# Firm Organization and Information Technology: Micro and Macro Implications

Asier Mariscal
U. Rovira-i-Virgili

August 30, 2023

# 40 years to today

- Emergence of information and communication technology capital (IT):
  - Dramatically changing the labor market.
  - White-collar workspace nothing like in the 60's.

# 40 years to today

- Emergence of information and communication technology capital (IT):
  - Dramatically changing the labor market.
  - White-collar workspace nothing like in the 60's.
  - IT has changed how firms are organized.

# 40 years to today

- Emergence of information and communication technology capital (IT):
  - Dramatically changing the labor market.
  - White-collar workspace nothing like in the 60's.
  - IT has changed how firms are organized.
  - How do firms organize production?

# THIS PAPER: How do firms organize production?

- Firm organization in the model involves choosing:
  - Capital, Labor and Worker-Knowledge at each hierarchy level.
    - As suggested in Lucas (1978).

# THIS PAPER: How do firms organize production?

- Firm organization in the model involves choosing:
  - Capital, Labor and Worker-Knowledge at each hierarchy level.
    - As suggested in Lucas (1978).
  - The number of layers $L \in \{2, 3, 4\}$ : complexity of organization.

# THIS PAPER: How do firms organize production?

- Firm organization in the model involves choosing:
    - Capital, Labor and Worker-Knowledge at each hierarchy level.
        - As suggested in Lucas (1978).
    - The number of layers $L \in \{2,3,4\}$ : complexity of organization.

- Add optimal capital to Caliendo&Rossi-Hansberg, (2012):
    - Two types of capital used:
        - IT capital *only* by managers.
        - Production (non-IT) capital *only* by production workers.

# THIS PAPER: How do firms organize production?

- Firm organization in the model involves choosing:
  - Capital, Labor and Worker-Knowledge at each hierarchy level.
    - As suggested in Lucas (1978).
  - The number of layers $L \in \{2, 3, 4\}$ : complexity of organization.

- Add optimal capital to Caliendo&Rossi-Hansberg, (2012):
  - Two types of capital used:
    - IT capital *only* by managers.
    - Production (non-IT) capital *only* by production workers.
  - Study effect of IT instead of international trade.

# THIS PAPER: How do firms organize production?

- Study wage inequality like Antràs, Garicano, and Rossi-Hansberg (2006).
    - They study international production teams in a stylized model.

# THIS PAPER: How do firms organize production?

- Study wage inequality like Antràs, Garicano, and Rossi-Hansberg (2006).
  - They study international production teams in a stylized model.
- Closer to Garicano&Rossi-Hansberg (2006), except here:
  - Capital adoption function of IT price, not exogenous parameters.
  - Calibration, not "illustration for maximal visibility".
  - Production function → capital-labor elasticity, productivity, etc.
  - Change in wage *levels* as IT price falls.

# THIS PAPER: How do firms organize production?

- Study wage inequality like Antràs, Garicano, and Rossi-Hansberg (2006).
  - They study international production teams in a stylized model.
- Closer to Garicano&Rossi-Hansberg (2006), except here:
  - Capital adoption function of IT price, not exogenous parameters.
  - Calibration, not "illustration for maximal visibility".
  - Production function → capital-labor elasticity, productivity, etc.
  - Change in wage *levels* as IT price falls.
  - No worker-firm assignment problem.

# TALK OUTLINE

- Model
- Within-firm wage reallocation when IT prices fall.
- Indirect IT capital-plant labor elasticity
- Empirical analysis
- Macro implications
- Conclusion

# Related Literature

- Hierarchies: Garicano, (2000), Antras et al, (2006), Antras et al, (2008), Caliendo and Rossi-Hansberg, (2012). Caliendo, Monte and Rossi-Hansberg, (2014), Fuchs et al (2015), Santamaria, (2017).
- Labor Markets: Autor et al. (2003), Autor and Dorn, (2013). Acemoglu and Restrepo, (2017,2018a&b), Hemous and Olsen (2016).
- Wage Inequality in Organizations: Akerman et al, (2015), Gaggl and Wright (2017), Bloom et al. (2017), Bloom et al. (2014), Garicano and Hubbard (2016).
- VA concentration: Autor et al (2017), De Loecker, Eeckout and Unger (2020).
- Labor Share: Karabarbournis and Neiman, (2012). Oberfield and Raval, (2014). Santaeulalia-Llopis et al, (2015), Grossman, et al, (2017). Lashkari et al. (2018).

