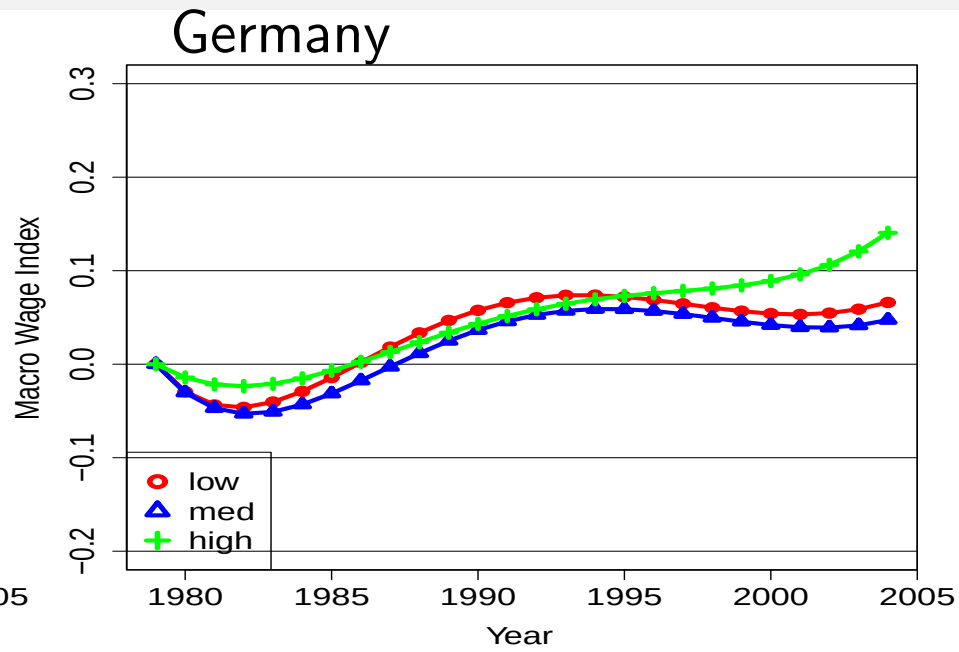



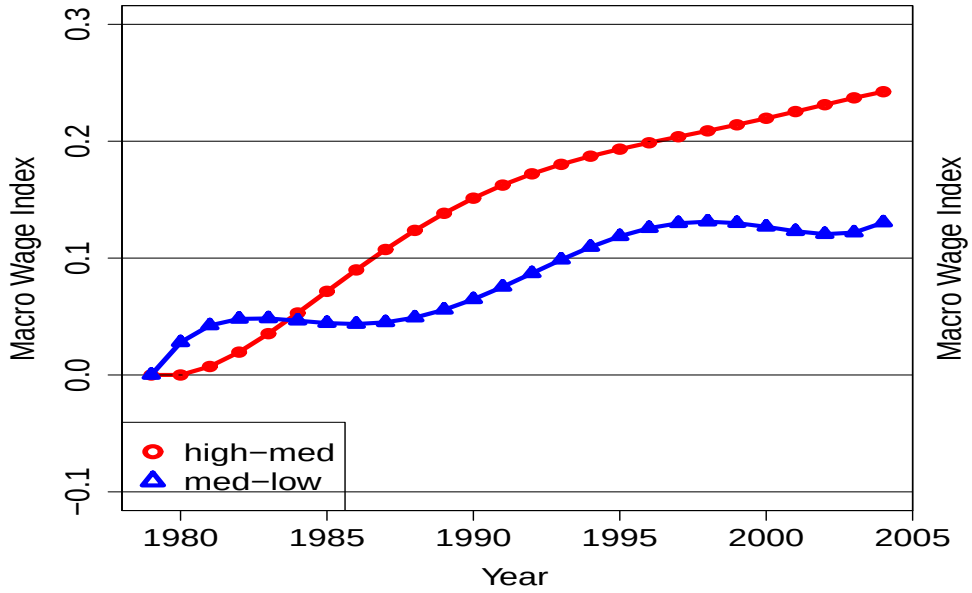



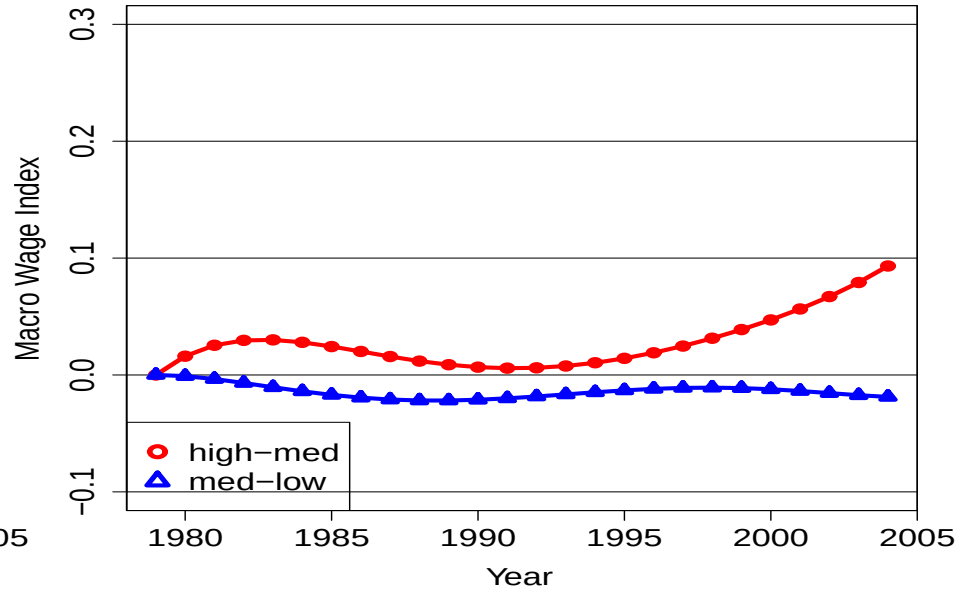



# Wage Trends across Skill Groups and Skill Premia



# Wage Dispersion

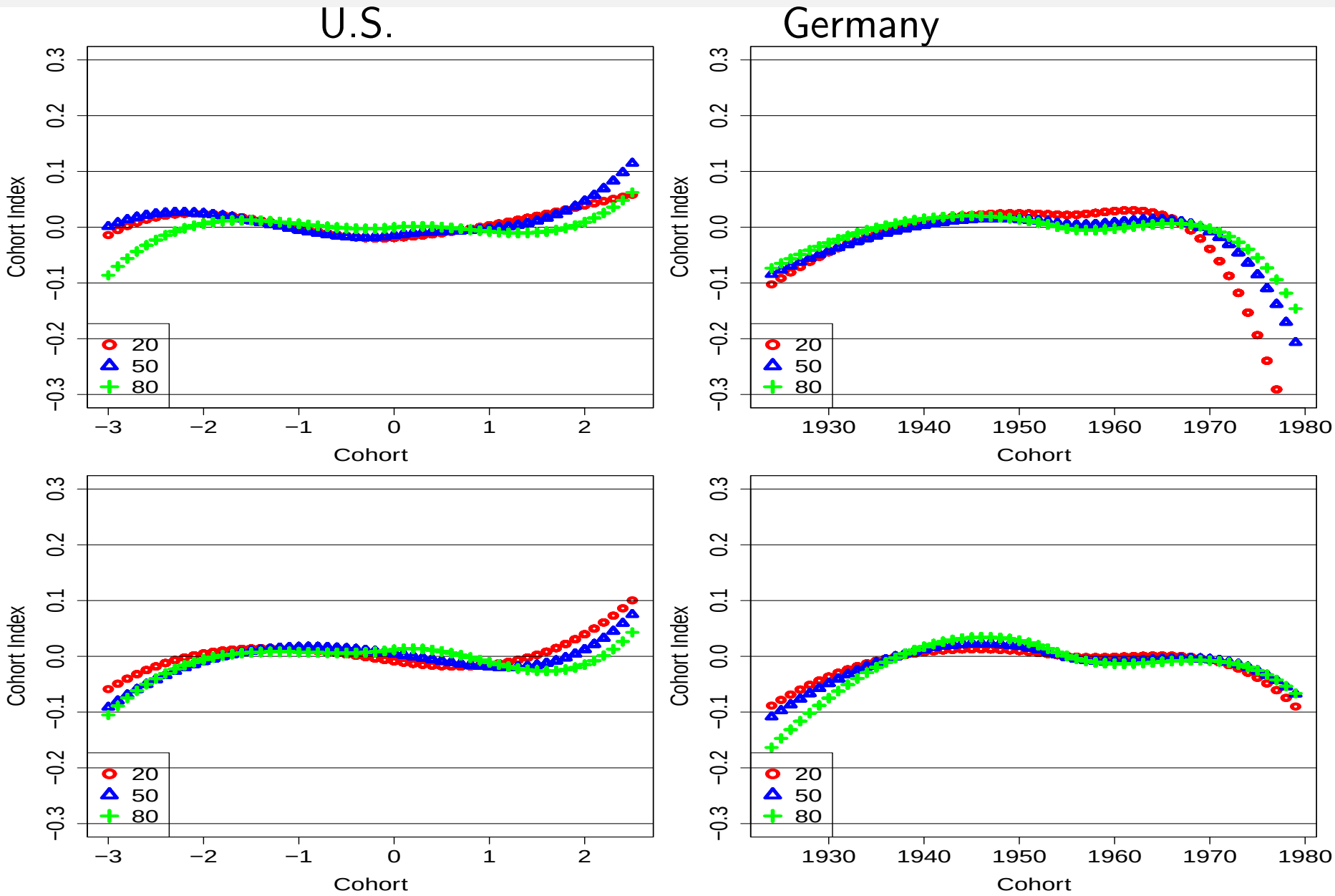
Within Skill Groups

- Polarization of wages (among low- and medium-skilled) in the U.S. since 1990 – Before recovery of wages!
- Negative trend for lower skilled workers after German Reunification and uniformly rising wage dispersion in Germany since mid 1990s
