Firming Up Inequality

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

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   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

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- No top-coding; no survey response error

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- MEF: **Universe of US workers** $\Longrightarrow$ **Universe of U.S. firms**
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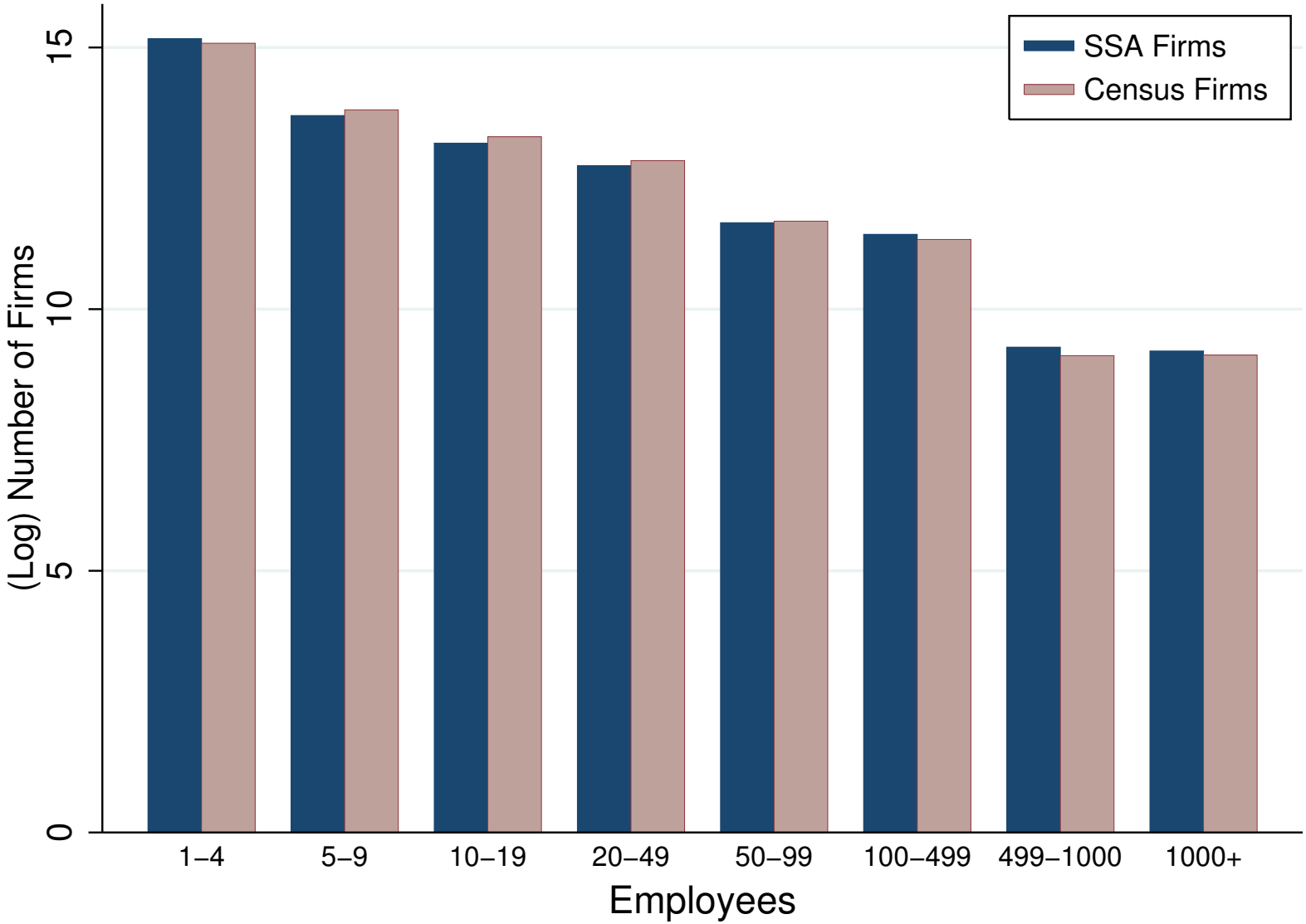
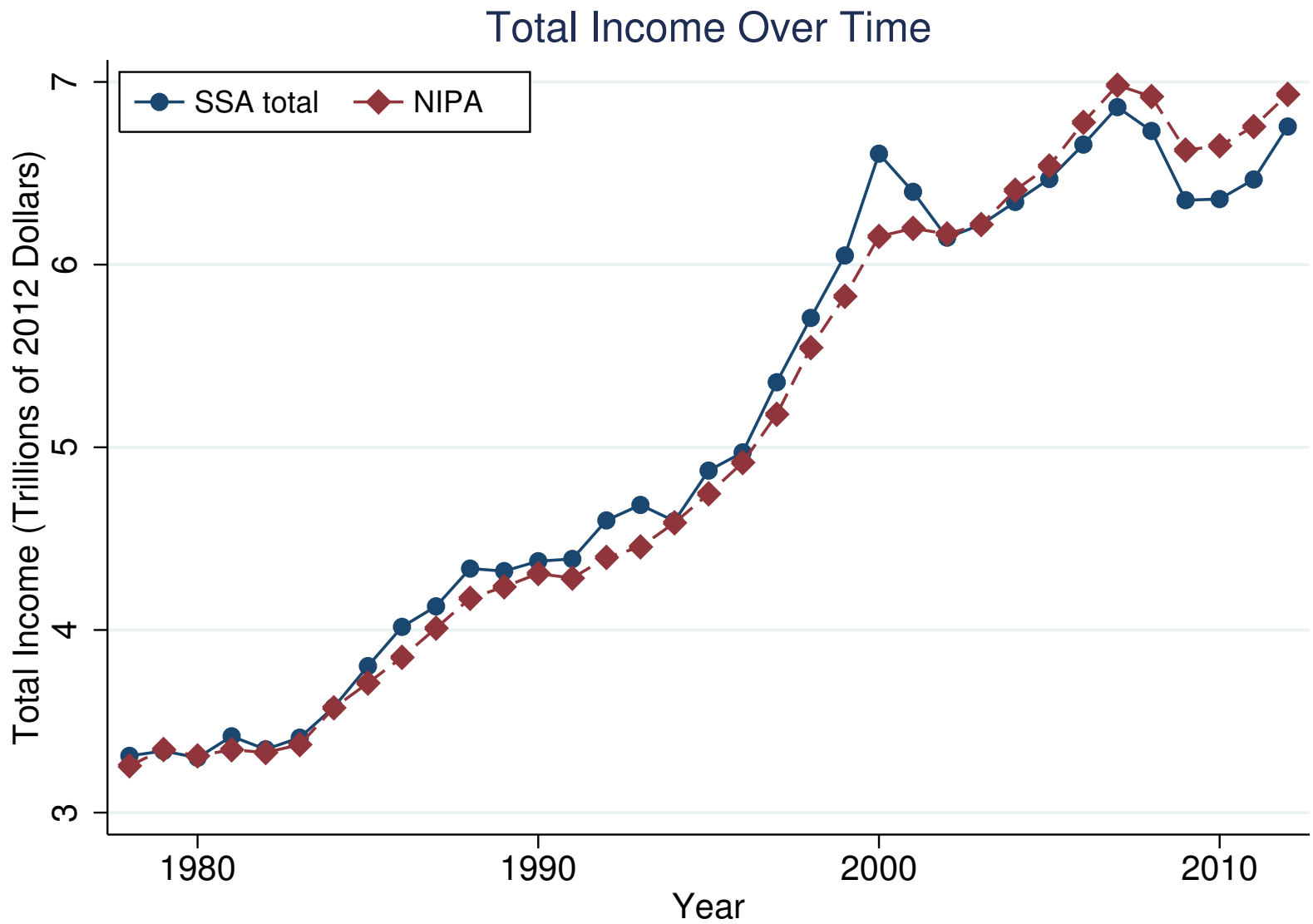
- MEF: **Universe of US workers** $\Longrightarrow$ **Universe of U.S. firms**
- Individuals assigned to firm where they earn most of their annual income.
- ***Baseline:*** Firms with **20+ employees**. Workers at those firms. Exclude government and education.
  - Covers 1.1 million firms (about 18% 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



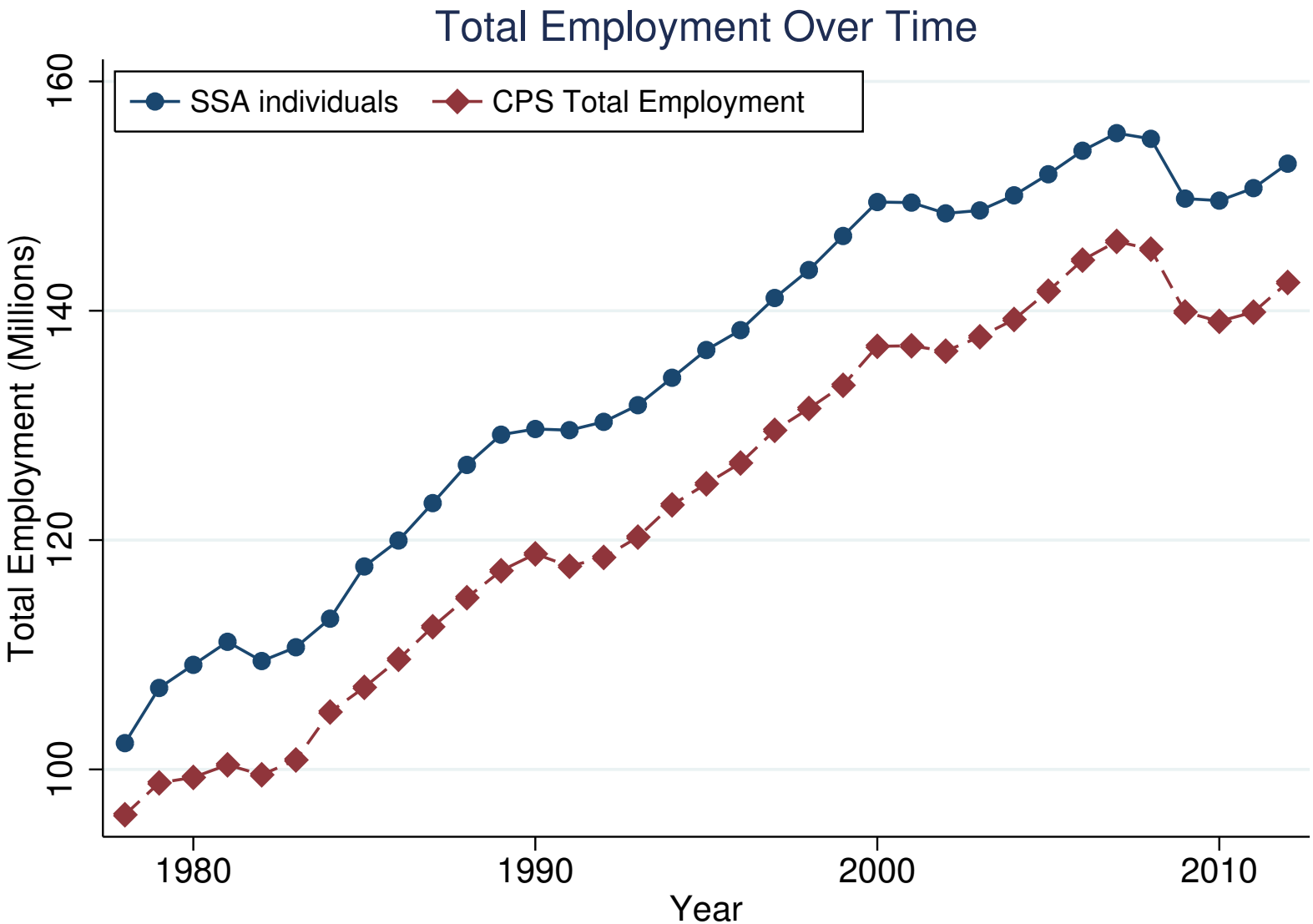
Notes: Natural log of the number of firms in each size category are shown. Census figures count the number of employees at a point in time, while the SSA numbers count the number of FTEs over the course of a year.

Total Payroll



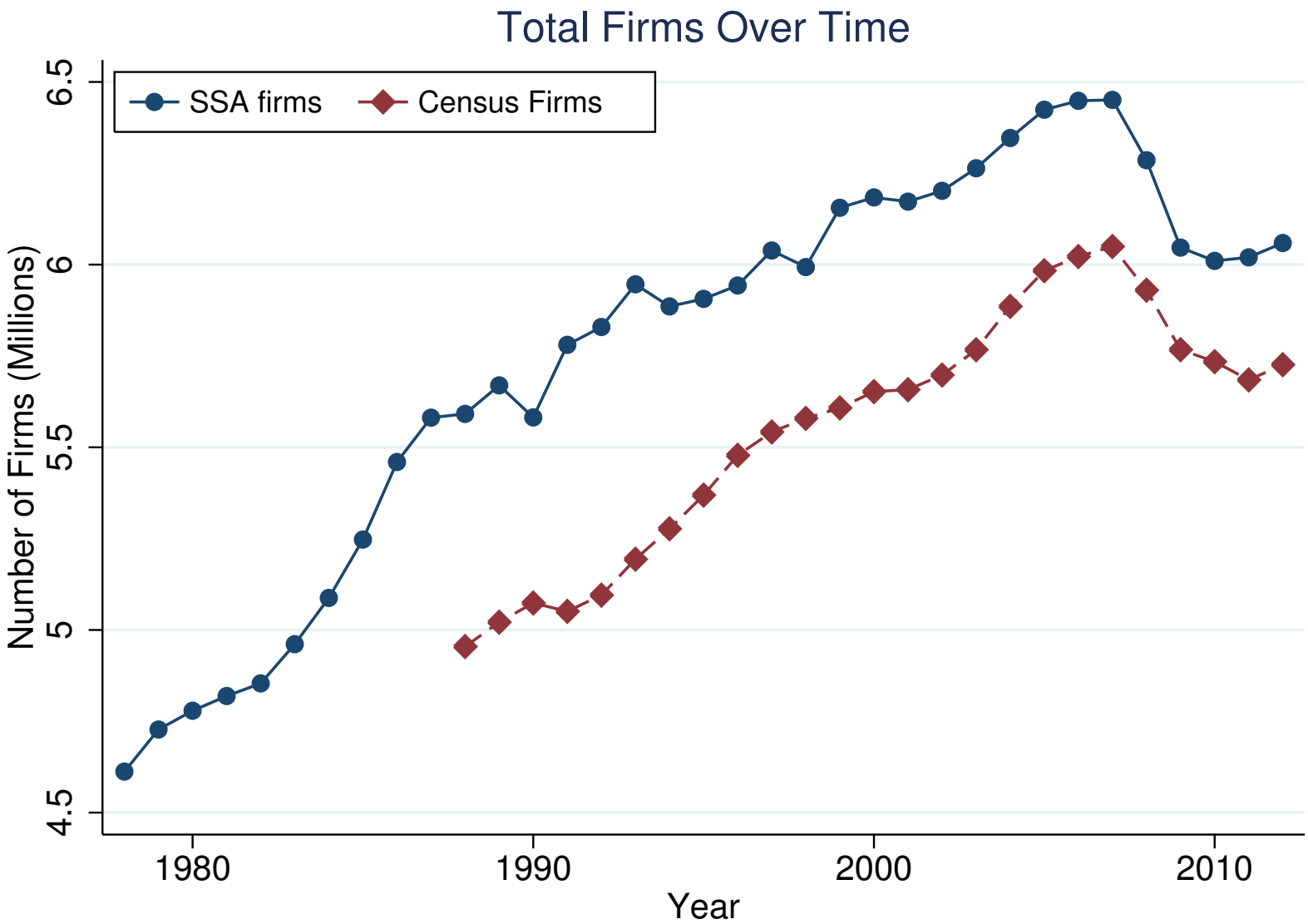
Notes: SSA data includes all entries in the MEF. All data are adjusted for inflation using the PCE price index.

Total Employment



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



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EMPIRICAL RESULTS

Basic Variance Decomposition

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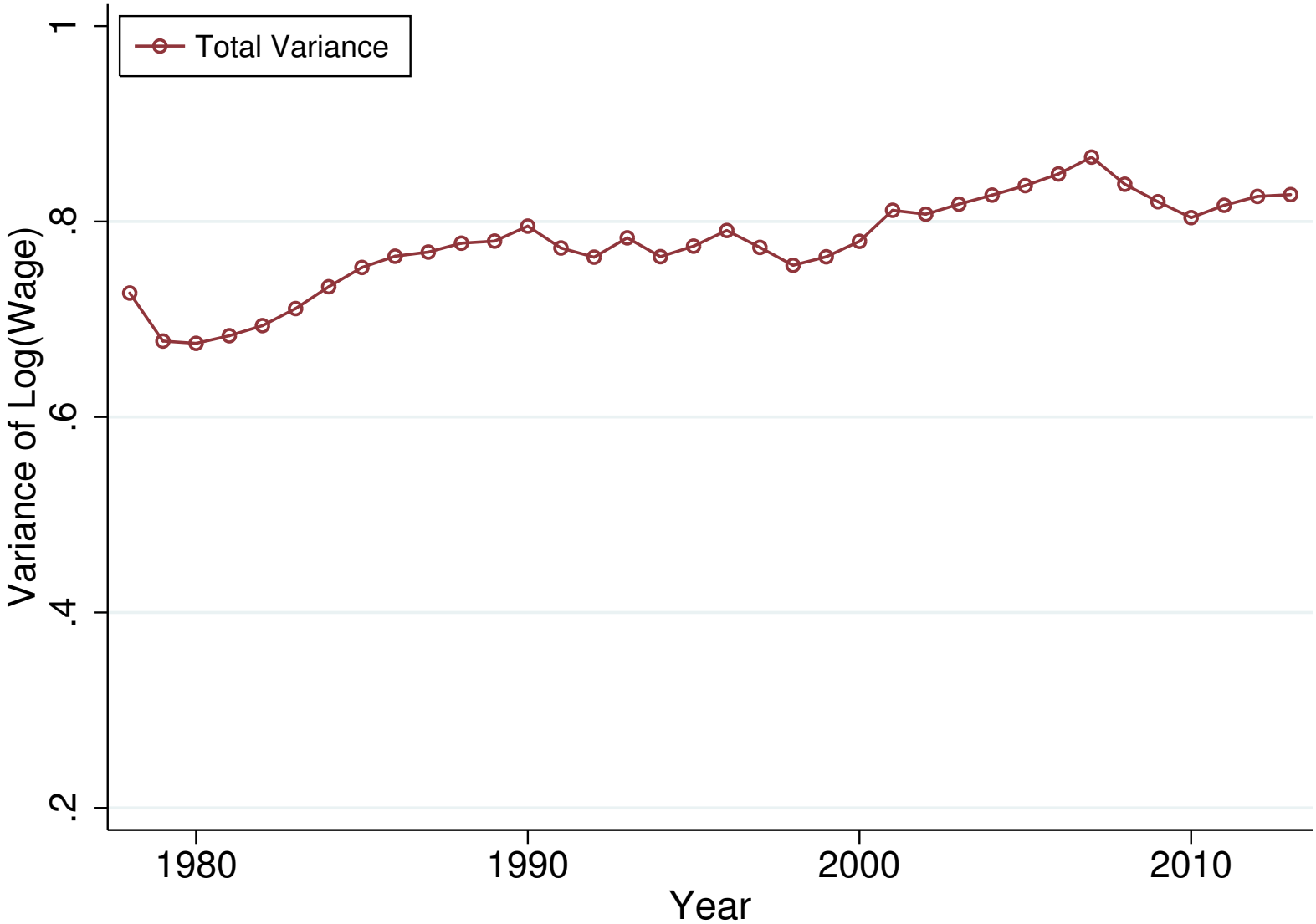
$$\Rightarrow \underbrace{\text{var}_i(w_t^{ij})}_{\text{Total dispersion}} \equiv \underbrace{\text{var}_j(\overline{w}_t^j)}_{\text{Between-firm dispersion}} + \sum_{j=1}^{J} P_j \times \underbrace{\text{var}_i(w_t^{ij} | i \in j)}_{\text{Within-firm } j \text{ dispersion}} .$$

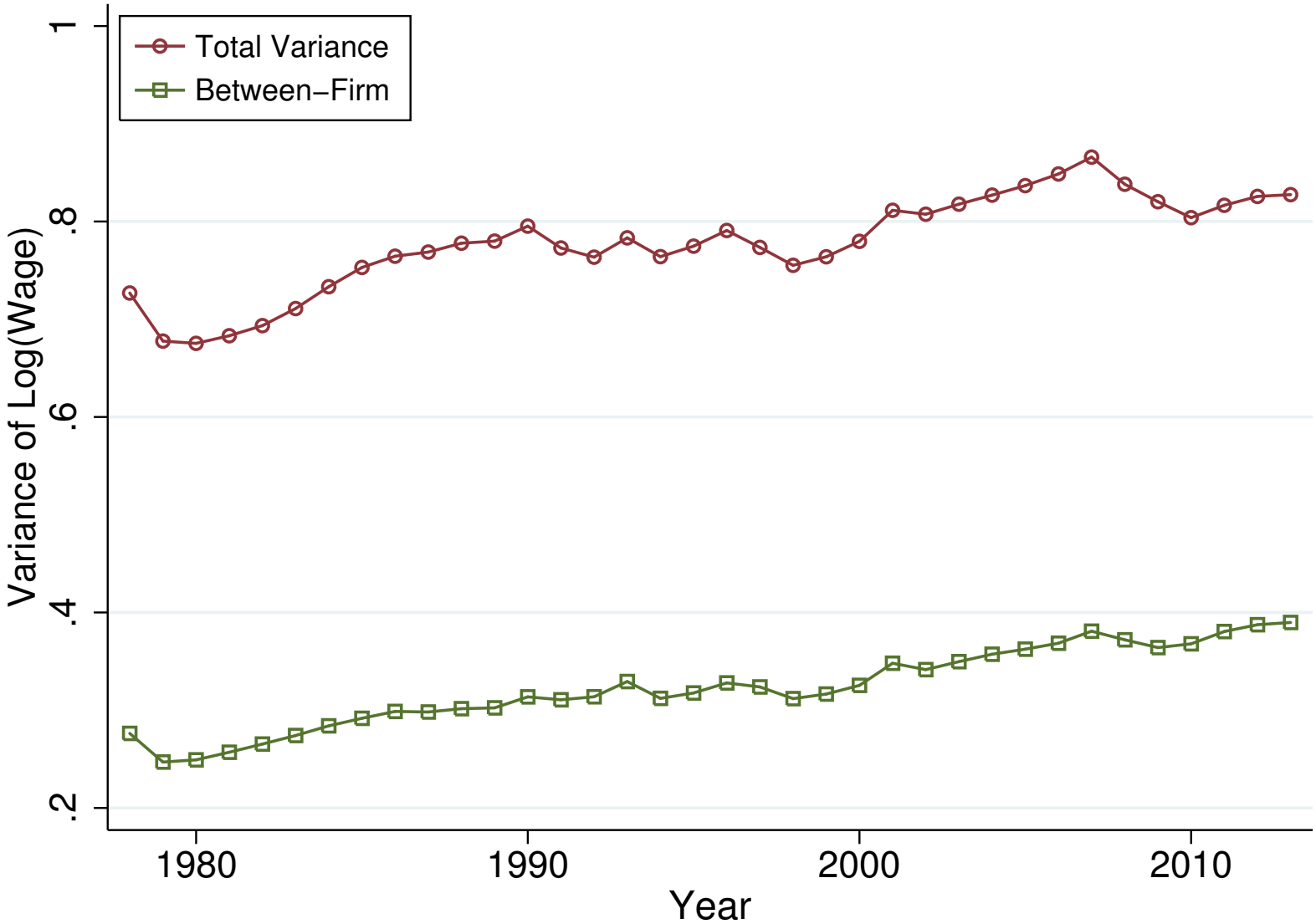
P_j : employment share of firm j

Total Wage Inequality



Note: Firms with less than 10,000 FTE employees

Total vs. Between-Firm Wage Inequality



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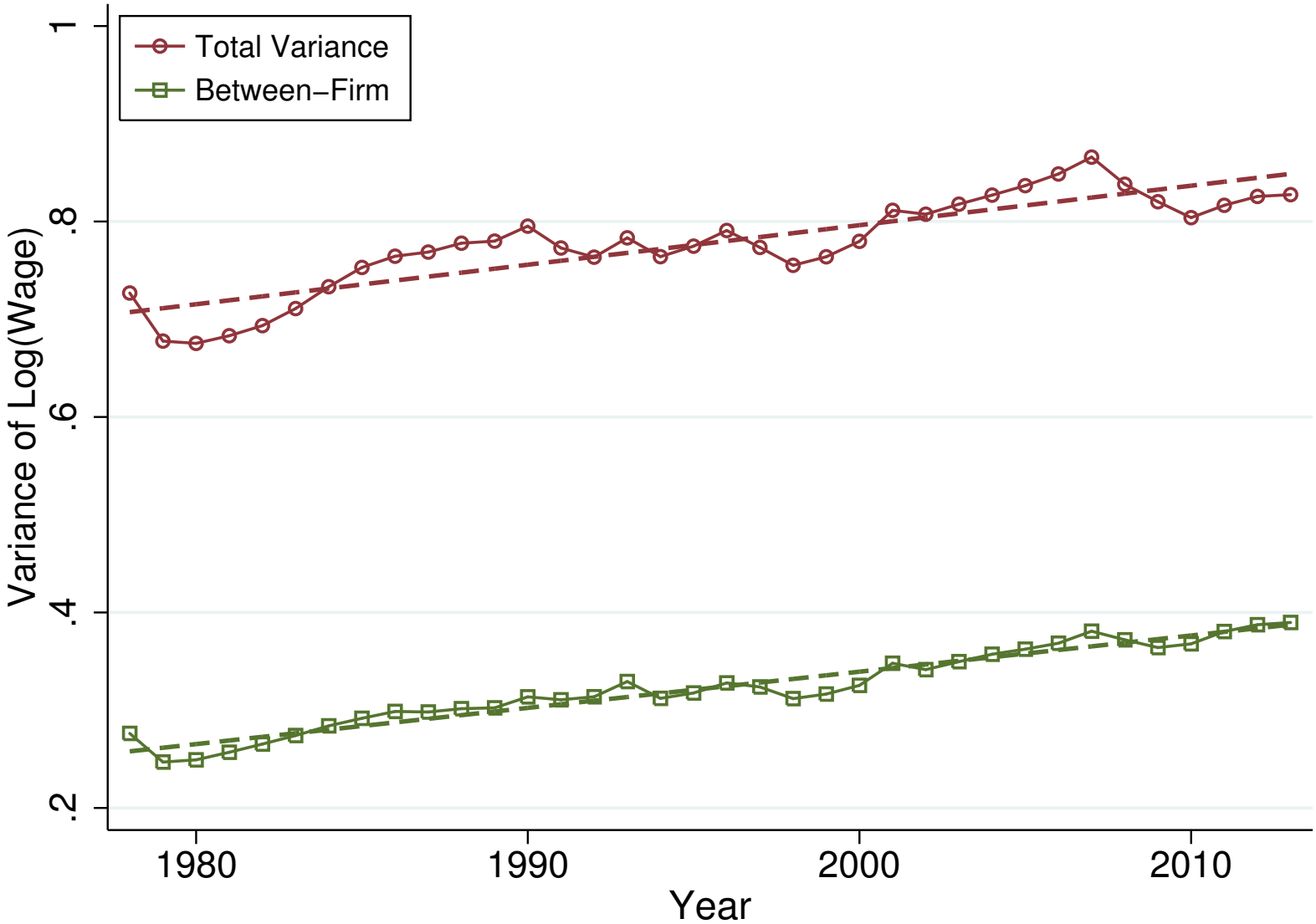

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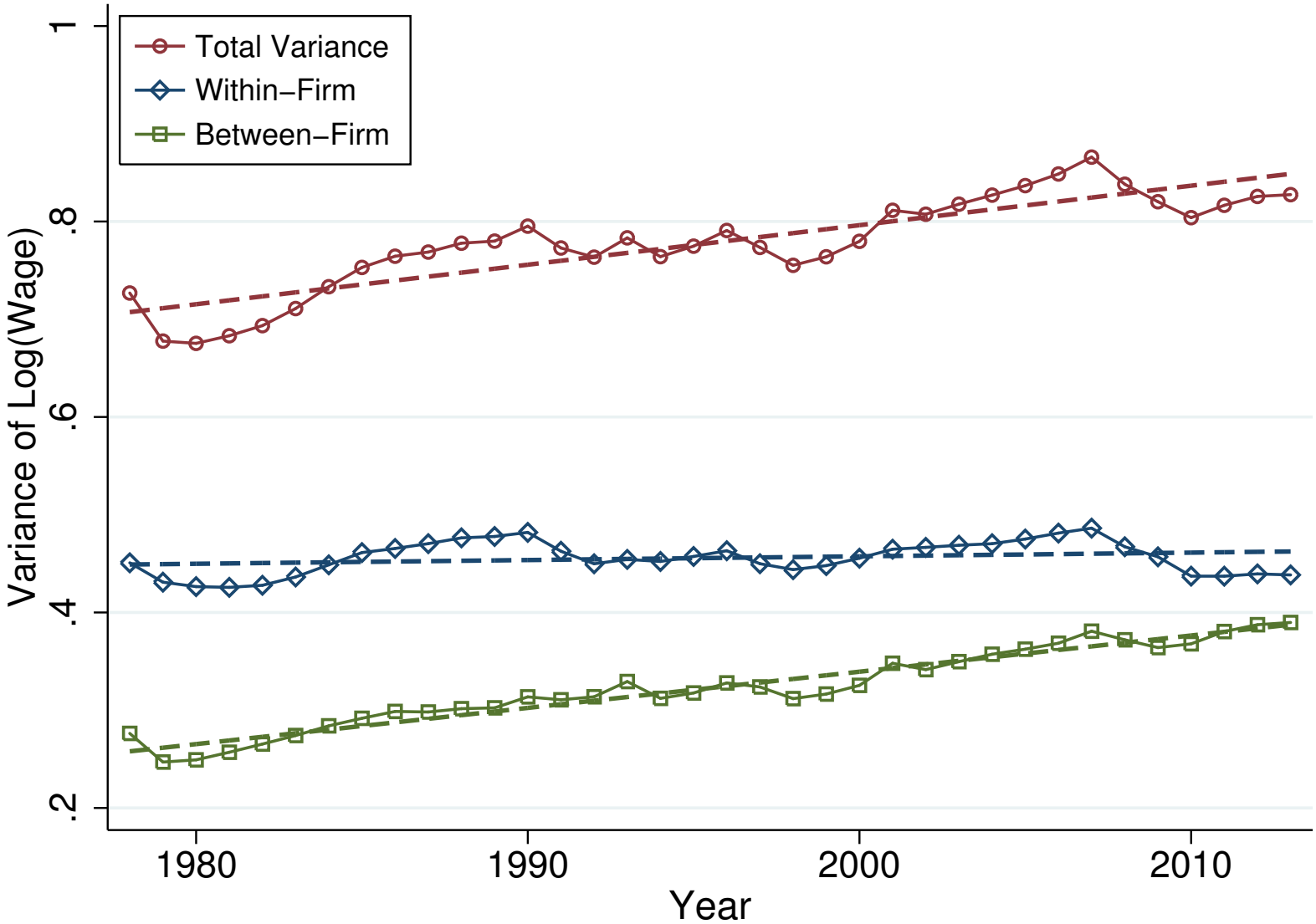
Total, Between- and Within-Firm Inequality



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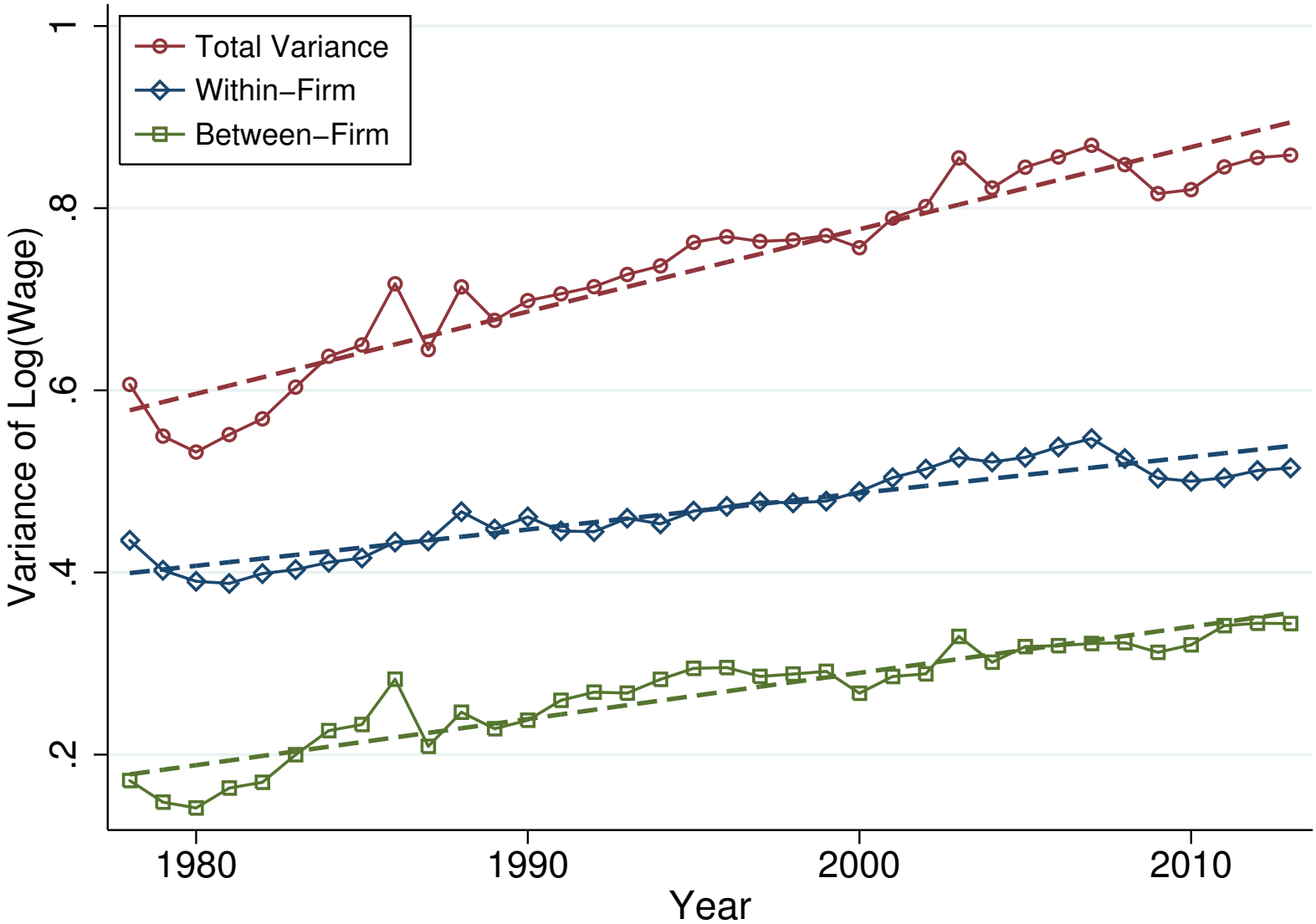
Large Firms Only (10,000+ FTE)



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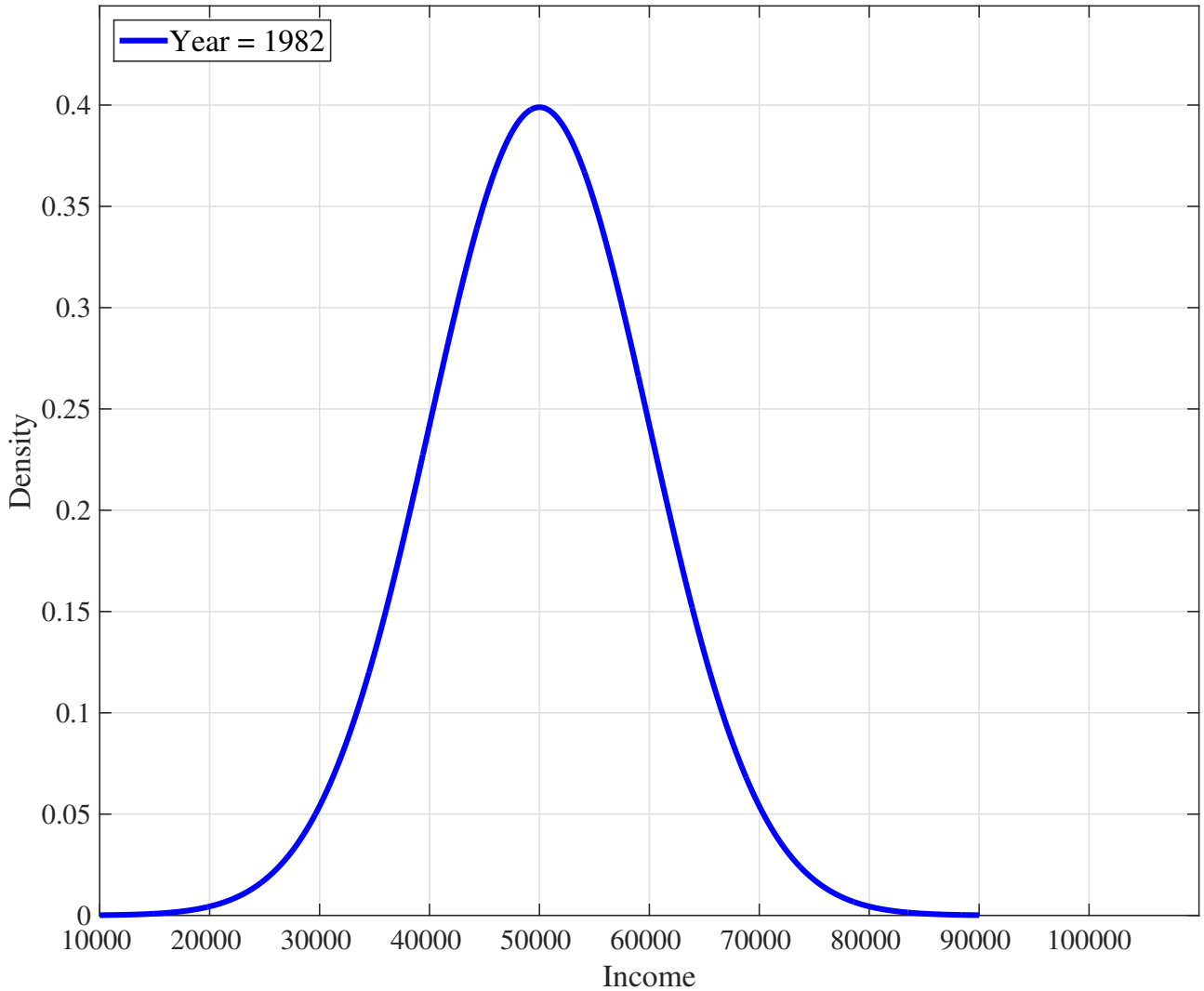
A GRAPHICAL FRAMEWORK

Empirical Framework



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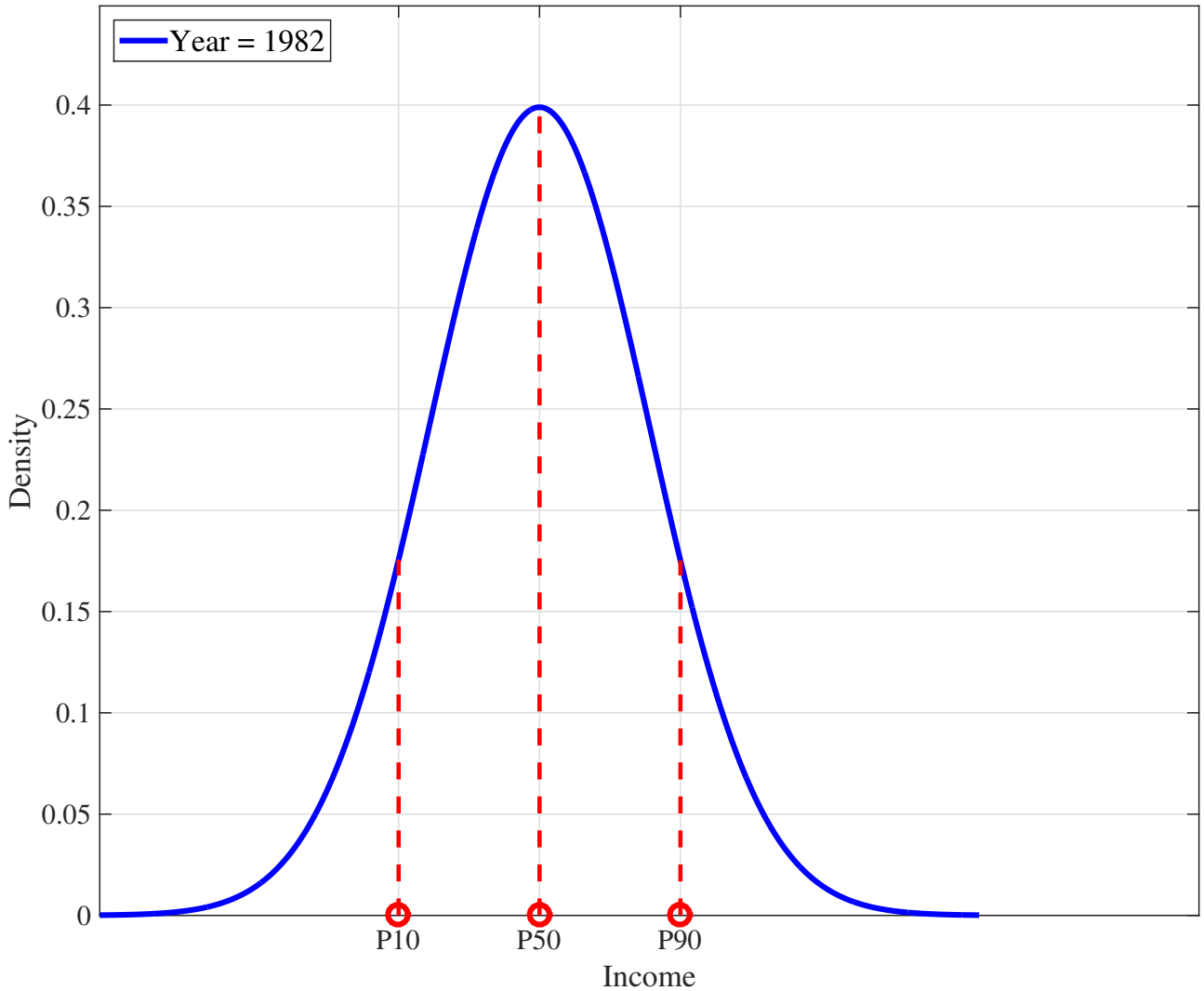

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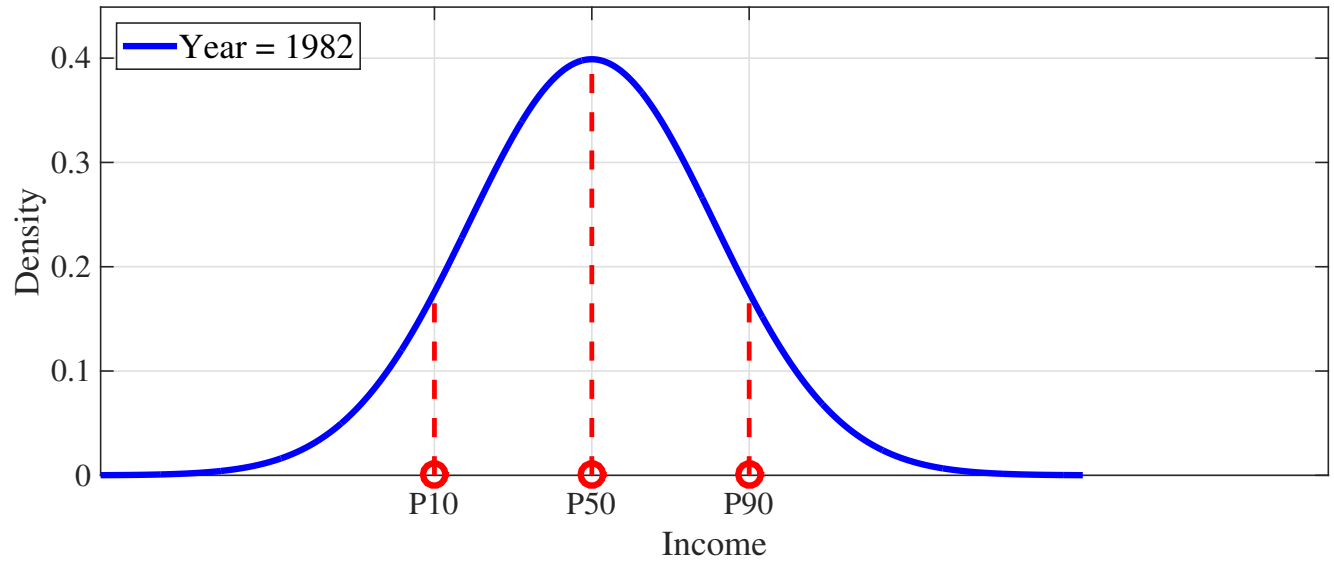
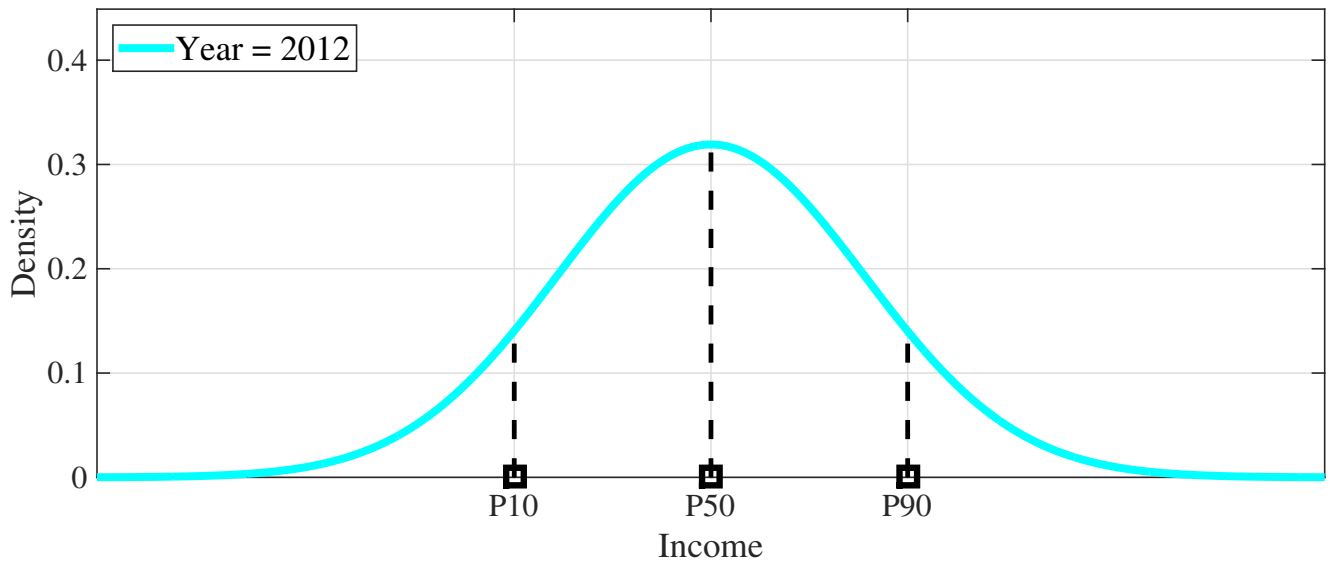
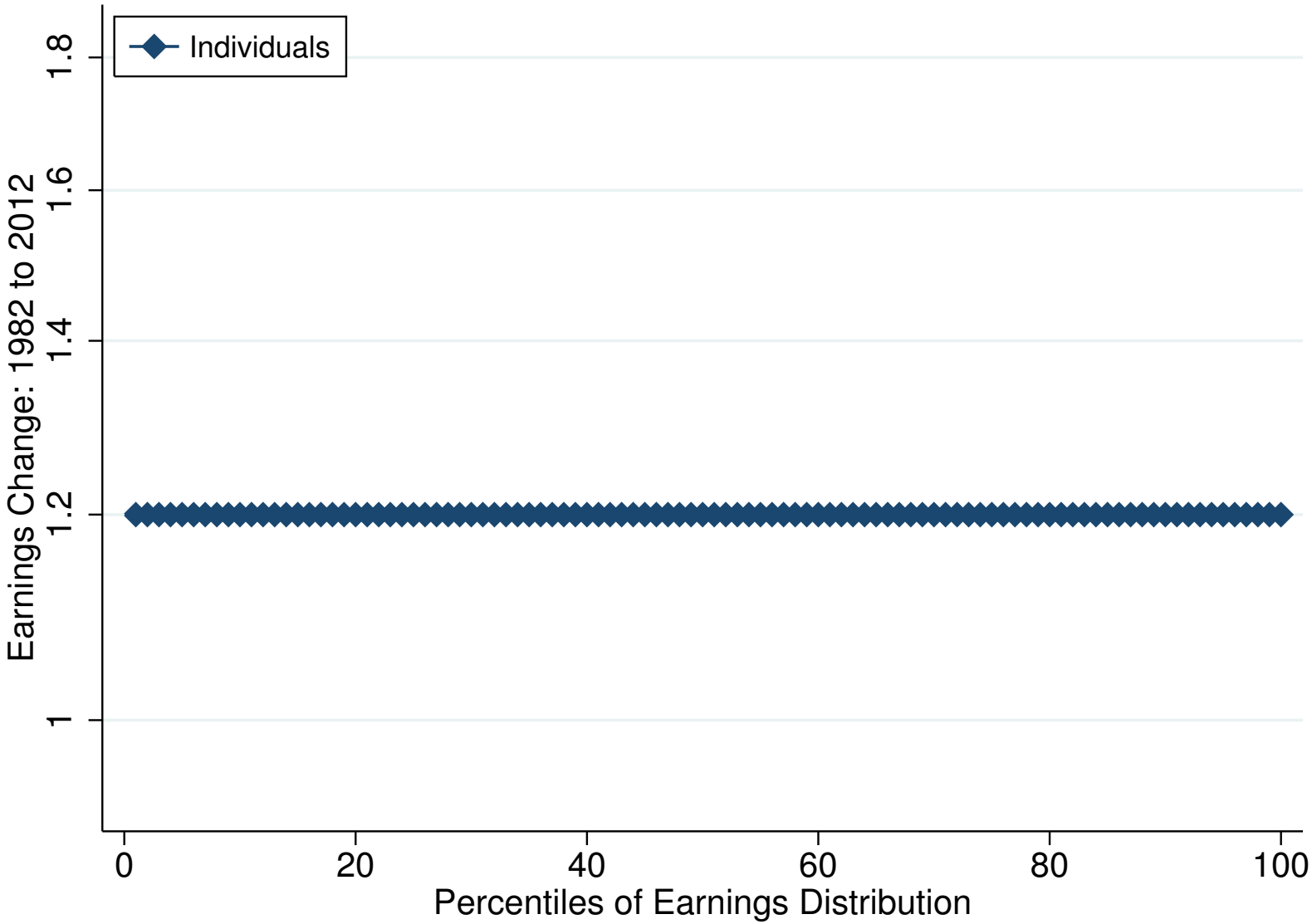
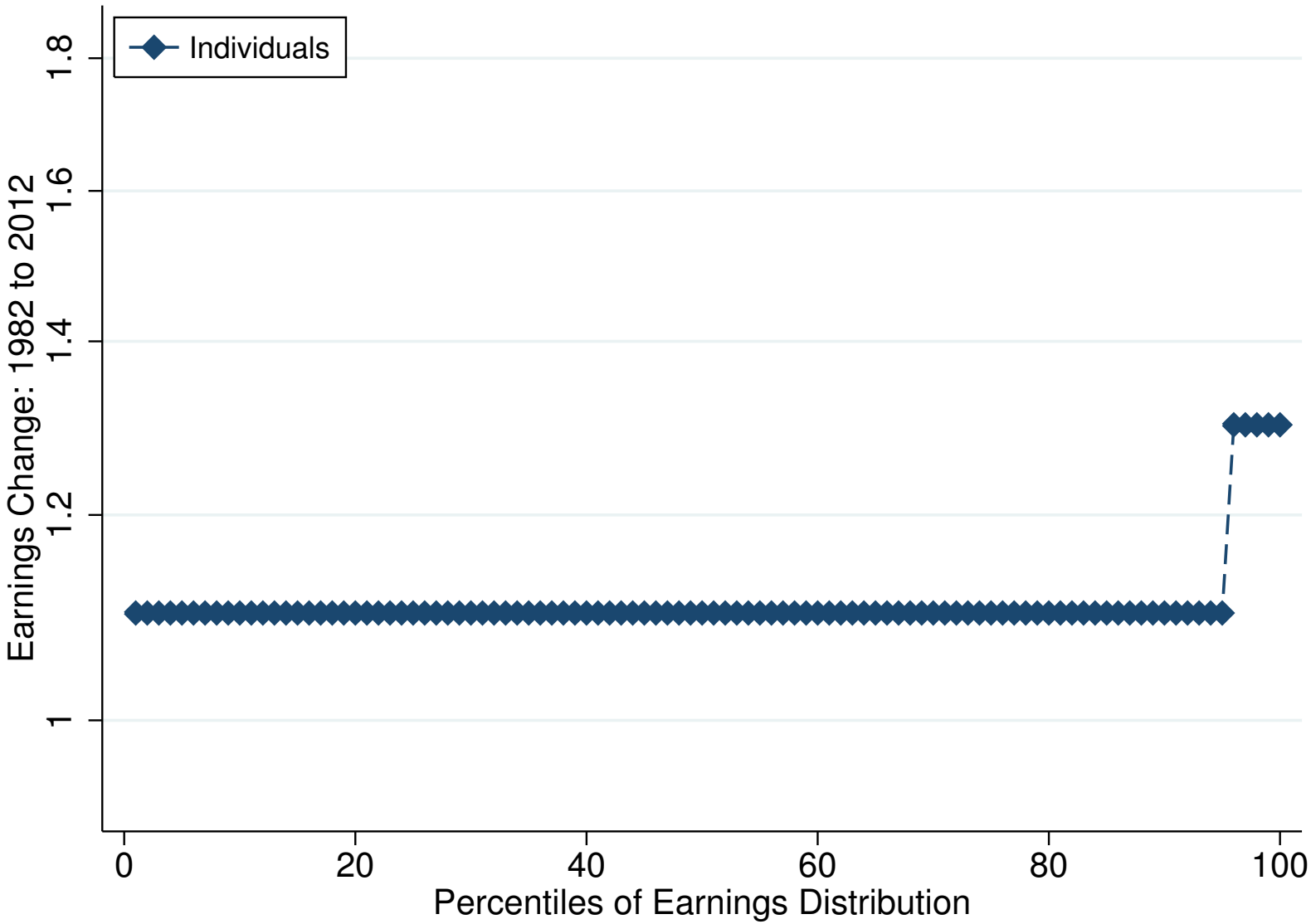




