

# The Role of Industries in Rising Inequality

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# Motivation

- Growth in pay inequality in many industrialized economies since 1980s. More recently, the focus on the role of firms.
- Increasingly some firms pay a lot, some little.
- Song et al. (2019) show that two thirds of the rise in US earnings inequality since 1980s took place between firms, only one third within firms.
  - ▶ Also documented by Faggio et al. (2010) for the UK, Card et al. (2013) for West Germany and Alvarez et al. (2018) for Brazil.

# Motivation

- What is the role of industry? Is earnings inequality growing mainly:
  - ▶ between firms in different industries?
  - ▶ between firms in the same industry?
- We investigate this question using admin data for Italy.
- At the same time, Haltiwanger et al. (2022) used US data and find:
  - ▶ Majority of the inequality growth in the USA occurred between industries.
  - ▶ Driven by a small number (just 10%) of industries.
- Little evidence for other countries.
  - ▶ Except Faggio et al. (2010) for the UK.
- Important for understanding drivers of inequality.

# Main Findings 1/3

- Between-sector variance dominant (as in Haltiwanger, 2022).
- Of the total increase in earnings inequality in Italy between 1985 and 2018:
  - ▶ 55% between industries
  - ▶ 18% between firms within the same industry
  - ▶ 27% within firms
- Less than 3% of industries accounting for two-thirds of the total inequality-increasing effect (between industries), while only initially representing around 7% of employment.
  - ▶ Similar concentration as in the USA.
- Key industries:
  - ▶ Low-paying: food and drink, accommodation, social care, cleaning of buildings, employment services.
  - ▶ Greater role of low-paying industries in Italy than in the USA.

## Main Findings 2/3

- Using econometric model of worker and firm fixed effects (AKM) we find:
  - ▶ Variance of worker FEs  $\uparrow$
  - ▶ Variance of firm FEs  $\downarrow$
  - ▶ Covariance of worker and firm FEs  $\uparrow$
  - ▶ The same patterns as in the USA.
- Investigating the role of segregation, sorting and firm pay premiums across and within industries:
  - ▶ Majority of the rise in earnings inequality is due to an an **increase in sorting and segregation across industries** (as in Haltiwanger et al.).
  - ▶ Firm pay premiums play no role.

## Main Findings 3/3

- Unlike the US studies, we have a measure of labour supply quantities.
- Contribution to the rise of variance of log annual earnings:
  - ▶ Variance of labour supply quantities: -10%
  - ▶ Variance of the rate of pay: 48%
  - ▶ Covariance of the two: 62%
- Growing inequality in the rate of pay and growing association between the rate of pay and labour supply quantities.
- Variance of labour supply across workers roughly constant.
- The fact that sectors with low rate of pay also employ workers for only a part of the year (temporary contracts) or part-time amplifies the effect on inequality.

# Contribution

- 1 Developments in a small number of industries explain a large part of the rise in earnings inequality.
- 2 Workers with low earnings ability are more likely to work with other low-income workers in the same industry, and they are more likely to work in industries with particularly low firm premia.
- 3 First paper to test the hypothesis in a very different institutional context to the one prevalent in the USA.
- 4 Similarities in the patterns of rising inequality between Italy and the USA suggest that the underlying forces were likely similar.
- 5 Additionally, we highlight the crucial role of growing association between the rate of pay and labour supply quantities.

## Related Literature

- The role of firms in accounting for rising earnings inequality
  - ▶ Faggio et al. 2010, Barth et al. 2016, Alvarez et al. 2018, Song et al. 2019, Haltiwanger et al. 2022, Kleinman 2022
- Decomposing earnings variance into the contribution of worker heterogeneity, firm heterogeneity and sorting of workers into firms
  - ▶ Abowd et al. 1999, Card et al. 2013, Bonhomme et al. 2019
- Estimating rent-sharing elasticities
  - ▶ Card et al. 2018, Lamadon et al. 2019
- Applications to Italian context
  - ▶ Bingley and Cappellari 2018, Devicienti et al. 2019

