Capital-Skill Complementarity in Firms and in the Aggregate Economy

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$$\text{capital-skill complementarity} + \downarrow \text{equipment prices} \Rightarrow \uparrow \text{inequality}$$

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- Identification: aggregate elasticities not identified in aggregate time series

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This paper: tackle both issues using theory + empirics using French manufacturing data

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equipment price $\downarrow \Rightarrow$ skill premium $\uparrow \equiv$ within-firm complementarity

$+$ cross-firm cov. of capital and skill intensity

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Study French manufacturing (1997-2007) where equipment price $\downarrow$ + skill premium stable

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- Moderate capital-skill complementarity: predicted 6% $\uparrow$ skill premium (3% w. homog. price shock)

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Study French manufacturing (1997-2007) where equipment price ↓ + skill premium stable

- Moderate capital-skill complementarity: predicted 6% ↑ skill premium (3% w. homog. price shock)
- Additional questions:
  - Impact of equipment prices on the labor share
  - Beyond equipment shock (in progress): impact of changes in wage “wedges” across firms

A Sample of Prior Work

SBTC: vast literature measures SBTC as a residual

Katz & Murphy (1992); and numerous followup contributions

Capital-skill complementarity: provides empirical proxy

Grilliches (1969); Greenwood & Yorukoglu (1997); Krusell, Ohanian, Rios-Rull, & Violante (2000); and many more

Aggregate elasticities from micro elasticities: alternative to time-series identification

Oberfield & Raval (2021); Baqaee & Farhi (2019); Lashkari, Bauer, & Boussard (2022)

Alternative approaches to observing SBTC: focus on IT, automation, etc

Caroli & Van Reenen (2001); Bresnahan, Brynjolfsson, & Hitt (2002); Akerman, Gaarder, & Mogstad (2015), Acemoglu & Restrepo (2018, 2020, 2022); Caunedo, Jaume, & Keller (2021); Adao, Beraja, & Pandalai-Nayar (2022), and many more

Roadmap

Theory

Data and Estimation

Results

Conclusion

Environment: Firms, Production, and Demand

Firms and production:

- Continuum of monopolistically competitive single-prod firms $i \in \mathcal{I}$
- Factor inputs X_{fi} with $f \in \{\ell, h, e\}$: low-skill labor ($X_{\ell i}$), high-skill labor (X_{hi}), and equipment (X_{ei})
- Arbitrary CRS technologies given by unit factor demand $(A_{\ell i}, A_{hi}, A_{ei})$ such that $X_{fi} = A_{fi} Y_i$

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Demand:

- Nested consumer demand over outputs of firms (sector s firms $\mathcal{I}_s \subseteq \mathcal{I}$):

$$Y_i = \Phi_i \left(\frac{P_i}{P_s}\right)^{-\varepsilon} \left(\frac{P_s}{P}\right)^{-\eta} Y$$

- Φ_i & P_i: firm demand shifter & price
- P_s: sector-specific price index
- P aggregate price index

Simplified Environment: Factor Markets

Factor supplies: inelastic aggregate supplies X_ℓ, X_h, and X_e

Factor prices equate aggregate supply and demand (assume common factor prices) ($W_\ell \equiv 1$)

$$X_\ell = \sum_i X_{\ell i} \qquad X_h = \sum_i X_{hi} \qquad X_e = \sum_i X_{ei}$$

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Goal: study shock to X_e that lowers equipment price W_e

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Skill premium: $W_h/W_\ell = W_h$

Skill Premium, Equipment Price, and Macro Elasticities of Substitution

Response of skill premium to equipment price shock with common factor prices:

$$\frac{d\ln\left(W_h/W_\ell\right)}{d\ln W_e} = -\frac{\sigma_{\ell e} - \sigma_{he}}{\sigma_{\ell h}}$$

Macro (aggregate-level) factor demand elasticity of substitution:

$$\sigma_{ff'} \equiv \frac{\partial \ln\left(X_f/X_{f'}\right)}{\partial \ln W_{f'}}$$