# MODEL

# Preferences

- CES demand for variety $\omega$: $q(\omega) = Dp(\omega)^{-\rho}\alpha(\omega)$

  where $\alpha(\omega)$ is the appeal of $\omega$.

- $\alpha(\omega)$ is the source of heterogeneity in the cross-section of firms.
- $\alpha(\omega)$ drawn from a lognormal distribution.

# Workers

- Supply labor: 1 unit inelastically. Wage rate is $w$.
- Workers homogenous ex-ante but different skills and occupations ex-post.
- Learning an interval of knowledge of length $z$, requires $cz$ teaching time:
  - cost to agent is $= wcz$.
  - agent receives from firms $w + wcz$.
- Ex post: different occupations but same *net* compensation $(w)$
  $\rightarrow$ workers indifferent across occupations.

# Firms

- Each entrepreneur has product with $\alpha$, the demand shifter. No entrepreneur entry.
- Today: Simplest model: firm with two layers ($L = 2$):
  1. Production level workers: encounter and solve problems: layer 1.
  2. CEO: solve problems with IT: layer 2.

# Firms

- Each entrepreneur has product with $\alpha$, the demand shifter. No entrepreneur entry.
- Today: Simplest model: firm with two layers ($L = 2$):
  1. Production level workers: encounter and solve problems: layer 1.
  2. CEO: solve problems with IT: layer 2.
- Intuitions are similar for more complex firms with number of layers $L \in [2, 3, 4]$:
  - Extra layers are managers and specialize in solving problems like the CEO.

# Firms: Production Level: Layer 1

Production workers:

- Production layer input bundle: $y_1 \equiv \underbrace{\left(k_1^{\frac{\sigma_1 - 1}{\sigma_1}} + n_1^{\frac{\sigma_1 - 1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1 - 1}}}_{\text{Chosen by firm}}$.
- Mass of problems equal to $y_1$.
- Total *potential* output is $Ay_1$; where $A$ is productivity.
- Workers can deal with $y_1$ problems, but can solve only a fraction: those they know.
- *Realized* output $= Ay_1 * \underbrace{\text{Fraction of Solved Problems}}_{\text{Worker-Knowledge: firm choice}}$.

# Firms: Production Level: Layer 1

Production workers:

- Production layer input bundle: $y_1 \equiv \underbrace{\left(k_1^{\frac{\sigma_1-1}{\sigma_1}} + n_1^{\frac{\sigma_1-1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1-1}}}_{\text{Chosen by firm}}$.
- Mass of problems equal to $y_1$.
- Total *potential* output is $Ay_1$; where $A$ is productivity.
- Workers can deal with $y_1$ problems, but can solve only a fraction: those they know.
- *Realized* output $= Ay_1 * \underbrace{\text{Fraction of Solved Problems}}_{\text{Worker-Knowledge: firm choice}}$.
- Which problems are solved? $= \underbrace{\text{What knowledge do agents acquire?}}_{\text{Chosen by firm}}$

# Firms: Production Level: Layer 1

- Problems arise from CDF: $F(z) = 1 - \exp(-\lambda z)$.
- Law of Large Numbers: the realized distribution of problems is also $F(.)$.
- Production workers learn how to solve interval of knowledge: $[0, z_1]$:
  - All problems in $[0, z_1]$ are solved; production realized: $AF(z_1)y_1$ .
  - Problems in $[z_1, \infty)$: passed to upper layer: CEO.