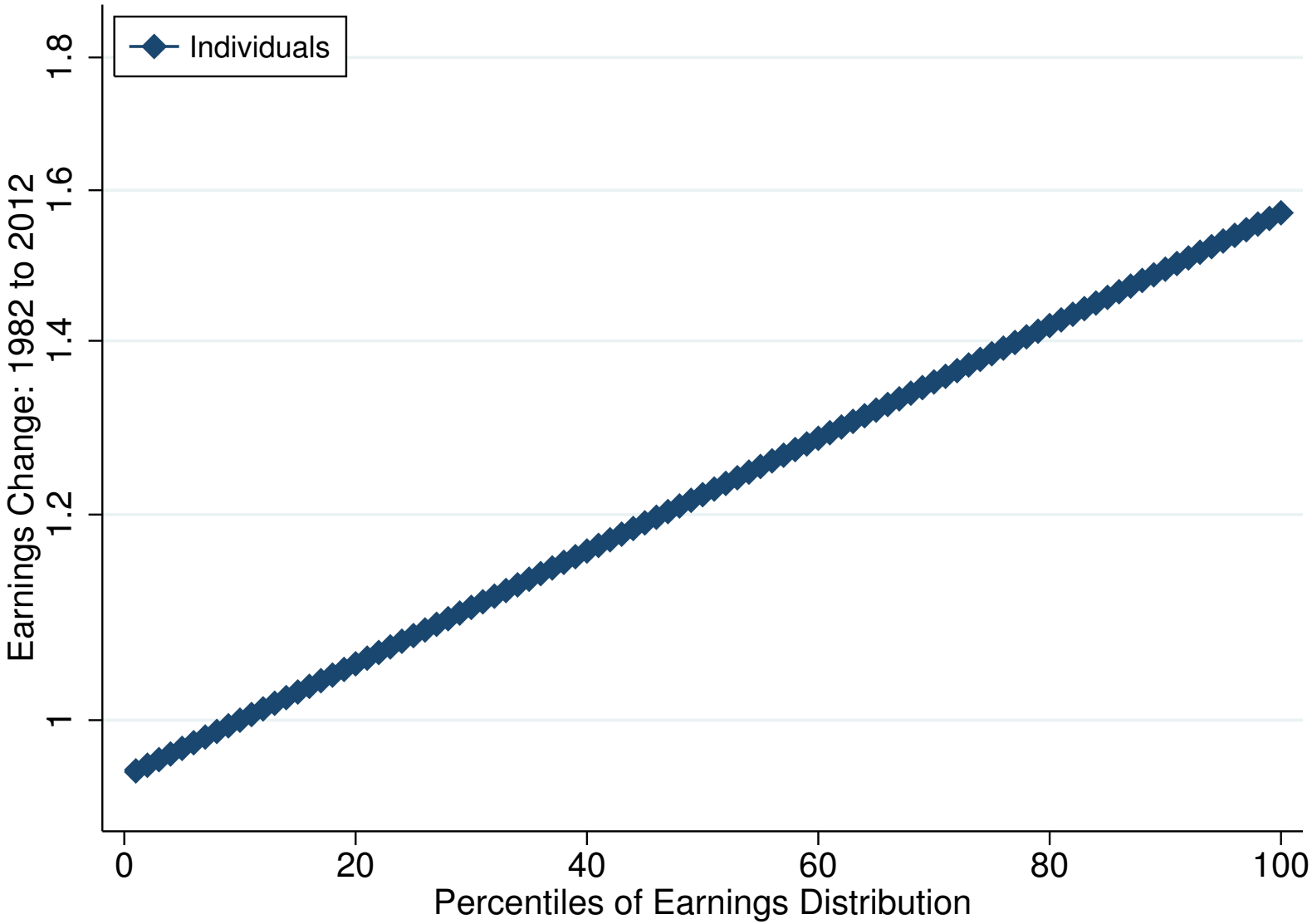
Example: No Rise in Inequality



Example: Rise in Inequality Between Top and Rest

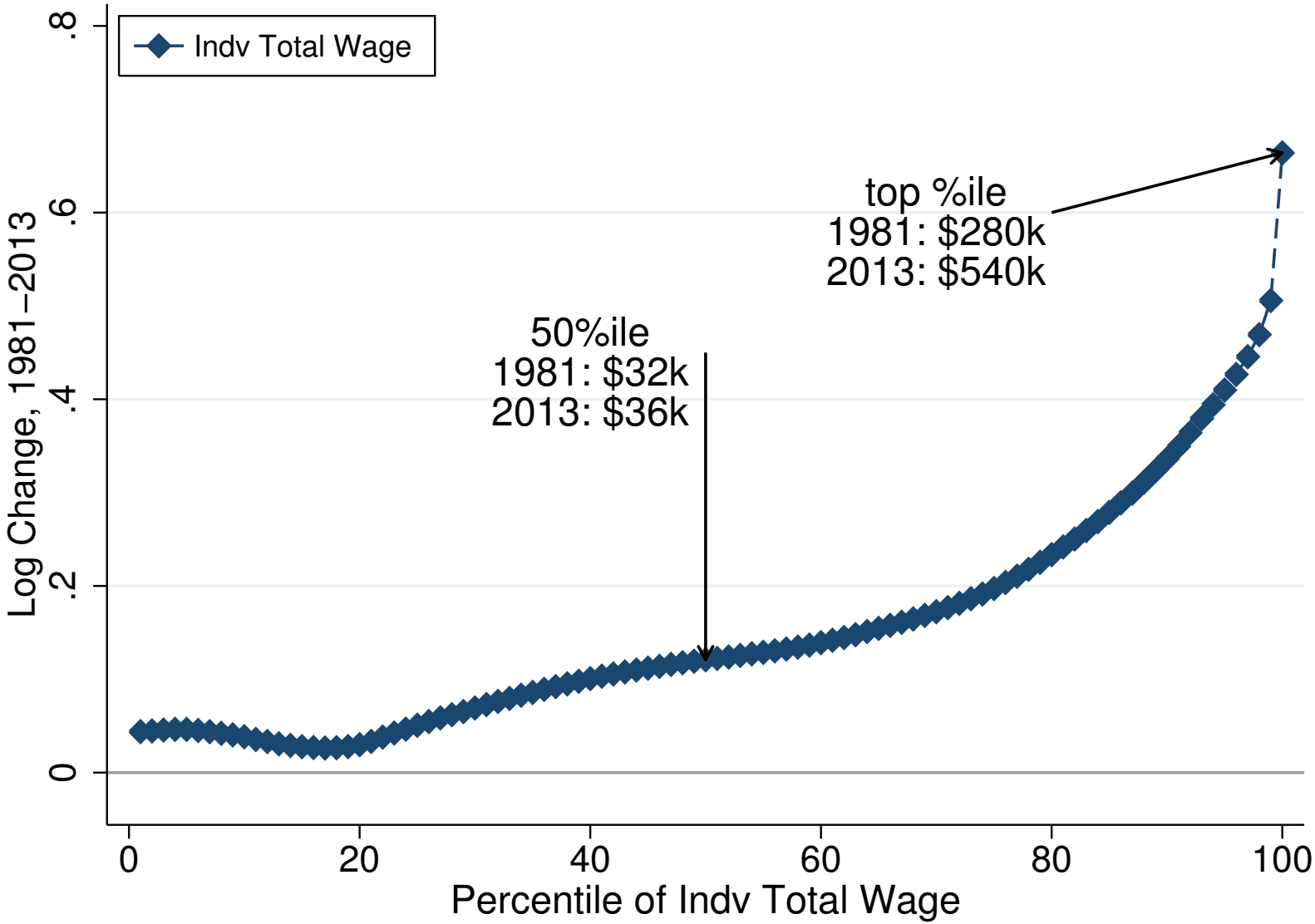


Example: Rise in Inequality Everywhere



RESULTS: BOTTOM 99%

Wage Inequality: **By Percentile**



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

Calculating **Average Log Employer Pay**

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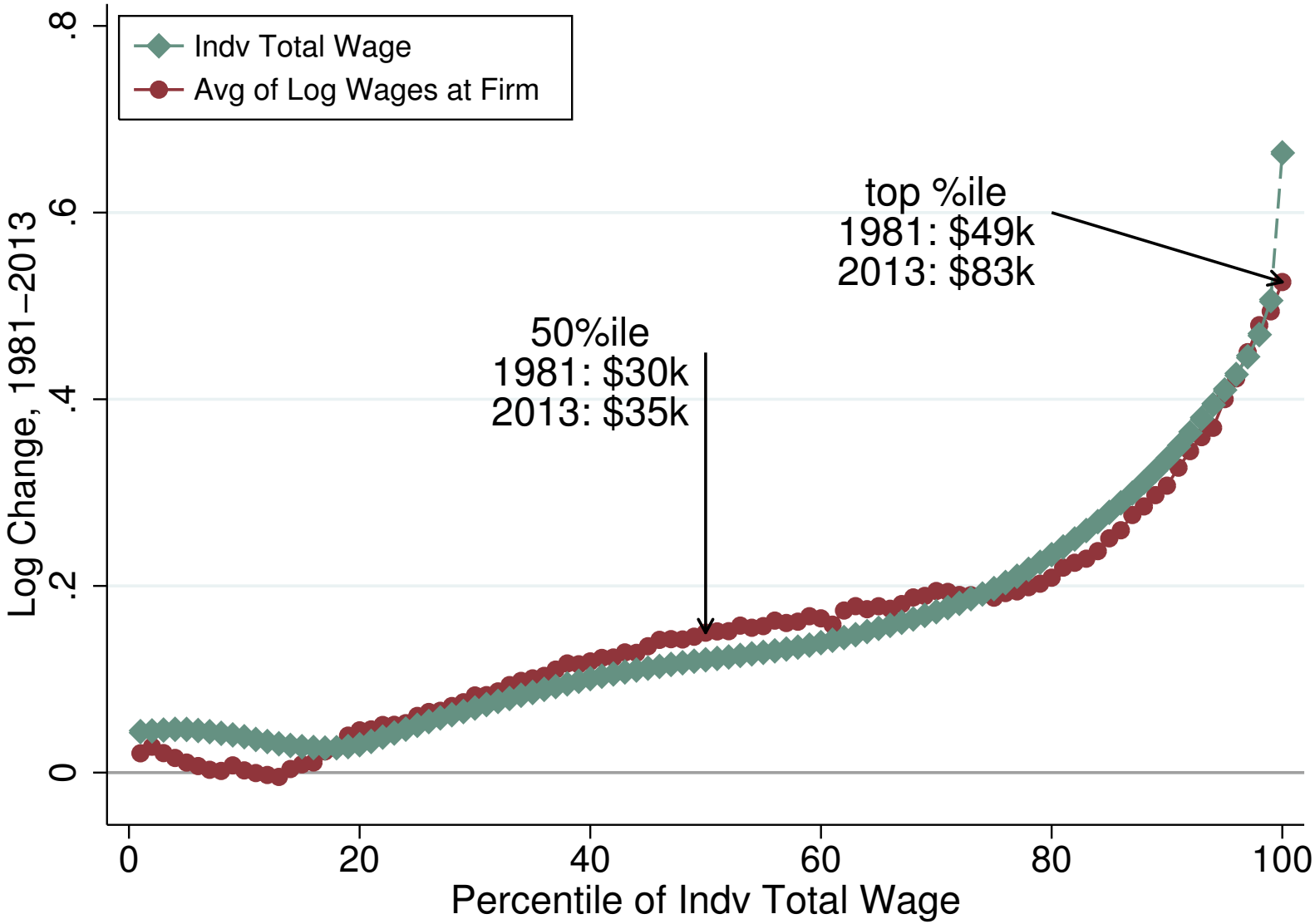
- Then compute the average of average log pay across all employers in the group

Wage Inequality: **Between Firms**



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Wage Inequality: **Within Firms**

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ROBUSTNESS

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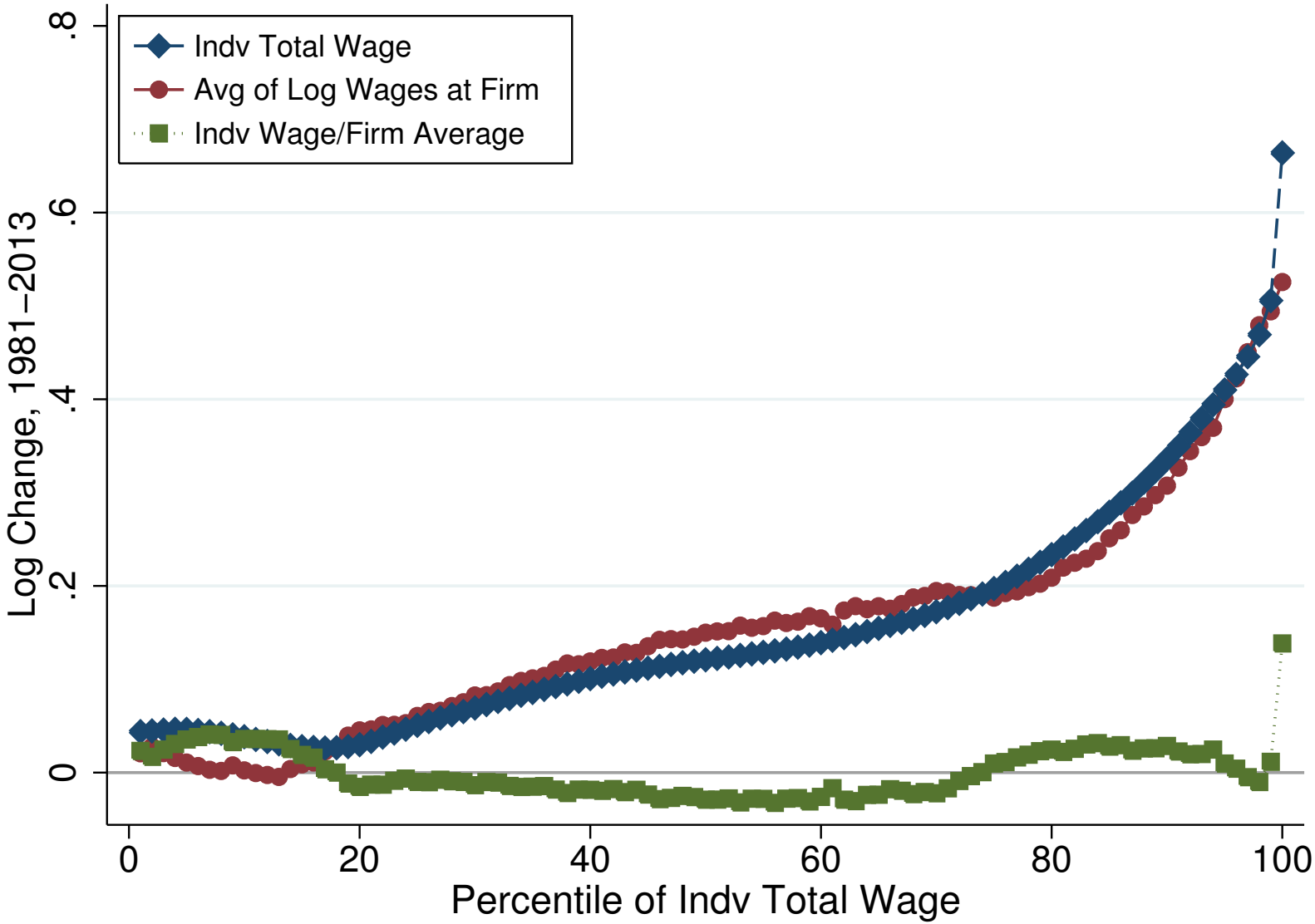

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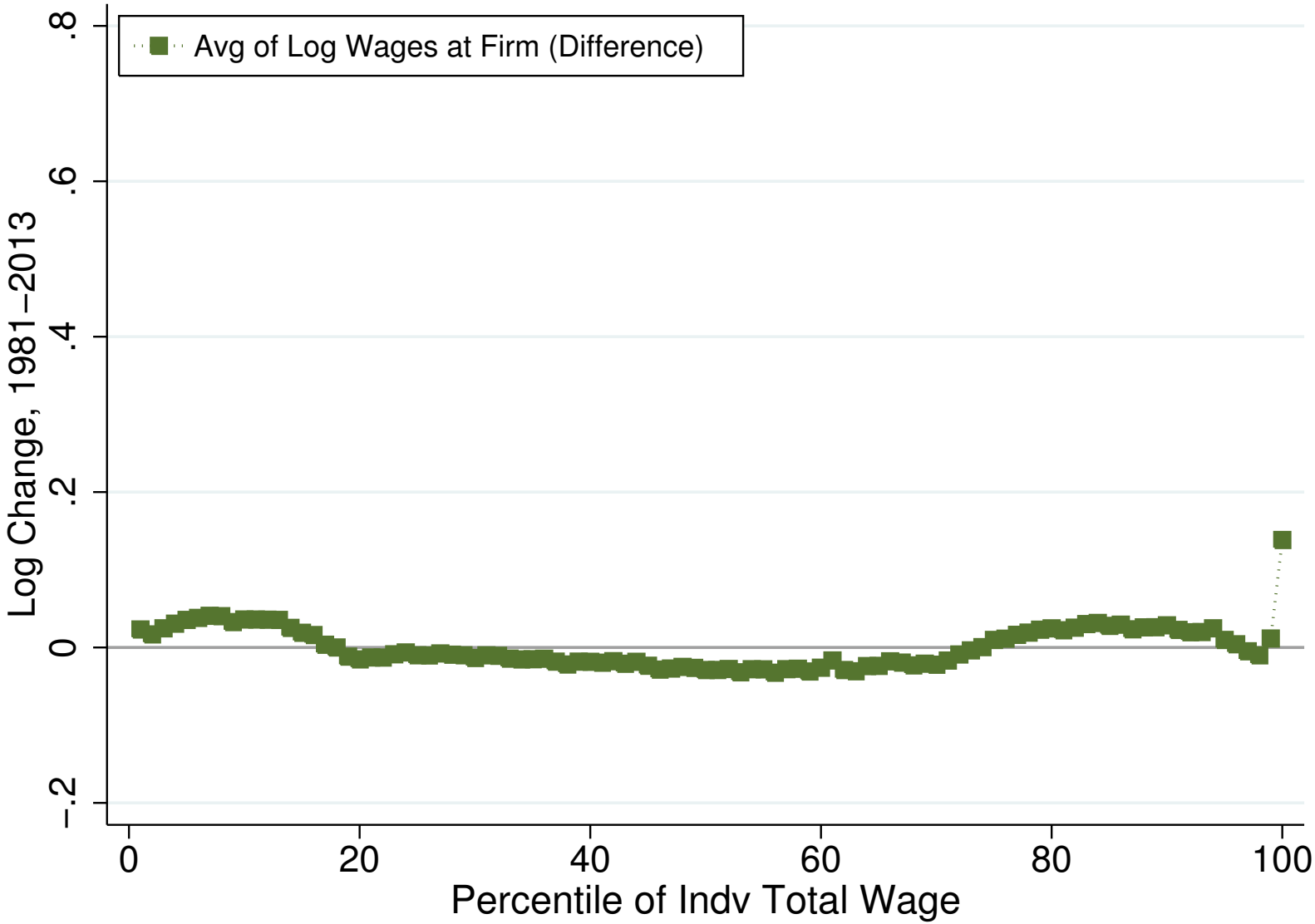
Many Measures of Firm Pay



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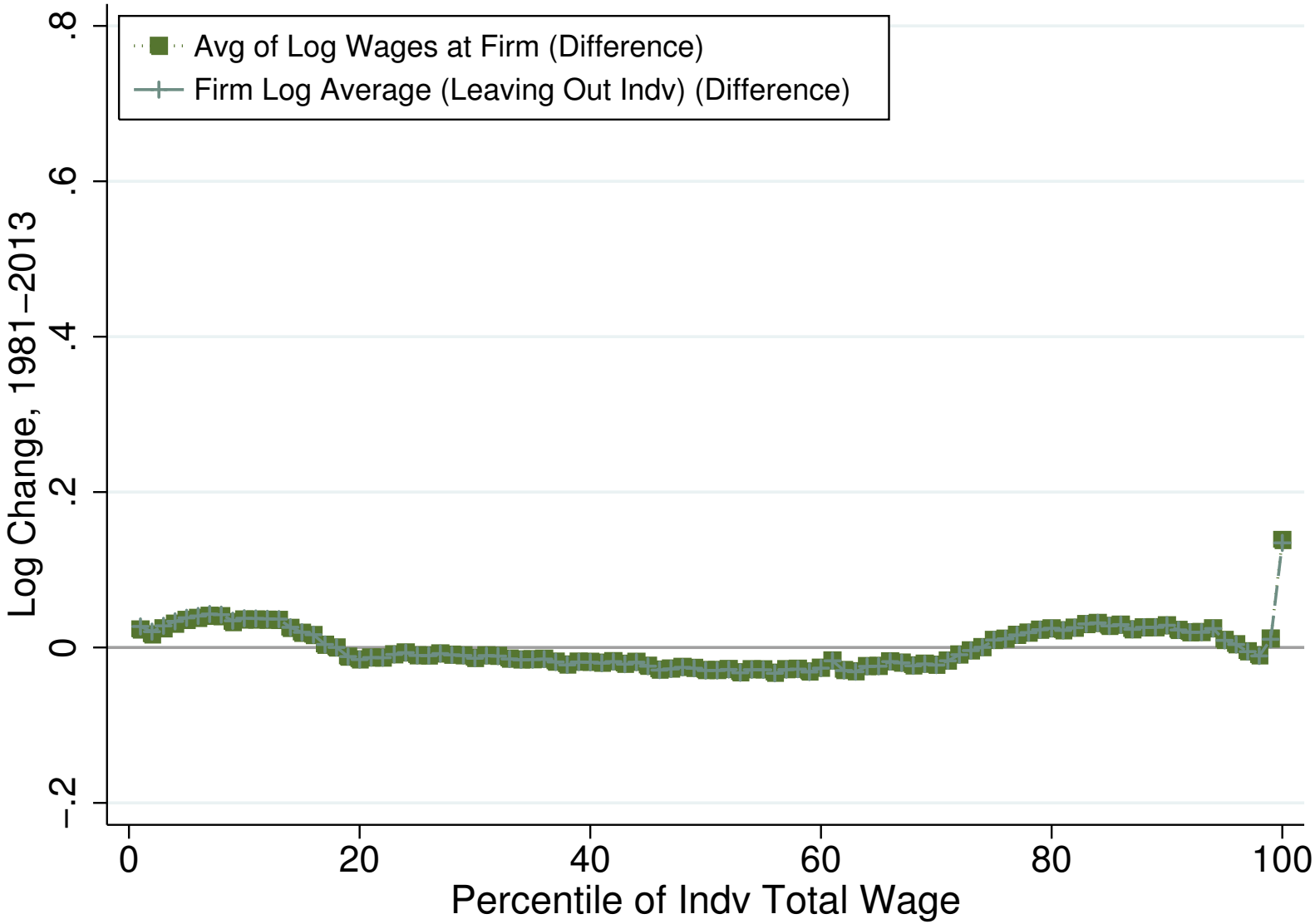

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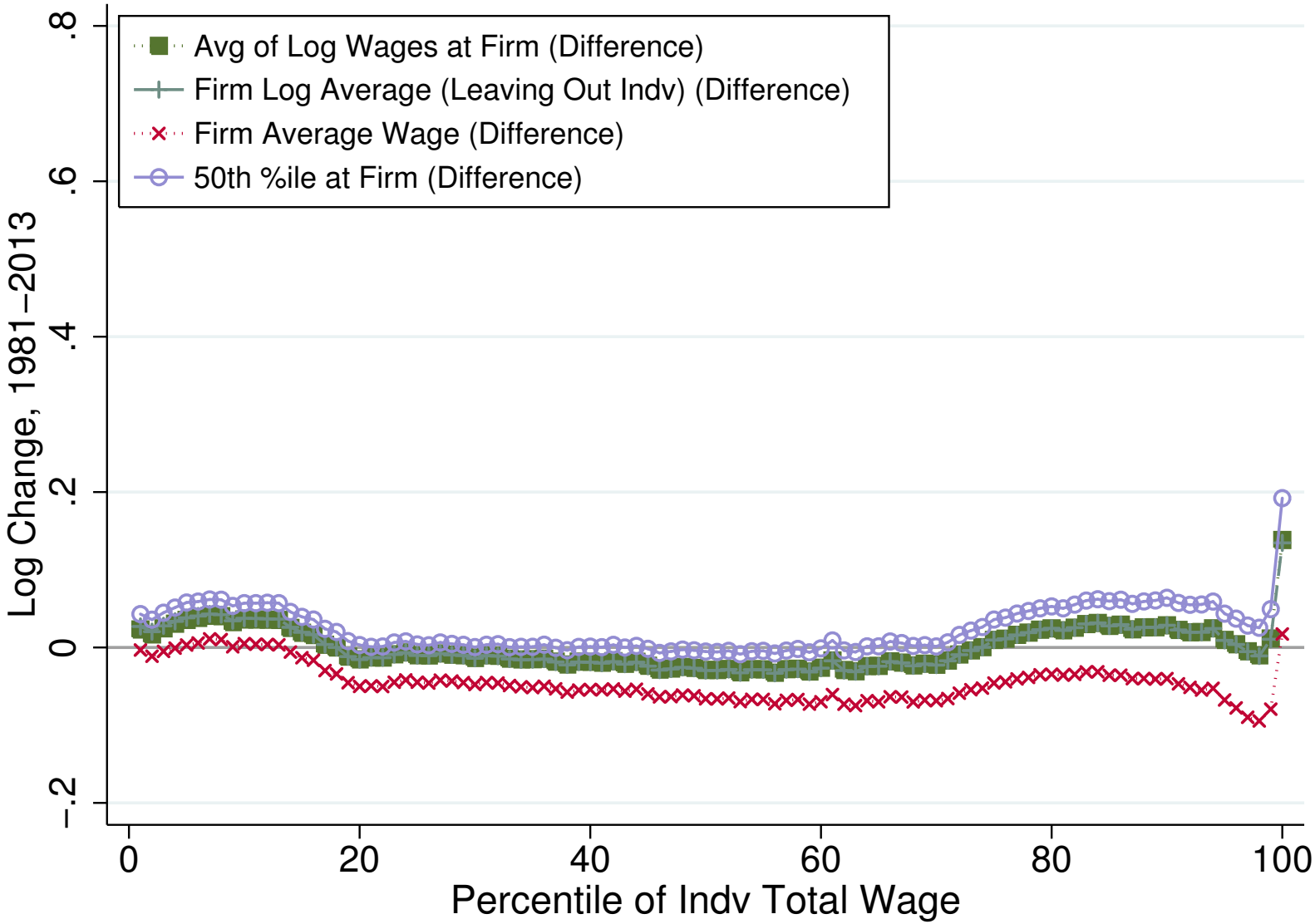

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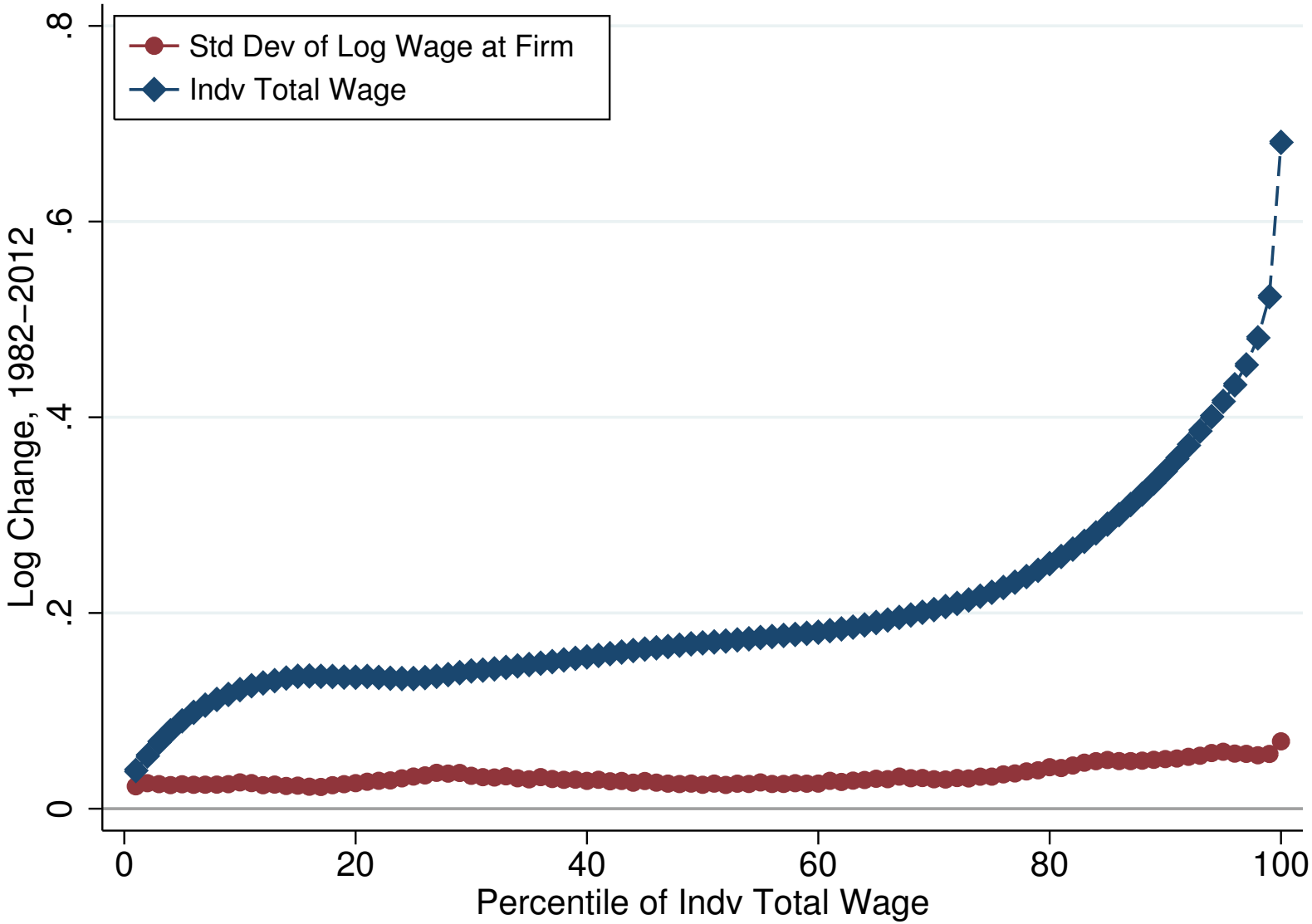

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Robustness: *Frac. Going to Bottom 95%*

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Individual Industries

Wage Inequality: Controlling for (4-Digit SIC) Industry

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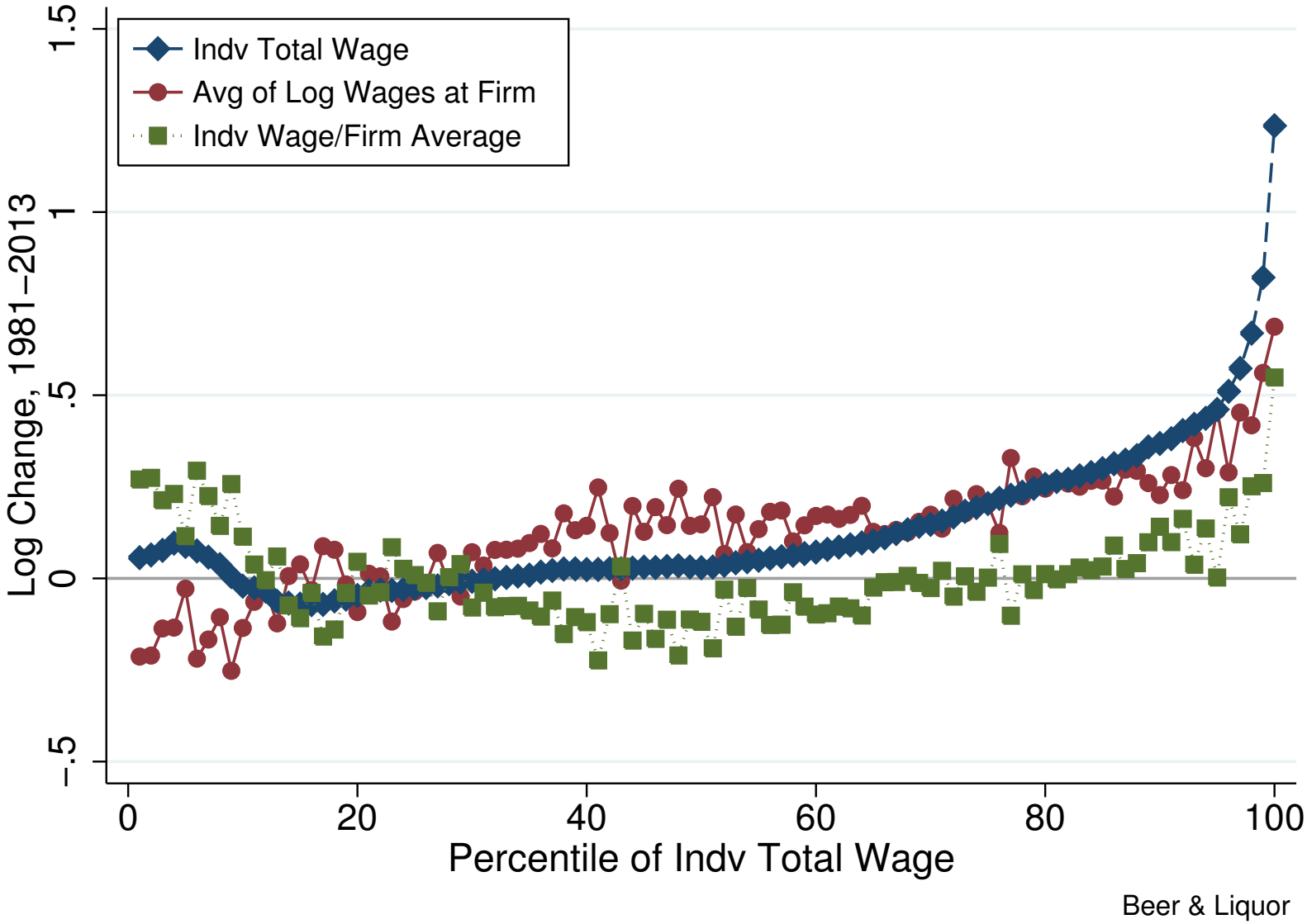
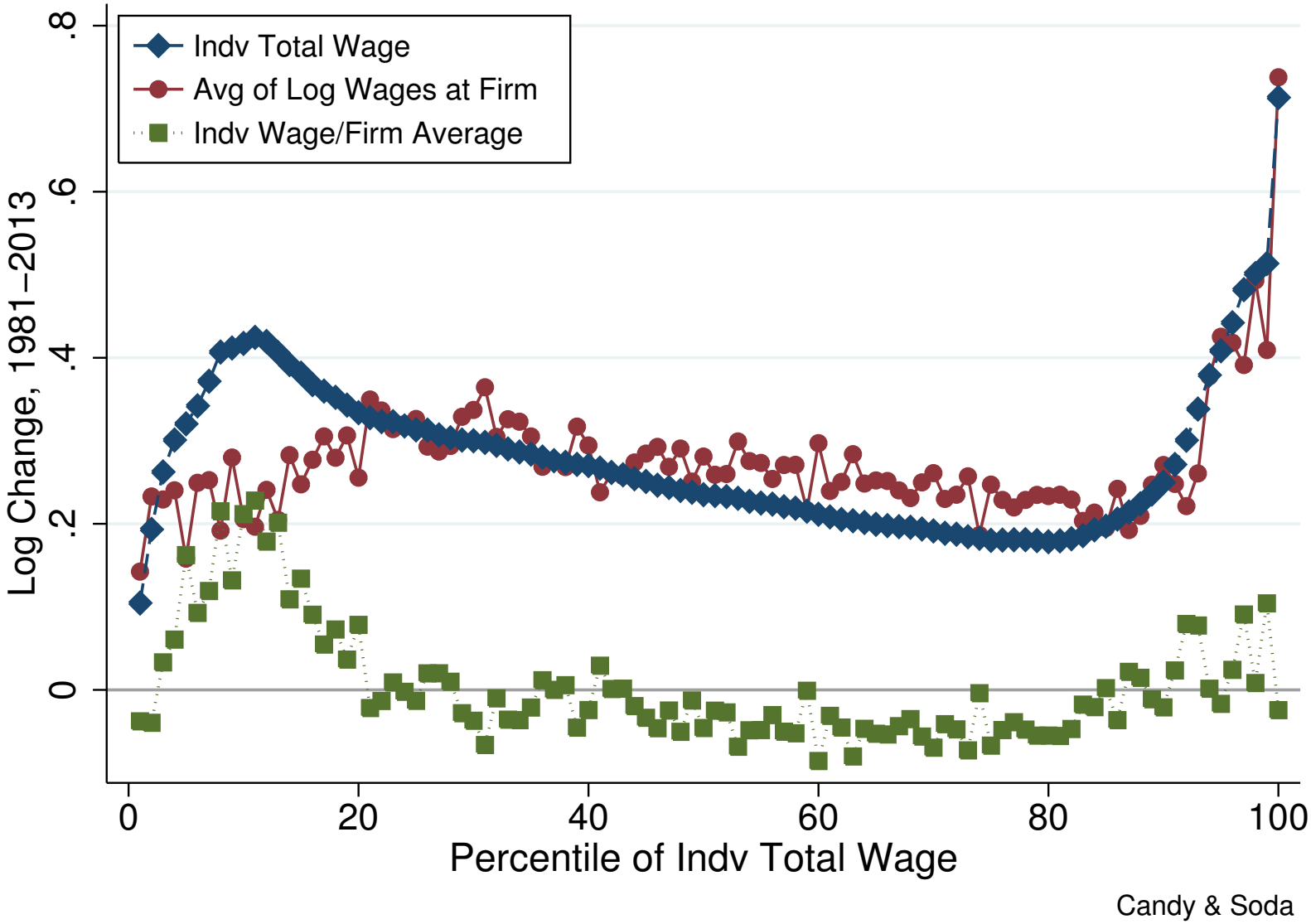
Fama-French Industries: **Beer and Liquor**



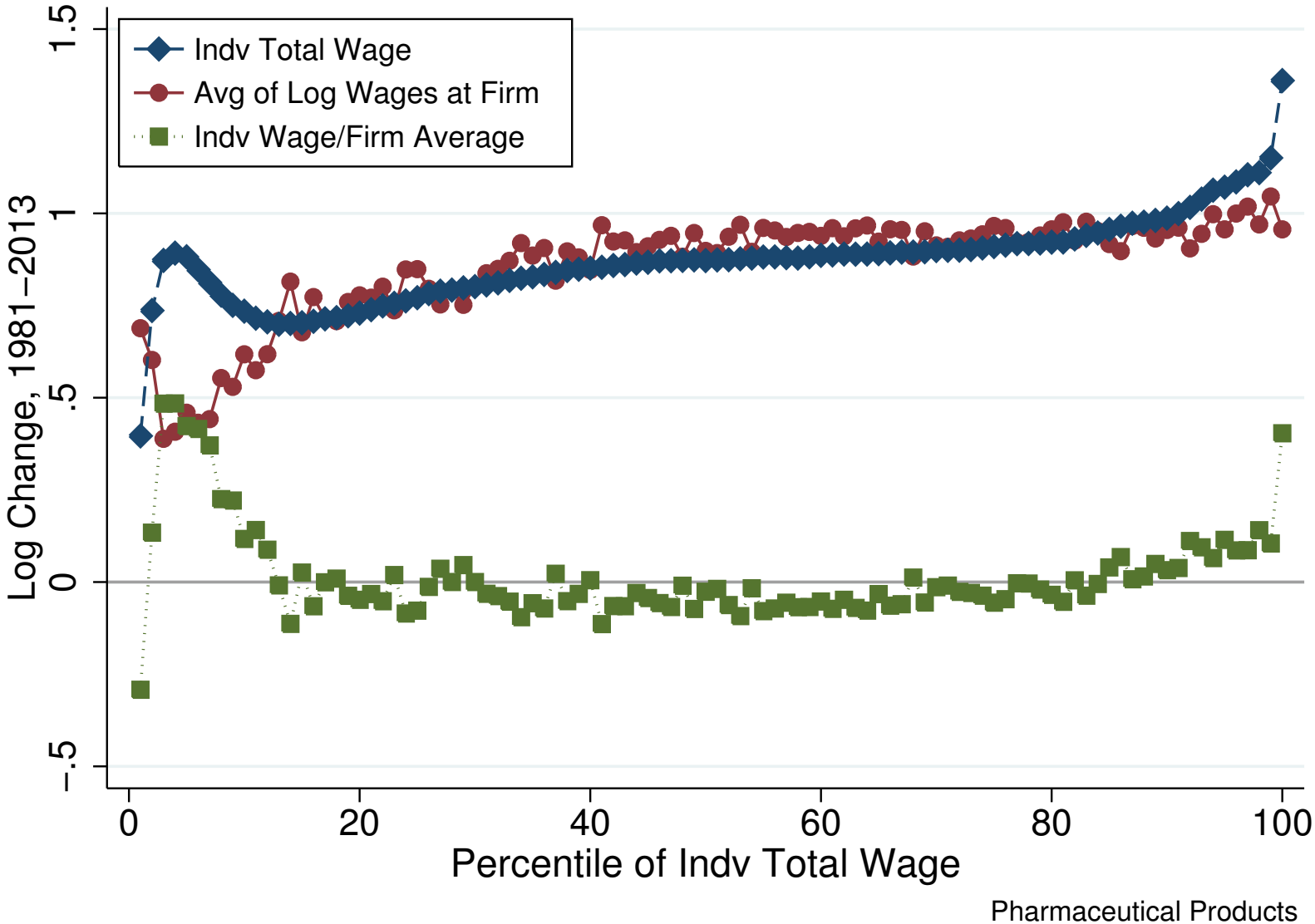
*Note: Sample contains an average of **65,660** workers in 1981 and 2013.*

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



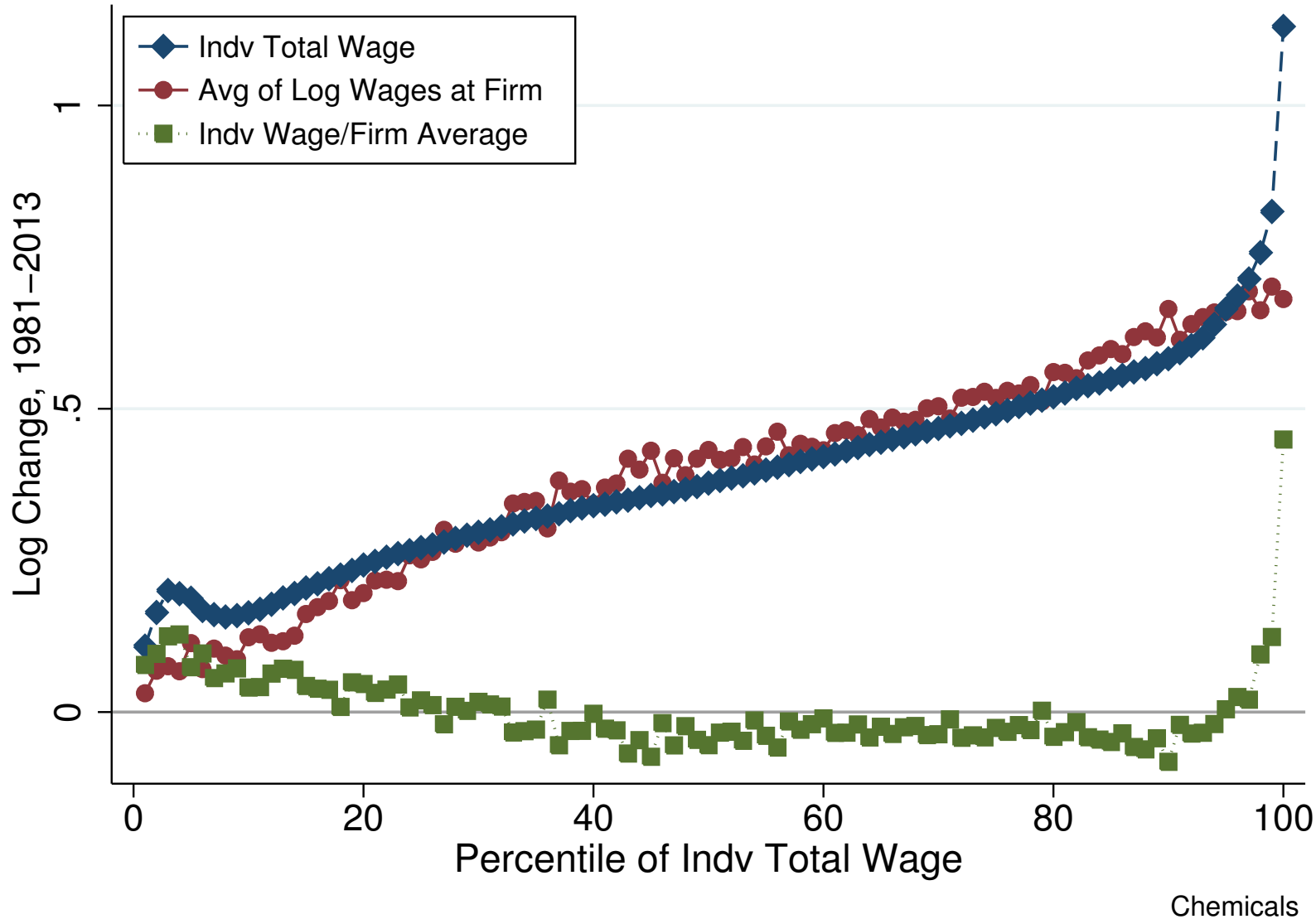
*Note: Sample contains an average of **193,000** workers in 1981 and 2013.*

Fama-French Industries: **Pharmaceuticals**



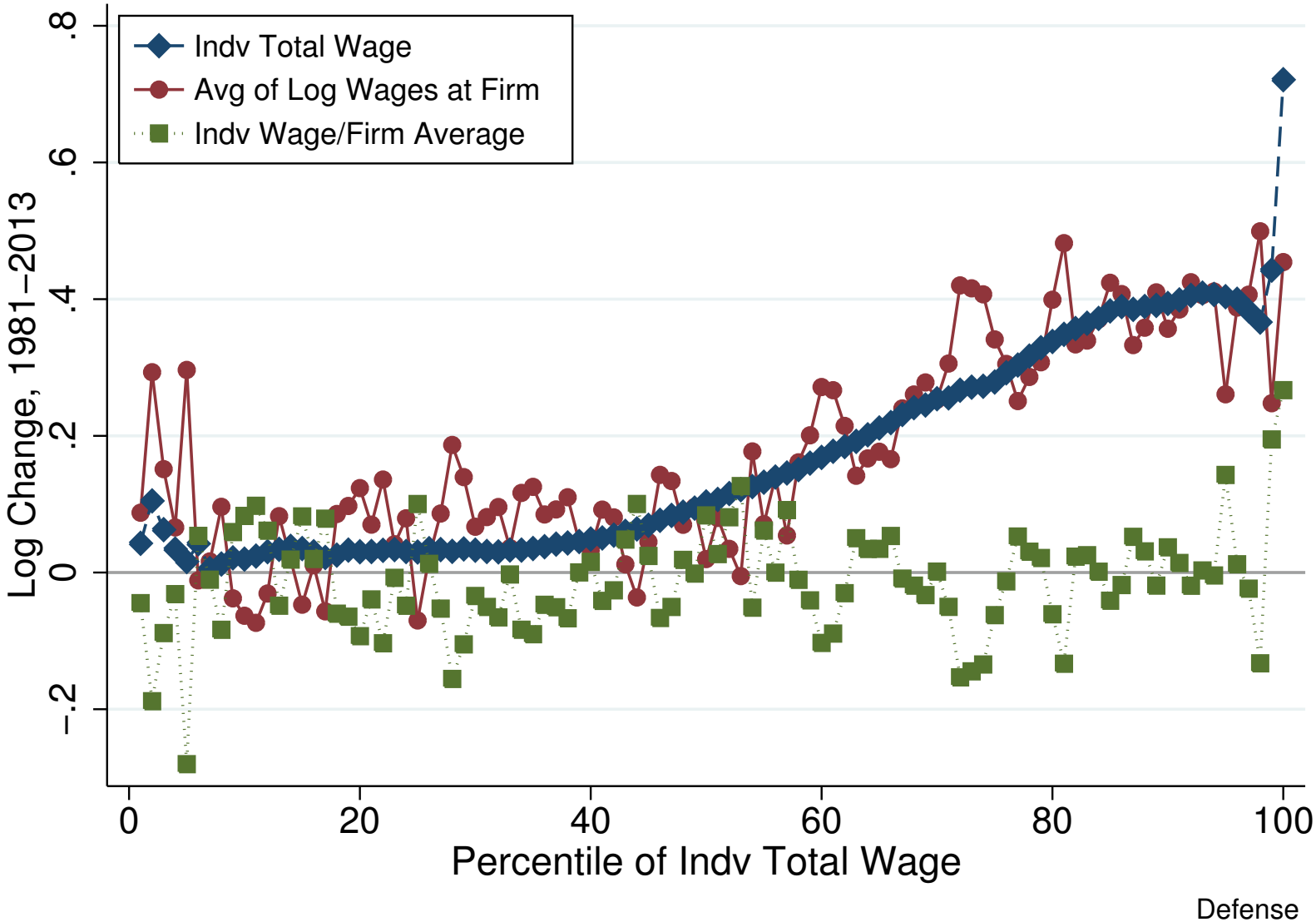
*Note: Sample contains an average of **140,650** workers in 1981 and 2013.*

Fama-French Industries: **Chemicals**



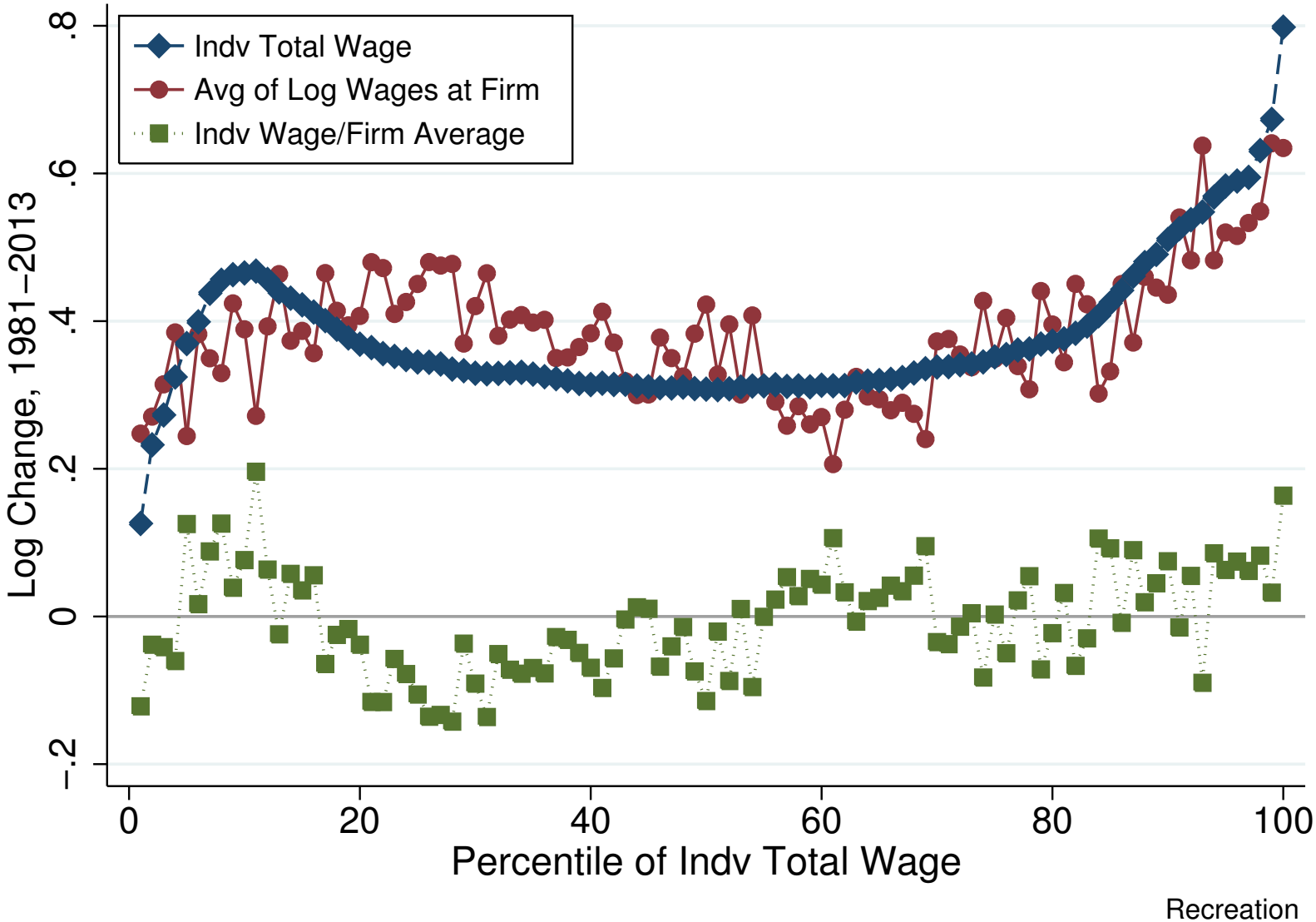
Note: Sample contains an average of 644,660 workers in 1981 and 2013.