- Rise in inequality in Germany delayed by one decade
  $\longrightarrow$ institutional factors?

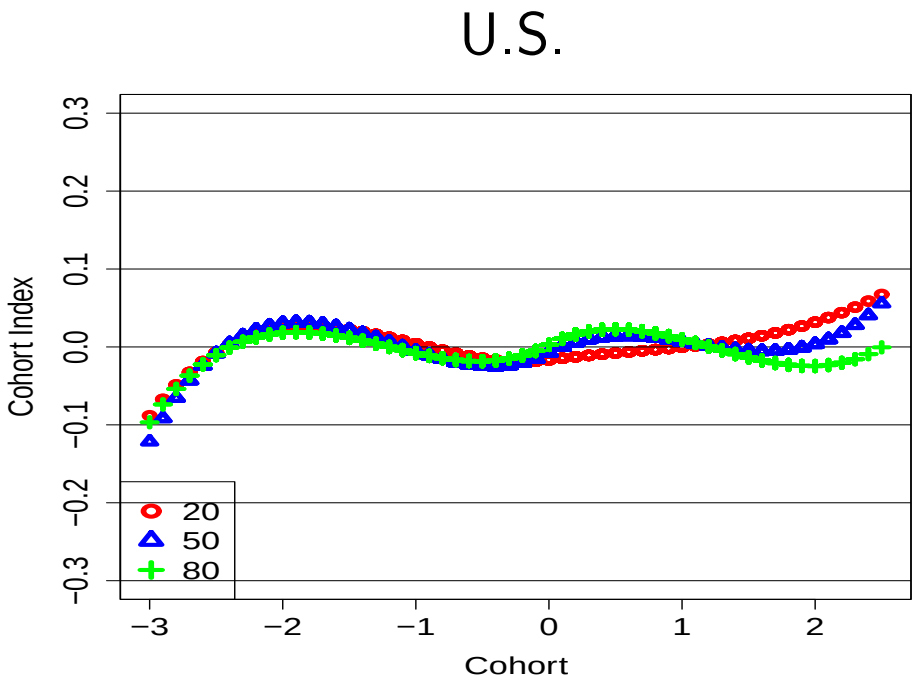
Between Skill Groups

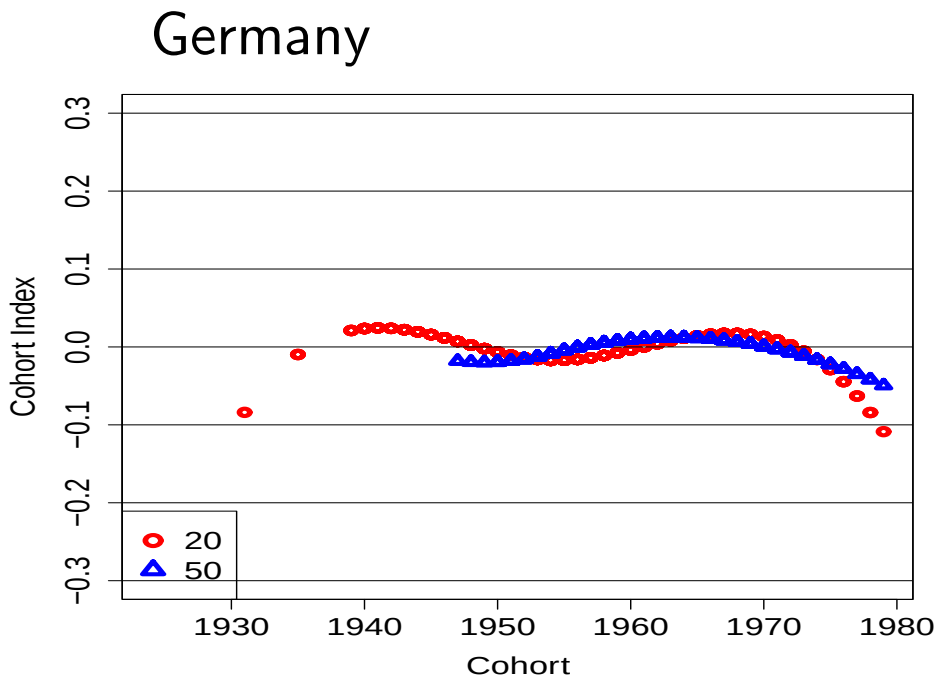
- U.S.: rising high-medium premium, medium-low premium ceases to increase during the 1990s
- Germany: Stable until mid-1990s, then increasing high-medium premium
- Differences between conditional and unconditional skill premia due to compositional effects

