The Dynamics of Firm-level Pay: Theory and Evidence from Portugal

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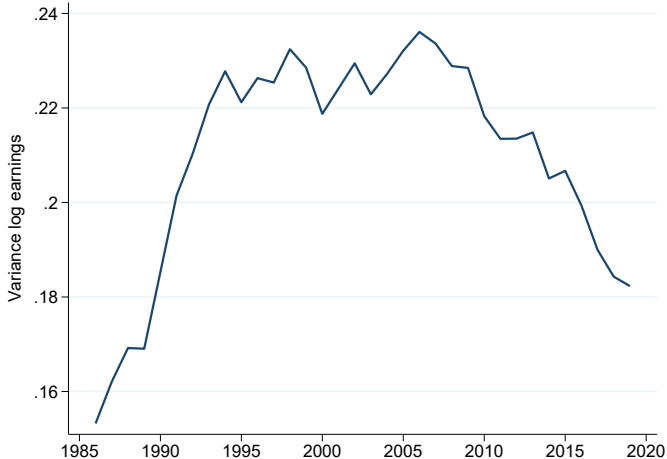
What is this paper about?

1. Document the dynamics of earnings inequality in Portugal
2. Investigate empirically the role played by firms in shaping such dynamics
3. Use theory and the data restrictions in order to gauge the role played by the economic forces likely to have caused that dynamics

Earnings inequality in Portugal

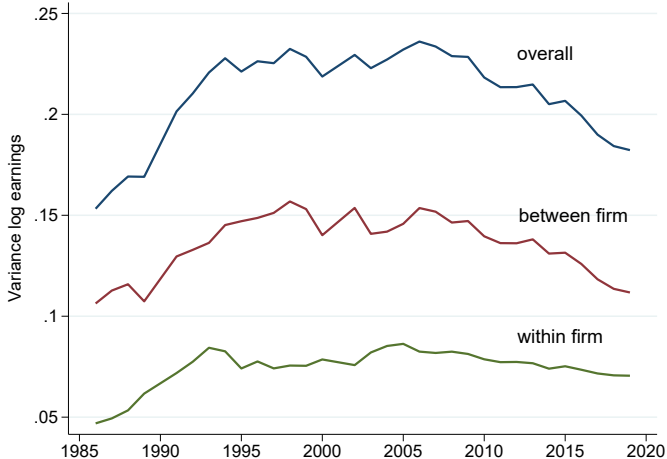


Quadros de Pessoal, 1986-2019

Quadros de Pessoal

- Admin annual data to ensure compliance with labor laws (1986-2019).
- Universe of private-sector firms with at least one salaried worker.
- Matched employer-employee. Rich worker information, basic firm information.
- Workers: aged 18–65, full-time, earning at least minimum wage.
- Firms: focus on non-financial market sector, excluding farming and fishing.

The role of firms: A first look



Between-within firm decomposition

AKM regression (Abowd, Kramarz, Margolis, Ema 1999)

$$y_{ijt} = \text{FFE}_i^p + \text{WFE}_j^p + \mathbf{X}'_{ijt}\beta^p + \varepsilon_{ijt}, \quad \text{for } t \in \text{period } p$$

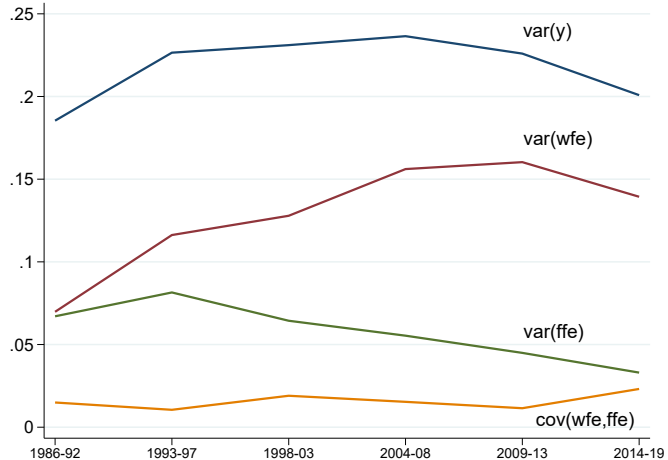
- y : log(earnings)
- $\mathbf{X}_{ijt}$: vector of time-varying observables
- estimated separately in 6 non-overlapping subperiods

