Firm-level Labor Shares and Technology-driven Occupational Changes

Ana Oliveira[1]

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Motivation

- Vast literature on the decline of the aggregate labor share and the contribution of technological change (e.g., Elsby et al., 2013; Karabarbounis and Neiman, 2014; Acemoglu and Restrepo, 2018; Autor and Salomons, 2018);
- However, much less is known about the labor share dynamics at firm-level.

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- However, much less is known about the labor share dynamics at firm-level.
- Technological advances have changed the employment structure across occupations (Goos et al., 2009), changing occupation-specific labor costs;
- Everything else constant, the direction of the impact of those changes on the labor share is uncertain.

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Main purposes of the paper:

To assess (i) if task-biased labor demand changes contribute to determine labor share dynamics at the firm-level, and (ii) how such contribution, if any, compares against other components of the labor share change decomposition.

Motivation

In Portugal:

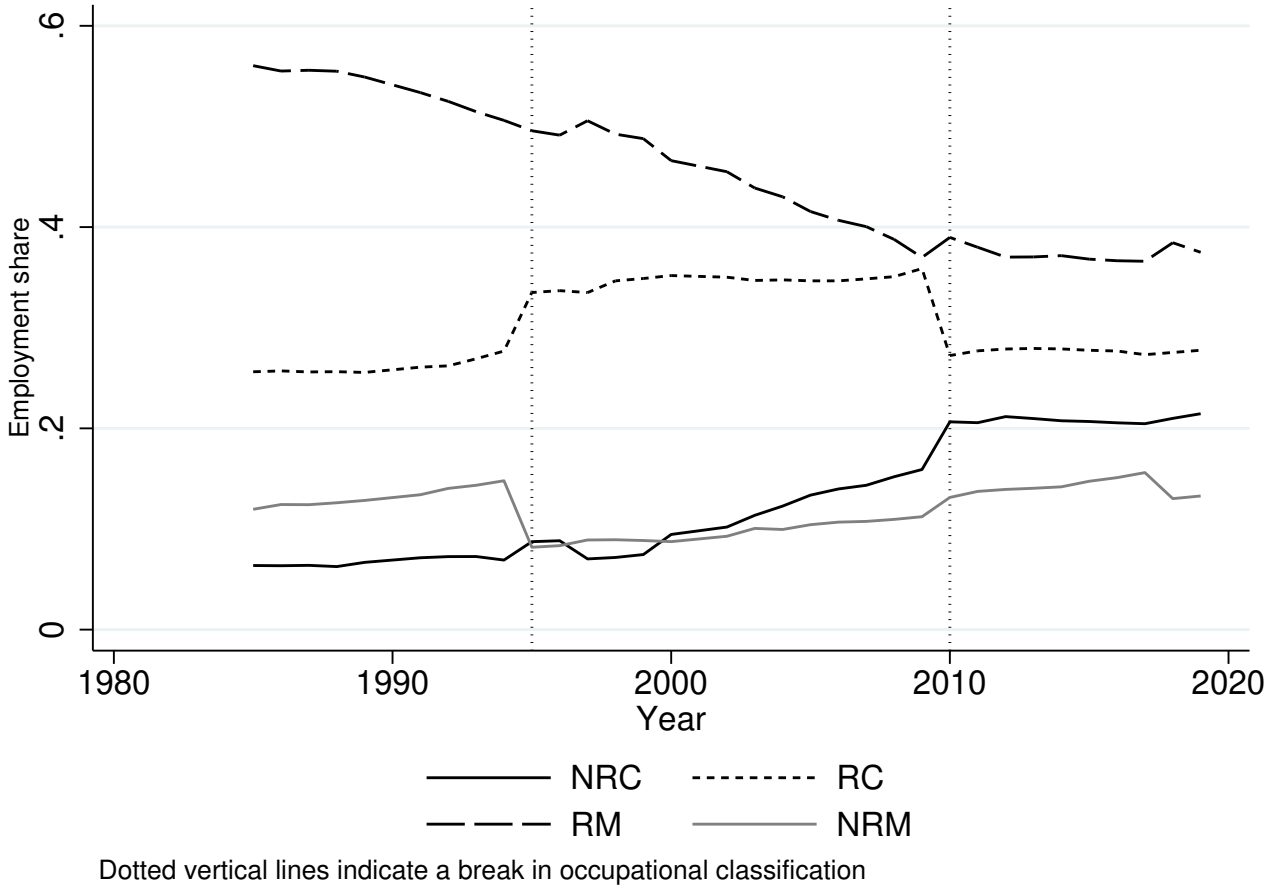


Figure: Employment shares by occupational group in Portugal. Source: *Quadros de Pessoal*. Own calculations

Motivation

The aggregate labor share in Portugal is aligned with the EU's average, and to what it is observed in the UK and US (around 60%). In the past 15 years, the aggregate labor share dynamics has followed a S-shaped behavior. Three distinct periods: 2004-2012, 2013-2016, 2017-2019.