# Cohort Effects, Low- and Medium-skilled workers



# Cohort Effects, High-skilled workers

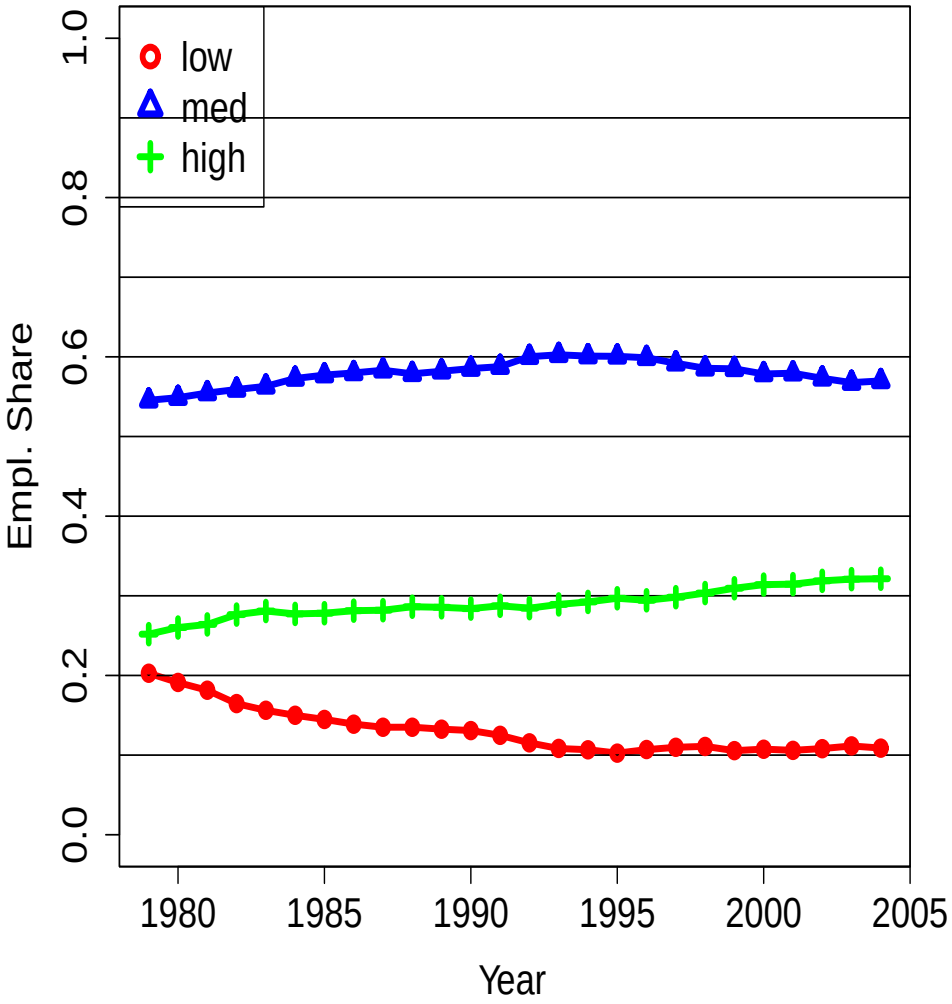


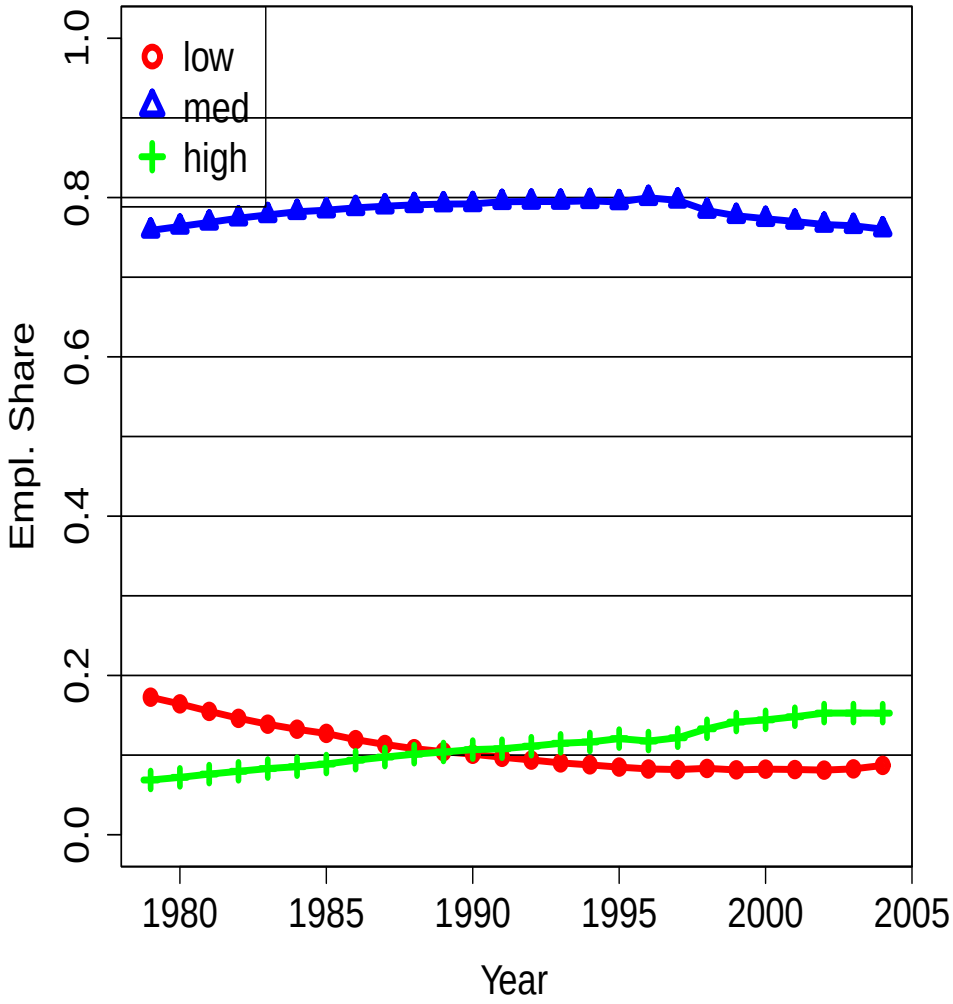
# Employment Shares of Different Skill Groups, 79–04

- Slowdown in skill-upgrading in both countries since beginning of 1990s

U.S.