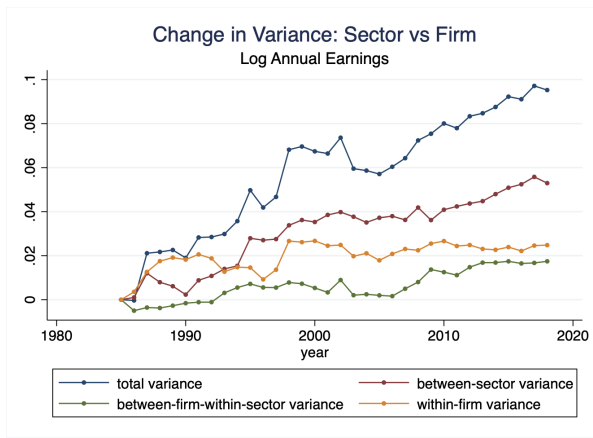


# Data

- Social security admin data covering the universe of private sector employment in Italy.
- The same sample restrictions as in Song et al. (2019) and Haltiwanger et al. (2022).
  - ▶ Sum income across all employment spells in a given year for each worker.
  - ▶ The worker is linked with the firm that accounts for the largest share of his/her income.
  - ▶ Threshold level of annual earnings imposed (in 2018,  $3520 \text{ €} = 6.77 \text{ €/hour}$  (lowest hourly wage)  $\times 13$  weeks (one quarter)  $\times 40$  hours/week).
  - ▶ Adjusted for all other years using an index of nominal wage growth.
  - ▶ Only workers between the ages of 20 and 60.
  - ▶ Only firms (and workers in firms) with at least 10 workers.

# Firms vs sectors

$$\underbrace{\frac{1}{N} \sum_{\forall i} (w_{ijs} - \bar{w})^2}_{\text{total variance}} = \underbrace{\sum_{\forall s} \frac{n_s}{N} (\bar{w}_s - \bar{w})^2}_{\text{between-sector variance}} + \underbrace{\sum_{\forall s} \frac{n_s}{N} \sum_{\forall j|j \in s} \frac{n_j}{n_s} (\bar{w}_j - \bar{w}_s)^2}_{\text{between-firm-within-sector variance}} + \underbrace{\sum_{\forall j} \frac{n_j}{N} \frac{\sum_{\forall i|i \in j} (w_{ijs} - \bar{w}_j)^2}{n_j}}_{\text{within-firm variance}} \quad (1)$$



# Firms vs sectors

## a) Variance change over time

	Between sector	Between firms within sector	Within firm	Total
1985	0.083	0.079	0.192	0.354
2018	0.136	0.096	0.218	0.450
Change	0.053	0.017	0.026	0.096
% of total increase	<b>55.2%</b>	<b>17.7%</b>	<b>27.1%</b>	100.0%

## b) Variance Shares:

	Between sector	Between firms within sector	Within firm
1985	23.4%	22.3%	54.2%
2018	30.2%	21.3%	48.4%

## Between vs within sectors

	Between sector variance			Total
	2 digit	3 digit	4 digit	
	(88 sectors)	(268 sectors)	(593 sectors)	
1985	0.065	0.077	0.083	0.354
2018	0.120	0.130	0.136	0.450
Change	0.055	0.053	0.053	0.096
% of total increase	<b>57.3%</b>	<b>55.2%</b>	<b>55.2%</b>	100.0%

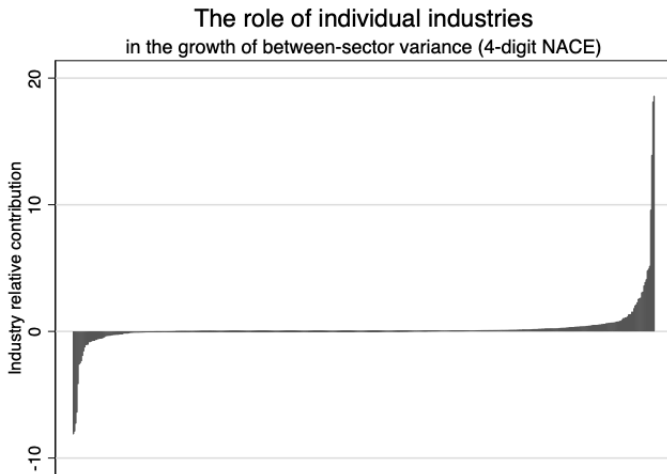
- The level of aggregation of industry doesn't seem to make a big difference.

# The sectors that drive growth in inequality

The contribution of individual sectors to the between sector variance growth:

$$\underbrace{\Delta \text{var}(\bar{w}_{s,p} - \bar{w}_p)}_{\text{between-sector variance growth}} = \sum_{s=1}^{523} \Delta \underbrace{\left( \frac{n_{s,p}}{N_p} \right)}_{\text{employment share}} \underbrace{(\bar{w}_{s,p} - \bar{w}_p)^2}_{\text{relative earnings}} \underbrace{\hspace{10em}}_{\text{sector's contribution to between sector variance growth}}$$

