Firming Up Inequality

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UCLA and NBER

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Stanford

Nicholas Bloom
Stanford and NBER

October 14, 2015
Motivation

- US income inequality has been rising for three decades
Motivation

▶ US income inequality has been rising for three 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.
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- This paper: study the employer/firm as another observable characteristic of workers:
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- 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 another observable characteristic of workers:
  - Between firms (e.g., top firms are paying better)
  - Within firms (e.g., higher executive pay relative to average pay)
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 (currently investigating why)
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2. Why has inequality risen so much between firms? Large rise in sorting between firms and workers (currently investigating why)
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 (AKM and CHK)
- Why is this happening - the changing structure of firms
Data: SSA Master Earnings File

- Universe of all W-2s from 1978 to 2012 (2013 now available)
Data: SSA Master Earnings File

- Universe of all W-2s from 1978 to 2012 (2013 now available)

- *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.
<table>
<thead>
<tr>
<th>Column</th>
<th>Data</th>
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<tbody>
<tr>
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<td>Employee’s social security number: 000-00-0000</td>
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<tr>
<td>b</td>
<td>Employer identification number (EIN): 999-99-9999</td>
</tr>
<tr>
<td>c</td>
<td>Employer’s name, address, and ZIP code</td>
</tr>
<tr>
<td>d</td>
<td>Control number</td>
</tr>
<tr>
<td>e</td>
<td>Employee’s first name and initial, Last name, Suff.</td>
</tr>
<tr>
<td>f</td>
<td>Employee’s address and ZIP code</td>
</tr>
<tr>
<td>1</td>
<td>Wages, tips, other compensation: 1,000,000</td>
</tr>
<tr>
<td>2</td>
<td>Federal income tax withheld</td>
</tr>
<tr>
<td>3</td>
<td>Social security wages</td>
</tr>
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<tr>
<td>11</td>
<td>Nonqualified plans</td>
</tr>
<tr>
<td>12a</td>
<td>See instructions for box 12</td>
</tr>
<tr>
<td>12b</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Statistical employee, Retirement plan, Third-party sick pay</td>
</tr>
<tr>
<td>14</td>
<td>Other</td>
</tr>
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<td>15</td>
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<td>16</td>
<td>State wages, tips, etc.</td>
</tr>
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</tr>
<tr>
<td>20</td>
<td>Locality name</td>
</tr>
</tbody>
</table>

Form W-2 Wage and Tax Statement 2015

Copy A For Social Security Administration — Send this entire page with Form W-3 to the Social Security Administration; photocopies are not acceptable.

Do Not Cut, Fold, or Staple Forms on This Page
<table>
<thead>
<tr>
<th>Column</th>
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<tbody>
<tr>
<td>a</td>
<td>Employee’s social security number</td>
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**Form W-2 Wage and Tax Statement**

**2015**

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<table>
<thead>
<tr>
<th>a. Employee’s social security number</th>
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<th>d. Control number</th>
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<tr>
<td>000-00-0000</td>
<td>999-99-9999</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>2,000,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Employee’s wages and taxes for 2015:**

- **Wages, tips, other compensation:** 2,000,000
- **Federal income tax withheld:**
- **Social security tax withheld:**
- **Medicare tax withheld:**
- **Social security wages:**
- **Medicare wages and tips:**
- **Social security tips:**
- **Allocated tips:**
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**Notes:**

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*W-2 Wage and Tax Statement*

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- No top-coding; no survey response error
What is an EIN?

- Our definition of a firm is an Employer Identification Number (EIN).

- Any firm with an employee (issued a W-2) must have an EIN, issued by the IRS.
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- Many firms use only 1 EIN (e.g. Facebook, Google, Walmart stores)
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- Many firms use only 1 EIN (e.g. Facebook, Google, Walmart stores)
- Some firms use different EINs for different divisions
  - For example: Stanford has 1 for the university, 1 for each hospital and 1 for the bookshop
  - General Electric has about 80 EINs.
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- Bureau of Labor Statistics uses the EIN as the definition of firm.
Because MEF is a 100% sample of US workers, it allows us to construct universe of all U.S. firms.