Germany

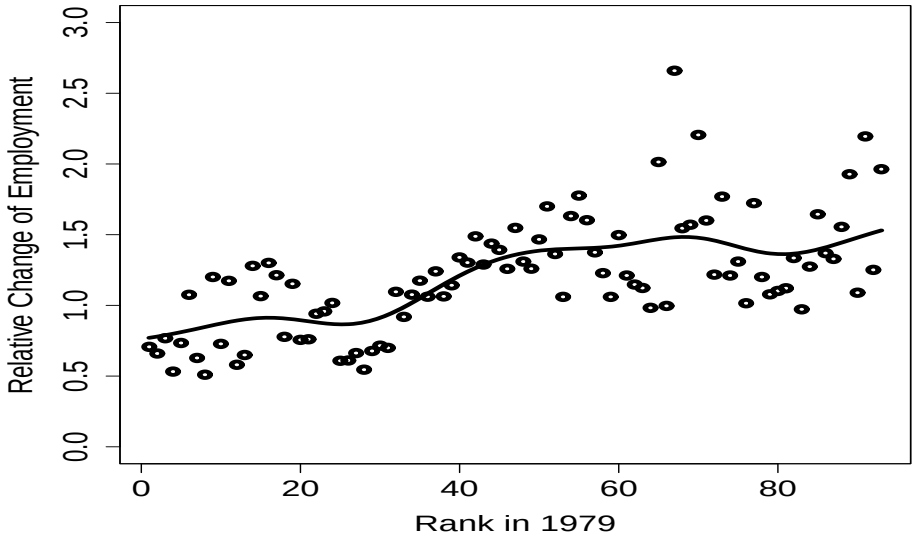


# Employment

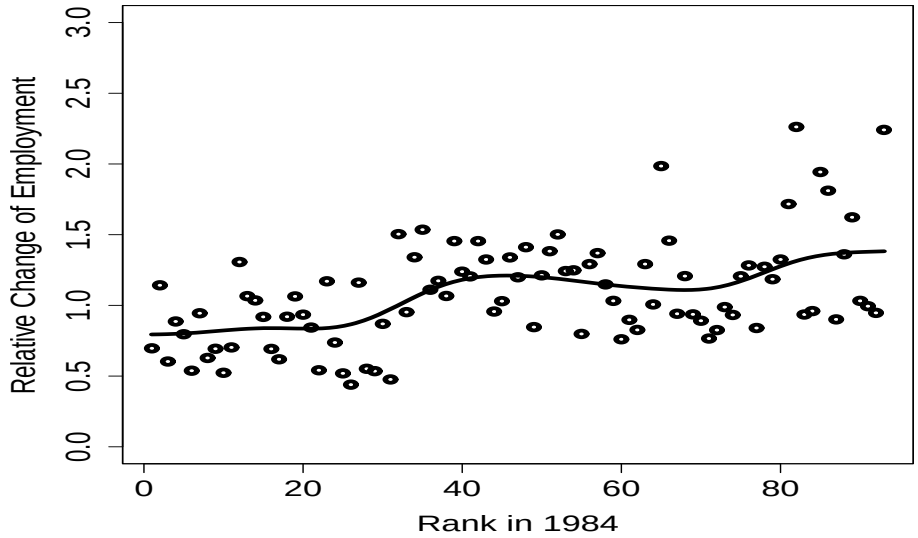
- Describe employment growth along wage distribution
- Rank age-education cells across skill groups for base year 0 by cell median wage
- Age variable is discrete (25-55), 3 educational levels, yielding 93 cells
- "Skill groups" $j$ comprising education and age:
  Wage in base year $ln(w_{j0})$ as proxy for relative demand shock faced by cell $j$ in subsequent years (Card et al., 1999)
- Calculate cumulated relative employment growth of each cell over next 10 years
- Find: Polarization in employment since mid-1990s

