Firming Up Inequality

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February 22, 2016
Motivation

- US income inequality has been rising for almost four decades

- Much research on inequality between groups defined by observable characteristics:
  - education/skill, occupation, age, gender, race, and so on.
  - Main conclusion: substantial rise in within-group inequality.

- This paper: study the employer/firm as an observable worker characteristic:
  - Between firms (e.g., top firms are paying better)
  - Within firms (e.g., higher executive pay relative to average pay)
This Paper

Two questions:

1. How much of the rise in income inequality is between firms and how much is within firms?
   - For bottom 99%: Almost all of it between firms
   - For the top 1%: Almost all of it between firms up to 99.8th percentile

2. Why has inequality risen so much between firms?
   - Large rise in sorting between firms and workers
Outline

- The Social Security Administration (SSA) database
- Non-parametric results on inequality
  - The bottom 99%
  - Robustness (region, industry, gender, age, measures)
  - The top 1%
- More formal econometric approach
- Why is this happening? The changing structure of firms
The Data
Data: SSA Master Earnings File

- Universe of all W-2s from 1978 to 2013.

- **For each job**: SSN, EIN, and total compensation
  - Total compensation includes: wages, salaries, tips, restricted stock grants, exercised stock options, severance payments, and many other types of income considered remuneration for labor services by the IRS.

- **For each worker**: age, sex, place of birth, date of death

- **For each EIN**: 4-digit SIC (industry) code, location
  - We define Firm = EIN (same as used by Bureau of Labor Statistics)

- No top-coding; no survey response error
Building a US Matched Employer-Employee Dataset

- **MEF:** *Universe of US workers* $\rightarrow$ *Universe of U.S. firms*

- Individuals assigned to firm where they earn most of their annual income.

- **Baseline:** Firms with *20+ employees*. Workers at those firms. Exclude government and education.
  - Covers *1.1 million firms* (about 18% of total) and *103 million workers* (73% of total) and $5.4tn in wages (80% of total)
  - Results *robust* to sample selection (All firms & all sectors) & worker assignment to firms.
Firm Size Distribution: EIN vs. Census Firm

Notes: Natural log of the number of firms in each size category are shown. Census figures count the number of employees at a point in time, while the SSA numbers count the number of FTEs over the course of a year.
Notes: SSA data includes all entries in the MEF. All data are adjusted for inflation using the PCE price index.
Total Employment

Total Employment Over Time

Notes: SSA data includes all entries in the MEF. Current Population Survey (CPS) total employment shows the yearly average of the monthly employment numbers in the CPS.
Number of Firms

Notes: SSA data includes all entries in the MEF. Census firms shows the total number of firms reported by the Census Bureau’s Statistics of U.S. Businesses data set.
EMPIRICAL RESULTS
Basic Variance Decomposition

- $w_{ij}^t$: log income of worker $i$ at firm $j$

- **Simple decomposition:**

$$w_{ij}^t \equiv \overline{w}_i^t + \left[ w_{ij}^t - \overline{w}_i^t \right]$$

  - $\overline{w}_i^t$: Firm avg. wage
  - $w_{ij}^t - \overline{w}_i^t$: Worker wage rel. to firm avg.

$$\Rightarrow \text{var}_i(w_{ij}^t) \equiv \text{var}_j(\overline{w}_i^t) + \sum_{j=1}^{J} P_j \times \text{var}_i(w_{ij}^t | i \in j).$$

  - $\text{var}_i(w_{ij}^t)$: Total dispersion
  - $\text{var}_j(\overline{w}_i^t)$: Between-firm dispersion
  - $\sum_{j=1}^{J} P_j \times \text{var}_i(w_{ij}^t | i \in j)$: Within-firm $j$ dispersion

$P_j$: employment share of firm $j$
Total Wage Inequality

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td></td>
</tr>
<tr>
<td>1990</td>
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<td>2000</td>
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<td>2010</td>
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</tbody>
</table>

Note: Firms with less than 10,000 FTE employees

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Total vs. Between-Firm Wage Inequality

Note: Firms with less than 10,000 FTE employees
Total vs. Between-Firm Wage Inequality

Note: Firms with less than 10,000 FTE employees
Total, Between- and Within-Firm Inequality

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Variance</th>
<th>Within-Firm</th>
<th>Between-Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>.2</td>
<td>.4</td>
<td>.6</td>
</tr>
<tr>
<td>1990</td>
<td>.8</td>
<td>.6</td>
<td>.4</td>
</tr>
<tr>
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Note: Firms with less than 10,000 FTE employees


**Large Firms Only** (10,000+ FTE)

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Note: Firms with more than 10,000 FTE employees

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Firming Up Inequality
A GRAPHICAL FRAMEWORK
Empirical Framework