Multifactor Composite Factors Factor Income Labor Share

Micro to Macro Elasticities

Aggregate elasticity between factors f and f':

$$\sigma_{ff'} = \underbrace{\sum_i \left(\Lambda_{fi}\sigma_{ff',i} - \Lambda_{f'i}\sigma_{f'f',i}\right)\theta_{f'i}}_{\text{within-firm substitution}} + \underbrace{\varepsilon \sum_i \left(\Lambda_{f'i} - \Lambda_{fi}\right)\theta_{f'i}}_{\text{cross-firm substitution}} - \underbrace{(\varepsilon - \eta)\sum_s \left(\Lambda_{f's} - \Lambda_{fs}\right)\theta_{f's}}_{\text{cross-sector substitution}}$$

Micro (firm-level) characteristics:

- Factor intensity (share of all firm's factor payments that goes to factor f) $\quad \theta_{fi} \equiv \frac{W_f X_{fi}}{\sum_{f'} W_{f'} X_{f'i}}$
- Share of factor (firm's share of aggregate factor demand) $\quad \Lambda_{fi} \equiv \frac{X_{fi}}{\sum_{i'} X_{fi'}}$
- Elasticity of substitution between factors $\quad \sigma_{ff',i} \equiv \frac{1}{\theta_{f'i}} \frac{\partial \ln A_{fi}}{\partial \ln W_{f'}}$

Decomposition of Capital-Skill Complementarity

Baseline Environment: Heterogeneous Equipment Prices

Equipment prices: firm-specific price $W_{ei} = W_e T_{ei}$

- “Shadow” equipment price: W_e
- Firm-specific equipment price “wedge”: T_{ei}

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Firm-specific equipment price "wedge": T_{ei}

Microfoundation: X_{ei} a CRS aggregate across J varieties of equipment, $G_i\left(X_{ei1}, \cdots, X_{eiJ}\right)$

- Firm$\times$variety-specific price distortions ($\sim$ iceberg costs) $\Rightarrow$ $W_{eij} = T_{eij} W_{ej}$

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Empirical Setting: use customs data to identify firm-level composition of equipment investment

- variety $j \equiv$ equipment product $\times$ origin country of product

Skill Premium, Equipment Prices, and Macro Elasticities

Response of skill premium to **heterogeneous** equipment price shocks:

$$\frac{d\ln\left(W_h/W_\ell\right)}{d\ln\overline{W}_e} = -\frac{\sigma^{\omega}_{\ell e} - \sigma^{\omega}_{he}}{\sigma_{\ell h}}$$

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Heterogeneous equipment price shocks: firm i experiences price change $d\ln W_{ei}$

$$d\ln\overline{W}_e \equiv \sum_i \Lambda^{*}_{ei}\, d\ln W_{ei} \qquad\qquad \Lambda^{*}_{ei} \equiv \frac{W_{ei}X_{ei}}{\sum_{i'} W_{ei'}X_{ei'}}$$

Generalized aggregate elasticity of substitution w.r.t. equipment price shocks:

$$\sigma^{\omega}_{fe} \equiv \frac{\partial\ln\left(X_f/X_e\right)}{\partial\ln\overline{W}_e}$$

Labor Share Multifactor

Micro to Generalized Macro Elasticities

Generalized aggregate elasticity of substitution w.r.t. equipment price shocks:

$$\sigma^{\omega}_{fe} \equiv \frac{\partial \ln \left(X_f / X_e\right)}{\partial \ln \overline{W}_e}$$