# Employment U.S.

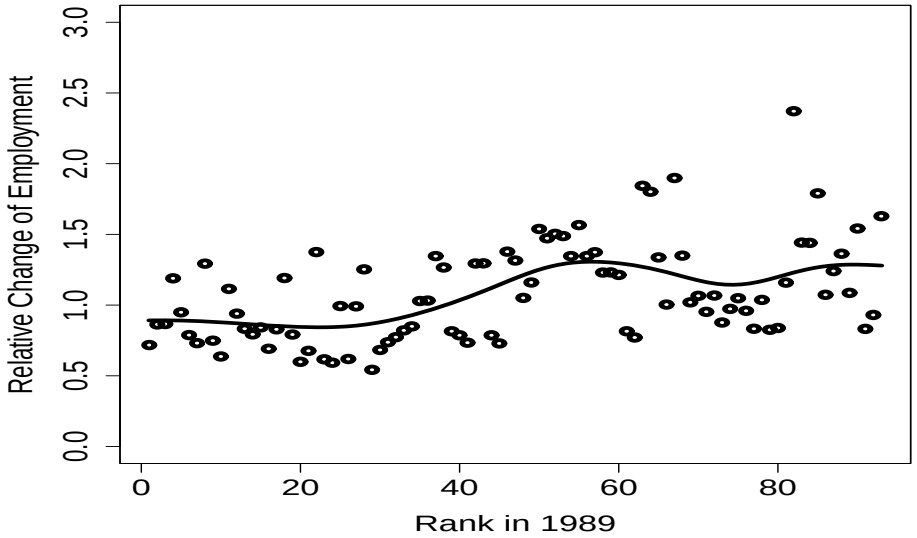
79–89



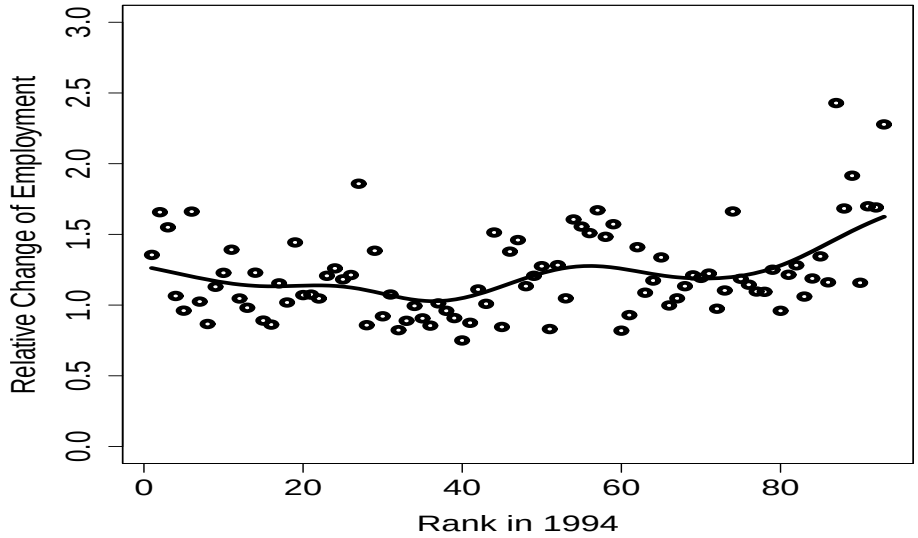

84–94




89–99

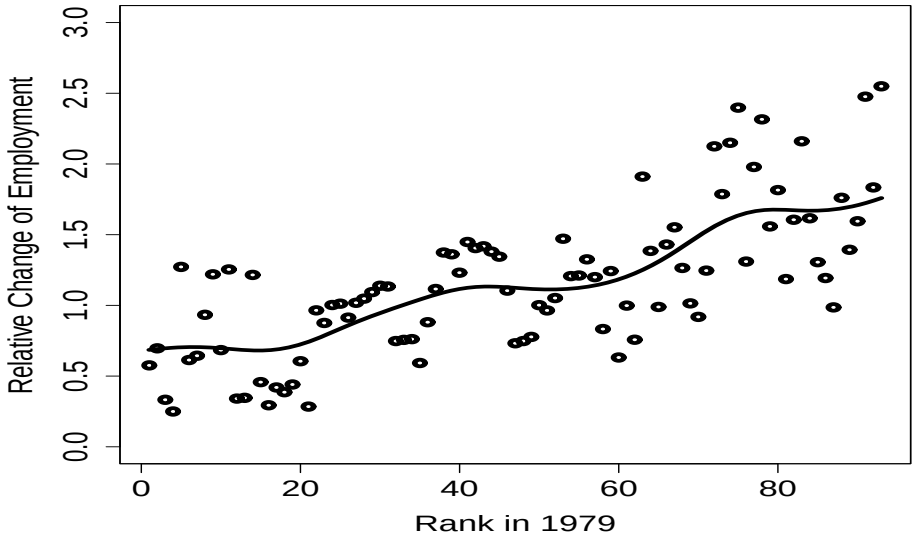



94–04

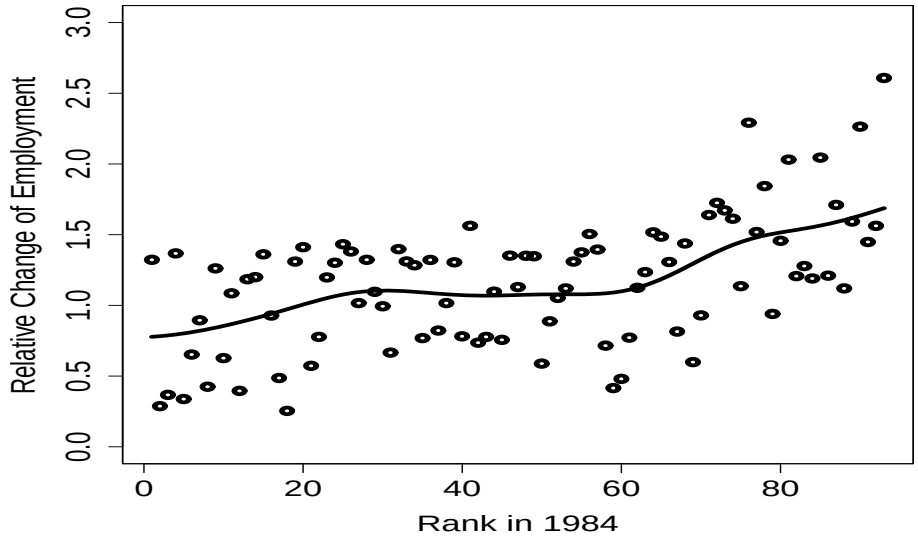


# Employment Germany

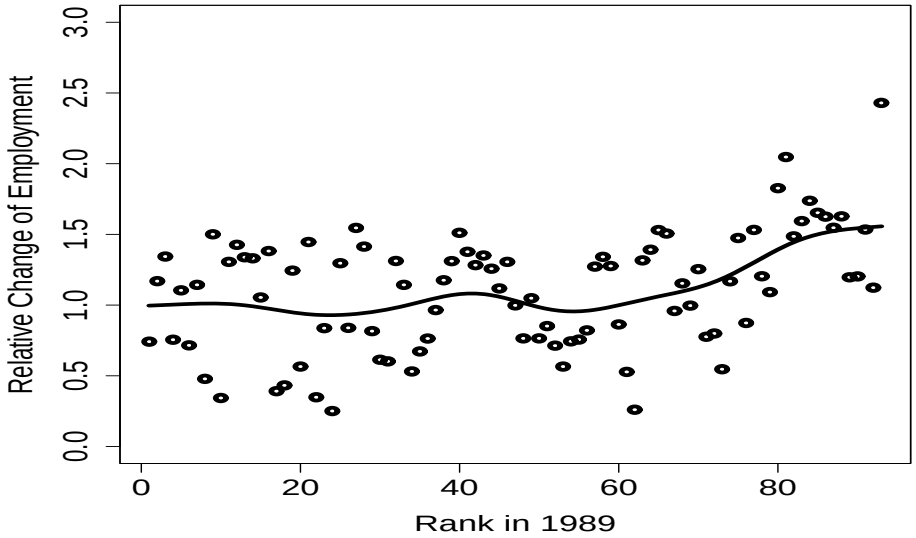
79–89



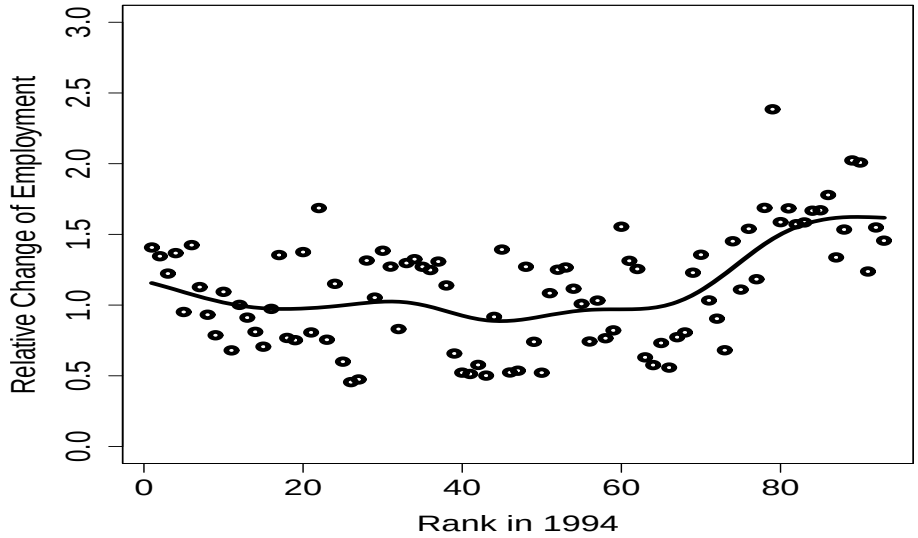

84–94




89–99




94–04



# Main Results

**U.S.**

- Polarization of employment
- And polarization of wages both across and within skill groups
- Small cohort effects

