COUNTRIES FOR OLD MEN:
AN ANALYSIS OF THE AGE WAGE GAP

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Workforce aging and the age wage gap

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▶ This paper: more older workers generate negative spillovers on younger cohorts
- provide conceptual framework, show consistent evidence, and test for alternatives

This paper

▶ **Negative career spillovers** in firms: success of older might come at cost for younger

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▶ Derive following predictions from increased supply of older workers:

1. deterioration in wages of younger: crowd out from top jobs, not change in wage premia
2. deterioration from both lower entry position and lower growth over lifecycle
3. crowd-out within firm, especially in top paying ones where older workers retire later
4. crowd-out between firms: younger workers pushed out of top-paying firms
5. larger spillovers in more constrained firms

What we find

1. **Deterioration of younger workers' careers:** pushed to bottom of wage distribution
   - Many O55 workers swapped positions with U35 workers in wage distribution
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   - e.g. low-growth, older, larger firms: less room for creating new positions at the top

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6. Complement with additional evidence to rule out alternative stories
   - among others: workforce composition, inequality trend, education and returns to experience

Literature review

1. **Wage gap between older and younger employees**
    - **Relatively small literature on age wage gap** (Rosolia & Torrini (2007); Naticchioni et al. (2014))
    - **Our contribution:**
        - Conceptual framework
        - Administrative and survey data from multiple countries
        - More tests and improved external validity
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3. **Link age wage gap with other strands of the labor literature**
   - **Wage inequality** (Autor et al. (2008); Card et al. (2013); Song et al. (2019)), **increases in returns to experience** (Jones (2009); Azoulay et al. (2020); Jeong et al. (2015)); **SBTC** (Acemoglu et al. (2011); Autor et al. (2006)); **domestic outsourcing** (Goldschmidt & Schmieder (2017)); **demand for skills** (Deming (2021)); **selection**

Outline

Conceptual framework

Labor demand with multiple jobs and constrained firms

Goal: highlight the two key elements needed to generate career spillovers

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2. limited resources: cannot promote all who deserve a promotion
   - generates bottleneck at the top of firms' hierarchies, "conflict" between opportunities

Model setup

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- ▶ **Imperfect ability to renegotiate:** firms inherit allocation of older workers and their wages
  - can demote x_o older workers by paying convex cost $c(x_o)$
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- ▶ **Constraint on resources:** firm must pay (κ) to maintain top job and cover adjustment

$$c(x_0) + \kappa \cdot \left(l_{t,o}^{-1} - x_0 + l_{t,y} \right) \leq K$$

Wage formation

▶ **Top jobs** pay some premium/wedge $\mu_{t,a}$ **over bottom jobs**

- can easily microfund with efficiency wage considerations

▶ Workers would like to take top jobs, but they are rationed

- firms will still be on labor demand (Acemoglu and Restrepo, 2023)
- will demand labor until wage equal MPL

Crowding out and career spillovers

Result 1: If constraint binds, larger older cohort (l_o) causes the following average wage change

$$\frac{\partial \bar{w}_y}{\partial l_o} = \underbrace{\frac{1}{l_y} \frac{\partial l_{t,y}}{\partial l_o} \left(\mu_{t,y} - 1 \right) w_{b,y}}_{\text{Crowding out (CO)}} + \underbrace{RS \left(F_{L_y L_o}, F_{L_y L_y} \right)}_{\text{Relative labor supply (RS)}}$$

▶ Crowding-out (-): fewer slots in top jobs, younger workers in lower positions

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▶ Extend to heterogeneous firms to get additional results

Predictions from the conceptual framework

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Three main data sources:

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  - samples of workforce, varying years
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- ▶ Use ITA as main setting, replicate for others when possible

The Careers of Young and Old Workers

Career Spillovers: implications on opportunities

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How does likelihood of being at the top changes for the two age groups?

U35 workers move towards bottom vigintiles

Bar chart with y-axis labeled "Percentage–point shift, 2019–1985" ranging from −.02 to .04, and x-axis labeled "Vigintiles" with values 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100.

▶ Quartiles time series
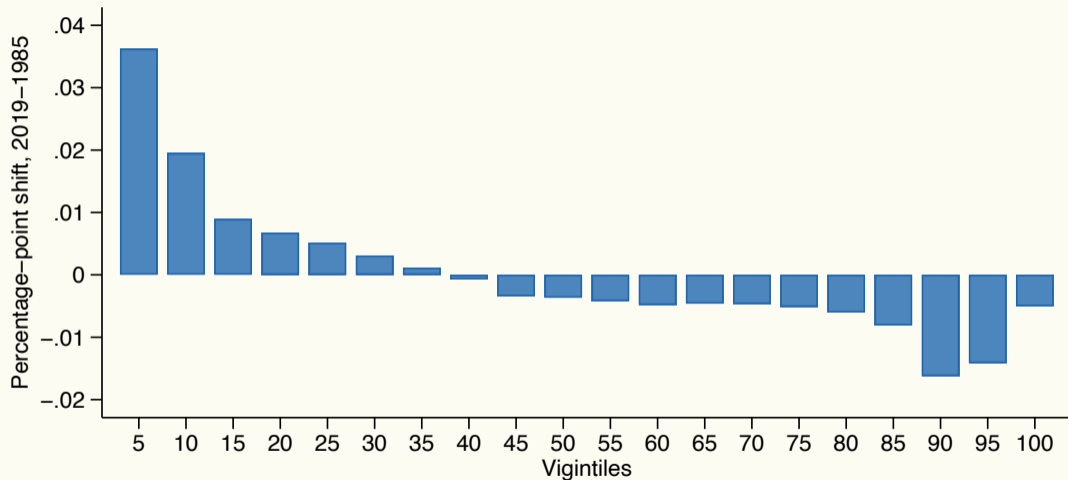
O55 workers move towards top vigintiles
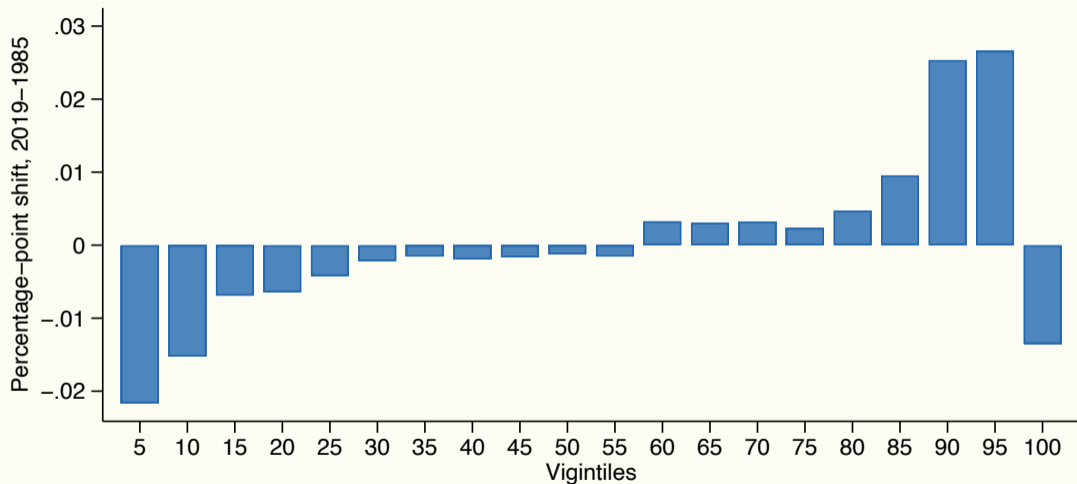
Opposite movements over the hierarchy of wages

Opposite shifts over the distribution of wages, consistent with changes in careers

▸ Job title movements

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However, there are other potential sources of increase in the gap

- ▶ changes in wages at the top might have influenced the age wage gap
- ▶ because O55 are more likely to be at the top

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Can we quantify contribution of each force?

Decomposition: rank gap and distributional gap

The change in mean wages for age group a between periods t and t′ can be written as follows:

$$\Delta w_a^{t,t'} = \underbrace{\sum_v s_{a,v,t} \left(\bar{w}_{v,t'} - \bar{w}_{v,t} \right)}_{\text{Distributional gap}} +$$

▶ $s_{a,v,t}$ = share of workers in age group $a \in \{U35, O55\}$, vigintile v of the distribution of wages, and year t

▶ $\bar{w}_{v,t}$ = mean log wage in vigintile v and year t

▸ Graphical intuition

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▶ Difference between age groups $a \in \{U35, O55\}$ to decompose change in age wage gap

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Most of the increase in age wage gap from larger rank gap

Figure: Line chart titled with y-axis "O55−U35 gap in log weekly wages, year t − 1985" and x-axis "Year" (1985 to 2020). Three series: Rank gap (blue, solid with circles), Distributional gap (red, dashed with squares), Residual (green, dotted with diamonds).
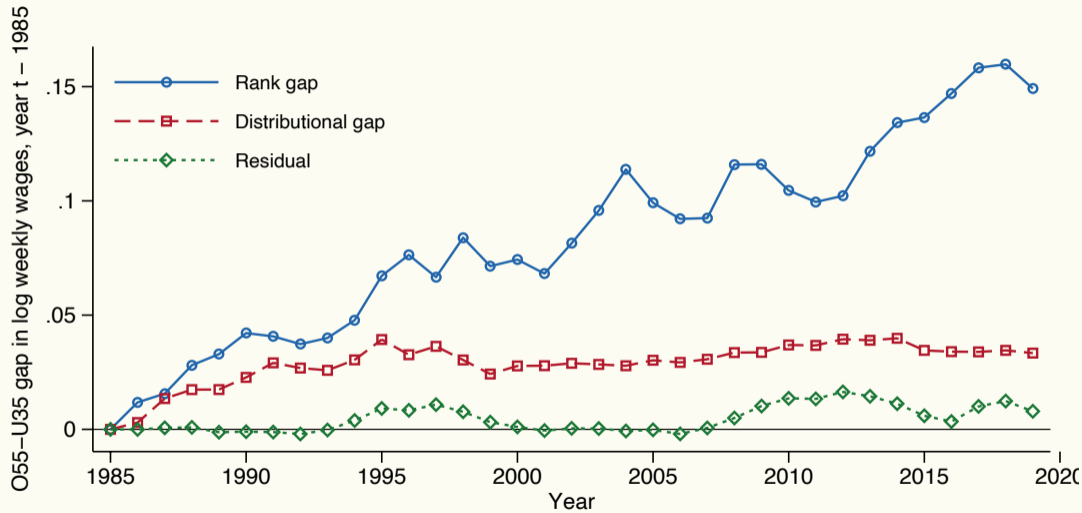
▸ By Cohort   ▸ Yearly Earnings   ▸ Germany

