

The Fall of the Labor Share and the Rise of Superstar Firms

David Autor, MIT and NBER

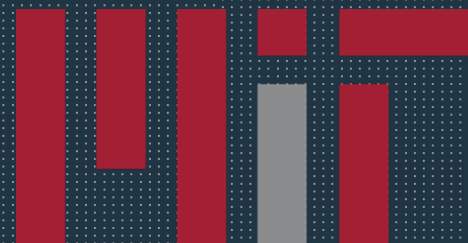
David Dorn, University of Zurich and CEPR

Lawrence Katz, Harvard and NBER

Christina Patterson, MIT

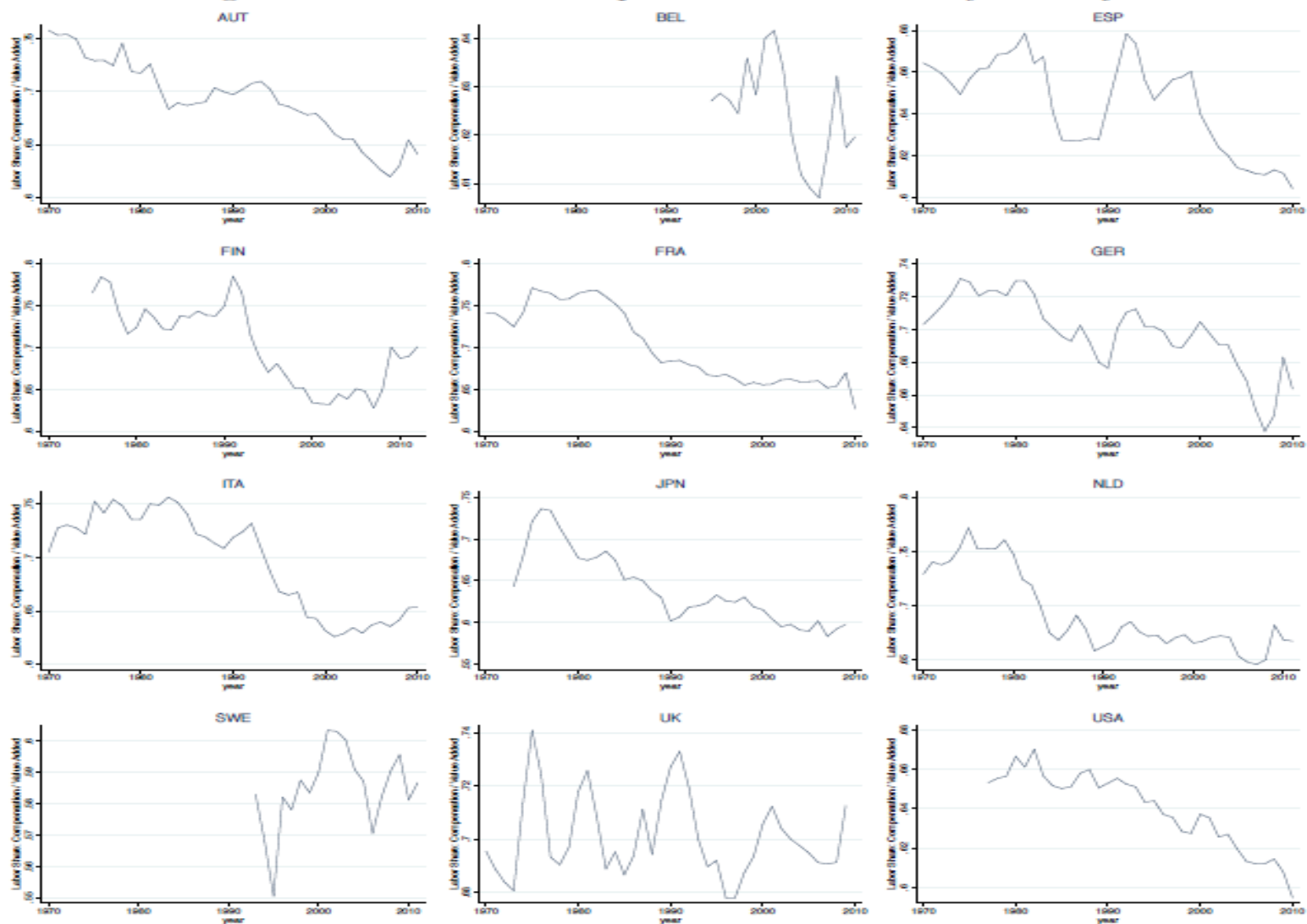
John Van Reenen, MIT and NBER

NBER, CRIW, June 2017



Change in the Labor Share of GDP since 1970

Figure 1: International Comparison: Labor Share by Country



Notes: Each panel plots the ratio of aggregate compensation over value-added for all industries in a country based on KLEMS data.

Significance of decline in Labor share

- **Overturms a key ‘Kaldor fact’**
- **Fall is real and significant**
 - Elsby et al. '13; **Karabarbounis & Neiman '14**; Rognlie '14; Koh et al. '16; Piketty '14; Bridgeman '14
- **Why is this a concern?**
 1. Slow GDP growth → Labor getting a shrinking slice of slow-growing pie
 2. Since distribution of capital far more unequal than distribution of labor → Growing income inequality (IMF, '17)

Causes of the Falling Labor Share?

Role of technology: Karabarbounis & Neiman '14

- Falling capital price (mainly due to ICT) and, critically, elasticity of L-K subst $\sigma > 1$
- But empirical literature suggests $\sigma \leq 1$, e.g., Lawrence '15, Oberfield-Raval '14, Antras '04, Hamermesh '90

Role of trade exposure: Elsby et al. '13

- Driven by falling labor share in trade-impacted manufacturing industries (China competition)
- But hard to explain why also in non-manufacturing

These representative firm models leave out fact that aggregate fall is reallocation between firms

Contributions of this Paper

Discuss a ‘Superstar Firms’ hypothesis (Furman & Orszag ’15)

- Large firms tend to have lower labor shares
- Rising prevalence of “winner take most” competition
- Small set of large firms capture increasing share of market, aggregate labor share falls due to reallocation

Presents evidence consistent with this hypothesis

1. Three decades of outcome measures
2. U.S. firm & establishment data – Economic Censuses from multiple sectors (not just manufacturing)
3. Cross-national OECD comparisons using industry (KLEMS, COMPNET) & firm-level (BVD ORBIS) data

Some Related Literature

General Trends: Piketty '14; IMF '17

Explanations of labor share fall: (a) *Measurement*: Rognlie '14; Koh et al. '16; (b) Market Power: Kalecki '38; **Barkai '16**; Berkowitz et al '17; (c) ICT: Karabarbounis & Neiman '14; (d) Trade: Elsby et al '13; (e) Regulations & Institutions: Blanchard & Giavazzi '03; Azmat et al '12;

“Superstar” Firms: Brynjolfsson & McAfee '08; **Furman & Orszag '15**; Bain '51; Demsetz '73; Schmalensee '87

Productivity: Andrews et al '15; Bartelsman et al '13

Firms & Inequality increase: Davis & Haltiwanger, '92; Faggio et al, '10; Card et al '13; Song et al '17

Firm-level Decompositions of labor share: Bockerman & Maliranta '12; Kehrig & Vincent '17

Overview

1. A Model of Superstar Firms

2. Data and Measurement

3. Empirical Evidence

- Sales Concentration rises
- Industries with larger increases in concentration see larger falls in labor share
- Labor share falls largely a reallocation between firms
- Reallocation component of falling labor share is largest in industries with rising concentration
- Patterns are broadly international in scope

4. Discussion

Superstar Firm Model Sketch

Heterogeneous firms i in an industry, A_i (TFPQ)

- $Y_i = A_i V_i^{1-\alpha} K_i^\alpha$
 - Y = value-added
 - K = capital
 - V = variable labor
- Total labor input is $L = V + F$; where F is overhead labor, a fixed cost of production
- Competitive factor markets: wage w , capital cost r
- Imperfectly competitive product markets with a mark-up μ_i of price P_i over marginal cost c_i

The Firm-level Labor Share, S_i

First Order Condition wrt labor gives labor share S = payroll wL in nominal value added PY for firm i

- $S_i = \left(\frac{wL}{PY}\right)_i = \frac{1-\alpha}{\mu_i} + \frac{wF}{(PY)_i}$
- More productive (high A_i) firms will have larger sales and *lower labor shares* because their:
 1. Share of fixed costs wF in total revenues is lower
 2. Mark-up μ_i is higher (in some imperfect competition models such as Cournot)
- Change in the environment (z) which reallocates more market share to productive firms will tend to reduce the aggregate labor share

The Industry Aggregate Labor Share

- $S = \sum \omega_i S_i$; $\omega_i = \frac{P_i Y_i}{\sum P_i Y_i}$; value added share of firm i

Olley-Pakes '96 decomposition applied to labor share:

$$S = [\sum (\omega_i - \bar{\omega})(S_i - \bar{S})] + \bar{S}$$

- Aggregate labor share divided into:
 1. **Reallocation** (covariance) term $\sum (\omega_i - \bar{\omega})(S_i - \bar{S})$
bigger firms have lower labor shares
 2. Cross-firm **unweighted average**, \bar{S}
- The effect of a change in economic environment depends on the effects on between-firm reallocation and “within firm” unweighted mean

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Data Sources (USA)

Labor share and sales concentration

- US Economic Censuses, 1982 - 2012
- Conducted every 5 years
- Use six sectors covering ~ 80% of private sector jobs
 1. Manufacturing
 2. Retail
 3. Wholesale
 4. Services
 5. Finance
 6. Utilities & Transportation
- 5.2 million establishment-year observations
- 4.0 million firm-year observations

Measurement

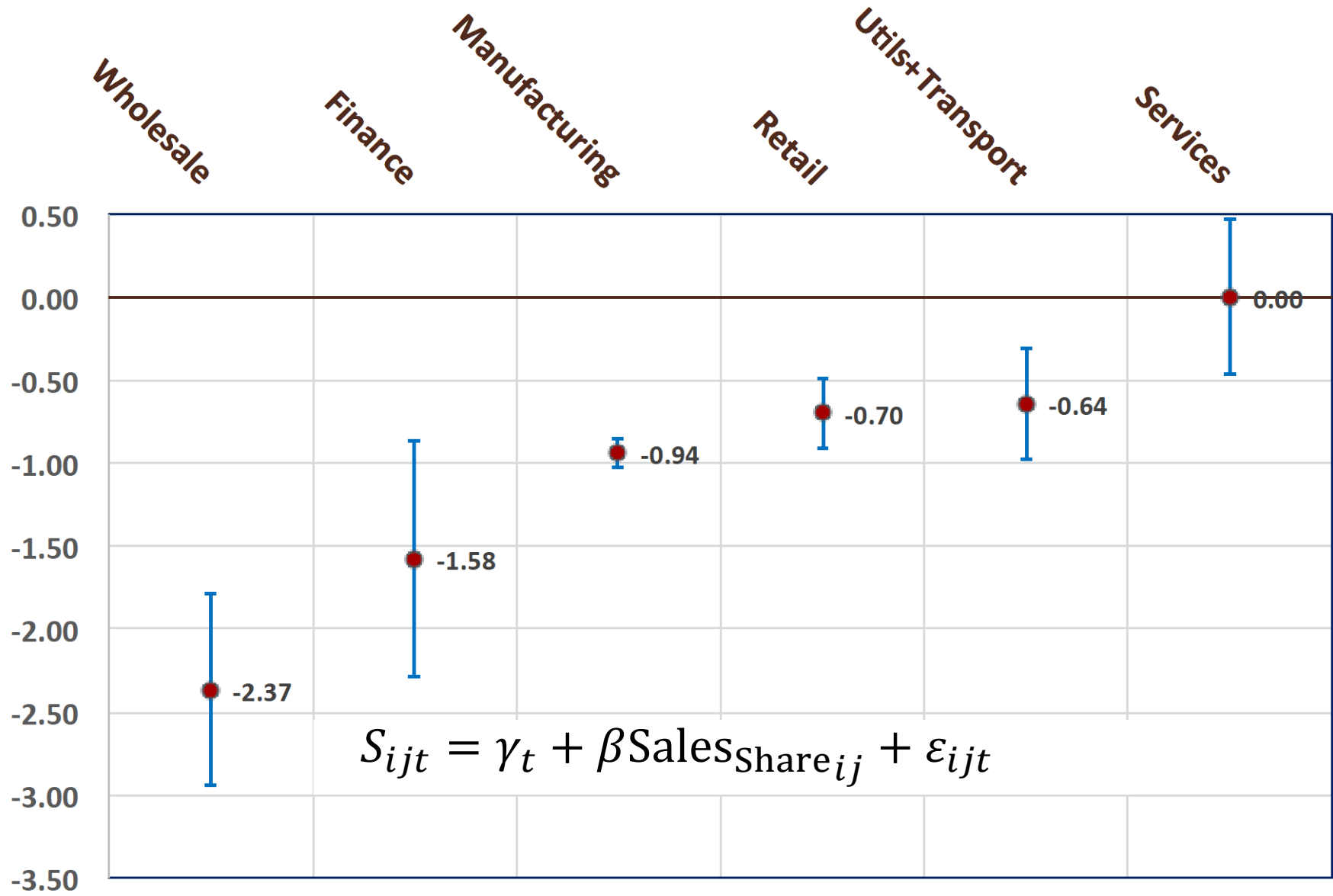
Measuring labor share

- Manufacturing sector
 - payroll/ value-added
- All other sectors
 - payroll / sales

Measuring sales concentration

- Time consistent industries (built on 4-digit SIC-87)
 - 288 in non-manufacturing, 388 in manufacturing
- CR4, CR20, HHI (Herfindahl-Hirschman Index)
- Robust to adjusting for contribution of imports to domestic market size