# Firms: CEO: Layer 2

CEO:

- Specializes in solving problems:
    - Deals unsolved problems from layer 1: those above $z_1$.
    - Attempts to solve all of the unsolved problems:
        - Ex ante, the CEO does not know if she knows the solution.
    - Learns interval $[z_1, z_1 + z_2]$: the solved problems at layer 2.
- Firm needs managerial inputs to attempt those problems...

# Firms: CEO: Layer 2

CEO:

- Firm needs managerial inputs given by ...

$$\underbrace{1 + Bk_L^{\beta_L}}_{\text{CEO time + IT capital}} = \underbrace{\left(k_1^{\frac{\sigma_1 - 1}{\sigma_1}} + n_1^{\frac{\sigma_1 - 1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1 - 1}} (1 - F(z_1))}_{\text{Unsolved problems at layer 1}}$$

- Realized production:

$$q = AF(Z_2)\left(k_1^{\frac{\sigma_1 - 1}{\sigma_1}} + n_1^{\frac{\sigma_1 - 1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1 - 1}}$$

where:

- $Z_2 \equiv z_1 + z_2$
- Note: $F(Z_2)$ is the fraction of problems solved by organization.

# Cost Minimization for L=2 Organization

$$C(q;\theta) \equiv \min_{\{k_l,n_l,z_l\}_{l\in 1,2}} n_1 w_1 + p_1 k_1 + w_2 + p_2 k_2$$

$$s.t. \begin{cases} q = AF(Z_2)\left(k_1^{\frac{\sigma_1-1}{\sigma_1}} + n_1^{\frac{\sigma_1-1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1-1}} \\ 1 + Bk_2^{\beta_2} = \left(k_1^{\frac{\sigma_1-1}{\sigma_1}} + n_1^{\frac{\sigma_1-1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1-1}} [1 - F(z_1)], \\ z_l > 0, l = 1, 2. \end{cases}$$

where:

- $k_l$ price is $p_l$.
- $n_l$ compensation is $w_l \equiv w(cz_l + 1)$.
- $\theta =$ set of all prices.

# Profit Max

Problem of $\alpha$ firm:

$$\pi(\alpha) \equiv \max_{q(\alpha)} p(\alpha)q(\alpha) - C(q(\alpha);\theta)$$

subject to $q(\omega) = Dp(\omega)^{-\rho}\alpha(\omega)$,

- $D$: aggregate demand shifter, taken as given.

# Profit Maximization

Problem of $\alpha$ firm:

$$\pi(\alpha) \equiv \max_{q(\alpha)} p(\alpha)q(\alpha) - C(q(\alpha);\theta)$$

subject to $q(\omega) = Dp(\omega)^{-\rho}\alpha(\omega)$.

Solution:

- $p(\alpha) = mMC(q(\alpha);\theta)$

where $m$ is the markup.

# Organization, Knowledge Reallocation, and IT price

**Optimal Knowledge**:

- Trade-off between layers 1 and 2 knowledge:

$$\underbrace{wcn_1}_{\text{MC of } z_1} - \underbrace{\overbrace{\frac{p_2}{\beta_L B k_2^{\beta_L - 1}}}^{\text{Cost per problem}} \overbrace{\left(k_1^{\frac{\sigma_1 - 1}{\sigma_1}} + n_1^{\frac{\sigma_1 - 1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1 - 1}} \lambda \exp(-\lambda z_1)}^{\text{Change in Mass of Problems}}}_{\text{Savings in Managerial Inputs}} = \underbrace{wc}_{\text{MC of } z_2}$$

# Organization, Knowledge Reallocation, and IT price

**Optimal Knowledge**:

- Trade-off between layers 1 and 2 knowledge:

$$\underbrace{wcn_1}_{\text{MC of } z_1} - \underbrace{\overbrace{\frac{p_2}{\beta_L B k_2^{\beta_L - 1}}}^{\text{Cost per problem}} \overbrace{\left(k_1^{\frac{\sigma_1-1}{\sigma_1}} + n_1^{\frac{\sigma_1-1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1-1}} \lambda \exp(-\lambda z_1)}^{\text{Change in Mass of Problems}}}_{\text{Savings in Managerial Inputs}} = \underbrace{wc}_{\text{MC of } z_2}$$