From micro to macro:

$$\sigma^{\omega}_{fe} = \sum_i \left(\Lambda_{fi}\sigma_{fe,i} - \Lambda_{ei}\sigma_{ee,i}\right)\theta_{ei}\omega_{ei} + \varepsilon \sum_i \left(\Lambda_{ei} - \Lambda_{fi}\right)\theta_{ei}\omega_{ei} - (\varepsilon - \eta)\sum_s \left(\Lambda_{es} - \Lambda_{fs}\right)\theta_{es}\omega_{es}$$

where

$$\omega_{ei} \equiv \frac{d \ln W_{ei}}{d \ln \overline{W}_e} \qquad \Rightarrow \quad d \ln W_{ei} = \omega_{ei}\, d \ln \overline{W}_e$$

$$\omega_{es} \equiv \sum_{i \in \mathcal{I}_s} \Lambda^{*}_{ei|s}\omega_{ei}$$

Decomposition of Capital-Skill Complementarity

Roadmap

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Requirements

Elasticities:

- Nested CES demand: ε, η
- Production function elasticities by firm and factor pair: $\sigma_{ff',i}$

Equilibrium "shares":

- Firm-level factor intensities: θ_{fi}
- Firm-level shares of factor demand: Λ_{fi}

Additional requirements for heterogeneous shocks:

- Firm-level equipment payment share: Λ^*_{ei}
- Elasticity of firm-level equipment price change to average: ω_{ei}

CRESH Firm-Level Technology

CRESH firm-level production function:

Hanoch (1971)

$$\sum_f \left(\frac{Z_{fi} X_{fi}}{Y_i} \right)^{\frac{\sigma_f - 1}{\sigma_f}} = 1$$

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Micro-level elasticity of substitution for CRESH firm-level technology ($\overline{\sigma}_i \equiv \sum_f \theta_{fi} \sigma_f$):

$$\sigma_{ff',i} = \frac{\sigma_f \sigma_{f'}}{\overline{\sigma}_i} - \frac{\sigma_f}{\theta_{f,i}} \mathbb{I}_{ff'} \qquad \Rightarrow \qquad \frac{\sigma_{\ell e,i}}{\sigma_{he,i}} = \frac{\sigma_\ell}{\sigma_h}$$

Generalizes CES, where $\sigma_f \equiv \sigma$ for all f

Relative to nested CES: no *a priori* nesting choice required

Macro Elasticities CES | Macro Elasticities CRESH | Within + Across Firms

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Nested CES demand: ε, η

Production function elasticities: $\sigma_\ell, \sigma_h, \sigma_e$

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Data

Administrative records from the universe of French firms (1994-2007)

FICUS Data: firm balance sheet information (based on tax records)

- Value added (Revenue) $R_{it} = P_{it}Y_{it}$
- Total equipment investment of firms

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DADS Data: employee-level data matched to employer firms

- Composition-adjusted wage and employment of skill groups W_{fit} and X_{fit} for $f \in \{\ell, h\}$

Details

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Customs Data: firm export/import quantities and unit values

- Use import composition to build firm-level equipment stocks and prices W_{eit} and X_{eit} Details

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Data further used to construct instruments needed for identifying micro elasticities

Summary Stats

Estimating Equations #1

Demand elasticity ε: sectoral CES demand gives firm revenue

$$\Delta r_{it} = -(\varepsilon - 1)\ \Delta p_{it} + \alpha_{st} + \Delta \phi_{it}$$

lower case $\equiv$ log of variable

- Use firm-level export quantities and prices (five-year differences everywhere)
- Endogeneity concern: firm-specific demand shifter $\Delta \phi_{it}$ correlated with price Δp_{it}

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- IV for price change Δp_{it}: import exposure to exchange rate shocks

Details

Estimating Equations #2

Production function elasticities σ_f: CRESH factor demand implies

$$\Delta x_{eit} - \Delta x_{\ell it} = -\sigma_\ell \left(\Delta w_{eit} - \Delta w_{\ell it}\right) + \left(\frac{\sigma_\ell}{\sigma_e} - 1\right) \left(\frac{\varepsilon}{\varepsilon - 1} \Delta r_{it} - \Delta x_{eit}\right) + \beta_{\ell t} + \nu_{\ell it}$$

$$\Delta x_{eit} - \Delta x_{hit} = -\sigma_h \left(\Delta w_{eit} - \Delta w_{hit}\right) + \left(\frac{\sigma_h}{\sigma_e} - 1\right) \left(\frac{\varepsilon}{\varepsilon - 1} \Delta r_{it} - \Delta x_{eit}\right) + \beta_{ht} + \nu_{hit}$$