Table 5: Basic Descriptive Relationship- Larger Firms Have Lower Labor Shares



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2. Data

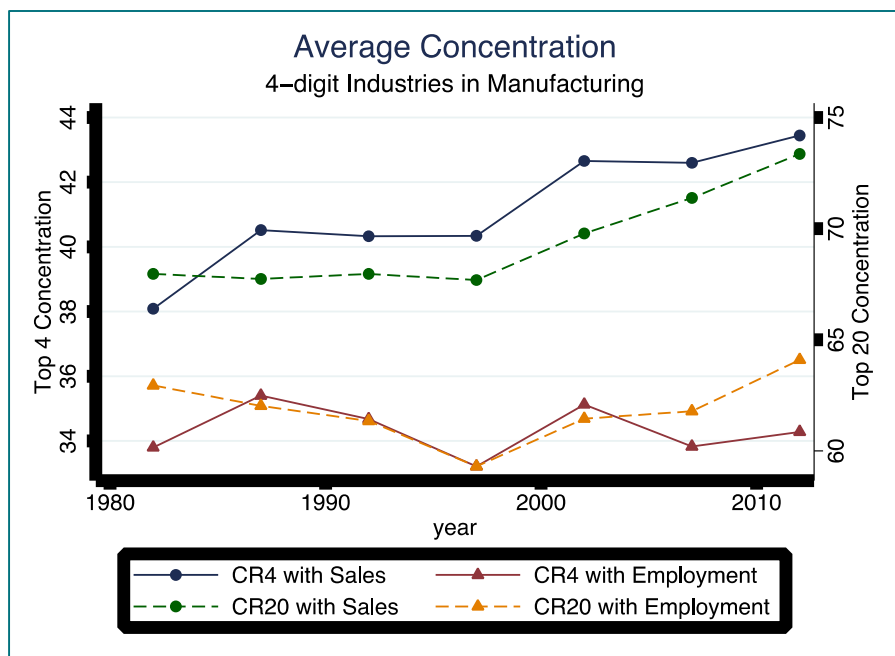
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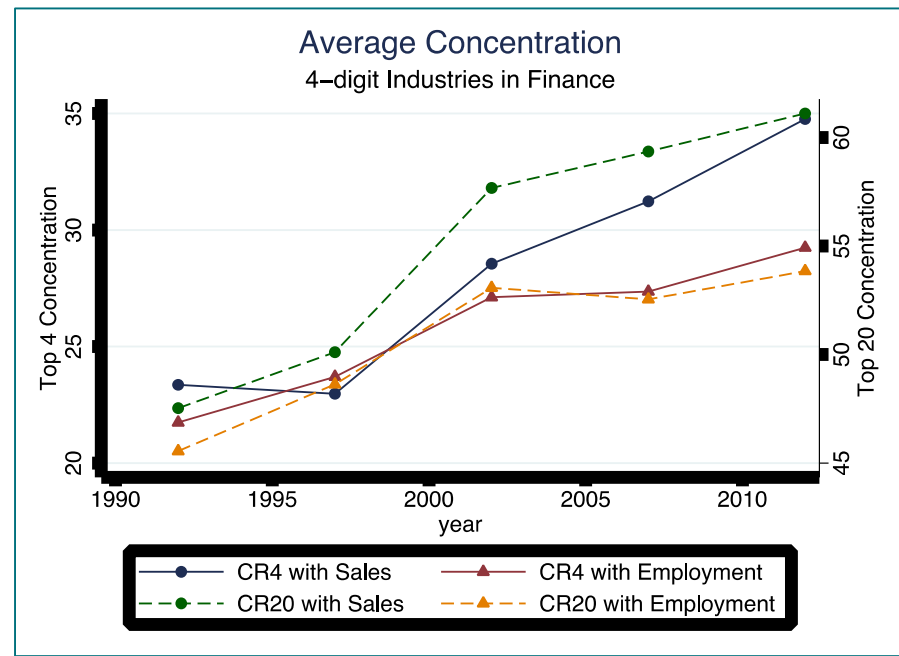
4. Discussion

Table 4: Rising Concentration in Manufacturing and Finance

Manufacturing Sector



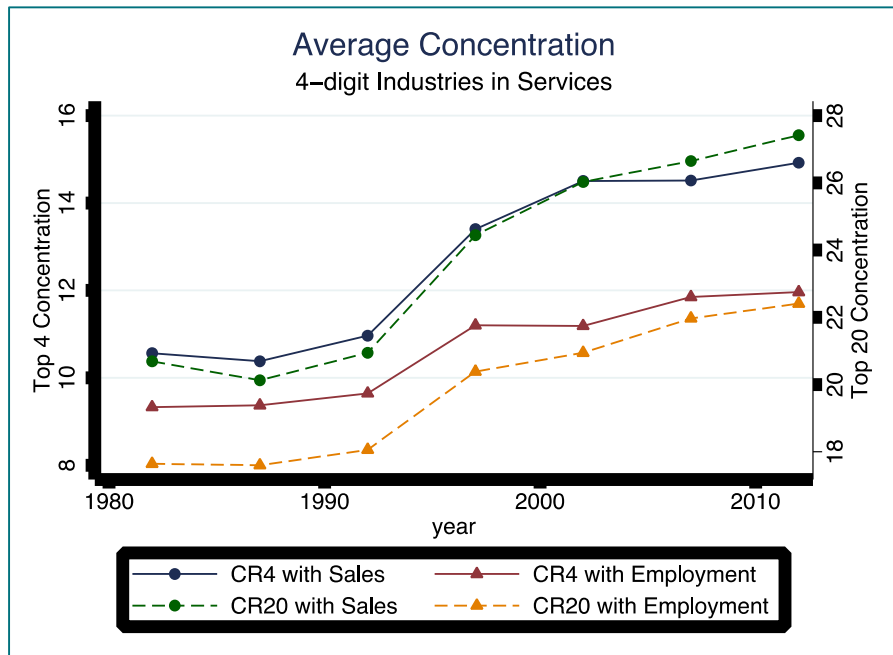
Finance Sector



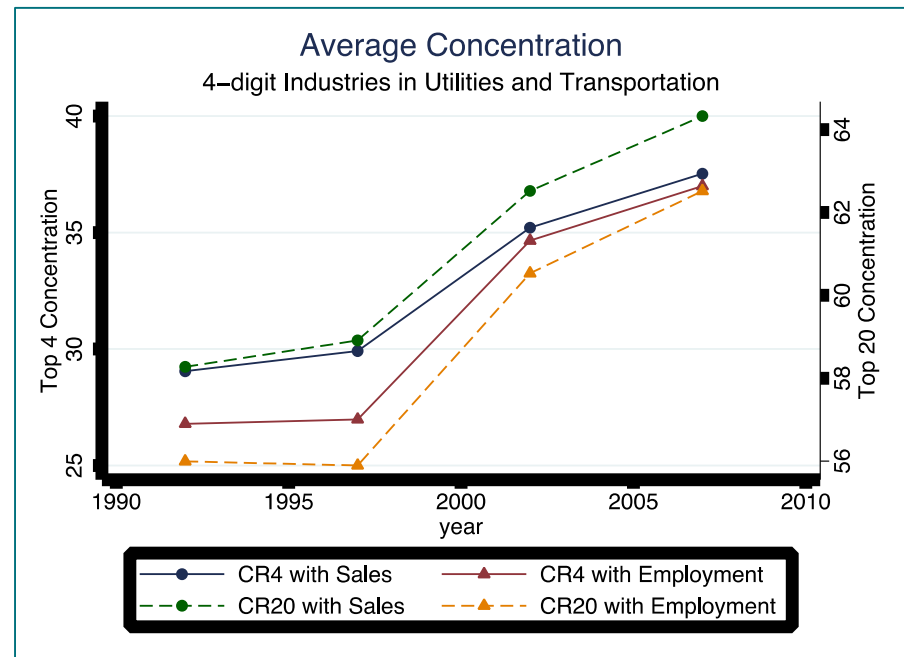
Notes: Weighted average of 4 digit industries within each large sector. Manufacturing: 388 inds; Finance: 31

Table 4 – cont.: Rising Concentration in Services and Utilities + Transport

Service Sector



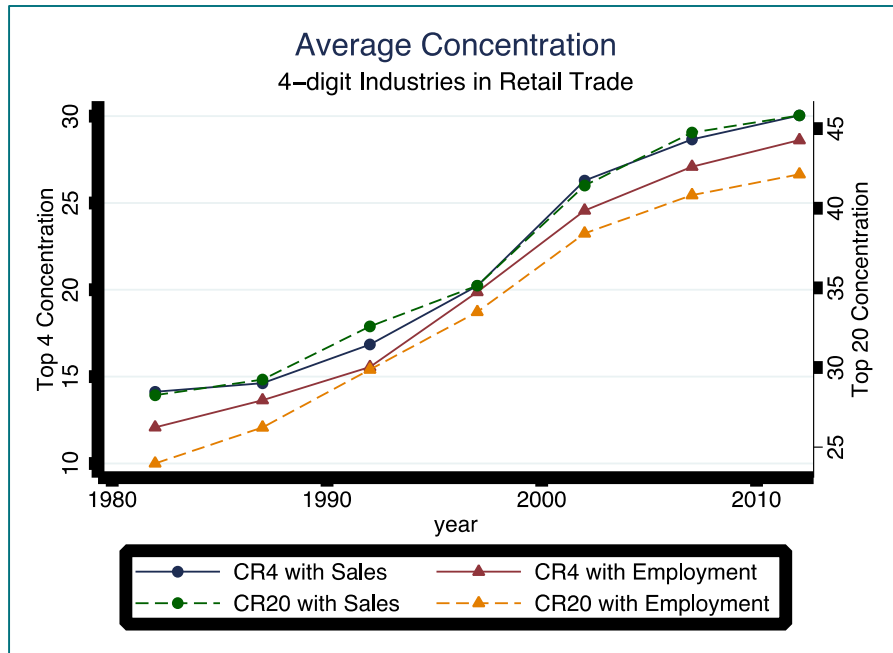
Utilities + Transportation Sector



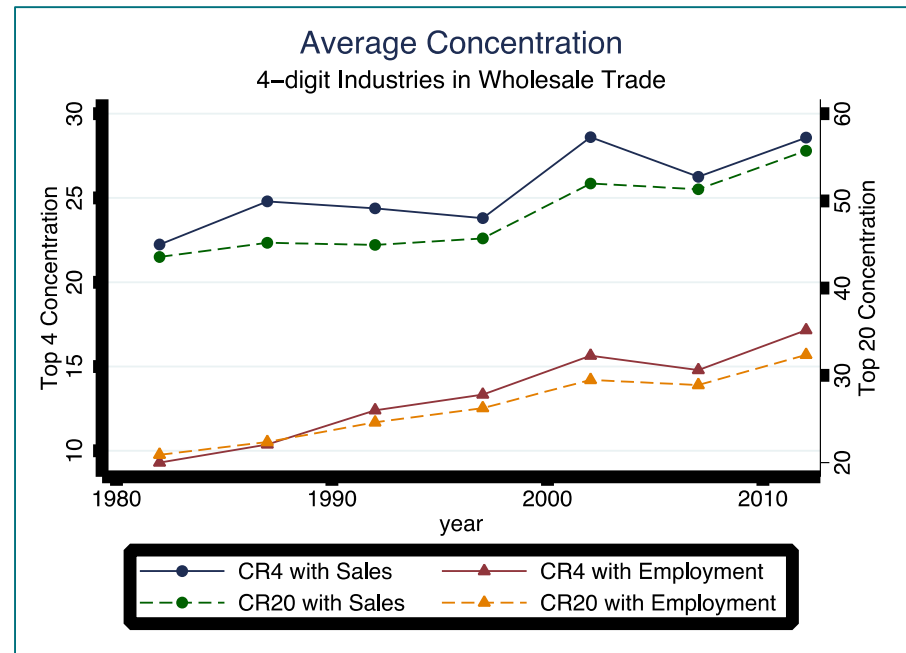
Notes: Weighted average of 4 digit industries within each large sector. Services: 95; Utilities & Transport: 48;

Table 4 – cont.: Rising Concentration in Retail and Wholesale Trade

Retail Trade



Wholesale Trade



Notes: Weighted average of 4 digit industries within each large sector. Retail: 58; Wholesale: 56

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Table 3: Rising Concentration → Falling Labor Share; Manufacturing, 5 year changes

$$\Delta \left(\frac{\text{Payroll}}{\text{Value Added}} \right)_{jt} = \Delta S_{jt} = \alpha + \beta \Delta \text{Conc}_{jt} + \gamma_t + \varepsilon_{jt}$$

	CR4		CR20		HHI	
1 Baseline	-0.148	**	-0.234	**	-0.189	*
	(0.036)		(0.047)		(0.096)	

Notes: ** 1% significance; * 5%; ~ 10%; 2,328 obs & 288 SIC4; SE clustered by ind

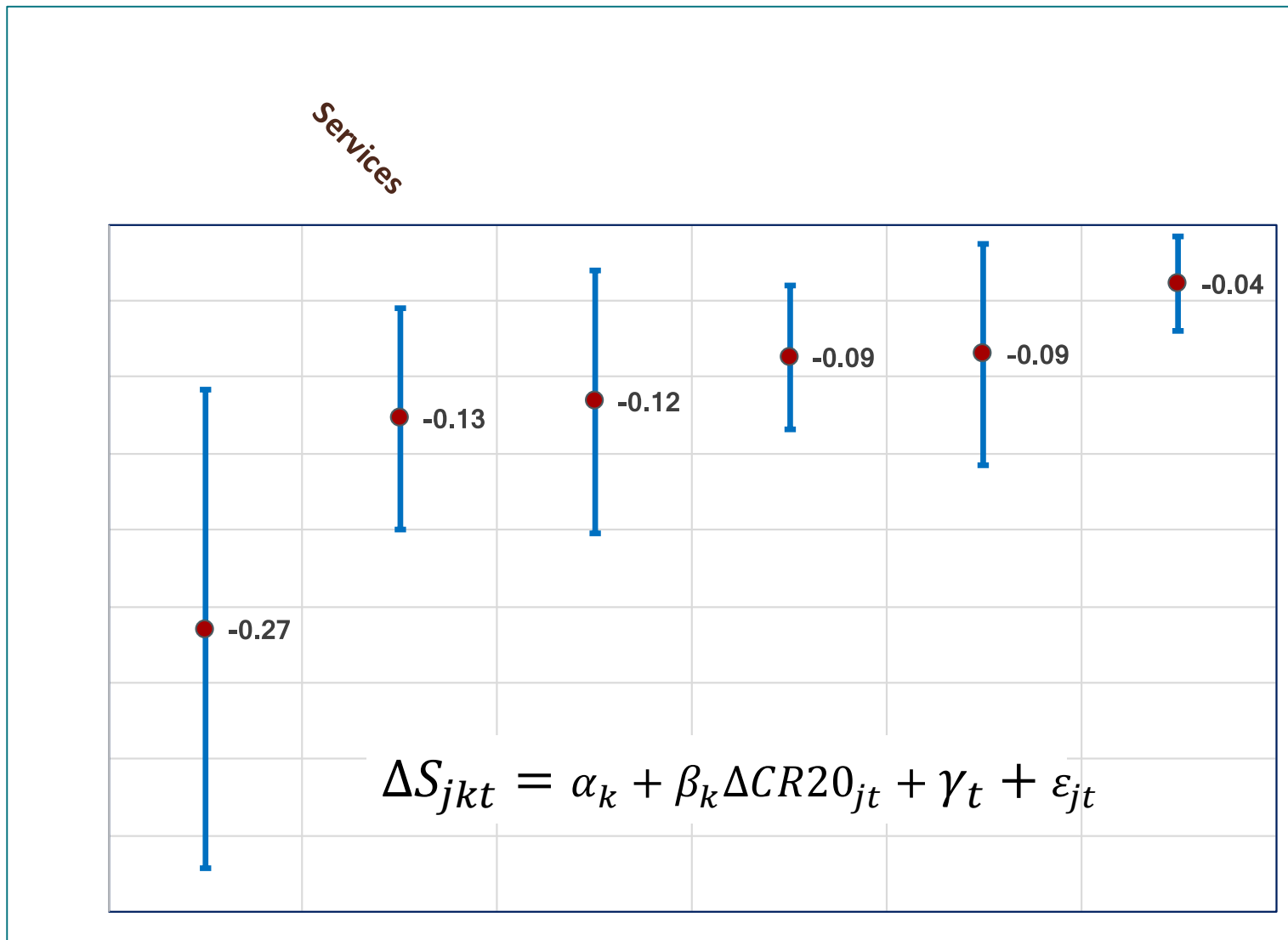
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	CR4		CR20		HHI	
1 Baseline	-0.148	**	-0.234	**	-0.189	*
	(0.036)		(0.047)		(0.096)	
2 Compensation Share of Value Added	-0.175	**	-0.264	**	-0.231	~
	(0.046)		(0.061)		(0.121)	
3 Deduct Service Intermediates from VA	-0.331	**	-0.517	**	-0.501	**
	(0.062)		(0.071)		(0.176)	
4 Industry Trends (Four-Digit Dummies)	-0.171	**	-0.307	**	-0.208	~
	(0.042)		(0.053)		(0.118)	
5 1992 - 2012 Sub-Period	-0.181	**	-0.316	**	-0.23	*
	(0.044)		(0.063)		(0.117)	
6 Including Imports (1992 - 2012)	-0.204	**	-0.288	**	-0.138	
	(0.052)		(0.045)		(0.180)	

Notes: ** significant at 1% level; * = significant at 5% level; ~ = significant to 10% level

Figure 6: Δ Labor Share of Sales regressed on Δ Concentration: Results Across Six Sectors



Notes: OLS Regression coefficient of Δ lab share (payroll over sales) on CR20 (5 year changes); 95% confidence intervals; 1982-2012.