Individuals are assigned to firm where they earn most of their annual income.
Building a US Matched Employer-Employee Dataset

- Because MEF is a 100% sample of US workers, it allows us to construct universe of all U.S. firms

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

- **Baseline:** Firms with 20+ employees. Workers who work 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).
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.
EIN vs. Firms vs. Establishments

Table: EIN is Much Closer to Firm Than to Establishment

<table>
<thead>
<tr>
<th>Firm Size</th>
<th># Census Firms</th>
<th># SSA EINs</th>
<th># Establishments</th>
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<tbody>
<tr>
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<td>8,090</td>
<td>266,115</td>
</tr>
<tr>
<td>5,000–9,999</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10,000+</td>
<td></td>
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Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality
**EIN vs. Firms vs. Establishments**

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</tr>
<tr>
<td>5,000–9,999</td>
<td>975</td>
<td>989</td>
<td>121,835</td>
</tr>
<tr>
<td>10,000+</td>
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<td>989</td>
<td>121,835</td>
</tr>
<tr>
<td>10,000+</td>
<td>981</td>
<td>823</td>
<td>678,182</td>
</tr>
</tbody>
</table>
Total Payroll

Total Income Over Time

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

Total Firms Over Time

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 Decomposition

- A simple decomposition:

\[ w_t^{ij} = \bar{w}_t^j + \left[ w_t^{ij} - \bar{w}_t^j \right] \]

\[ \text{var}_i(w_t^{ij}) = \underbrace{\text{var}_j(\bar{w}_t^j)}_{\text{Between-firm dispersion}} + \sum_{j=1}^{J} P_j \times \underbrace{\text{var}_i(w_t^{ij} | i \in j)}_{\text{Within-firm } j\text{-dispersion}}. \]
Total Wage Inequality

![Graph showing total wage inequality from 1980 to 2010. The variance of the log wage increases over time, indicating rising inequality.]
Total vs. Between-Firm Wage Inequality

![Graph showing the variance of log wages from 1980 to 2010 for total variance and between-firm variance.](image-url)
Total vs. Between-Firm Wage Inequality

![Graph showing the variance of log wages over years from 1980 to 2010. The graph compares total variance and between-firm variance. The total variance line (red) shows a steady increase, while the between-firm variance line (green) shows a less steep increase.](image_url)
### Total, Between- and Within-Firm Inequality

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Variance</th>
<th>Within-Firm</th>
<th>Between-Firm</th>
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<tbody>
<tr>
<td>1980</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
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<td></td>
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<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
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</table>
A GRAPHICAL FRAMEWORK
Empirical Framework

![Graph showing income distribution with density on the y-axis and income on the x-axis. The year 1982 is indicated on the graph.]

Year = 1982

Income

Density

0

0.05

0.1

0.15

0.2

0.25

0.3

0.35

0.4

10000 20000 30000 40000 50000 60000 70000 80000 90000 100000

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Empirical Framework
Example: No Rise in Inequality
Example: Rise in Inequality Between Top and Rest

Earnings Change: 1982 to 2012

Percentiles of Earnings Distribution

Individuals

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality 22 / 197
Example: Rise in Inequality Everywhere

![Graph showing earnings change from 1982 to 2012 across different percentiles of the earnings distribution.](image-url)
RESULTS: BOTTOM 99%
Wage Inequality: By Percentile

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Between-Firm Pay Inequality

- Take the employers of workers who are in the same percentile bin of income distribution.
Between-Firm Pay Inequality

- 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.
Between-Firm Pay Inequality

- 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

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
Robustness: Dispersion Measures

We consider different ways to construct measures of dispersion that emphasize different aspects of inequality:

1. Five different measures of firm average pay
2. Standard deviation of log wages
3. P90-10
4. Fraction of wages going to bottom 95% of workers
Many Measures of Firm Wage

Other Firm Wage Measures: Top 1%

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Firming Up Inequality
Many Measures of Firm Wage

OTHER FIRM WAGE MEASURES: TOP 1%

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Many Measures of Firm Wage

**Other Firm Wage Measures: Top 1%**

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Many Measures of Firm Wage

**OTHER FIRM WAGE MEASURES: TOP 1%**
Many Measures of Firm Wage

- Avg of Log Wages at Firm (Difference)
- Firm Average Wage (Difference)
- Firm Average (Leaving Out Indv) (Difference)
- Avg of Bottom 95% at Firm (Difference)