# Sector contributions are very concentrated



## Top 4-digit sectors

NACE code	Industry	Employment share		Relative earnings		Share of variance growth between sector
		1985	2018	1985	2018	
7830	Other human resources provision	0.0%	4.9%	0.41	-0.44	18.6%
5610	Restaurants and mobile food service activities	0.4%	2.6%	-0.28	-0.61	18.2%
8129	Other cleaning activities	1.5%	3.2%	-0.54	-0.60	13.9%
8899	Other non-residential social work	0.5%	2.6%	-0.22	-0.44	9.6%
5629	Other food service activities	0.5%	1.0%	-0.27	-0.55	5.2%
5510	Hotels and similar accommodation	1.1%	2.1%	-0.42	-0.47	5.0%
5630	Beverage serving activities	0.2%	0.8%	-0.28	-0.56	4.8%
8121	General cleaning of buildings	0.0%	0.3%	-0.51	-0.80	4.1%
3514	Trade of electricity	0.1%	0.5%	0.75	0.72	3.9%
4910	Passenger rail transport	0.1%	0.7%	-0.11	0.54	3.6%
6209	Servicing of personal computers	0.2%	2.0%	0.13	0.29	3.2%
8790	Other residential care activities	0.1%	0.9%	-0.34	-0.43	3.1%
3312	Repair of machinery	2.6%	2.5%	0.06	0.25	2.7%
2120	Pharmaceutical manufacturing	0.5%	0.4%	0.34	0.69	2.6%

# The role of firm and worker heterogeneity

We estimate the regression model of worker and firm fixed effects (AKM model):

$$y_t^{i,j,s,p} = \theta^{i,p} + \psi^{j,s,p} + X_t^{i,p} \beta^p + \epsilon_t^{i,j,s,p} \quad (2)$$

AKM variance decomposition:

$$\begin{aligned} \text{Var}(y_t^{i,j,s}) &= \text{Var}(\theta^i) + \text{Var}(\psi^{j,s}) + \text{Var}(X_t^i \beta) \\ &\quad + 2\text{Cov}(\theta^i, \psi^{j,s}) + 2\text{Cov}(\theta^i, X_t^i \beta) \\ &\quad + 2\text{Cov}(\psi^{j,s}, X_t^i \beta) + \text{Var}(\epsilon_t^{i,j,s}) \end{aligned} \quad (3)$$



# The role of firm and worker heterogeneity

	Interval 1 1985-1991		Interval 5 2013-2019		Growth 1 to 5	
	Comp.	Share	Comp.	Share	Change	% of total var. change
	(1)	(2)	(3)	(4)	(5)	(6)
Total variance						
Var(y)	0.341	-	0.422	-	0.081	-
Components						
<b>Var(WFE)</b>	0.188	55.1%	0.252	59.7%	0.064	<b>79.0%</b>
<b>Var(FFE)</b>	0.071	20.8%	0.057	13.5%	-0.014	<b>-17.3%</b>
Var(Xb)	0.020	5.9%	0.015	3.6%	-0.005	-6.2%
Var( $\epsilon$ )	0.072	21.1%	0.058	13.7%	-0.014	-17.3%
<b>2*Cov(WFE,FFE)</b>	-0.013	-3.8%	0.045	10.7%	0.058	<b>71.6%</b>
2 * Cov(WFE, Xb)	-0.002	-0.6%	-0.009	-2.1%	-0.007	-8.6%
2 * Cov(FFE, Xb)	0.005	1.5%	0.004	0.9%	-0.001	-1.2%
Sample size (millions)	33.9		59.0			
Workers (millions)	6.9		11.4			
Firms (thousands)	162		300			

# Industry-enhanced AKM variance decomposition

$$\begin{aligned}
 \text{Var}(y_t^{i,j,s}) = & \underbrace{\text{Var}(\bar{\psi}^s)}_{\text{between-sector pay premia}} + \underbrace{2\text{Cov}(\bar{\psi}^s, \bar{\theta}^s) + 2\text{Cov}(\bar{\psi}^s, \bar{X}^s\beta)}_{\text{between-sector sorting}} \\
 & + \underbrace{\text{Var}(\bar{\theta}^s) + \text{Var}(\bar{X}^s\beta) + 2\text{Cov}(\bar{\theta}^s, \bar{X}^s\beta)}_{\text{between-sector segregation}} + \underbrace{\text{Var}(\psi^{j,s} - \bar{\psi}^s)}_{\text{between-firm within-sector pay premia}} \\
 & + \underbrace{2\text{Cov}(\bar{\theta}^{j,s} - \bar{\theta}^s, \psi^{j,s} - \bar{\psi}^s) + 2\text{Cov}(\psi^{j,s} - \bar{\psi}^s, \bar{X}^{j,s}\beta - \bar{X}^s\beta)}_{\text{between-firm within-sector sorting}} \\
 & + \underbrace{\text{Var}(\bar{\theta}^{j,s} - \bar{\theta}^s) + \text{Var}(\bar{X}^{j,s}\beta - \bar{X}^s\beta) + 2\text{Cov}(\bar{\theta}^{j,s} - \bar{\theta}^s, \bar{X}^{j,s}\beta - \bar{X}^s\beta)}_{\text{between-firm within-sector segregation}} \\
 & + \underbrace{\text{Var}(\theta^i - \bar{\theta}^{j,s}) + \text{Var}(X_t^i\beta - \bar{X}_t^{j,s}\beta) + 2\text{Cov}(\theta^i - \bar{\theta}^{j,s}, X_t^i\beta - \bar{X}_t^{j,s}\beta) + \text{Var}(\epsilon_t^{i,j,s})}_{\text{within-firm person effect, observables, their covariance and residual}}
 \end{aligned} \tag{4}$$