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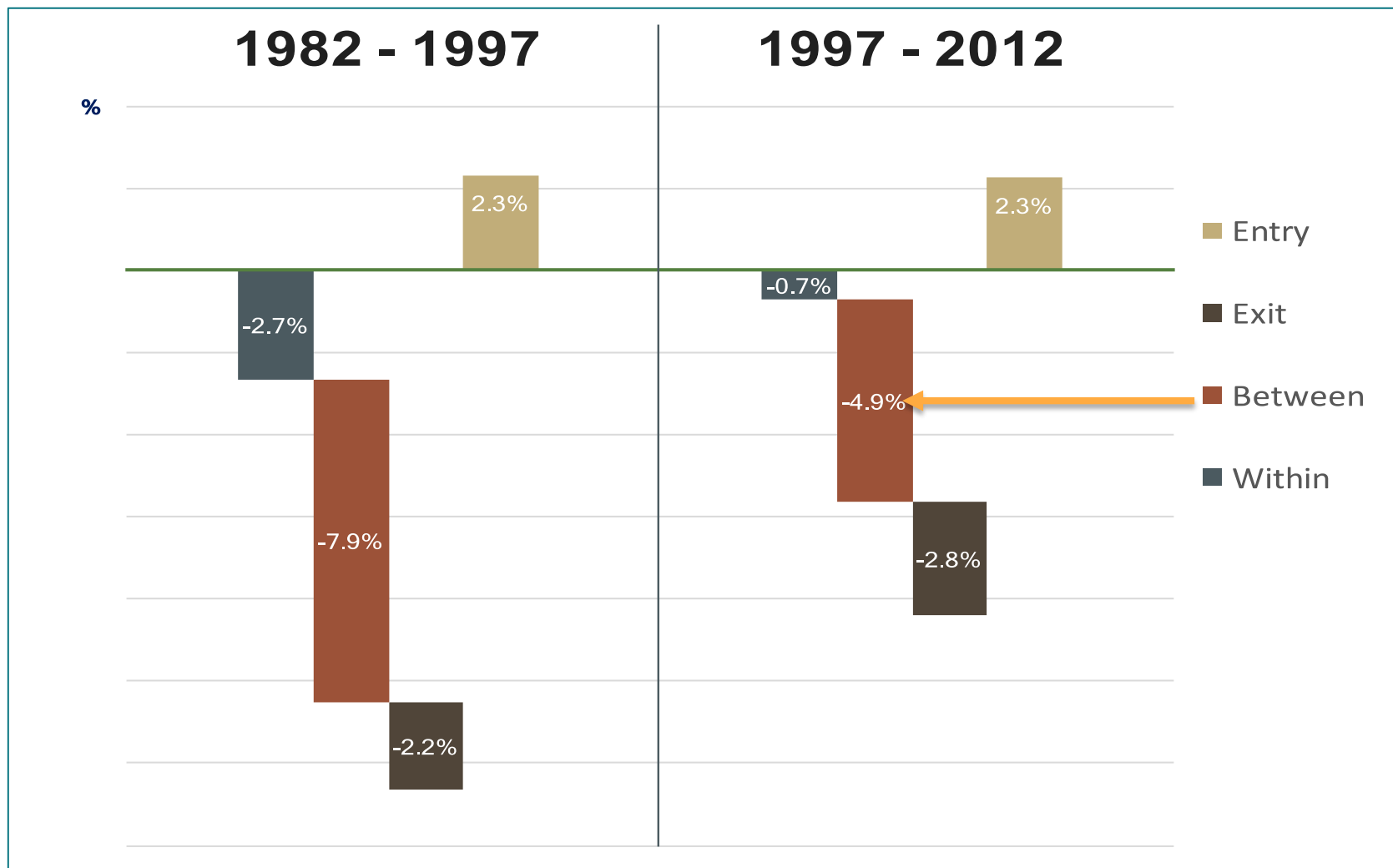
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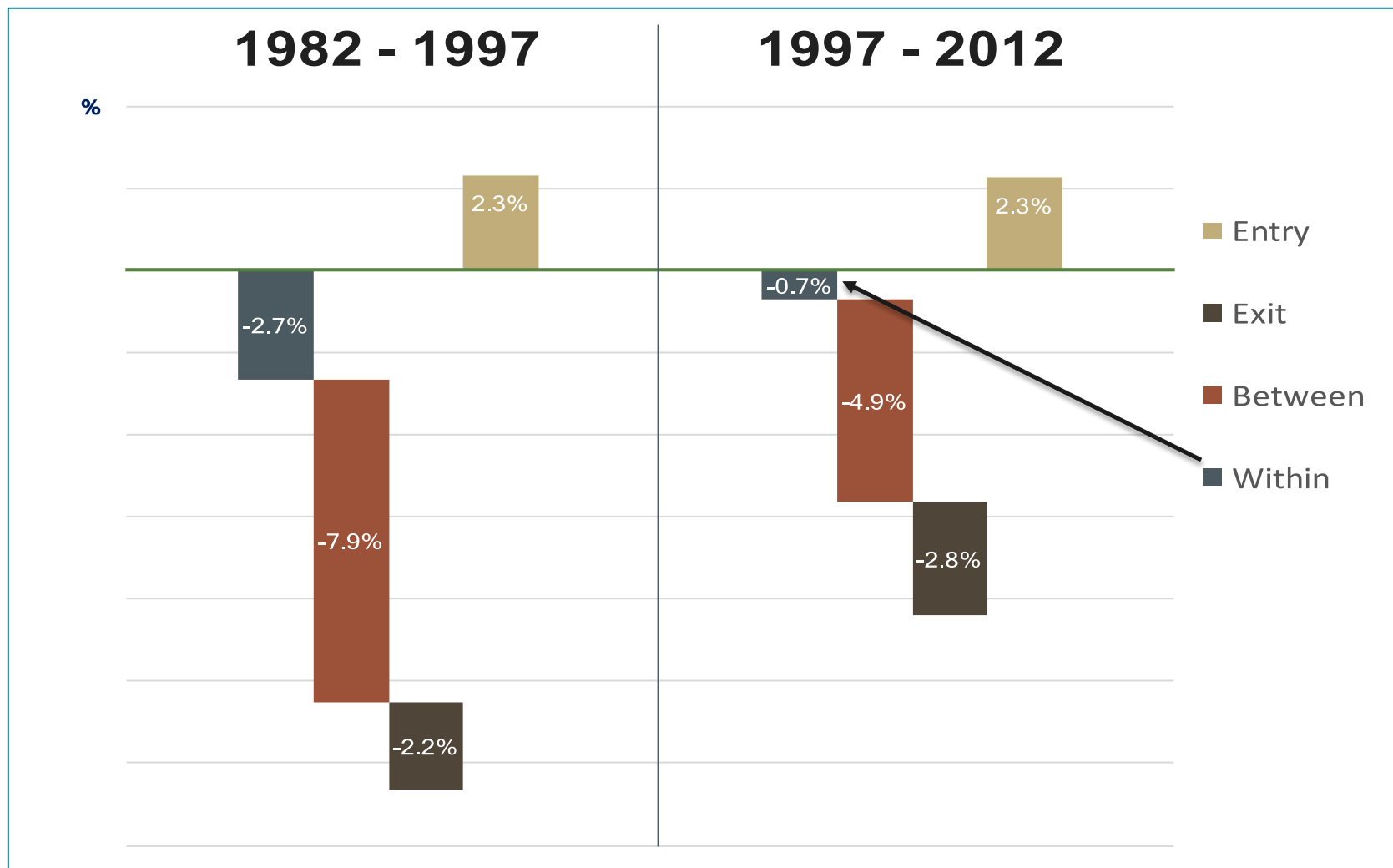
4. Discussion

Fig 9: Melitz-Polanec (2015) Decomp Between firm reallocation is main component; Manufacturing



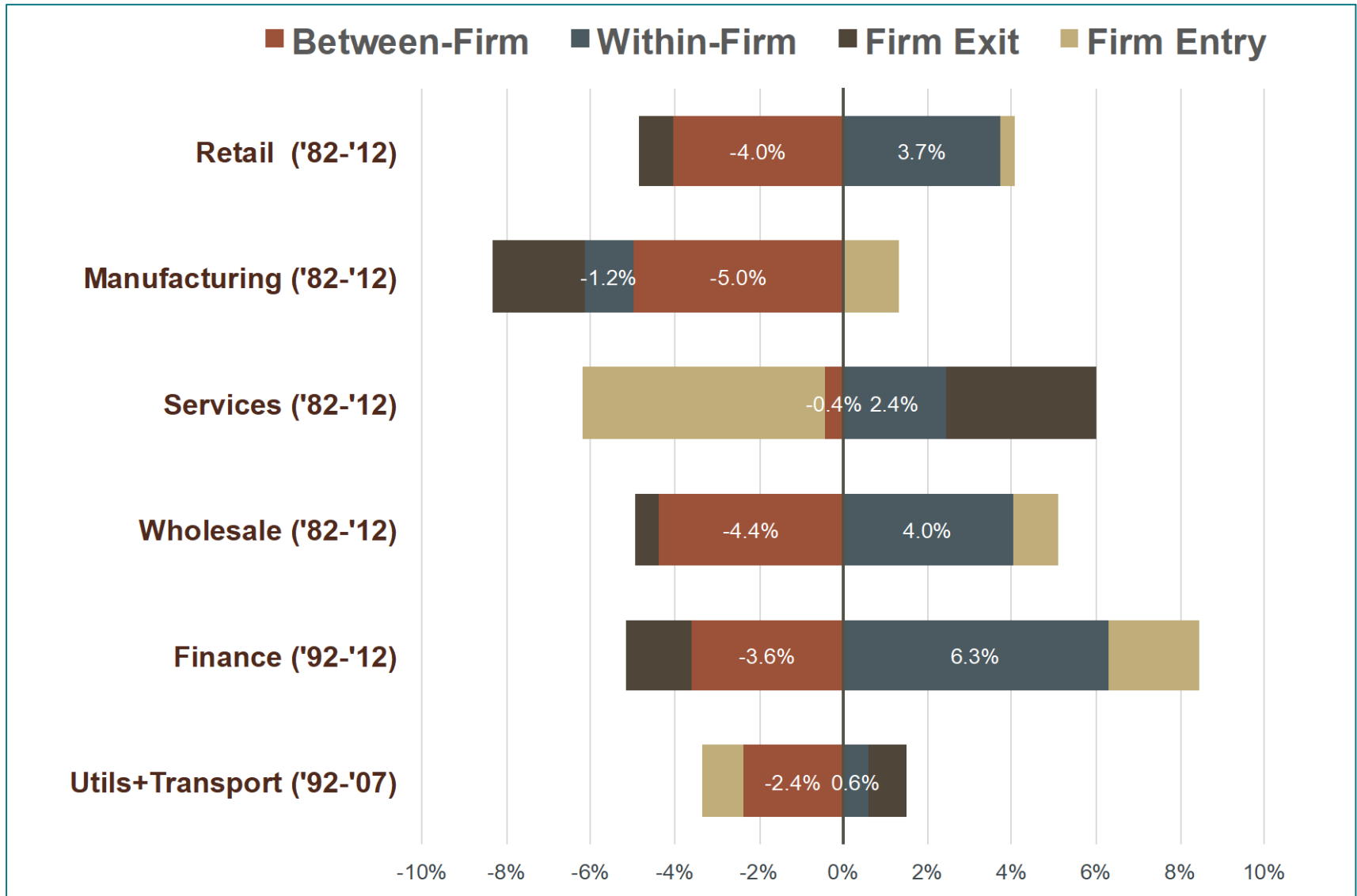
Notes: MP decomposition over 5 year periods, aggregated to two 15 year periods

Fig 9: Melitz-Polanec Decomp Between firm reallocation is main component; Manufacturing