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Rank gap more important in most countries
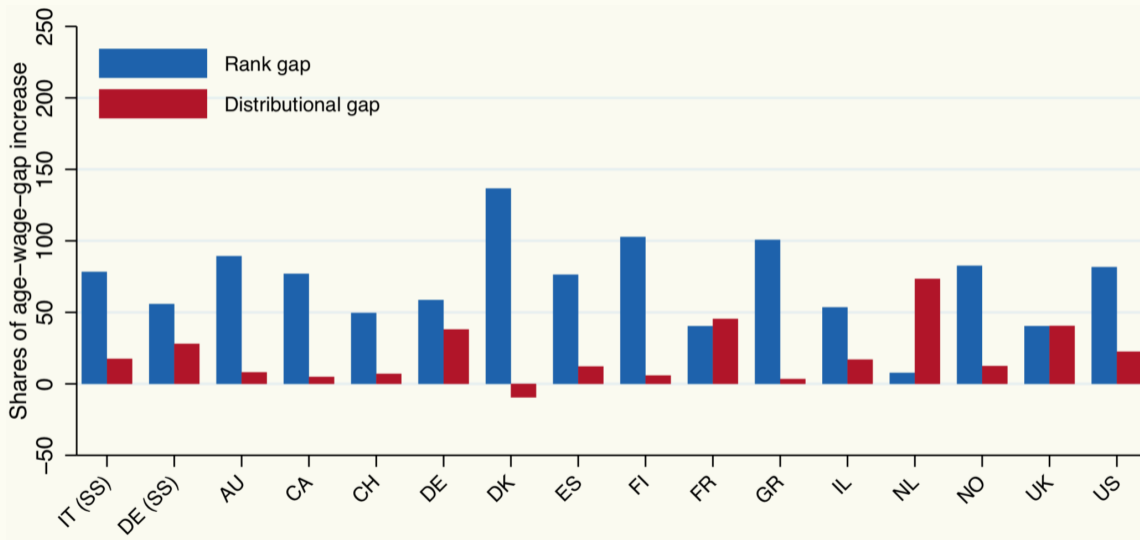
Entry Rank Vs. Rank Growth

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▶ **Result 2:** lower entry position and lower growth over lifecycle

▶ **Decomposition of wage-rank loss for U35 workers** between period t and t′

   ● **Intercept:** change in rank at labor-market entry between t and t′

   ● **Slope:** change in post-entry rank growth between t and t′

▶ Details of the decomposition

U35: loss from both entry and post-entry growth
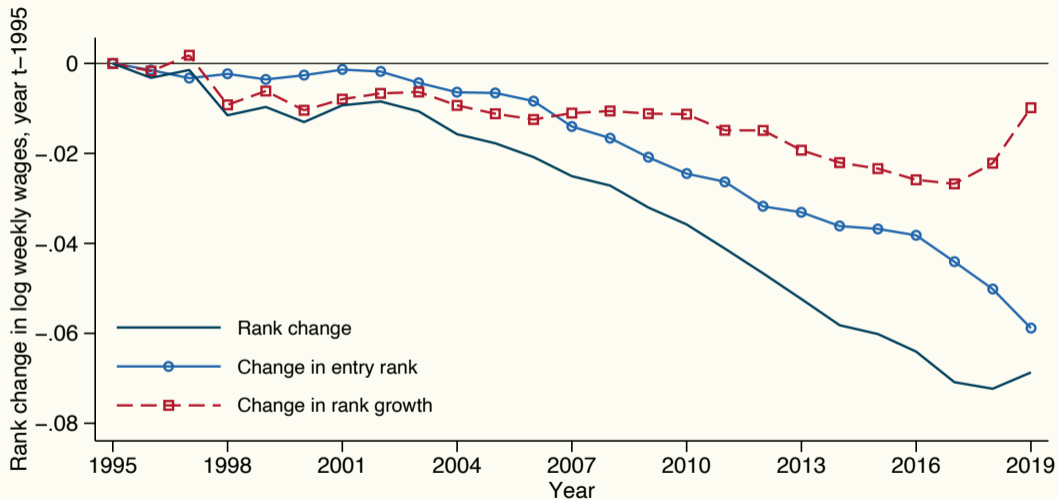
The Importance of Within and Between Firm Dynamics

Sorting of workers

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► In every year, divide workers into 50,000 firm-worker groups (Machado & Mata (2005)):
  - 100 firm groups (f) depending on average firm wage
  - 500 worker groups (e) within each firm group

▸ Decomposition within vs between firms

U35 lose rank within any level of firm pay, O55 gain almost everywhere
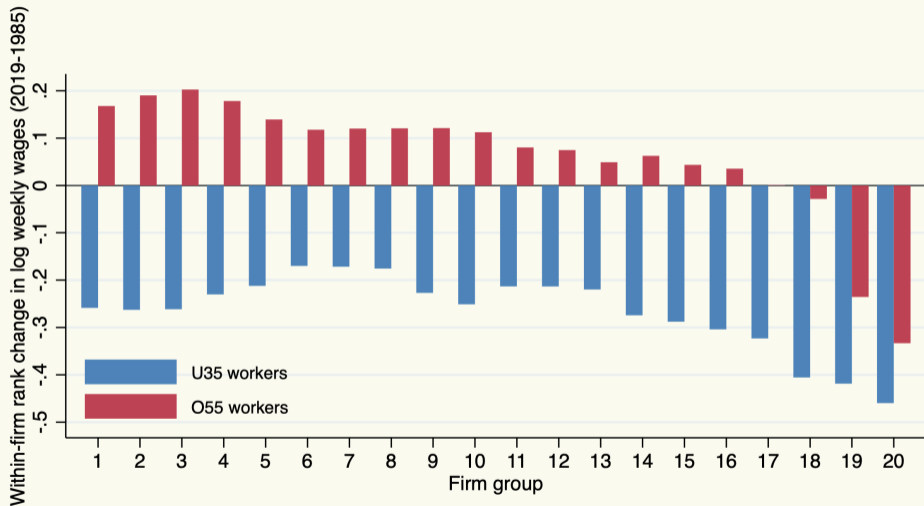
O55 concentrate in high-paying firms and generate competition
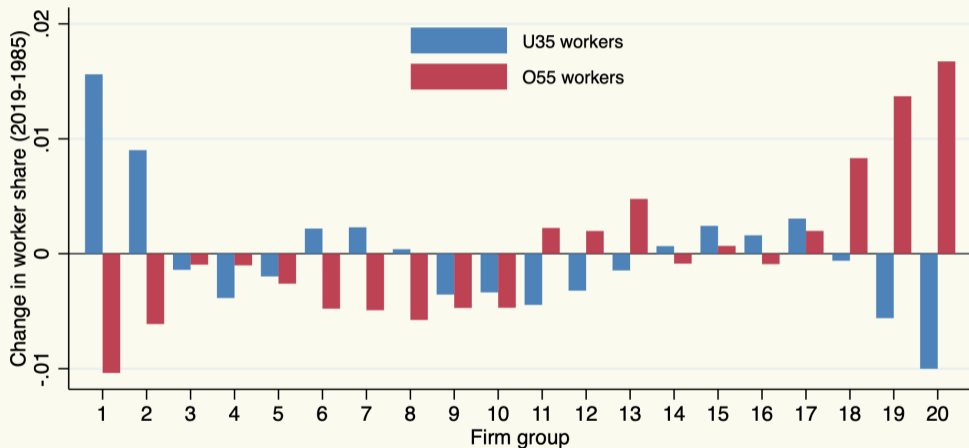
Firm Heterogeneity

Larger effects in more constrained firms

Result 5: career spillovers are larger in more constrained firms

▶ Key: crowd-out depends on constraints in adding higher-ranked jobs

▶ Constrained firms: do not grow, are in mature stage of their life cycle

▶ Consistent with prior findings (Bennett & Levinthal (2017); Bianchi et al. (2022))

▶ These firms are becoming more common:

- Firms become older over time (▸ Firm Age), and
- Lower GDP growth in most high-income countries (▸ GDP)

Larger effects within older, larger, slow-growing firms
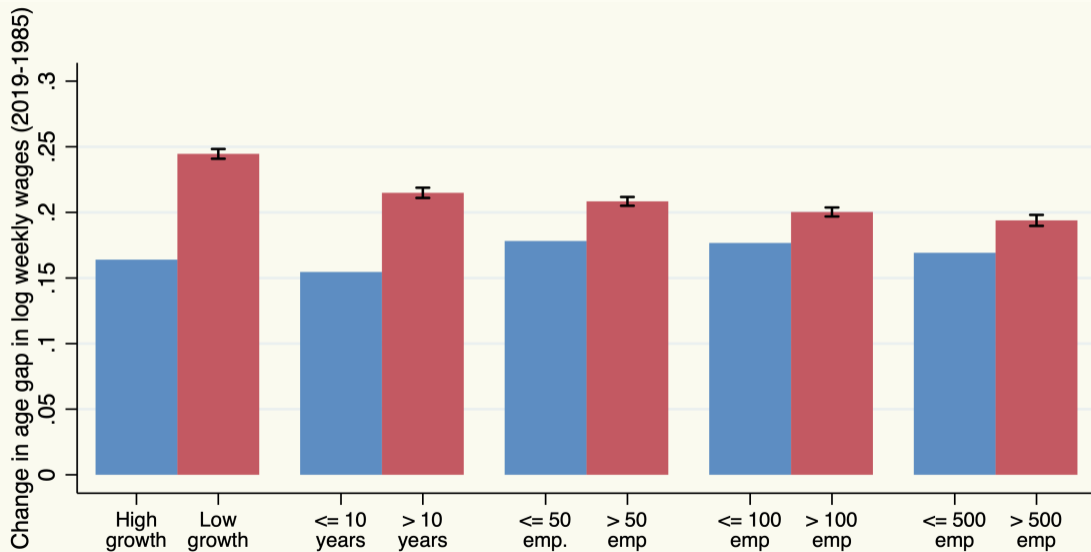
Alternative Mechanisms