Percentile of Indv Total Wage

Log Change, 1982-2012

Other Firm Wage Measures: Top 1%
Many Measures of Firm Wage

OTHER FIRM WAGE MEASURES: TOP 1%

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Robustness: $Std \text{ Dev. Log Wage}$

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: \textit{Frac. Going to Bottom 95%}

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

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

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Wage Inequality: Retail and Wholesale Trade

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Wage Inequality: Retail and Wholesale Trade

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

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Wage Inequality: Finance, Insurance, Real Estate
Wage Inequality: Finance, Insurance, Real Estate

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Wage Inequality: Ag., Mining, Constr., Gov’t
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Wage Inequality: Transport & Comm.
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Log Change, 1981−2013

Percentile of Indv Total Wage

Indv Total Wage
Avg of Log Wages at Firm
Indv Wage/Firm Average

Utilities

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
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

Song, Price, Guvenen, Bloom, von Wachter

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

Log Change, 1982−2012

Percentile of Indv Total Wage

Firm Average Wage

Indv Total Wage
Rise in Top 1% Inequality: Largely Between Firms

![Graph showing the rise in top 1% inequality largely between firms, with blue dots representing firm average wages, blue diamonds representing individual total wages, and green bars representing individual wages divided by firm average wages.](image-url)
Top 1% Inequality: Standard Deviation of Log

Log Change, 1982−2012

Percentile of Indv Total Wage

Std Dev of Log Wage at Firm

Indv Total Wage

Song, Price, Guvenen, Bloom, von Wachter
Firming Up Inequality
Top 1% Inequality: P90-10

![Graph showing log change in 1982-2012 for 90-10 differential at firm and individual total wage.](graph.png)

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality
Top 1% Inequality: Fraction Wages to Bottom 95%

Log Change, 1982–2012

Percentile of Indv Total Wage

Frac of Wages to Bottom 95%

Indv Total Wage

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
CAUTION
Firm Size: 20 – 10,000 FTE (Top 1%)
Firm Size: 10,000+ FTE (Top 1%)
Recap: Between- vs. Within
Bottom 99%: Almost All Between Firms

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality
Rise in Within-Firm: Top 0.5% of Firms & Indv.
Preview: Between-vs. Within

Rise in Inequality: Fraction Within-Firm

Song, Price, Guvenen, Bloom, von Wachter

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)

Wage inequalities increased rapidly... because U.S. and British corporations became much more tolerant of extremely generous pay packages after 1970. Piketty (2013, p. 332)

▶ Policy: Dodd-Frank act (Section 953(b)): companies to report the ratio of top executives' compensation to average wage in the firm.

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality 61 / 197
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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 rise in inequality with baseline data. The graph plots the log change in 1982-2012 against the percentile of individual total wage. The x-axis represents the percentile of individual total wage, ranging from 0% to 100%. The y-axis shows the log change, ranging from 0 to 0.8. The data points indicate a significant increase in inequality towards the higher percentiles.]

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality
Rise in Inequality *Without Top Executives*

![Graph showing the log change in individual total wage from 1982 to 2012, with a focus on the percentile of individual total wage.](image-url)
Rise in Inequality *Without Top Executives*

Graph showing the log change in individual total wages from 1982 to 2012 across different percentiles of the wage distribution. The graph compares the total wages of individuals (both top and non-top executives) and non-top 1 and non-top 5 employees against their percentiles.

Song, Price, Guvenen, Bloom, von Wachter
Firming Up Inequality
Rise in Inequality *Without Top Executives: 1000+ FTE*

![Graph showing log change in individual total wage (Non-Top 1 Employees) and (Non-Top 5 Employees) across percentiles of individual total wage from 1982 to 2012.](image)

- Red line: Individual total wage
- Blue line: Individual total wage (Non-Top 1 Employees)
- Green line: Individual total wage (Non-Top 5 Employees)
Top 1% Inequality Without Top Executives: **Baseline**

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

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

- **Red line**: Indv Total Wage
- **Blue line**: Indv Total Wage (Non-Top 1 Employees)
- **Green line**: Indv Total Wage (Non-Top 5 Employees)

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
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
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  - Total income: $22 million × 500 = $11 Billion
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- 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:

\[ w_{ij}^t = \bar{w}_i^j + \left[ w_{ij}^t - \bar{w}_i^j \right] \]