Notes: MP decomposition over 5 year periods, aggregated to two 15 year periods

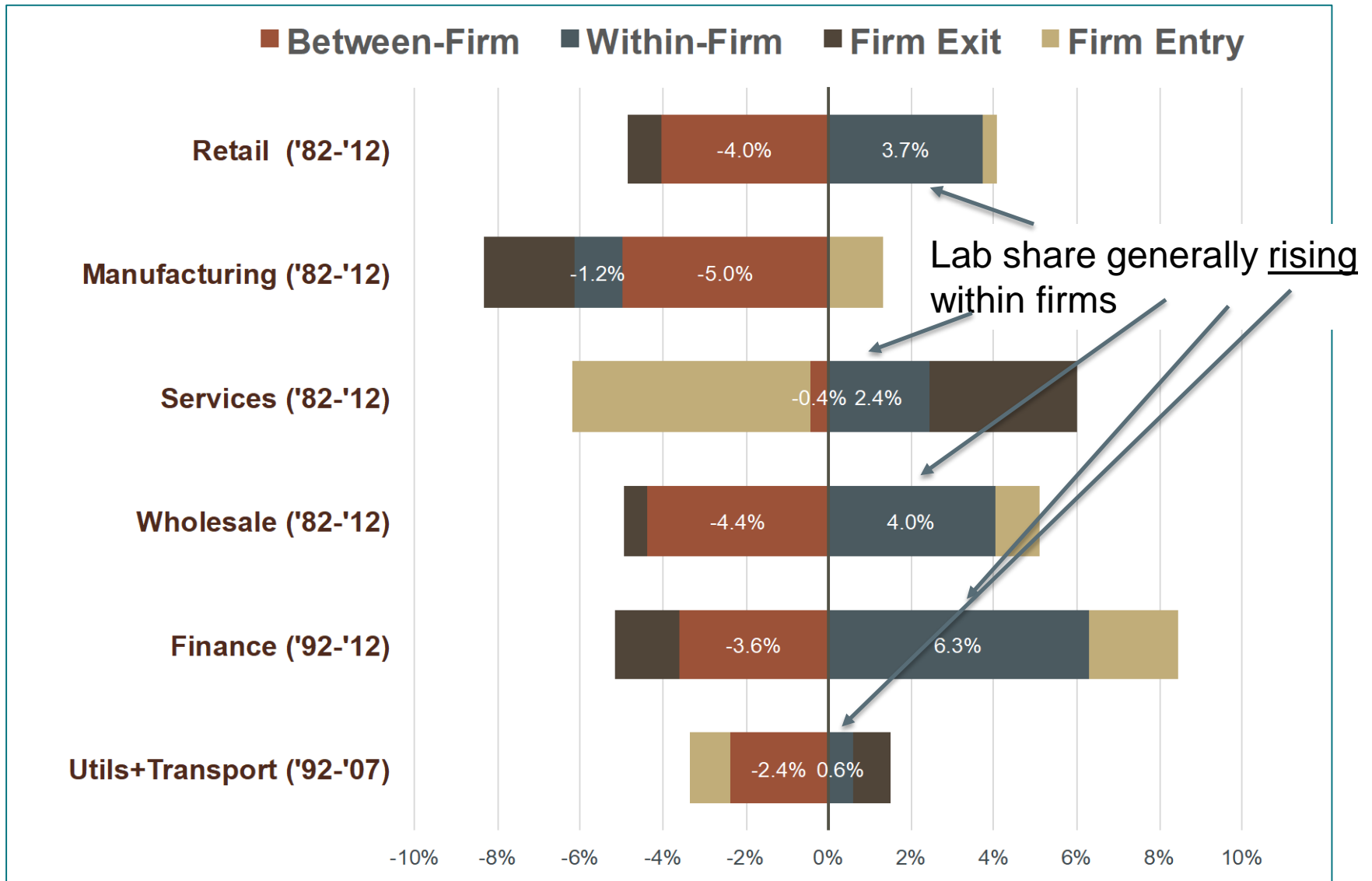
Fig 10: Δ Labor-Share Decomposition in 6 Sectors; Reallocation component dominates



Notes: MP decomposition over 5 year periods, aggregated over the full sample period

10: Δ Labor-Share Decomposition in 6 Sectors

Unweighted av lab share for incumbents *rises*



Notes: MP decomposition over 5 year periods, aggregated over the full sample period

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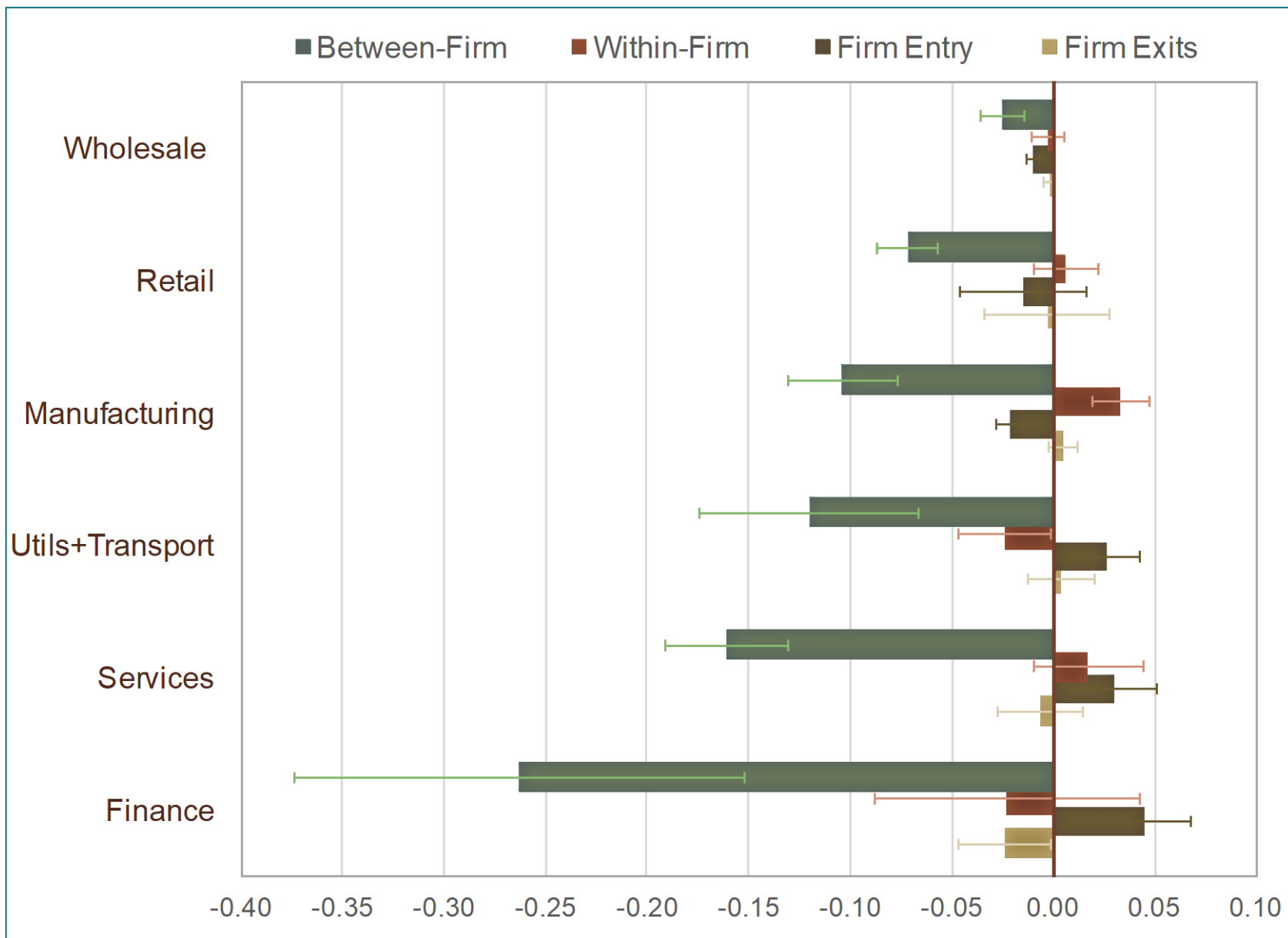
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11. Regression of Δ Labor Share Components on Sector Level Δ CR20: Loads on reallocation term



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Summary of Empirical Findings

1. A **pervasive** fall in labor share across countries
2. Mainly due to reallocation of sales **between-firms** within industries rather than **within-firm** changes
3. Industries with largest increases in **concentration** had largest falls in labor share
4. And this was due to the **reallocation** component of falling labor share, not a general fall in share
5. Comparable **international** findings in industry & firm-level data across OECD countries

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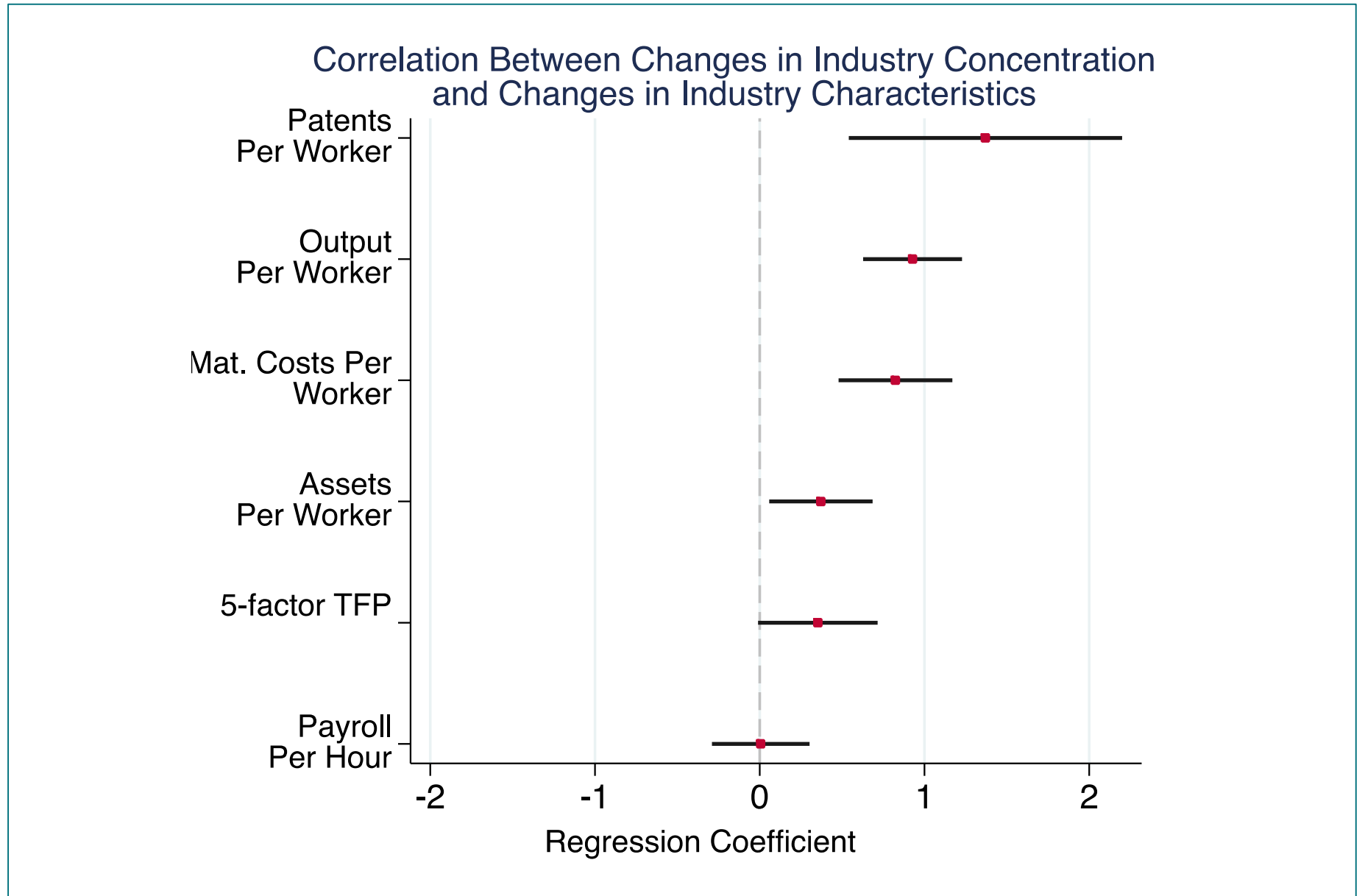
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What's Not Going on

Results do **not** appear explained by

- Purely U.S.-specific factors such as antitrust law; weakening labor institutions
- Susceptibility to 'routine-replacing technical change'
- 'China shock' – trade exposure not major predictor (Table A6)

Not simple “Rigged Economy” story: Concentrating industries have fastest increases in innovation & Productivity



Conclusions

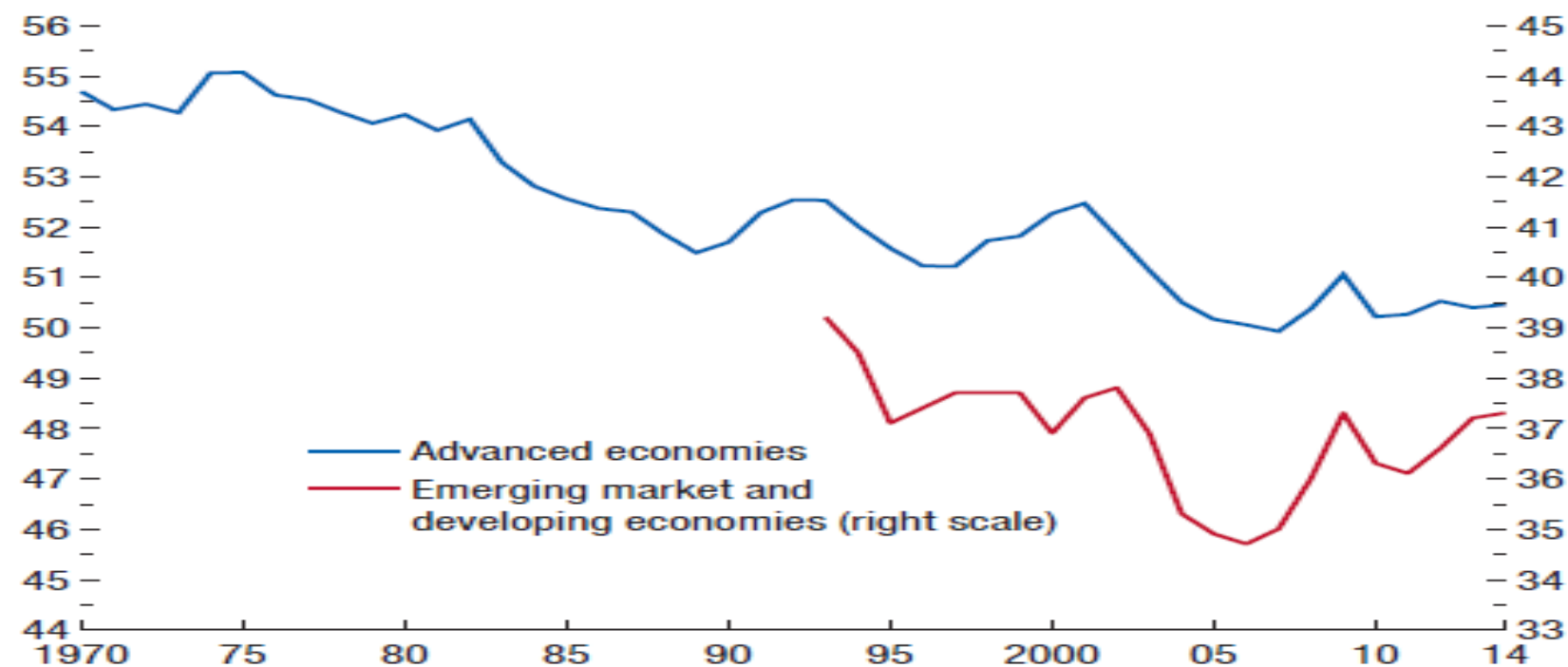
- Develop Superstar Firm model to explain fall in labor share
- Generates 5 predictions that are consistent with US and international micro-data
- Concern that even if superstars become dominant on the merits, can now erect entry barriers
- Next steps: Link to general increase in inequality between workers (Song et al, 2017)

Back Up

Thank You!