Fama-French Industries: **Defense**



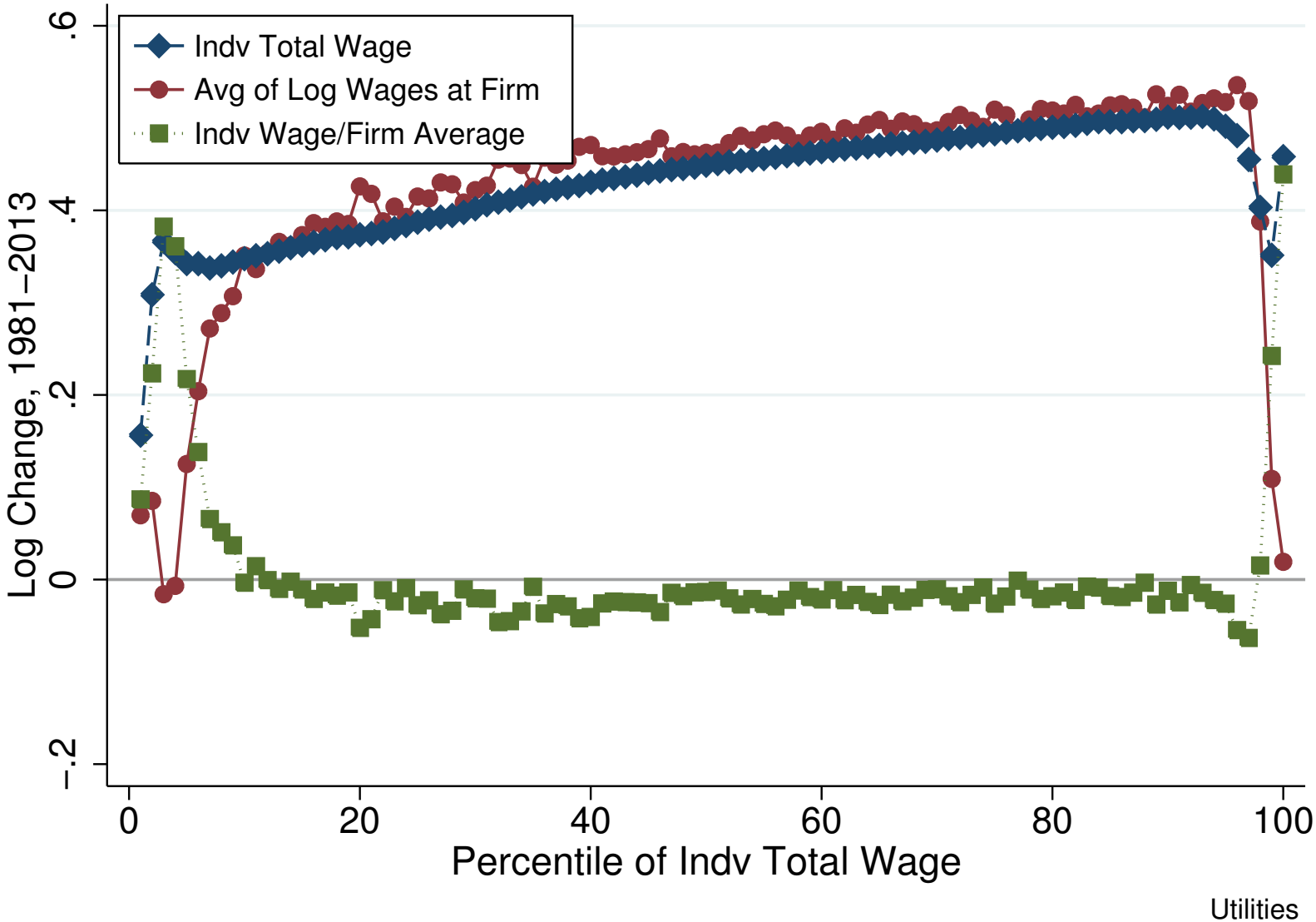
*Note: Sample contains an average of **74,350** workers in 1981 and 2013.*

Fama-French Industries: **Recreation**



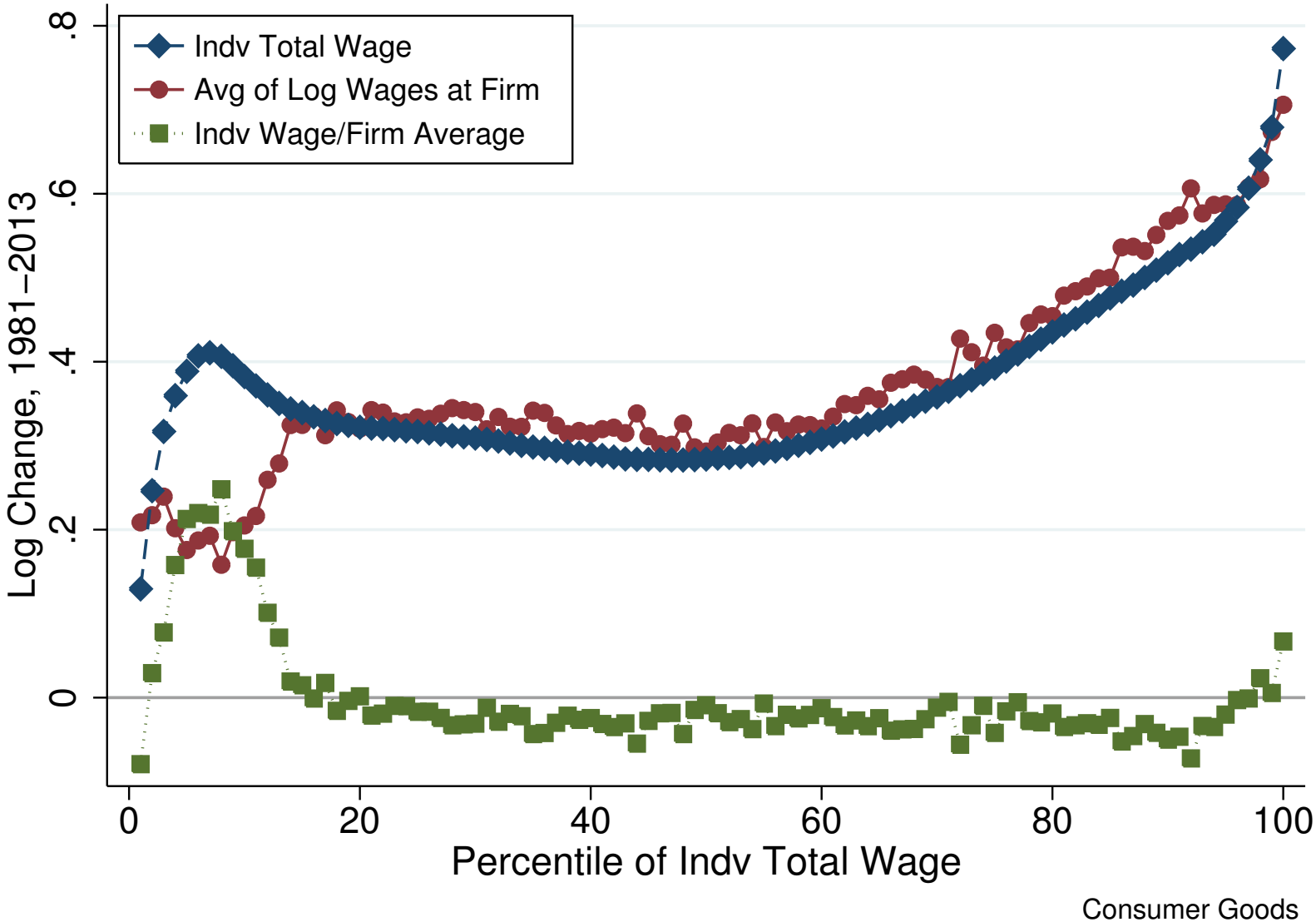
Note: Sample contains an average of 142,200 workers in 1981 and 2013.

Fama-French Industries: **Utilities**



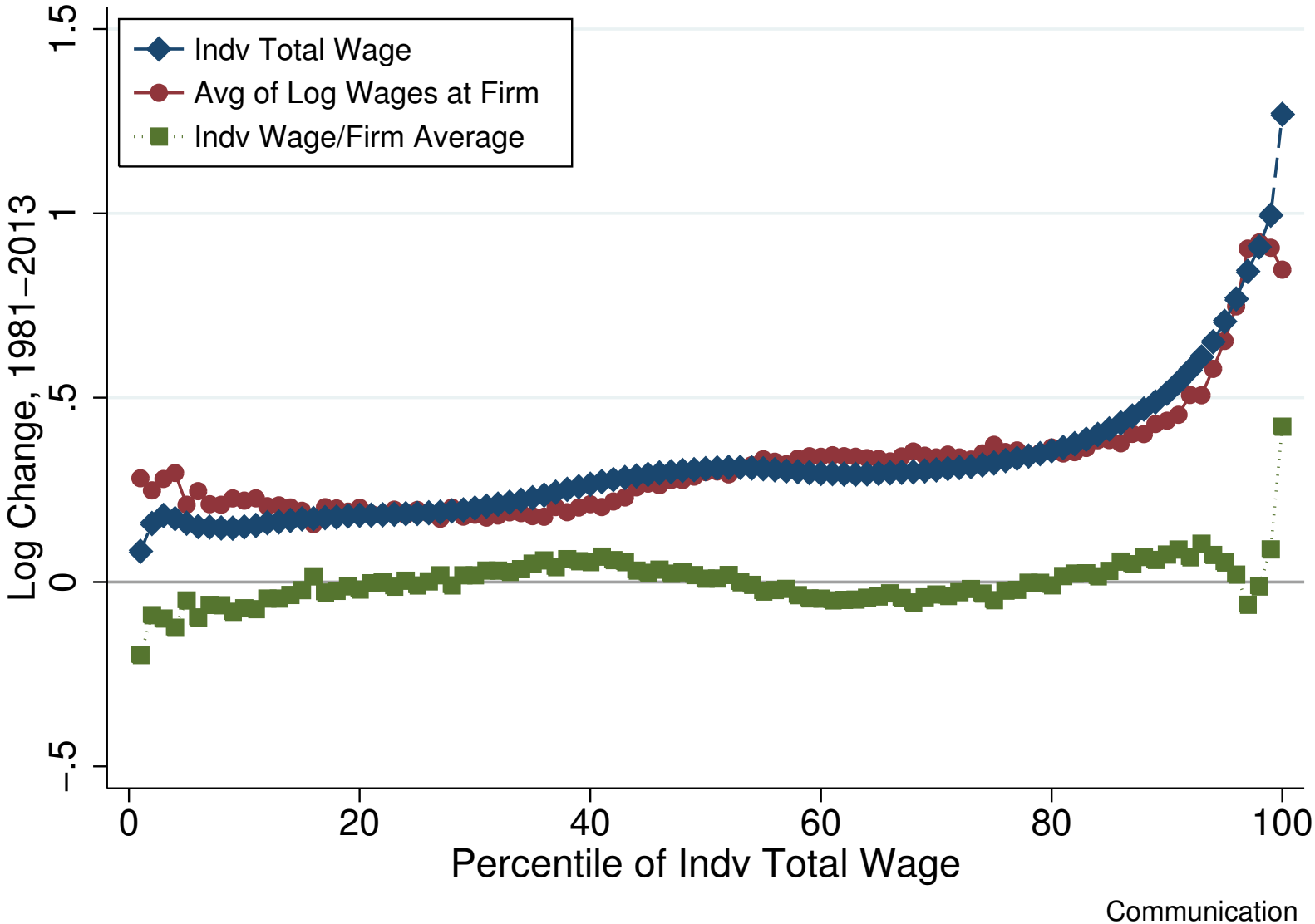
Note: Sample contains an average of 703,320 workers in 1981 and 2013.

Fama-French Industries: **Consumer Goods**



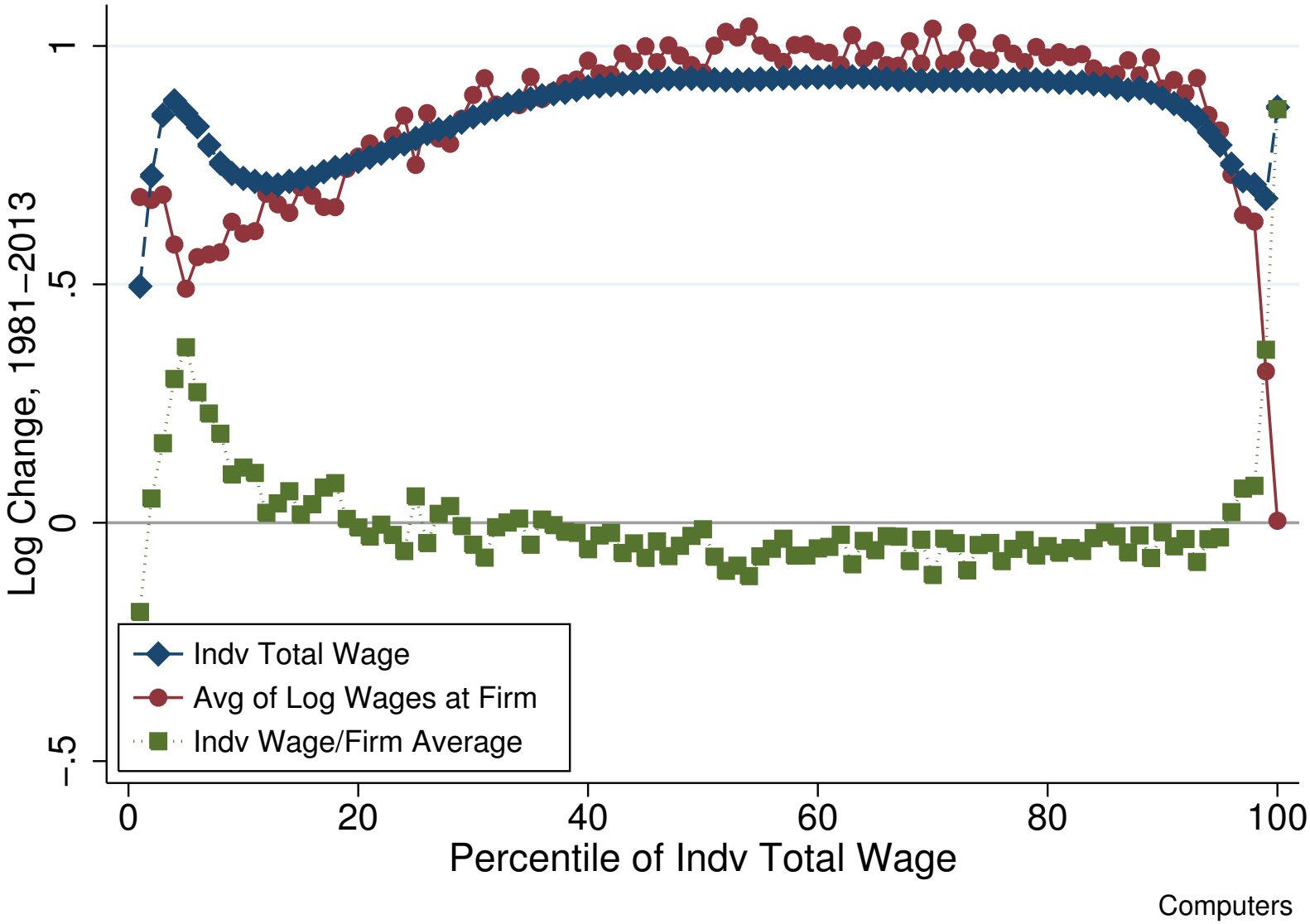
*Note: Sample contains an average of **1,699,270** workers in 1981 and 2013.*

Fama-French Industries: **Communication**



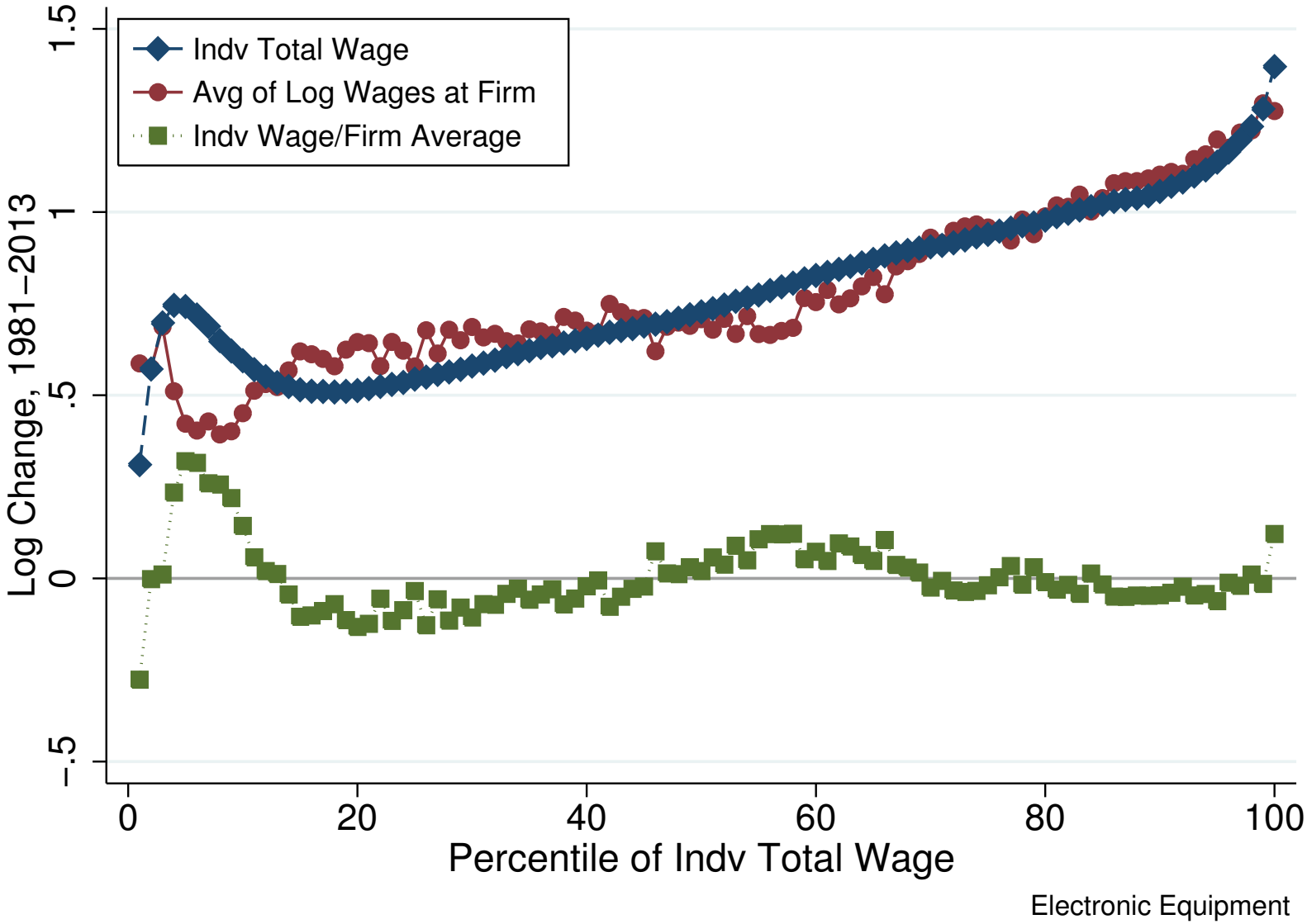
*Note: Sample contains an average of **951,920** workers in 1981 and 2013.*

Fama-French Industries: **Computers**



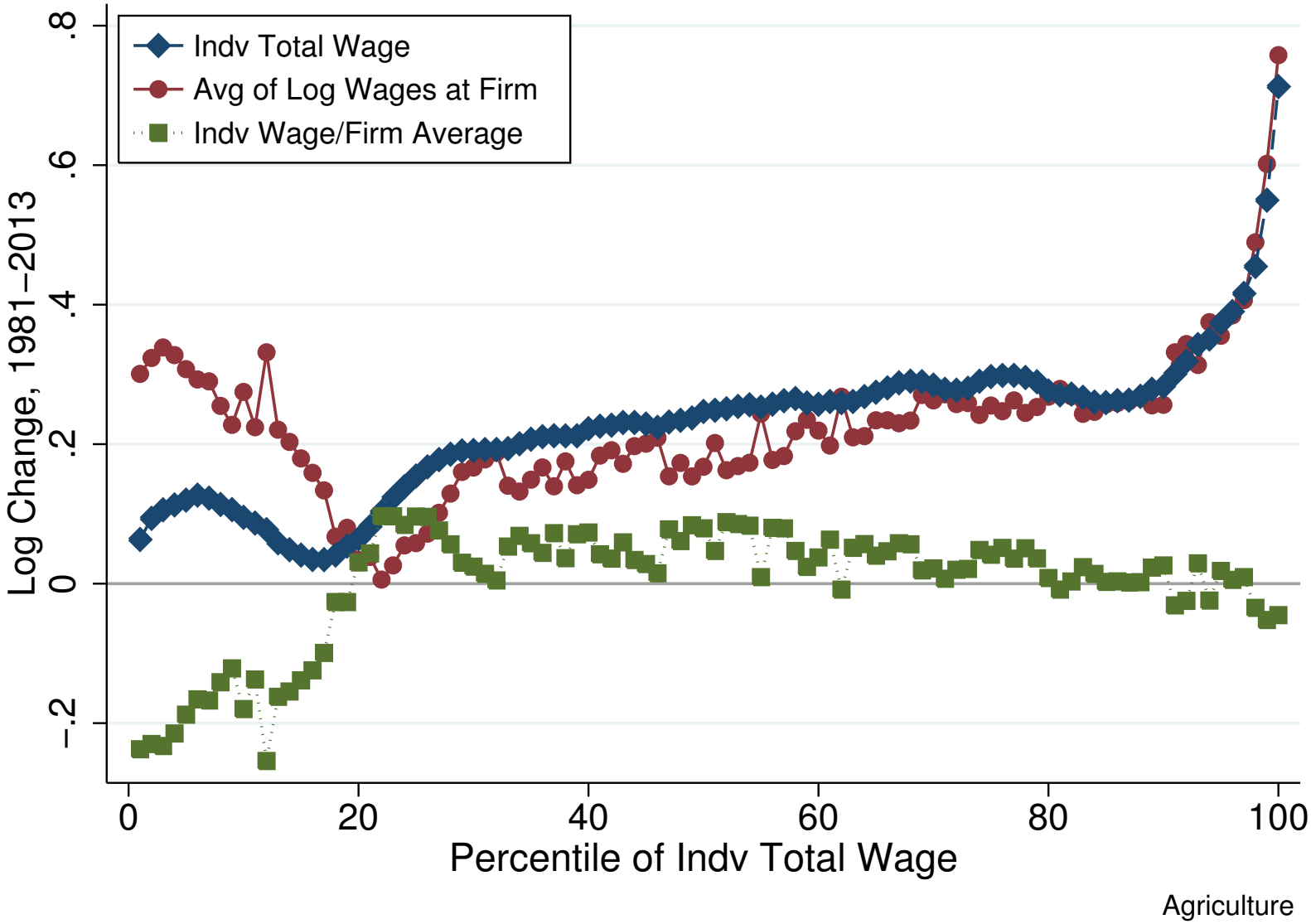
Note: Sample contains an average of 197,520 workers in 1981 and 2013.

Fama-French Industries: **Electronic Equipment**



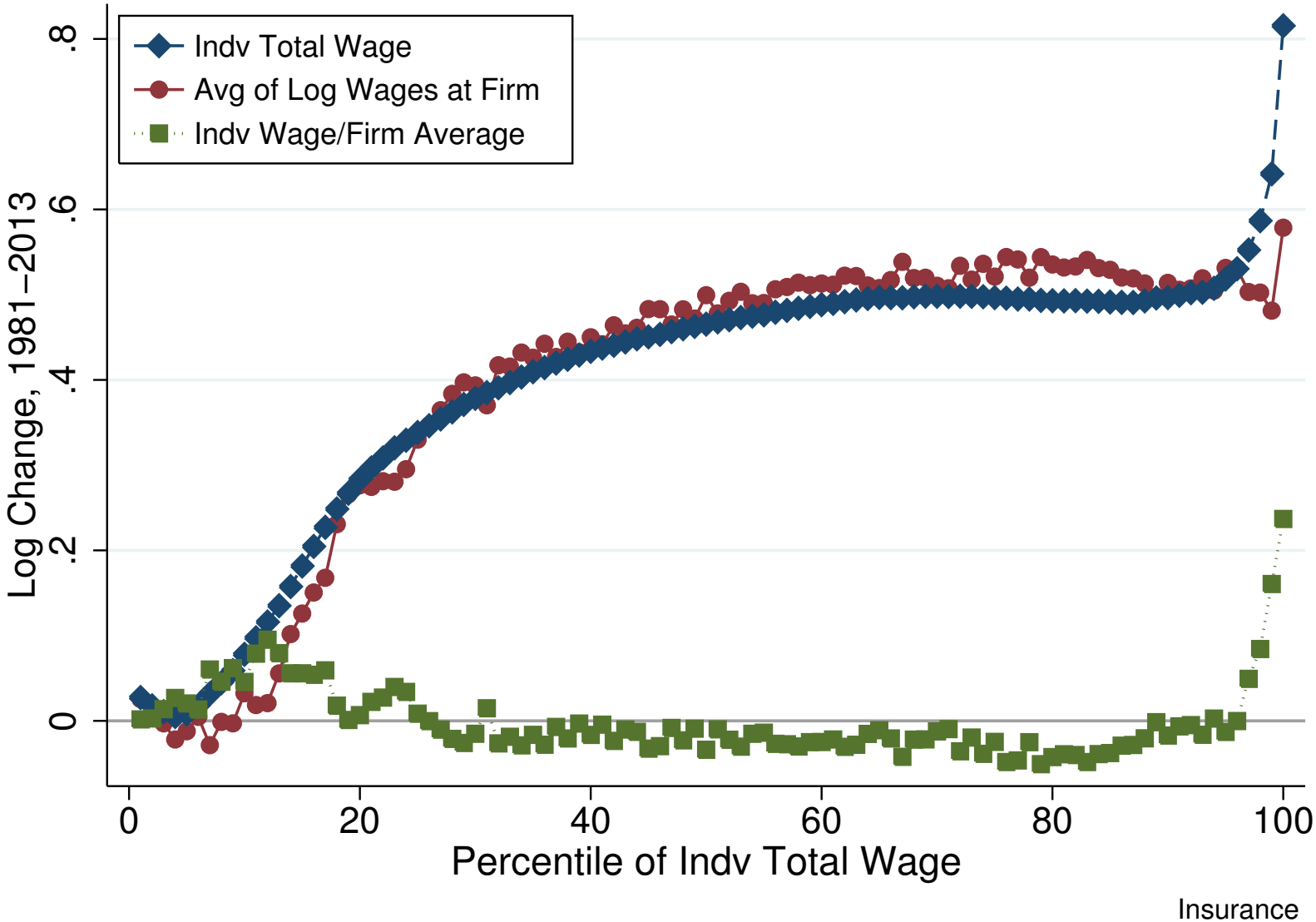
Note: Sample contains an average of 407,150 workers in 1981 and 2013.

Fama-French Industries: **Agriculture**



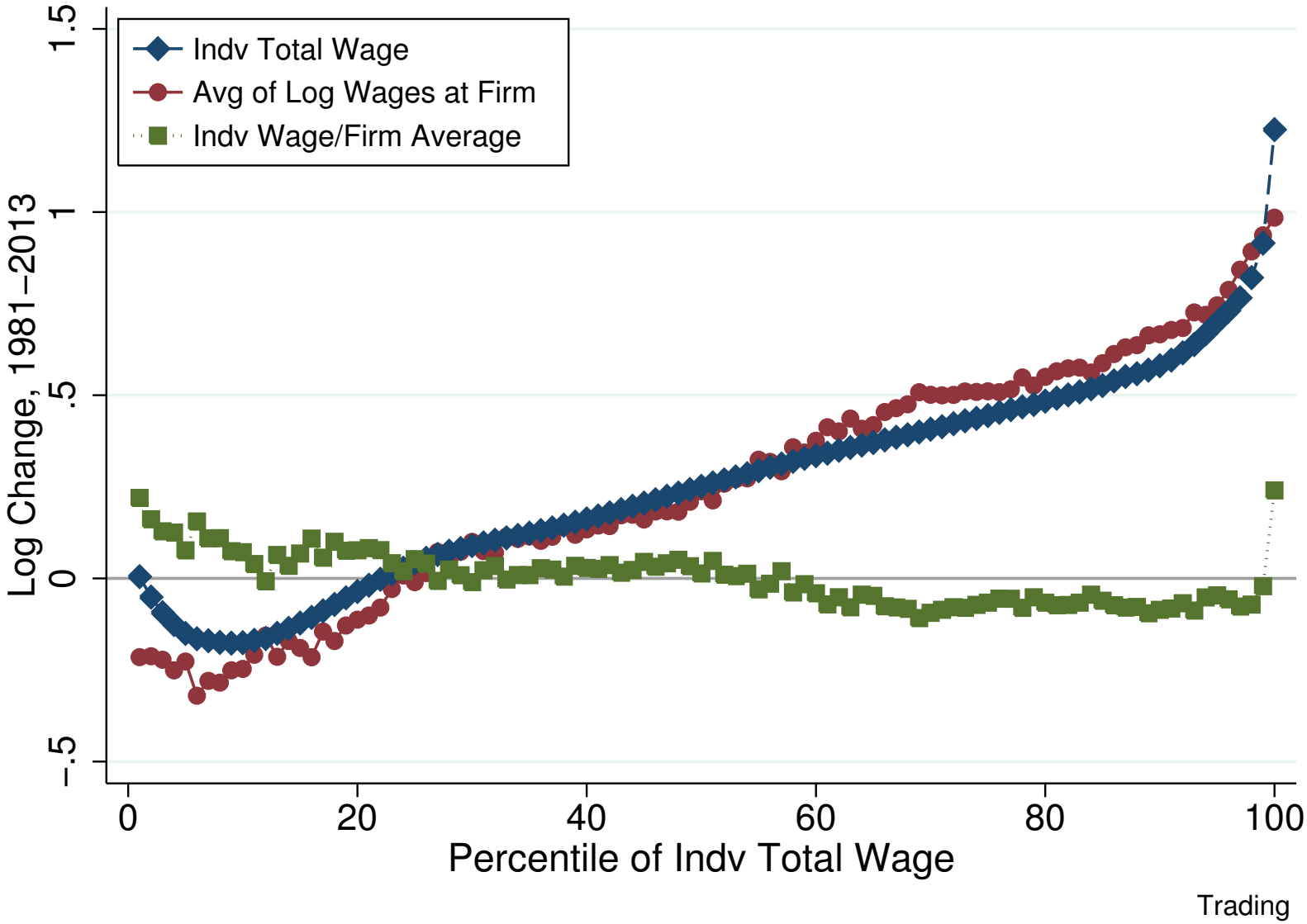
*Note: Sample contains an average of **931,380** workers in 1981 and 2013.*

Fama-French Industries: **Insurance**



*Note: Sample contains an average of **1,452,050** workers in 1981 and 2013.*

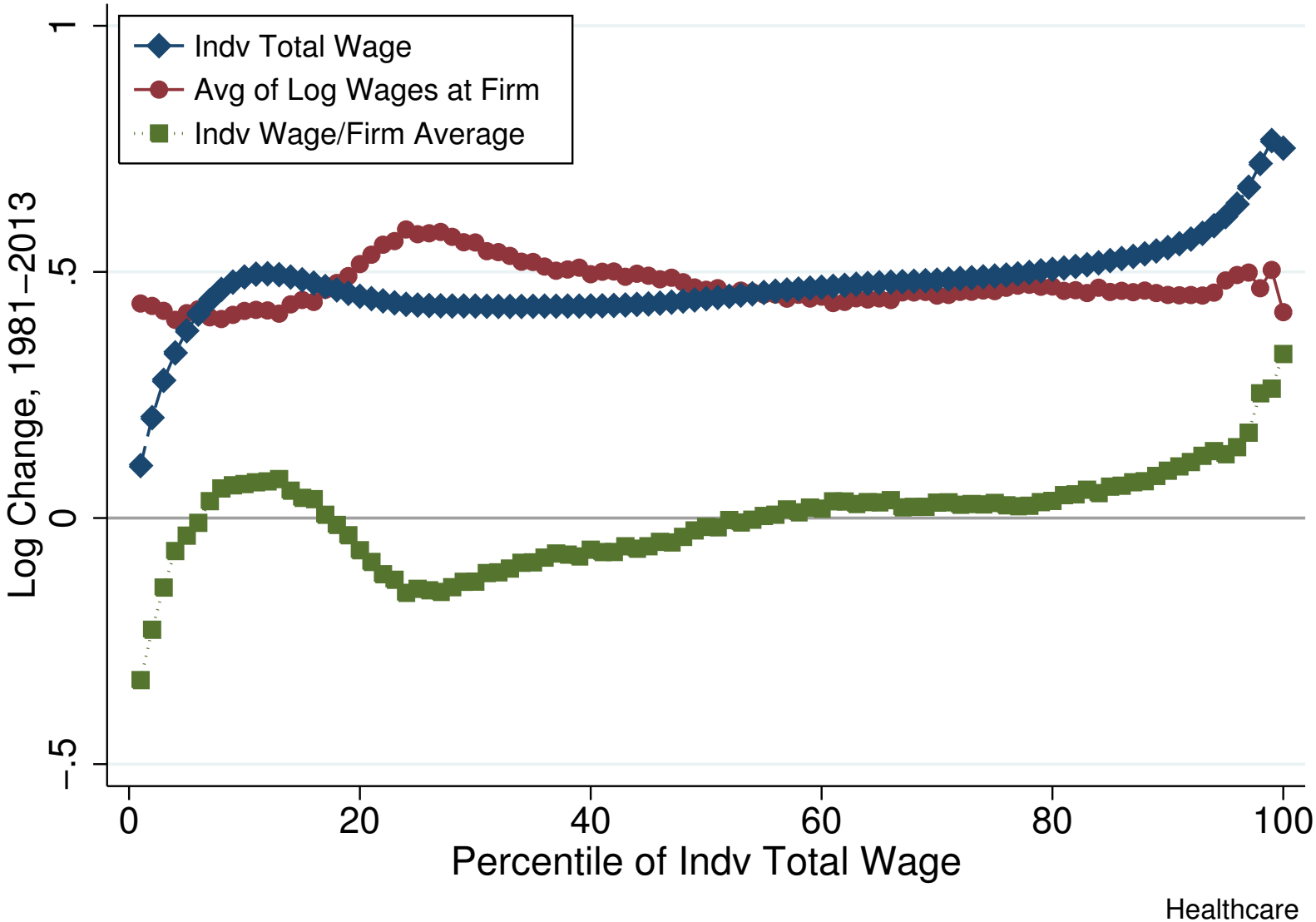
Fama-French Industries: **Trading**



*Note: Sample contains an average of **1,240,390** workers in 1981 and 2013.*

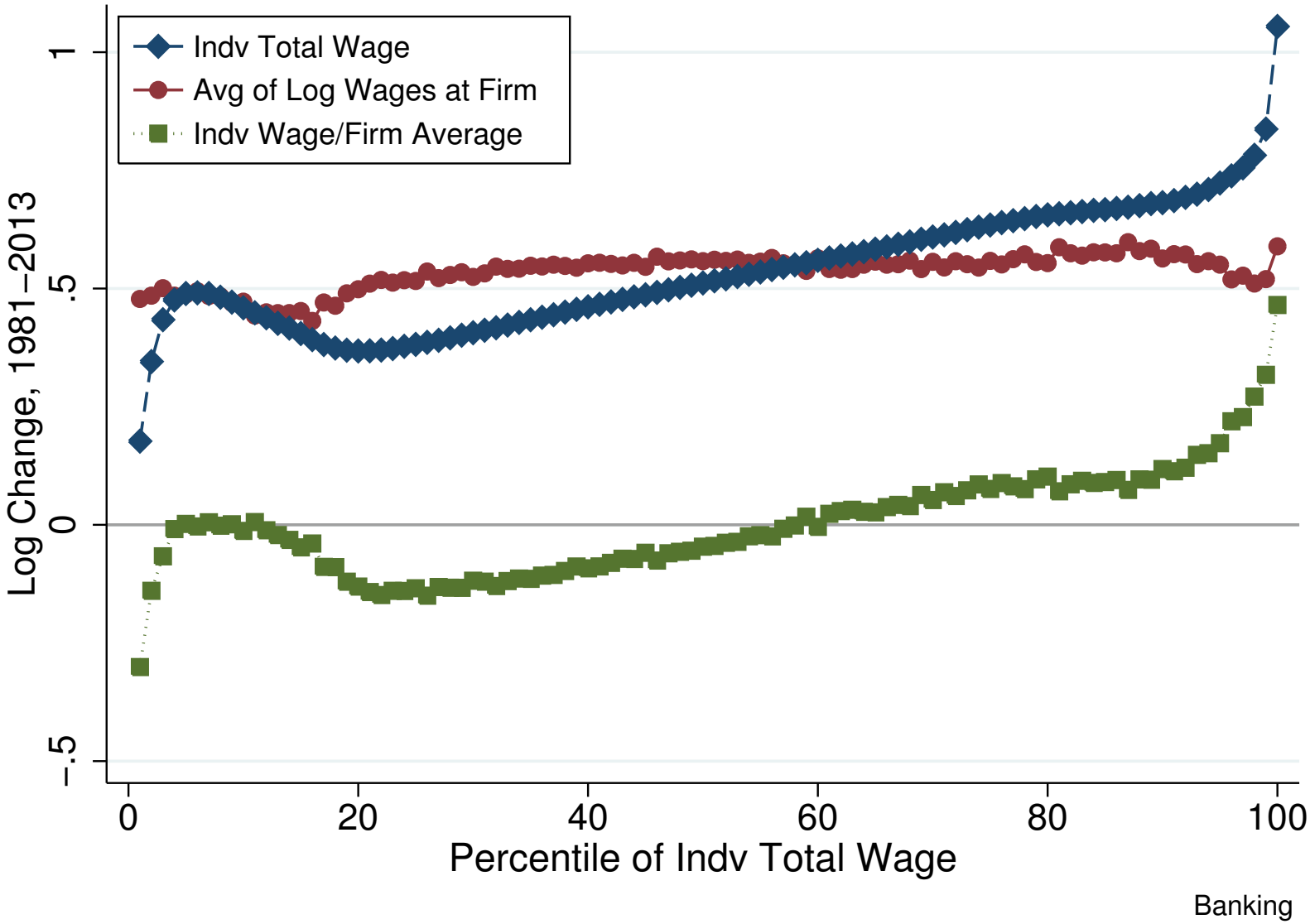
Exceptions

Fama-French Industries: **Healthcare**



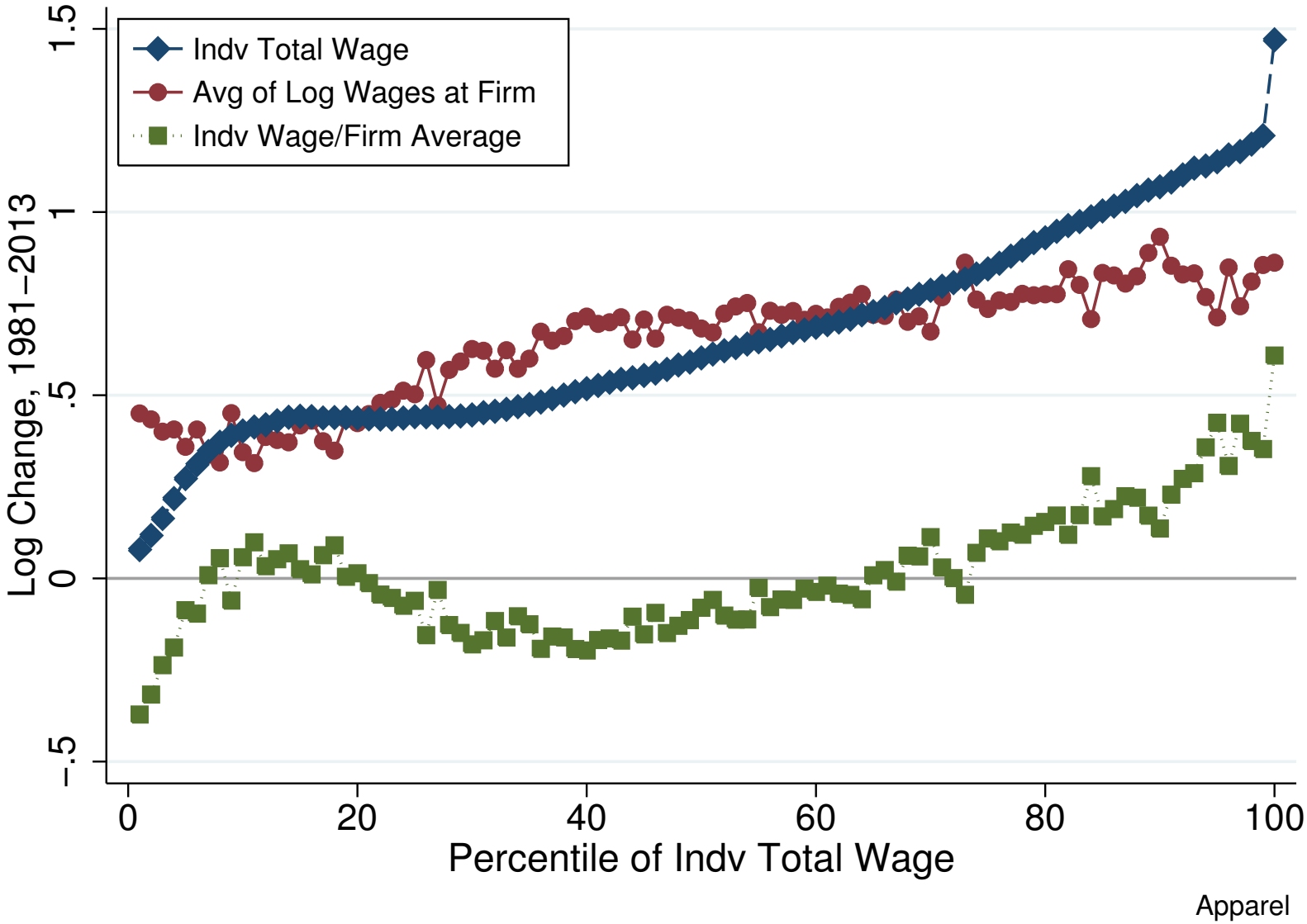
*Note: Sample contains an average of **7,667,800** workers in 1981 and 2013.*

Fama-French Industries: **Banking**



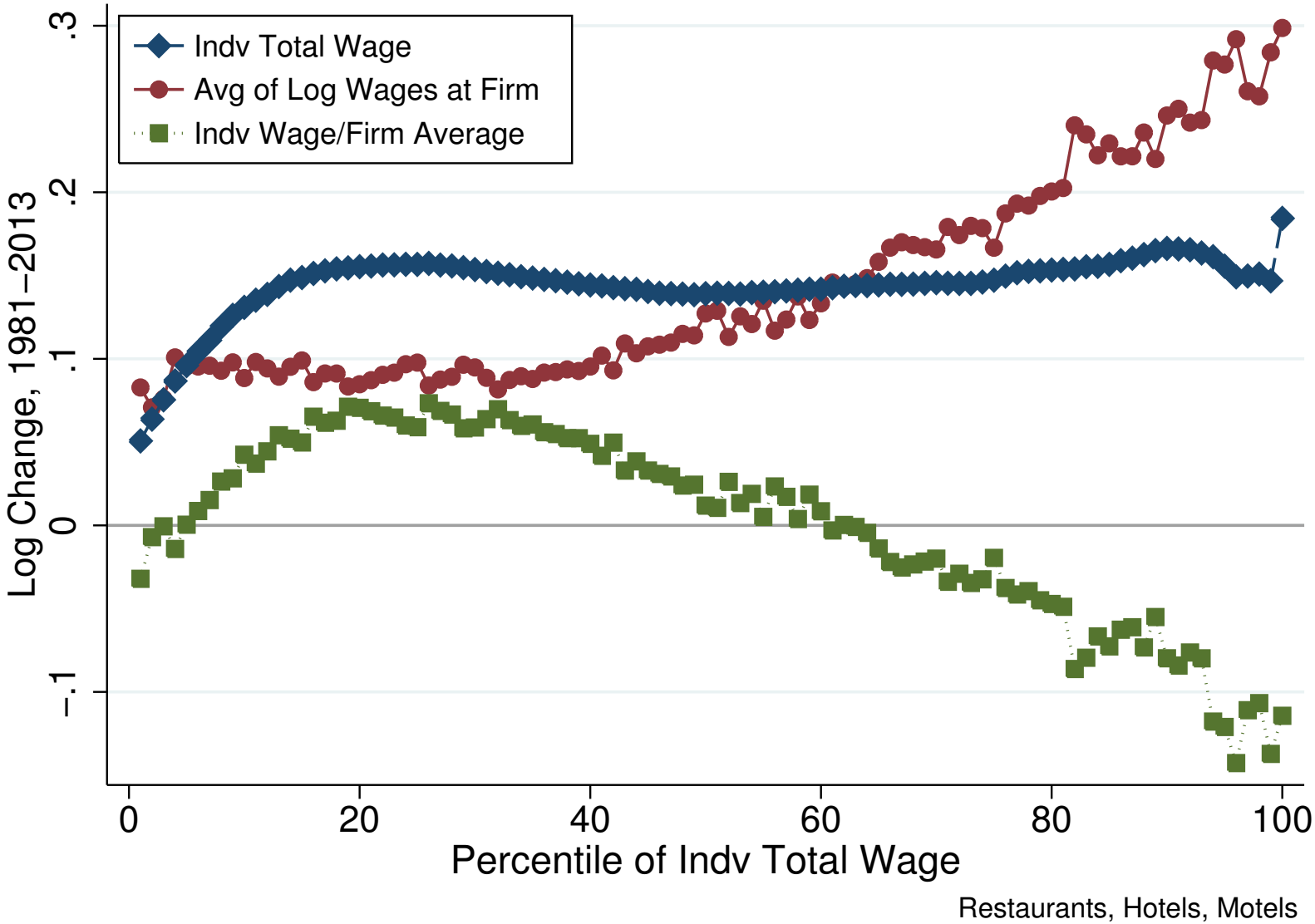
*Note: Sample contains an average of **2,013,760** workers in 1981 and 2013.*

Fama-French Industries: **Apparel**



Note: Sample contains an average of 606,320 workers in 1981 and 2013.