Proposition 3: **Optimal Reorganization of Knowledge**:

- A reduction in $p_2$ (IT price) makes layer 2 relatively cheaper $\rightarrow$
  - in layer 1: decrease knowledge and wages: supported by empirics.
  - in layer 2: increase knowledge and wages.

# IT Capital and Production Labor Elasticity

DEFINITION: The IT capital-to-production-labor elasticity for **layers** $l > 1$, when $p_{IT}$ changes is:

$$\varepsilon_{n_1,k_l} \equiv -\frac{d\log\left(\frac{k_l}{n_1}\right)}{d\log\left(\frac{p_2}{w_1}\right)}\Bigg|_{q=\overline{q}}$$

for fixed output $\overline{q}$, when all other inputs are allowed to adjust.

- Captures reorganization.
- A long-run elasticity:
  - Calibrated to 1980-2015.
  - Calibrated using long-run $\sigma_l$, the within layer elasticity.
- I obtain $\varepsilon_{n_1,k_2} > 1$: Substitution, $\forall L = 2, 3, 4$.

# Indirect Substitution of IT Capital and Production Labor

- IT capital and production labor are substitutes:
  - Despite capital-labor complementarity in each layer: $0 < \sigma_l < 1$

# Indirect Substitution of IT Capital and Production Labor

- IT capital and production labor are substitutes:
  - Despite capital-labor complementarity in each layer: $0 < \sigma_l < 1$
  - Not a parametric assumption about substitution.

# Indirect Substitution of IT Capital and Production Labor

- IT capital and production labor are substitutes:
  - Despite capital-labor complementarity in each layer: $0 < \sigma_l < 1$
  - Not a parametric assumption about substitution.
  - Endogenous substitution is due to knowledge reallocation: $\frac{\partial z_1}{\partial p_2} > 0$
    - Test in the data using wage impact of IT price!
    - Existing evidence is in line with decline in $w_1$ when $p_{IT}$ falls.
- Firm organization matters for factor substitution inference.

# Problem for any organization complexity, $L \in 2,3,4$

$$\pi(\alpha) \equiv \max_{q(\alpha)} p(\alpha)q(\alpha) - C(q(\alpha);\omega)$$

where

$$\left. C(q(\alpha)) \equiv \min_{2 \leq L \leq 4} C_L(q(\alpha);\omega) \right\} \textit{NEW: L Choice}$$

and

$$C_L(q(\alpha);\omega) \equiv \min_{\{k,n,z\}_{l=1}^{L}} \sum_{l=1}^{L} (n_l w(cz_l+1) + p_l k_l)$$

$$s.t. \begin{cases} q(\alpha) = AF(Z_L)\left(k_1^{\frac{\sigma_1-1}{\sigma_1}} + n_1^{\frac{\sigma_1-1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1-1}} \\ \left. \left(k_l^{\frac{\sigma_l-1}{\sigma_l}} + n_l^{\frac{\sigma_l-1}{\sigma_l}}\right)^{\frac{\sigma_l}{\sigma_l-1}} = \left(k_1^{\frac{\sigma_1-1}{\sigma_1}} + n_1^{\frac{\sigma_1-1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1-1}} [1-F(Z_{l-1})], L > l > 1 \right\} \textit{NEW: Intermediate Layers} \\ 1 + Bk_L^{\beta_L} = \left(k_1^{\frac{\sigma_1-1}{\sigma_1}} + n_1^{\frac{\sigma_1-1}{\sigma_1}}\right)^{\frac{\sigma_1}{\sigma_1-1}} [1-F(Z_{L-1})], \\ n_L = 1 \\ z_l > 0, \forall l \geq 1 \end{cases}$$

# Links to Macro Trends

The trends in the data:

1. Aggregate labor share decline. Karabarbounis and Neiman, (2012), Autor et al, (2017), Oberfield and Raval, (2019), Santaeulalia et al (2020), Grossman et al. (2018)
2. Labor share of routine (nonroutine) occupations is declining (rising), IMF (2017).
3. Value added increasingly concentrated in large firms. Autor et al, (2020).
4. Increasing aggregate mark-up: due to large firms, De Loecker, Eeckout and Unger (2020).