# Industry-enhanced AKM variance decomposition

	Interval 1 1985-1991	Interval 5 2013-2019	Growth 1 to 5
Total variance	0.341	0.422	0.081
Component shares			
<b>Between-sector</b>	<b>22.6%</b>	<b>29.9%</b>	<b>60.5%</b>
Sector pay premium	6.9%	4.6%	-4.7%
<b>Sector sorting</b>	8.7%	12.9%	<b>30.5%</b>
<b>Sector segregation</b>	6.9%	12.2%	<b>34.3%</b>
<b>Between-firm-within-sector</b>	<b>16.7%</b>	<b>19.9%</b>	<b>33.3%</b>
Firm pay premium	14.0%	9.0%	-12.1%
Firm sorting	-11.0%	-1.4%	39.1%
Firm segregation	13.7%	12.2%	5.8%
<b>Within-firm</b>	<b>60.7%</b>	<b>50.5%</b>	<b>7.4%</b>
Person effect	36.0%	36.5%	38.8%
Time-variant characteristics	5.1%	3.2%	-5.1%
Covariance of the above two	-1.5%	-3.0%	-9.4%
Residuals	21.1%	13.7%	-17.3%

## Weekly earnings vs weeks worked

Annual earnings can be broken up into weekly earnings and weeks worked in a year (full-time equivalent)

$$Y_t^i = W_t^i H_t^i \quad (5)$$

where  $W_t^i = Y_t^i / H_t^i$ .

Taking logs:

$$y_t^i = w_t^i + h_t^i \quad (6)$$

Variance decomposition:

$$\text{Var}(y_t^i) = \text{Var}(w_t^i) + \text{Var}(h_t^i) + 2\text{Cov}(w_t^i, h_t^i) \quad (7)$$

# Weekly earnings vs weeks worked

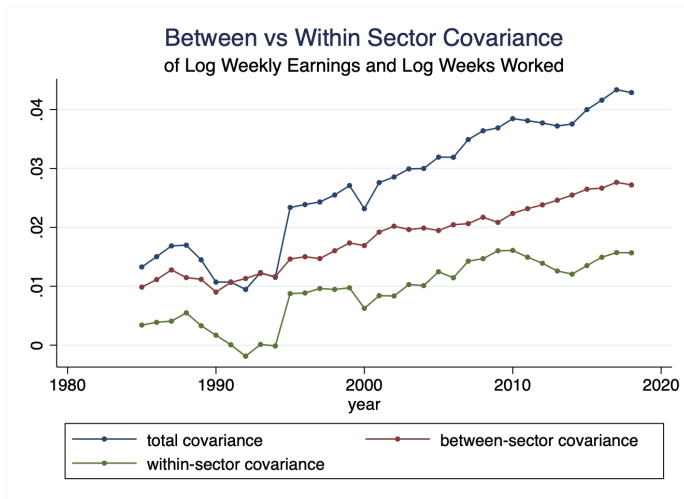
## a) Variance change over time

	Weekly earnings variance	Weeks worked variance	2*Covariance of weeks and earnings	Annual earnings variance
1985	0.159	0.168	0.027	0.353
2018	0.205	0.158	0.086	0.449
Change	0.046	-0.010	0.059	0.096
% of total increase	<b>47.9%</b>	<b>-10.4%</b>	<b>61.5%</b>	100.0%

## b) Variance shares

	Weekly earnings	Weeks worked	2*Covariance of weeks and earnings
1985	45.0%	47.6%	7.6%
2018	45.7%	35.2%	19.2%

# Covariance: between vs within sectors



# Conclusion

- Inequality of annual earnings in Italy grew:
  - ① mostly between industries, driven by a small number of industries,
  - ② due to changes in the allocation and workers across industries (between-sector sorting and segregation)
  - ③ and due to rising positive association between the rate of pay and labour supply quantities across industries.
- First paper to test the hypothesis in a very different institutional context to the USA.
- Similarities in the patterns of rising inequality suggest that the underlying forces were likely similar.

# Possible explanations

- 1 Outsourcing
  - 2 Dual labour market
  - 3 Structural transformation: from manufacturing to services
    - ▶ Falling pay and rising employment in the key low-paid service sectors.
  - 4 Routine-biased technological change
  - 5 Trade
- Structure of industry-level labour demand has changed.