Basic variance decomposition

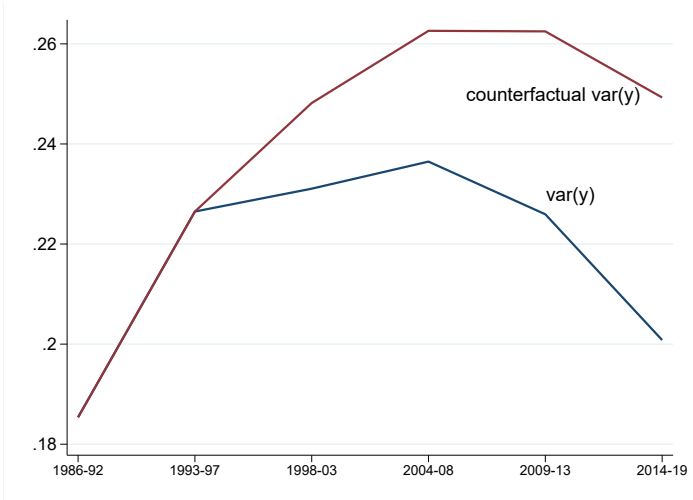
- For each period p (ignoring observables $\mathbf{X}_{ijt}$):

$$\text{var}\left(y_{ijt}\right) = \underbrace{\underbrace{\underbrace{\text{var}\left(\text{WFE}_i\right)}_{\text{fixed}} + \underbrace{\text{var}\left(\varepsilon_{ijt}\right)}_{\text{random}}}_{\text{workers}} + \underbrace{\underbrace{\text{var}\left(\text{FFE}_j\right)}_{\text{firm pay}} + \underbrace{2\text{cov}\left(\text{WFE}_i, \text{FFE}_j\right)}_{\text{assortative matching}}}_{\text{firms}}}$$

Basic variance decomposition



Counterfactual variance w/o firm pay compression



What drove down the variance of firm-level pay?

- Prior work has identified firm-level productivity as a covariate of firm-level pay
- For firm j and period p, consider this simple log-linear specification

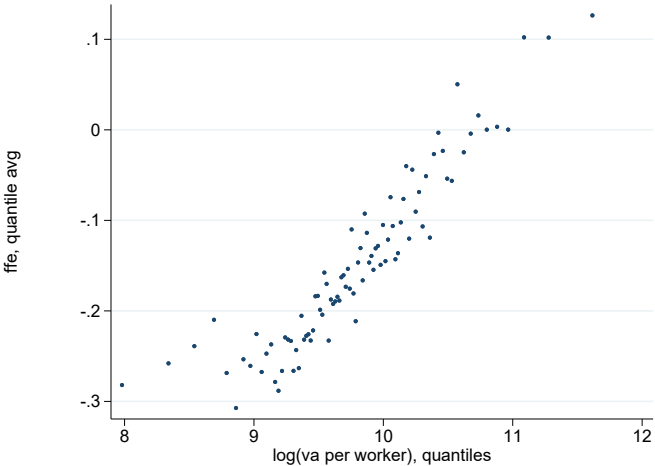
$$\begin{aligned} \text{FFE}_p^j &= \alpha_p + \gamma_p \log z_p^j \\ \implies \text{var}\left(\text{FFE}_p^j\right) &= \gamma_p^2 \text{var}\left(\log z_p^j\right). \end{aligned}$$

- According to this simple approach, the decline in $\text{var}\left(\text{FFE}_p^j\right)$ since mid-1990s may have been associated with
  - either a drop in $\text{var}\left(\log z_p^j\right)$
  - or a decline in the *pass-through* γ_p
  - or both