# Links to Macro Trends

The trends in the data:

1. Aggregate labor share decline. Karabarbounis and Neiman, (2012), Autor et al, (2017), Oberfield and Raval, (2019), Santaeulalia et al (2020), Grossman et al. (2018)
2. Labor share of routine (nonroutine) occupations is declining (rising), IMF (2017).
3. Value added increasingly concentrated in large firms. Autor et al, (2020).
4. Increasing aggregate mark-up: due to large firms, De Loecker, Eeckout and Unger (2020).

The question:

- What are the implications of firm organization with IT for these trends?
    - Production side discipline is required for inference about demand elasticity.

# Calibration for 1980-2015

Observed macro trends require **two changes**:

1. Lower IT price: today 1/3 of price in 1980 (BEA).
2. Lower demand elasticity: consistent with De Loecker, Eeckout and Unger (2020).

# Counterfactual exercises

A IT price decline produces :

- Micro: decline of production workers' wage in large firms (Song et al at QJE)
- Macro: decline in wage bill share of routine, along with increase of non-routine share (IMF).

B Lower demand elasticity causes:

- Macro: labor share decline
- Macro: VA concentration in large firms
- Macro: Rising markup

# Empirical predictions (II): Data match on IT price

Table reports the sign of variable change due IT price decline:

| | Model | | | | Data | | |
|---|---|---|---|---|---|---|---|
| | **A. Firm-Layer Level** | | | | | | |
| | Layer | | | | Layer | | |
| | 1 | 2 | 3 | CEO | 1 | 2 | 3 |
| **Moments** | | | | | | | |
| $w_l$ | -* | - | + | + | - | + | + |
| $\frac{n_l}{\sum_{j=1}^{L} n_j}$ | - | + | + | - | - | + | + |
| $\frac{w_l n_l}{\sum_{j=1}^{L} w_j n_j}$ | - | + | + | - | - | + | + |
| | **B. Firm Level** | | | | | | |
| $\frac{\sum_{l=2}^{L} k_l}{n_1}$ | + | | | | + | | |
| $Z_L$ | +* | | | | + | | |
| $\frac{\sum_{l=1}^{L} p_l k_l + w_l n_l}{p(\alpha) q(\alpha)}$ | + | | | | + | | |
| $L$ | + | | | | + | | |

*****: **result is a proposition**

# Conclusion

- A firm organization theory with a well-specified role for IT.
- Implications for:
  1. Rising (within-firm) wage inequality due to IT adoption.

# Conclusion

- A firm organization theory with a well-specified role for IT.
- Implications for:
  1. Rising (within-firm) wage inequality due to IT adoption.
  2. An *indirect* IT capital-production labor elasticity: *substitution*.

# Conclusion

- A firm organization theory with a well-specified role for IT.
- Implications for:
  1. Rising (within-firm) wage inequality due to IT adoption.
  2. An *indirect* IT capital-production labor elasticity: *substitution*.
  3. TFP effects of IT, which are still insufficiently understood.

# Conclusion

- A firm organization theory with a well-specified role for IT.
- Implications for:
  1. Rising (within-firm) wage inequality due to IT adoption.
  2. An *indirect* IT capital-production labor elasticity: *substitution*.
  3. TFP effects of IT, which are still insufficiently understood.
  4. Macro implications: factor shares, value-added reallocation to large firms, rising markup.