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▶ Changes in workforce composition `▸ Evidence`
  - residual (education, gender, type of contract) age gap shows similar increase
  - look at subpopulations: e.g. men, women, domestic, permanent contract
  - focus on 55-60 males to avoid changes in composition b/c of pension reforms

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  • Larger effects within older and slower-growing firms

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- ► These results point to the importance of negative career spillovers

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▶ Find evidence in line with career spillover story:
  • Younger workers are less likely to be at the top of wage ranking, older are more likely
  • Younger workers enter in lower-ranked positions and grow less
  • Within firm dynamics matter mostly for younger; younger pushed towards low-paying firms
  • Larger effects within older and slower-growing firms

▶ These results point to the importance of negative career spillovers

▶ Implications for gender pay gap: Arellano-Bover, Bianchi, Lattanzio, Paradisi (soon!)
  • younger men's opportunities deteriorate more than women: started from higher positions
  • compression of younger opportunities is important driver of gender pay gap decrease

THANK YOU

Appendix

Wage gap between older and younger workers increased

Time series

30
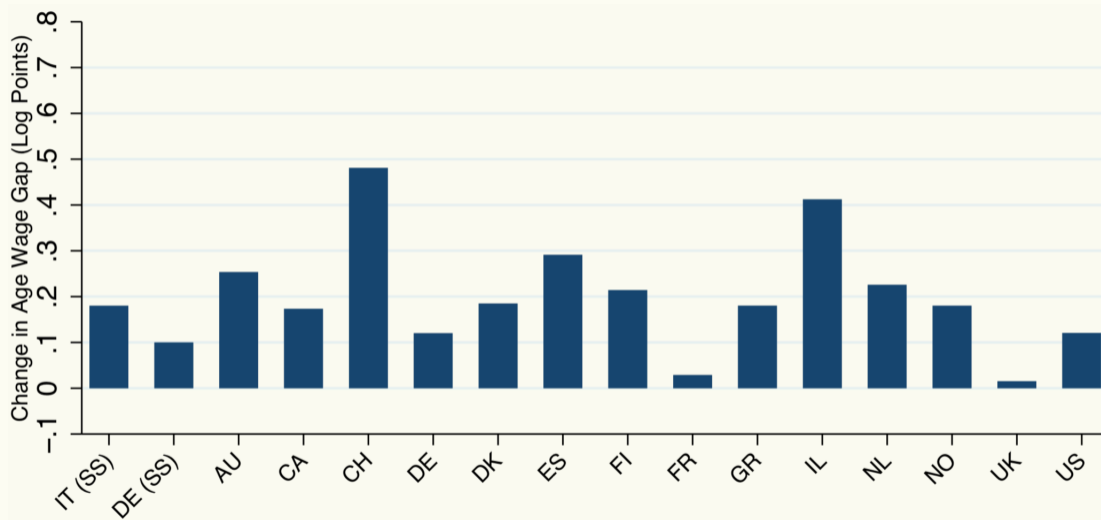
ITA: Increase of Age Wage Gap at Mean and Median
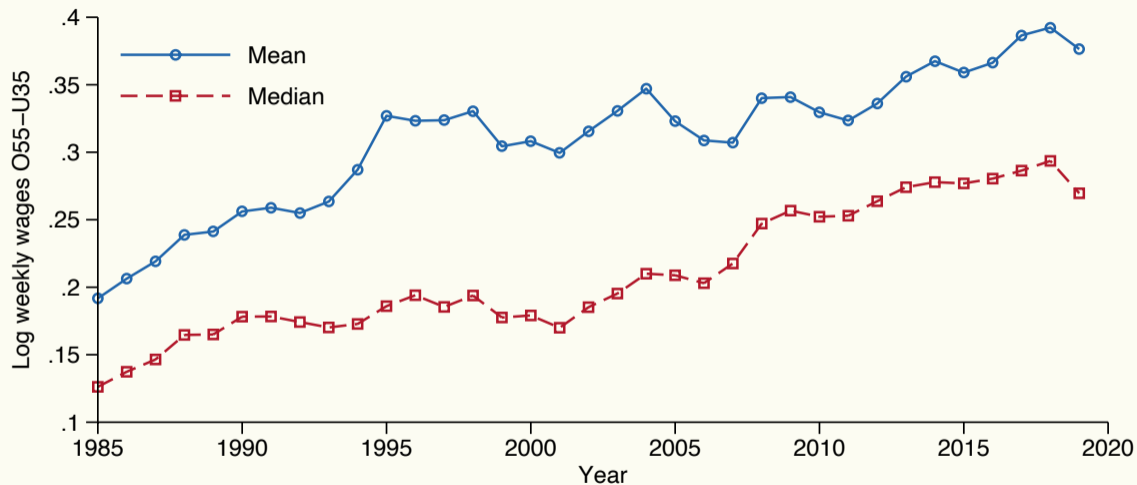
Steeper Wage Curve Over Life Cycle
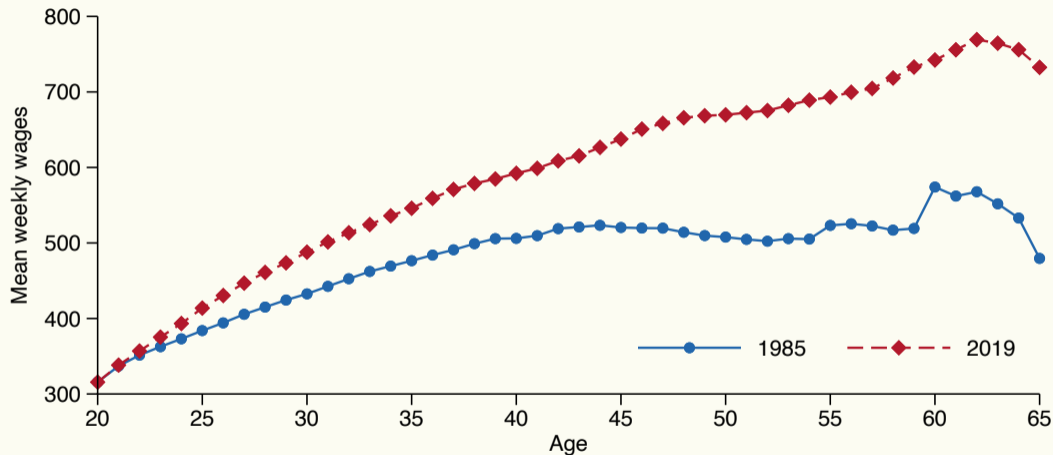
U35 workers from top to bottom quartile

▸ Back
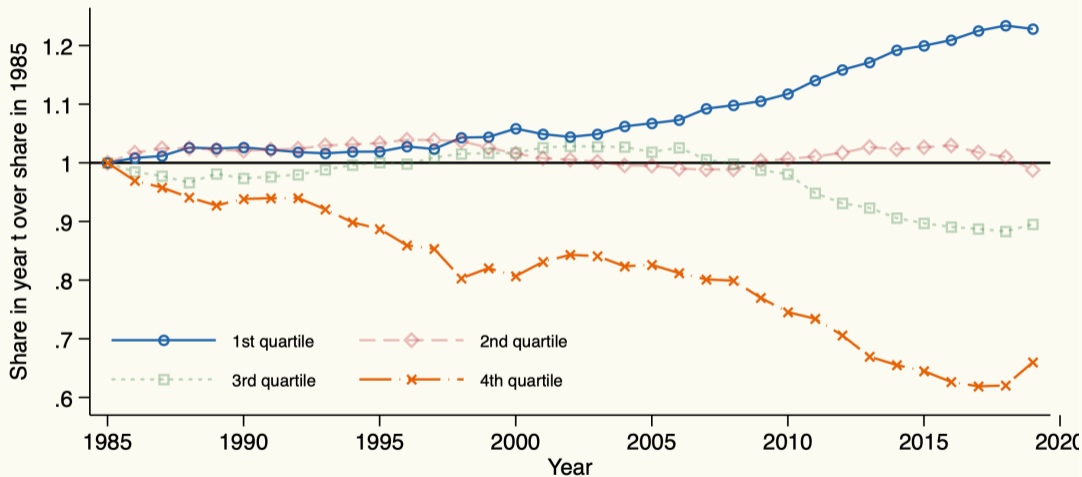
O55 workers from bottom to top quartile
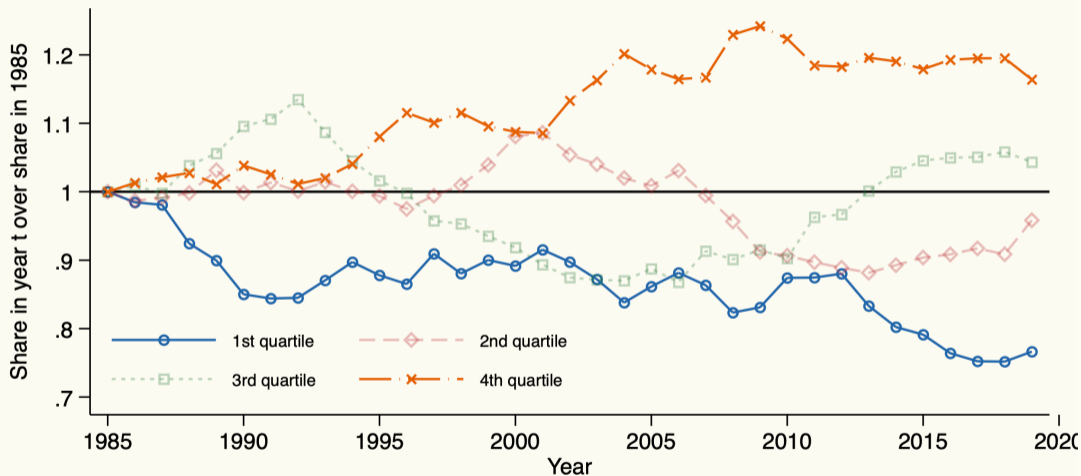
U–35 move to apprenticeship, O-55 to managerial jobs