Density

Year = 1982

Income

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Empirical Framework

Firming Up Inequality

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Empirical Framework

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Firming Up Inequality
Example: No Rise in Inequality
Example: Rise in Inequality Between Top and Rest
Example: Rise in Inequality Everywhere

Earnings Change: 1982 to 2012

Percentiles of Earnings Distribution

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Firming Up Inequality
RESULTS: BOTTOM 99%
Wage Inequality: By Percentile

<table>
<thead>
<tr>
<th>Percentile of Indv Total Wage</th>
<th>Log Change, 1981–2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%ile</td>
<td>1981: $32k</td>
</tr>
<tr>
<td></td>
<td>2013: $36k</td>
</tr>
<tr>
<td>top %ile</td>
<td>1981: $280k</td>
</tr>
<tr>
<td></td>
<td>2013: $540k</td>
</tr>
</tbody>
</table>

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Calculating **Average Log Employer Pay**

- Take the employers of workers who are in the same percentile bin of income distribution.

- Then compute the average of log pay of each employer in this group.

- Then compute the average of average log pay across all employers in the group.
Wage Inequality: Between Firms

50%ile
1981: $30k
2013: $35k

Top %ile
1981: $49k
2013: $83k

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Wage Inequality: **Within Firms**

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
ROBUSTNESS
Wage Inequality: **Within Firms**

Note: *Sample contains workers in firms with 20+ full-time equivalent employees.*
Many Measures of Firm Pay

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Many Measures of Firm Pay

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Many Measures of Firm Pay

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Many Measures of Firm Pay

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Robustness: **Std Dev. Log Wage**

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Robustness: **Frac. Going to Bottom 95%**

![Graph showing Frac of Wages to Bottom 95% and Indv Total Wage over percentiles.](image)

**Note:** Sample contains workers in firms with 20+ full-time equivalent employees.
Individual Industries
Wage Inequality: Controlling for (4-Digit SIC) Industry

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Fama-French Industries: Beer and Liquor

Fama-French Industries: **Candy and Soda**

Note: Sample contains an average of **193,000 workers** in 1981 and 2013.
Fama-French Industries: Pharmaceuticals

Note: Sample contains an average of 140,650 workers in 1981 and 2013.
Fama-French Industries: Chemicals

Fama-French Industries: Defense

Note: Sample contains an average of 74,350 workers in 1981 and 2013.
Fama-French Industries: Recreation

Note: Sample contains an average of 142,200 workers in 1981 and 2013.
Fama-French Industries: Utilities

Note: Sample contains an average of 703,320 workers in 1981 and 2013.
Fama-French Industries: **Consumer Goods**

Note: Sample contains an average of **1,699,270 workers in 1981 and 2013**.
Fama-French Industries: Communication

Note: Sample contains an average of 951,920 workers in 1981 and 2013.
Fama-French Industries: **Computers**

![Graph showing changes in wages over time in the Computers Industry.](image)

**Note:** Sample contains an average of **197,520 workers in 1981 and 2013.**
Fama-French Industries: Electronic Equipment

Fama-French Industries: Agriculture

Fama-French Industries: Insurance

Note: Sample contains an average of 1,452,050 workers in 1981 and 2013.
Fama-French Industries: Trading

Note: Sample contains an average of 1,240,390 workers in 1981 and 2013.
Exceptions
Fama-French Industries: Healthcare

Fama-French Industries: Banking

Fama-French Industries: Apparel

Note: Sample contains an average of 606,320 workers in 1981 and 2013.
Fama-French Industries: **Hotels & Restaurants**

![Graph showing trends in log change of individual total wages, average log wages at firm, and individual wage/firm average over the years 1981-2013.]

**Note:** Sample contains an average of **2,610,400 workers** in 1981 and 2013.

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**Firming Up Inequality**
Subgroups: Bottom 99 pct

- By Industry: [HERE]
- By Region: [HERE]
- By Firm Size: [HERE]
- By Sex: [HERE]
- By Age: [HERE]
RESULTS: TOP 1%
Rise in Top 1% Inequality
Rise in Top 1% Inequality: Largely Between Firms

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Firming Up Inequality
Rise in Top 1% Inequality: Largely Between Firms

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CAUTION
Firm Size: 20 – 10,000 FTE (Top 1%)
Firm Size: 10,000+ FTE (Top 1%)
Recap: Between- vs. Within

Firm Size Percentiles

Income Percentiles

Rise in Inequality: Fraction Within-Firm

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Firming Up Inequality
Bottom 99%: **Almost All Between Firms**

![Graph showing the rise in inequality: fraction within-firm](image)