Figure 3.1. Evolution of the Labor Share of Income (Percent)

The labor share of income has been on a downward trend in both advanced economies and emerging market and developing economies.



Sources: CEIC database; Karabarbounis and Neiman (2014); national authorities; Organisation for Economic Co-operation and Development; and IMF staff calculations.

Note: For advanced economies the figure shows averages weighted by nominal GDP in current U.S. dollars. For emerging market and developing economies the figure shows year fixed effects weighted least squares regressions (using nominal GDP weights) that also include country fixed effects. Year fixed effects are normalized to reflect the level of the labor share in 2000.

Example of Superstar Firm Model (akin to Bartelsman et al. '13, AER)

- Monopolistic competition: CES demand with consumer price elasticity $\rho > 1$
- Firms pay sunk cost of entry $\kappa > 0$ for random draw of productivity A_i
- Low productivity firms who cannot cover fixed costs exit. Selection on extensive margin

$$\tilde{A}^\rho = \frac{b^{\rho-1} r^{\alpha\rho} w^{1-\rho\alpha} F^{1-\rho\gamma}}{\alpha^{\rho\alpha} (\gamma - \alpha)^{\rho(\gamma-\alpha)} \rho^\rho (1 - \gamma\rho)^{1-\gamma\rho}}$$

- Revenues of producing firms increases in relative productivity. Selection on intensive margin

Some Predictions

1. Consider Rise in product market competition $\rho \uparrow$
 - Output shifts to high A_i (low labor share) firms
 - This reallocation will push down the aggregate labor share
2. Note
 - Fall of labor share reinforced by selection on the extensive margin as low productivity/high labor firms exit when competition gets tougher
 - But offset by squeeze on profit margins of incumbent firms which will lift firm-specific labor share

Example of Superstar Firm Model

$$K_i^* = A_i^{\frac{\rho}{1-\rho\gamma}} \Omega(w, r)$$

$$V_i^* = L_i^* - F = A_i^{\frac{\rho}{1-\rho\gamma}} \frac{r(\gamma - \alpha)}{w\alpha} \Omega$$

$$S_i \equiv \frac{wL_i^*}{P_i Y_i} = \frac{wF}{P_i Y_i} + wb^{\rho-1} \left(\frac{r(\gamma - \alpha)}{w\alpha} \right)^{1-\rho(\gamma-\alpha)} \Omega^{1-\rho\gamma}$$

For pair of firms $A_i > A_j$ implies

$$\omega_i / \omega_j = (A_i / A_j)^{(\rho-1)/\rho(1-\rho\gamma)} > 1$$

Higher ρ amplifies effect of productivity differences on market shares

How Aggregate Labor Share changes when environment shifts (z)

$$\frac{\partial S}{\partial z} = \frac{\partial}{\partial z} [\Sigma(\omega_i - \bar{\omega})(S_i - \bar{S})] + \frac{\partial \bar{S}}{\partial z}$$

Reallocation Effect: what effect of z on covariance of firm relative size & firm relative labor share?

Within firm effect: what effect of z on the unweighted labor share average

How Aggregate Labor Share changes when product market competition rises ($\rho \uparrow$).

Example: 2 Firms, both stay in market; $A_1 > A_2 \Rightarrow \omega_1 > \omega_2$; z = increase in competition ($\rho \uparrow$).

$$\bullet \frac{\partial S}{\partial \rho} = \frac{\partial \omega_1}{\partial \rho} (S_1 - S_2) + \omega_1 \frac{\partial S_1}{\partial \rho} + (1 - \omega_1) \frac{\partial S_2}{\partial \rho}$$

Size share of superstar firm rises

Labor share of superstar firms are always smaller

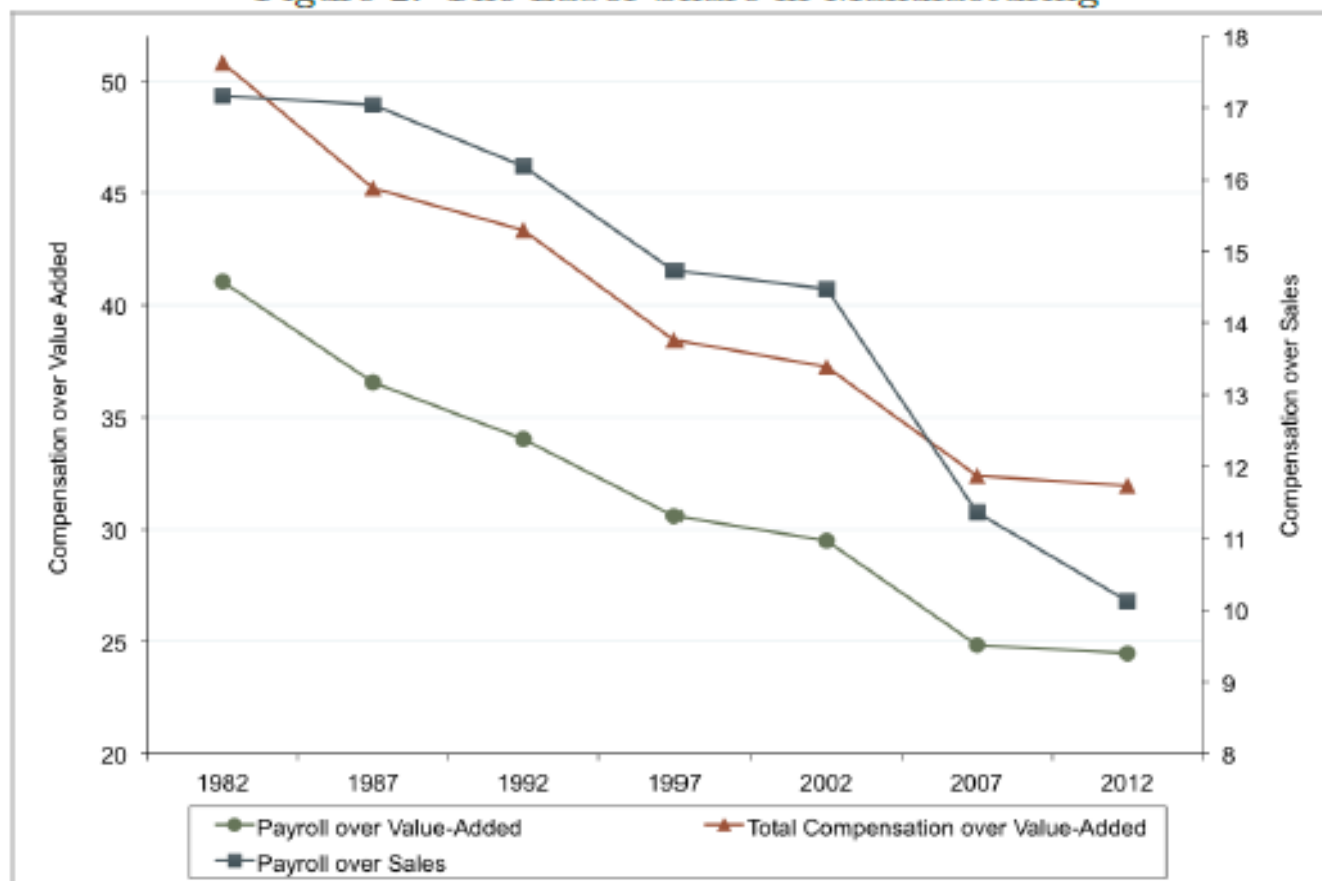
Change in labor share within each firm (weighted by market shares)

Reallocation Effect: as superstar firm (with low lab share) gains bigger market share: $S \downarrow$

Within firm effect: both firms see a rise in labor share as competition squeezes margins, $S \uparrow$

Change in the Labor Share in US manufacturing

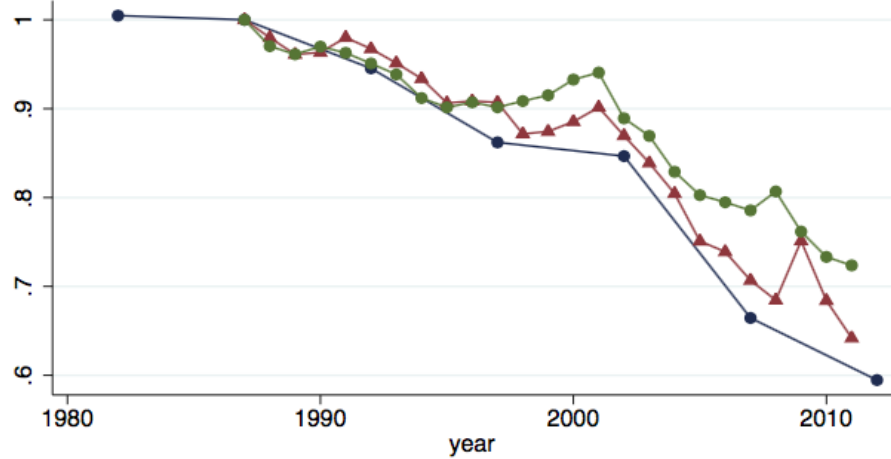
Figure 2: The Labor Share in Manufacturing



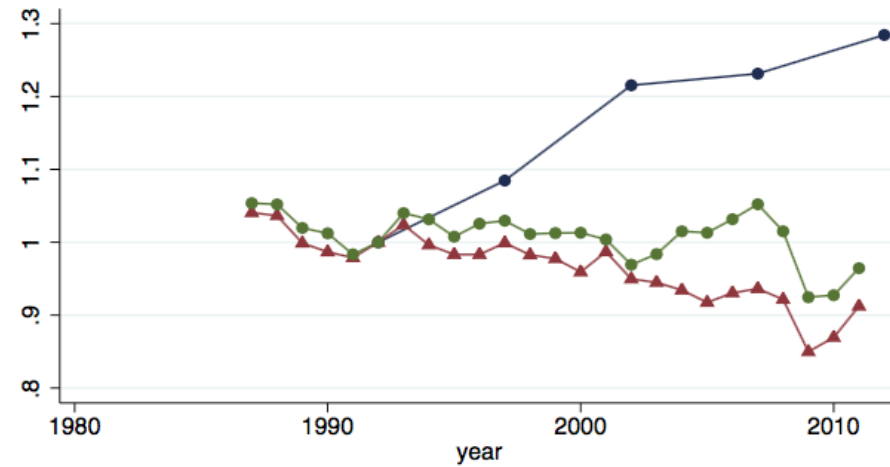
Notes: This figure plots the aggregate labor share in manufacturing from 1982-2012. The green circles (plotted on the left axis) represent the ratio of wages and salaries to value-added. The red diamonds (also plotted on the left axis) include a broader definition of labor income and plots the ratio of wages, salaries and fringe benefits to value-added. The blue squares (plotted on the right axis) show wages and salaries normalized by sales rather than value-added.

Change in Labor Share (Payroll-Sales Ratio): Manufacturing, Finance

Panel A: Manufacturing

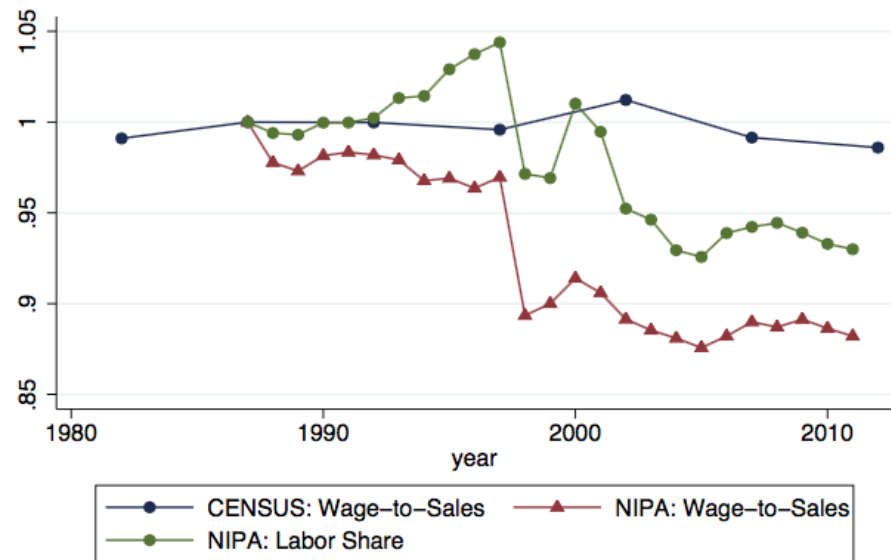


Panel B: Finance

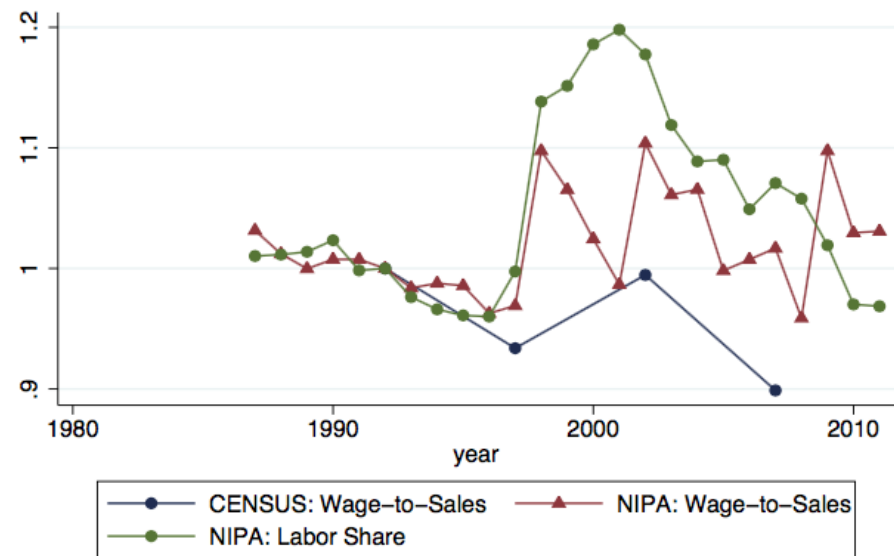


Change in Labor Share (Payroll-Sales Ratio): Services, Utilities & Transportation