**Germany**

- Polarization of employment
- But polarization of wages only between skill groups
- Sizeable cohort effects: Recent cohorts hit most strongly

# Conclusions

- Trends in employment and some of the trends in wages are consistent with technology driven polarization of labor market
- Patterns in wage inequality between the U.S. and Germany differ strongly
  $\longrightarrow$ unlikely that technological change alone can explain the empirical findings
- SBTC may interact with institutional factors
  $\longrightarrow$ differences in institutions across economies maybe the reason why we observe different trends in inequality across the U.S. and Germany

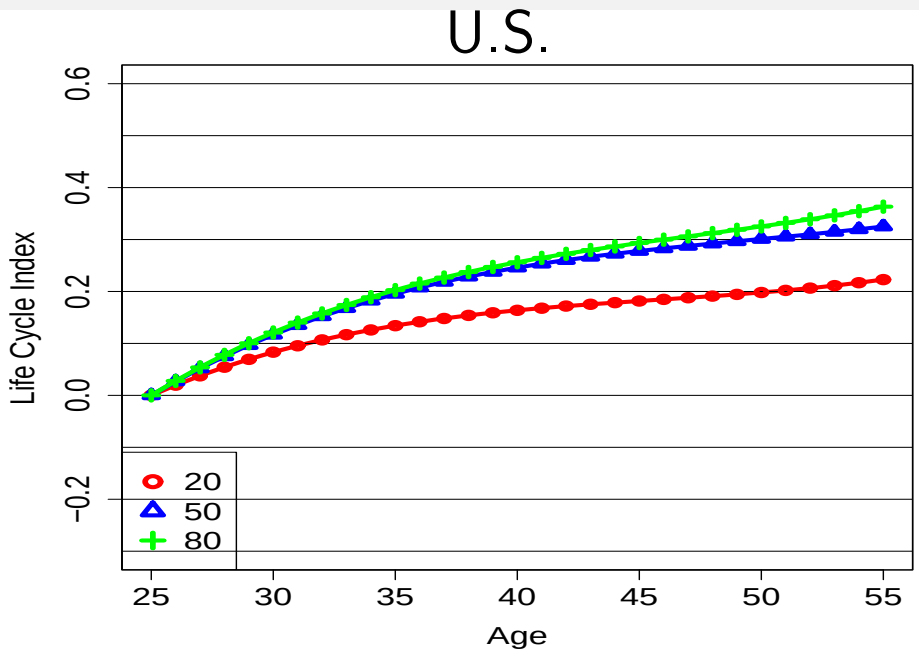
# Empirical Implementation

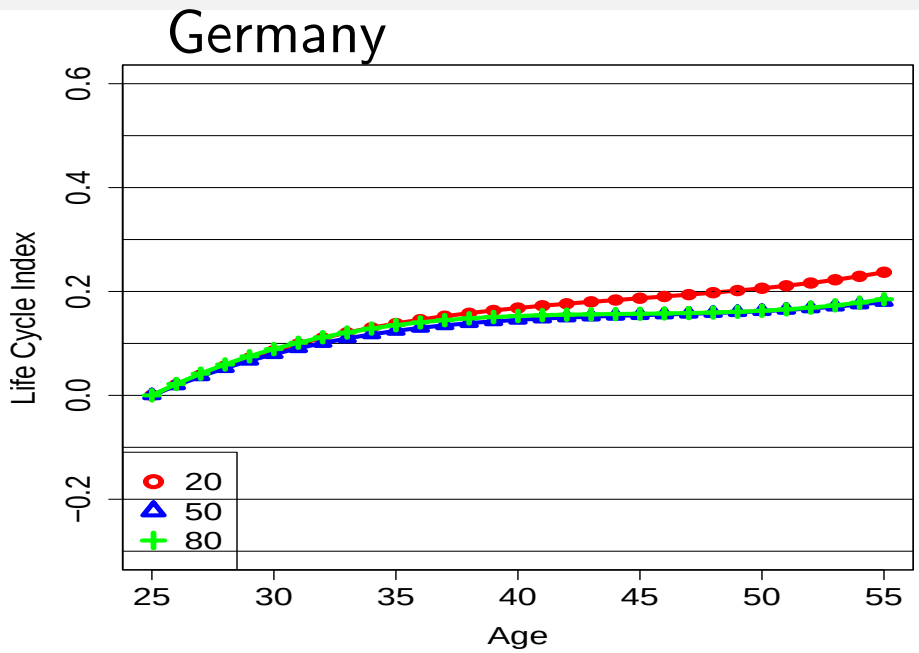
- $A(\alpha) = A_1\alpha + A_{(2)}(\alpha) = a_1\alpha + a_2\alpha^2 + a_3\alpha^3$
- $B(t) = B_1 t + B_{(2)}(t) = b_1 t + b_2 t^2 + b_3 t^3 + b_4 t^4 + b_5 t^5$
- $K(c) = K_1 c + (1-\delta)K_b(c) + \delta K_a(c)$