Firm–level data

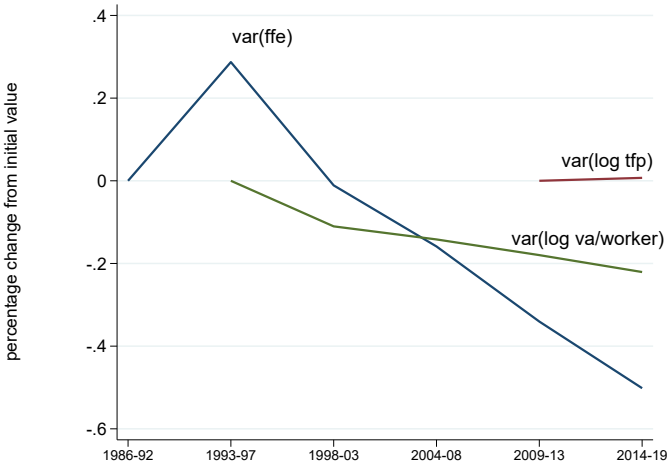
- Sistema de Contas Integradas das Empresas (SCIE, 1996-2019).
  - 1996-2004: survey-based, mandatory for large private sector corporations and random sample for small (≤ 100 employees), provided annually to the National Statistic Agency, from Inquérito à Empresa Harmonizado (IEH).
  - 2005-2019: administrative balance–sheet information for the universe of (private sector, non-financial, for-profit) firms operating in Portugal, provided annually to the Public Administration and the Bank of Portugal, mostly from Informação Empresarial Simplificada (IES).
- Two productivity measures (subperiod averages):
  - Firm-level (revenue) productivity (2010+): $z = y/(n^{\alpha_n} m^{\alpha_m} k^{1-\alpha_n-\alpha_m})$.
  - Real value-added per worker (1996+): $va = (y - p_m m)/n$.

More productive firms do pay more



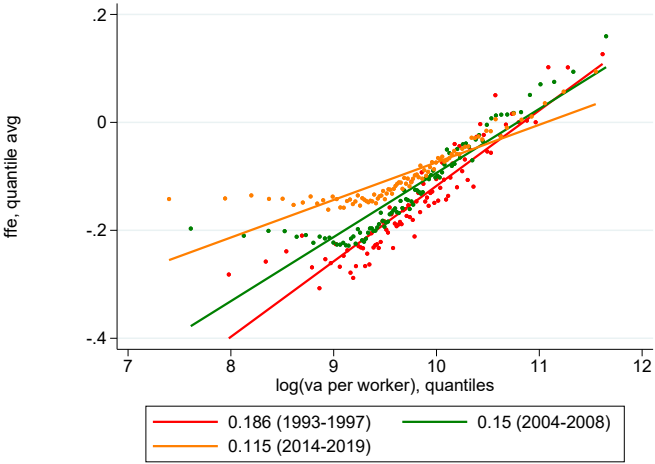
Firm pay and value added per worker, 1993-1997

Productivity dispersion played a minor role



Variance of firm pay, VA per worker, and TFP

The *pass-through* clearly declined

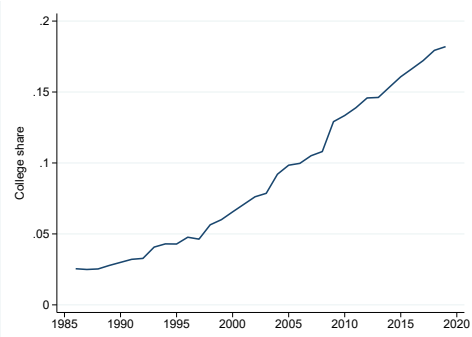


Firm pay and value added per worker

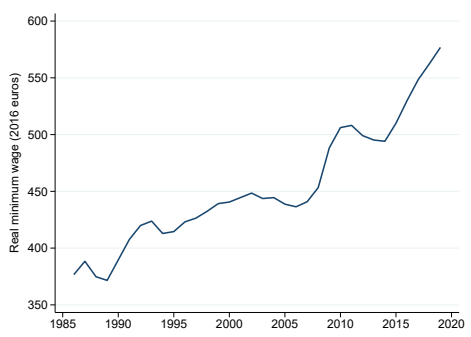
Taking stock

1. Earnings inequality has stopped growing in the mid-90s and has declined over the last fifteen years
2. Variance in workers fixed effect has grown throughout
3. Decline is due to a lower variance of firm fixed effect, associated with a drop in the pass-through of productivity into wages
4. Next: Employ these restrictions and a model to gauge the role played by a variety of forces. In particular:
   - Increase in school attainment
   - Increase in minimum wage