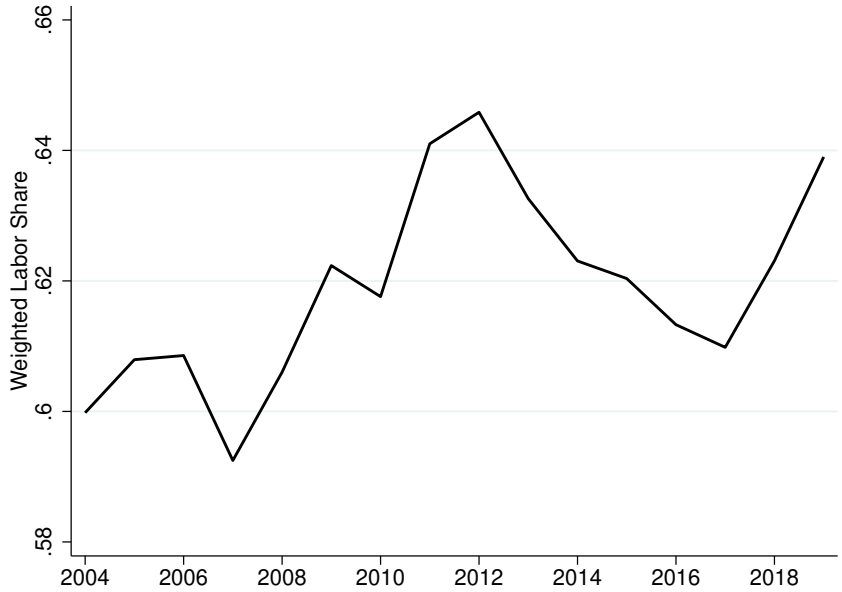


Figure: Labor share in Portugal. Source: SCIE database (INE). Own calculations

Preliminary findings

Main contributions of this paper:

1. The S-shaped dynamic of the aggregate labor share between 2004 and 2019 is mostly driven by changes in firms' unweighted labor shares rather than value added reallocation across the labor share distribution;
2. firm-specific labor shares have been rising due to positive growth in occupational wage rates, specially high among Routine Manual and Non-Routine Manual occupations;
3. the impact of changes in task group employment shares have been limited in the past decade, due to the stabilization of occupational employment shares since 2010.

Related Literature

Technological change and income distribution:

- Empirical evidence suggests **technological change as one of the main drivers of lower aggregate labor shares** (Acemoglu, 2003; Jones, 2005; Karabarbounis and Neiman, 2014; Irmen and Tabaković, 2017);
- Theoretical and empirical literature focused on the impacts of **automation have shown that it reduces the labor share** (A: vom Lehn (2018), I: Acemoglu and Restrepo (2018), F: Humlum (2019); Acemoglu et al. (2020); Koch et al. (2021))

Labor share at firm-level:

- Autor et al. (2020) and ``**superstar firms**";
- De Loecker et al. (2020) and **the role of markups and market concentration**;
- Zhang (2019) on **firm-level heterogeneity**;
- Kehrig and Vincent (2021) and the **high value-added growth of low labor share firms**;
- Kyyrä and Maliranta (2008) and Bloise et al. (2021) on the importance of **compositional effects**.

Data

***Sistema de Contas Integradas das Empresas*, SCIE**: administrative dataset; 2004-2019; firm-level indicators from balance sheets and financial statements, including: yearly labor costs and value-added. From here, we derive

$$l_{it} = \frac{TLC_{it}}{y_{it}} \qquad \text{and} \qquad L_t = \sum_{i=1} \gamma_{it} l_{it},$$

where l_{it} is the firm-level labor share, TLC_{it} total labor costs, y_{it} value-added, γ_{it} value-added weight and L_t the aggregate labor share.