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

Between-firm dispersion

Within-firm \( j \) dispersion

Q: Can we go deeper into between and within-firm components?
What We Have Done So Far

- A simple decomposition:

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

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

- Our main conclusion:
  - large increase in between-firm dispersion
  - little change in within-firm dispersion, except at the top end for very large firms
What We Have Done So Far

▶ A simple decomposition:

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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?
Consider this model for wages:

\[ w_{ij}^t = \alpha_i + \psi_j + X_i^t \beta + \epsilon_i^t \]  

(1)

Let us set \( X_i^t \equiv 0 \) for a moment.

Average firm wage:

\[ w_j^t = \alpha_j + \psi_j. \]

Once we estimate (1), we can compute the decomposition:

\[
\text{var}_i(w_{ij}^t) = \text{var}_j(\alpha_j) + \text{var}_j(\psi_j) + \text{cov}(\alpha_i, \psi_j) + \sum_j P_j \times \text{var}_i(\alpha_i | i \in j) + \text{var}_i(\epsilon_i^t | i \in j)
\]

Between-firm dispersion

Within-firm dispersion
AKM+ Decomposition

Consider this model for wages:

\[ w_{ij}^t = \alpha_i + \psi_j + X_{i}^t \beta + \varepsilon_t \]  

(1)

Let us set \( X_t^i \equiv 0 \) for a moment.
AKM+ Decomposition

Consider this model for wages:

\[ w_{it}^{ij} = \alpha_i + \psi_j + X_t^i \beta + \varepsilon_{it} \]  

(1)

Let us set \( X_t^i \equiv 0 \) for a moment.

Average firm wage: \( \bar{w}_t^j = \bar{\alpha}^j + \psi^j \).
Consider this model for wages:

\[ w_{ij}^t = \alpha_i + \psi_j + X_t^i \beta + \varepsilon_i^t \]  

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Between-firm dispersion

\[ + \sum_j P_j \times \text{var}_i(\alpha^i | i \in j) + \text{var}_i(\varepsilon_t^i | i \in j) \]

Within-firm dispersion
AKM Decomposition

Consider this model for wages:

\[ w_{ij}^t = \alpha_i^j + \psi_j + X_t^i \beta + \varepsilon_t^i \]  

(2)

Estimating (2) from the entire US population entails estimating 150 Million worker FEs and 6 million firm FEs.

Let us set \( X_i^t \equiv 0 \) for a moment.

Average firm wage:

\[ w_j^t = \alpha_j + \psi_j. \]

Key decomposition:

\[ \text{var}(w_{ij}^t) = \text{var}(\alpha_j) + \text{var}(\psi_j) + \text{cov}(\alpha_i^j, \psi_j) \]

Between-firm dispersion

\[ \sum_j P_j \times (\text{var}(\alpha_i^j | i \in j) + \text{var}(\varepsilon_t^i | i \in j)) \]

Within-firm dispersion
Consider this model for wages:

\[ w_{ijt} = \alpha_i + \psi_j + X_{it}^t \beta + \varepsilon_{it} \]  

Estimating (2) from the entire US population entails estimating 150 Million worker FEs and 6 million firm FEs.

Let us set \( X_{it}^t \equiv 0 \) for a moment.
AKM Decomposition

Consider this model for wages:

\[ w_{ijt} = \alpha^i + \psi^j + X_t^i \beta + \varepsilon_t \]  

(2)

Estimating (2) from the entire US population entails estimating 150 Million worker FEs and 6 million firm FEs.

Let us set \( X_t^i \equiv 0 \) for a moment.

Average firm wage: \( \bar{w}_{jt} = \bar{\alpha}^j + \psi^j \).
Consider this model for wages:

\[ w_{ij}^t = \alpha_i + \psi_j + X_{t/\beta} + \varepsilon_i^t \]  

Estimating (2) from the entire US population entails estimating 150 Million worker FEs and 6 million firm FEs.

Let us set \( X_t^i \equiv 0 \) for a moment.