Fama-French Industries: **Hotels & Restaurants**



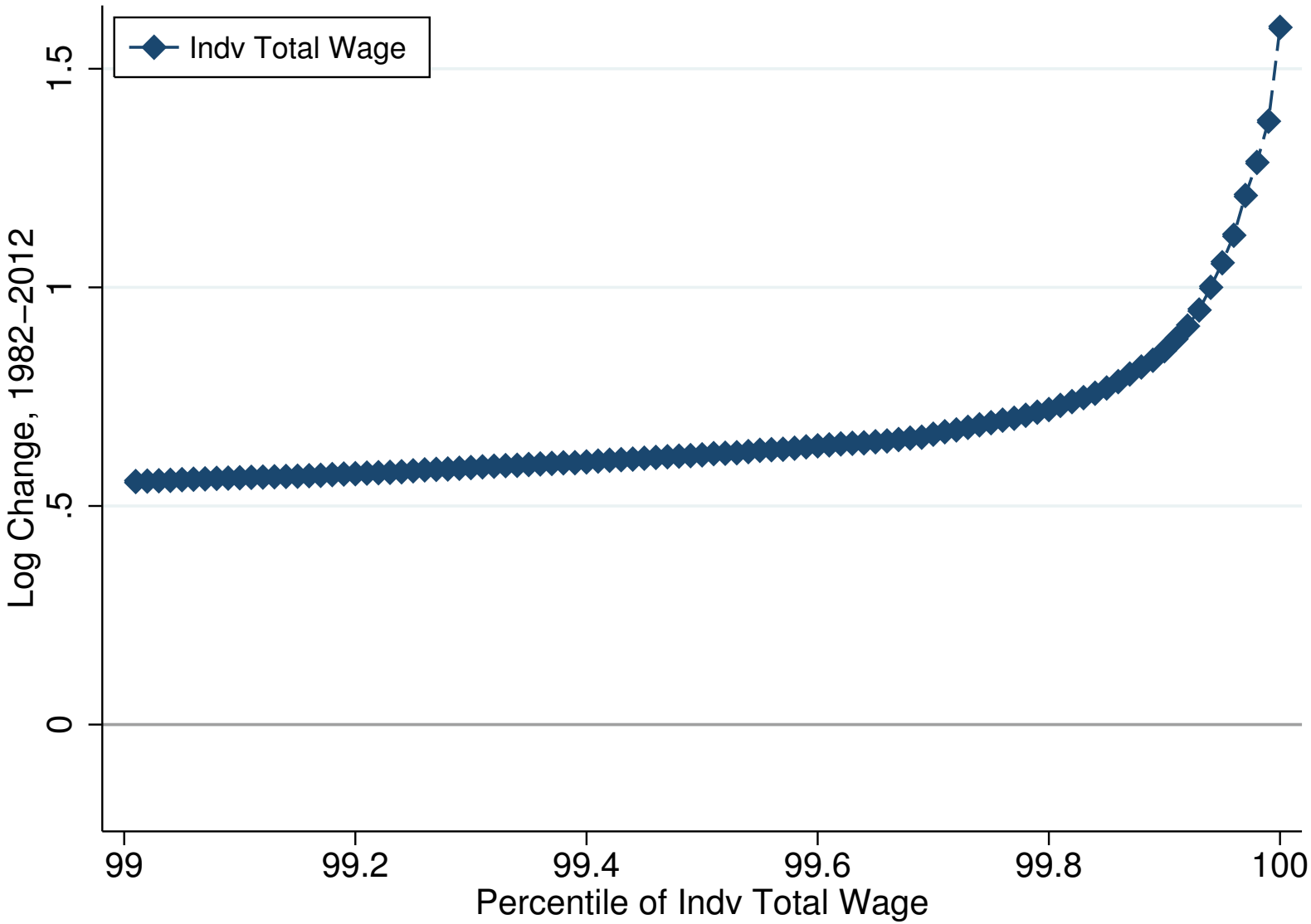
*Note: Sample contains an average of **2,610,400** workers in 1981 and 2013.*

Subgroups: Bottom 99 pct

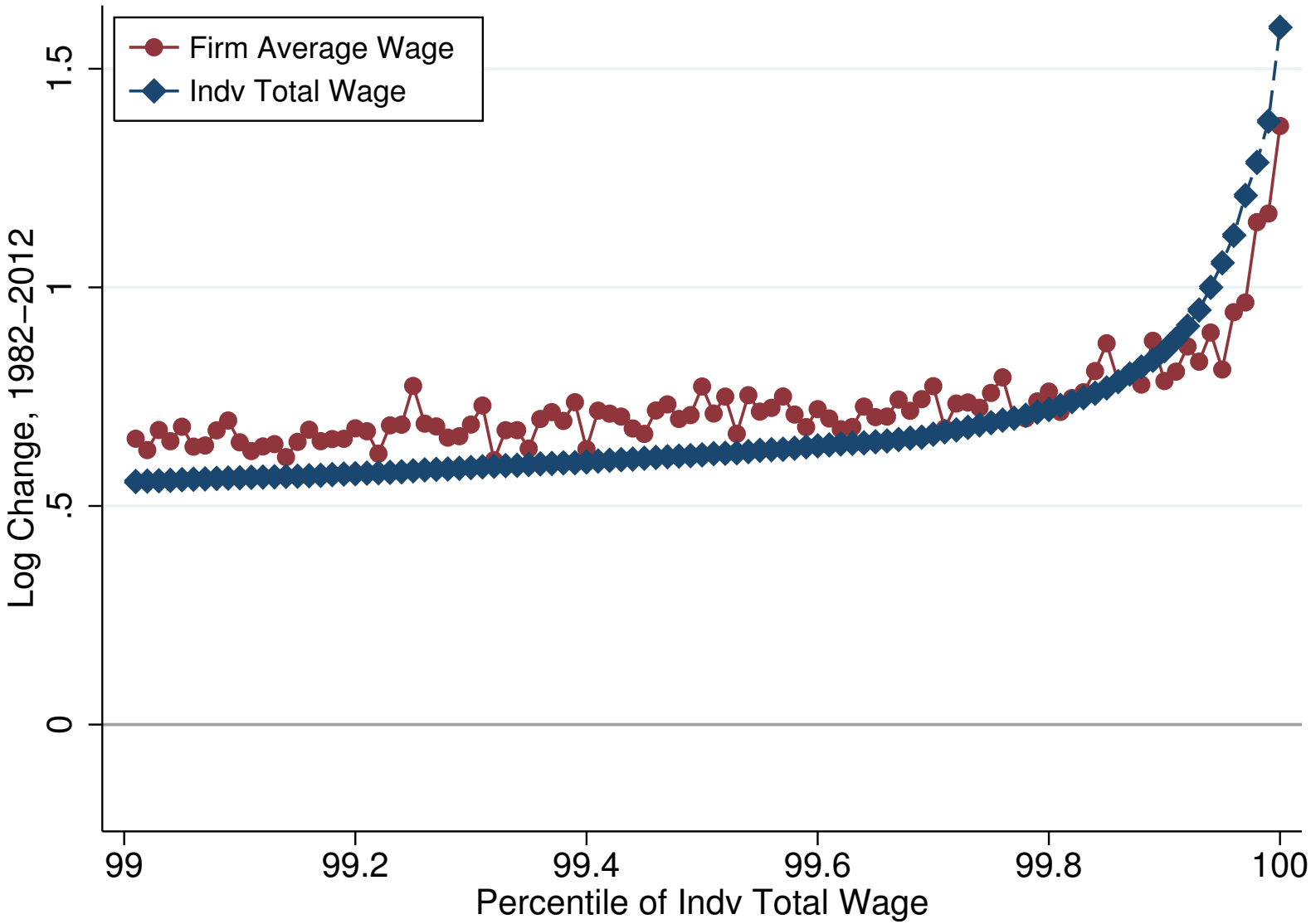
- By Industry: HERE
- By Region: HERE
- By Firm Size: HERE
- By Sex: HERE
- By Age: HERE

RESULTS: TOP 1%

Rise in Top 1% Inequality



Rise in Top 1% Inequality: **Largely Between Firms**



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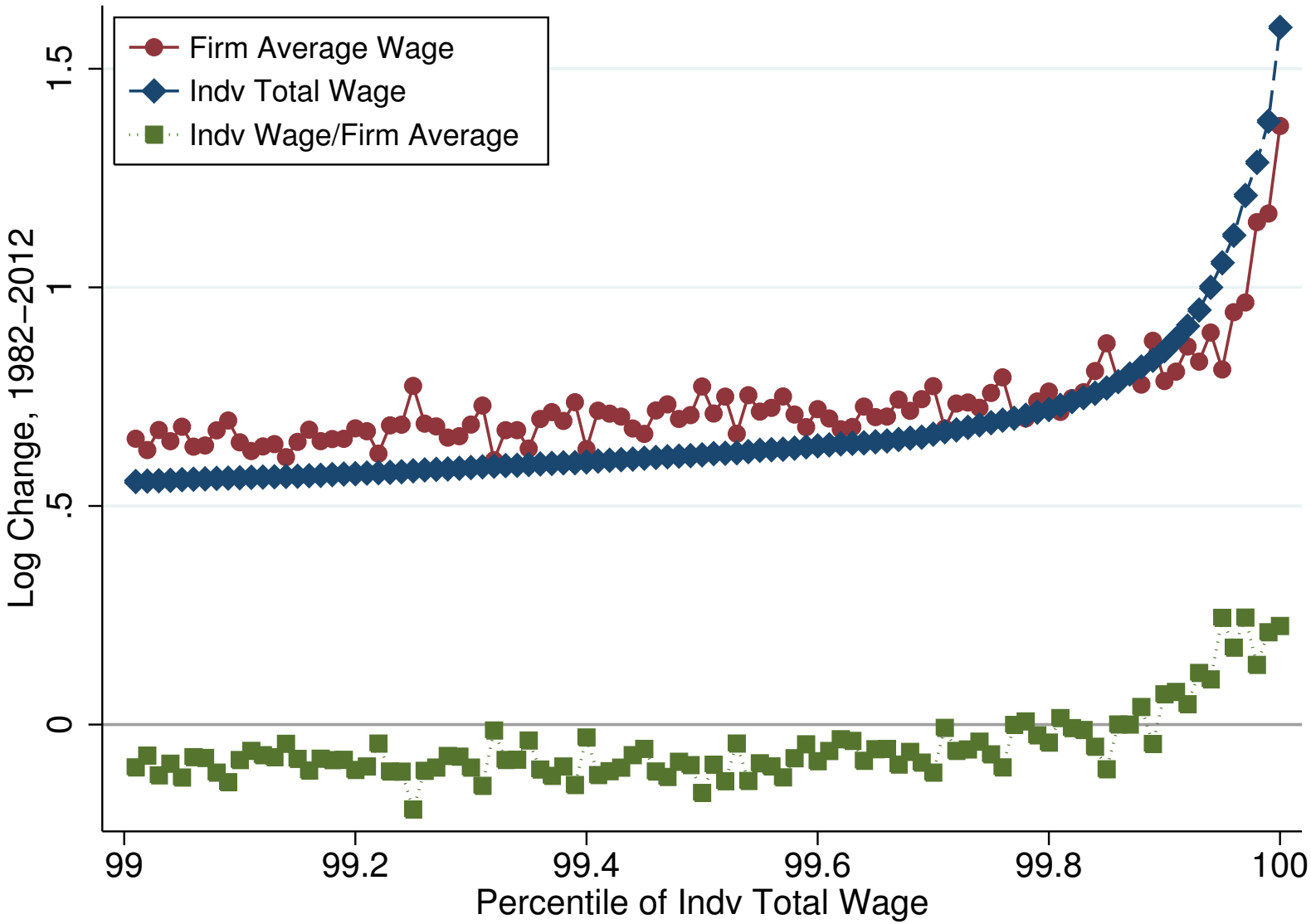
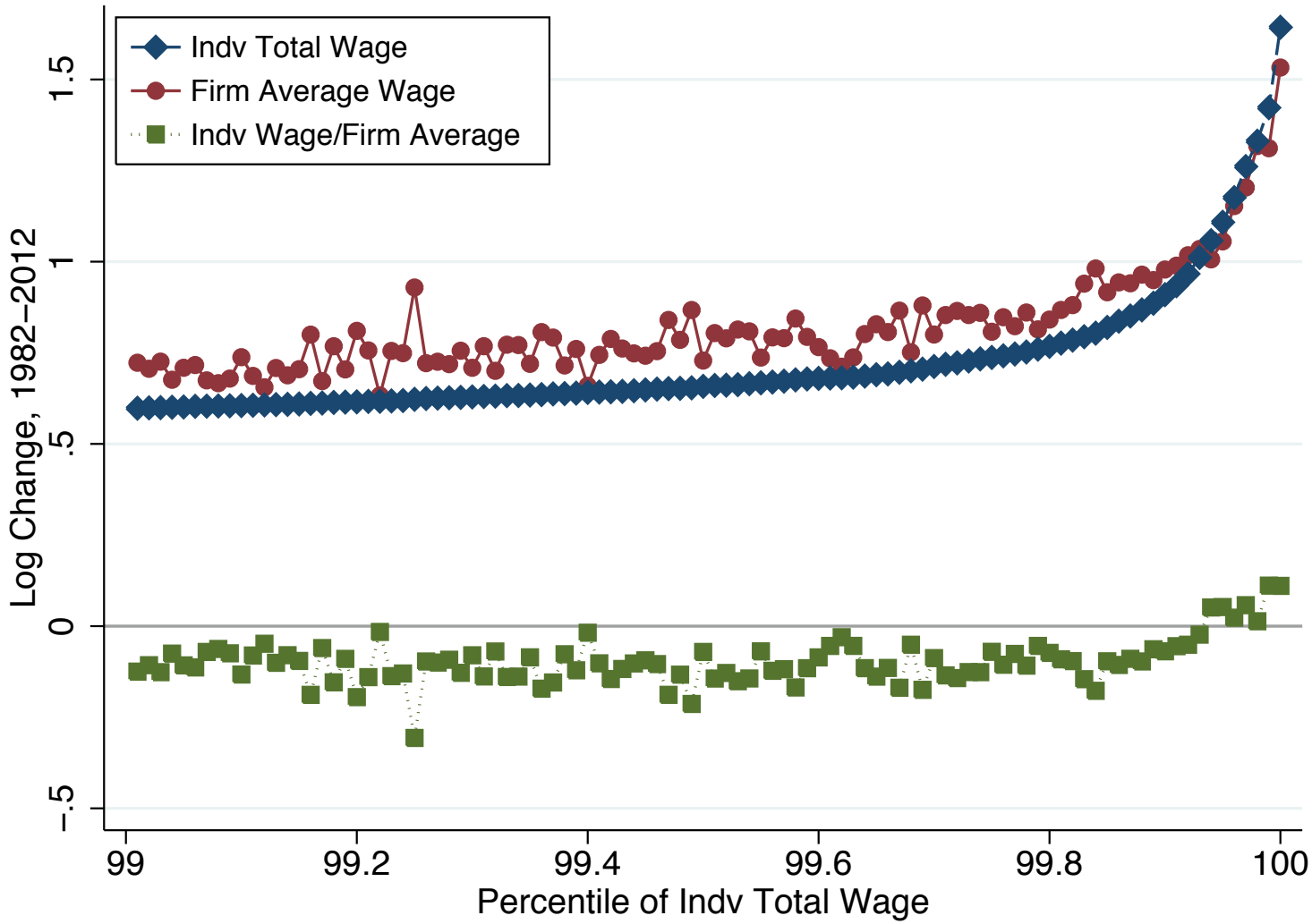
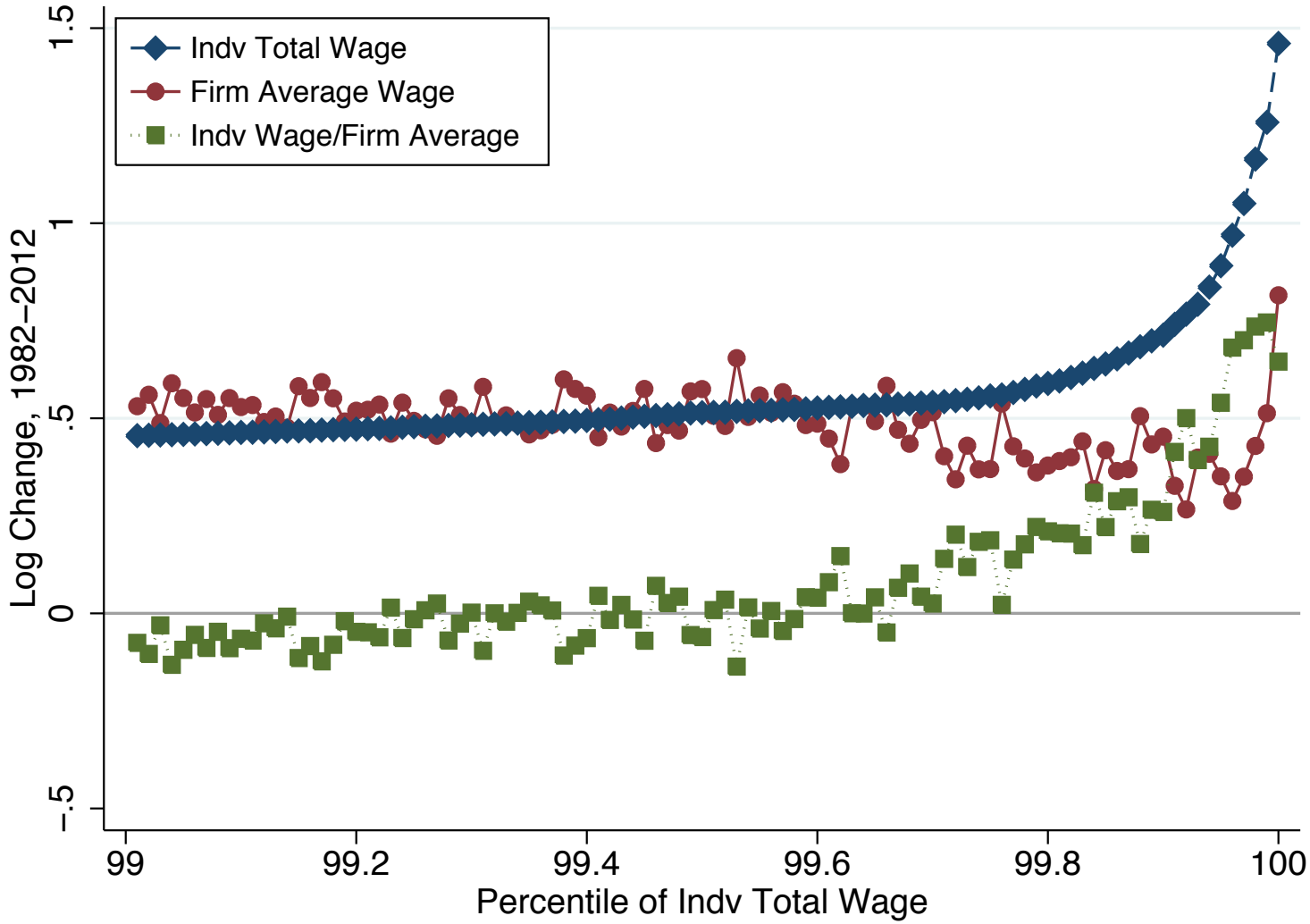


CAUTION

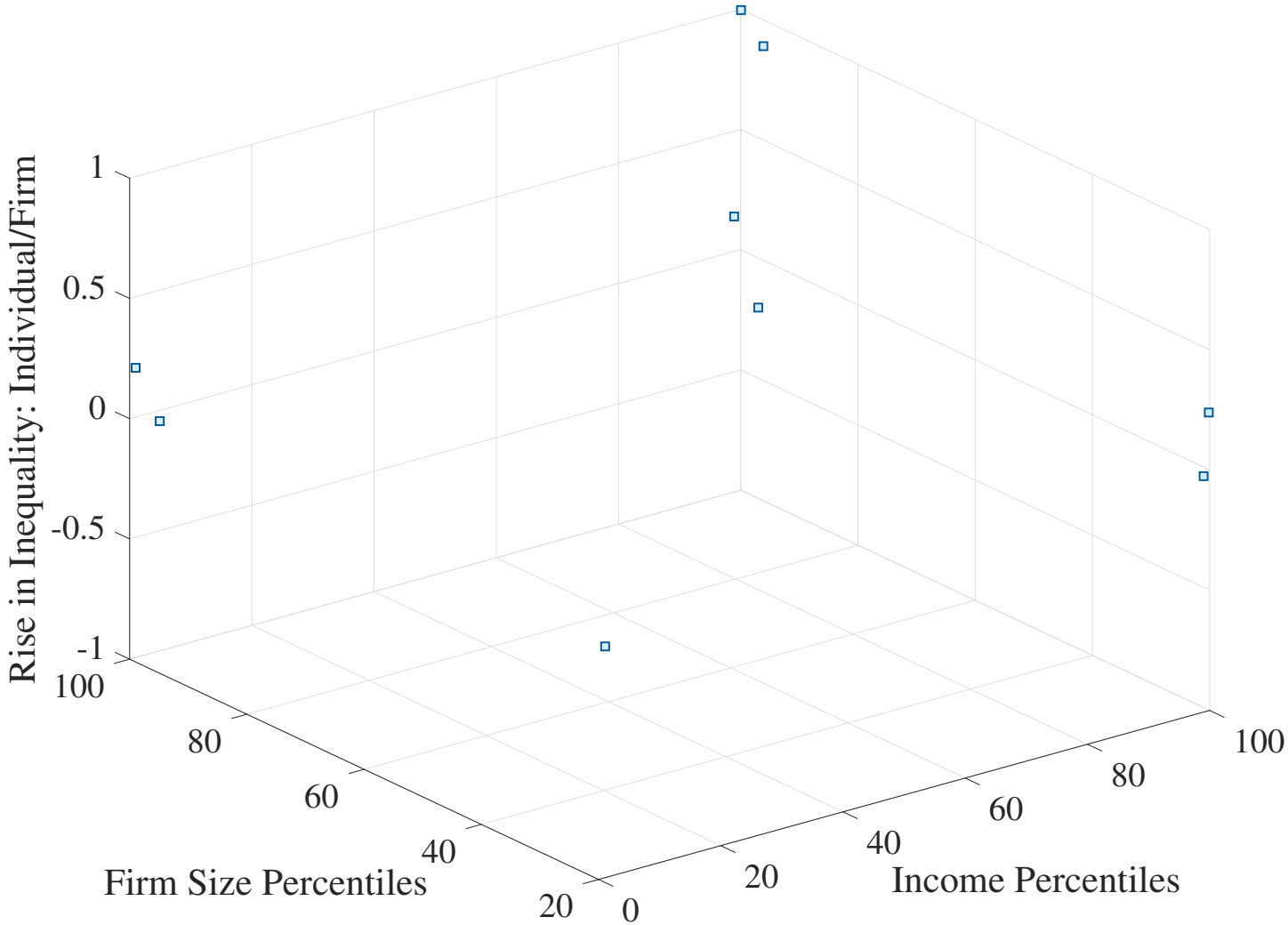
Firm Size: 20 – 10,000 FTE (Top 1%)



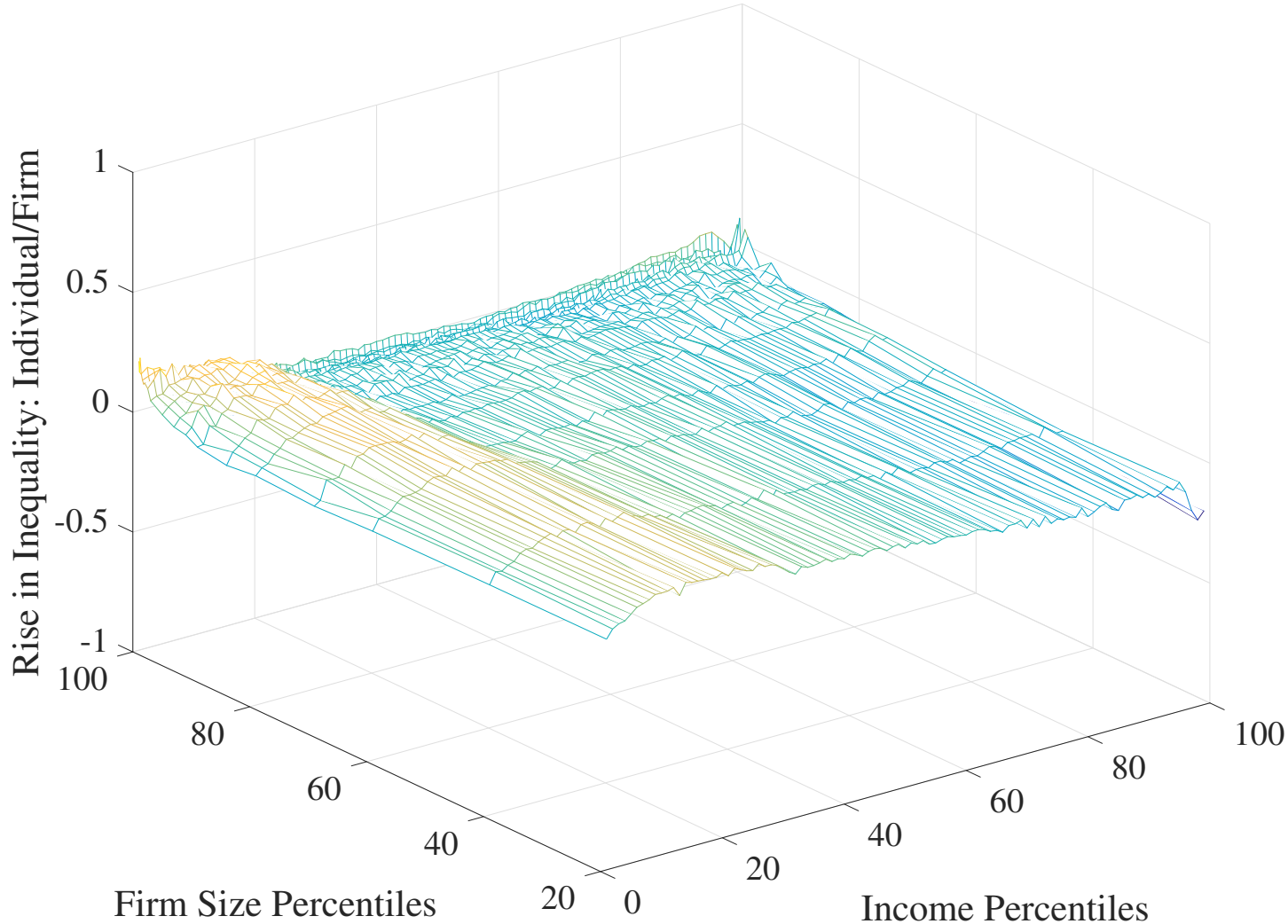
Firm Size: 10,000+ FTE (Top 1%)



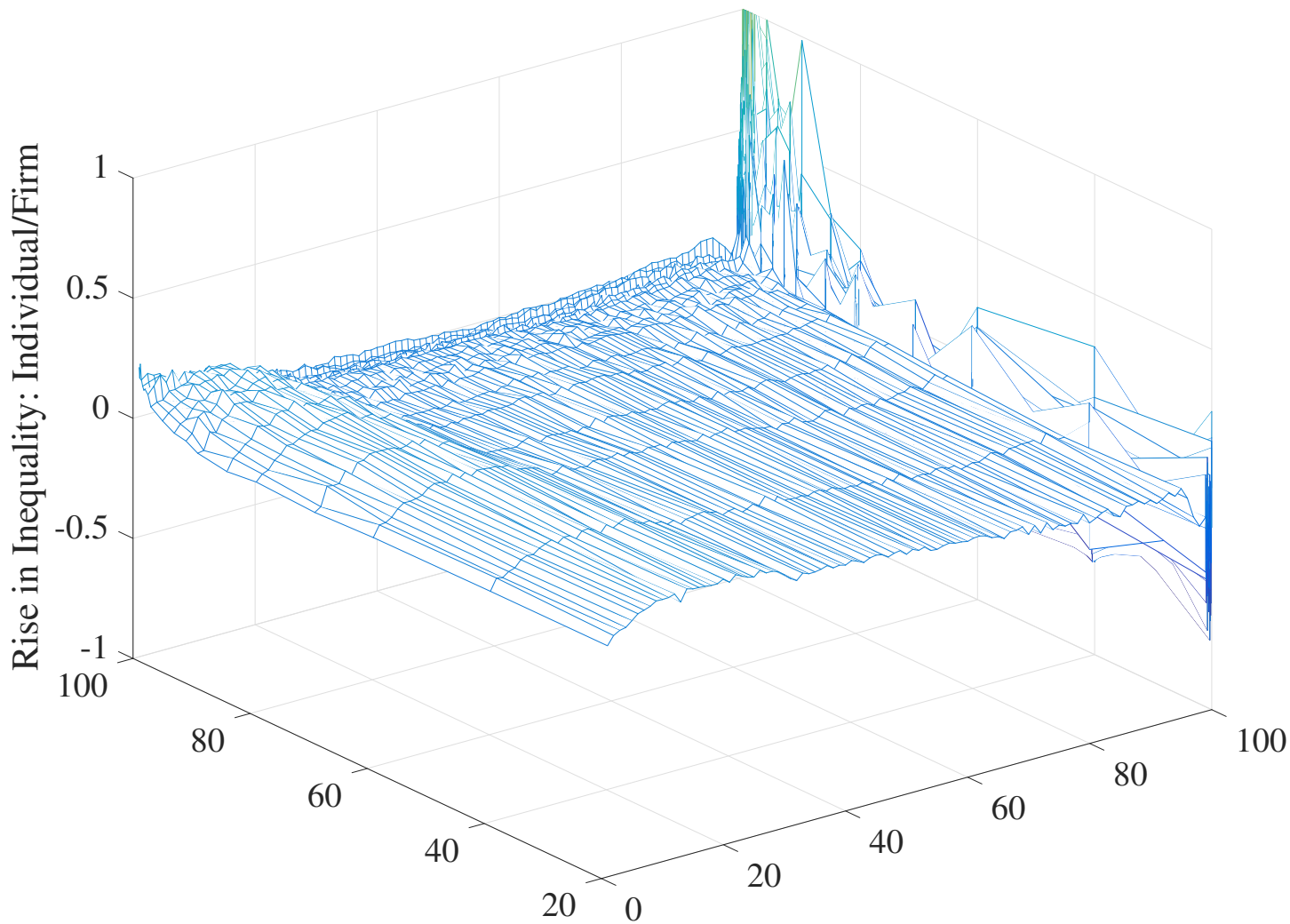
Recap: Between- vs. Within



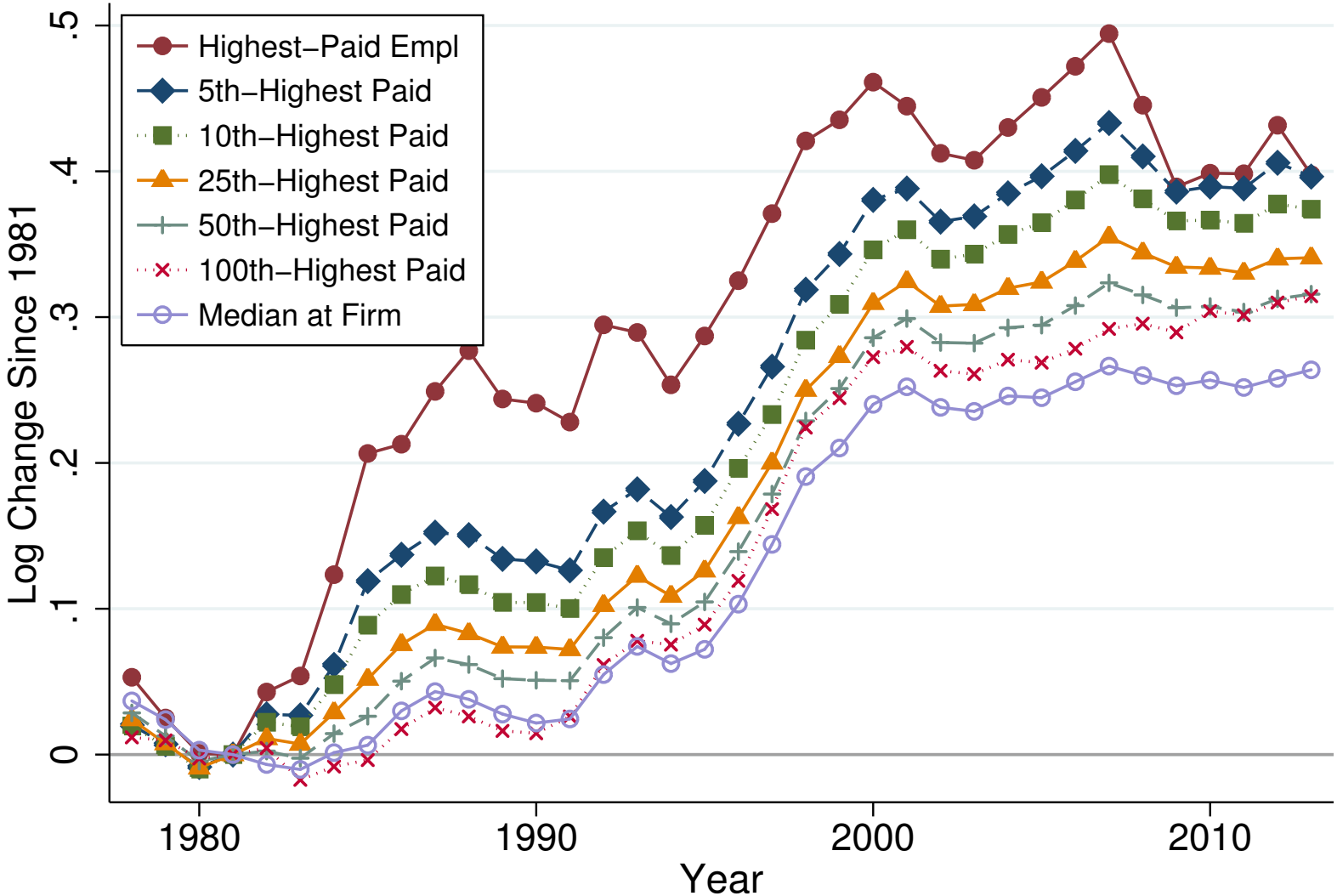
Bottom 99%: **Almost All Between Firms**



Rise in Within-Firm: Top 0.5% of Firms

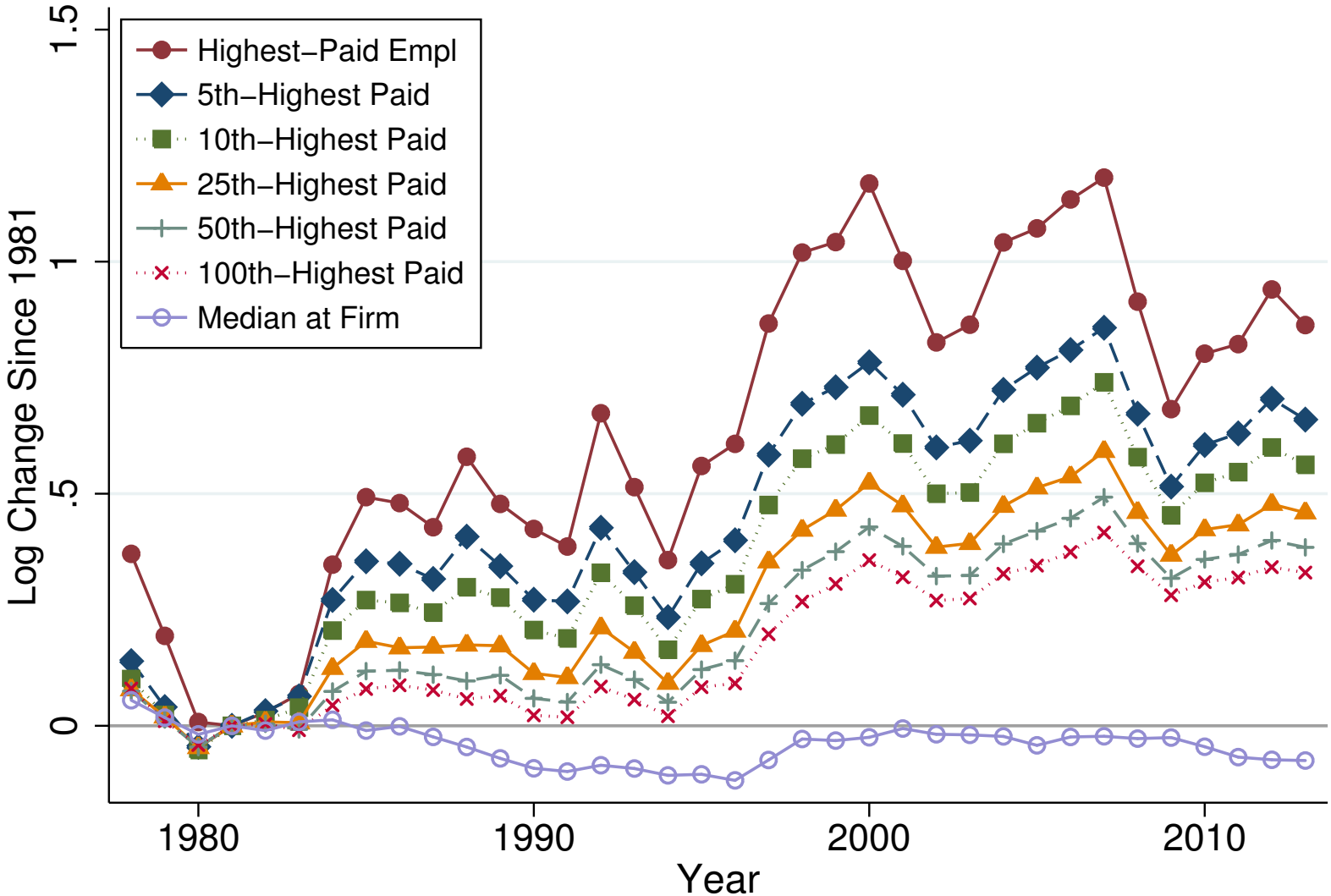


Non-Mega Firms (10,000 FTE)



Subgroup: 100 ≤ Firm Size < 10k

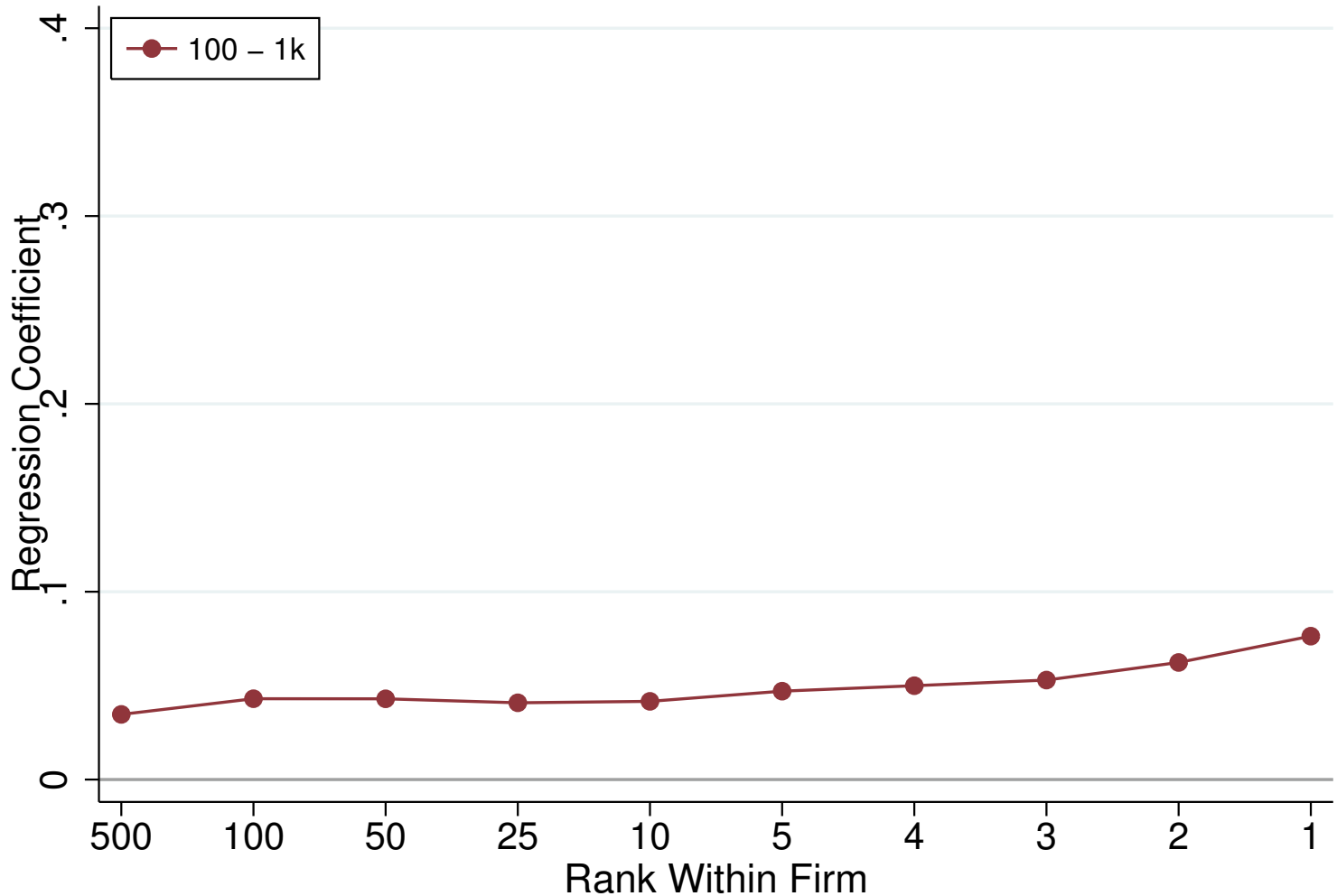
Mega Firms (10,000+ FTE)



Subgroup: 10000 ≤ Firm Size

Why Are Large Firms Different? 1. Top End

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



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

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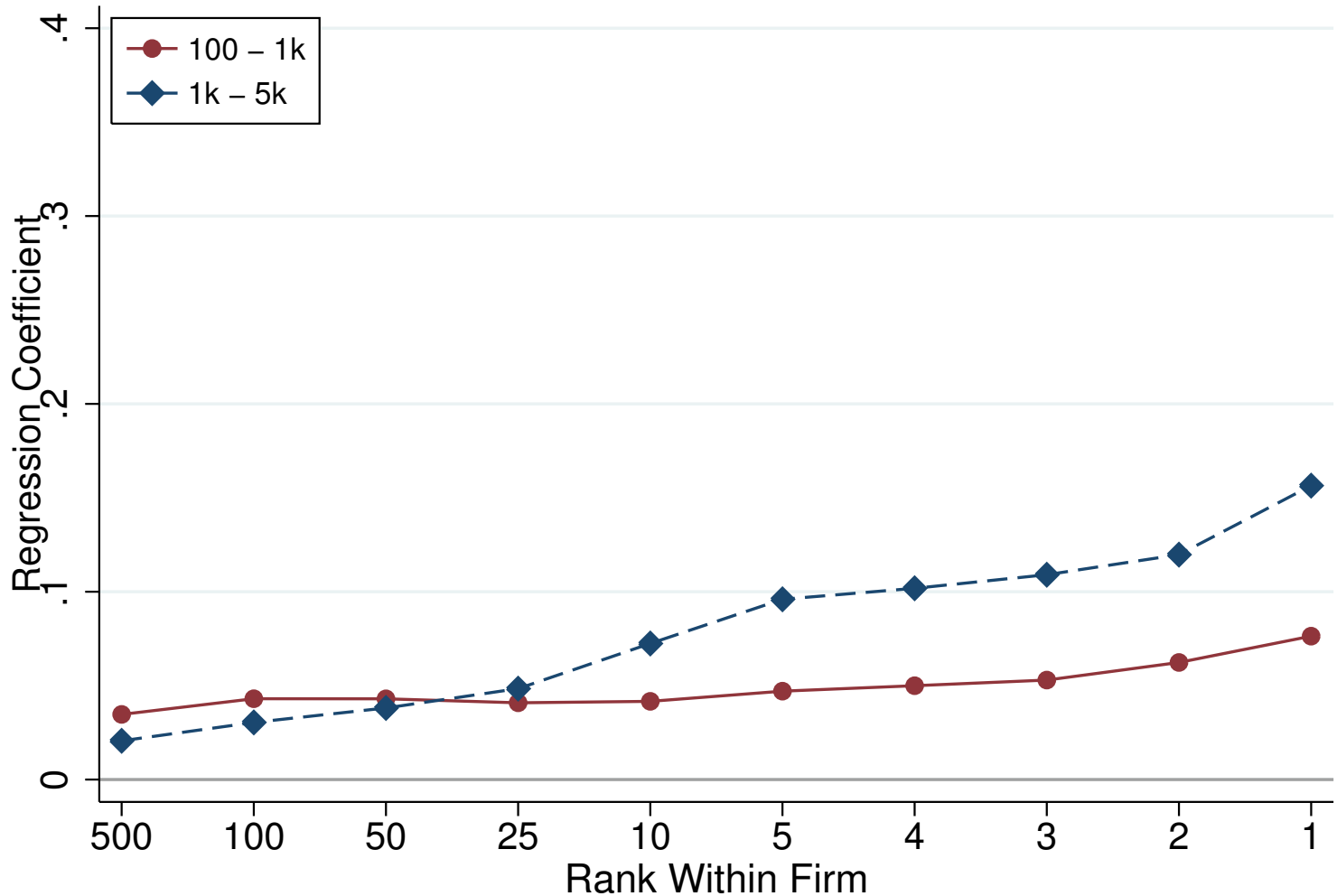

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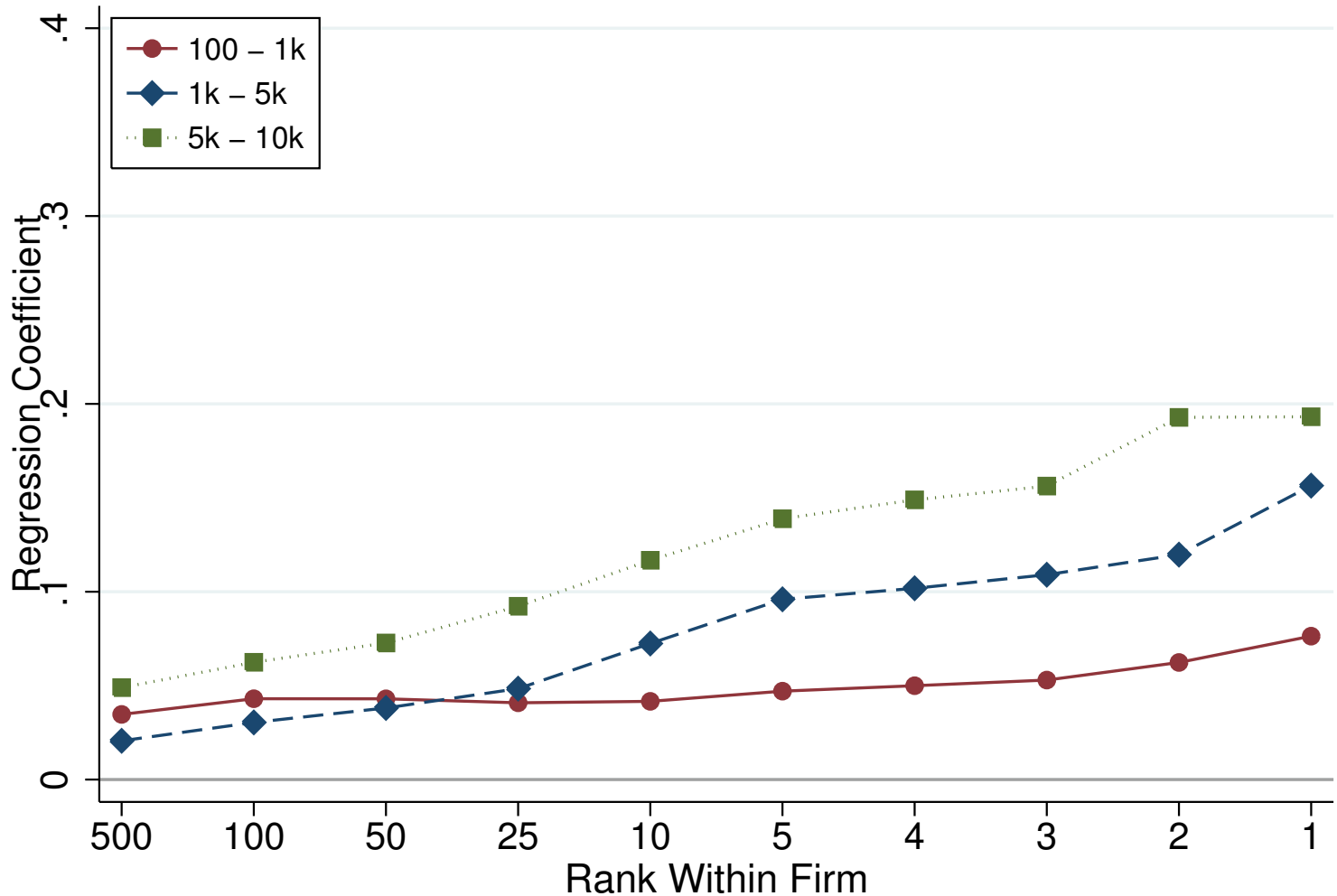

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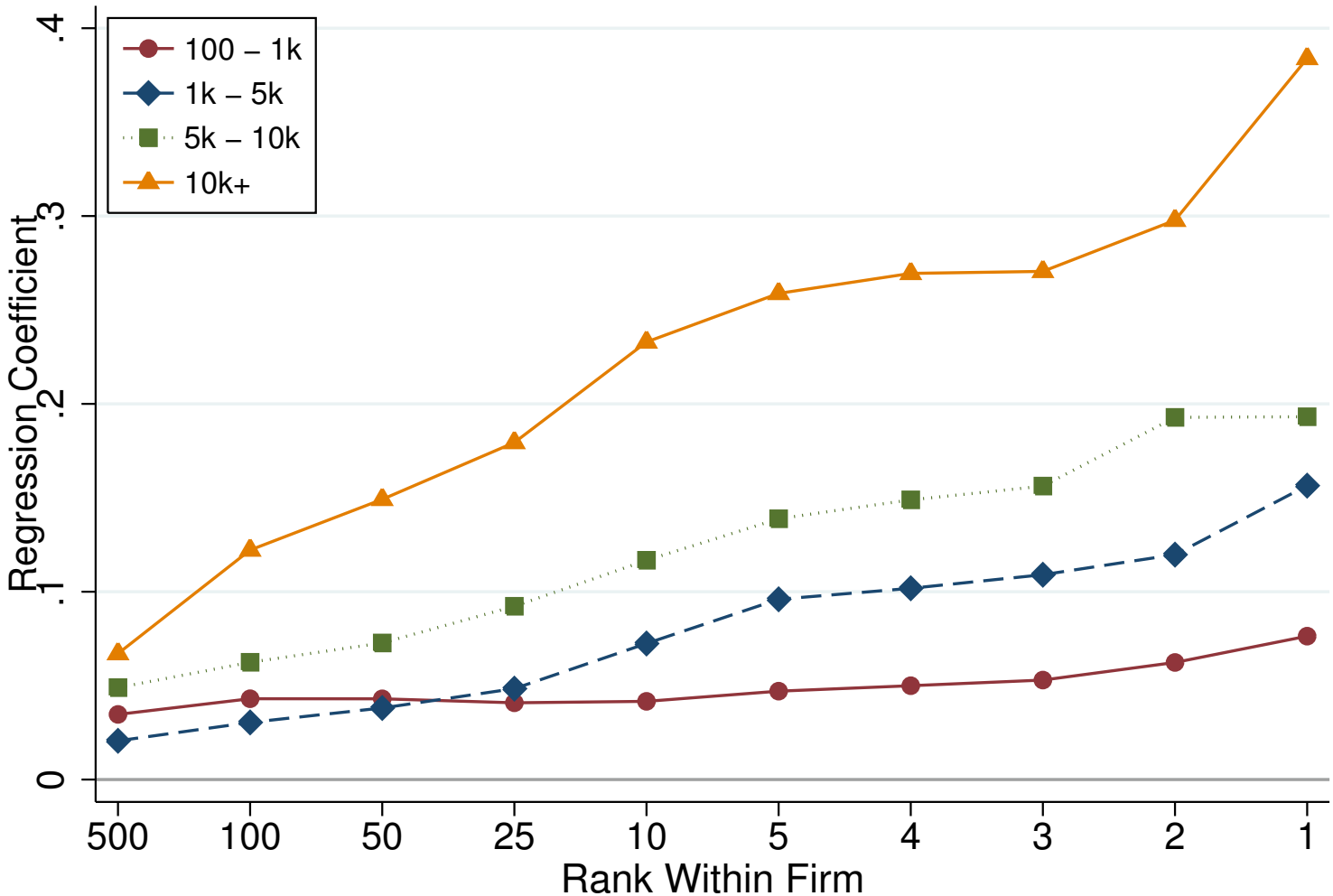

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Why Are Large Firms Different? **2. Bottom End**

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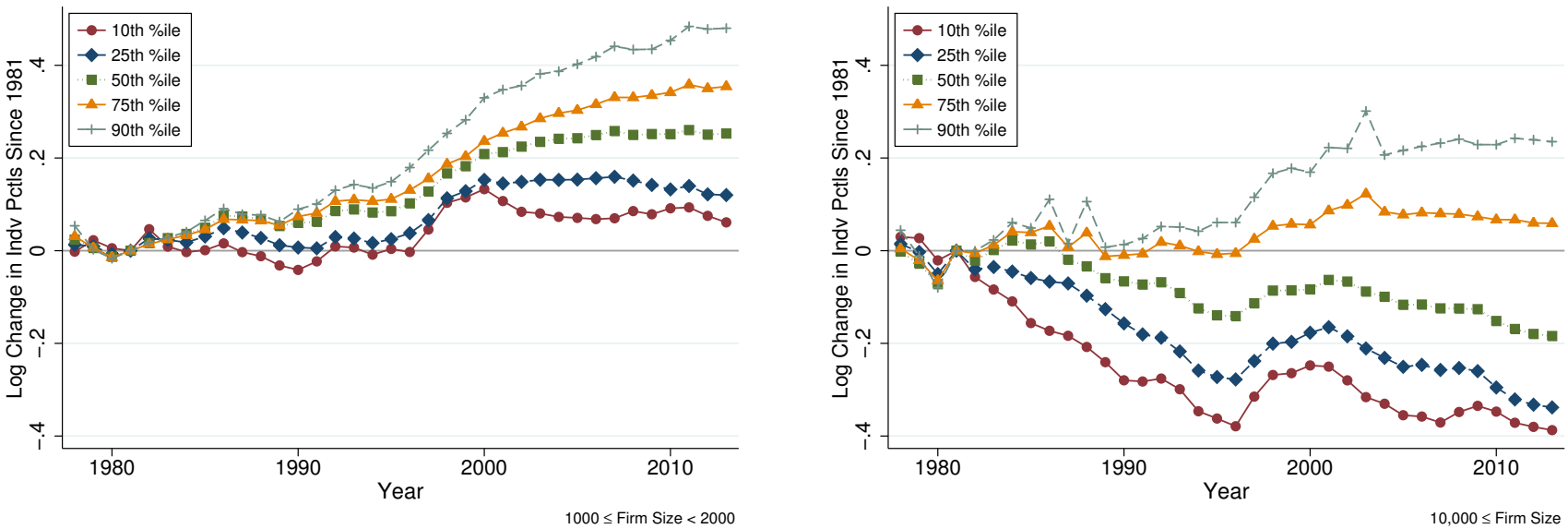
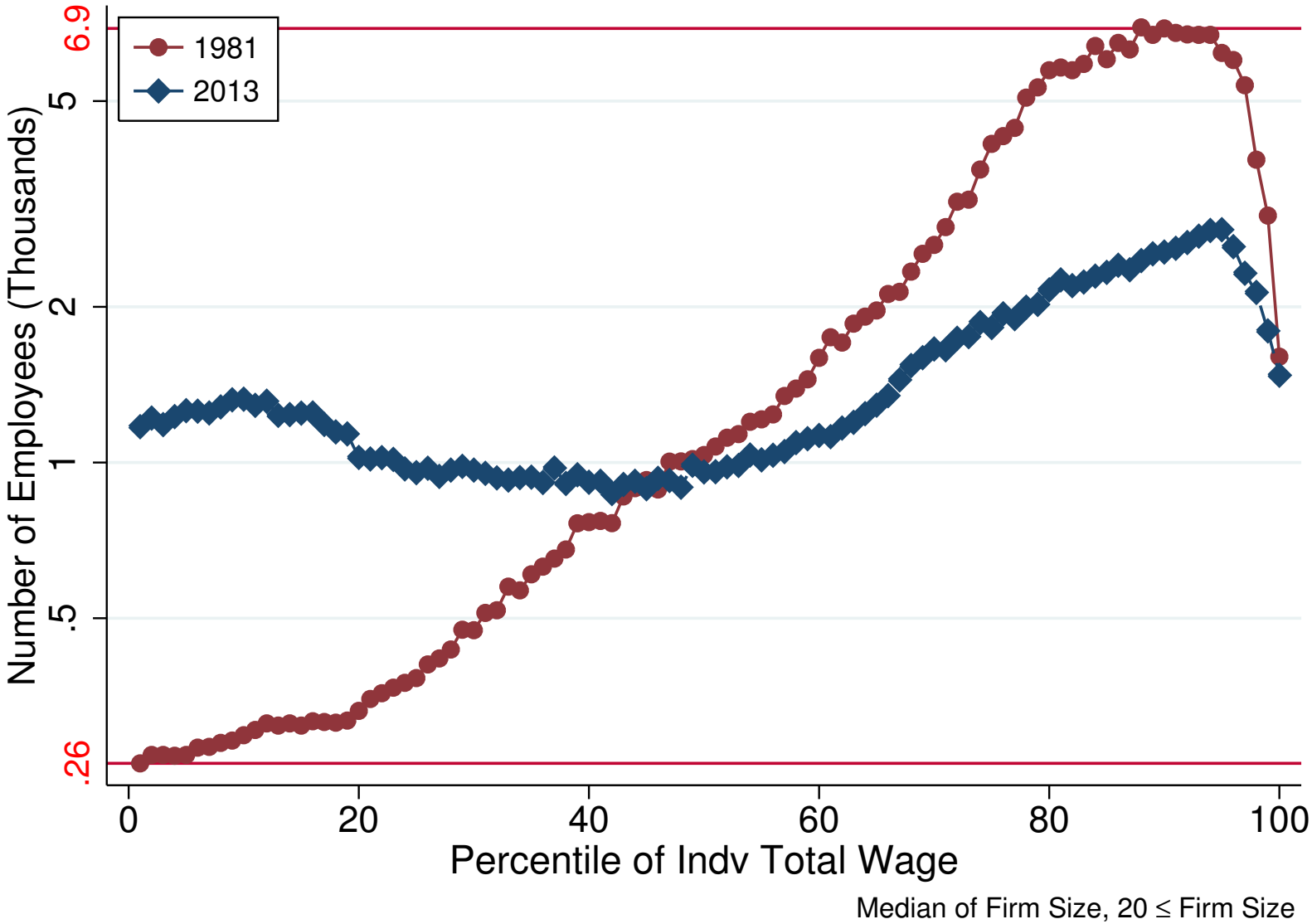
Figure: Change in Wage Percentiles By Firm Size



∴ Major Change in Firm Size – Pay Relation



What is the Role of CEO Pay in Rising Inequality?