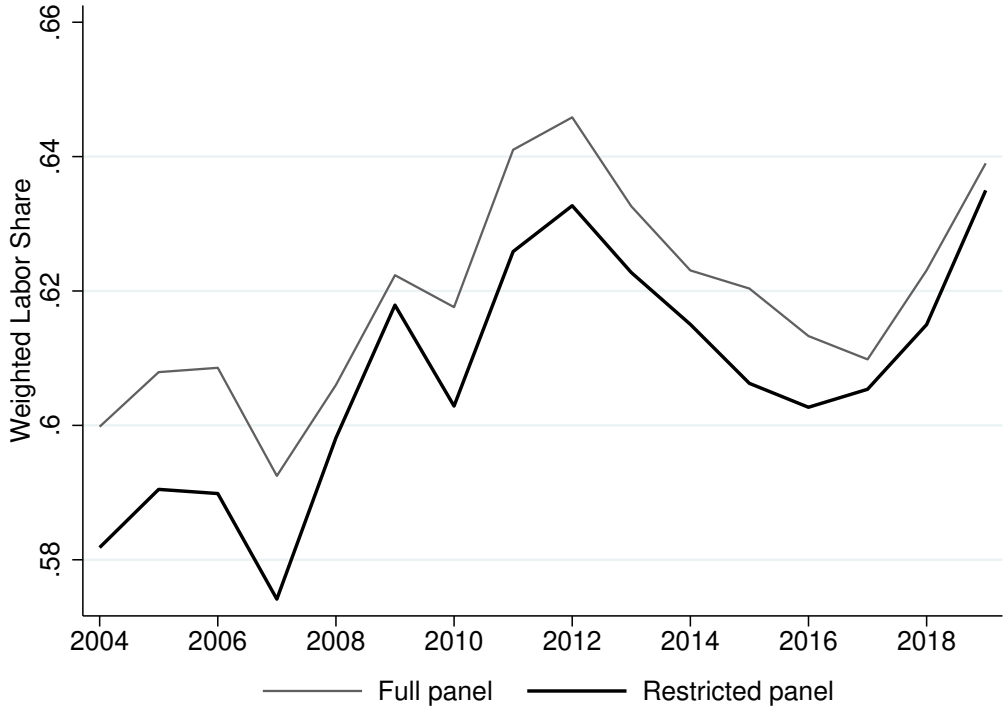
Quadros de Pessoal: employer-employee administrative dataset; 1985-2019; includes, e.g., individual worker's occupation, monthly hours worked, base and total wage in October.

We group 3-digit occupations in 4 task groups according to their automation potential (Routine/Non-Routine) and their complexity (Cognitive/Manual) (as in Autor et al., 2003, and Cortes et al., 2017).

Data

The final panel has around 180k firms in 2004 and 190k in 2019. 21.6% of which are survivors, 37.5% exiters and 41% entrants. These figures change in each sub-period.

Figure: Aggregate Labor Share, full and restricted panel



Do task groups matter for the labor share?

Mechanisms through which changes in employment shares by task group may affect the labor share, **for given value-added**:

- Job polarization implies redistribution of employment from routine occupations (RC/RM) to non-routine occupations, which pay wages either at the top (NRC), or at the bottom (NRM) of the wage distribution:
  - If workers move to NRM, labor shares $\downarrow$;
  - if workers move to NRC, labor shares $\uparrow$

  We call this channel as the **within-firm, between task groups effect**;
- However, if wages in declining task groups growth by more than wages in high demand task-groups, it smooths out job polarization. We call the wage channel as the **within-firm, within task groups effect**.

Do task groups matter for the labor share?

Regression analysis at firm level, to study the significance of Routine-employment share, controlling for other labor share determinants:

$$l_{it} = \beta_0 + \beta_1 \lambda_{it}^{Routine} + \beta_3 \text{HHI}_{st} + \delta \Omega_{it} + \epsilon_{it}$$

where i indexes firms,and s 5-digit level industry codes.

λ_{ji}	Firm-level routine employment share
HHI_s	Herfindahl - Hirhschman Index to measure market concentration in each s
Ω_i	Firm-level controls: Labor relations: proxy for unionization rates and share of temporary employment; Firm-size, labor productivity and export share; Market share, by deciles.

Does the employment structure matter to the firm's labor share?