▸ Back
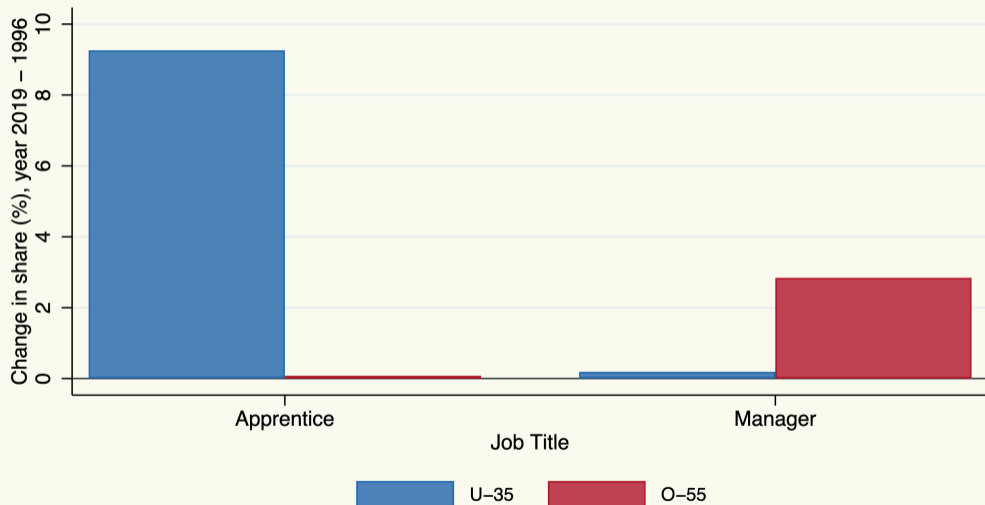
Shares of Managerial Positions
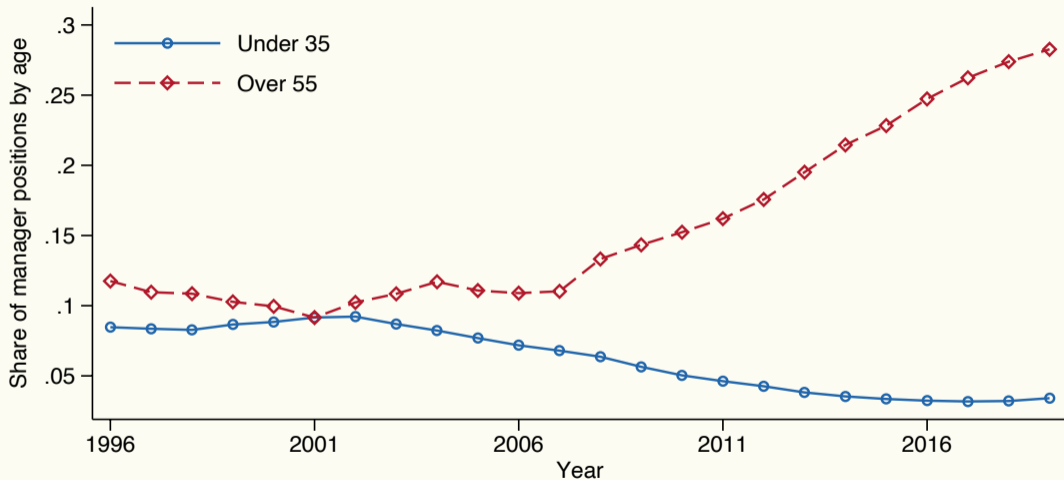
Shares in Age Group with Managerial Job
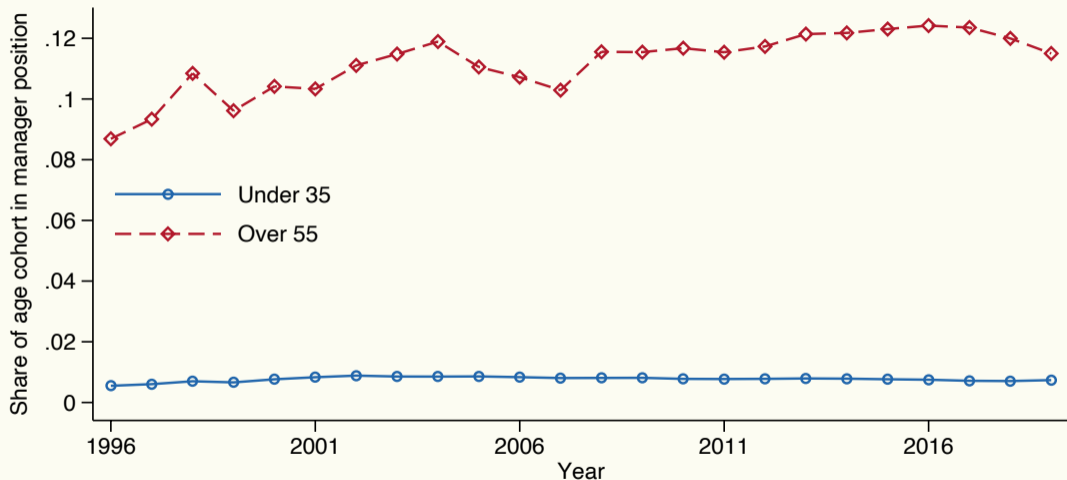
Two types of increases in the age wage gap

► Wage distribution at baseline:
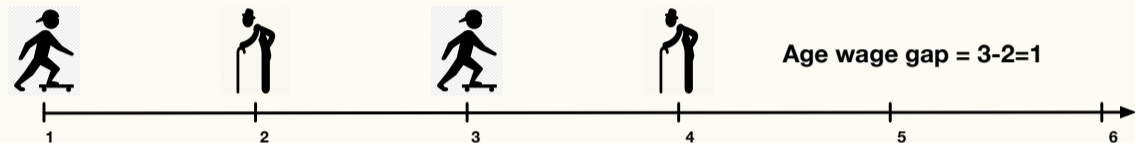
Age wage gap = 3-2=1

► Age wage gap can increase through a change in wage rank:
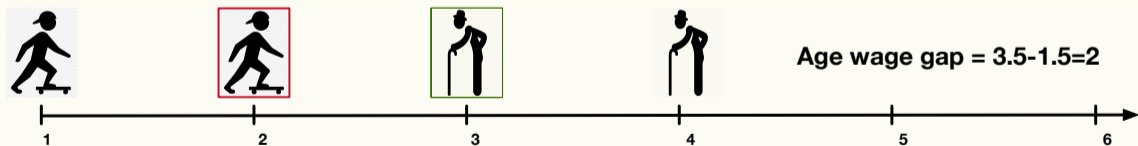
Age wage gap = 3.5-1.5=2

► Back

Two types of increases in the age wage gap

► Wage distribution at baseline:
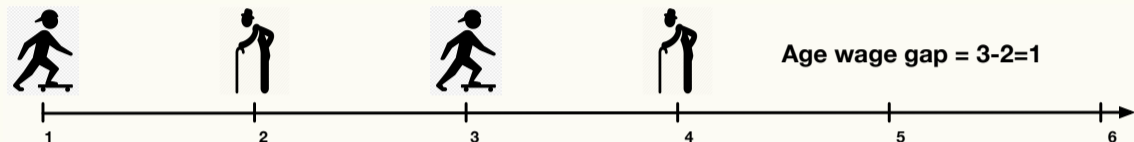
Age wage gap = 3-2=1

► Age wage gap can increase through a change in mean wages at different percentiles:

Age wage gap = 4-2=2

► Back
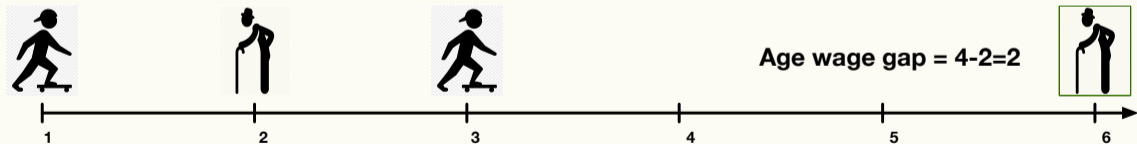
Decomposition by age group: U35 lose, while O55 gain
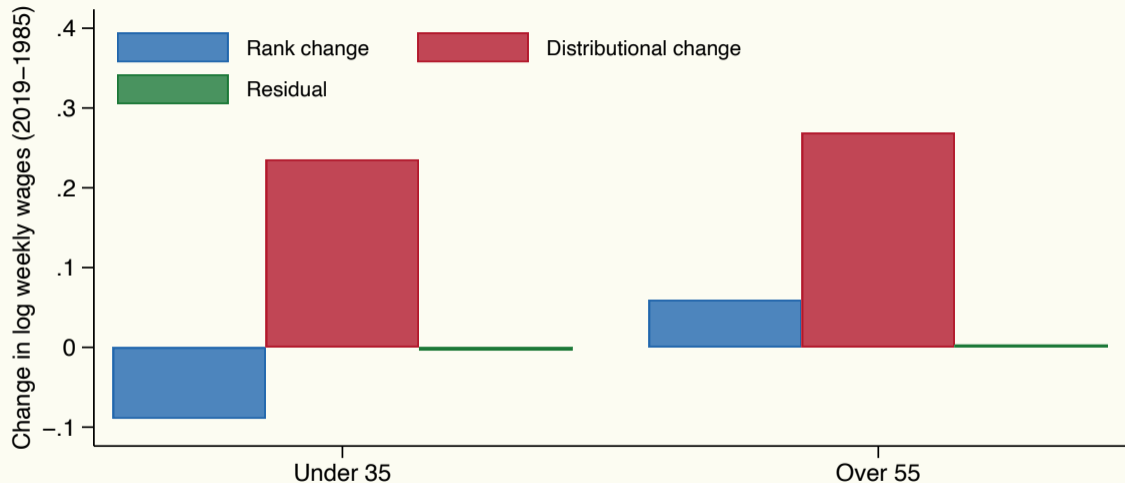
Rank Gap with Yearly Labor Earnings