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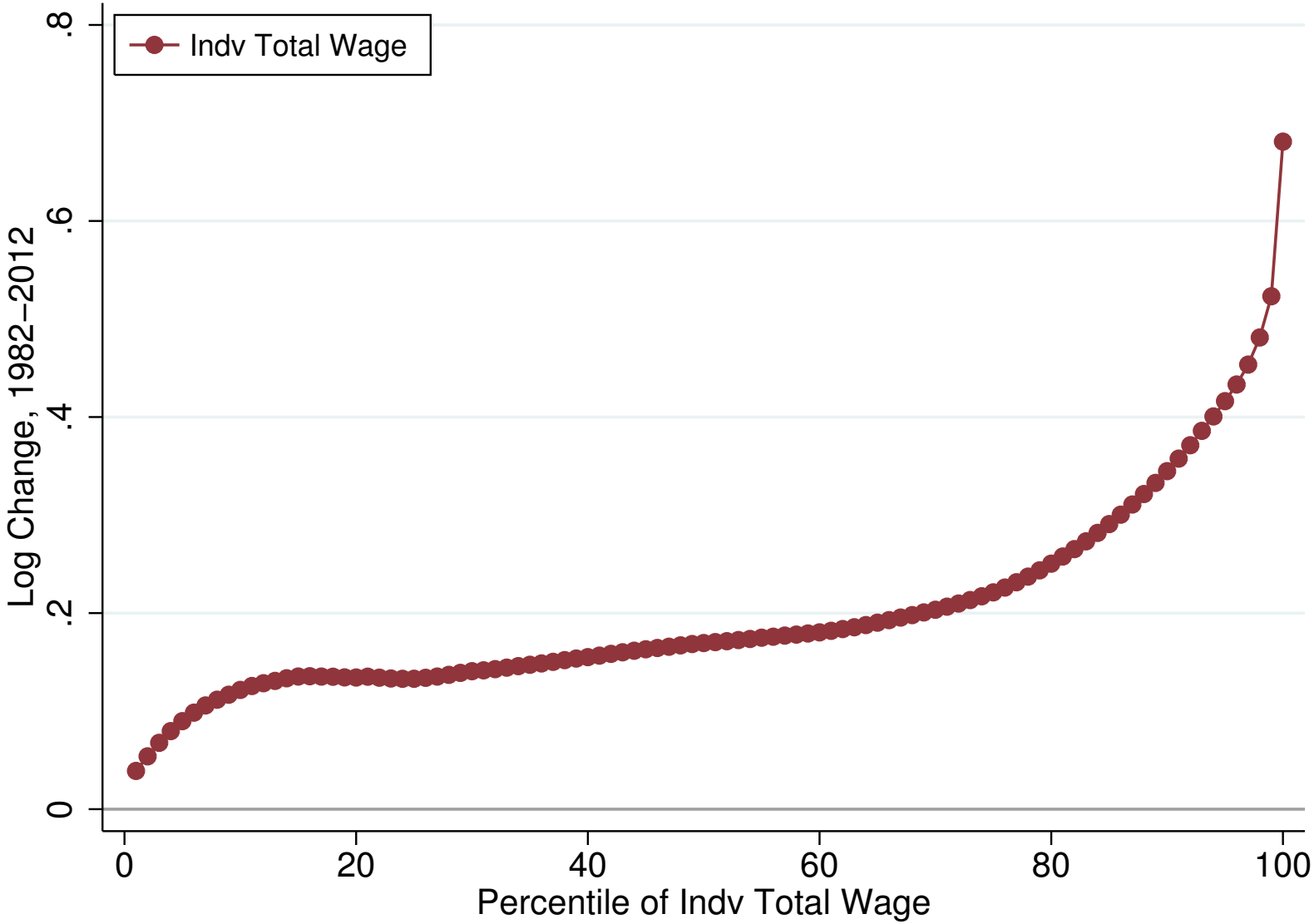
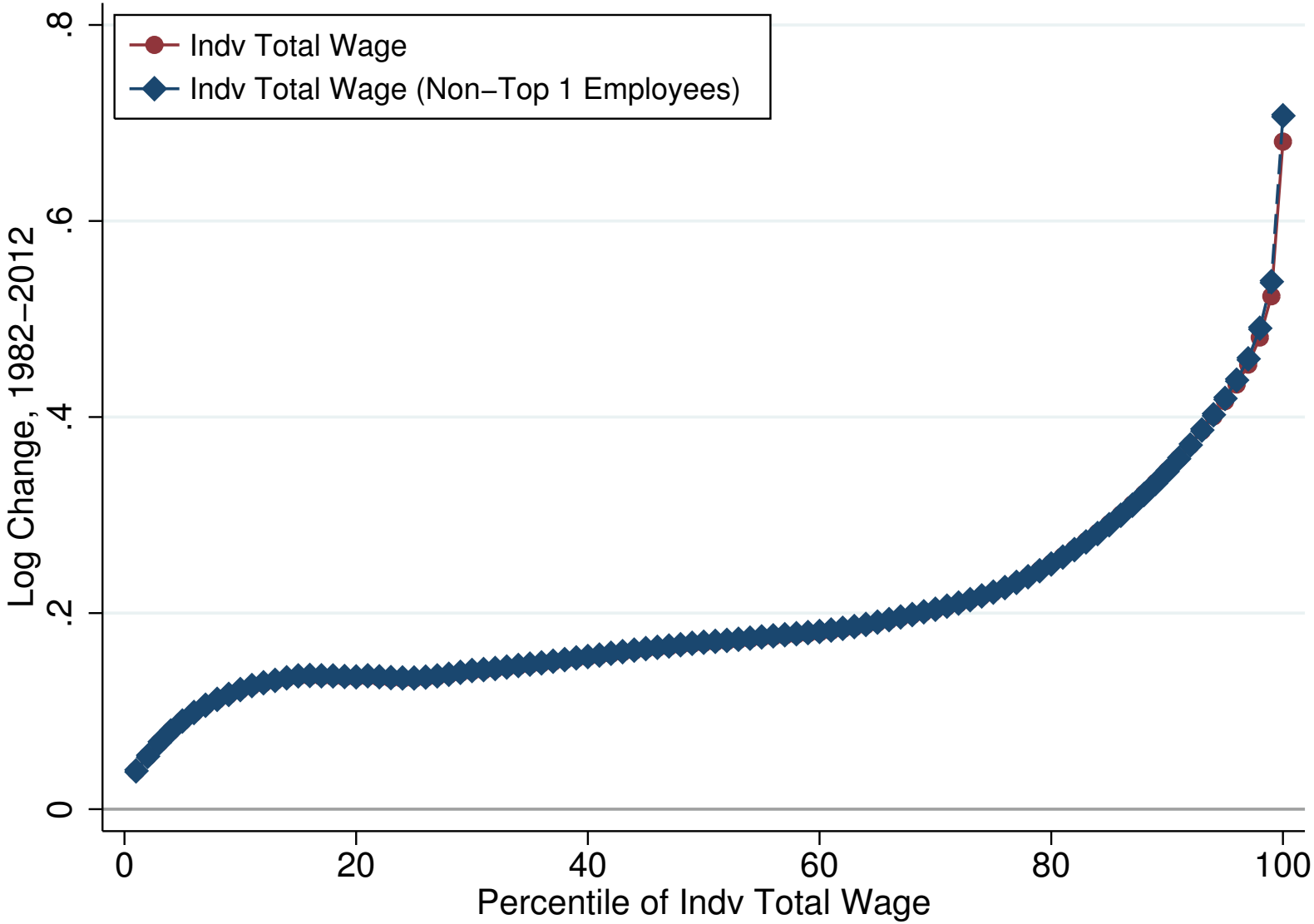
- Policy: Dodd-Frank act (Section 953(b)): companies to report the ratio of top executives' compensation to average wage in the firm.

Rise in Inequality: **Baseline**



Rise in Inequality ***Without Top Executives***



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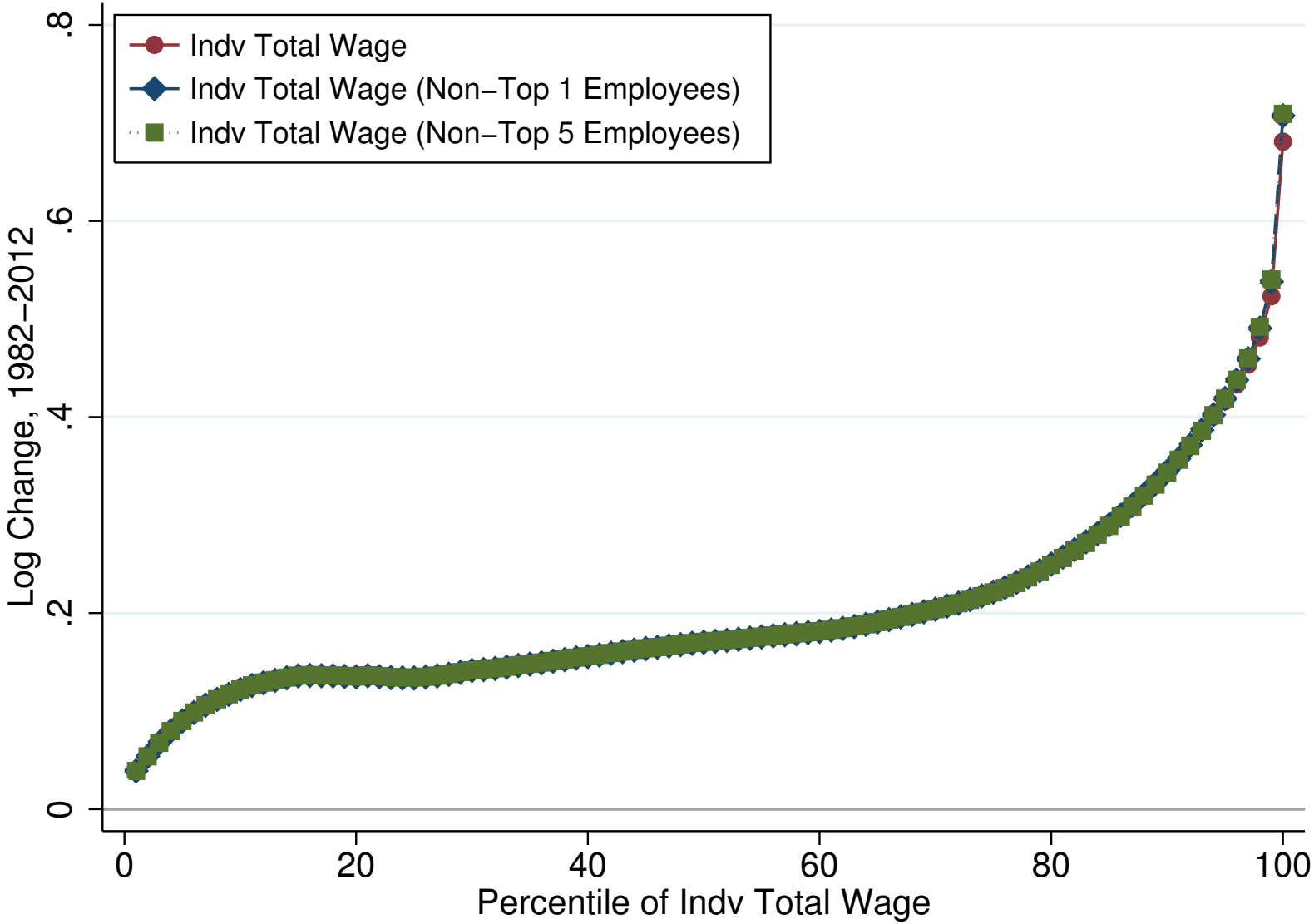
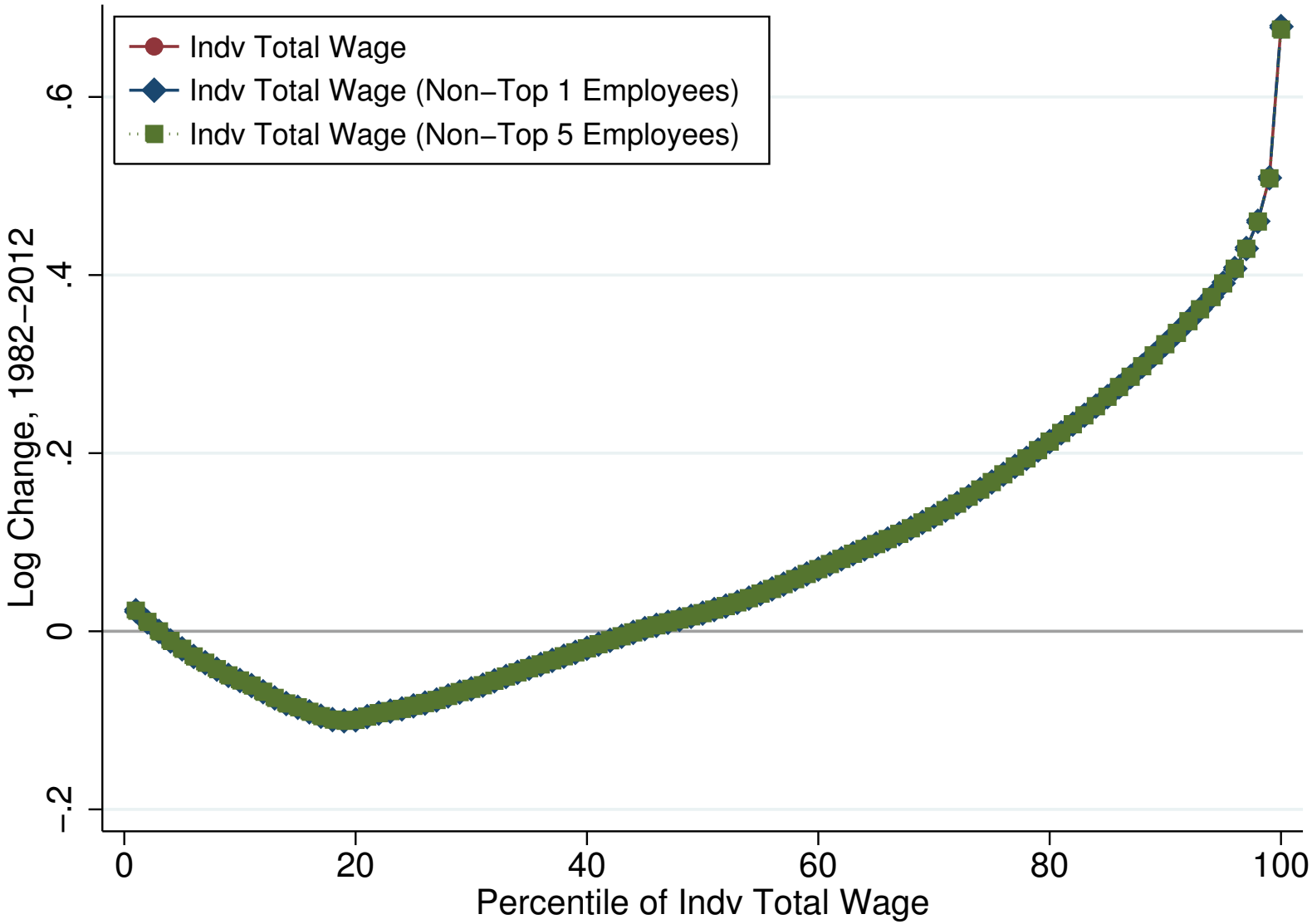
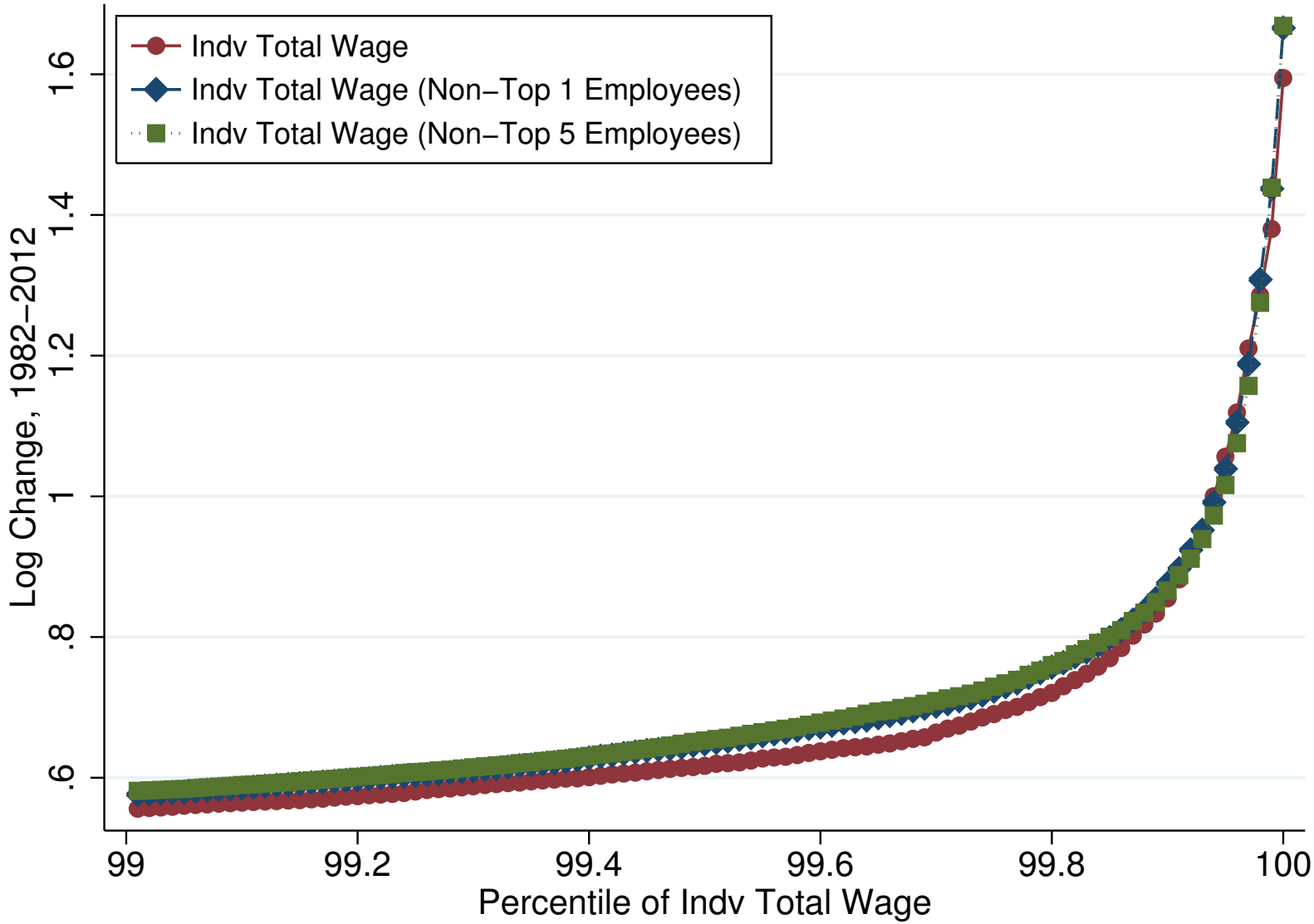


Rise in Inequality ***Without Top Execs: 1000+ FTE***

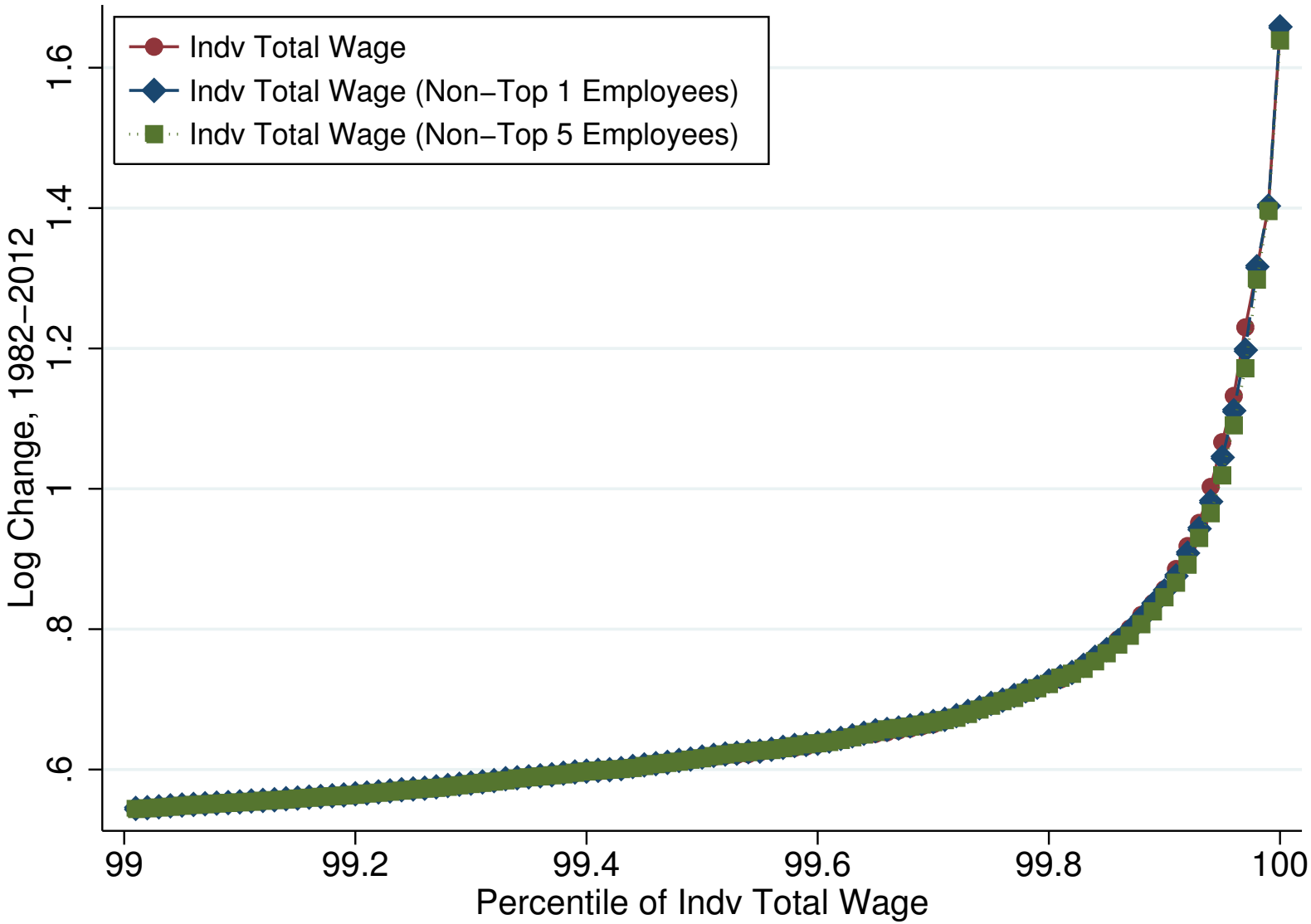


Top 1% Inequality Without Top Executives: ***Baseline***



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***



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:

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

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

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

AKM+ Decomposition

- Consider this model for wages:

$$w_t^{ij} = \underbrace{\alpha^i}_{\text{Worker FE}} + \underbrace{\psi^j}_{\text{Firm FE}} + \underbrace{X_t^i \beta}_{\text{Time var. char.}} + \varepsilon_t^i \tag{1}$$

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- Estimating (1) from US population:
  - **150 million worker FEs** and **6 million firm FEs**.

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- Key decomposition:

$$\text{var}_i(w_t^{ij}) = \underbrace{\text{var}_j(\overline{\alpha}^j) + \text{var}_j(\psi^j) + \text{cov}(\overline{\alpha}^i, \psi^j)}_{\text{Between-firm dispersion}}$$

$$+ \underbrace{\sum_j P_j \times (\text{var}_i(\alpha^i | i \in j) + \text{var}_i(\varepsilon_t^i | i \in j))}_{\text{Within-firm dispersion}}$$

AKM Decomposition, Cont'd

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		$w_t^{ij} = \alpha^i + \psi^j + X_t^i\beta + \varepsilon_t^i$		
		Baseline		
	Change in:			
Between-Firm	$\text{var}_j(\overline{\alpha}^j)$	**35.6**	.	.
Components	+ $\text{var}_j(\psi^j)$	–6.6	.	.
of Variance	+ $2 \times \text{cov}(\overline{\alpha}^i, \psi^j)$	**31.4**	.	.
	+ $2 \times \text{cov}(\overline{\alpha}^i + \psi^j, \overline{X}^i b)$	8.2	.	.
	= Δ **Between-firm var.**	**69.1**	.	.
Within-Firm	$\text{var}_i(\alpha^i + X^i b \mid i \in j)$	40.0	.	.
Components	+ $\text{var}_i(\varepsilon_t^i \mid i \in j)$	–9.2	.	.
of Variance				
	= Δ **Within-firm var.**	**30.9**	.	.
Δ Total in $\text{var}(w_t^{ij})$		100		

AKM Decomposition, Cont'd

			$w_t^{ij} = \alpha^i + \psi^j + X_t^i\beta + \varepsilon_t^i$		
			Baseline	***Drop mega firms***	
	Change in:				
Between-Firm		$\text{var}_j(\overline{\alpha}^j)$	35.6	**42.6**	.
Components	+	$\text{var}_j(\psi^j)$	–6.6	1.2	.
of Variance	+	$2 \times \text{cov}(\overline{\alpha}^i, \psi^j)$	31.4	**33.0**	.
	+	$2 \times \text{cov}(\overline{\alpha}^i + \psi^j, \overline{X}^i b)$	8.2	10.2	.
	=	Δ **Between-firm var.**	69.1	**87.6**	.
Within-Firm		$\text{var}_i(\alpha^i + X^i b \mid i \in j)$	40.0	29.4	.
Components	+	$\text{var}_i(\varepsilon_t^i \mid i \in j)$	–9.2	–16.1	.
of Variance					
	=	Δ **Within-firm var.**	30.9	**12.4**	.
Δ Total in $\text{var}(w_t^{ij})$			100	100	

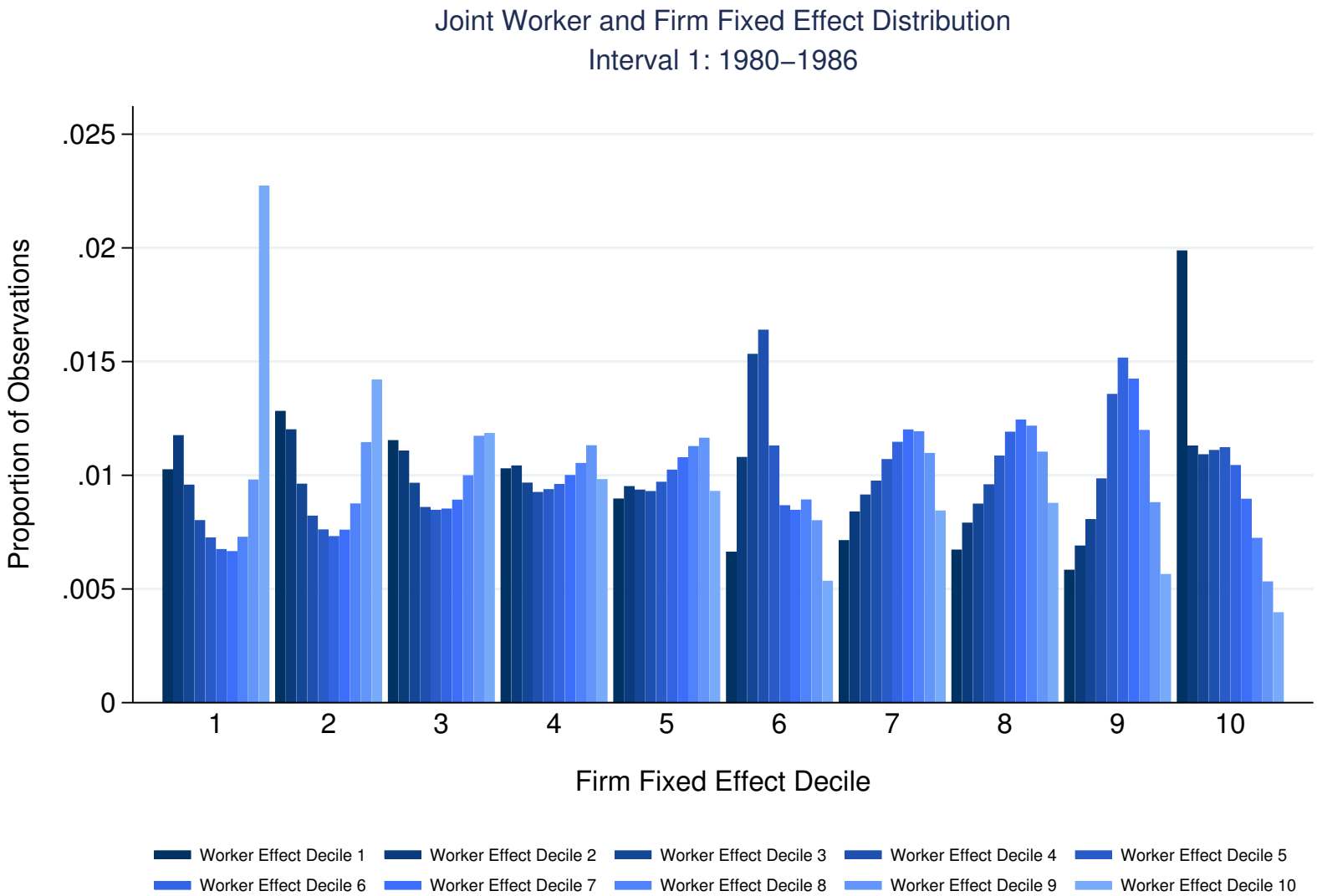
Note: Mega firms: 10,000+ male employees.

AKM Decomposition, Cont'd

			$w_t^{ij} = \alpha^i + \psi^j + X_t^i\beta + \varepsilon_t^i$		
			Baseline	*Drop mega firms*	***Drop large firms***
	Change in:				
Between-Firm		$\text{var}_j(\overline{\alpha}^j)$	35.6	42.6	**52.5**
Components	+	$\text{var}_j(\psi^j)$	–6.6	1.2	4.9
of Variance	+	$2 \times \text{cov}(\overline{\alpha}^i, \psi^j)$	31.4	33.0	**31.9**
	+	$2 \times \text{cov}(\overline{\alpha}^i + \psi^j, \overline{X}^i b)$	8.2	10.2	12.3
	=	Δ **Between-firm var.**	**69.1**	**87.6**	**102.1**
Within-Firm		$\text{var}_i(\alpha^i + X^i b \mid i \in j)$	40.0	29.4	21.5
Components	+	$\text{var}_i(\varepsilon_t^i \mid i \in j)$	–9.2	–16.1	–22.3
of Variance					
	=	Δ **Within-firm var.**	**30.9**	**12.4**	**–2.1**
Δ Total in $\text{var}(w_t^{ij})$			100	100	

Note: Mega firms: 10,000+ male employees. Large firms: 1,000+ male employees.

Increasing Sorting



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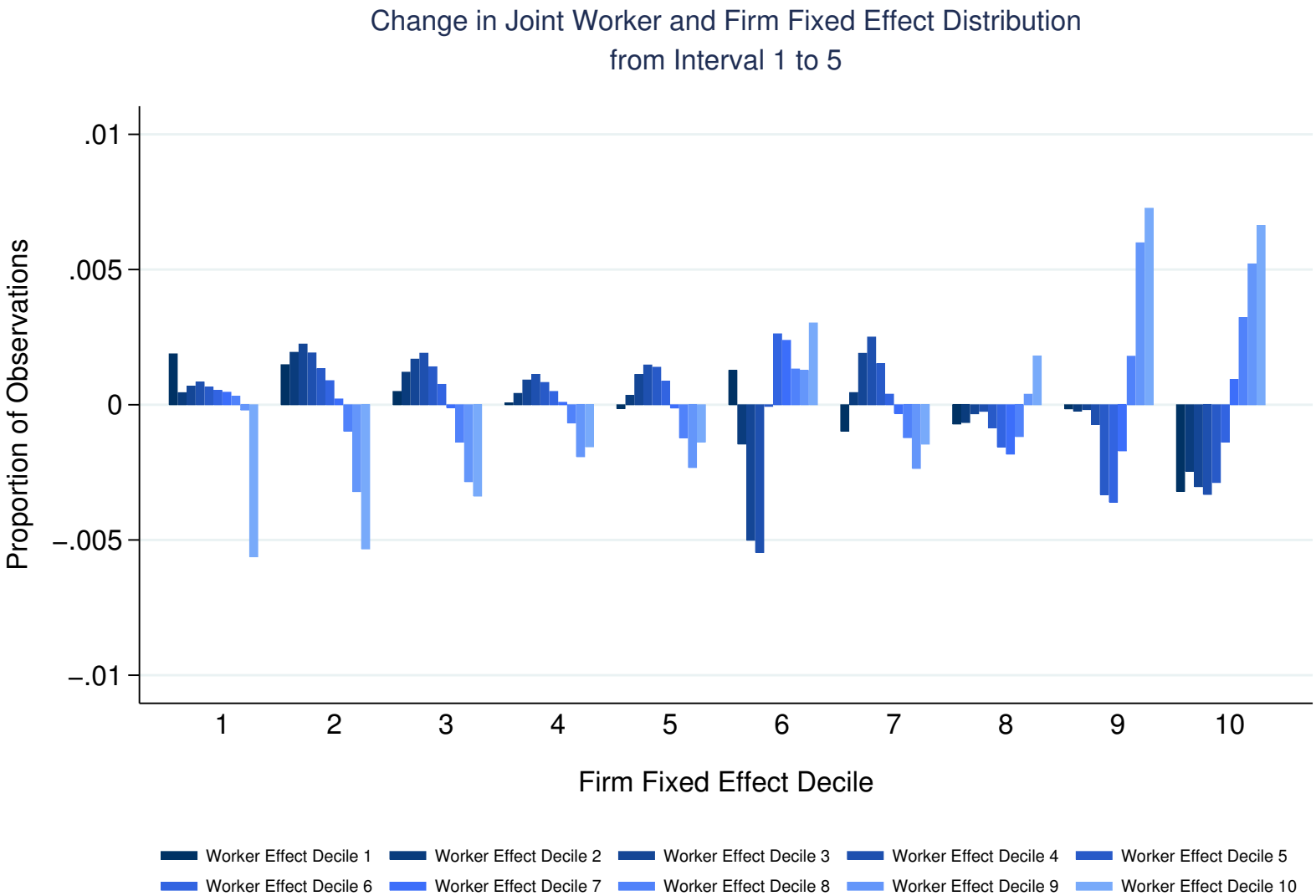

Related Evidence

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- (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
  - UK (1984–2001), Faggio, et al (2007)
  - Germany (1985–2009), Card et al (2013)
  - Brazil (1986–1995), Helpman et al (2015)
  - Sweden (1986–2008), Håkanson et al (2015))
- 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)?

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- Why are worker FEs getting (i) more dispersed across firms, and (ii) more systematically related to firm FEs (sorting)?
- In our estimation, correlation between $\overline{\alpha}^j$ and ψ^j goes from 0.12 up to 0.52 (by 0.40) over the period.
  - Hakanson et al (2015): increasing sorting by cognitive and noncognitive skills in Sweden—due to stronger complementarities between worker skills and technology.
  - 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.

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- Evidence points to major changes in firms' organization.

APPENDIX

What is an EIN?

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- 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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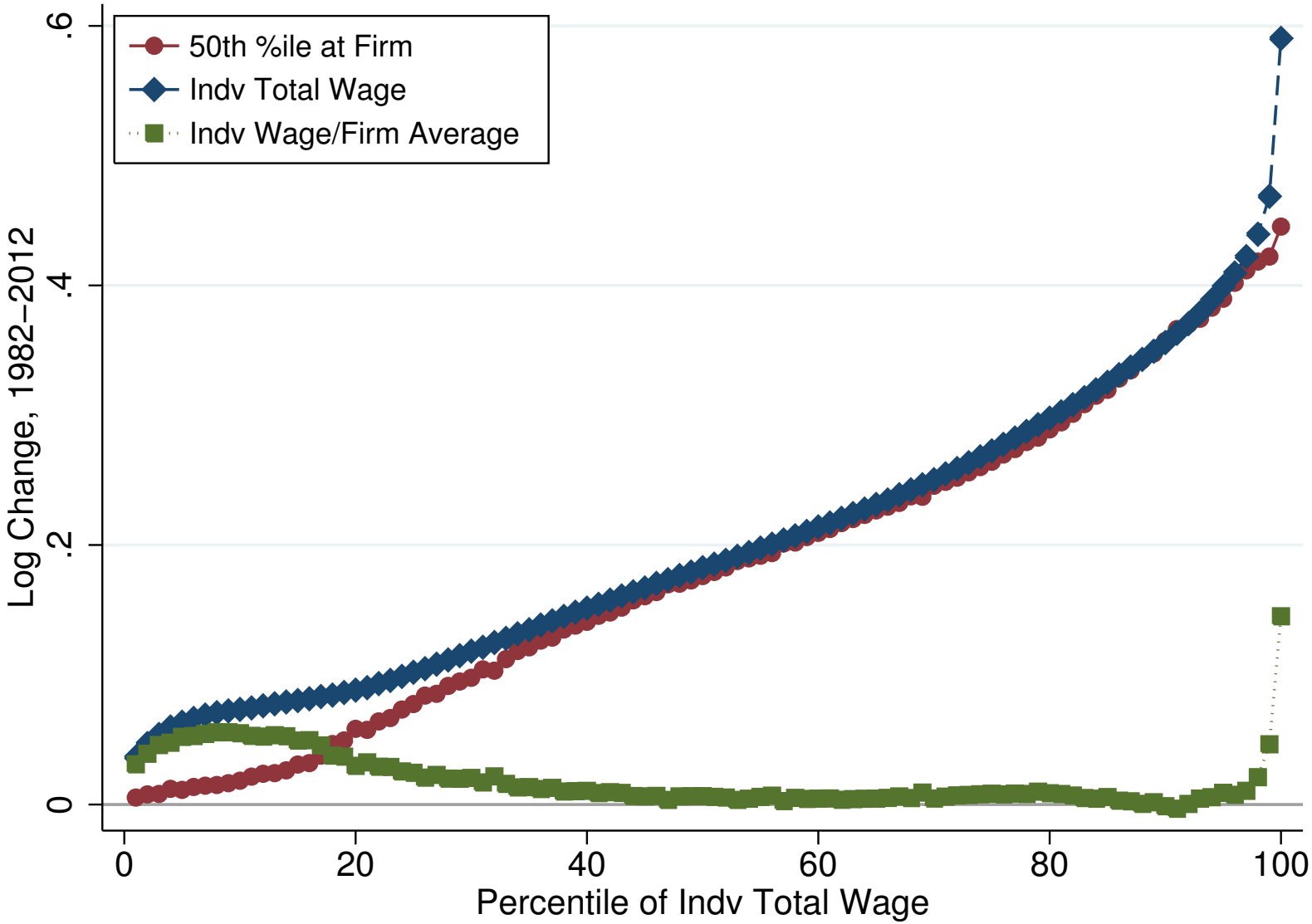
- Our definition of a firm is an Employer Identification Number (EIN)
- Any firm with an employee (issued a W-2) must have an EIN, issued by the IRS.
- Many firms use only 1 EIN (e.g. Facebook, Google, Walmart stores)
- Some firms use different EINs for different divisions
  - For example: Stanford has 1 for the university, 1 for each hospital and 1 for the bookshop
  - General Electric has about 80 EINs.
- Bureau of Labor Statistics uses the EIN as the definition of firm.

Wage Inequality: *Median Firm Wage*

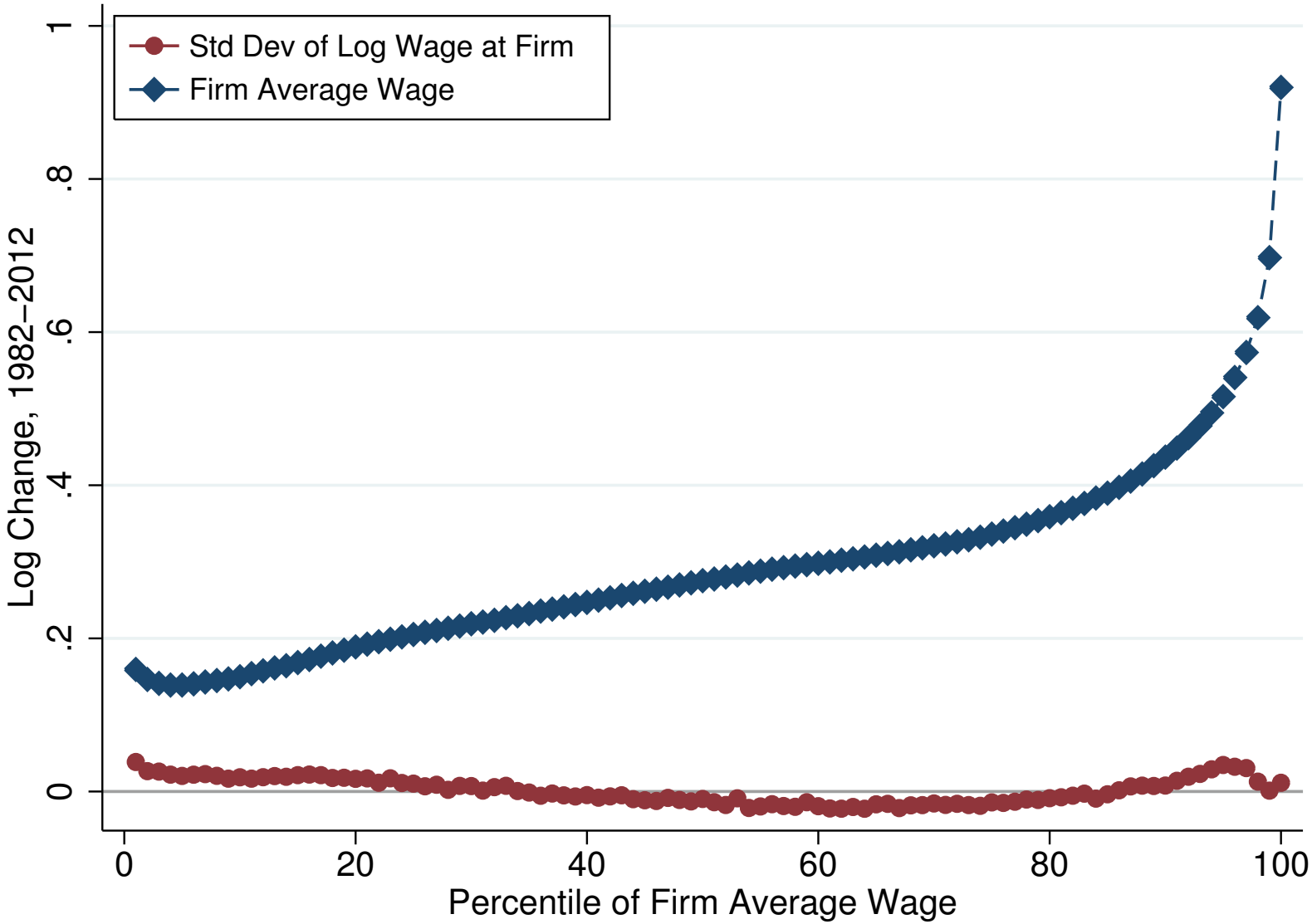


Note: Sample contains workers in firms with 20+ full-time equivalent employees.

Firm as the Unit of Analysis

- Group firms by average pay
- Group firms by size (employment)

Standard Deviation of Log Wages

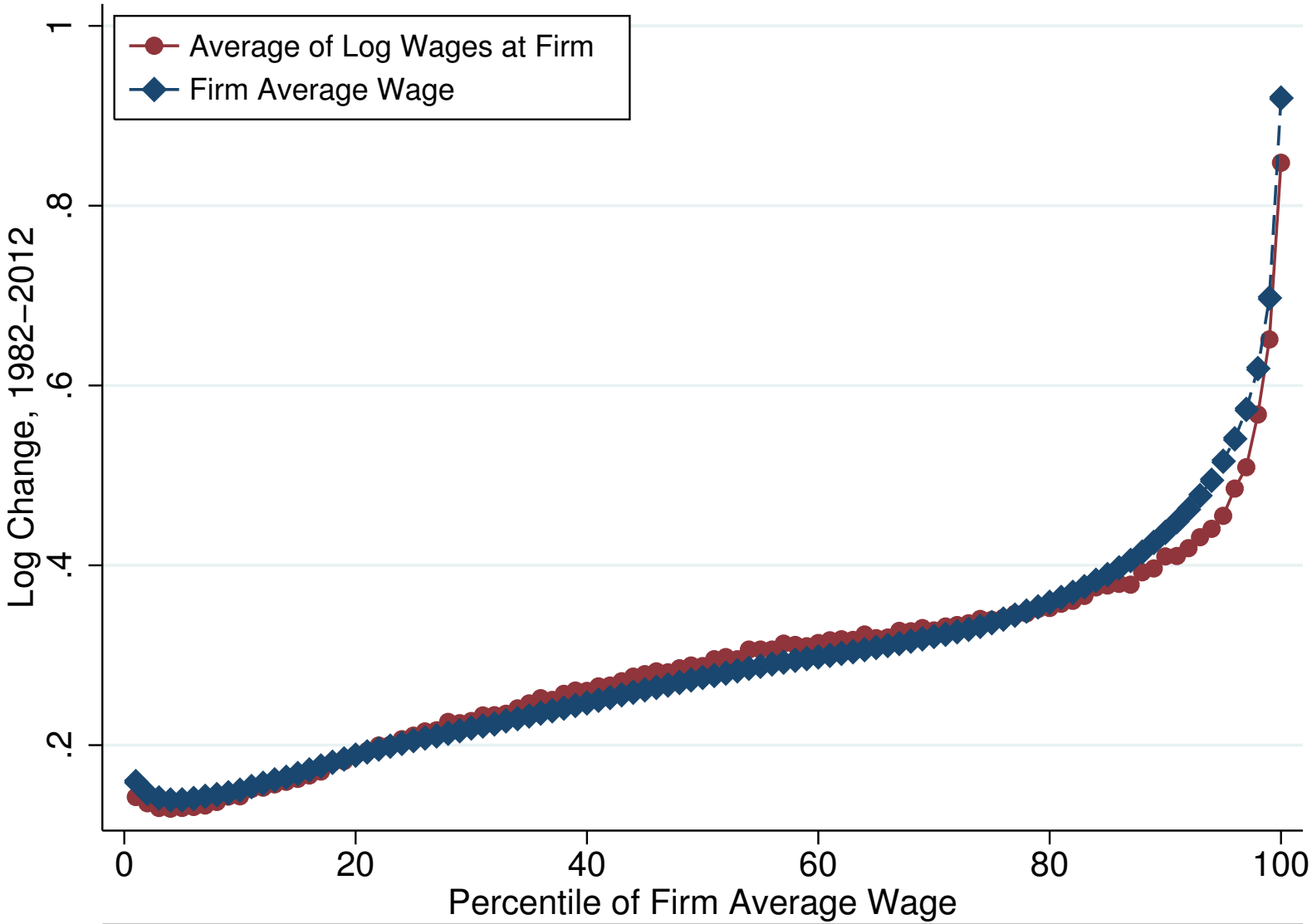


Note: Sample contains firms with 20+ full-time equivalent employees.