Panel C: Services

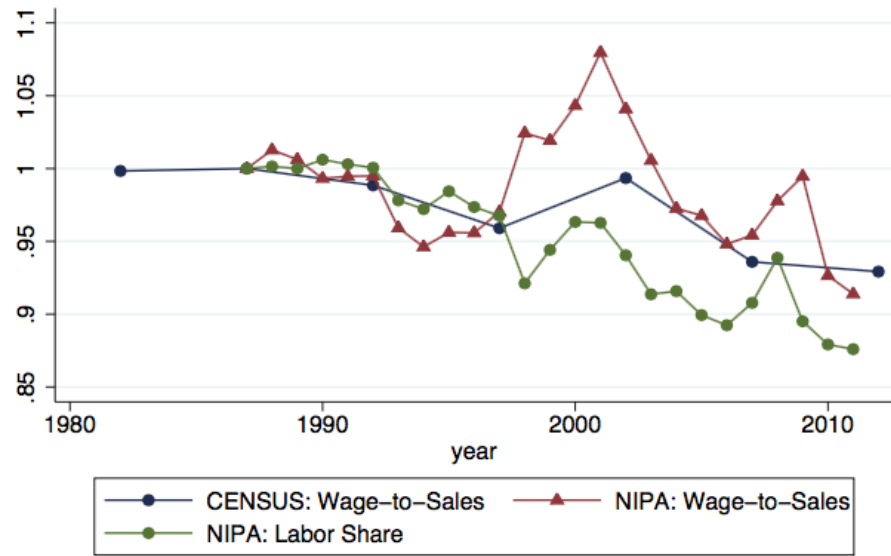


Panel D: Utilities and Transportation

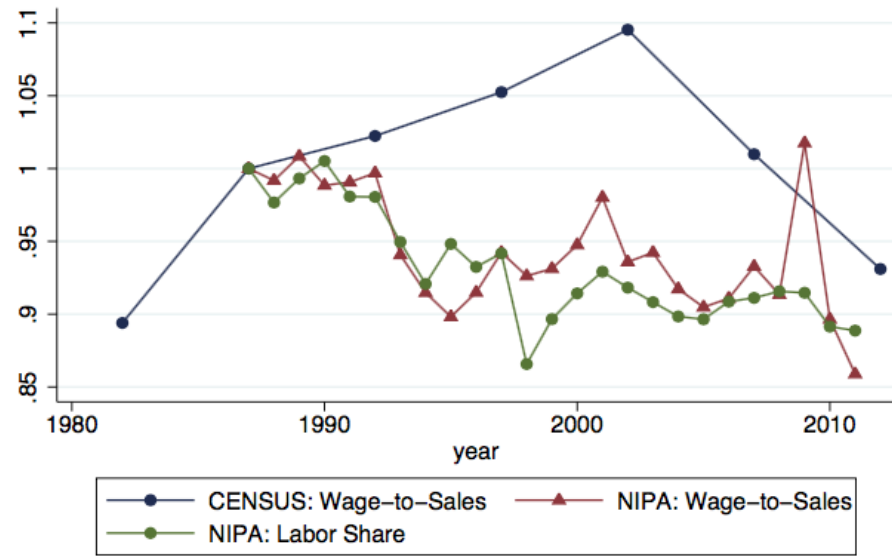


Change in Labor Share (Payroll-Sales Ratio): Retail and Wholesale Trade

Panel E: Retail Trade



Panel F: Wholesale Trade



Falling Labor Share of Value-Added Evident in Many Countries

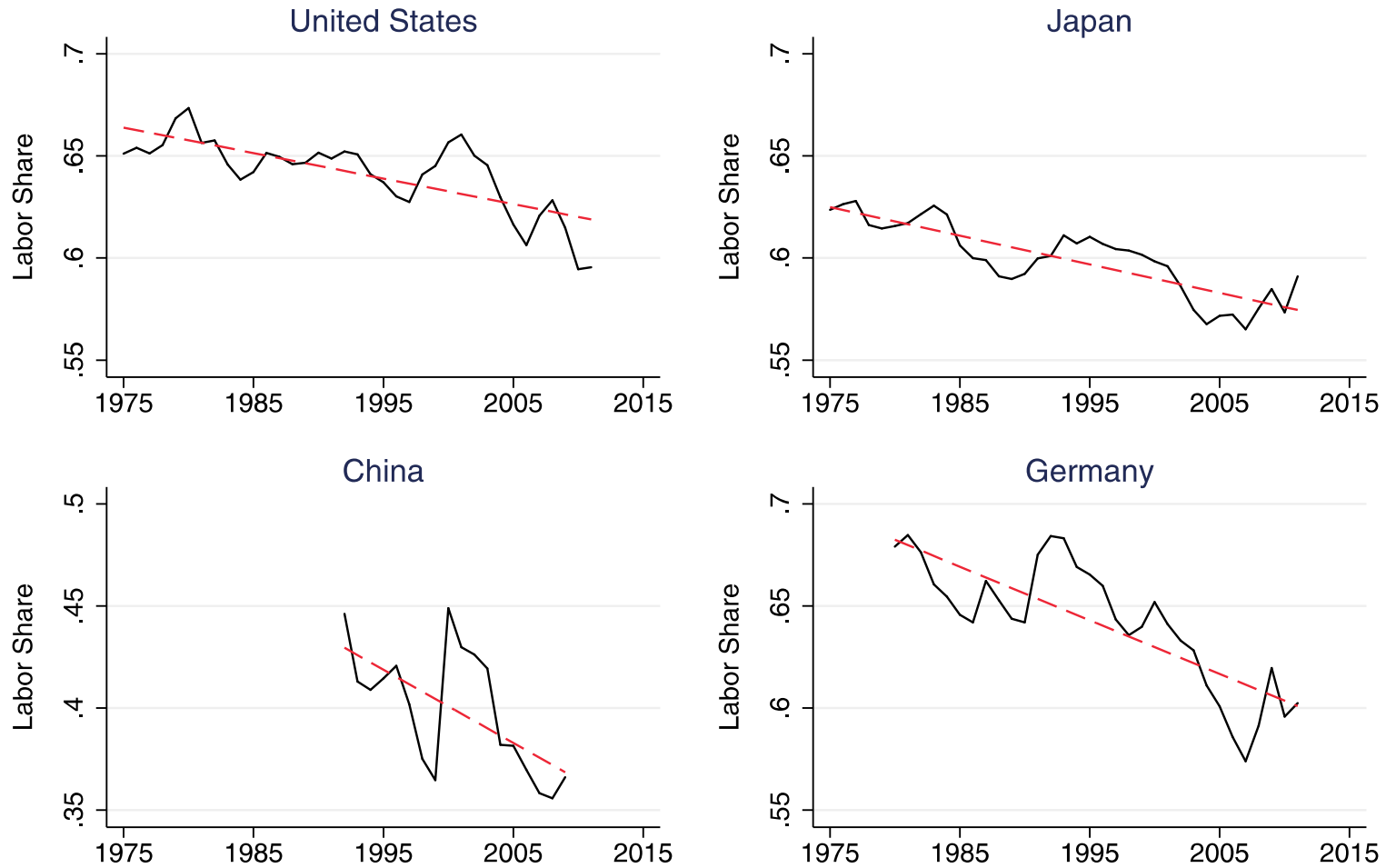


FIGURE II

Declining Labor Share for the Largest Countries

Table 5: Basic Descriptive Relationship- Larger Firms Have Lower Labor Shares

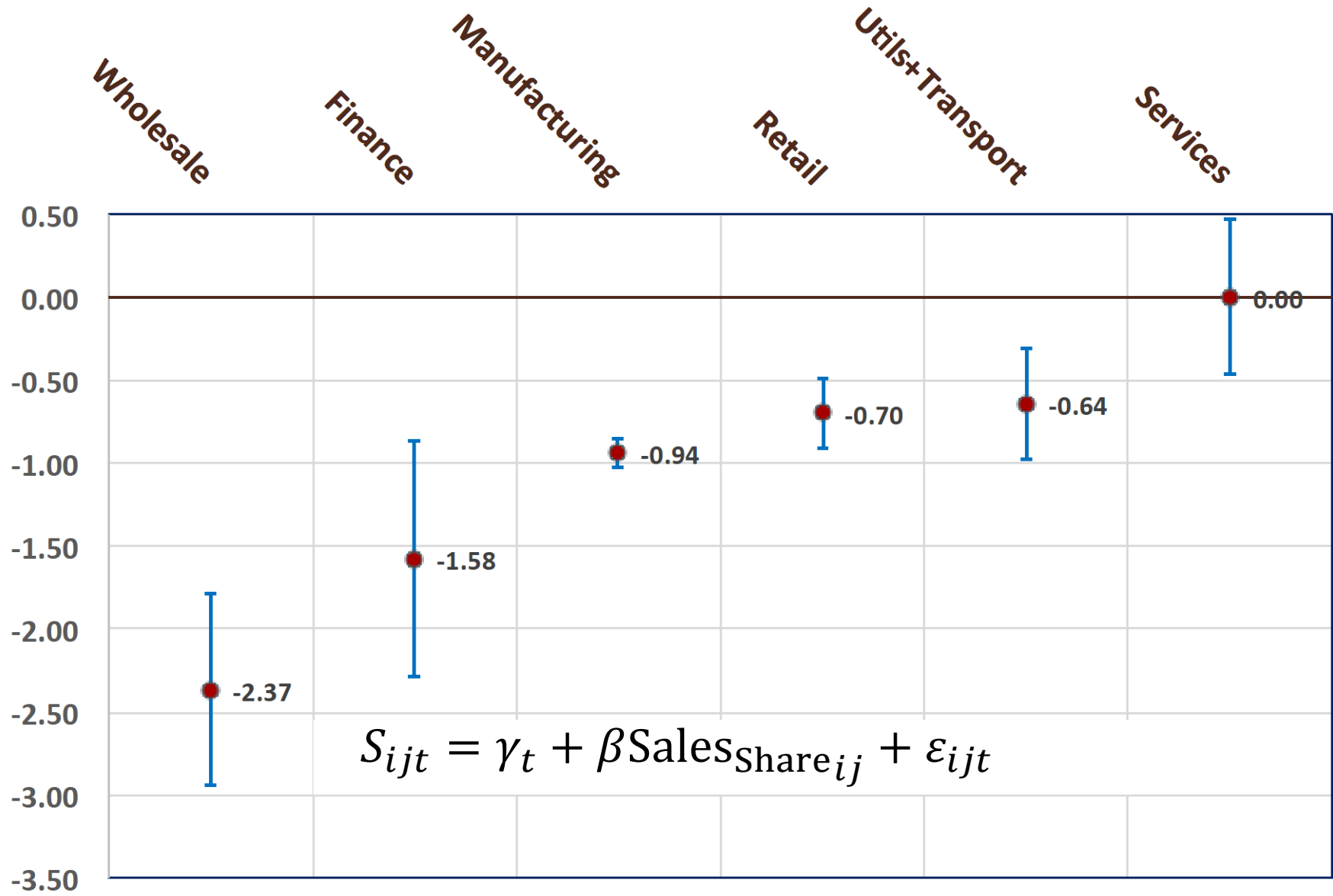


Table 3: Results in 6 Broad Sectors (Δ Labor Share of Sales)

$$\Delta S_{jt} = \alpha + \beta \Delta \text{Conc}_{jt} + \gamma_t + \varepsilon_{jt}$$

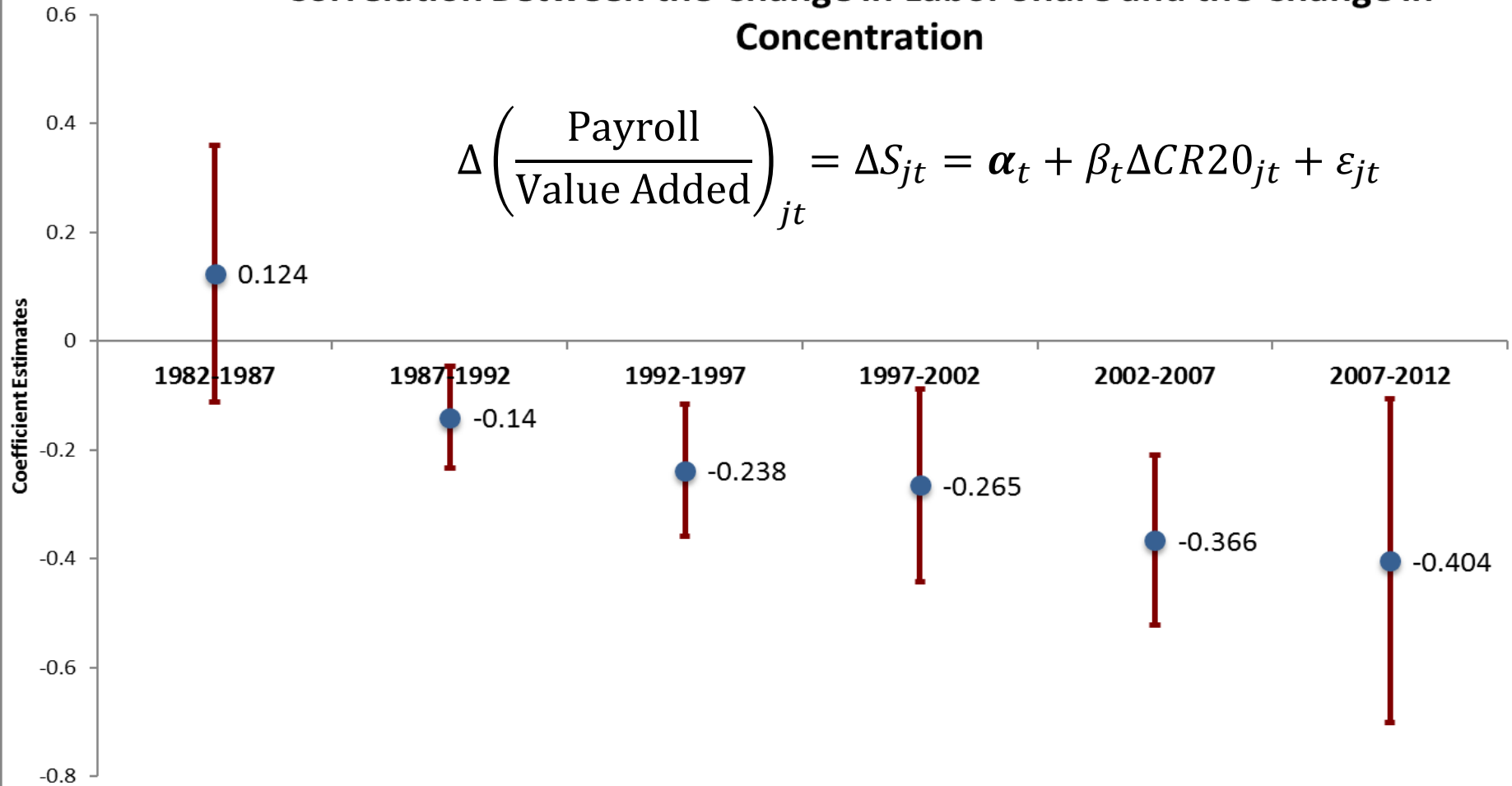
	<u>Stacked Five-Year Changes</u>						<u>Stacked Ten-Year Changes</u>					
	CR4		CR20		HHI		CR4		CR20		HHI	
1. Manufacturing <i>n</i> = 2328; 1,164	-0.064	**	-0.087	**	-0.107	**	-0.044	*	-0.044		-0.096	**
	(0.013)		(0.024)		(0.027)		(0.022)		(0.034)		(0.037)	
2. Retail <i>n</i> = 348; 174	-0.036	~	-0.085	*	-0.045	~	-0.045	*	-0.070	*	-0.075	**
	(0.021)		(0.037)		(0.026)		(0.018)		(0.029)		(0.023)	
3. Services <i>n</i> = 570; 285	-0.090		-0.127	**	-0.354	**	-0.087		-0.129	**	-0.378	*
	(0.057)		(0.037)		(0.083)		(0.070)		(0.043)		(0.158)	
4. Wholesale <i>n</i> = 336; 168	-0.035	**	-0.039	*	-0.079	*	-0.037	*	-0.036	*	-0.067	
	(0.012)		(0.016)		(0.039)		(0.018)		(0.018)		(0.050)	
5. Finance <i>n</i> = 124; 62	-0.230	**	-0.265	**	-0.565	**	-0.252	**	-0.291	**	-0.740	*
	(0.083)		(0.080)		(0.204)		(0.091)		(0.070)		(0.294)	
6. Utilits + Transport <i>n</i> = 144; 48	-0.118	**	-0.116	**	-0.434	**	-0.048		-0.122	*	-0.269	**
	(0.026)		(0.044)		(0.054)		(0.072)		(0.051)		(0.104)	
7. All combined <i>n</i> = 3,850; 1,901	-0.076	**	-0.093	**	-0.144	**	-0.063	**	-0.083	**	-0.122	**
	(0.016)		(0.022)		(0.028)		(0.019)		(0.024)		(0.033)	