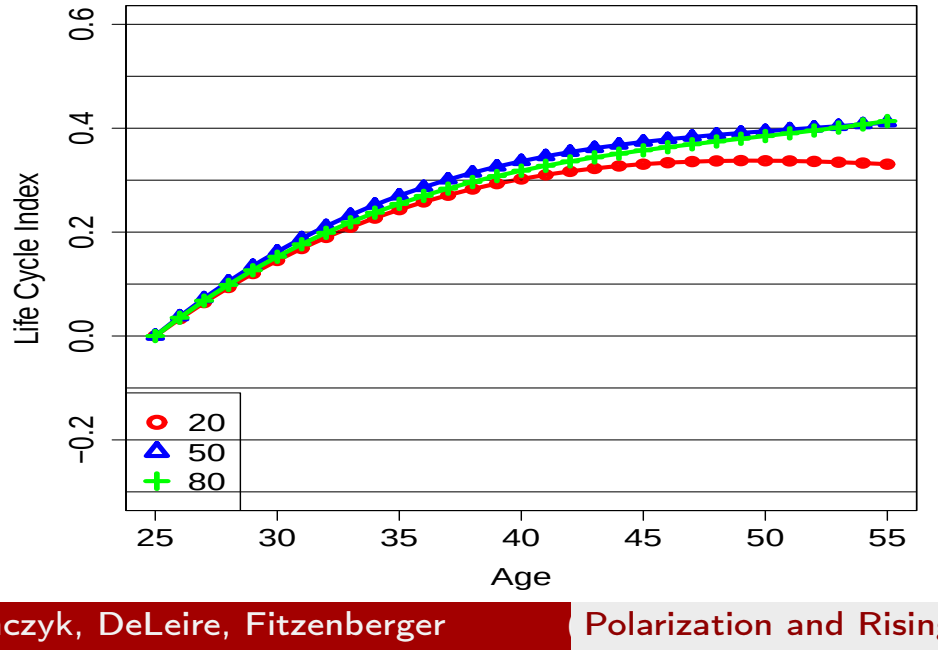
$$g(c,\alpha) + \bar{u}_t = G + (A_1 - K_1)\alpha + (B_1 + K_1)t + A_{(2)}(\alpha) + B_{(2)}(t) + (1-\delta)K_b(c) + \delta K_a(c) + \sum_{i=1}^{4} \gamma_i R_i + \sum_{i=1979}^{2004-N_b-1} \kappa_i YD_i$$

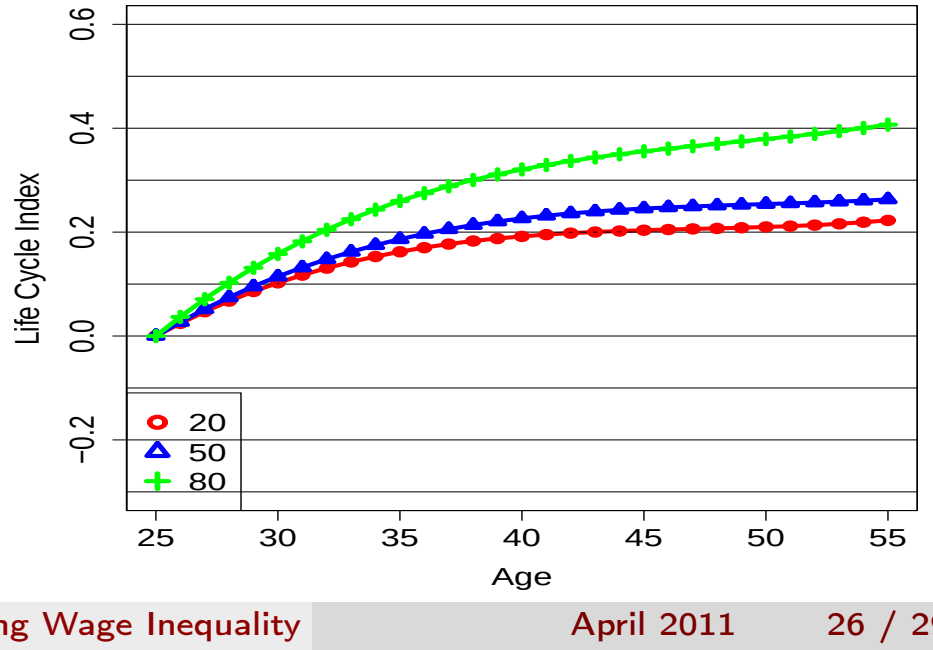
- $YD_i$: Orthogonalized year dummies
- $R_j$: Integrated mixed terms