Average firm wage:

\[ \bar{w}_j^t = \bar{\alpha}_j^i + \psi_j. \]

Key decomposition:

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

Between-firm dispersion

\[ + \sum_j P_j \times (\text{var}_i(\alpha_i^j | i \in j) + \text{var}_i(\varepsilon_i^j | i \in j)) \]

Within-firm dispersion
### AKM Decomposition, Cont’d

\[ w_{ij}^t = \alpha_i^t + \psi_j^t + X_i^t \beta_i + \varepsilon_i^t \]

<table>
<thead>
<tr>
<th>Change in:</th>
<th>Baseline</th>
<th>Excl. “large” firms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between-Firm Components</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>of Variance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \text{var}_j(\alpha^j) )</td>
<td>38.3</td>
<td>43.1</td>
</tr>
<tr>
<td>( + \text{var}_j(\psi^j) )</td>
<td>-6.8</td>
<td>-4.6</td>
</tr>
<tr>
<td>( + 2 \times \text{cov}(\alpha^j, \psi^j) )</td>
<td>39.8</td>
<td>50.0</td>
</tr>
<tr>
<td>( + 2 \times \text{cov}(\alpha^j, X_i^t \beta_i) )</td>
<td>-3.6</td>
<td>-3.9</td>
</tr>
<tr>
<td></td>
<td><strong>= \Delta \text{Betw.-Firm var.}</strong></td>
<td></td>
</tr>
</tbody>
</table>

| **Within-Firm Components**        |              |                     |
| of Variance                       |              |                     |
| \( \text{var}_i(\alpha_i^t + X_i^t \beta_i | i \in j) \) | 38.2         | 27.4                |
| \( + \text{var}_i(\varepsilon_i^t | i \in j) \) | -6.1         | -11.9               |
|                                   | **= \Delta \text{Within firm var.}** |                     |

\[ \Delta \text{Total in var}(w_{ij}^t) \]
### AKM Decomposition, Cont’d

\[ w_{ij}^t = \alpha^i + \psi^j + X^i_t \beta + \varepsilon^i_t \]

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</tr>
<tr>
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<td>–6.8</td>
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<td></td>
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</tr>
<tr>
<td></td>
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<td>–3.6</td>
</tr>
<tr>
<td><strong>Δ Between-Firm var.</strong></td>
<td></td>
<td>67.9</td>
</tr>
</tbody>
</table>

| **Within-Firm** | \( \text{var}_i(\alpha^i + X^i \beta | i \in j) \) | 38.2 |  |
| Components of Variance | \( + \text{var}_i(\varepsilon^i_t | i \in j) \) | –6.1 |  |
| **Δ Total in \( \text{var}(w_{ij}^t) \)** | | 100 |  |
### AKM Decomposition, Cont’d

\[ w_{ij}^{ij} = \alpha_i^j + \psi_j^i + X_i^j \beta + \varepsilon_i^j \]

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<td>-3.9</td>
</tr>
<tr>
<td>( \Delta \text{Betw.-Firm var.} )</td>
<td>67.9</td>
<td>85.4</td>
</tr>
</tbody>
</table>

| **Within-Firm Components**   |          |                     |
| \( \text{var}_i(\alpha^i + X^i b | i \in j) \)  | 38.2     | 27.4                |
| + \( \text{var}_i(\varepsilon_i^j | i \in j) \)  | -6.1     | -11.9               |
| \( \Delta \text{Within firm var.} \) | 32.1     | 14.6                |

| \( \Delta \text{Total in var}(w_{ij}^{ij}) \) | 100      | 100                 |
Joint Worker and Firm Fixed Effect Distribution
Interval 1: 1980–1986

Increasing Sorting

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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Firming Up Inequality

75 / 197
Increasing Sorting

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

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

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality

77 / 197
Related Evidence


- (US: 1992–2007) Rise in between-establishment inequality is 2/3 of rise in overall wage inequality (Barth et al (2014)).

- Very similar results for

- So, whatever the driving force(s) are, they seem global.
Related Evidence


Related Evidence


- Very similar results for

- So, whatever the driving force(s) are, they seem global.
Main Takeaways

- Evidence points to major changes in firms’ organization.
Main Takeaways

- Evidence points to major changes in firms’ organization.