Frac. to Bottom 95%

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

Avg. of Log Wages



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

Ranking Firms By Size

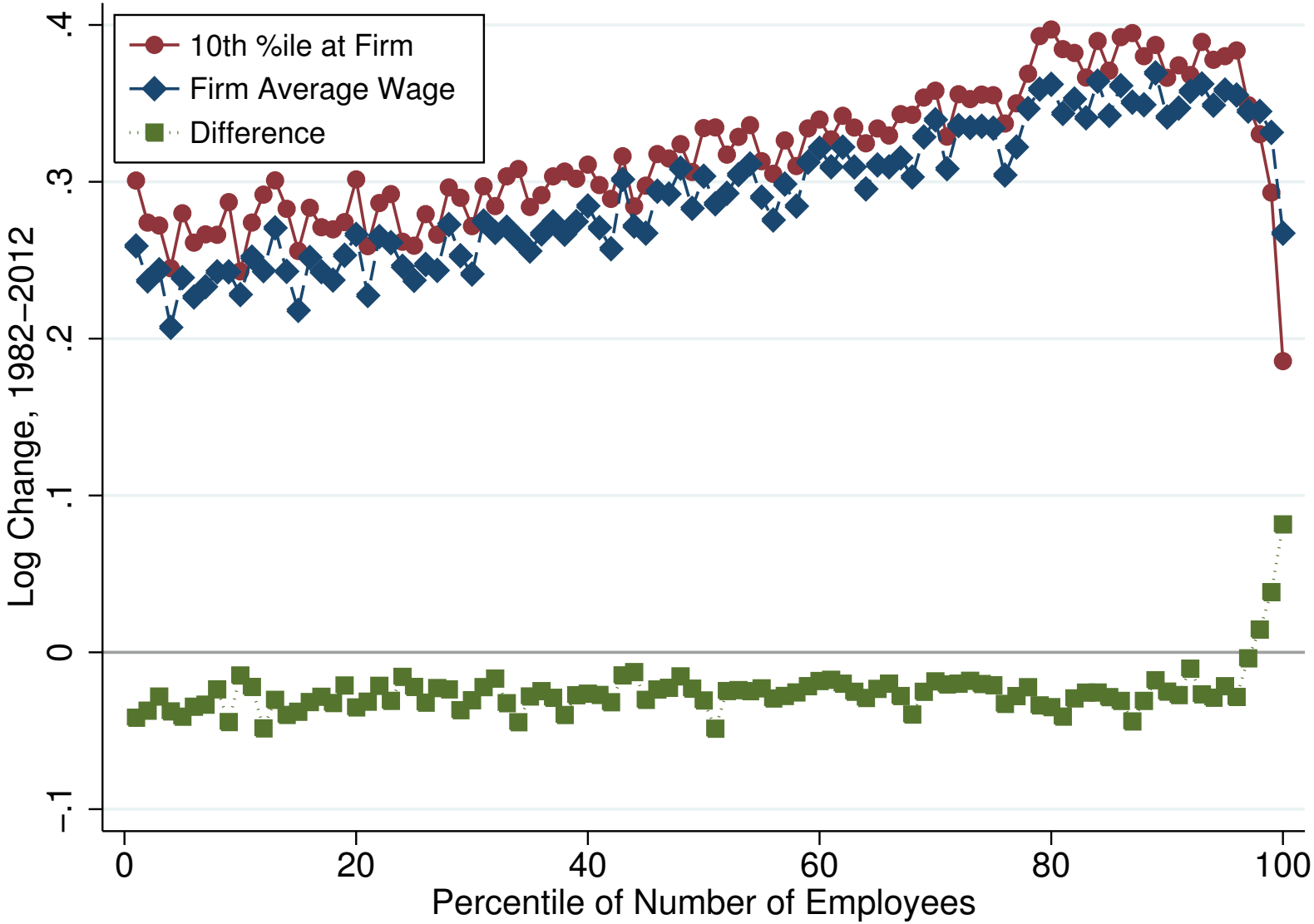
Firm Size Distribution

Table: Percentiles for Firm Size Distribution

Number of Employees						
P50	P90	P95	P99	P99.5	P99.9	P99.99
40	182	335	1,178	3,270	13,180	58,335

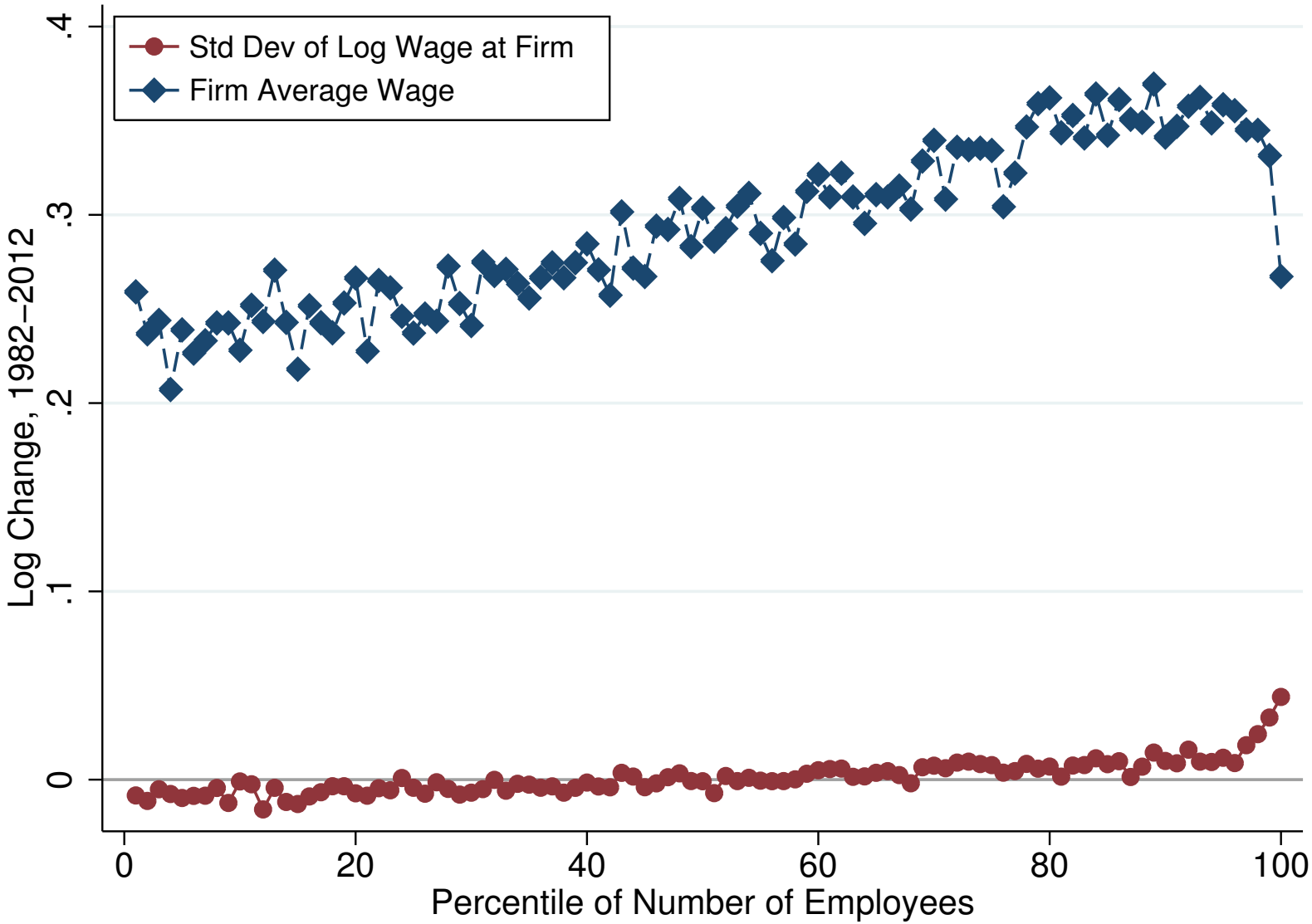
Rise in Pay Inequality: Firms By Size

Change in P10 by Firm Size



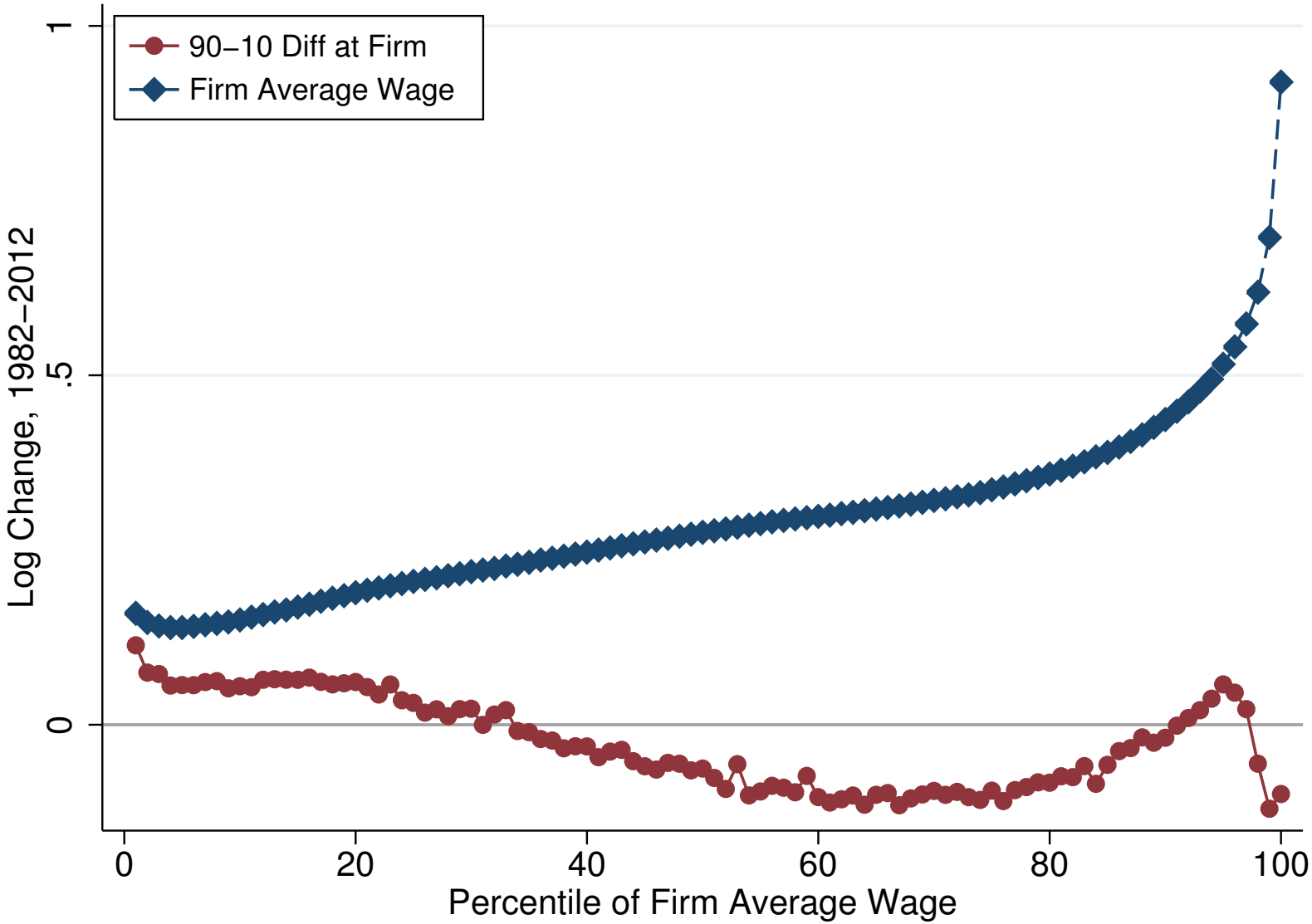
Change in P90 By Firm Size

Inequality by Firm Size: Standard Deviation



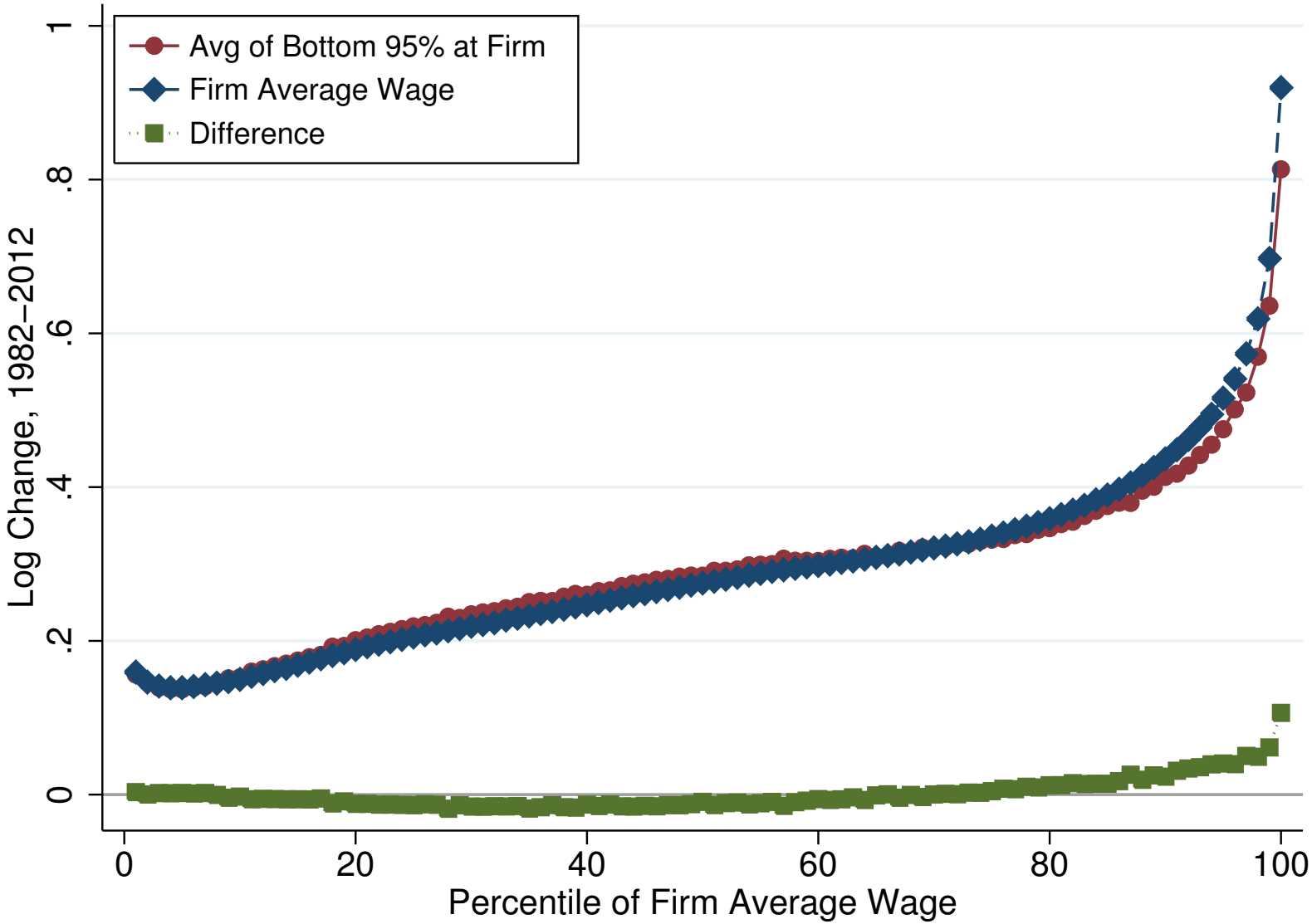
Inequality by Firm Size: Frac. Wages to Bottom 95%

P90-10



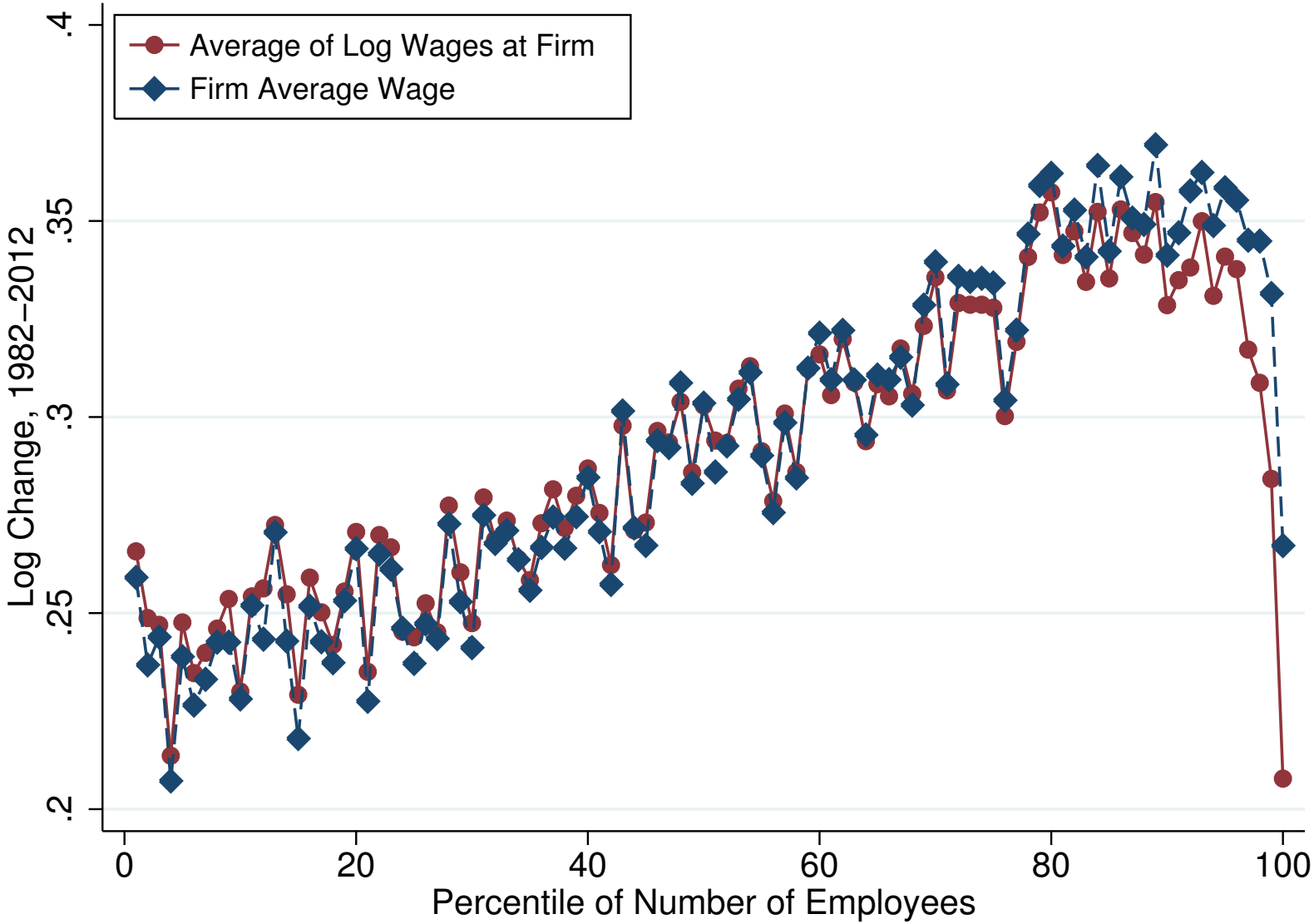
Note: Sample contains firms with 20+ full-time equivalent employees.

Avg of Bottom 95%

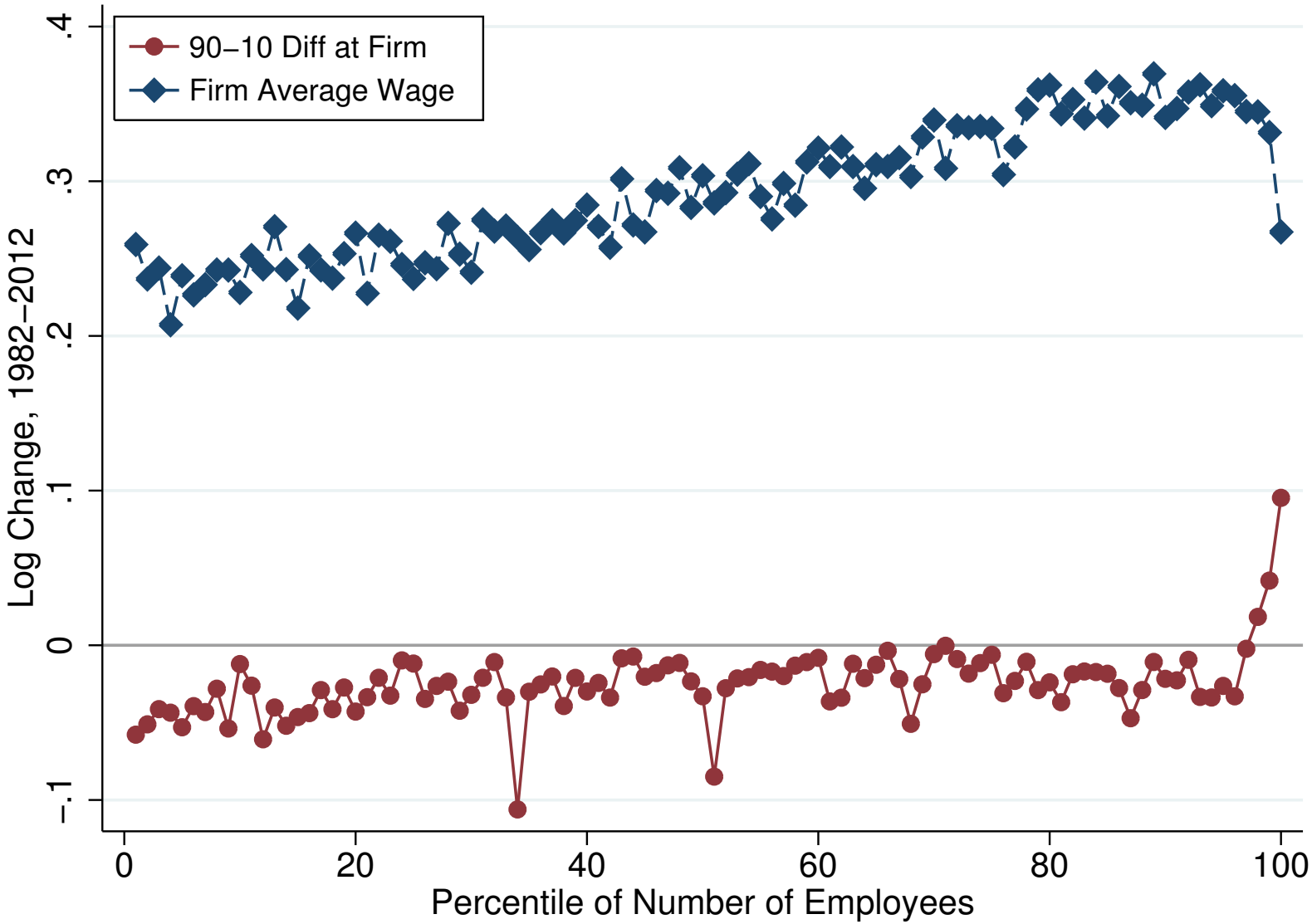


Note: Sample contains firms with 20+ full-time equivalent employees.