	2004-2009	2004-2009	2010-2019	2010-2019
Share of Routine Emp.	0.075***	0.069***	0.035***	0.042***
	(0.005)	(0.007)	(0.003)	(0.004)
Ln value-added (3-year mean)	-0.599***	-1.029***	-0.615***	-0.779***
	(0.012)	(0.026)	(0.011)	(0.015)
Share of nonpermanent emp.	0.014***	0.007*	0.020***	-0.009**
	(0.003)	(0.003)	(0.003)	(0.003)
Mean log wage	0.355***	0.133***	0.395***	0.182***
	(0.010)	(0.005)	(0.007)	(0.004)
Log firm Emp. (in hours)	-0.143***	-0.247***	-0.119***	-0.083***
	(0.004)	(0.011)	(0.004)	(0.004)
Share of Exports (on total sales)			0.110***	-0.013*
			(0.007)	(0.006)
Outsourcing (share on total expenditure)			-0.093***	-0.057***
			(0.013)	(0.012)
Year	Yes	Yes	Yes	Yes
Industry	Yes	No	Yes	No
Firm	No	Yes	No	Yes
Observations	1.09e+06	1.06e+06	1.68e+06	1.64e+06
R2	0.317	0.635	0.314	0.575

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Decomposition analysis

Aggregate labor share decomposition (following Melitz and Polanec, 2015):

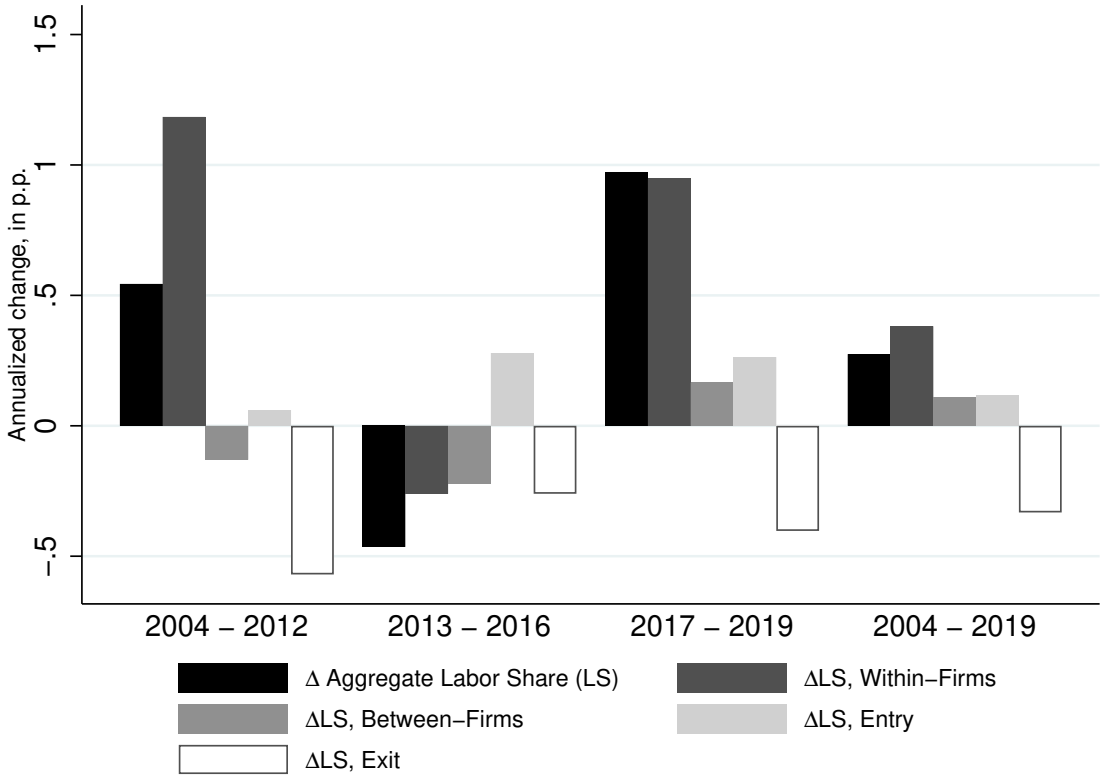
$$\Delta L = \overbrace{\underbrace{\sum_{i \in S} \overline{\gamma_i^s} \Delta l_i^s}_{\text{within-firms}} + \underbrace{\sum_{i \in S} \Delta \gamma_i^s \overline{l_i^s}}_{\text{between-firms}}}^{\text{Survivors' contribution}} + \underbrace{\Gamma_{t+m}^X \left(\sum_{i \in E} \gamma_{i,t+m}^E l_{i,t+m}^E - \sum_{i \in S} \gamma_{i,t+m}^S l_{i,t+m}^S \right)}_{\text{Entrants' contribution}} - \underbrace{\Gamma_{t_0}^X \left(\sum_{i \in X} \gamma_{i,t_0}^X l_{i,t_0}^X - \sum_{i \in S} \gamma_{i,t_0}^S l_{i,t_0}^S \right)}_{\text{Exiters' contribution}},$$

where i indexes firms, S surviving firms, X exiters, E entrants, and overline bars, long-difference averages.

t_0 indexes the first year of the period/sub-period, and $t+m$ the last.