- **Income Percentiles**
- **Firm Size Percentiles**

The graph illustrates the rise in inequality within firms across different percentiles of income and firm size. It indicates that almost all the increase in inequality is due to within-firm dynamics.
Rise in Within-Firm: Top 0.5% of Firms

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Firming Up Inequality
Why Are Large Firms Different? 1. Top End

Figure: Sensitivity to S&P Returns, By Employee Rank and Firm Size

$\Delta \log(wage)$ vs $\Delta \log(S&P 500)$ w/ controls, Aggregated by Geometric Mean, Winsorized at Max in Execucomp
Why Are Large Firms Different? 1. Top End

Figure: Sensitivity to S&P Returns, By Employee Rank and Firm Size

∆log(wage) vs ∆log(S&P 500) w/ controls, Aggregated by Geometric Mean, Winsorized at Max in Execucomp

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Why Are Large Firms Different? 1. Top End

Figure: Sensitivity to S&P Returns, By Employee Rank and Firm Size

Regression Coefficient vs Rank Within Firm

Δlog(wage) vs Δlog(S&P 500) w/ controls, Aggregated by Geometric Mean, Winsorized at Max in Execucomp

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Firming Up Inequality
Why Are Large Firms Different? 1. Top End

Figure: Sensitivity to S&P Returns, By Employee Rank and Firm Size

\[ \Delta \log(\text{wage}) \text{ vs } \Delta \log(\text{S&P 500}) \text{ w/ controls, Aggregated by Geometric Mean, Winsorized at Max in Execucomp} \]
Why Are Large Firms Different? 2. Bottom End

Figure: Change in Wage Percentiles By Firm Size

Log Change in Indv Pctls Since 1981

1000 ≤ Firm Size < 2000

10,000 ≤ Firm Size
Major Change in Firm Size – Pay Relation

Number of Employees (Thousands)

Percentile of Indv Total Wage

Median of Firm Size, 20 ≤ Firm Size

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Firming Up Inequality
What is the Role of CEO Pay in Rising Inequality?

As for wages and salaries . . . all the big gains are going to a tiny group of individuals holding strategic positions in corporate suites.

Paul Krugman (NY Times, 02/23/2015)

The primary reason for increased income inequality in recent decades is the rise of the supermanager.

Piketty (2013, p. 315)

Policy: Dodd-Frank act (Section 953(b)): companies to report the ratio of top executives’ compensation to average wage in the firm.
Rise in Inequality: **Baseline**

![Graph showing the relationship between percentiles of individual total wages and log change from 1982 to 2012.](image)

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Firming Up Inequality
Rise in Inequality *Without Top Executives*

![Graph showing the rise in inequality without top executives.](image)

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Firming Up Inequality
Rise in Inequality *Without Top Executives*

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Firming Up Inequality
Rise in Inequality *Without Top Execs: 1000+ FTE*

![Graph showing the log change in Indv Total Wage, Indv Total Wage (Non-Top 1 Employees), and Indv Total Wage (Non-Top 5 Employees) across different percentiles of Indv Total Wage from 1982-2012.](image-url)
Top 1% Inequality Without Top Executives: **Baseline**

![Graph showing Inequality without Top Executives]

**Note:** Excluding top 5 individuals reduces the sample size from 76,251 to 73,620 in 1982 (−3.45%) and from 119,155 to 115,602 in 2012 (−2.97%).
Top 1% Inequality Without Top Executives: 1000+ FTE
Why Don’t Executives Matter (Much)?

- **US Wages and Salaries**: $6.9 Trillion

- **Wage income share of top 1 percent**: 12% (Guvenen, Kaplan, and Song (2014))
  
  - 12% of $6.9 Tr = $828 Billion

- **Average annual compensation of S&P500 CEOs**: $22 million
  
  - Total income: $22 million $\times$ 500 = $11 Billion

- **Large firm CEOs account for**: $\frac{$11B}{828B} = 1.3\%$ of the total compensation of top 1 percent.

- **Bottom line**: Top executives control too small a share of the top incomes to make a dent.
Subgroups: Top 1 pct

- By Industry: HERE
- By Region: HERE
- By Firm Size: HERE
- By Sex: HERE
- By Age: HERE
A More Formal Econometric Approach
What We Have Done So Far

- A simple decomposition:

\[ w_{ij}^t = w_{ij}^t + \left[ w_{ij}^t - w_{ij}^t \right] \]

\[ \text{var}_i(w_{ij}^t) = \text{var}_j(w_{ij}^t) + \sum_{j=1}^{J} P_j \times \text{var}_i(w_{ij}^t | i \in j) \]

Between-firm dispersion

Within-firm \( j \) dispersion

- Our main conclusion:
  - large increase in between-firm dispersion
  - little change in within-firm dispersion, except at the top end for very large firms

- Q: Can we go deeper into between and within-firm components?
AKM+ Decomposition

Consider this model for wages:

\[ w_{ij}^t = \underbrace{\alpha^i}_\text{Worker FE} + \underbrace{\psi^j}_\text{Firm FE} + \underbrace{X^i_t\beta}_\text{Time var. char.} + \varepsilon^i_t \] (1)

Estimating (1) from US population:

- 150 million worker FEs and 6 million firm FEs.