Significance at the **1% level, *5% level, ~10% level. Each cell is the coefficient on a concentration measure from a separate OLS regression (standard errors in parentheses clustered by industry). Time period is 1982-2012 using different Censuses aggregated up to four digit industry-level. The combined regression in row 7 includes 6 sector fixed effects. Regressions are weighted by the share of sales of the four digit industry in total sector sales in the initial year.

7. Negative relationship between Δ Labor Share & Δ Concentration strengthening; Manufacturing

Correlation Between the Change in Labor Share and the Change in Concentration

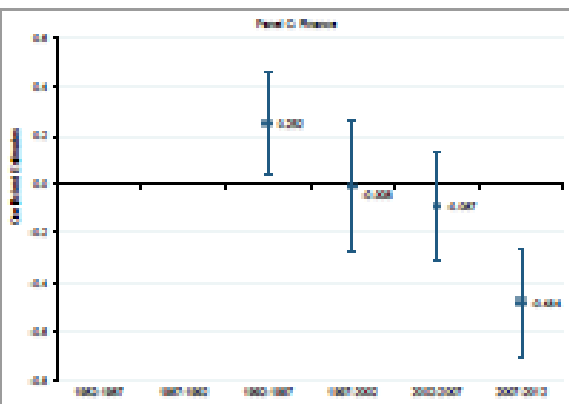
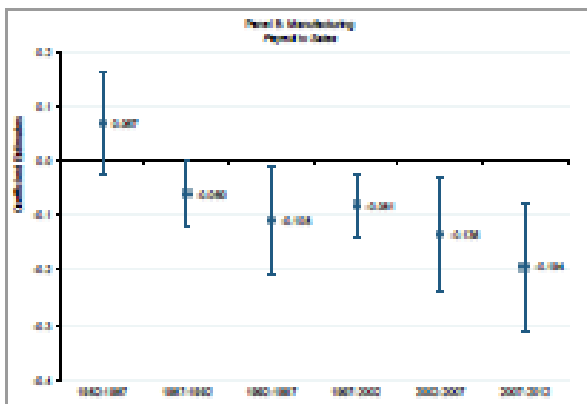
$$\Delta \left(\frac{\text{Payroll}}{\text{Value Added}} \right)_{jt} = \Delta S_{jt} = \alpha_t + \beta_t \Delta CR20_{jt} + \varepsilon_{jt}$$



Notes: Average $\beta = -0.148$ over period as a whole (including time dummies).
Concentration changes account for bigger % of lab share change in post 1997 period (about 34% of manufacturing change)

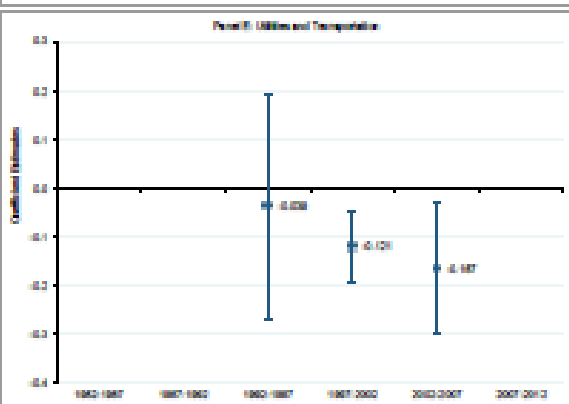
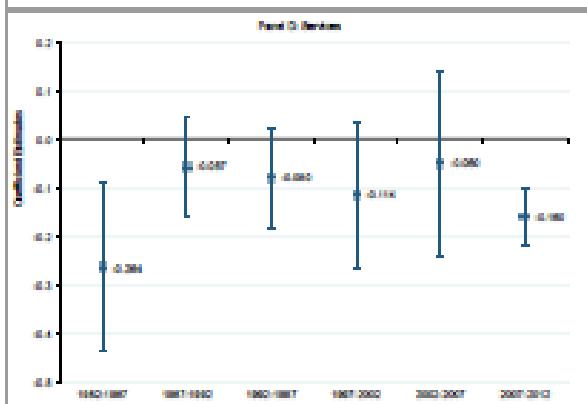
7. Relationship between change in lab share of sales & concentration over time

Manufacturing



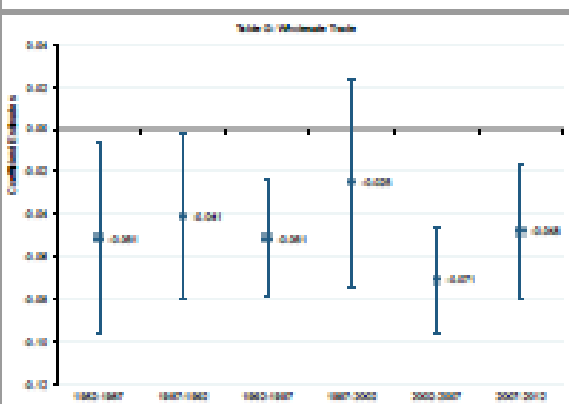
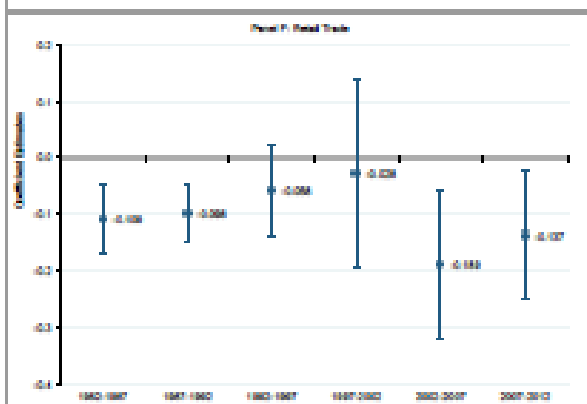
Finance

Services



Utilities & transport

Retail



Wholesale

Fig 8: 'Explained' Share of Falling Labor Share

Service Sector

**Utilities + Transportation
Sector**

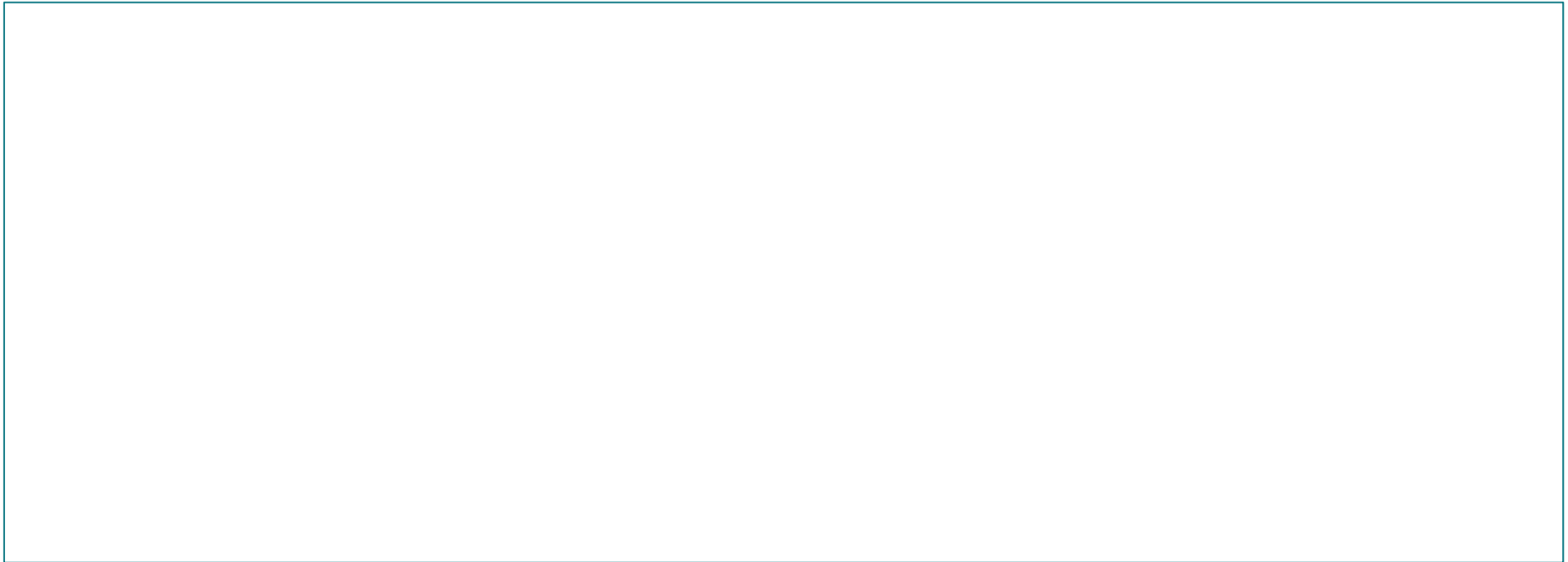
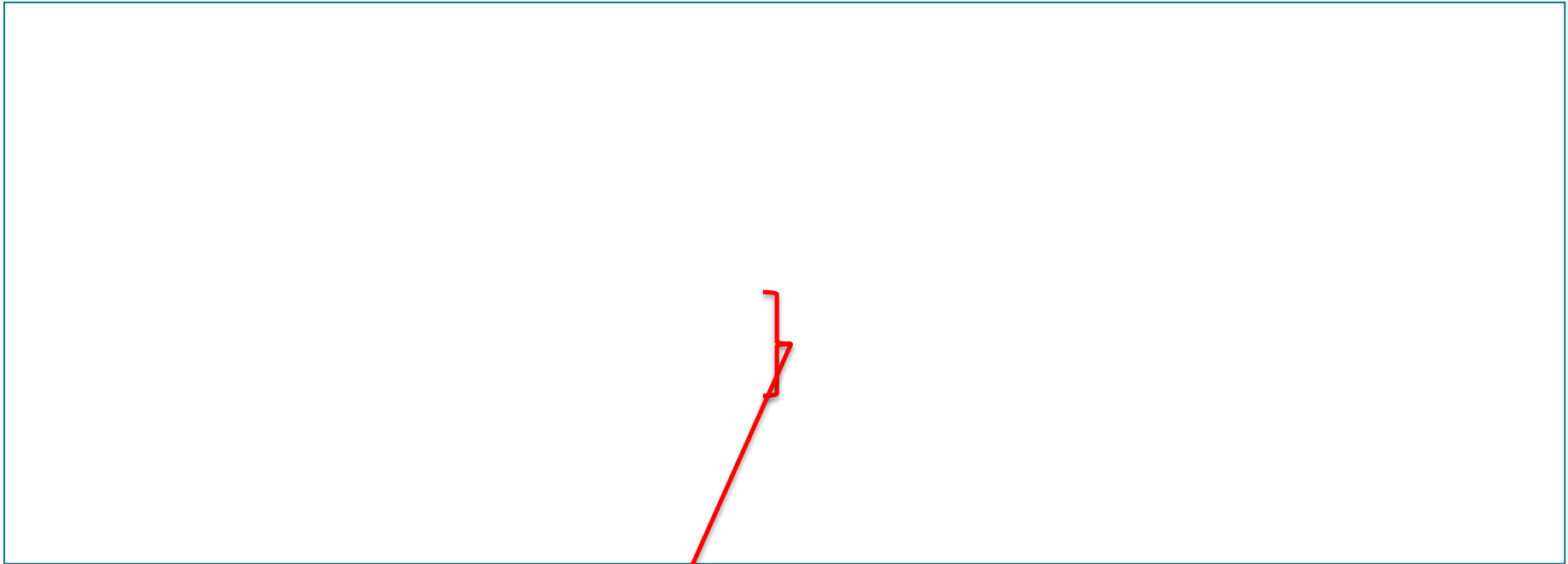


Fig 8: 'Explained' Share of Falling Labor Share

Service Sector

Utilities + Transportation
Sector



Example: About a third ($0.32 = 0.8/2.5$) of 2012-1982 decline in labor share accounted for by concentration increases