γ_i^z stand for the firm value-added weight within-group, and Γ^z group value-added weight on total value-added ($z \in S, X, E$).

Decomposition analysis



First insights:

1. Negative impact of net entry: extensive margin decreases the labor share
2. Modest contribution of value-added reallocation across firms (between-firms effects)
3. The main driver of changes in the aggregate labor share is within-firm component, i.e., changes in unweighted labor shares.

Decomposition analysis

Firm-level labor share decomposition:

We start by rewrite the labor share as:

$$l_{it} = \frac{\sum_j^4 w_{jit}\lambda_{jit}E_{it}}{y_{it}},$$

where j is the task group, i indexes firms and t years.

$w_{jit} \rightarrow$ hourly nominal wages by task group, firm and year;

$\lambda_{jit} \rightarrow$ task group employment share on firm-year employment;

$E_{it} \rightarrow$ firm-year employment;

$y_{it} \rightarrow$ firm-year value added.

Unweighted labor shares (of surviving firms) can be decomposed as:

$$\Delta l_i = \underbrace{\sum_{j=1}^{4} \Delta w_{ji} \frac{\overline{\lambda_{ji}}\,\overline{E_i}}{\overline{y_i}}}_{\text{WF, within-task groups}} + \underbrace{\sum_{j=1}^{4} \Delta \lambda_{ji} \frac{\overline{w_{ji}}\,\overline{E_i}}{\overline{y_i}}}_{\text{WF, between-task groups}} + \underbrace{\sum_{j=1}^{4} \Delta E_i \frac{\overline{w_{ji}}\,\overline{\lambda_{ji}}}{\overline{y_i}}}_{\text{WF, employment level}} - \underbrace{\overline{l_{it}} \frac{\Delta y_i}{\overline{y_i}}}_{\text{WF, distribution}}$$

Decomposition analysis

Within-firm decomposition:

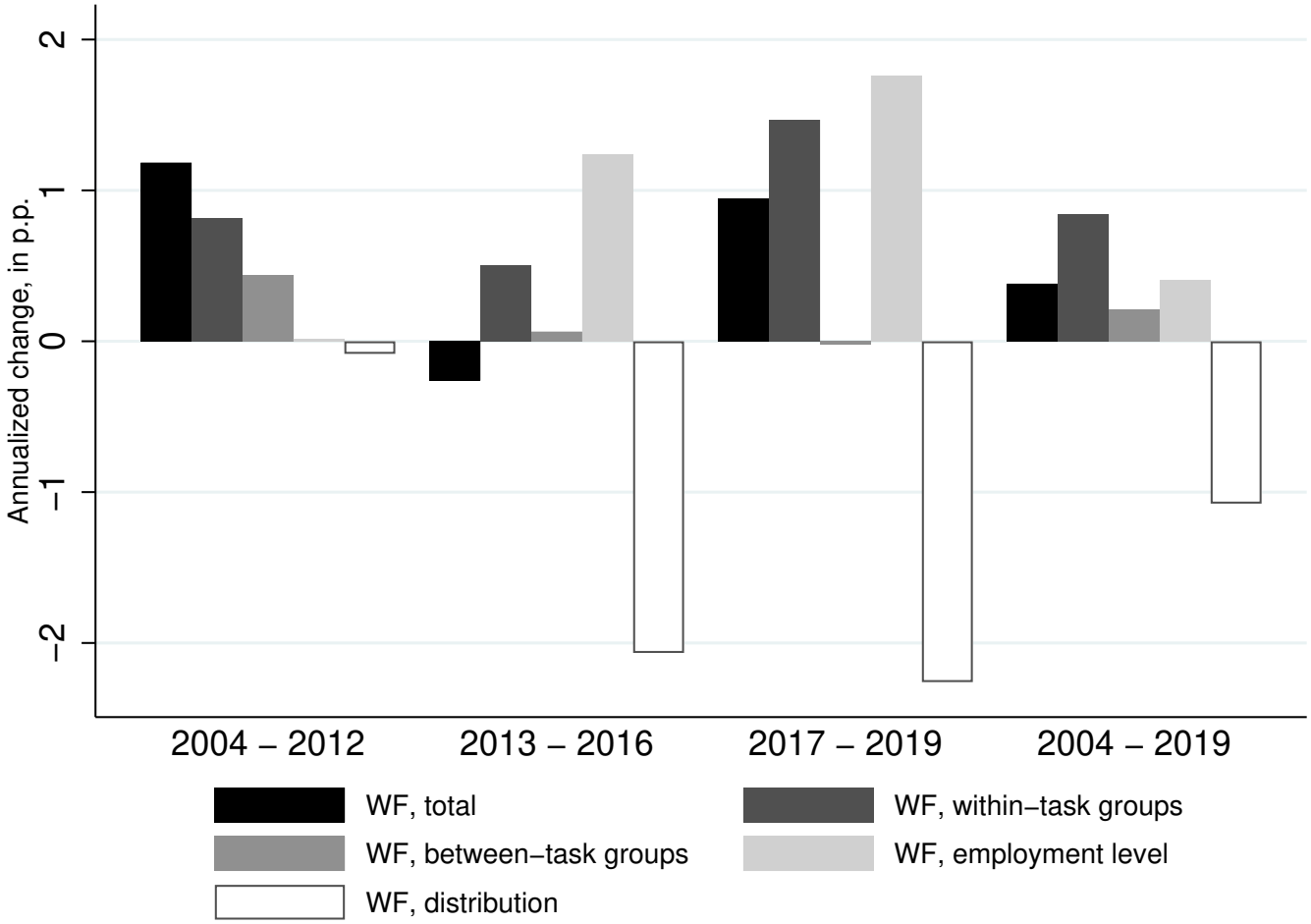


Figure: Decomposition of unweighted labor shares. Sources: *Quadros de Pessoal* and *SCIE*; author's calculations.

Conclusions

1. The dynamics of the aggregate labor share is mostly driven by changes in unweighted labor shares -- the *"within-firm effect"* -- than by value-added reallocation across the LS distribution -- the *"between-firm" effect*;
2. Firm-level labor shares between 2004-2019 rose because nominal wages have also increased, specially among lower paying task groups (RM and NRM);
3. High nominal wage growth among RM occupations (relatively to other task groups) and the increase in NRC employment share smooths out the potential effect of job polarization on the labor share;
4. Stabilization of employment shares by task group since 2010 has limited the impact of job polarization on firm-level labor shares;
5. Changes in total labor costs have been more persistent than changes in firms' value added.

Discussion: wages, productivity and firm-level labor share

What the literature says: Low labor share firms do not pay, in average, lower wages (Autor et al., 2020; Kehrig and Vincent, 2021; Bloise et al., 2021).

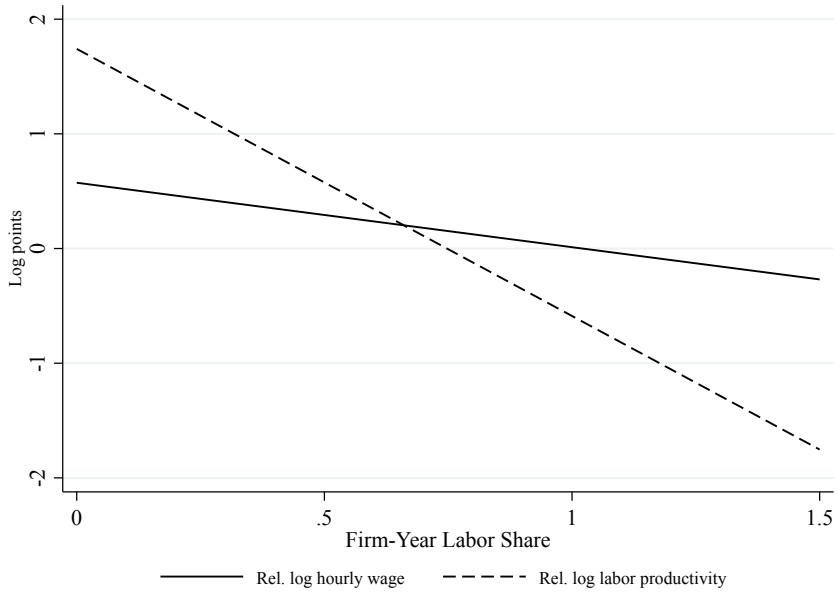


Figure: Best-fitted line from a linear regression of log l_{it} on relative hourly wages and log productivity.

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