‣ Back
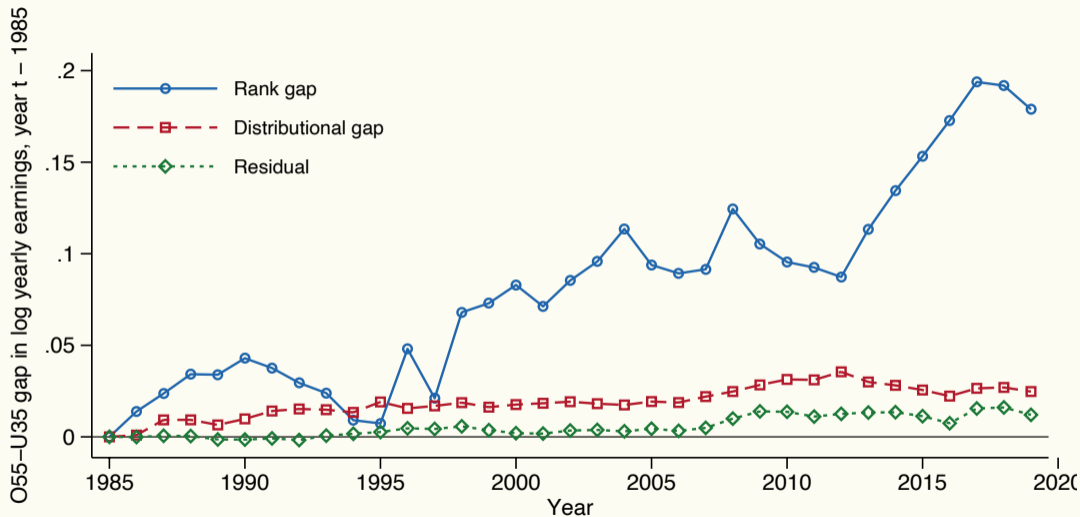
Rank Gap in Germany – Daily Wages
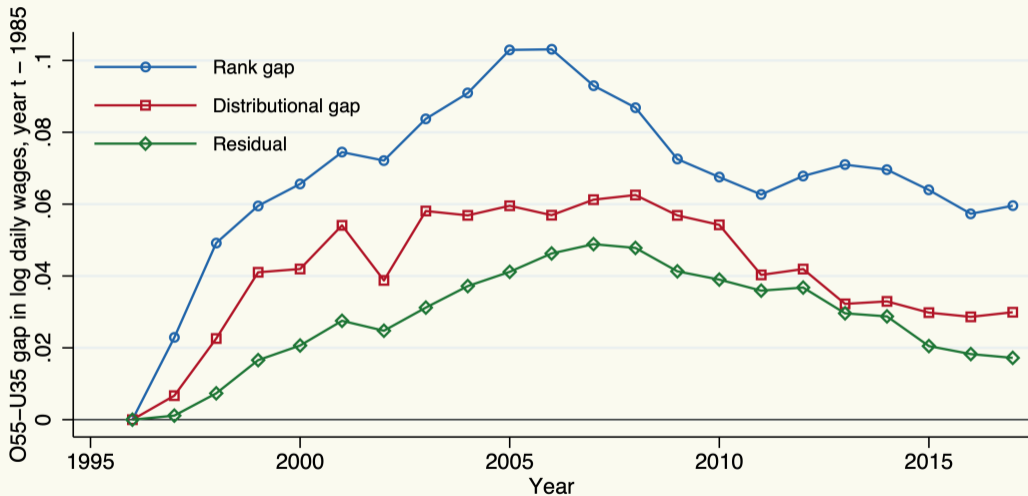
▸ Back

► Decomposition of wage-rank loss for U35 workers between period t and t$'$

Entry rank Vs. rank growth

▶ Decomposition of wage-rank loss for U35 workers between period t and t'

▶ Change in rank at labor-market entry between t and t' (e is years from entry)

$$\underbrace{\sum_{e \in [0,18]} s_{e,t} \cdot \sum_v \left[\left(s^E_{e,t',v} - s^E_{e,t,v} \right) \cdot \bar{w}_{v,t} \right]}_{\text{Change in entry rank}}$$

- $s^E_{e,t,v}$ = the share of workers who are e years from entry in year t in vigintile v at the time of entry in the labor market (E)
- $s_{e,t}$ = the share of workers who are e years from entry in year t out of all U-35

Entry rank Vs. rank growth

▶ Decomposition of wage-rank loss for U35 workers between period t and t′

▶ Change in rank at labor-market entry between t and t′ (e is years from entry)

$$\underbrace{\sum_{e \in [0,18]} s_{e,t} \cdot \sum_{v} \left[\left(s_{e,t',v}^{E} - s_{e,t,v}^{E} \right) \cdot \bar{w}_{v,t} \right]}_{\text{Change in entry rank}}$$

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- $s_{e,t}$ = the share of workers who are e years from entry in year t out of all U-35

▶ Change in post-entry rank growth between t and t′

$$\underbrace{\sum_{e \in [0,18]} s_{e,t} \cdot \sum_{v} \left[\left(\Delta s_{e,t',v}^{t'-E} - \Delta s_{e,t,v}^{t-E} \right) \cdot \bar{w}_{v,t} \right]}_{\text{Change in rank growth}}$$

- $\Delta s_{e,t',v}^{t'-E} = s_{e,t,v} - s_{e,t,v}^{E}$ = change in share at vingtile v of those who are e years from entry in t

# U30 Loss Mostly Comes from Worse Rank at Entry
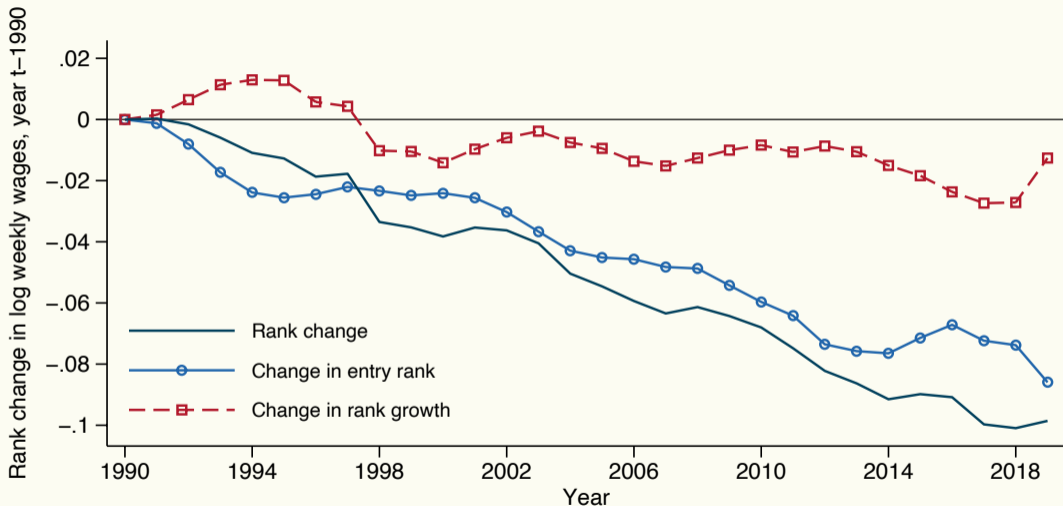
Rank gap: between Vs. within firms

The change in the rank gap for age group $a \in \{U35, O55\}$ can be written as follows:

$$\underbrace{\sum_{v} \left(s_{a,v,t'} - s_{a,v,t}\right) \bar{w}_{v,t}}_{\text{Rank gap}} = \underbrace{\sum_{g \in (f,e)} \left(s_{a,f,t'} - s_{a,f,t}\right) \cdot s_{a,(e|f),t} \cdot \bar{w}_{g,t}}_{\text{Between firms}}$$

$$+$$

Rank gap: between Vs. within firms

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$$

$$
+ \underbrace{\sum_{g \in (f,e)} s_{a,f,t} \cdot \left(s_{a,(e|f),t'} - s_{a,(e|f),t}\right) \cdot \bar{w}_{g,t}}_{\text{Within firms}} + \underbrace{\varepsilon_{a}^{t,t'}}_{\text{Residual}}
$$