- Endogeneity concern: residual a function of
  - firm-level factor-augmenting productivity shocks + demand shifters
  - sector-level price index

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- Endogeneity concern: residual a function of
  - firm-level factor-augmenting productivity shocks + demand shifters
  - sector-level price index
- IV for equipment: equipment import exposure to bilateral transport cost shocks Details
- IV for revenues: import exposure to origin supply shocks Details
- IVs for wages: local exposure to sector-level labor demand shocks in France Details

Estimation Results: Demand Elasticity ε

	OLS	2SLS				
	(1)	**(2)**	(3)	(4)	(5)	(6)
ε	0.98	**2.92**	3.63	2.22	2.93	2.32
	(0.01)	**(0.80)**	(1.350)	(0.45)	(0.80)	(0.51)
Observations	72,202	**45,435**	55,101	45,435	45,435	44,992
Year FE	-	**-**	-	Yes	-	-
Year-Sector FE	Yes	**Yes**	Yes	No	Yes	Yes
Controls	No	**No**	No	No	Yes	No
Exp/GO$\geq$ 5%	Yes	**Yes**	No	Yes	Yes	Yes
IV	-	**RER**	RER	RER	RER	RER+SSW
KP F stat	-	**12.75**	9.81	16.39	12.60	9.446

Alternative IV

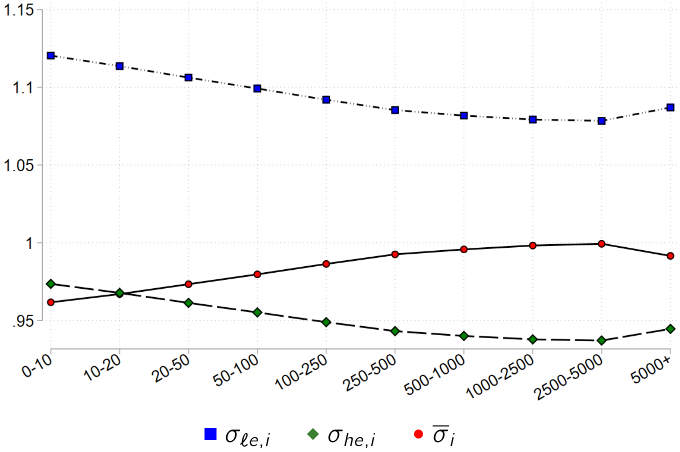
Estimation Results: Production Function Elasticities σ_f

	(1)	**(2)**	(3)	(4)	(5)	(6)	(7)	(8)
	$\Delta x_e - \Delta x_\ell$	$\Delta x_e - \Delta x_h$	$\Delta x_e - \Delta x_\ell$	$\Delta x_e - \Delta x_h$	$\Delta x_e - \Delta x_\ell$	$\Delta x_e - \Delta x_h$	$\Delta x_e - \Delta x_\ell$	$\Delta x_e - \Delta x_h$
$\Delta w_e - \Delta w_\ell$	**-0.97**		-0.97		-0.97		-1.00	
	(0.18)		(0.17)		(0.18)		(0.46)	
$\frac{\varepsilon}{\varepsilon-1}\Delta r - \Delta x_e$	**-0.13**		-0.11		-0.14		-0.01	
	(0.06)		(0.06)		(0.07)		(0.16)	
$\Delta w_e - \Delta w_h$		**-0.84**		-0.86		-0.82		-0.80
		(0.15)		(0.15)		(0.14)		(0.34)
ε	**2.92**		2.32		3.63		2.92	
Observations	**35,142**		35,142		35,142		35,188	
Year FE	**Yes**		Yes		Yes		No	
Year-Sector FE	**No**		No		No		Yes	
σ_ℓ	**0.97**		0.97		0.97		1.00	
	(0.18)		(0.17)		(0.18)		(0.46)	
σ_h	**0.84**		0.86		0.82		0.80	
	(0.15)		(0.15)		(0.14)		(0.34)	
σ_e	**1.11**		1.09		1.13		1.01	
	(0.25)		(0.22)		(0.25)		(0.67)	
$\Pr[\sigma_\ell \leq \sigma_h]$	**0.005**		0.005		0.005		0.015	