- Here is one more piece:
Figure: Firm Size – Average Pay Relation
Further Thoughts (Work in Progress)

- Why are worker FEs getting (i) more dispersed across firms, and (ii) more systematically related to firm FEs (sorting)?
Further Thoughts (Work in Progress)

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

- In our estimation, correlation between $\alpha^j$ and $\psi^j$ goes up by 0.30 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)
Further Thoughts (Work in Progress)

We are exploring a model along the lines of Kremer and Maskin (1996):

- Production consists of a number of tasks who must all be completed.
- Captured by a production function in which tasks enter multiplicative.
- Different tasks matter differently for final output.
- Model can generate both
  - cross-matching, so within firm heterogeneity
  - and assortative matching, so within firm sorting.
Conclusions and Current Work

- Rise in pay inequality between firms explain vast majority of rise in overall income inequality.

- However, not due to firm effects, but due to rising dispersion of worker FEs and increased sorting.
Conclusions and Current Work

- Rise in pay inequality between firms explain vast majority of rise in overall income inequality.

- However, not due to firm effects, but due to rising dispersion of worker FEs and increased sorting.

- Evidence points to major changes in firms’ organization.
  - But why is it happening in a way that leaves within-firm inequality almost exactly unchanged?
  - Can shed light on theories about the boundaries of firms.
  - How much of the rise in between-firm due to technology adoption?
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  - How much of the rise in between-firm due to technology adoption?

- Because we have a long panel we will analyze “continuing” firms to learn more.
APPENDIX
Wage Inequality: *Median Firm Wage*

Note: Sample contains workers in firms with 20+ full-time equivalent employees.
Firm as the Unit of Analysis

- Group firms by average pay
- Group firms by size (employment)
Standard Deviation of Log Wages

Note: Sample contains firms with 20+ full-time equivalent employees.
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Avg. of Log Wages

Note: Sample contains firms with 20+ full-time equivalent employees.
Ranking Firms By Size
Table: Percentiles for Firm Size Distribution

<table>
<thead>
<tr>
<th>Number of Employees</th>
<th>P50</th>
<th>P90</th>
<th>P95</th>
<th>P99</th>
<th>P99.5</th>
<th>P99.9</th>
<th>P99.99</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>182</td>
<td>335</td>
<td>1,178</td>
<td>3,270</td>
<td>13,180</td>
<td>58,335</td>
<td></td>
</tr>
</tbody>
</table>
Rise in Pay Inequality: Firms By Size

Log Change, 1982–2012

Percentile of Number of Employees

Firm Average Wage

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality 93 / 197
Change in P90 By Firm Size
Inequality by Firm Size: Standard Deviation

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Inequality by Firm Size: Frac. Wages to Bottom 95%

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Note: Sample contains firms with 20+ full-time equivalent employees.
Avg of Bottom 95%

Note: Sample contains firms with 20+ full-time equivalent employees.
Change in Avg. Log Wages by Firm Size

Log Change, 1982−2012

Percentile of Number of Employees

Average of Log Wages at Firm
Firm Average Wage
Inequality by Firm Size

- Log Change, 1982–2012
- Percentile of Number of Employees
- Firm Average Wage
- 90–10 Diff at Firm

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality
Avg. of Bottom 95% by Firm Size

Song, Price, Guvenen, Bloom, von Wachter
Firming Up Inequality
Bottom 99%: Industries
Industry: Manufacturing

![Graph showing log change in wages from 1982 to 2012 across different percentiles of individual total wages.]

- Blue diamonds represent individual total wages.
- Red dots represent firm average wages.
- Green squares represent individual wages divided by firm average wages.

The graph illustrates the trend in wage inequality across different percentiles of individual total wages within the manufacturing industry, with a focus on how individual wages compare to firm average wages.
Industry: Utilities

- Log Change, 1982-2012
- Percentile of Indv Total Wage
- Indv Total Wage
- Firm Average Wage
- Indv Wage/Firm Average

BACK TO SUBGROUPS

Song, Price, Guvenen, Bloom, von Wachter
Firming Up Inequality
Industry: Finance/Insurance/Real Estate

![Graph showing the distribution of individual total wages, firm average wages, and individual wages relative to the firm average across percentiles.](image)

- **Indv Total Wage**
- **Firm Average Wage**
- **Indv Wage/Firm Average**

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality
Bottom 99%: US Regions
Region: South