Evolution of human capital and minimum wage



(a) Share of college graduates



(b) Real minimum wage

A theory of firm pay

1. In a nutshell: Hopenhayn (1992) with monopsony in labor markets
2. Monopsony power stems from matching frictions and amenities

   Related: Card, Cardoso, Heining, Kline (JoLE, 2018), Gouin-Bonenfant (2020), Bilal, Engbom, Mongey, Violante (2021), Berger, Herkenhoff, Mongey (AER, 2022).

3. More productive firms
   - pay higher wages because it is the only way to hire more workers
   - charge larger markdowns, because they face less *local* competition (face more rigid labor supply)

Labor supply

- Continuum of ex-ante identical workers
- Each worker is matched randomly with two firms
- Each worker gets at most 2 job offers $\{w, \varepsilon\}$ every period.
- Value of a job offer $\{w, \varepsilon\}$ is $u(w) = w + \sigma\varepsilon, \quad \sigma > 0$.
- $\varepsilon \sim$ Standard Gumbel. (Match-specific amenities)
- Choice problem:

$$\max\{w_i + \sigma\varepsilon_i, w_j + \sigma\varepsilon_j\}$$

$$\rightarrow \Pr(\text{accept } i) = \Pr(w_i + \sigma\varepsilon_i \geq w_j + \sigma\varepsilon_j) = \frac{1}{1 + e^{\frac{w_j - w_i}{\sigma}}}.$$

Labor demand

- Continuum of operating firms
- $y = zl^{\gamma}, \quad 0 < \gamma \leq 1.$
- $z \in \{z_1, \ldots, z_N\}$ follows Markov chain.
- Each firm is matched randomly with $\bar{m} \equiv 2N_w/N_f$ workers
- Firms' decisions
  - How many binding job offers to extend
  - What wage to pay

Incumbent's optimization (in stationary eq.)

- $\Phi(w)$: firm-level labor supply (probability that a wage offer w is accepted)

$$v(z_i, \Phi) = \max \left\{ 0, \max_{m,w} \; z_i [l(w)]^{\gamma} - w l(w) - c_f + \beta \sum_{j=1}^{N} \pi_{ij} v(z_j, \Phi) \right\}$$

$$\text{s.t.} \;\; l(w) = m\Phi(w),$$
$$m \leq \bar{m}.$$

- $\Phi(w)$ is endogenous, as it depends from firms' wage posting

Firm's pay policy

- Optimal wage setting:

$$\frac{z\gamma l^{\gamma-1} - w}{w} = \frac{1}{\epsilon_s(w)}$$

- Elasticity of firm-level labor supply:

$$\epsilon_s(w) \equiv \frac{\Phi'(w)w}{\Phi(w)}$$

- Firm-level labor supply

$$\Phi(w) = \sum_{j=1}^{N} \frac{1}{1 + e^{\frac{w(z_j,\Phi)-w}{\sigma}}} \mu(z_j)$$

- μ: stationary distribution of firms

Entrant's problem

- Mass M of potential entrants, each draws productivity signal η.
- Initial productivity draw from $G(\eta)$, decreasing in η.
- Entry decision (conditional on η):

$$\sum_{i=1}^{N} v(z_i; \Phi) g_i(\eta) \geq c_e.$$

- Enter if $\eta \geq \eta^*$ (and then produce if $z_i > z^*$) - entry selection.