▶ You can further differentiate between two age groups $a \in \{U35, O55\}$

Within-firm component accounts for 61% of rank-gap increase
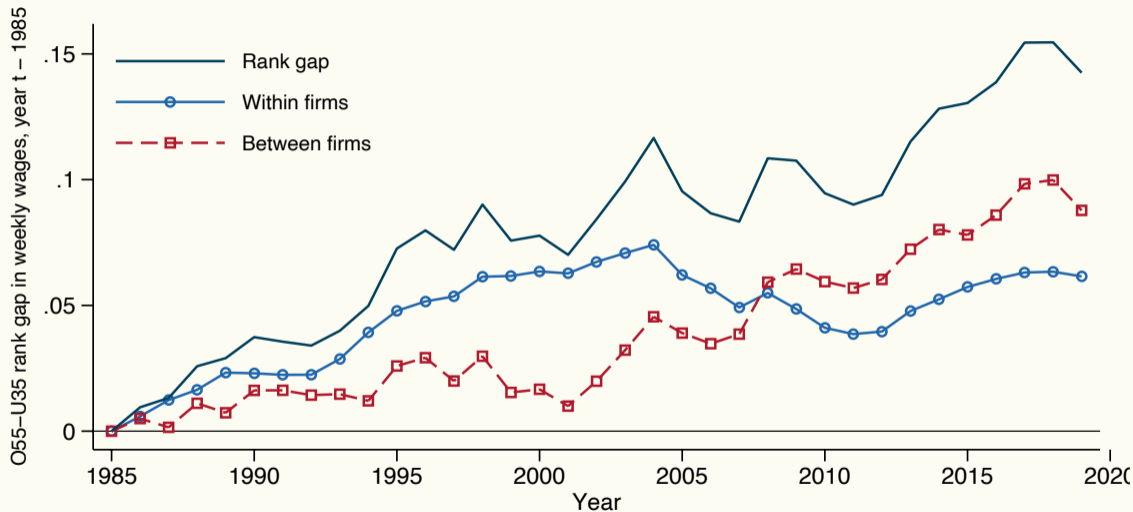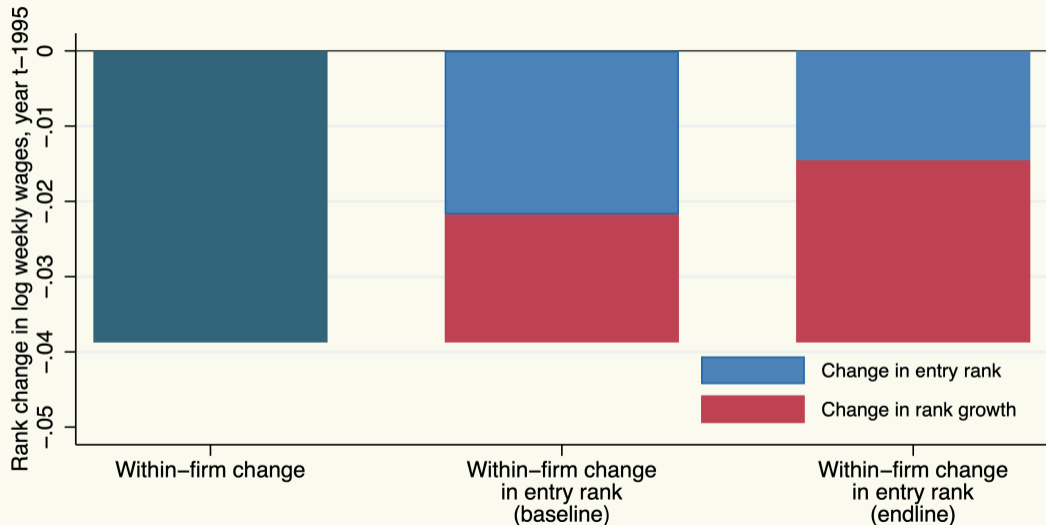
Within firm dynamics are mostly important for U35
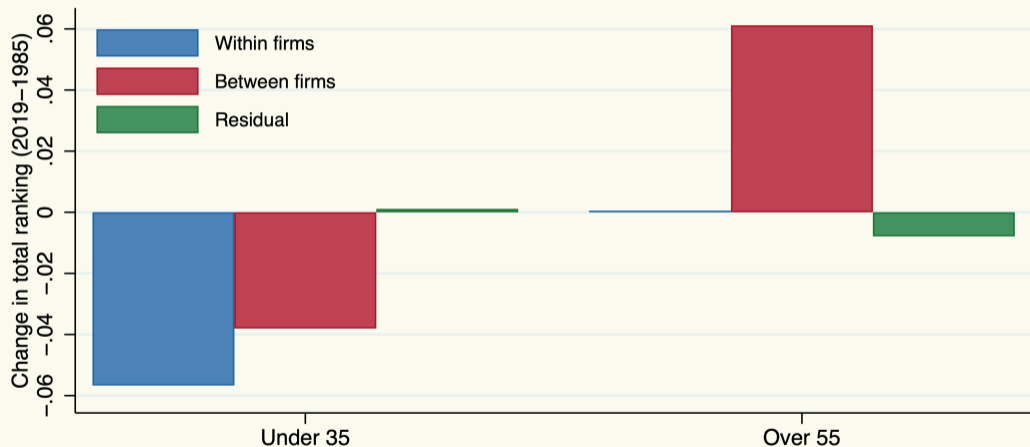
Between Vs. Within Firms in Germany
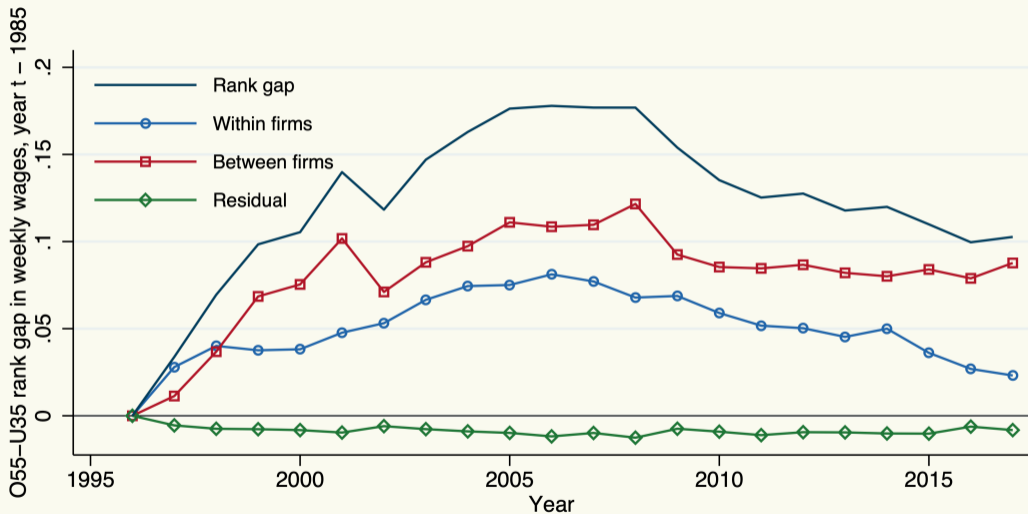
Between Vs. Within Firms in Germany - By Age Group
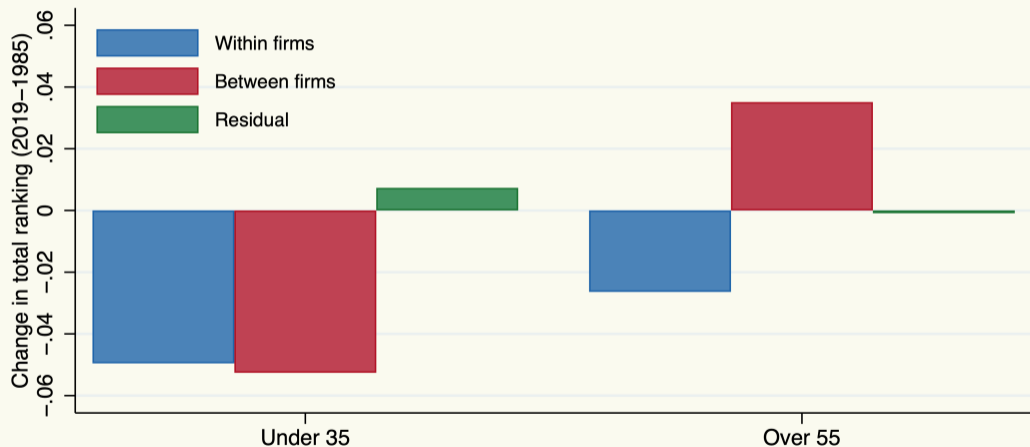
U35 lose rank within firms at entry, and for lower growth

U35 find it harder to grow within firms

Within-firm loss is the main source of U35 career deterioration

- ► U35 enter in lower-ranked position and progress less within their firm

- ► U35 lose rank in any firm group

U35 find it harder to grow within firms

Within-firm loss is the main source of U35 career deterioration

- ► U35 enter in lower-ranked position and progress less within their firm

- ► U35 lose rank in any firm group

Older workers have small/zero gains within firms

- ► Two opposing forces:
  - longer tenure improves their relative position within firm
  - higher competion with other O55 deteriorates their relative position

- ► Consistently, O55 gain everywhere within firms, except at the top where they concentrate

U35 seem to have been crowded out of high-paying firms

Older workers concentrate more in top-paying firms

- ▶ Not as a consequence of late move: have high tenure (> 12 yrs in above median group)

- ▶ Tenure change across firms follows O55 incentives (lower tenure loss in higher groups)

- ▶ O55 age increases more for top-paying firm groups (delay retirement more)

- ▶ High-paying groups have more than doubled firm age
  - O55 concentration at top might have been favored by business dynamics

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    - • O55 concentration at top might have been favored by business dynamics

U35 became more likely to be in low-paying firms

- ▶ U35 less present in top-paying firms where O55 concentrate

- ▶ U35 seem to have been segregated more to low-paying firms
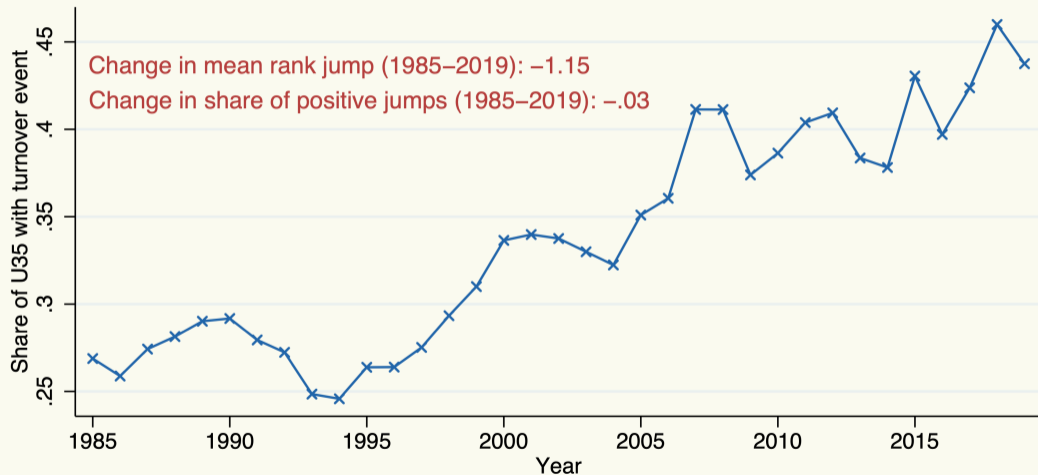
▸ Back