Log Change, 1982−2012

0 20 40 60 80 100

Percentile of Indv Total Wage

Indv Total Wage

Firm Average Wage

Indv Wage/Firm Average

BACK TO SUBGROUPS

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Region: West

Log Change, 1982−2012

Percentile of Indv Total Wage

Indv Total Wage
Firm Average Wage
Indv Wage/Firm Average
Robustness: Average of Bottom 95pct
ADDITIONAL FIGURES
Within 4-Digit Industry Code
Firm Size: 20 – 10,000 FTE (Top 1%)
Firm Size: 10,000+ FTE (Top 1%)

The graph shows the log change in 1982-2012 for various percentiles of individual total wages, firm average wages, and the ratio of individual wages to firm average wages. The data points indicate increasing inequality over time, with a clear upward trend in the log change for the top 1% of the distribution.
Fraction Top-Paid Employee

![Graph showing the fraction of top-paid employees at a firm across different percentiles of individual total wages for 1982 and 2012. The graph indicates an increase in the fraction of top-paid employees over time.]
Fraction Top-Paid Employee (Top 1%)
Rising Inequality Among Non-CEOs
Rising Inequality Among Non-CEOs (Top 1%)
Many Measures of Firm Wage

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality 123 / 197
Many Measures of Firm Wage (Top 1%)
Many Measures of Firm Wage (Top 1%)

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Standard Deviation of Log Wage in Firm

Log Change, 1982-2012

Percentile of Indv Total Wage

Indv Total Wage

Std Dev of Log Wage at Firm

FIRM 90-10 DIFFERENTIAL
Standard Deviation of Log Wage in Firm (Top 1%)

Firm 90-10 Differential

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Firming Up Inequality
Frac. Wages to Bottom 95%

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality
Max Wage in Firm

Song, Price, Guvenen, Bloom, von Wachter  Firming Up Inequality
By Percentile for Group

![Graph showing the distribution of individual total wages, firm average wages, and individual wage-to-firm average ratios by percentile from 1982 to 2012. The graph illustrates the progression of inequality over time.]
Top 1%: Industries
Industry: Ag/Mining/Construction/Other (Top 1%)
Industry: Manufacturing (Top 1%)
Industry: Finance/Insurance/Real Estate (Top 1%)
Industry: Services (Top 1%)
Top 1%: US Regions
Region: Northeast  (Top 1%)
Region: South (Top 1%)
Region: Midwest (Top 1%)
Region: West (Top 1%)
Bottom 99%: Size
Firm Size: 1+ FTE

Log Change, 1982–2012

Percentile of Indv Total Wage

Indv Total Wage

Firm Average Wage

Indv Wage/Firm Average

BACK TO SUBGROUPS
Firm Size: 5+ FTE

The graph shows the log change in wages from 1982 to 2012 for different percentiles of individual total wages. The lines represent:
- Indv Total Wage
- Firm Average Wage
- Indv Wage/Firm Average

The data suggests an increase in wage disparity over time, with the lines indicating higher wages for higher percentiles of individual total wages.
Firm Size: 10+ FTE

Percentile of Indv Total Wage

Log Change, 1982−2012

Indv Total Wage
Firm Average Wage
Indv Wage/Firm Average

Firming Up Inequality

Song, Price, Guvenen, Bloom, von Wachter
Firm Size: 20-100 FTE

The graph shows the log change in wages from 1982-2012 across different percentiles of individual total wages. The data points represent different firm sizes, with Firm Size 20-100 FTE highlighted in the graph.

[Graph showing wage changes across percentiles of individual total wages for Firm Size 20-100 FTE.]
Firm Size: 100+ FTE

![Graph showing changes in individual total wages, firm average wages, and individual wages relative to firm average wages across percentiles.](image)

- **Indv Total Wage**
- **Firm Average Wage**
- **Indv Wage/Firm Average**

Percentile of Indv Total Wage

Log Change, 1982-2012

Firming Up Inequality

Song, Price, Guvenen, Bloom, von Wachter

BACK TO SUBGROUPS
Firm Size: 20-1,000 FTE

- Log Change, 1982–2012
- Percentile of Indv Total Wage
- Indv Total Wage
- Firm Average Wage
- Indv Wage/Firm Average