Stationary Recursive Equilibrium

Key equilibrium objects:

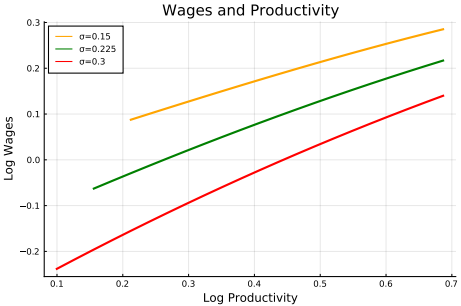
- Optimal firm pay policy $w(z, \Phi)$.
- Measure of active firms $\mu(z)$, and associated mass N_f.
- Wage distribution $\Phi(w)$.

such that (fixed point in Φ):

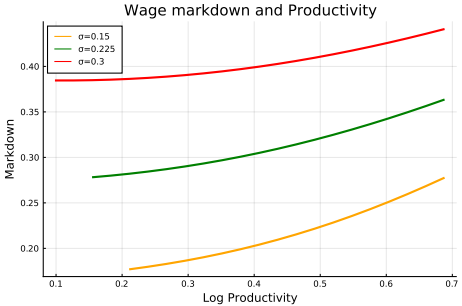
- μ, N_f are consistent with entry and exit decisions, measure of entrants, and productivity distribution (standard Hopenhayn).
- Φ is consistent with worker choices, and optimal firm pay policies:

$$\Phi(w) = \sum_{j=1}^{N} \frac{1}{1 + e^{\frac{w(z_j, \Phi) - w}{\sigma}}} \mu(z_j).$$

Wage profiles (comparative statics w.r.t. σ)



(a) Wages



(b) Markdown

Accounting for the dynamics of inequality

- Can the increase in minimum wage and educational attainment alone account for
  - The decline in the variance of earnings
  - The decline in the variance of firm fixed effects
  - The increase in the variance of worker fixed effects

Generalize the model

- Workers' heterogeneity:
  - A fraction N_1 of workers is low-skill (non-college),
  - A fraction N_2 is high-skill (college)
- Production function:

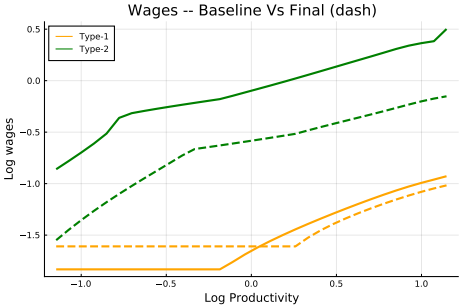
$$y = z_i \left[\chi (s_1 l_1)^{\frac{\nu-1}{\nu}} + (1-\chi)(s_2 l_2)^{\frac{\nu-1}{\nu}} \right]^{\frac{\gamma}{\nu-1}}$$

- Minimum wage: $w \geq \underline{w}$

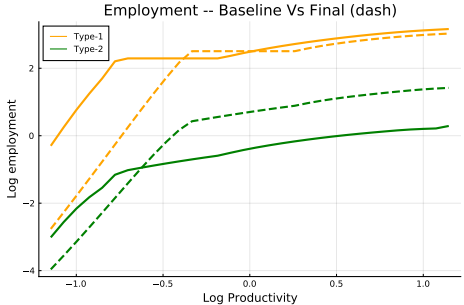
Quantitative exercise

- Initial steady-state: 1993-1997
- Set the fraction of non-college to 5%
- Choose: TFP level, minimum wage $\underline{w}$, market power σ, skill bias χ to match
  - ratio of min wage to median wage
  - aggregate labor share
  - variance of firm fixed effects
  - variance of workers fixed effects
- Final steady-state: 2014-2019
- Raise the fraction of non college to 16%, raise the minimum wage by 25%
- Ask: Under what conditions is the new state equilibrium consistent with the new targets?