Set \( X^i_t \equiv 0 \) for a moment. **Average firm wage:** \( \bar{w}^j_t = \bar{\alpha}^j + \psi^j \)

Key decomposition:

\[
\text{var}_i(w_{ij}^t) = \text{var}_j(\alpha^i) + \text{var}_j(\psi^j) + \text{cov}(\alpha^i, \psi^j)
\]

Between-firm dispersion

\[ + \sum_{j} P_j \times (\text{var}_i(\alpha^i | i \in j) + \text{var}_i(\varepsilon^i_t | i \in j)) \]

Within-firm dispersion
AKM Decomposition, Cont’d

$$w_t^i = \alpha^i + \psi^i + X_t^i \beta + \varepsilon_t^i$$

<table>
<thead>
<tr>
<th>Change in:</th>
<th>Baseline</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between-Firm Components</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{var}_i(\bar{\alpha}^i)$</td>
<td></td>
<td>35.6</td>
</tr>
<tr>
<td>$\text{var}_i(\psi^i)$</td>
<td></td>
<td>-6.6</td>
</tr>
<tr>
<td>$2 \times \text{cov}(\bar{\alpha}^i, \psi^i)$</td>
<td></td>
<td>31.4</td>
</tr>
<tr>
<td>$2 \times \text{cov}((\bar{\alpha}^i + \psi^i, X^i b)$</td>
<td></td>
<td>8.2</td>
</tr>
<tr>
<td>= $\Delta$ Between-firm var.</td>
<td></td>
<td>69.1</td>
</tr>
</tbody>
</table>

| **Within-Firm Components**   |          |       |
| $\text{var}_i(\alpha^i + X^i b| i \in j)$ |          | 40.0  |
| $\text{var}_i(\varepsilon_i^i| i \in j)$     |          | -9.2  |
| = $\Delta$ Within-firm var.  |          | 30.9  |
Increasing Sorting

Joint Worker and Firm Fixed Effect Distribution
Interval 1: 1980–1986

Proportion of Observations

Firm Fixed Effect Decile

Worker Effect Decile 1  Worker Effect Decile 2  Worker Effect Decile 3  Worker Effect Decile 4  Worker Effect Decile 5
Worker Effect Decile 6  Worker Effect Decile 7  Worker Effect Decile 8  Worker Effect Decile 9  Worker Effect Decile 10
Increasing Sorting

Joint Worker and Firm Fixed Effect Distribution
Interval 5: 2007–2013

Proportion of Observations

Firm Fixed Effect Decile

Worker Effect Decile 1  Worker Effect Decile 2  Worker Effect Decile 3  Worker Effect Decile 4  Worker Effect Decile 5
Worker Effect Decile 6  Worker Effect Decile 7  Worker Effect Decile 8  Worker Effect Decile 9  Worker Effect Decile 10

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Increasing Sorting

Change in Joint Worker and Firm Fixed Effect Distribution from Interval 1 to 5

Proportion of Observations

Worker Effect Decile 1  Worker Effect Decile 2  Worker Effect Decile 3  Worker Effect Decile 4  Worker Effect Decile 5
Worker Effect Decile 6  Worker Effect Decile 7  Worker Effect Decile 8  Worker Effect Decile 9  Worker Effect Decile 10

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Firming Up Inequality
Related Evidence


- **Very similar results for**

- **So, whatever the driving force(s) are, they seem global.**
Further Thoughts

Why are worker FEs getting (i) more dispersed across firms, and (ii) more systematically related to firm FEs (sorting)?

In our estimation, correlation between $\bar{\alpha}^j$ and $\psi^j$ goes from 0.12 up to 0.52 (by 0.40) over the period.

- Handwerker and Spletzer (2015): Increasing occupational segregation in the US.
- Increased domestic outsourcing: Dube and Kaplan (2010), Berlingieri (2014), and Goldschmidt and Schmieder (2015)
Conclusions

- Rising in income inequality is *almost entirely between firms*. Within-firm inequality flat.
  - True for *very fine industry groups*, across *regions*, and across *firm size categories*.
  - Only exception: *Very large firms*. Within dispersion increased both at very top end and bottom end.

- Rise in between inequality, not due to firm effects, but *due to rising dispersion of worker FEs and increased sorting*.

- Evidence points to *major changes in firms’ organization*.