Shares with Turnover Events
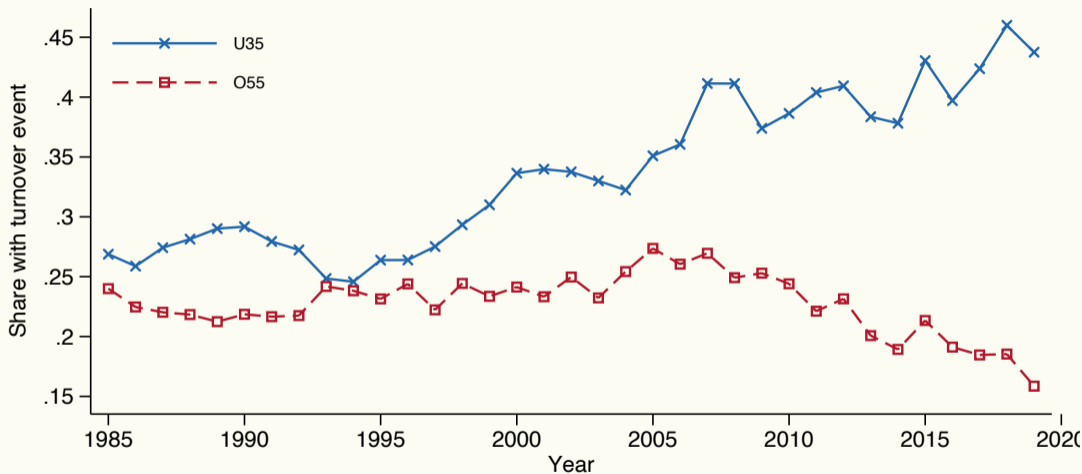
Despite larger turnover, average rank growth in turnover declines
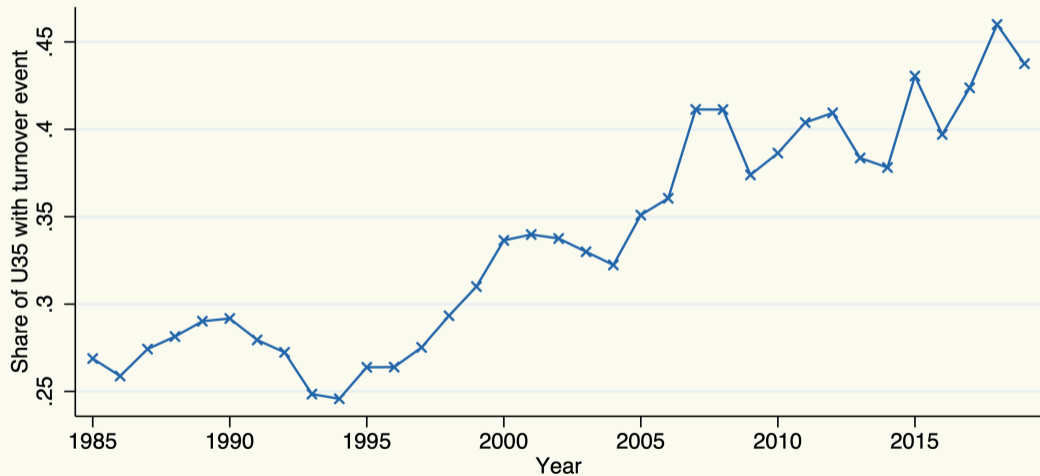
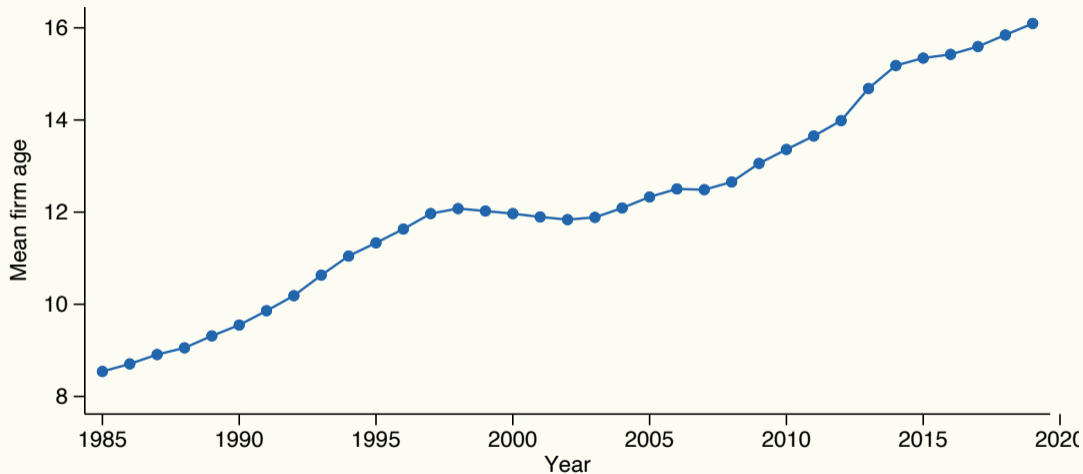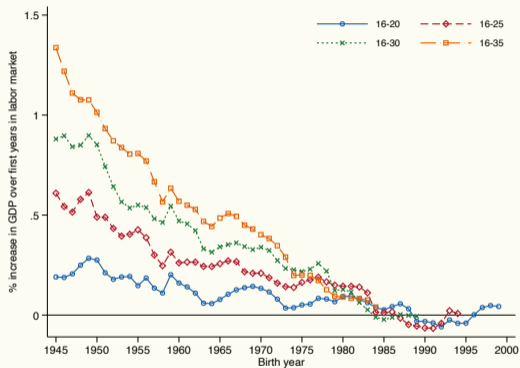# Despite larger turnover, average rank growth in turnover declines

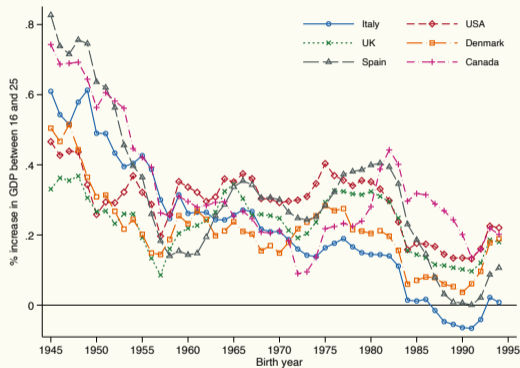# Despite larger turnover, average rank growth in turnover declines

Change in mean rank jump (1985–2019): −1.15
Change in share of positive jumps (1985–2019): −.03

Mean Firm Age

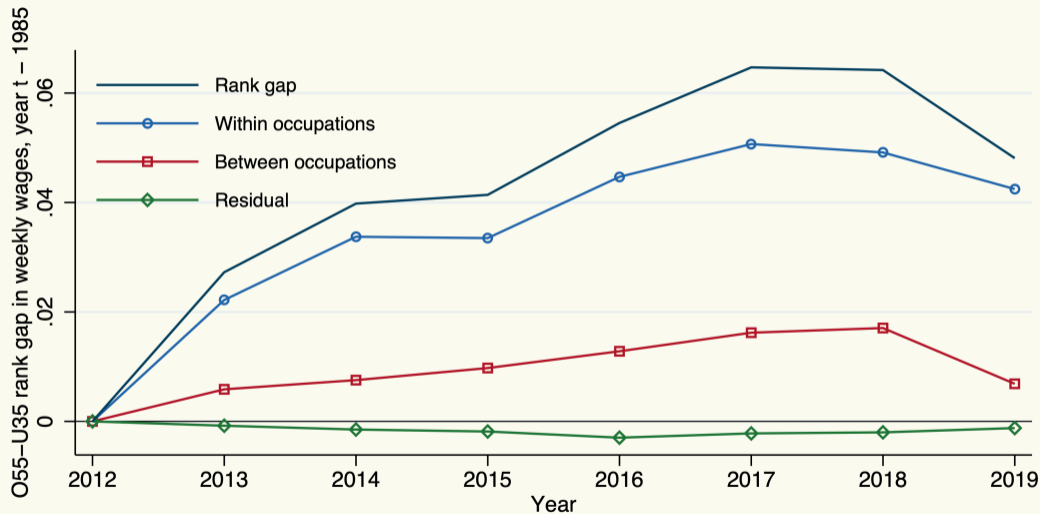# Decreasing GDP Growth In Most High-Income Countries

Several cohorts in Italy

16-25 across countries

Within-Occupation Component Accounts Most of Rank-Gap Increase

Numerical Framework - Mincerian Equation

► Consider a simple but general wage equation:

$$w_{i,a}^t = \beta_0 + \beta_1^t x_{i,a}^t$$

- $w_{i,a}^t$ = wage of worker i of age group a in period t
- $x_{i,a}^t$ = quantity of wage-enhancing factor possessed by worker i in period t
- β_1^t = unitary price of factor x in period t
- Older workers posses on average a higher quantity of x
    - Age wage gap positive in every country and year

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▶ Age wage gap can increase because

- Price of factor x increases
- Gap in quantity of x between older and younger workers increases

▶ Back

Simulate Changes in Price

► Baseline scenario (matches data moments in Italian admin data):

- $x_Y^t \sim N(4.6, 0.25)$ and $x_O^t \sim N(4.7, 0.49)$
- $\beta_1^t = 1$, $\beta_0 = 1$
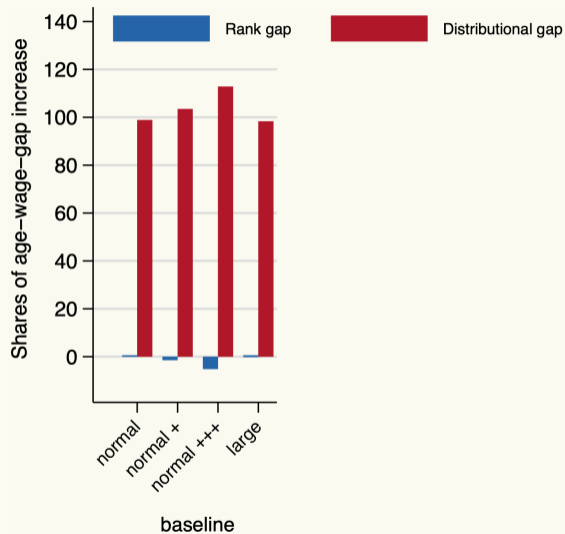- Share older workers $(s_O^t) = 0.08$

Simulate Changes in Price

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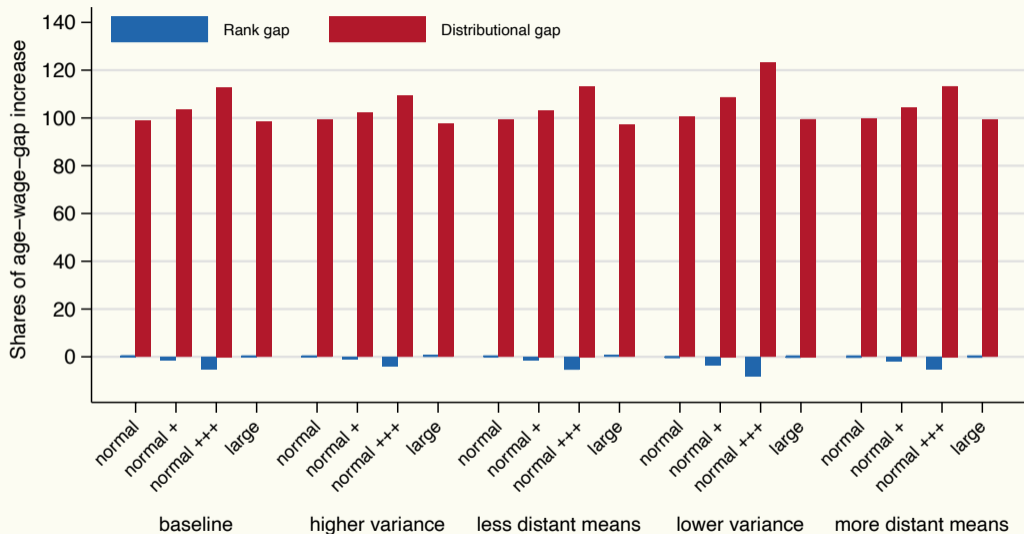 - $\beta_1^t = 1, \beta_0 = 1$
  - Share older workers $(s_O^t) = 0.08$