Quantitative Exercise



(a) Wages



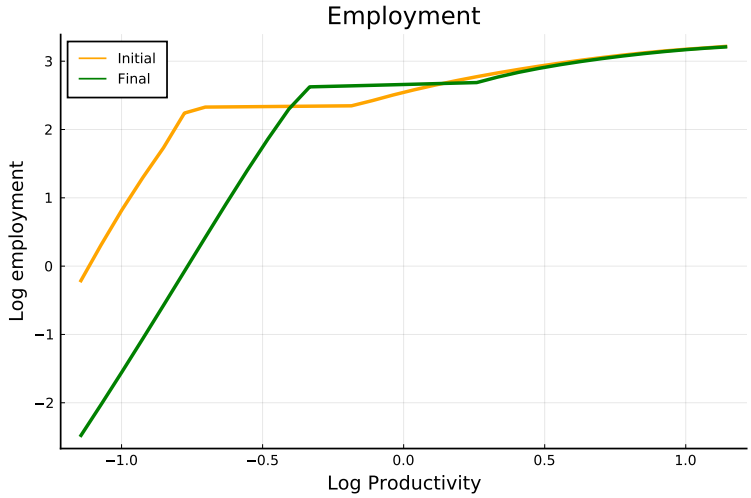
(b) Employment

Upshot

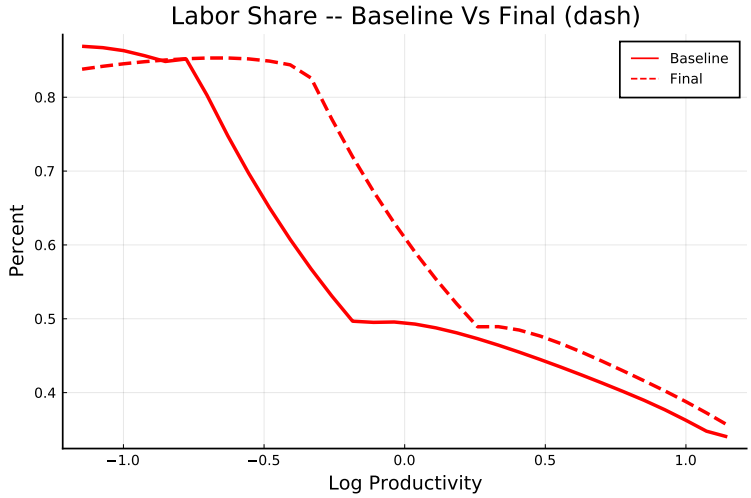
- With the right amount of skill-biased technical change, the rise in minimum wage and educational attainment go a long way towards accounting for the dynamics of inequality
- The labor share increases
- Value added and employment declines
- Wages decline at all jobs except those that pay minimum wage

Cumulative Wage Distribution

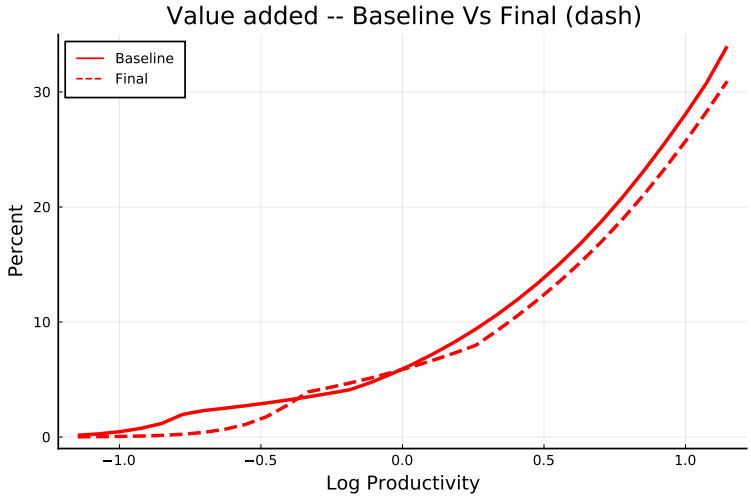
Total Employment



Labor Share


Labor Share -- Baseline Vs Final (dash)
Baseline
Final
Percent
0.8
0.7
0.6
0.5
0.4
−1.0
−0.5
0.0
0.5
1.0
Log Productivity

Value Added


Value added -- Baseline Vs Final (dash)
Baseline
Final
Percent
30
20
10
0
−1.0
−0.5
0.0
0.5
1.0
Log Productivity