Joint Estimation

Roadmap

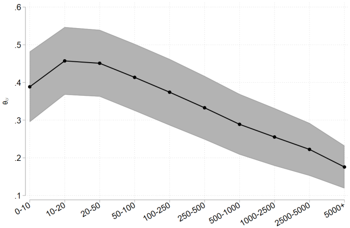
Estimation Results: Firm Size and the Elasticities of Substitution



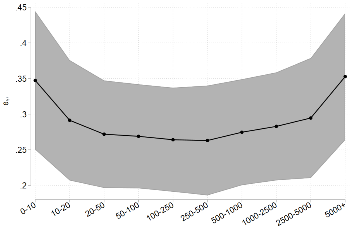
Elasticities of substitution with equipment $\sigma_{fe,i} \equiv \sigma_f \sigma_e / \overline{\sigma}_i$ slightly fall in firm size

Factor Intensities and Firm Size

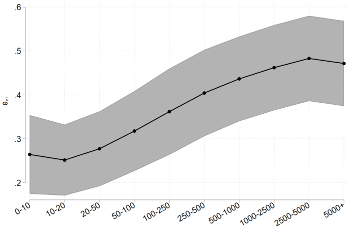
Low-skill shares ($\theta_{\ell i}$)



High-skill shares (θ_{hi})

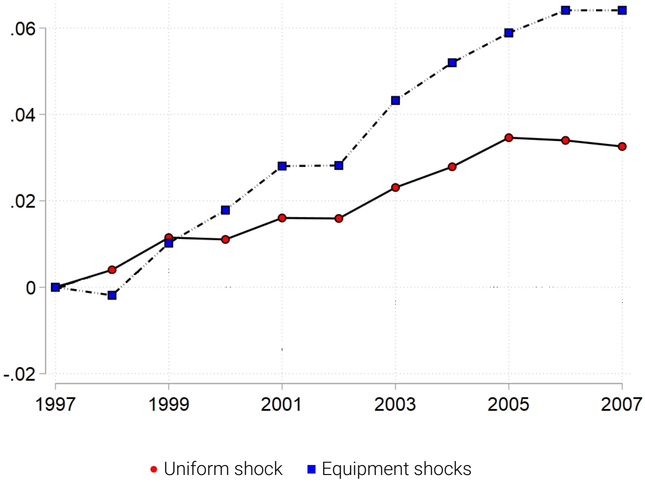


Equipment shares (θ_{ei})



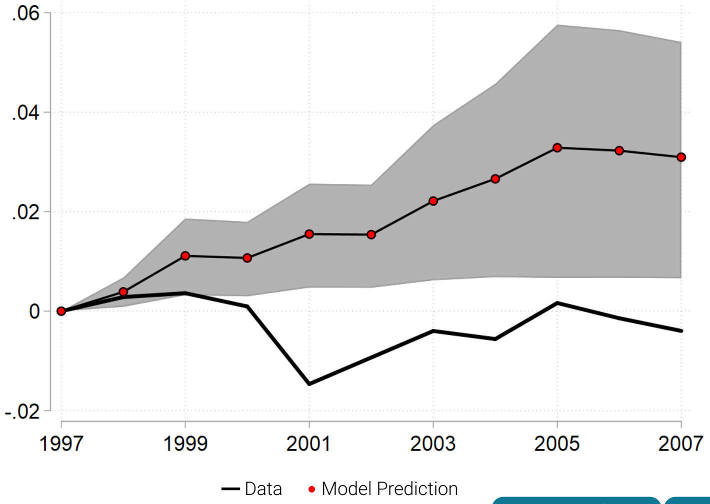
Larger firms have lower intensities in low-skilled labor and higher intensities of equipment