# Life Cycle, Low- and Medium-skilled Workers

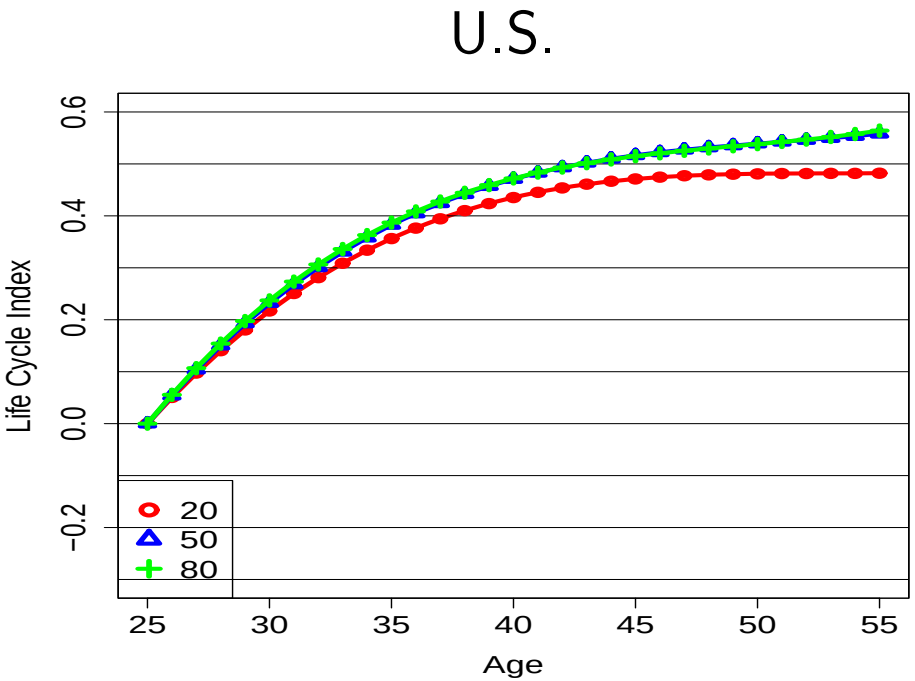


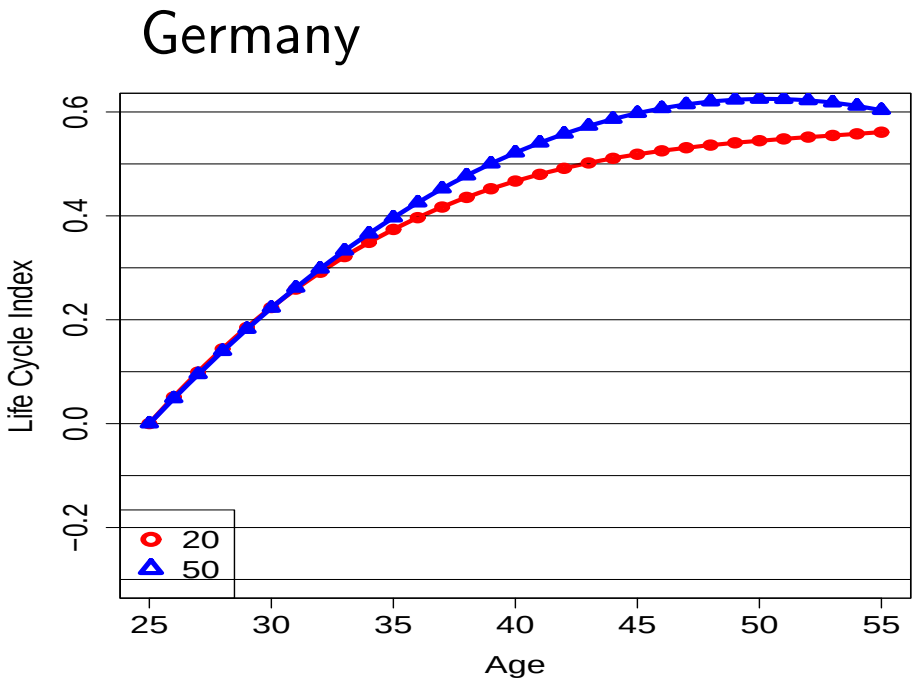



# Lifecycle, High-skilled workers

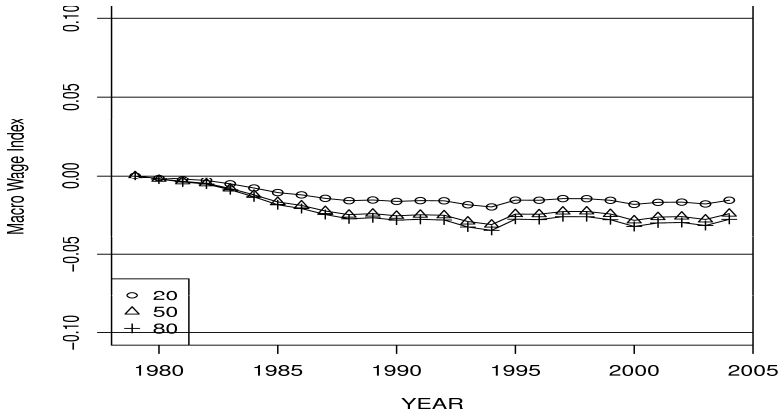


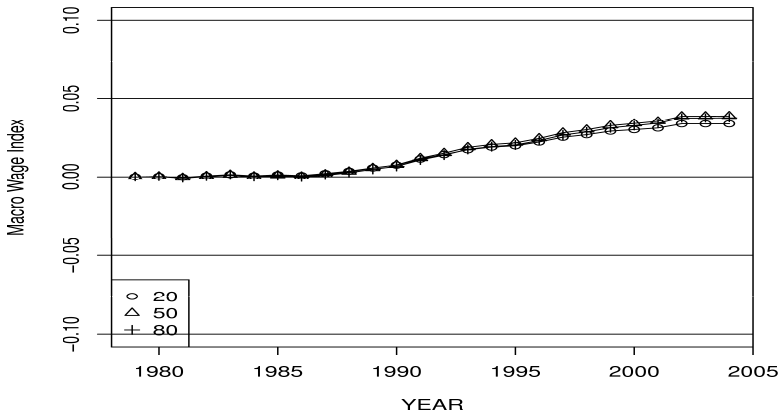




- Wage growth over the life-cycle at the median wage, positively correlated with educational level

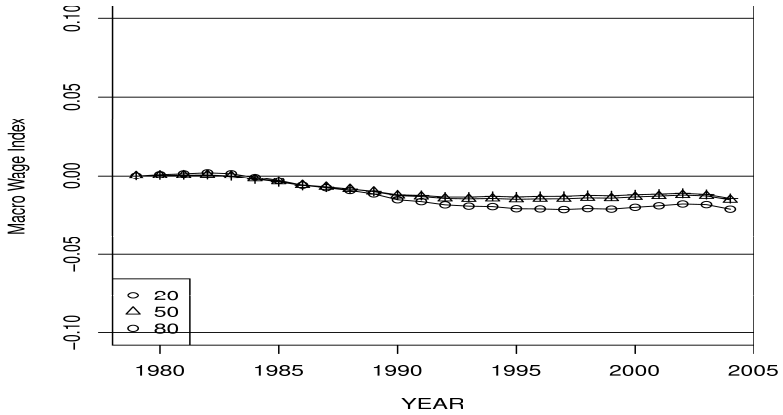
# Effect of changes in the age structure on wage growth: 79-04, Low- and Medium-skilled Workers

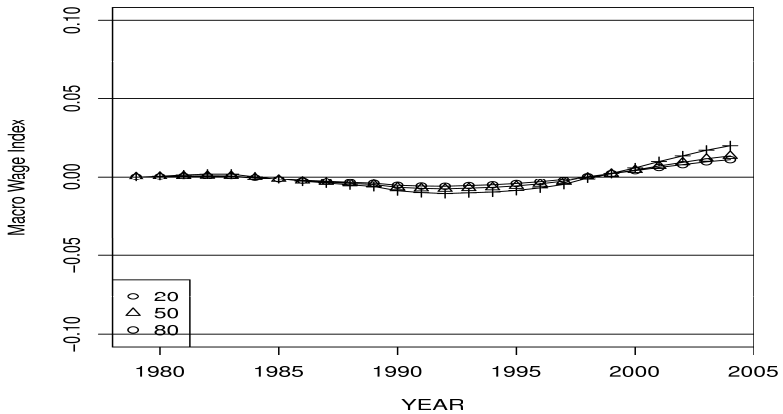
U.S.



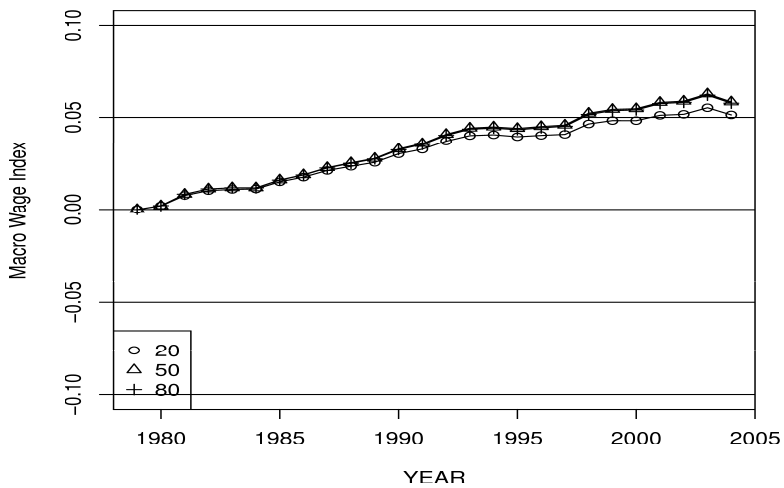

Germany



# Effect of changes in the age structure on wage growth: 79-04, High-skilled workers

U.S.




Germany