- ▶ 4 simulated changes in price
  - "Normal" price hike: $\beta_1^{t'} = 2$
  - "Normal" price hike & more older workers: $\beta_1^{t'} = 2, s_O^{t'} = 0.2$
  - "Normal" price hike & way more older workers: $\beta_1^{t'} = 2, s_O^{t'} = 0.35$
  - "Large" price hike: $\beta_1^{t'} = 4$

▸ Back

Price Hikes Act Through Distributional Gap

Price Hikes Act Through Distributional Gap

▸ Back

Simulate Changes in Quantities

▶ Baseline scenario (matches data moments in Italian admin data):

- $x_Y^t \sim N(4.6, 0.25)$ and $x_O^t \sim N(4.7, 0.49)$
- $\beta_1^t = 1, \beta_0 = 1$
- Share older workers $(s_O^t) = 0.08$

▶ 4 simulated changes in distribution of x

- "Normal" distribution change: $\mathbb{E}\left[x_O^{t'}\right] = 4.8$

- "Normal" distribution change & more older workers: $\mathbb{E}\left[x_O^{t'}\right] = 4.8, s_O^{t'} = 0.2$

- "Normal" distribution change & way more older workers: $\mathbb{E}\left[x_O^{t'}\right] = 4.8, s_O^{t'} = 0.35$

- "Large" distribution change: $\mathbb{E}\left[x_O^{t'}\right] = 5$

▶ Back

Quantity Changes Act Mostly Through Rank Gap
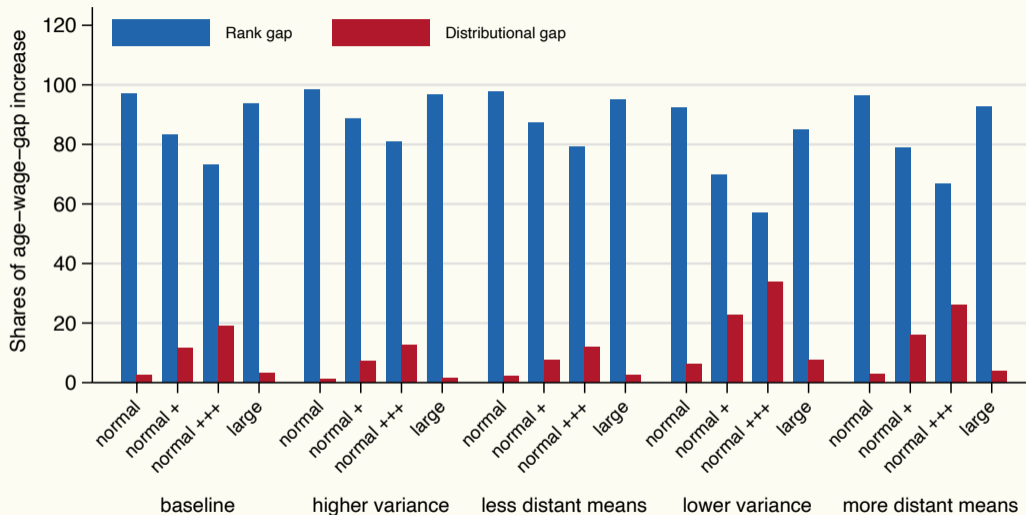
Intuition About Results of Numerical Framework

▶ Price increase when baseline difference in xs
  - increases dispersion of young and old distribution
  - spreads out the overall earnings distribution
  - captured by distributional component

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▶ Quantity increase with overlapping distributions
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  - more overlap at baseline: more older workers overcome young
  - captured by rank component

Intuition About Results of Numerical Framework

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- increases dispersion of young and old distribution
- spreads out the overall earnings distribution
- captured by distributional component

► **Quantity increase** with overlapping distributions
- moves young and old distributions apart
- more overlap at baseline: more older workers overcome young
- captured by rank component

► Similar logic in Bayer and Charles (2018) for black-white gap
- positional: reduced discrimination, better access to schools
- distributional: changes in returns to education, skills
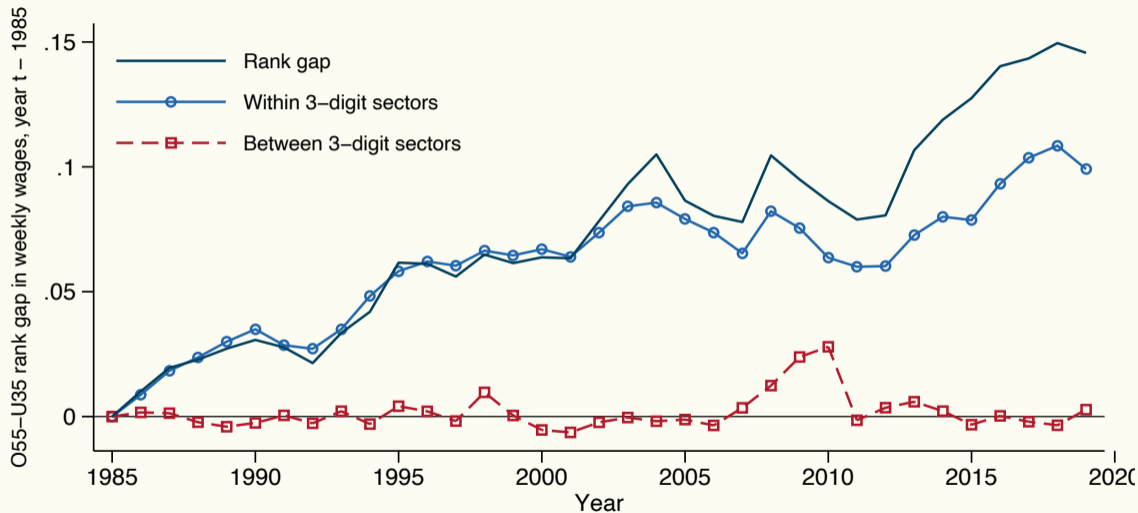
► Back

Takeaways From Numerical Framework

Increases in price of wage-enhancing factors incompatible with increased rank gap:
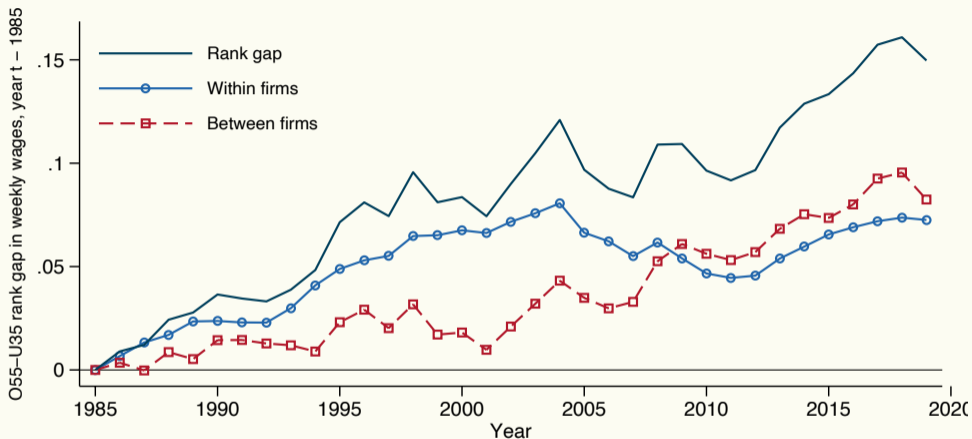
- ▶ **Increase in returns to experience** (Jones (2009); Azoulay et al. (2020); Jeong et al. (2015))
- ▶ **Skill-biased technological change** (Acemoglu & Autor (2011); Autor et al. (2006))

▶ Back

Within-Sector Component Accounts for 90% of Rank-Gap Increase

Y-axis: O55–U35 rank gap in weekly wages, year t – 1985

X-axis: Year

Legend:
- Rank gap
- Within 3–digit sectors
- Between 3–digit sectors

Back

# Between Vs. Within Firms: No High-Outsourcing Sectors

Notes: Sample does not include all sectors identified by Goldschmidt and Schmieder (2017) as primary receivers of most domestically outsourced jobs: 49.2, 49.4, 50.2, 50.4, 51.2, 52.1, 52.2, 56.2, 78.1, 78.2, 78.3, 80.1, 80.2, 80.3, 81.1, 81.2, 82.1, 82.2, 82.9 (NACE Rev. 2). ▶ Back

Changing Composition of U-35 and O55 Workforce

▶ Trends in other characteristics of young and old can be confounders

▶ We might be referring to age the byproduct of something else

▶ Some contemporaneous changes in demographics
- increased share migrants in U35
- increased share temporary contracts in U35
- increased share of females in U35
- increased education for both age groups
- health improvements for older workers over time
- longer working lives for O-55

▶ Back

Age Wage Gap After Controlling for Demographic and Labor Variables
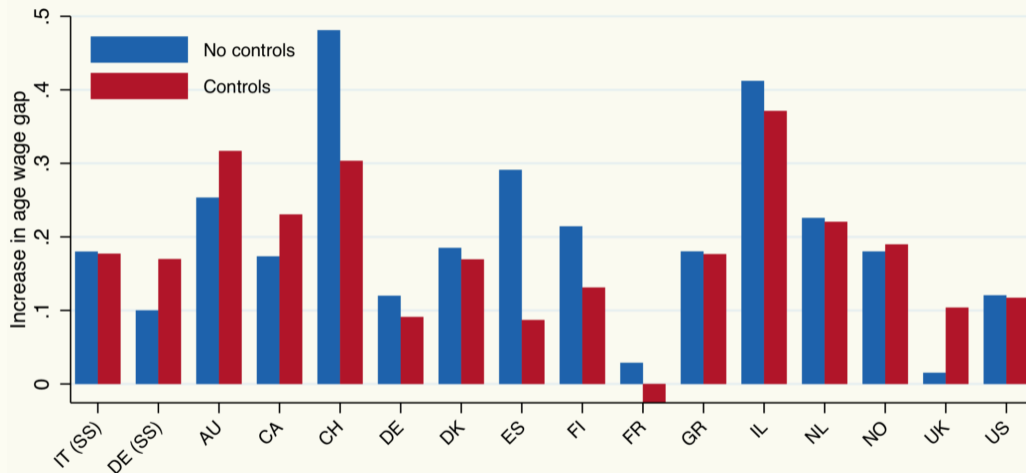
Notes: Age wage gap with controls uses residuals from year-specific regressions of log wages on gender, nationality (race in US), temp. contracts, education, disability status. ▸ Back

O55 Workers = 56-60 Years Old Men

▸ Back