# Conclusion

- A firm organization theory with a well-specified role for IT.
- Implications for:
  1. Rising (within-firm) wage inequality due to IT adoption.
  2. An *indirect* IT capital-production labor elasticity: *substitution*.
  3. TFP effects of IT, which are still insufficiently understood.
  4. Macro implications: factor shares, value-added reallocation to large firms, rising markup.

# APPENDIX

# Calibration

| Parameter | Value | Description | Source/Target |
|---|---|---|---|
| | | **Calibrated Externally** | |
| $\hat{\Delta} p_1$ | 0 | Change in capital price at layer $l=1$ | Eden&Gaggl (2018) |
| $\hat{\Delta} p_l,\ l>1$ | -2/3 | Change in capital price at layers $l\ \forall l>1$ | Eden&Gaggl (2018) |
| $\sigma_1$ | 0.87 | Capital-labor elasticity at layer $l=1$ | Raval (2010) |
| $\sigma_l,\ l>1$ | 0.36 | Capital-labor elasticity at layers $1<l<L$ | Raval (2010) |
| | | **Calibrated Internally** | |
| $\rho$ | markup table | Demand elasticity, distribution | Labor share of VA, top firms' average, 1980&2015<br>Slope(log(Markup),log(TFP)), 1980&2015 |
| $\beta_L$ | 0.51 | Capital exponent at layer L | Slope(log(FC),log(VA)) |
| $B$ | 5 | TFP of CEO IT capital | P75/P25 FC distribution |
| $c$ | 0.1 | Employee training cost | Labor share of cost, average |
| $\lambda$ | 1 | Mean of problem CDF, $F(.)$ | Slope(log(Capital-Labor Ratio),log(VA)) |
| $A$ | 5 | TFP | Employment share by firm size (7 bins) |
| $\mu_\alpha$ | 5 | Mean of $\alpha$ | |
| $\xi_\alpha$ | 2.4 | Standard deviation of $\alpha$ | |
| $w$ | 2 | Wage rate | |
| $p_1$ | 0.001 | Production-level capital price | |
| $p_2$ | 25 | IT capital price | |

NOTE: $FC \equiv \frac{\sum_{l=1}^{L} p_l k_l}{\sum_{l=1}^{L} n_l w_l}$, VA= value-added, $\hat{\Delta}_x = (x_t - x_{t-1})/x_{t-1}$

# Calibration of demand elasticity: production-side discipline

$$\underbrace{\frac{\sum_{l=1}^{L} w_l n_l}{p(q)q}}_{\text{Labor share of VA}} = \underbrace{\frac{\sum_{l=1}^{L} w_l n_l}{C(q)}}_{\text{Labor share of cost}} \underbrace{\frac{C(q)}{qMC(q)}}_{AVC/MC} \underbrace{\frac{1}{m}}_{\text{Inverse of markup}}$$

1. Cross-section:
   - Markup $m$ rises with size (De Loecker&Warczinsky 2012; Autor et al 2020).
   - Labor share of value added falls with size (Autor et al 2020).
2. Over time:
   - Markups increase more for higher percentiles (De Loecker, Eeckout and Unger 2020).
   - Labor share in large firms falls over time (Autor et al 2020).

# Markups in calibration

Consistent with De Loecker, Eeckout and Unger (2020)

| | DEU | | | Calibration | | | | |
|---|---|---|---|---|---|---|---|---|
| | Markup | | | Markup | | | Elasticity, $\rho$ | |
| | 1980 | 2014 | % Change | 1980 | 2015 | % Change | 1980 | 2015 |
| Min | | | | 1.33 | 1.4 | 5.00 | 3.81 | 2.47 |
| P50 | 1.2 | 1.2 | 0.00 | 1.33 | 1.48 | 10.84 | 3.97 | 3.04 |
| P75 | 1.28 | 1.50 | 17.18 | 1.34 | 1.51 | 12.67 | 3.94 | 3.15 |
| P90 | 1.5 | 2.5 | 66.66 | 1.35 | 1.54 | 14.44 | 3.95 | 3.26 |
| Max | | | | 1.36 | 1.68 | 23.81 | 4.01 | 3.5 |