BACK TO SUBGROUPS

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality

148 / 197
Firm Size: 1,000+ FTE

- Log Change, 1982−2012
- Percentile of Indv Total Wage
- Indv Total Wage
- Firm Average Wage
- Indv Wage/Firm Average

BACK TO SUBGROUPS

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Firm Size: 20-10,000 FTE

Log Change, 1982-2012

Percentile of Indv Total Wage

Indv Total Wage
Firm Average Wage
Indv Wage/Firm Average

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Firm Size: 10,000+ FTE

Back to Subgroups

Song, Price, Guvenen, Bloom, von Wachter
Firming Up Inequality
Bottom 99%: Gender
Women Only

[Graph showing changes in Indv Total Wage, Firm Average Wage, and Indv Wage/Firm Average over the percentile of Indv Total Wage]
Bottom 99%: Age
Top 1%: Firm Size
Firm Size: 1+ FTE (Top 1%)
Firm Size: 5+ FTE (Top 1%)
Firm Size: 10+ FTE (Top 1%)

![Graph showing the log change in individual total wage, firm average wage, and individual wage divided by firm average wage over the percentile of individual total wage from 1982 to 2012.](image-url)

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Firm Size: 20-100 FTE (Top 1%)
Firm Size: 100+ FTE (Top 1%)
Firm Size: 20-1,000 FTE (Top 1%)
Firm Size: 1,000+ FTE (Top 1%)
Firm Size: 10,000+ FTE (Top 1%)
Top 1%: Gender
Women Only (Top 1%)

Log Change, 1982−2012

Percentile of Indv Total Wage

Indv Total Wage

Firm Average Wage

Indv Wage/Firm Average

BACK TO SUBGROUPS

Song, Price, Guvenen, Bloom, von Wachter

Firming Up Inequality
Top 1%: Age
Age 34 and Below (Top 1%)
Age 35-44 (Top 1%)
Age 45-54 (Top 1%)
Age 55 and Above (Top 1%)
Lorenz Curve of Firm Size
Lorenz Curve of Firm Size (Top 1%)

Percentile of Number of Employees

Frac. People in Firms up to This Size

1982
2012

Song, Price, Guvenen, Bloom, von Wachter
Firming Up Inequality
Values in Both Years

![Graph showing the comparison of log individual total wage and percentile of individual total wage in 1982 and 2012.](image)

Song, Price, Guvenen, Bloom, von Wachter
Firming Up Inequality
Values in Both Years, 10,000+ FTE
Values in Both Years

Song, Price, Guvenen, Bloom, von Wachter Firming Up Inequality
Values in Both Years

![Graph showing the log standard deviation of log wage at firm against the percentile of individual total wage for two years (1982 and 2012).](chart)

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Values in Both Years

Values in Both Years

Log Number of Employees

percentile of Firm Average Wage

1982
2012

3.6 3.8 4 4.2

0 20 40 60 80 100

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Values in Both Years

Song, Price, Guvenen, Bloom, von Wachter
Firming Up Inequality
Values in Both Years (Top 1%)
Values in Both Years, 10,000+ FTE (Top 1%)
Values in Both Years (Top 1%)
Values in Both Years (Top 1%)
Values in Both Years (Top 1%)

![Graph showing the fraction of wages to the bottom 95% across different percentiles of individual total wages for 1982 and 2012. The graph indicates an increase in inequality over time.]
Values in Both Years (Top 1%)
### Values in Both Years (Top 1%)

<table>
<thead>
<tr>
<th>Log Number of Employees</th>
<th>Percentile of Firm Average Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>99</td>
<td>1982</td>
</tr>
<tr>
<td>99.2</td>
<td>1982</td>
</tr>
<tr>
<td>99.4</td>
<td>1982</td>
</tr>
<tr>
<td>99.6</td>
<td>1982</td>
</tr>
<tr>
<td>99.8</td>
<td>1982</td>
</tr>
<tr>
<td>100</td>
<td>1982</td>
</tr>
</tbody>
</table>

**1982:**
- Log Number of Employees: 99, 99.2, 99.4, 99.6, 99.8, 100
- Percentile of Firm Average Wage: 1982

**2012:**
- Log Number of Employees: 99, 99.2, 99.4, 99.6, 99.8, 100
- Percentile of Firm Average Wage: 2012

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Values in Both Years (Top 1%)