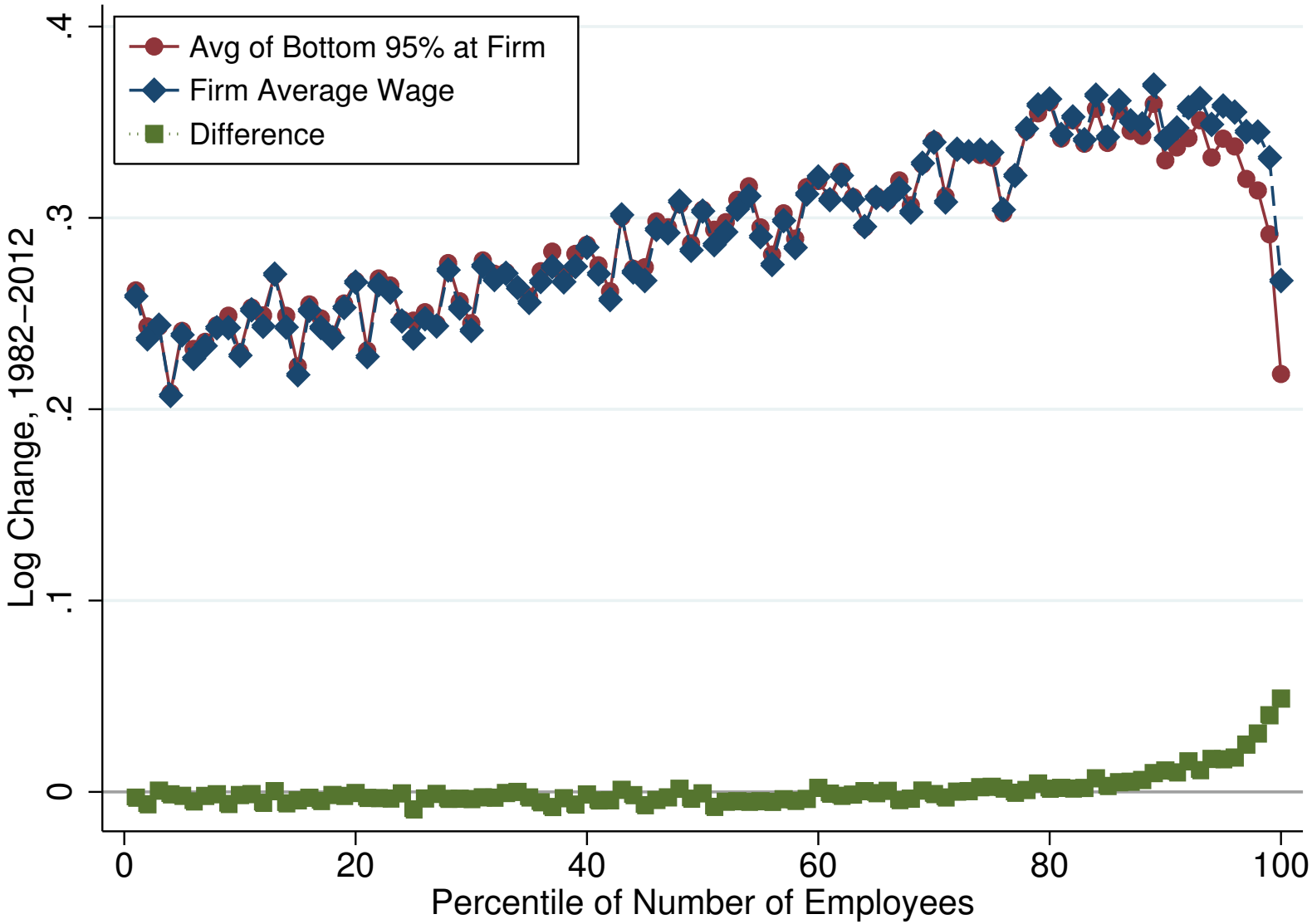
Change in Avg. Log Wages by Firm Size



Inequality by Firm Size

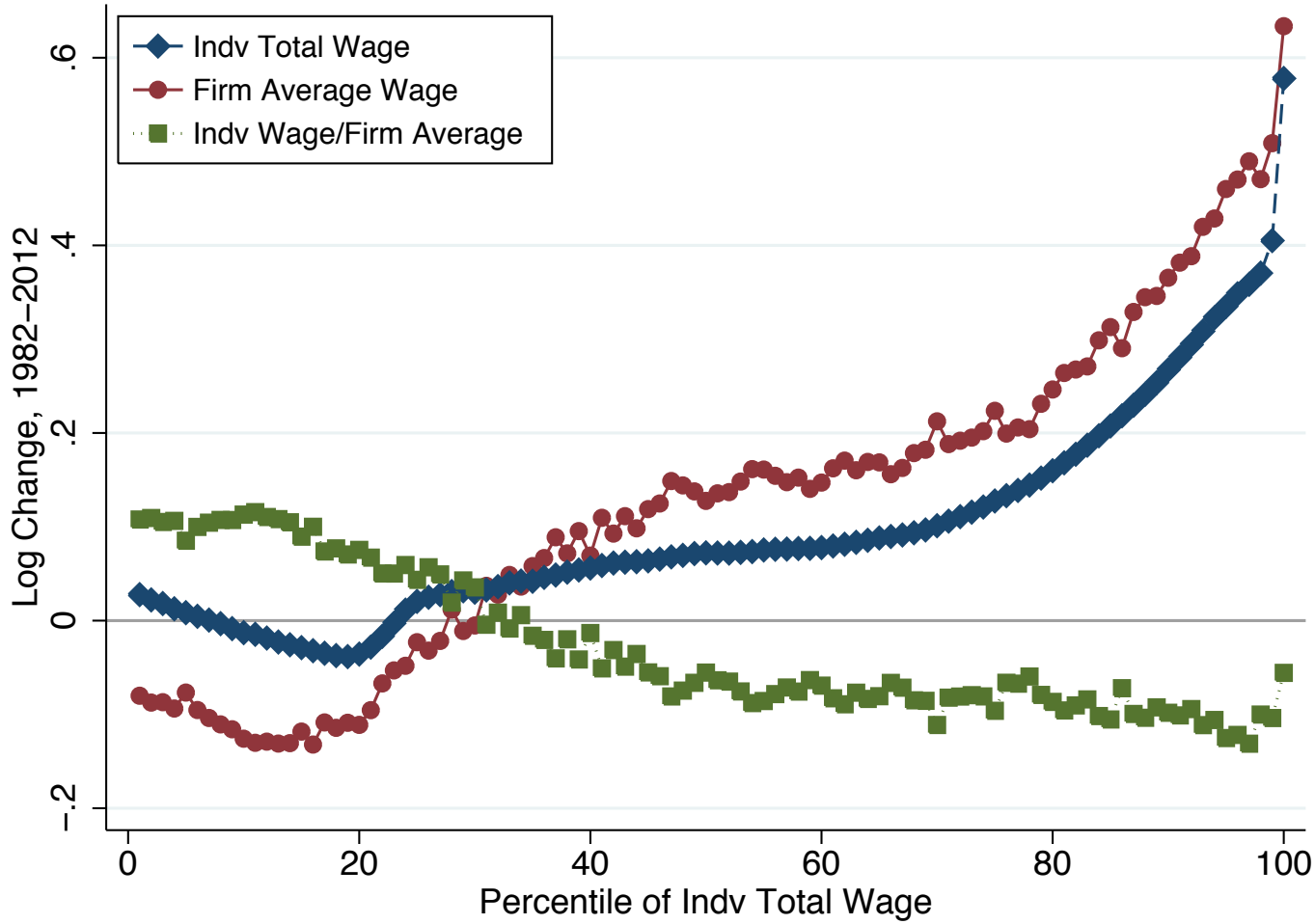


Avg. of Bottom 95% by Firm Size



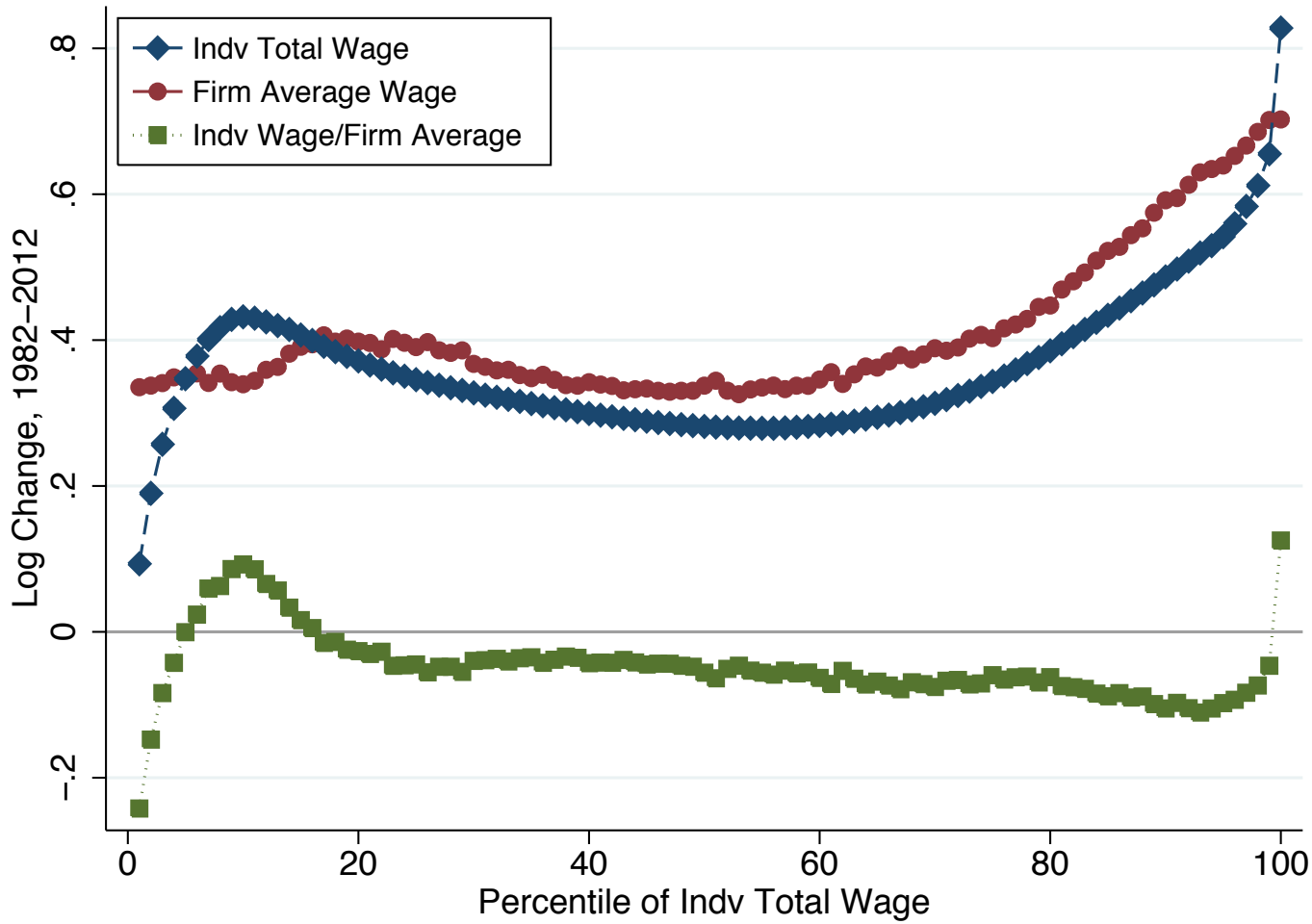
Bottom 99%: Industries

Industry: Ag/Mining/Construction/Other



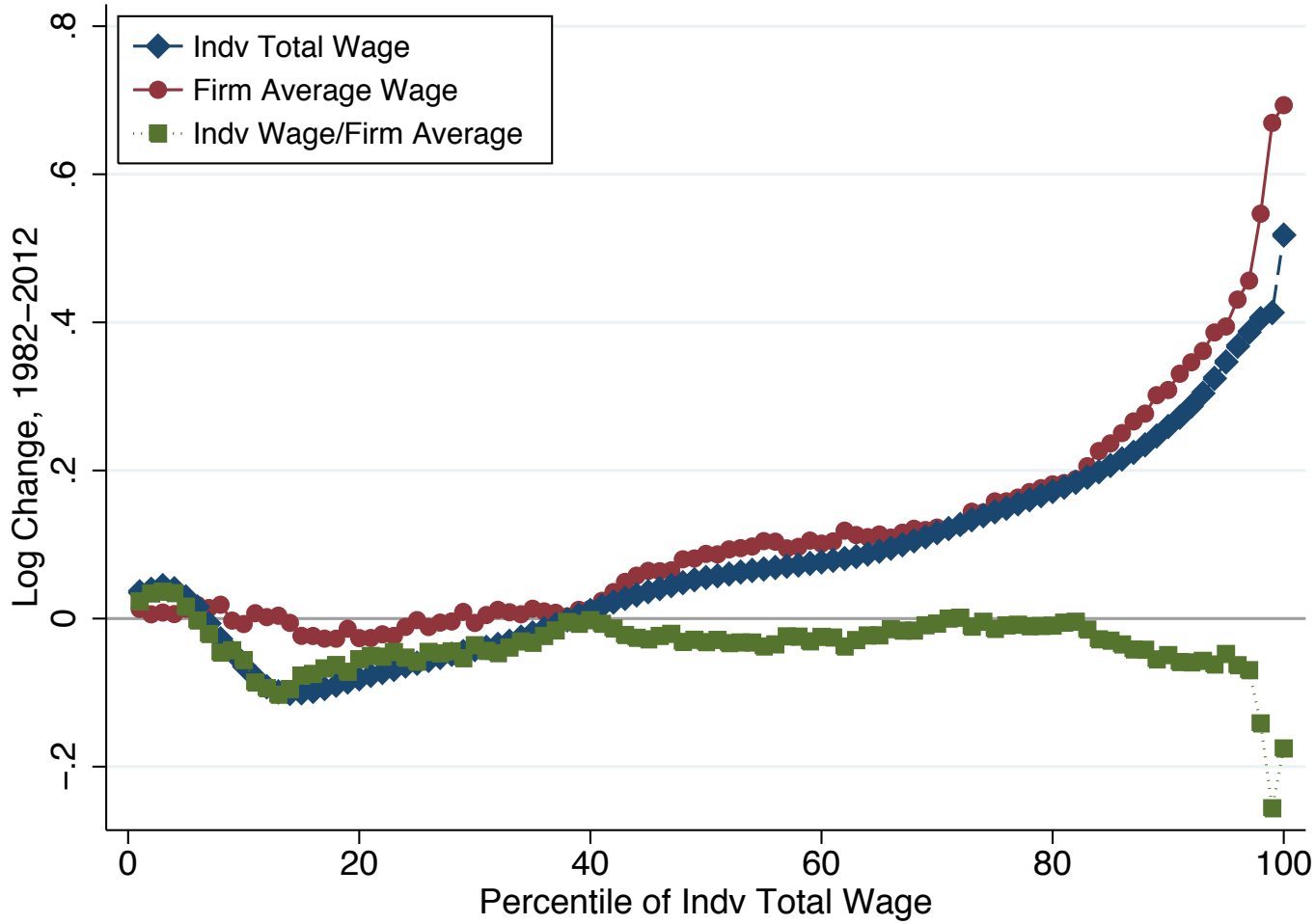
BACK TO SUBGROUPS

Industry: Manufacturing



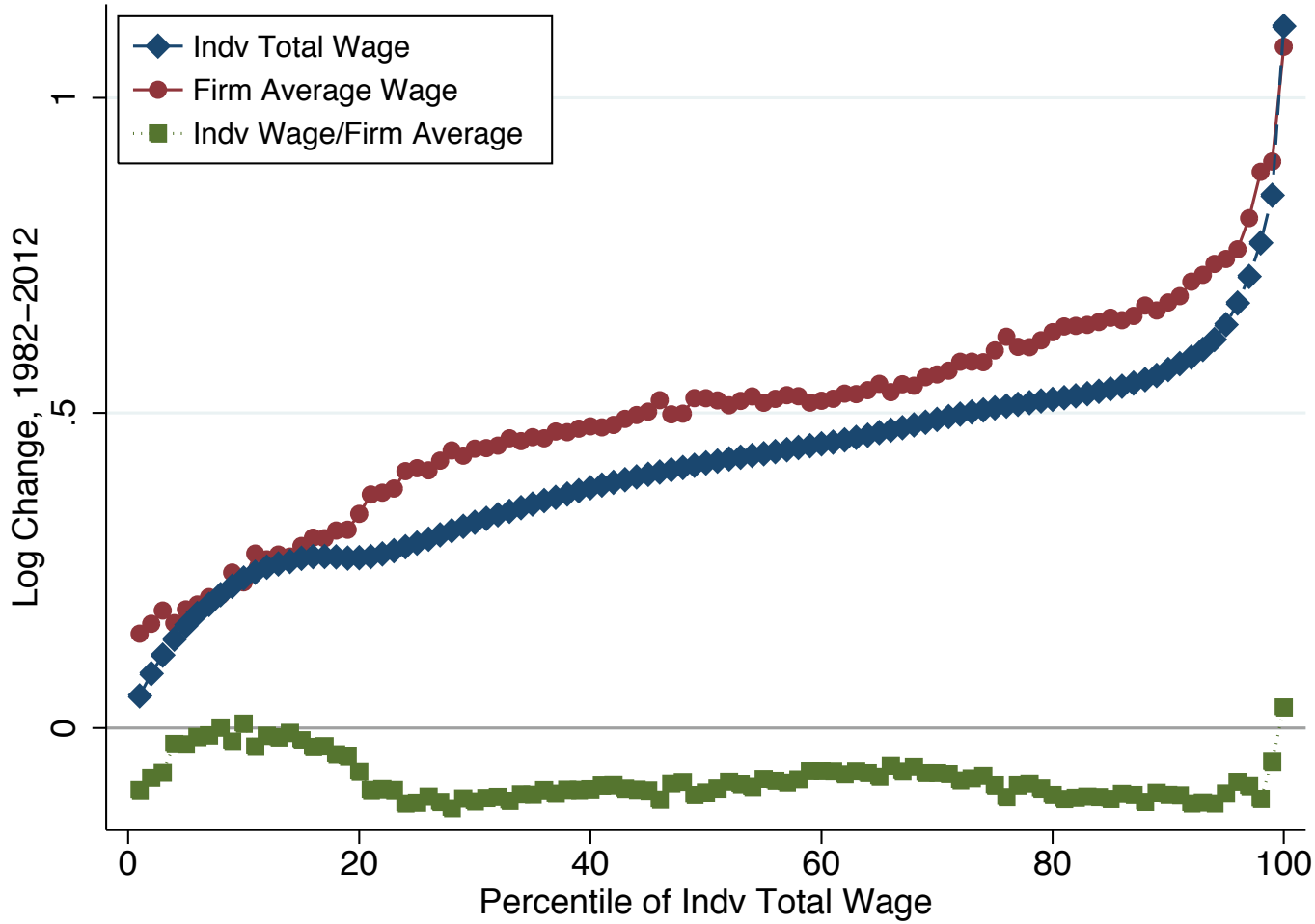
BACK TO SUBGROUPS

Industry: Utilities



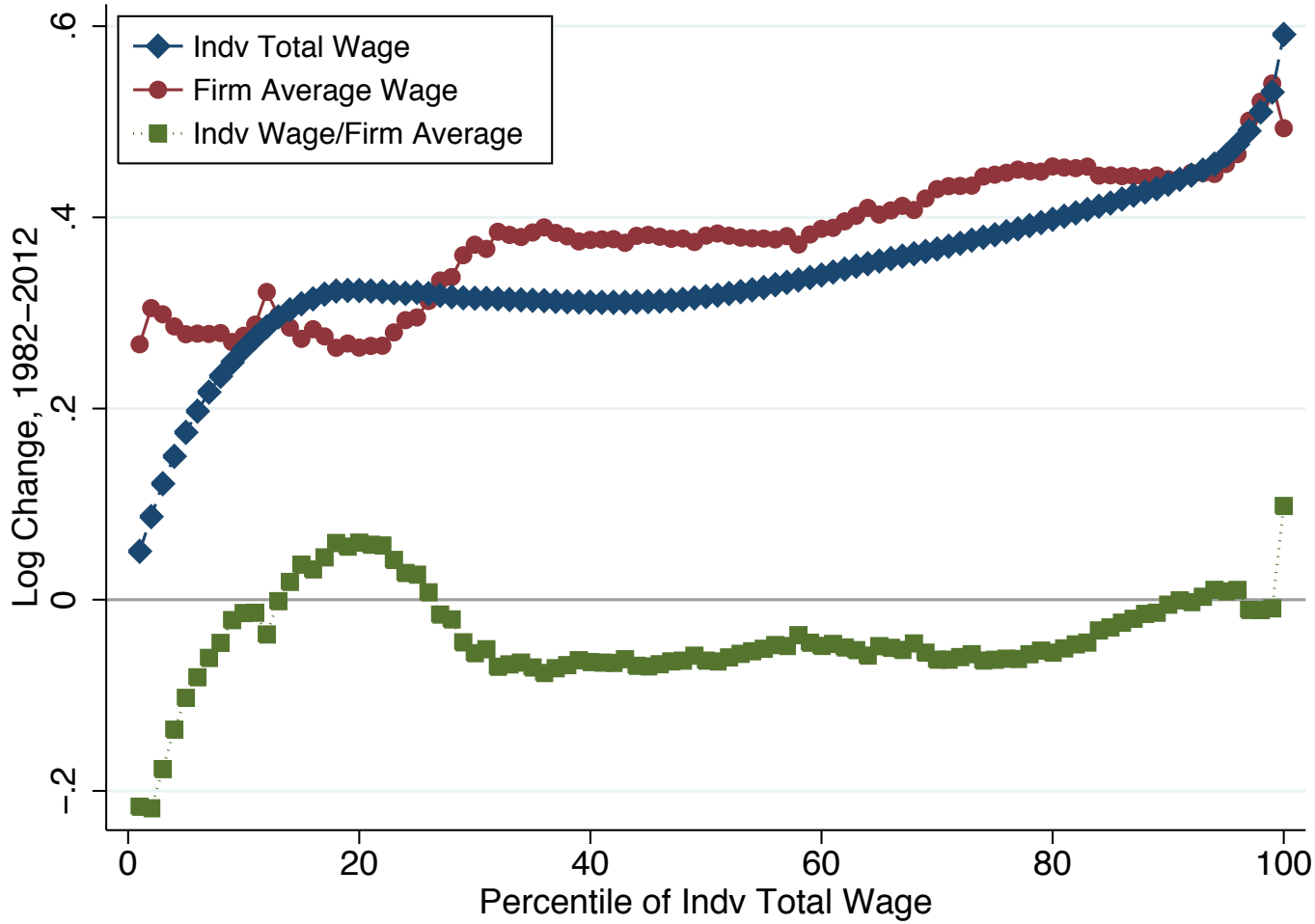
BACK TO SUBGROUPS

Industry: Finance/Insurance/Real Estate



BACK TO SUBGROUPS

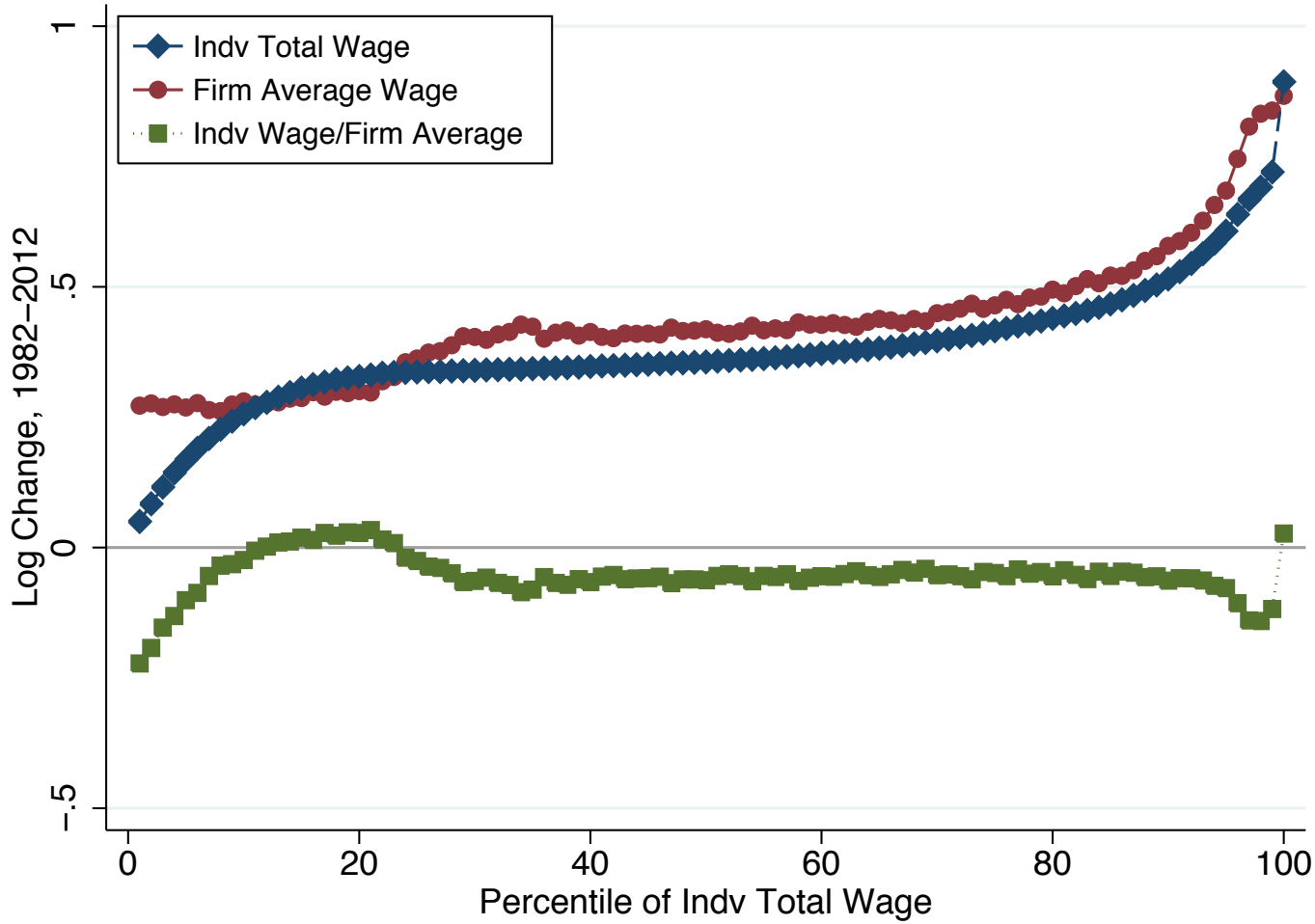
Industry: Services



BACK TO SUBGROUPS

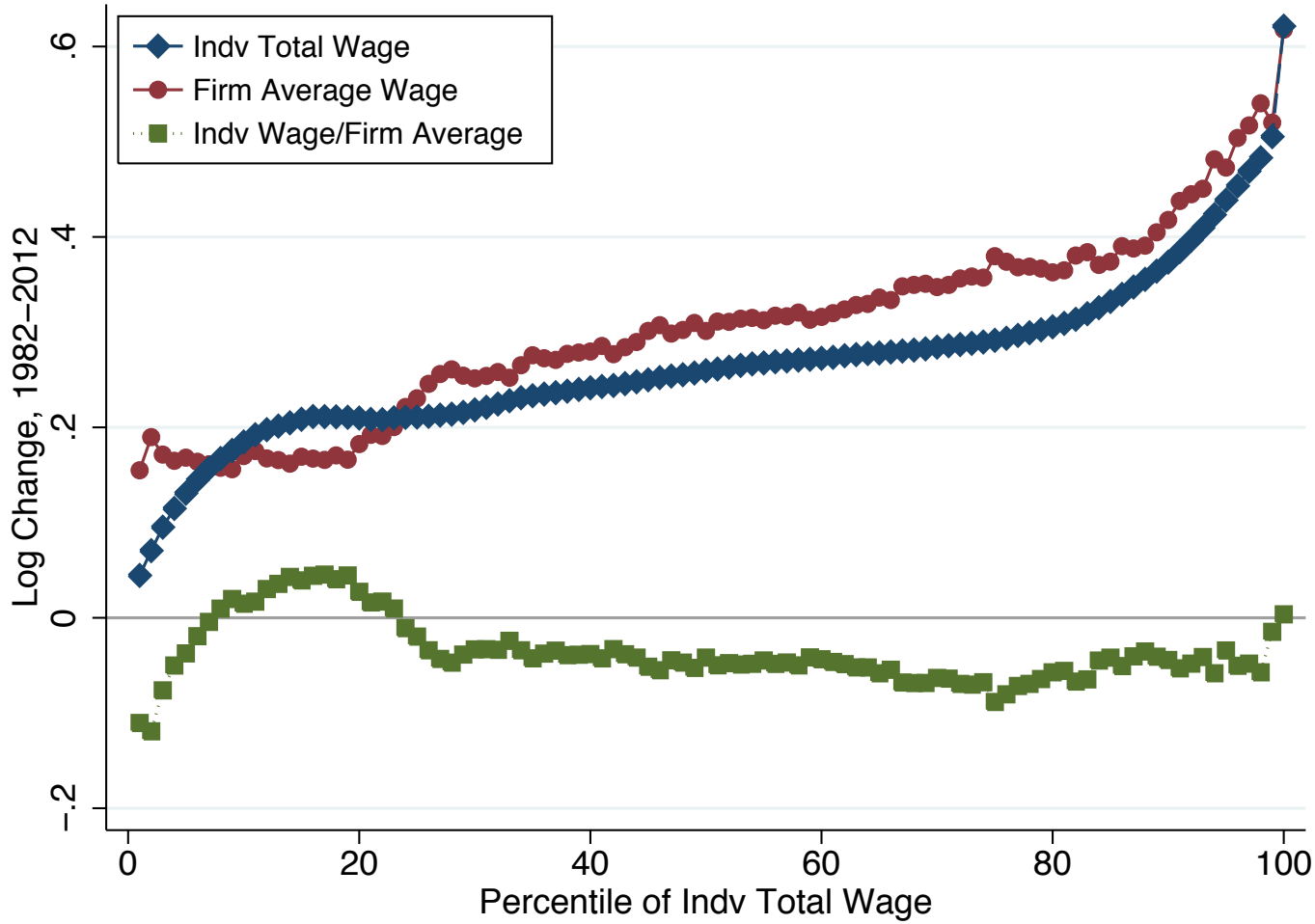
Bottom 99%: US Regions

Region: Northeast



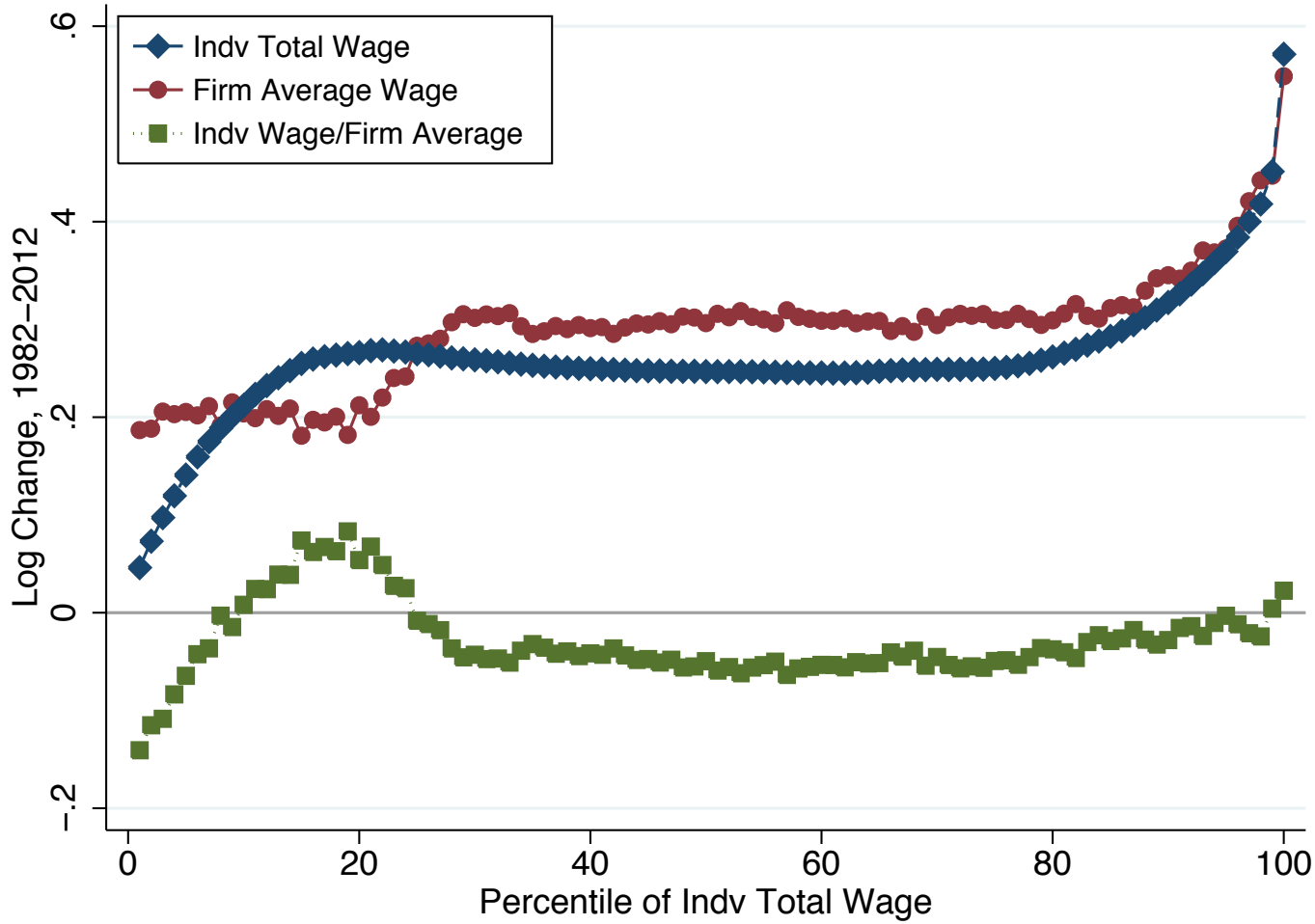
BACK TO SUBGROUPS

Region: South



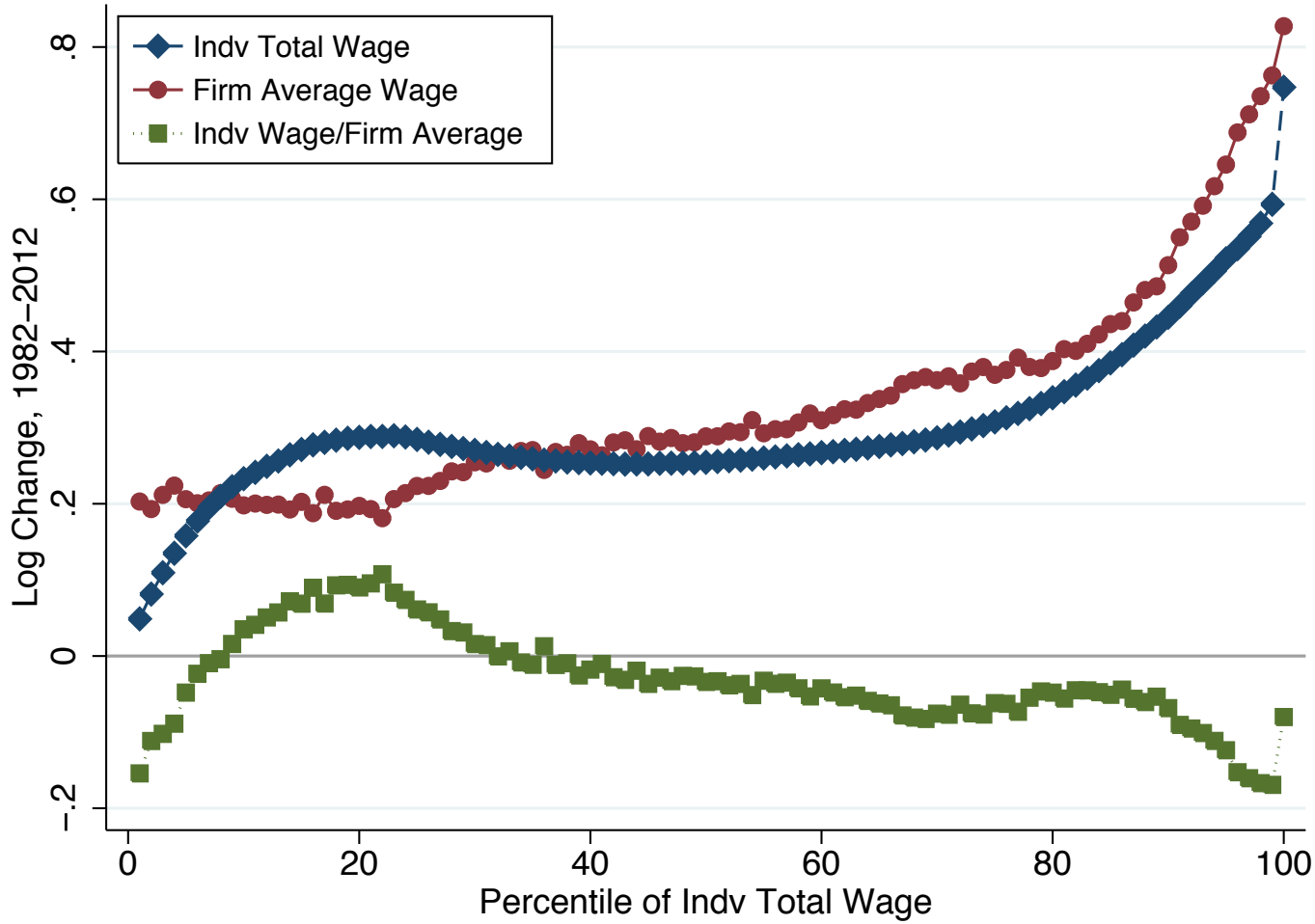
BACK TO SUBGROUPS

Region: Midwest



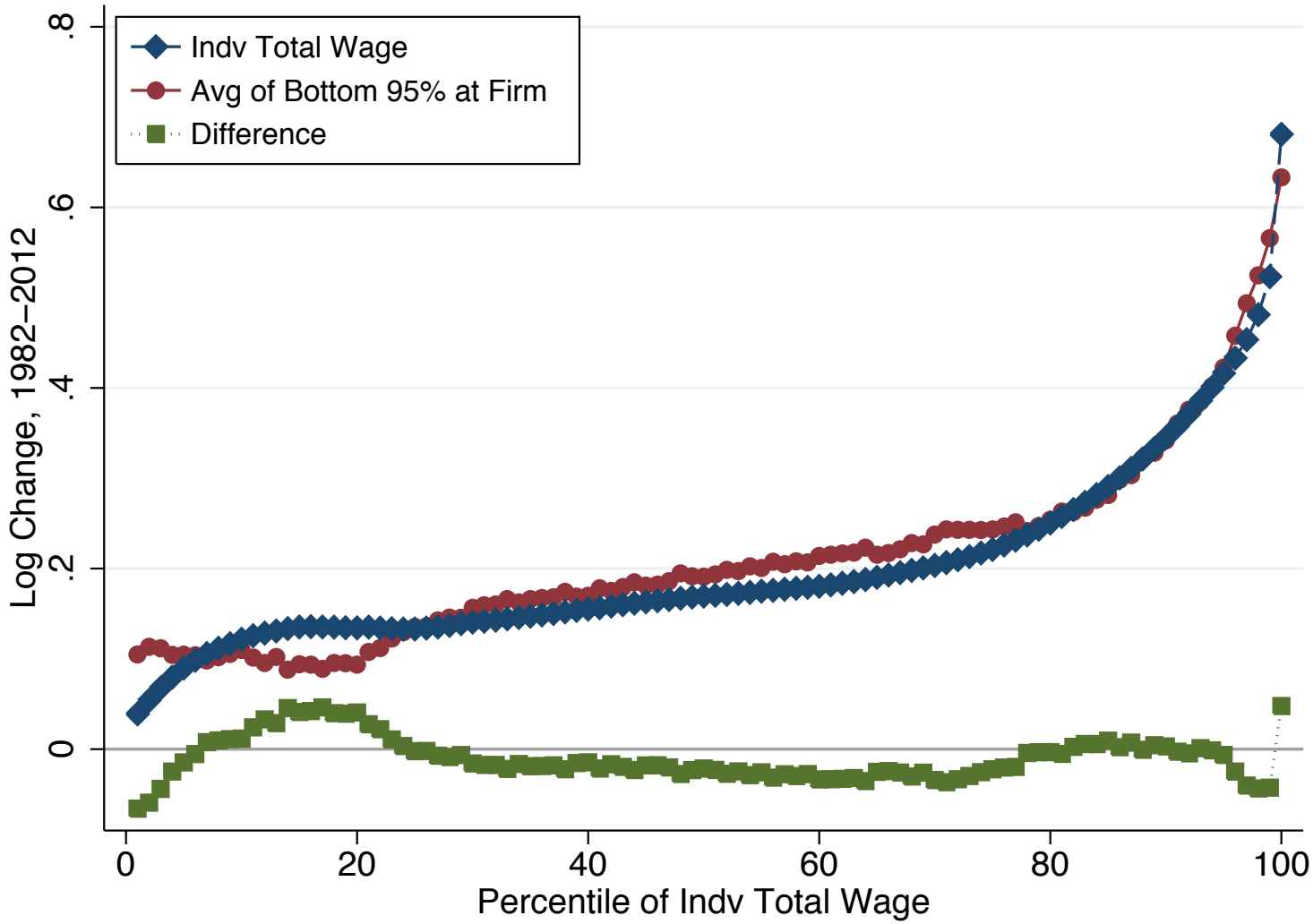
BACK TO SUBGROUPS

Region: West



BACK TO SUBGROUPS

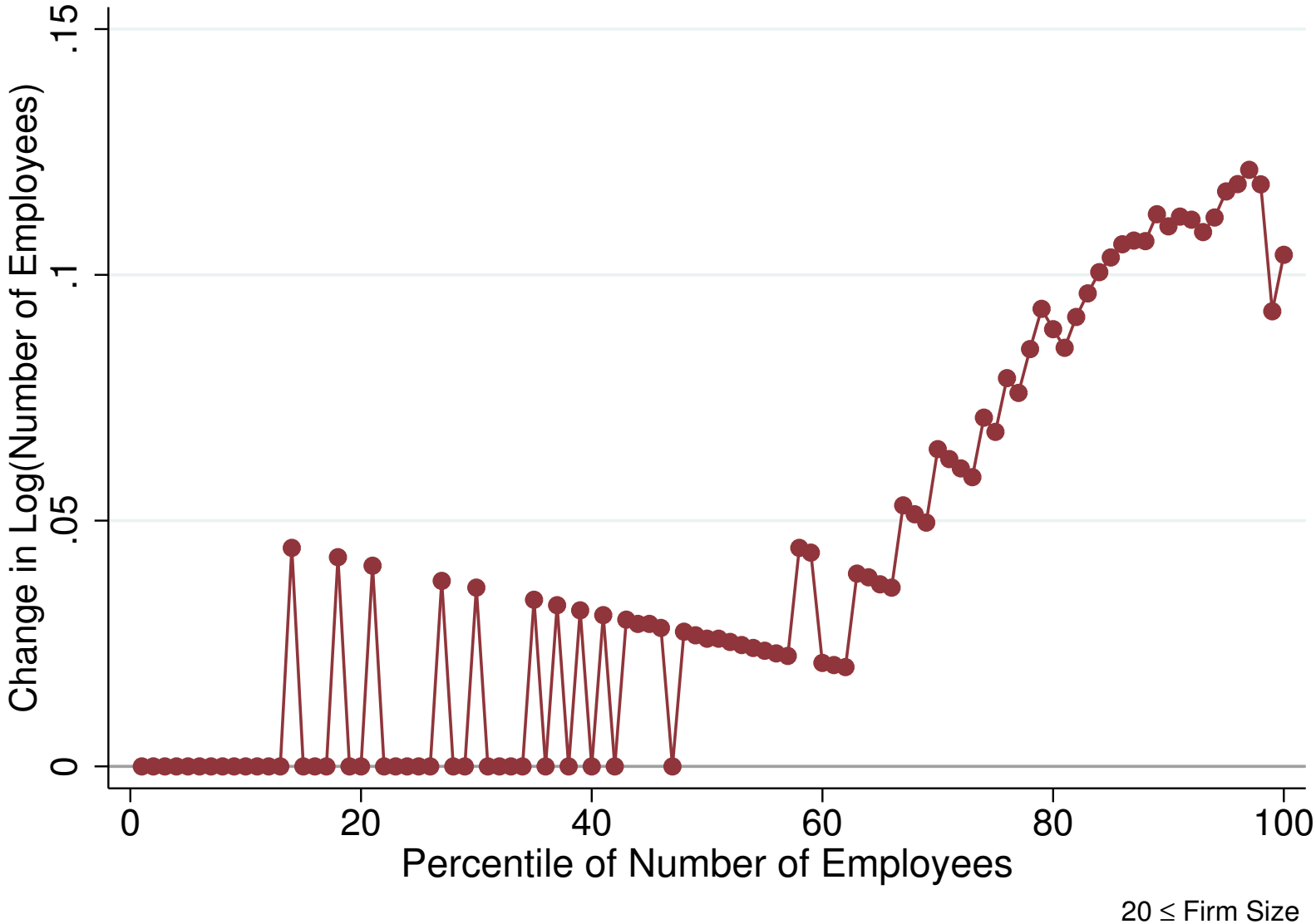
Robustness: Average of Bottom 95pct



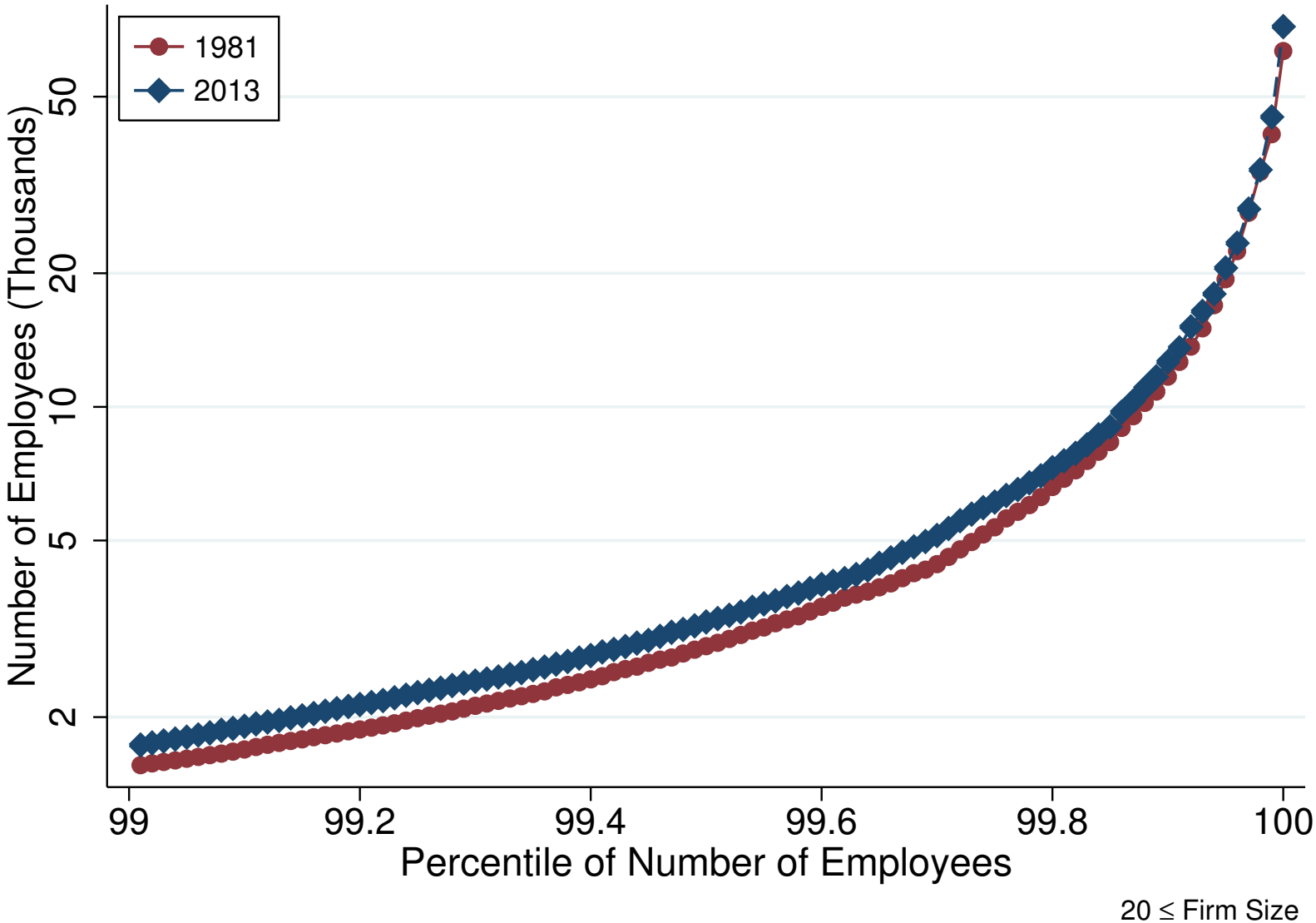
BACK TO SUBGROUPS

ADDITIONAL FIGURES

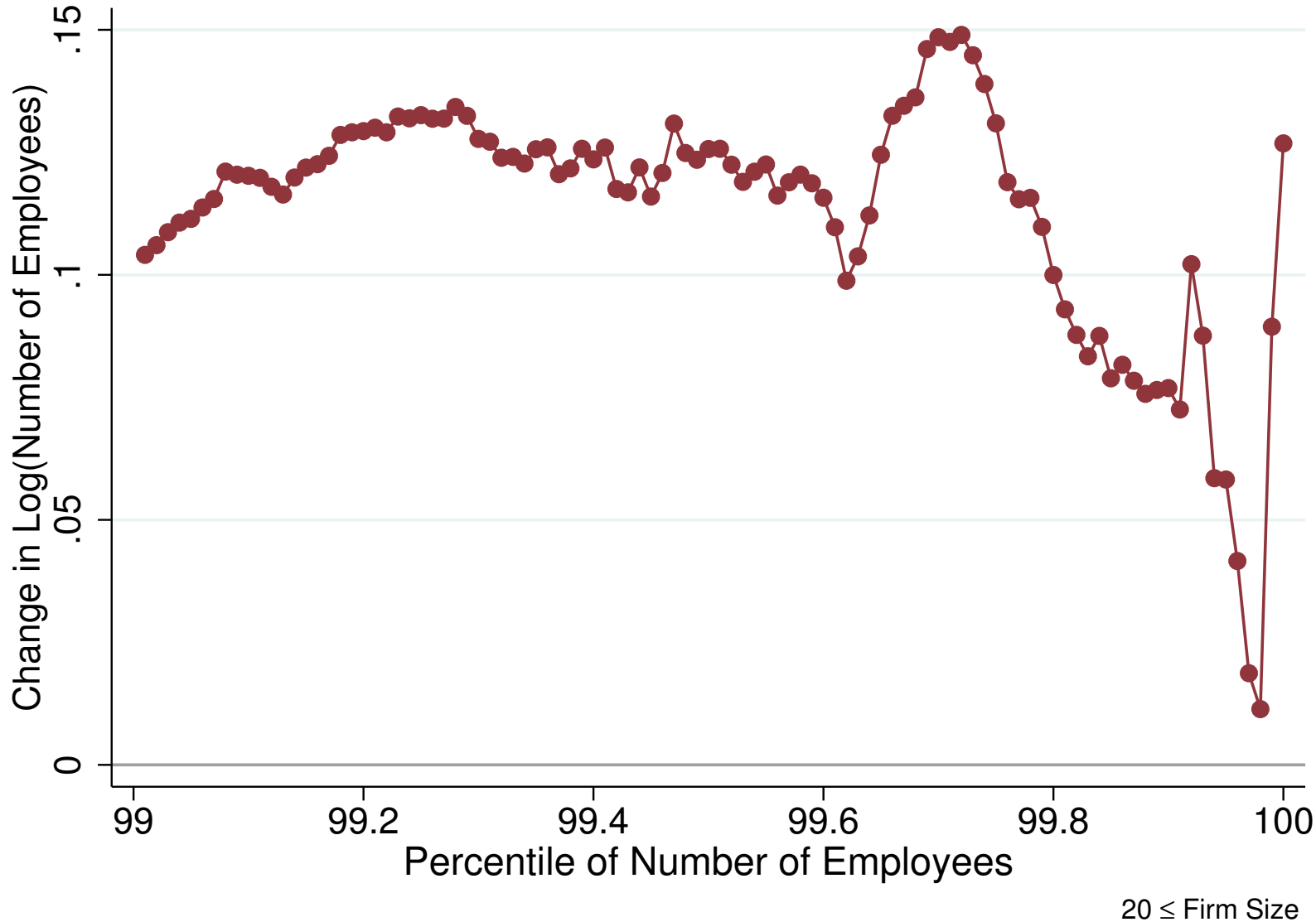
Change in Firm Size: All Firms



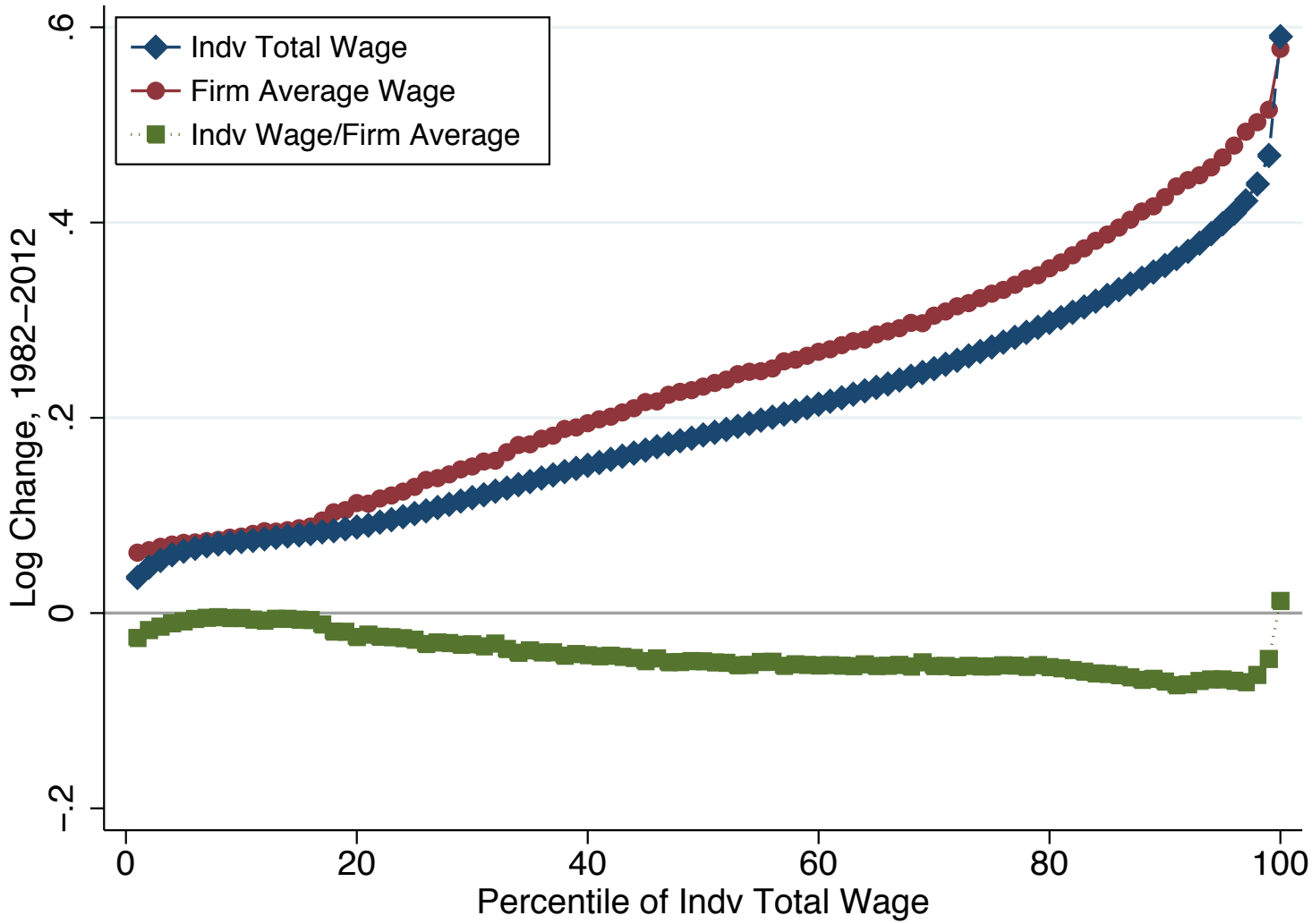
Firm Size Distribution: Top 1% of Firms



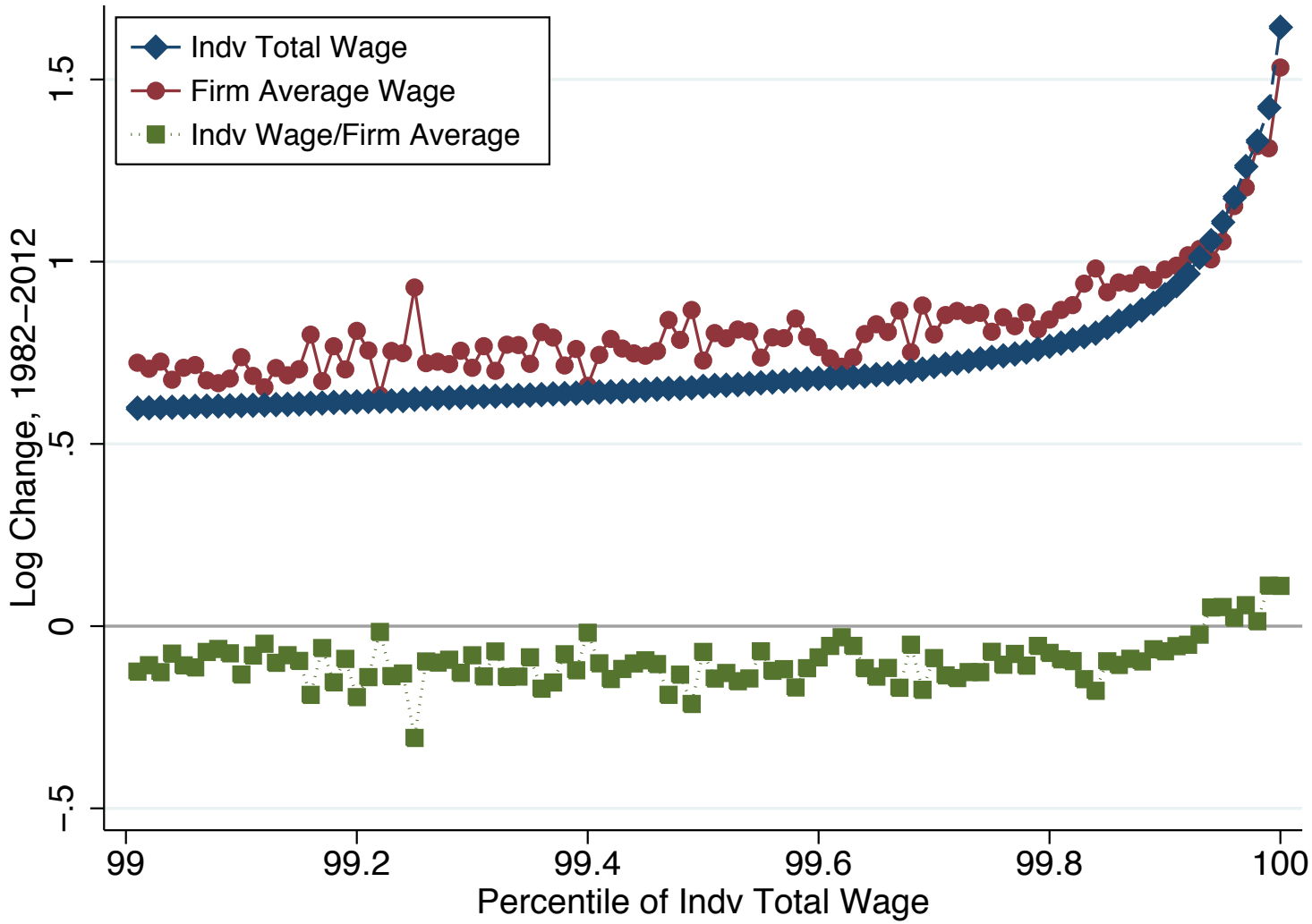
Change in Firm Size: Top 1% of Firms



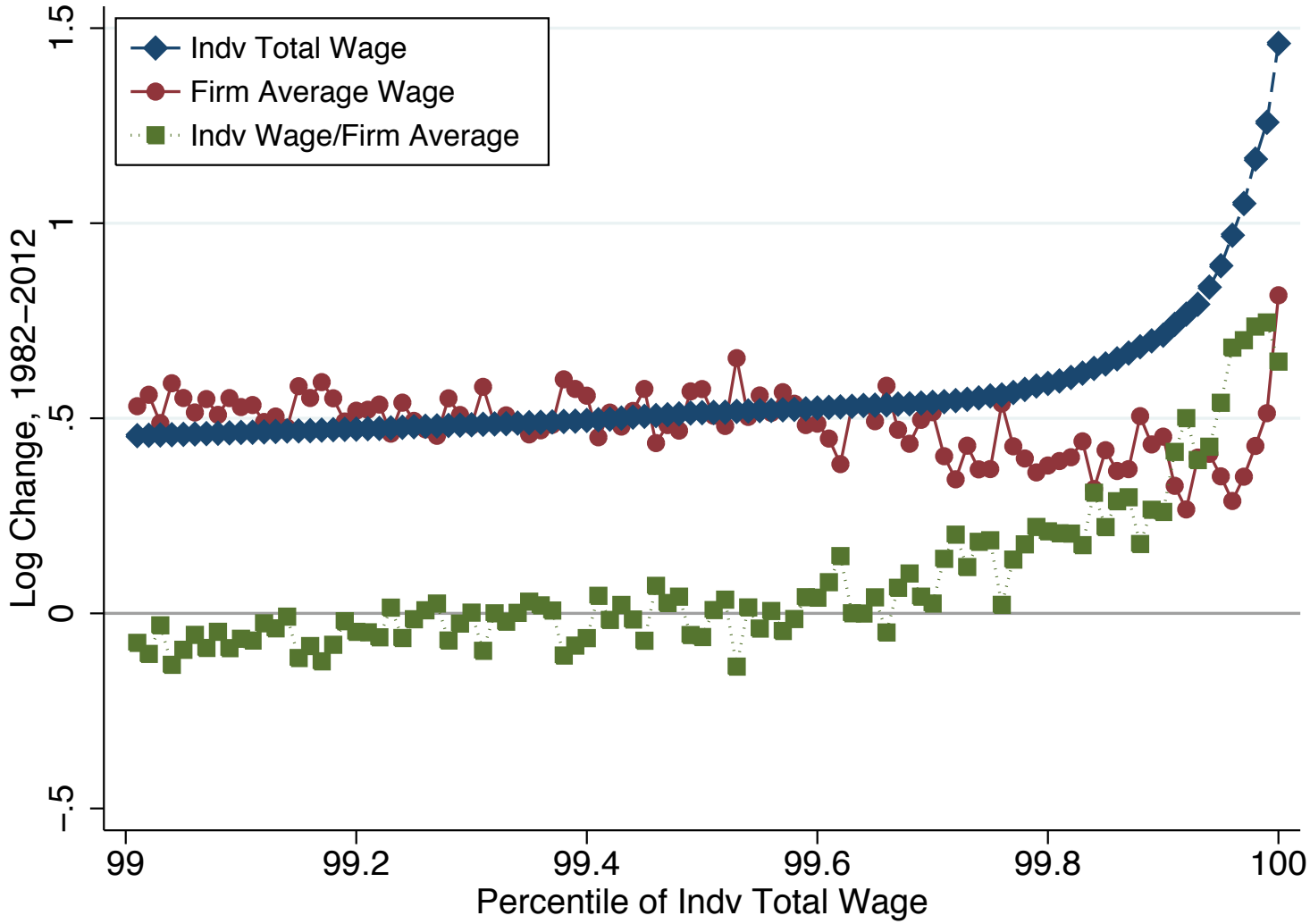
Within 4-Digit Industry Code



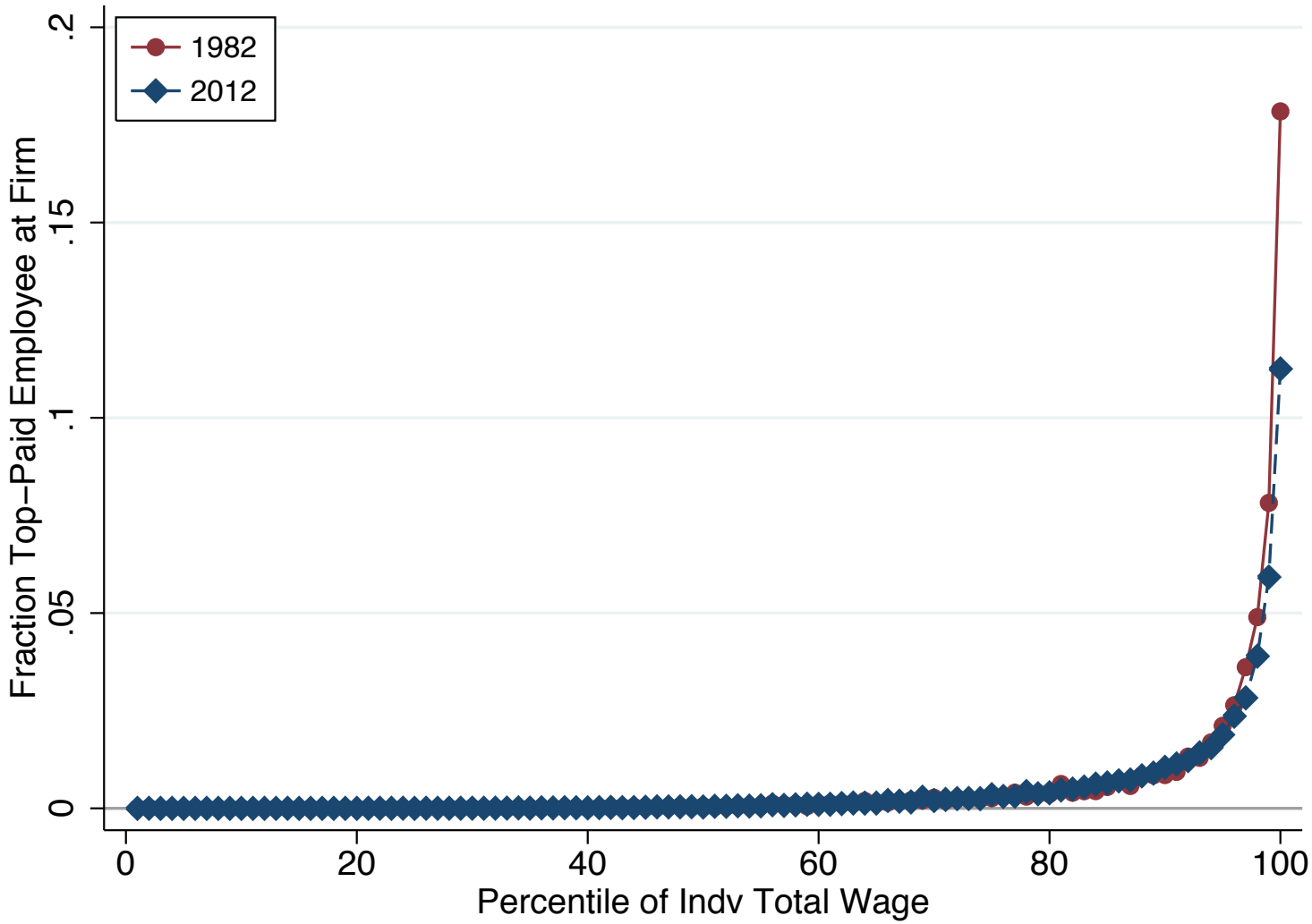
Firm Size: 20 – 10,000 FTE (Top 1%)



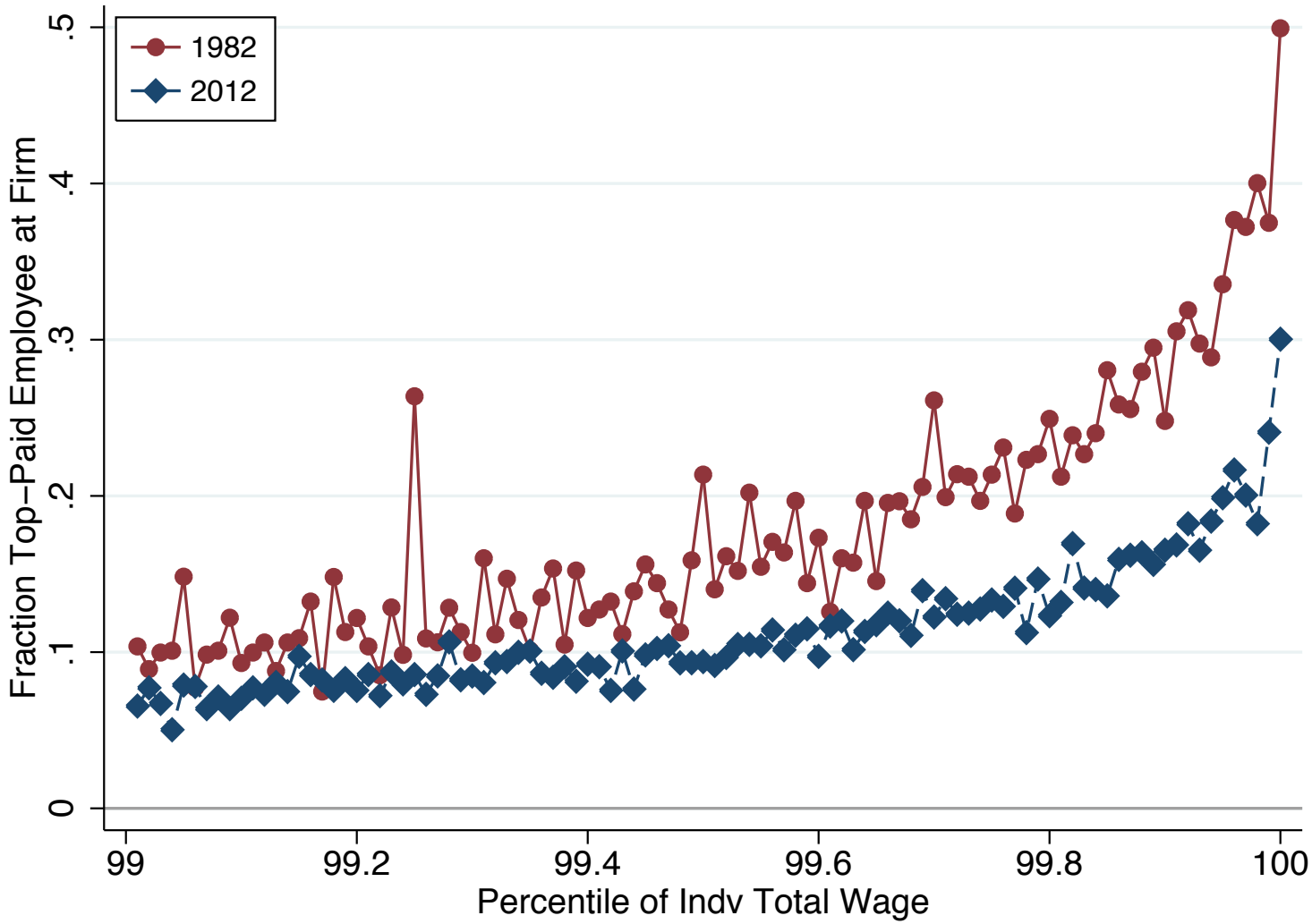
Firm Size: 10,000+ FTE (Top 1%)



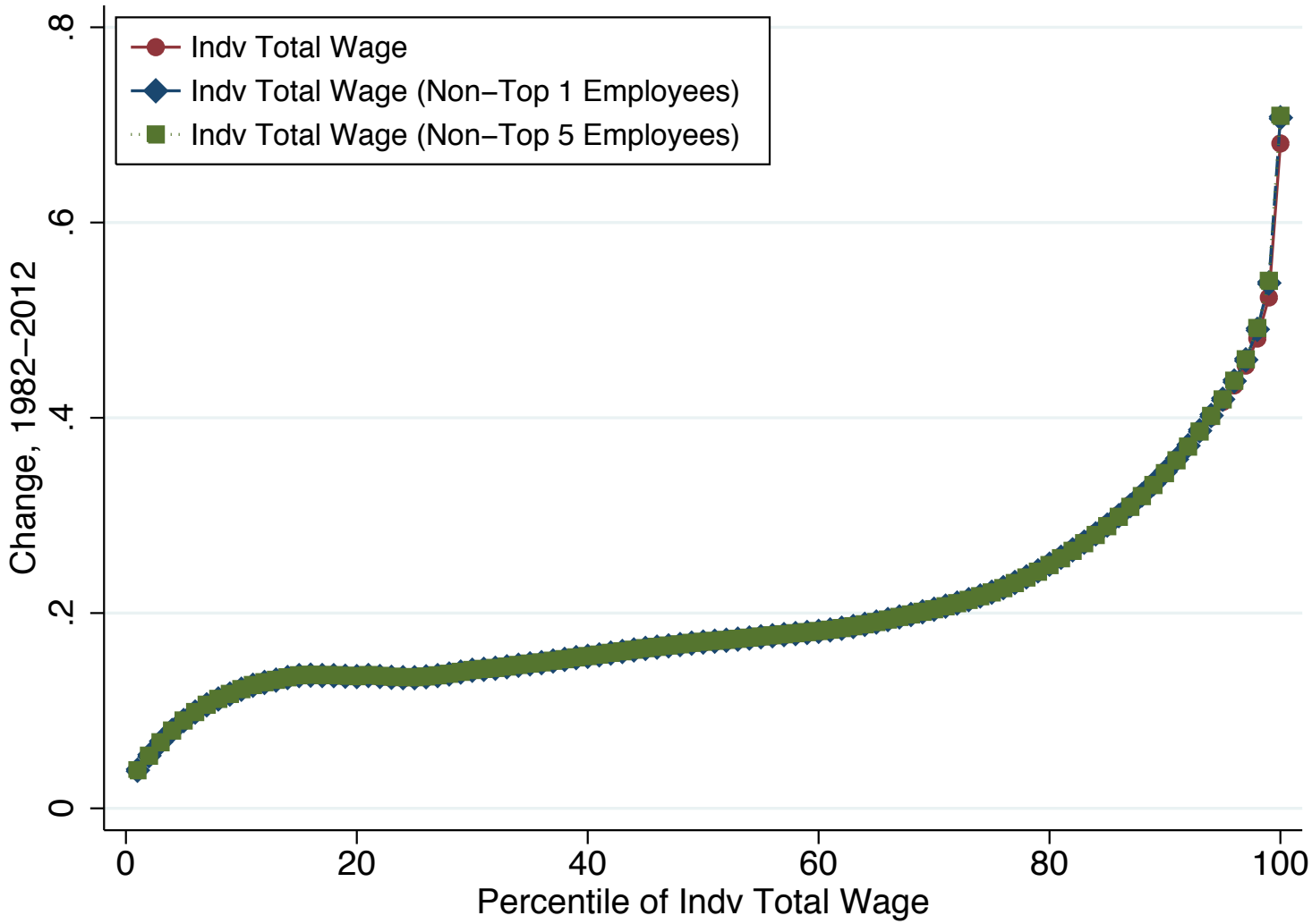
Fraction Top-Paid Employee



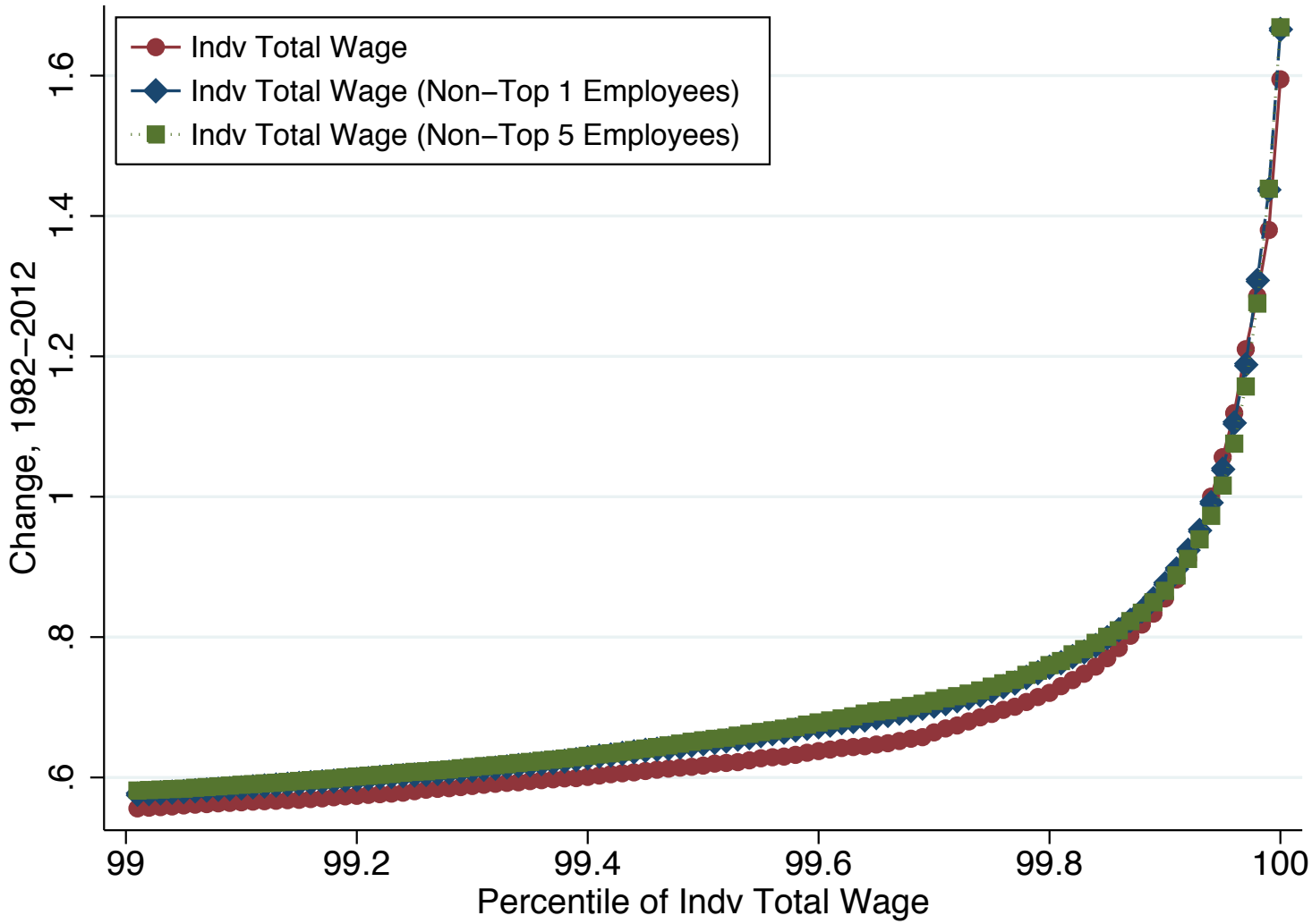
Fraction Top-Paid Employee (Top 1%)



Rising Inequality Among Non-CEOs

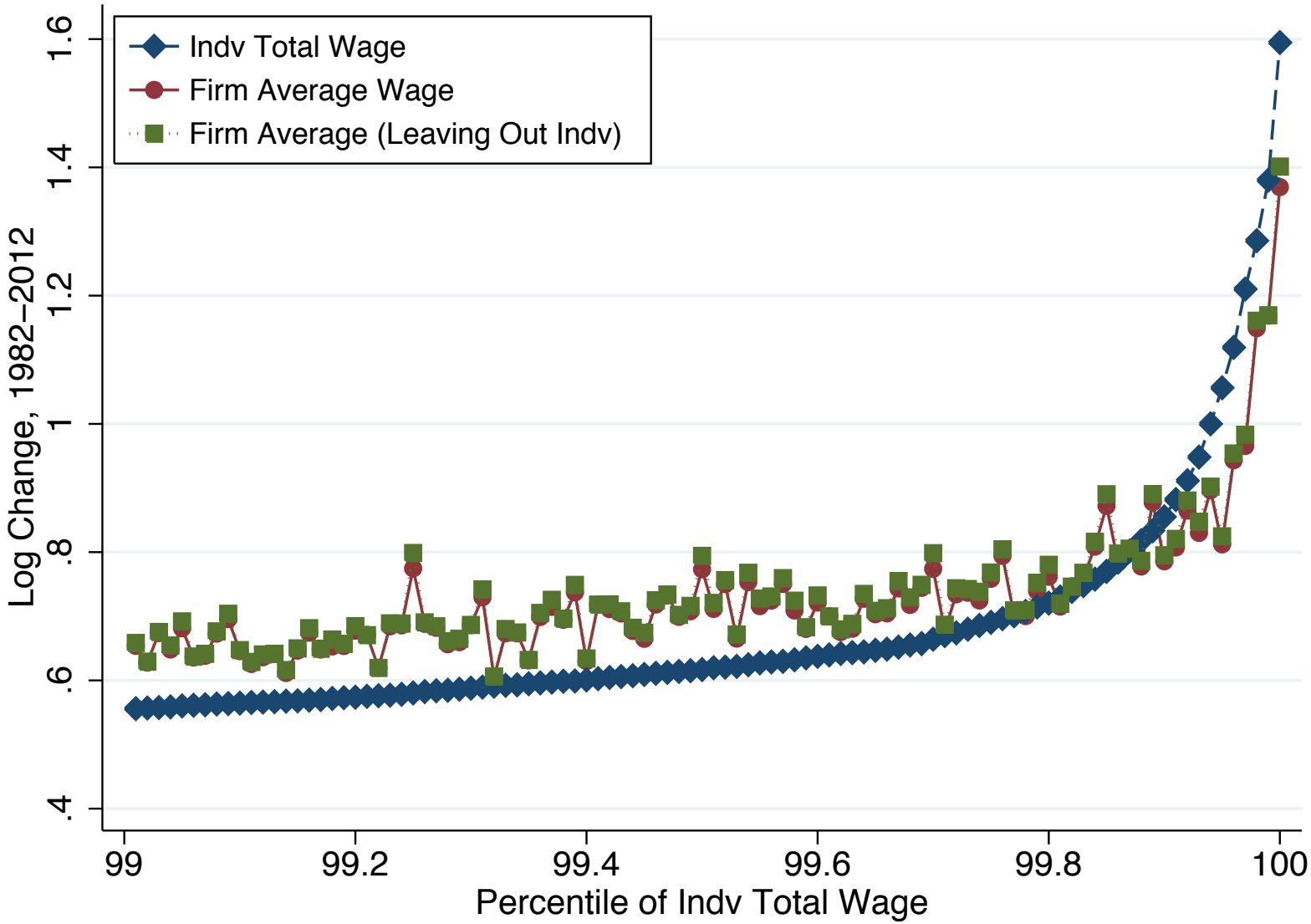


Rising Inequality Among Non-CEOs (Top 1%)

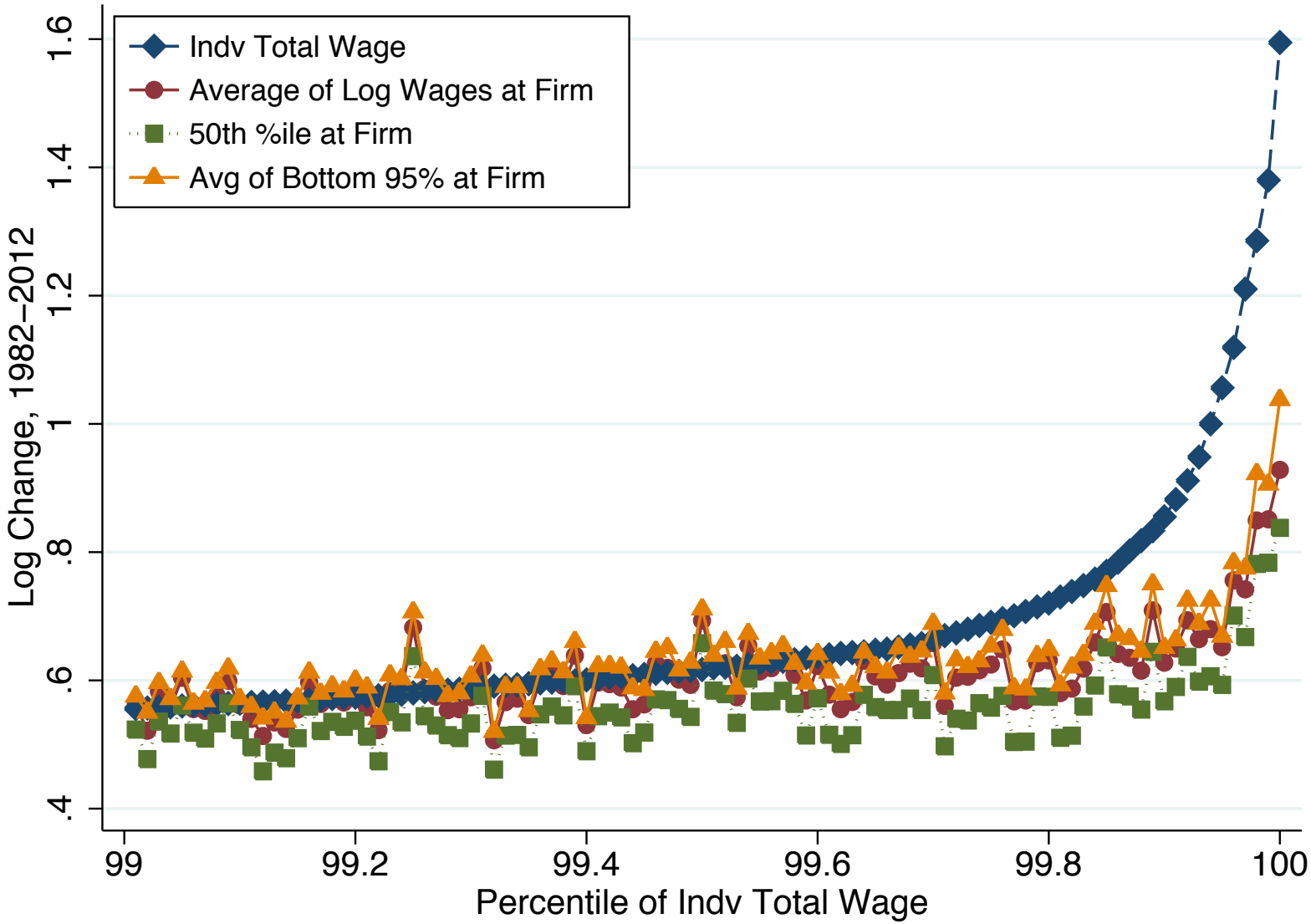


Many Measures of Firm Wage

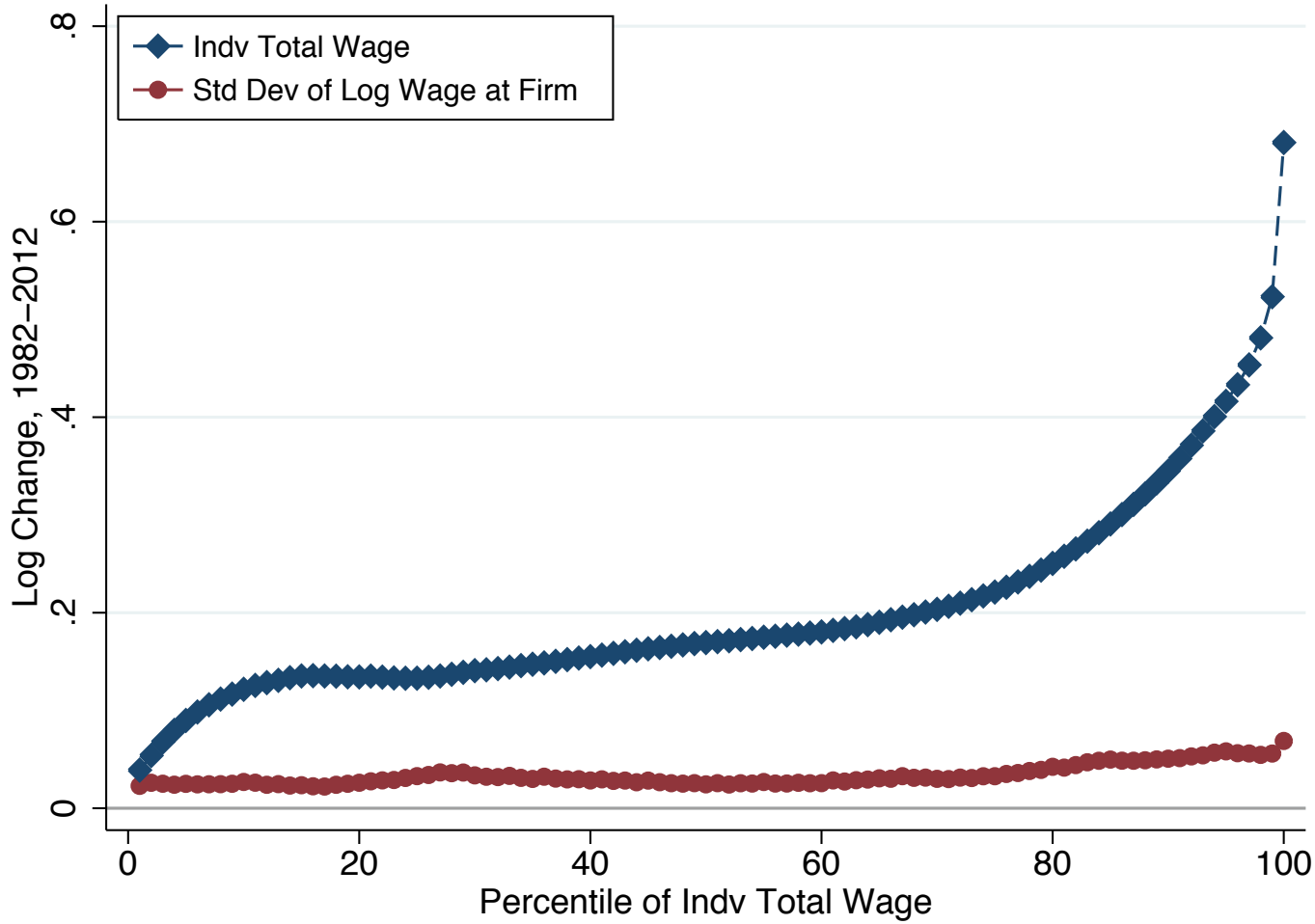
Many Measures of Firm Wage (Top 1%)