# Calibrated moments

| Moment | Model | Data | Data Source |
|---|---|---|---|
| Labor share of VA, top firms' average, 1980 | 0.52 | 0.51 | ADKPV |
| Labor share of VA, top firms' average, 2015 | 0.43 | 0.43 | ADKPV |
| Slope(log(Markup),log(TFP)), 1980 | 0.37 | 0.3 | De Loecker and Warzynski (2012) |
| Slope(log(Markup),log(TFP)), 2015 | 3.76 | 3 | Imputed |
| Slope(log(FC),log(VA)) | 0.07 | 0.02 | Raval (2019) |
| P75/P25 of factor cost distribution | 1.20 | 2.1 | Raval (2019) |
| Labor share of cost, average | 0.73 | 0.7 | Imputed |
| Slope(log(Capital-labor ratio),log(VA)) | 0.07 | 0.15 | Raval (2010) |
| Employment share by firm size (7 bins) | $R^2 = 0.76$ | | BLS |

# Untargeted Moments

| Moment | Model | Data | Data Source |
|---|---|---|---|
| Panel A.Aggregate moments | | | |
| Revenue concentration, CR4 % change | 28 | 10.25 | ADKPV |
| Slope(log(CR20),log(Aggregate labor share)) | -0.43 | -0.9 | ADKPV |
| Aggregate labor share, % change | -10.06 | -28.69 | Kehrig and Vincent (2014) |
| Aggregate markup, % change | 10.99 | 16.13 | DEU |
| Routine aggregate share of wage bill, % change | -0.21 | -30.36 | Eden and Gaggl (2018) |
| Nonroutine aggregate share of wage bill, % change | 16.32 | 10.83 | Eden and Gaggl (2018) |
| Panel B. Firm-level moments | | | |
| P50 Real wage, % change in firms with 100 to 1000 employees | 4.86 | 31 | Song et al (2019) |
| P50 Real wage, % change in firms with 10,000+ employees | -2.81 | -7 | Song et al (2019) |
| P75 Real wage, % change in firms with 10,000+ employees | 17.29 | 64 | Song et al (2019) |
| Highest real wage, % change in firms with 10,000+ employees | 12.02 | 137 | Song et al (2019) |

# Counterfactuals: IT vs Demand Elasticity

Table values relative to the baseline in %:

| Moment | IT Price | Demand Elasticity |
|---|---|---|
| Panel A. Targeted moments | | |
| Labor share of VA, top firms' average, 2015 | 121 | 99 |
| Panel B. Untargeted moments: Aggregate | | |
| Revenue concentration, CR4 % change | 14 | 94 |
| Slope(log(CR20),log(Aggregate labor share)) | -11 | 106 |
| Aggregate labor share, % change | -2 | 100 |
| Routine aggregate share of wage bill, % change | 211 | -177 |
| Nonroutine aggregate share of wage bill, % change | 211 | -177 |
| Panel C. Untargeted moments: Firm-level | | |
| P50 Real wage, % change in firms with 100 to 1000 employees | -74 | 174 |
| P50 Real wage, % change in firms with 10,000+ employees | 212 | -112 |
| P75 Real wage, % change in firms with 10,000+ employees | 43 | 71 |
| Highest real wage, % change in firms with 10,000+ employees | 42 | 49 |

# Sales reallocation with lower demand elasticity?

$\varepsilon_{r,\rho} \equiv \frac{\partial \log(r)}{\partial \log(\rho)}$

| | Organization | | |
|---|---|---|---|
| | $L = 2$ | $L = 3$ | $L = 4$ |
| $\varepsilon_{r,\rho}$ | -5.7 | -4.4 | -3.5 |

Lesson: Reallocation of sales to large firms due to their larger decline in $\rho$.