Aggregation Results: Predicted Skill Demand - Manufacturing



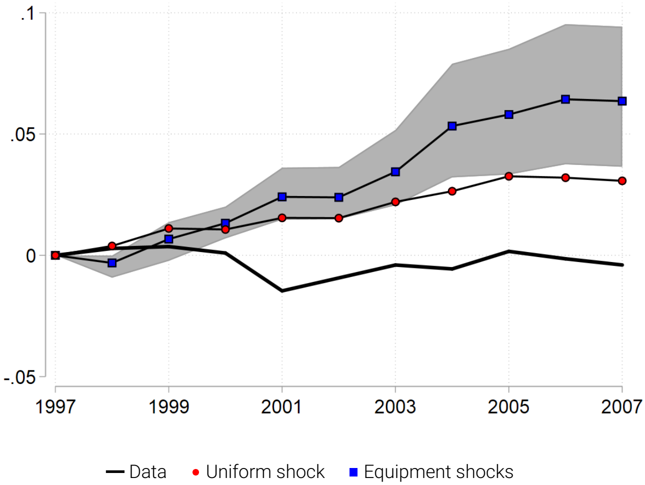
Decomposition

Aggregation Results: Predicted Skill Premium/Uniform Shock



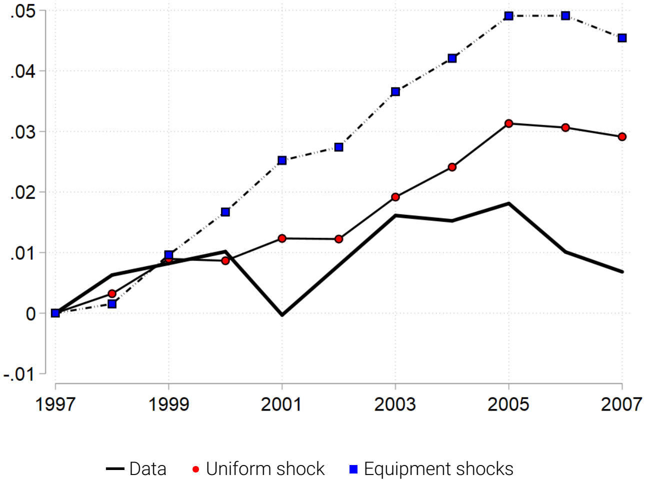
Alternative Specifications | Aggregate Elasticities | Labor Share

Aggregation Results: Predicted Skill Premium/Heterogeneous Shock



Shocks Labor Share Decomposition

Aggregation Results: Predicted Skill Premium - Entire Economy



Labor Share Decomposition

Comparison with KORV

Our benchmark result (French manufacturing):

$$\sigma_{\ell e} - \sigma_{he} = 0.06$$

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KORV specification: composite factor X_c aggregates X_h and X_e

Krusell, Ohanian, Rios-Rull, & Violante (2000)

$$Y = CES\,(\,Z_\ell X_\ell,\; X_c;\; \widetilde{\sigma}_{\ell c}) \qquad\qquad X_c \equiv CES\,(Z_h X_h,\; Z_e X_e; \widetilde{\sigma}_{he})$$

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KORV specification: composite factor X_c aggregates X_h and X_e

Krusell, Ohanian, Rios-Rull, & Violante (2000)

$$Y = CES\left(Z_\ell X_\ell,\, X_c;\, \widetilde{\sigma}_{\ell c} \right) \qquad X_c \equiv CES\left(Z_h X_h,\, Z_e X_e;\, \widetilde{\sigma}_{he} \right)$$