Many Measures of Firm Wage (Top 1%)

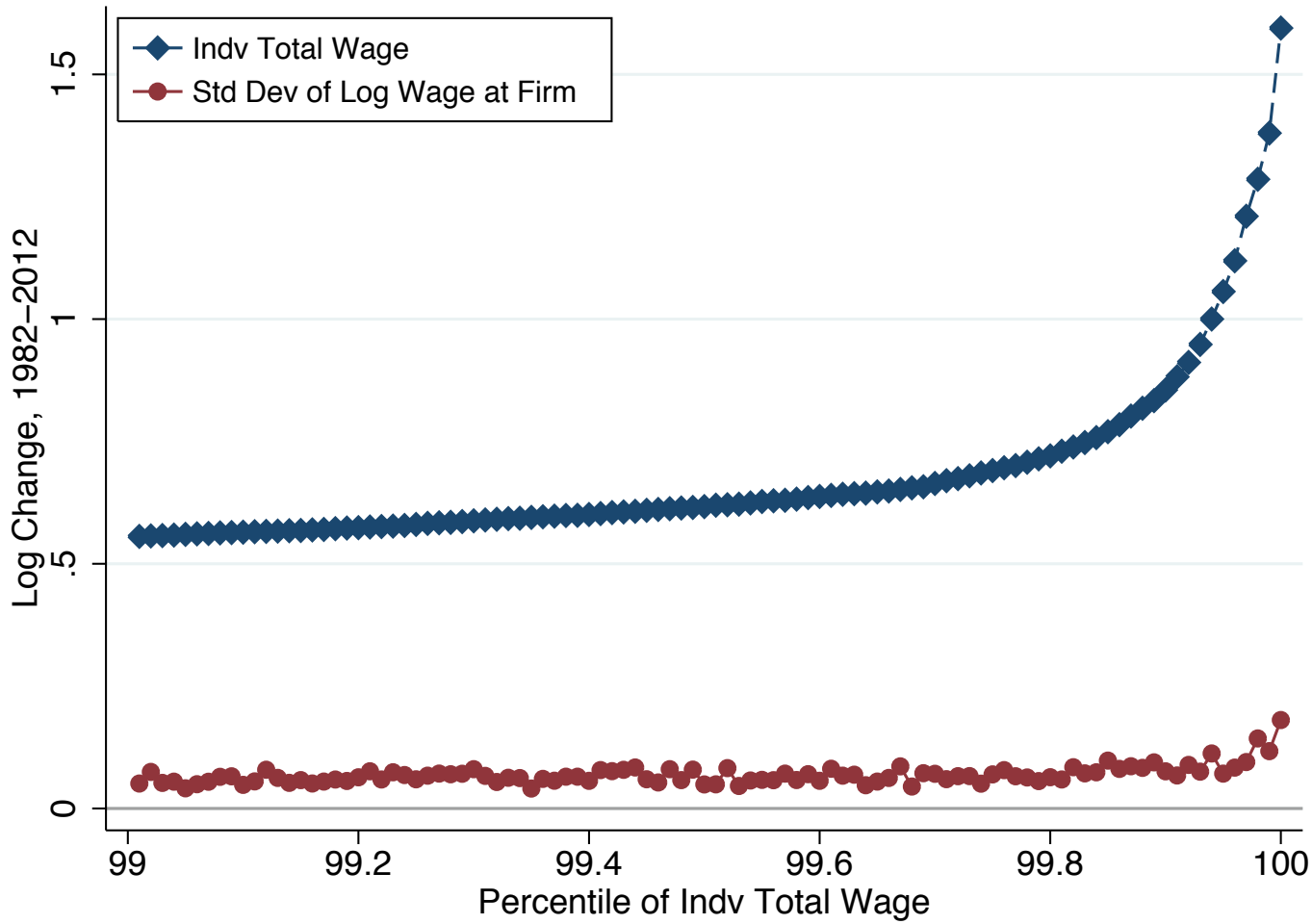


Standard Deviation of Log Wage in Firm



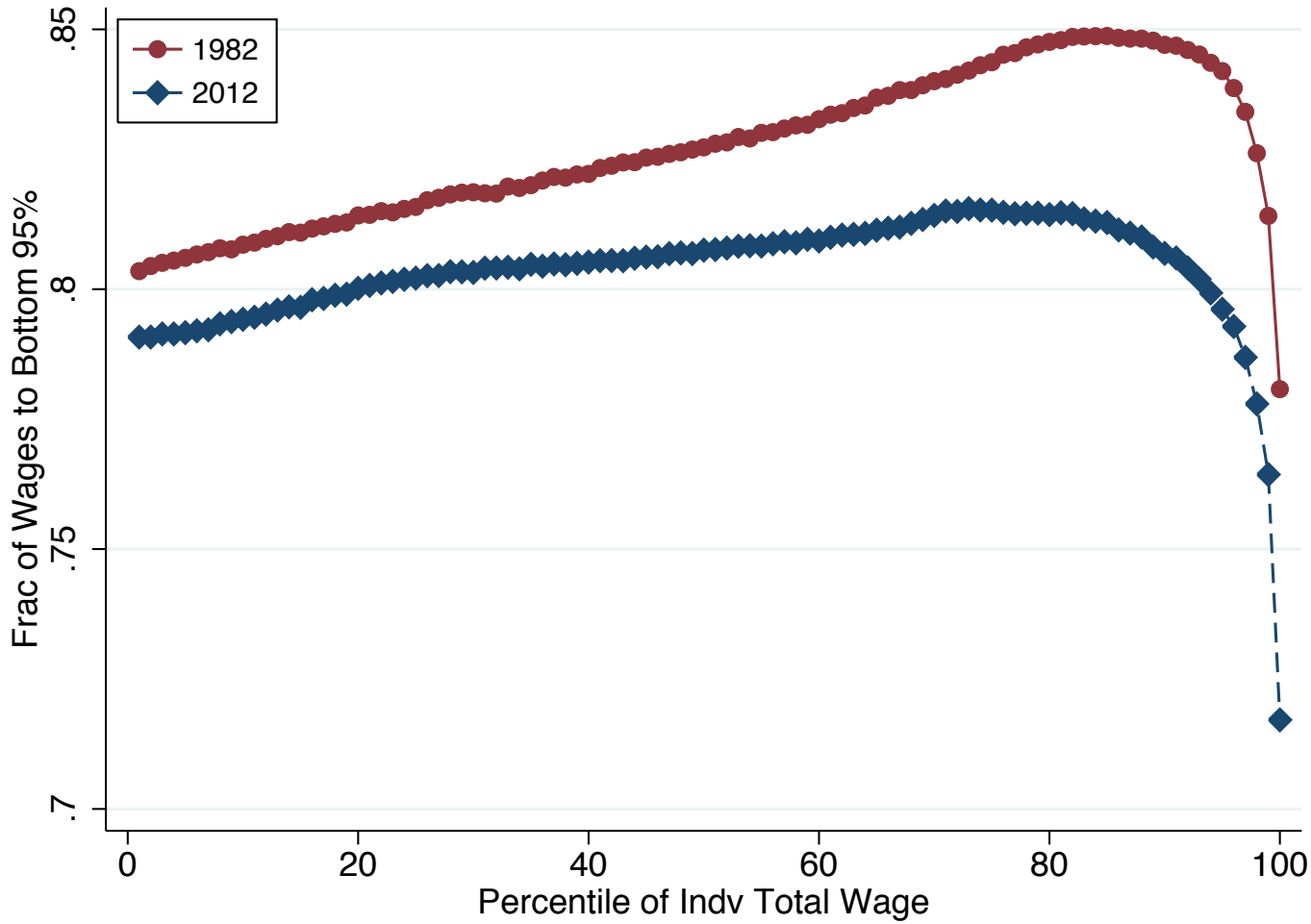
FIRM 90-10 DIFFERENTIAL

Standard Deviation of Log Wage in Firm (Top 1%)

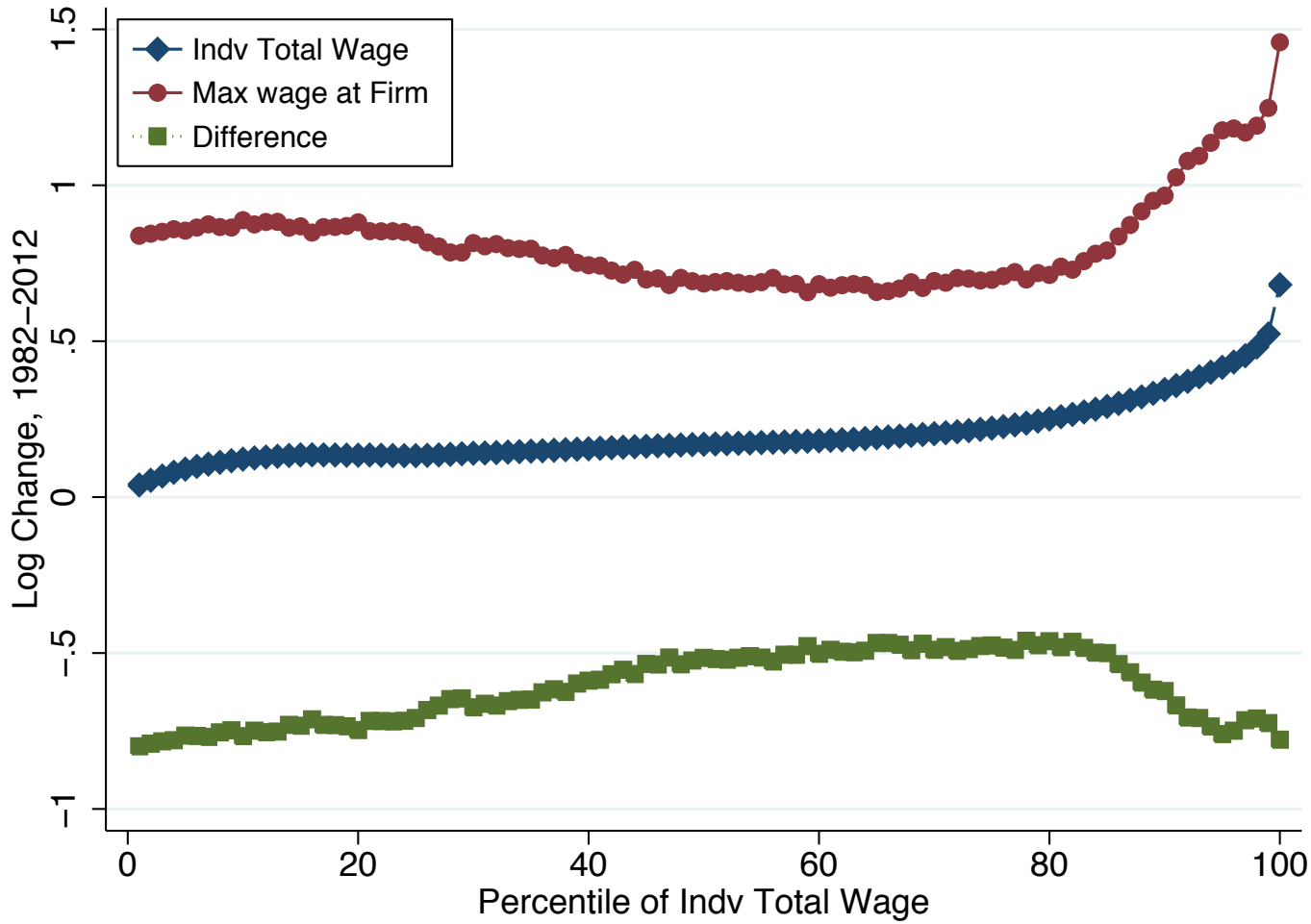


FIRM 90-10 DIFFERENTIAL

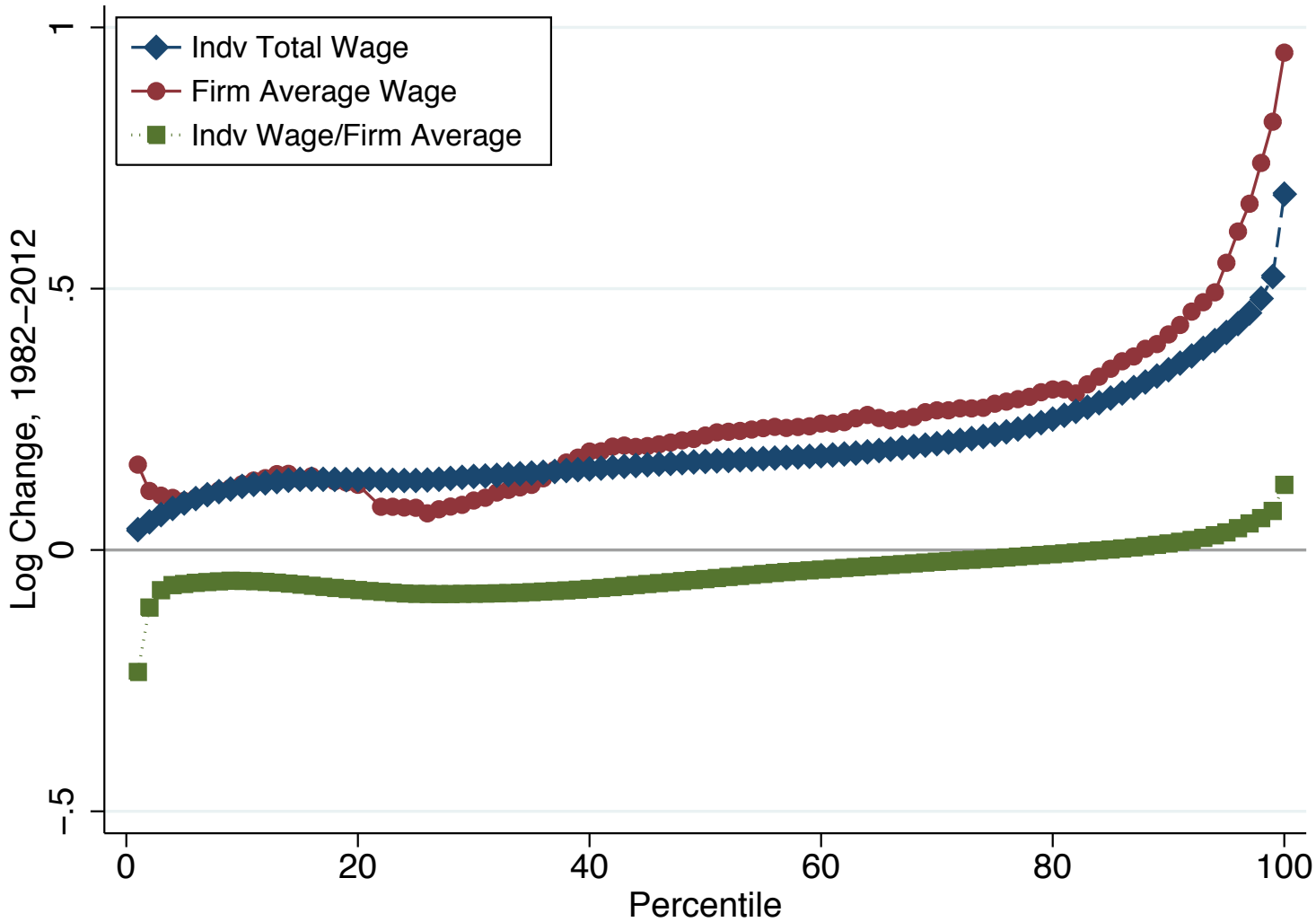
Frac. Wages to Bottom 95%



Max Wage in Firm

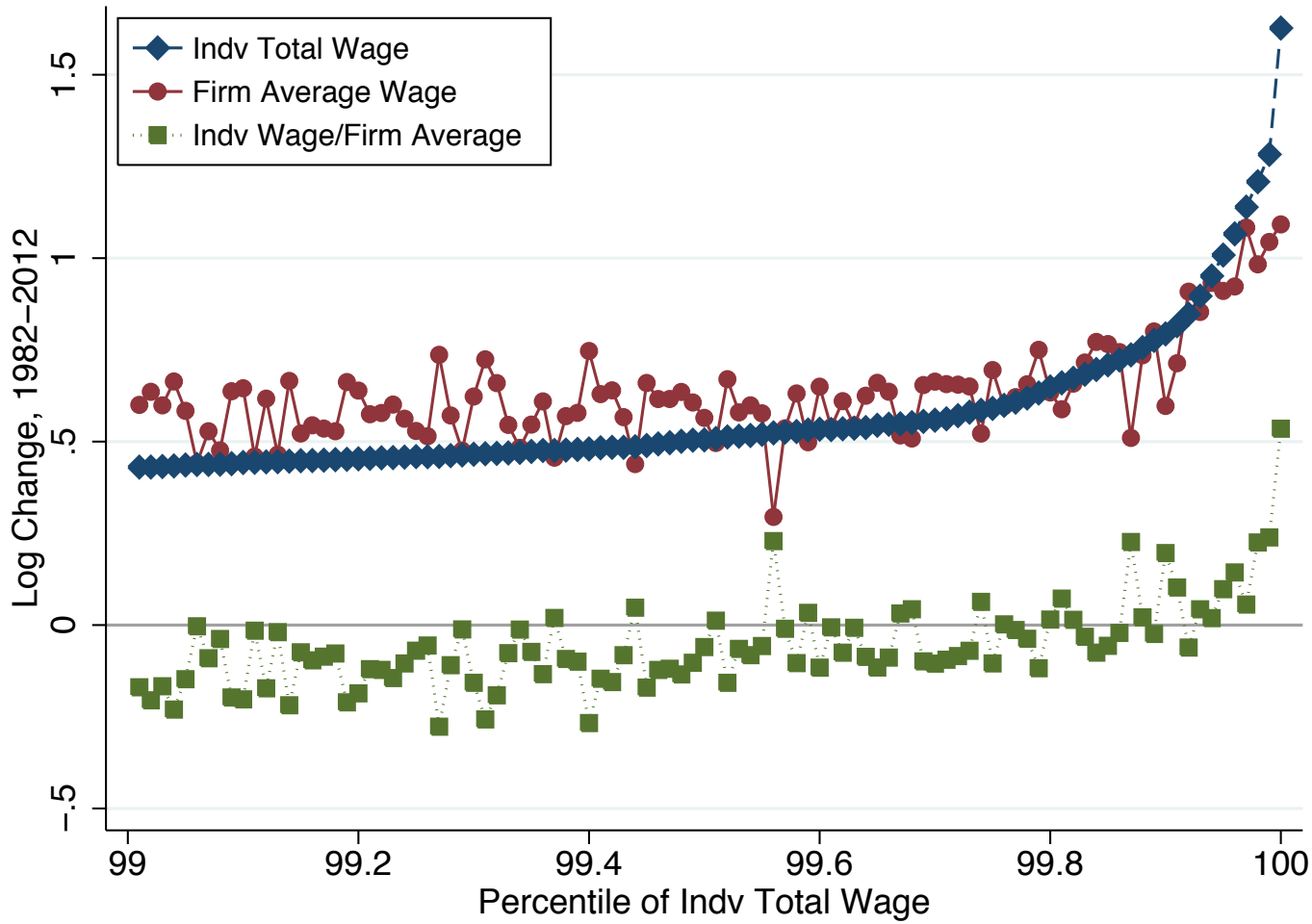


By Percentile for Group



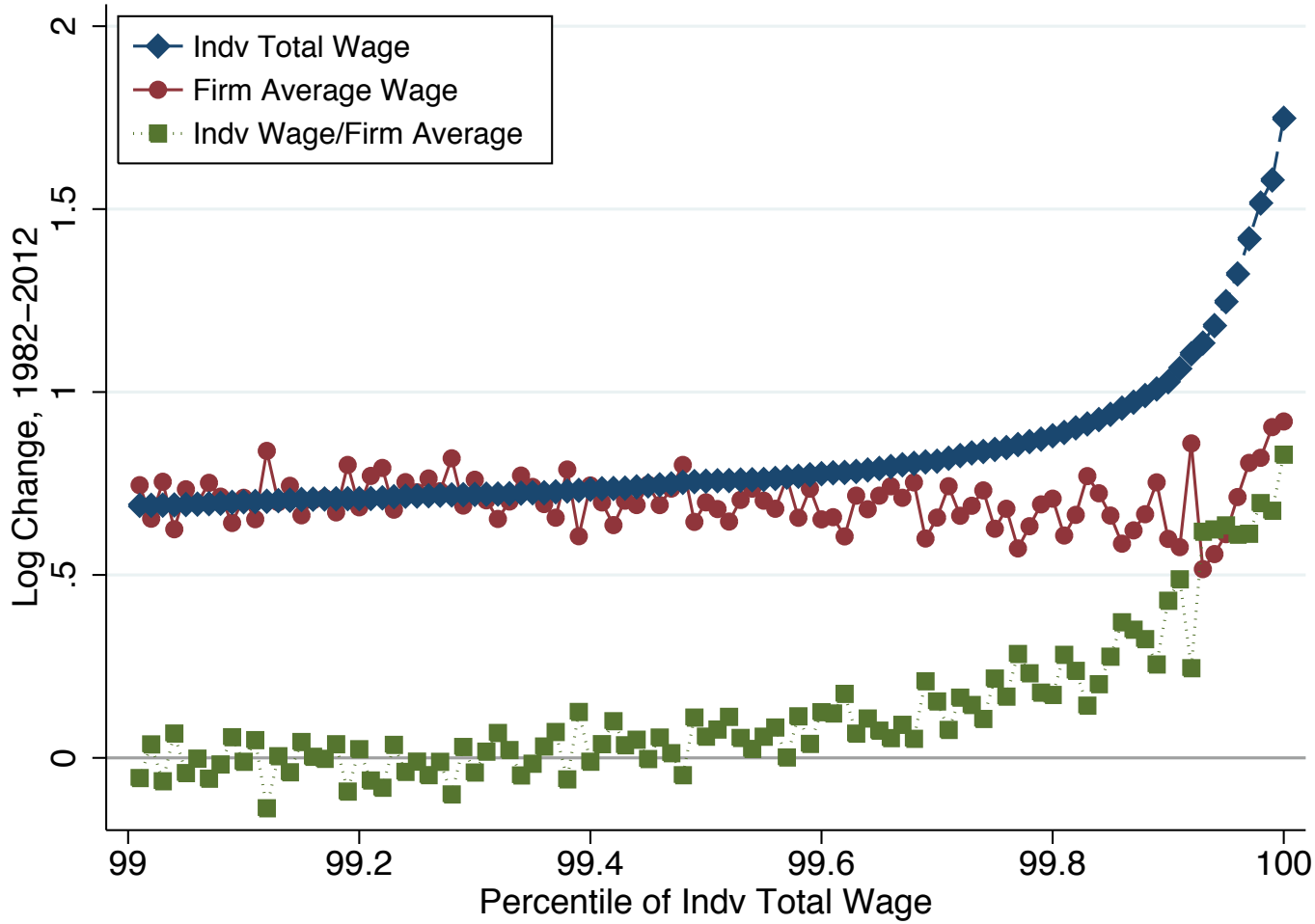
Top 1%: Industries

Industry: Ag/Mining/Construction/Other (Top 1%)



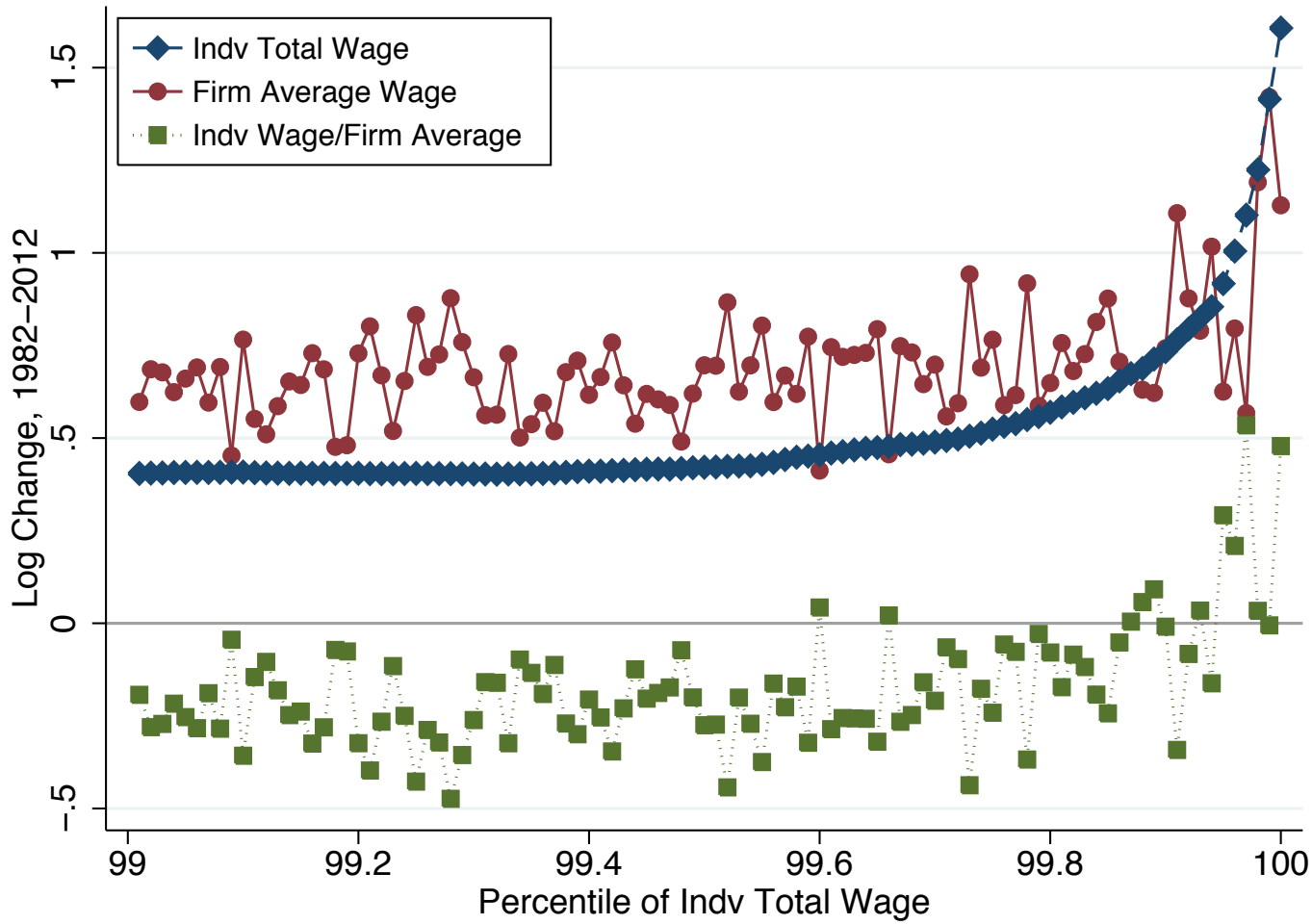
BACK TO SUBGROUPS

Industry: Manufacturing (Top 1%)



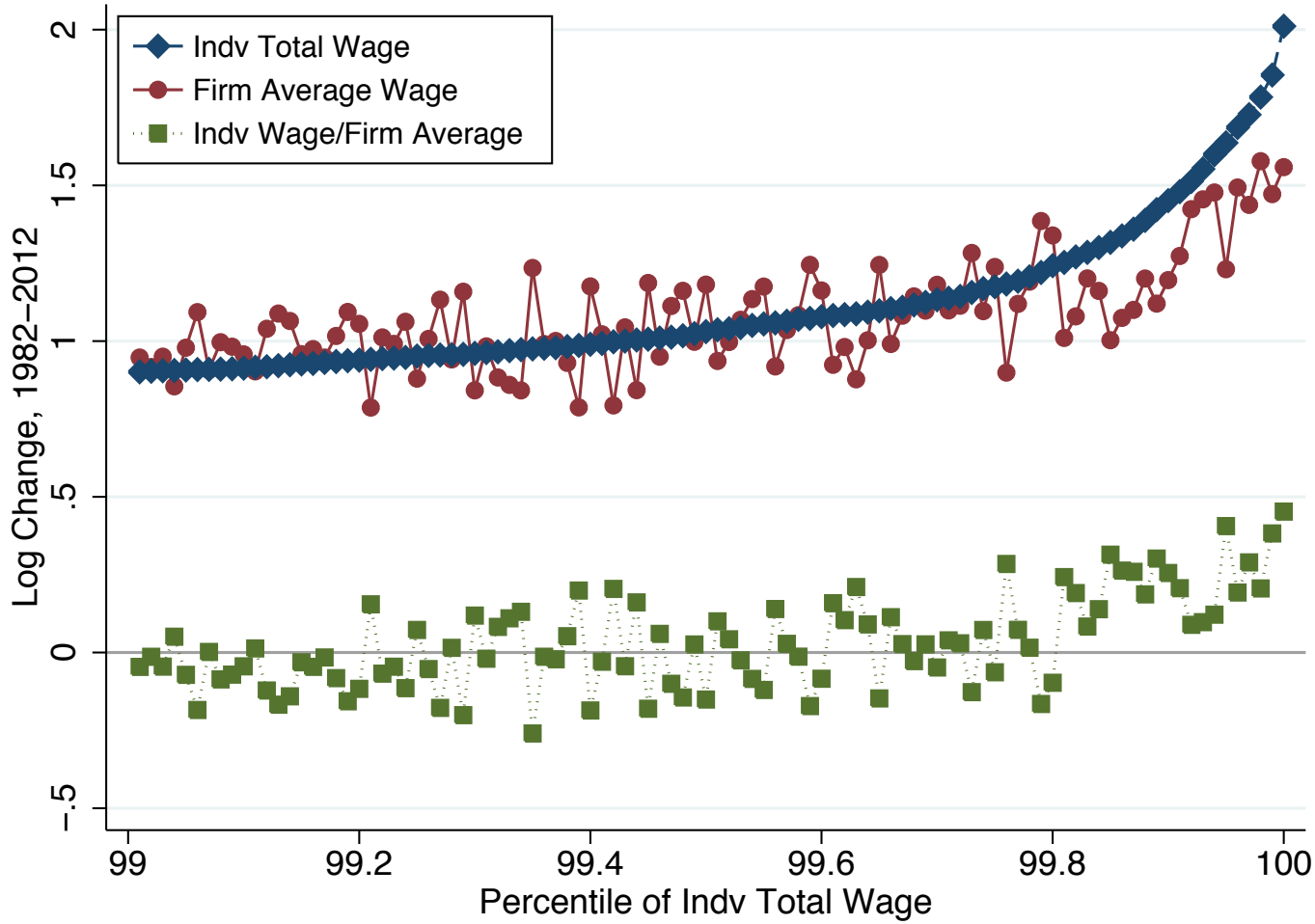
BACK TO SUBGROUPS

Industry: Utilities (Top 1%)



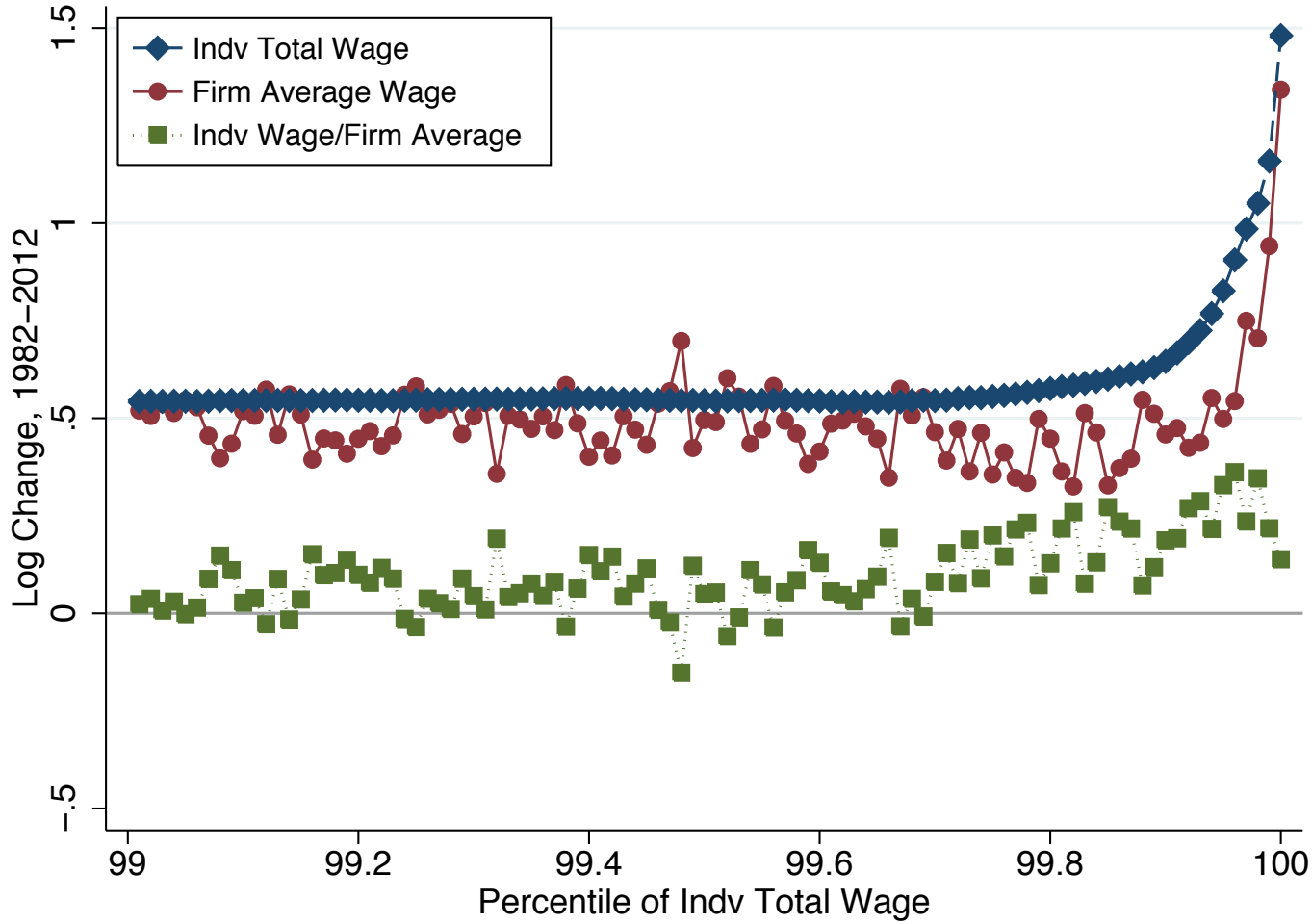
BACK TO SUBGROUPS

Industry: Finance/Insurance/Real Estate (Top 1%)



BACK TO SUBGROUPS

Industry: Services (Top 1%)



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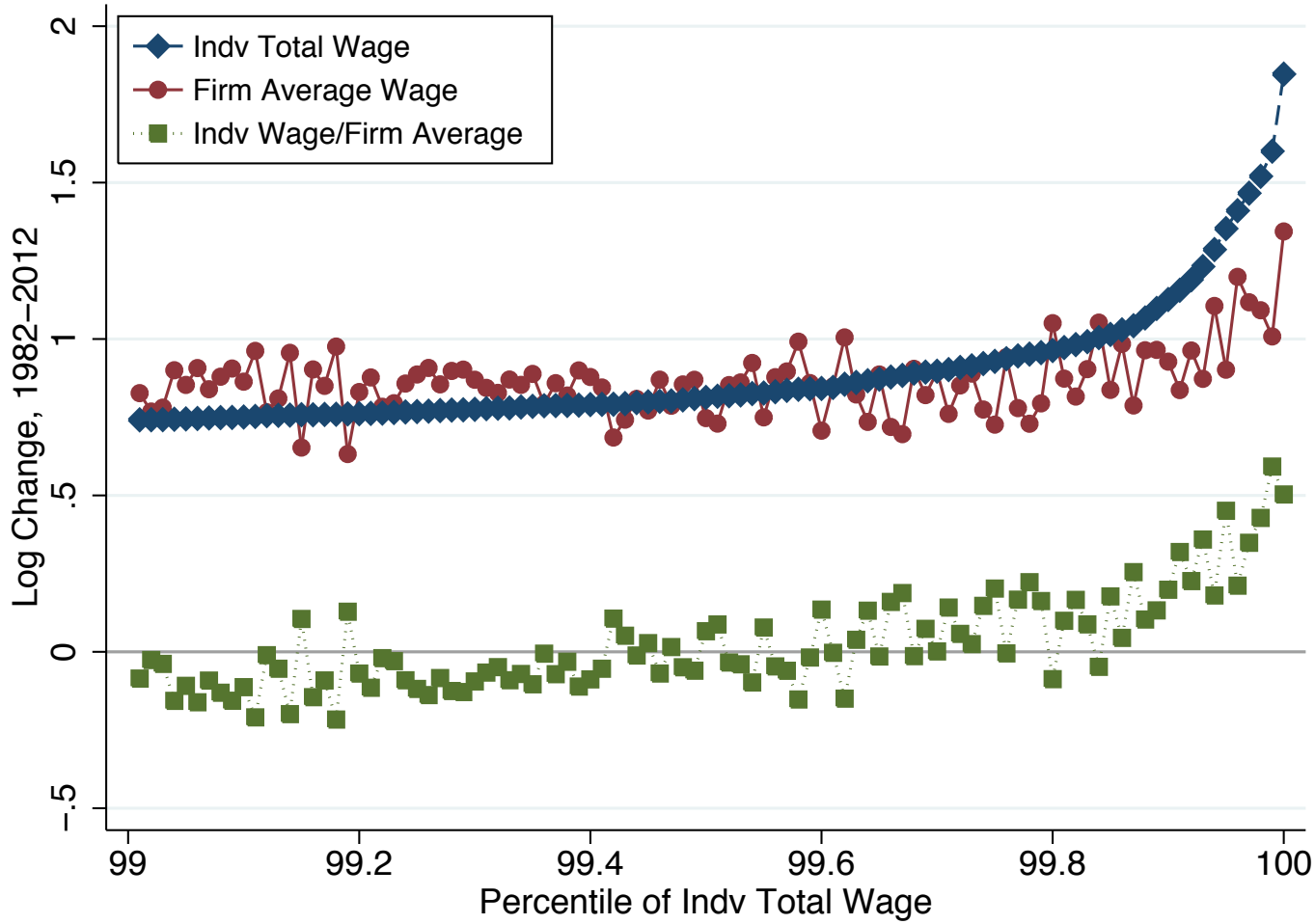
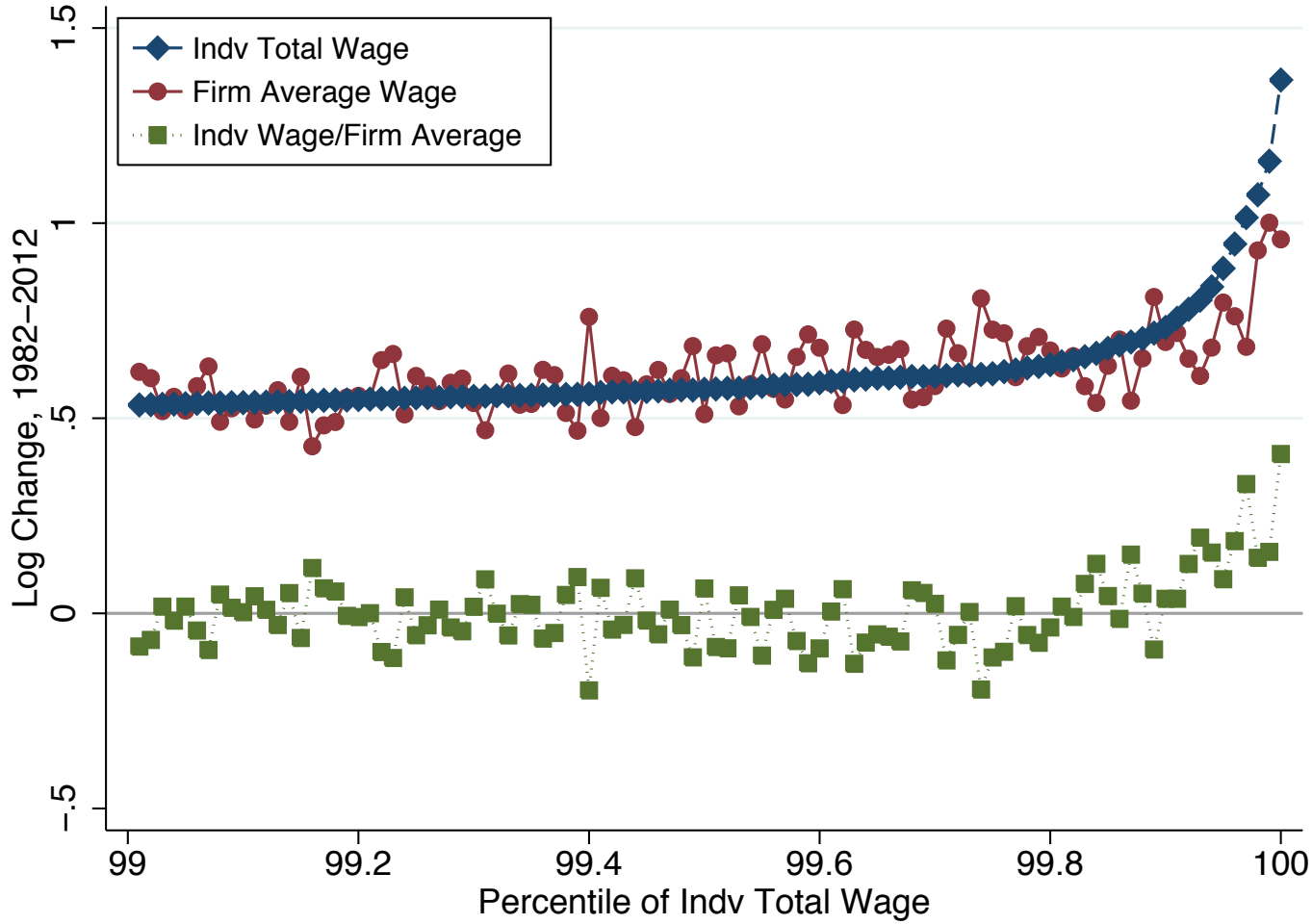
Top 1%: US Regions

Region: Northeast (Top 1%)



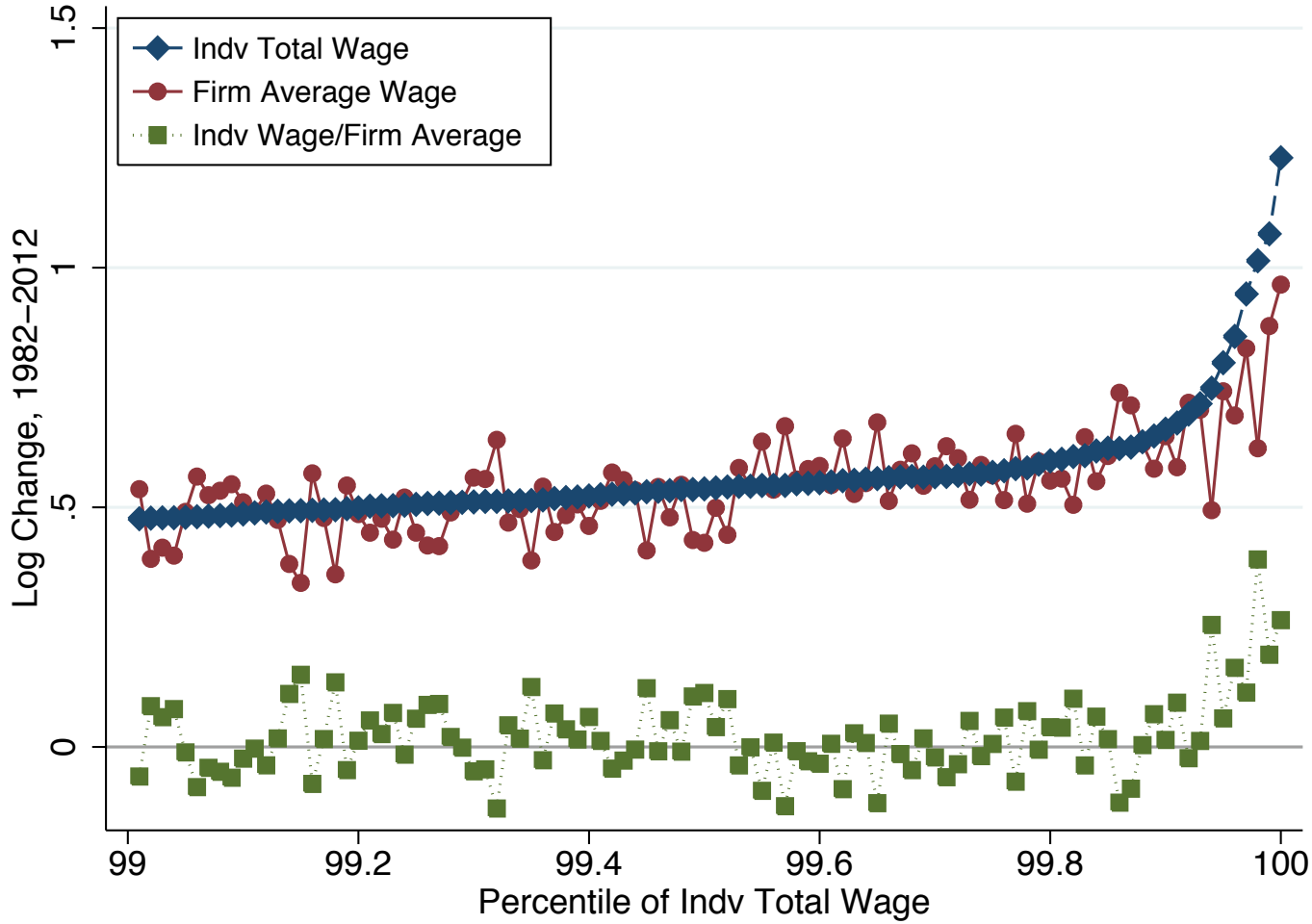
BACK TO SUBGROUPS

Region: South (Top 1%)



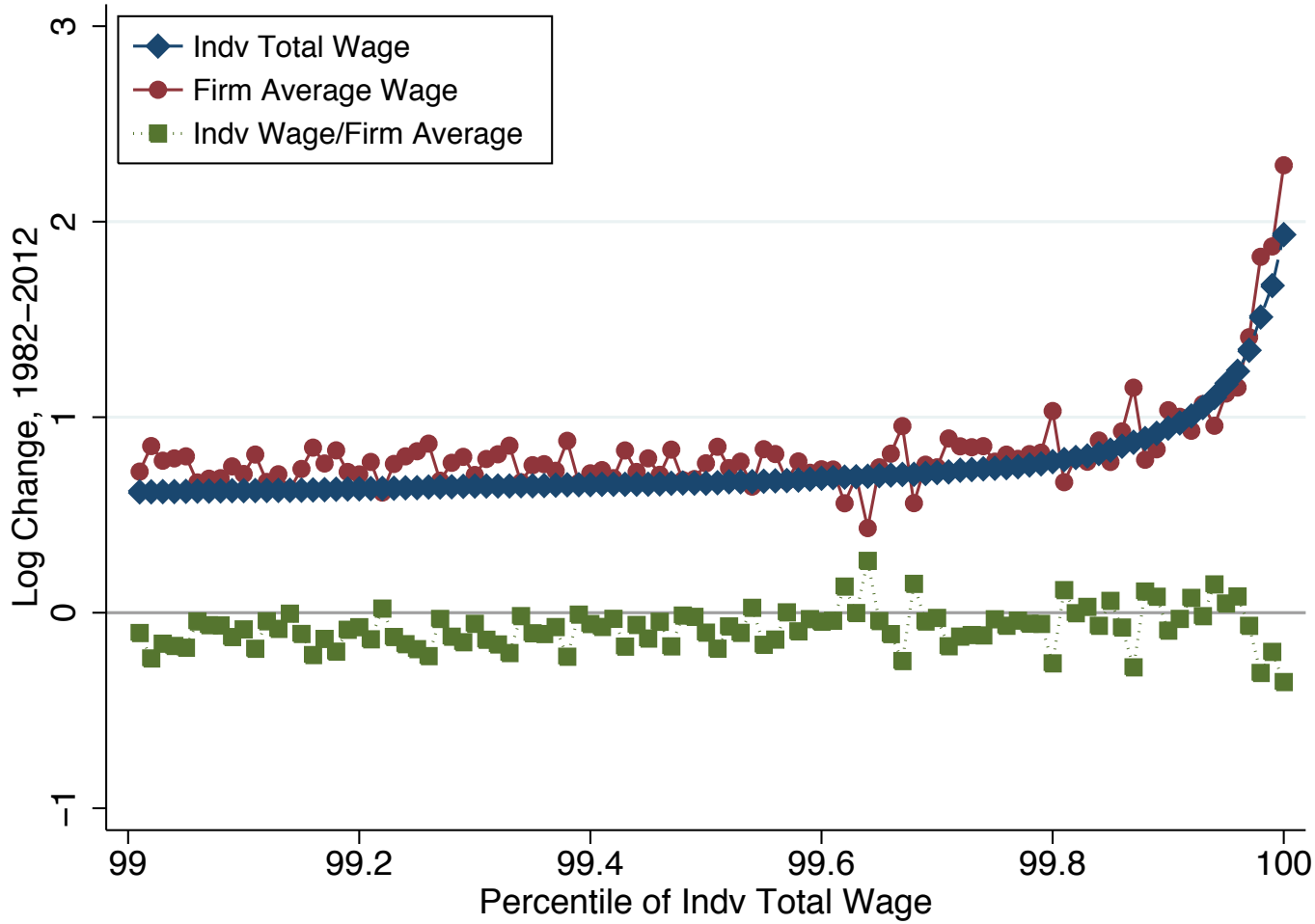
BACK TO SUBGROUPS

Region: Midwest (Top 1%)



BACK TO SUBGROUPS

Region: West (Top 1%)



BACK TO SUBGROUPS

What Types of Executive Compensation Are Tax Deductible?

Components of the compensation package

	Tax Status	
Compensation component	**Executive**	**Firm**
Salary	Taxable	Deductible subject to $1 million cap
Bonuses	Taxable	Deductible subject to $1 million cap
Non-equity incentive plan	Taxable	Likely to be fully deductible
Stock grants	Taxable	Deductible subject to $1 million cap
Stock options	Taxable	Likely to be fully deductible
Stock appreciation rights	Taxable	Likely to be fully deductible
Pension and deferred compensation	Taxable	If deferred to after retirement likely to be fully deductible
Other compensation	Taxable	Deductible subject to $1 million cap

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