Fig 8: 'Explained' Share of Falling Labor Share

Manufacturing Sector

Finance Sector

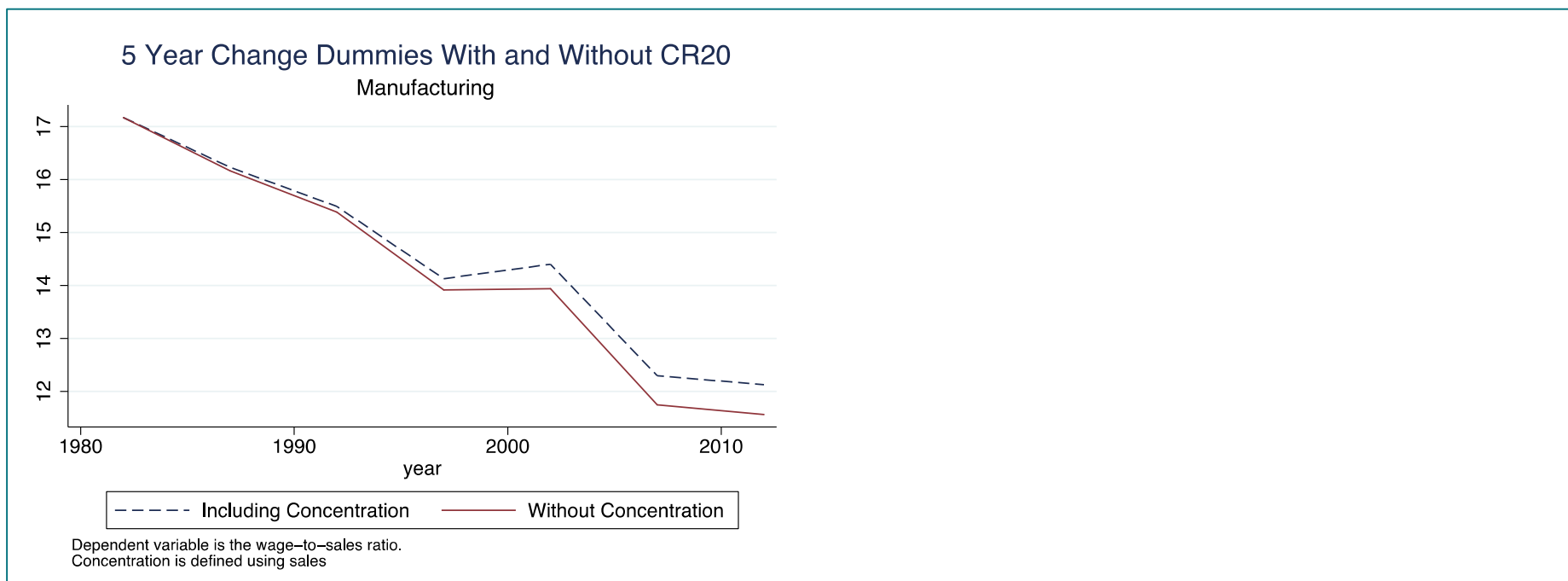
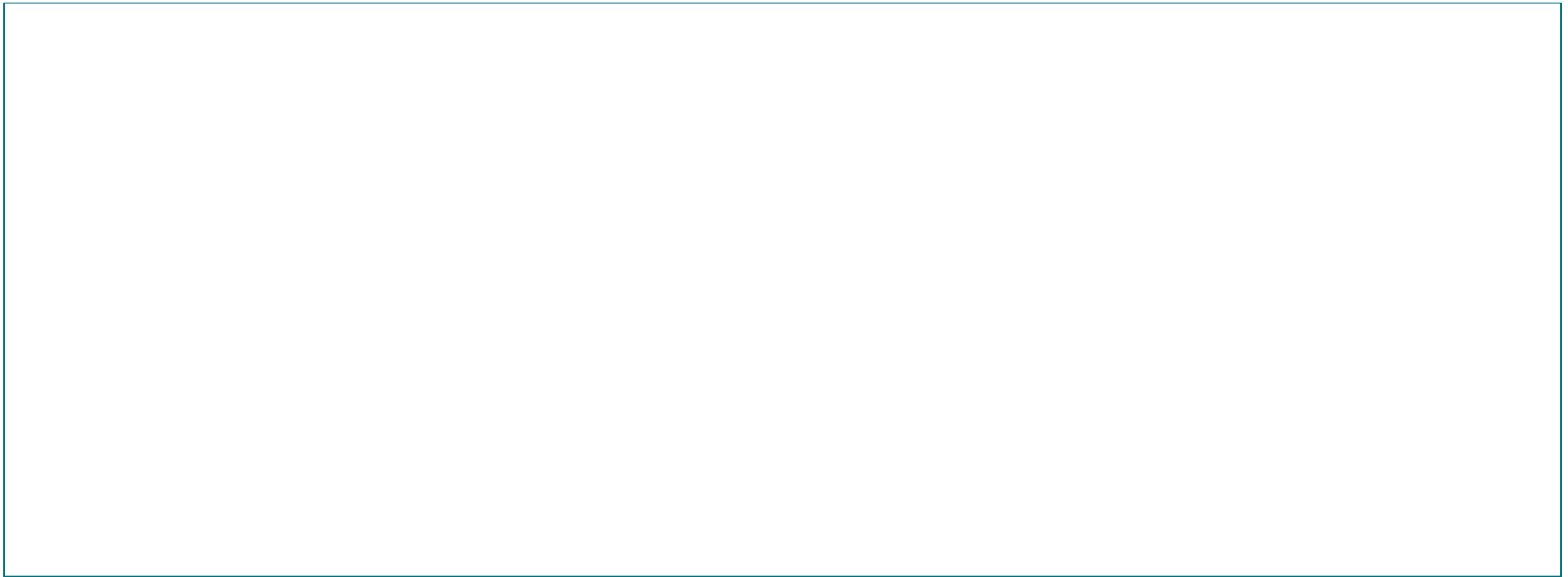


Fig 8: 'Explained' Share of Falling Labor Share

Retail Trade

Wholesale Trade



Olley-Pakes (1996) Decomposition Applied to Labor Share

$$S = \bar{S} + [\Sigma(\omega_i - \bar{\omega})(S_i - \bar{S})]$$

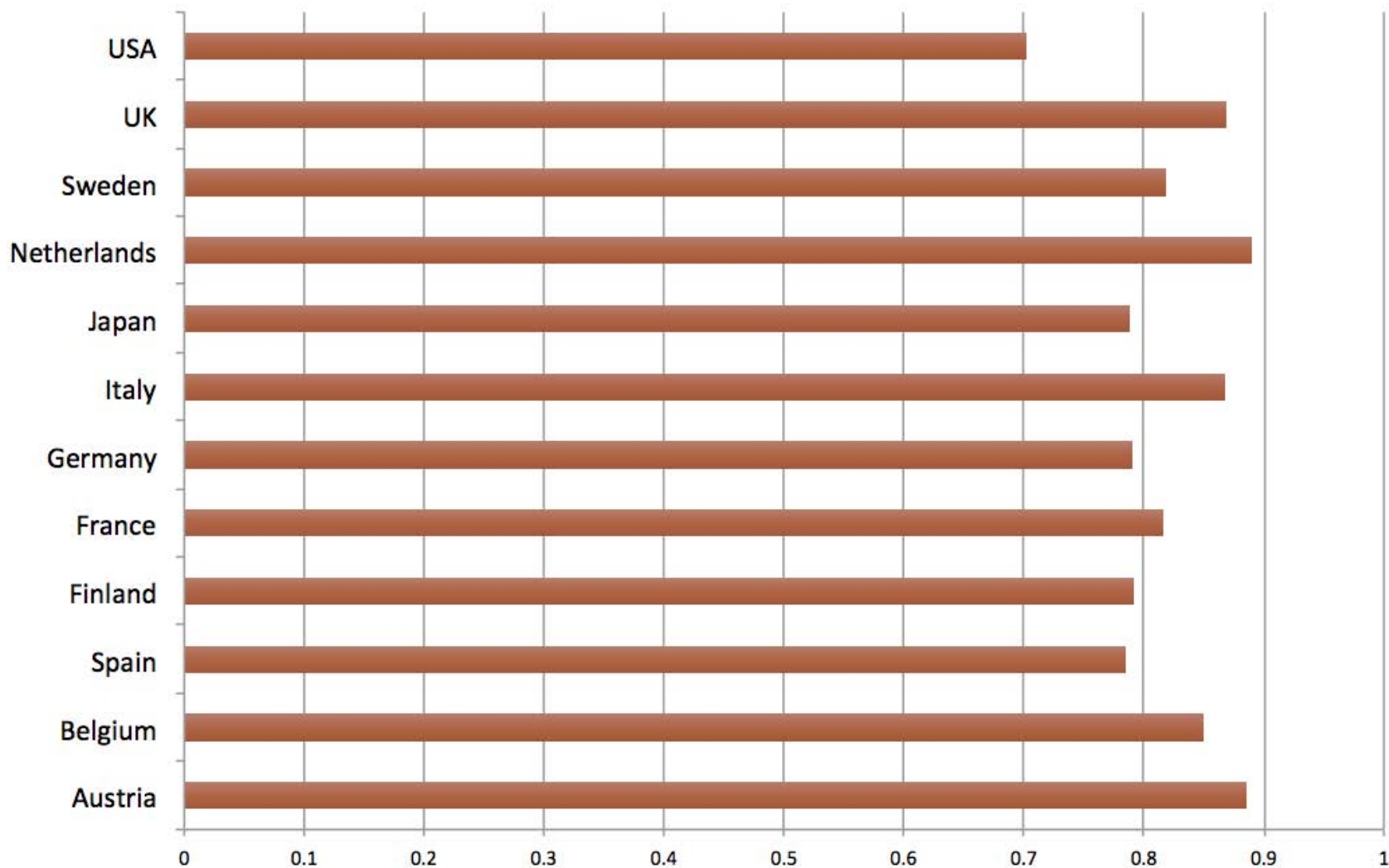
- Aggregate labor share (S) divided into
 1. Cross-firm **unweighted average**, \bar{S}
 2. **Reallocation** (covariance) term $\Sigma(\omega_i - \bar{\omega})(S_i - \bar{S})$

Extended OP Decomposition: Melitz-Polanec (2015) add Entry + Exit

$$\Delta S = \Delta \bar{S}_S + \Delta [\Sigma(\omega_i - \bar{\omega})(S_i - \bar{S})] \\ + \omega_{X,1}(S_{S,1} - S_{X,1}) + \omega_{E,2}(S_{E,2} - S_{S,2})$$

1. $\Delta \bar{S}_S$ is the change in unweighted mean labor share *within* surviving firms
2. $\Delta [\Sigma(\omega_i - \bar{\omega})(S_i - \bar{S})]$ is reallocation *between* survivors
3. $\omega_{X,1}(S_{S,1} - S_{X,1})$ is contribution of *exiting* firms
4. $\omega_{E,2}(S_{E,2} - S_{S,2})$ is contribution of *entering* firms

Figure 12 Panel A: Correlations of Labor Share Levels Across Countries



Average correlation coefficient from pairwise correlations between indicated country and each of the 11 other countries

Figure 12 Panel B: Correlation of Labor Share Changes Across Countries



Average correlation coefficient from pairwise correlations between indicated country and each of the 11 other countries; fraction of negative correlations

Industry Regs of Δ Labor Share of Sales on Δ Concentration (COMPNET, 10 year change)

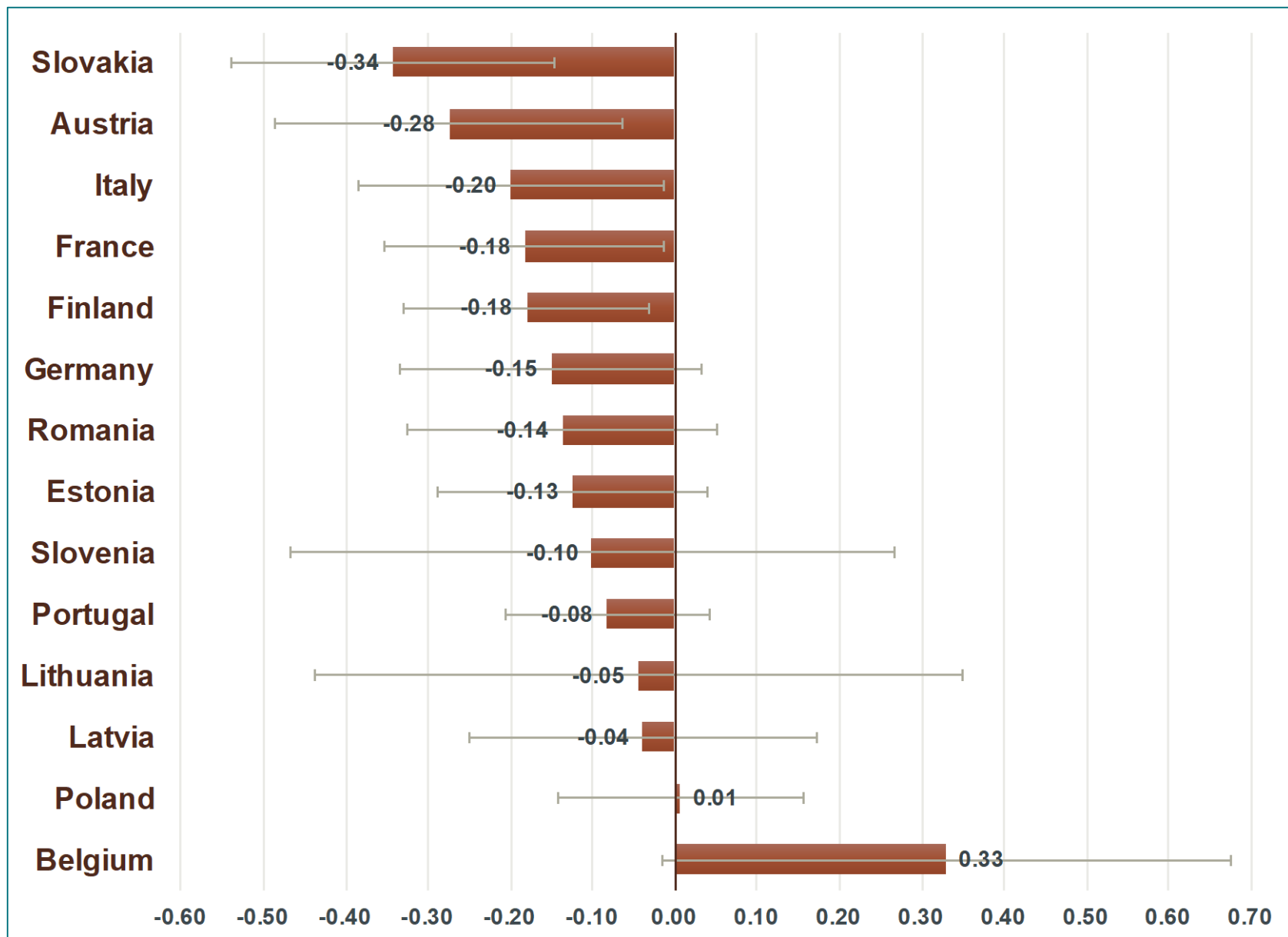


Figure 13: Δ Labor Share: Within/Between-Firm Decomposition by Country (BVD Orbis Data)