- Calibration with aggregate time-series data

KORV Elasticities

US (1963-2000): $\sigma_{\ell e} - \sigma_{he} = 0.93$

French manufacturing (1997-2007): $\sigma_{\ell e} - \sigma_{he} = 0.76$

Comparison with KORV

Our benchmark result (French manufacturing):

$$\sigma_{\ell e} - \sigma_{he} = 0.06$$

KORV specification: composite factor X_c aggregates X_h and X_e

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$$Y = CES\left(Z_\ell X_\ell,\ X_c;\ \widetilde{\sigma}_{\ell c} \right) \qquad X_c \equiv CES\left(Z_h X_h,\ Z_e X_e; \widetilde{\sigma}_{he} \right)$$

- Calibration with aggregate time-series data

KORV Elasticities

US (1963-2000): $\sigma_{\ell e} - \sigma_{he} = 0.93$

French manufacturing (1997-2007): $\sigma_{\ell e} - \sigma_{he} = 0.76$

Our strategy (micro estimation + aggregation) implies lower capital-skill complementarity

Roadmap

Theory

Data and Estimation

Results

Conclusion

Conclusion

Theory: multi-factor/sector model with arbitrary CRS technologies + het. equipment prices

- Skill premium response to factor price shock in terms of generalized agg. substitution elasticities
- Characterized aggregate elasticities in terms of firm-level elalsticities + demand elasticity

Estimation: matched employer-employee + customs data from France (1997-2007)

- Credibly estimate micro elasticities using trade + labor market instruments
- Aggregate to predict response of skill premium to observed fall in equipment price(s)

Moderate agg. capital-skill complementarity: observed shock leads to 6% rise in skill premium

Roadmap

Appendix

Microfoundations for Equipment Wedges

Equipment inputs for firm i is a CRS aggregate across J varieties of equipment capital

$$X_{ei} = G_i \left(X_{ei1}, \cdots, X_{eij}, \cdots, X_{eiJ} \right)$$

- Firm$\times$variety-specific price distortions ($\sim$ iceberg costs) $\Rightarrow$ $W_{eij} = T_{eij} W_{ej}$
- Marginal products bounded above $\Rightarrow$ variety demand has a choke price

$$\frac{\partial G_i}{\partial X_{eij}} \leq B < \infty, \qquad \forall i, j$$

Empirical Setting: use customs data to identify firm-level composition of equipment investment

- variety $j \equiv$ equipment product $\times$ origin country of product

back

Composite Factors

Composite factor defined as a combination of other factors

$$X_c \equiv \sum_{f \in \mathcal{F}_c} X_f$$

- Example: labor n as a composite of both high and low skilled labor $\mathcal{F}_n \equiv \{\ell, h\}$

Factor f share of income $\theta_f \equiv \frac{W_f X_f}{\sum_{f'} W_{f'} X_{f'}}$

Elasticities of Substitution (defined in terms of payments):

$$\sigma^*_{cf'} \equiv 1 + \frac{\partial \ln (\theta_c / \theta_{f'})}{\partial \ln W_{f'}} = \sum_{f \in \mathcal{F}_c} \frac{\theta_f}{\theta_c} \sigma_{ff'} \qquad \text{where} \qquad \theta_c \equiv \sum_{f \in \mathcal{F}_c} \theta_f$$

back

Response of Composite Factor Shares

Elasticities of Substitution (defined in terms of payments) for composite factor

$$\frac{\partial \ln \theta_c}{\partial w_f} = \begin{cases} \sigma^*_{cf} - \theta_{\overline{f}}\, \sigma^*_{\overline{f}f} - \theta_f, & f \notin \mathcal{F}_c \\ \frac{\theta_{\overline{c}_f}}{\theta_c}\, \sigma^*_{\overline{c}_f f} - \theta_{\overline{f}}\, \sigma^*_{\overline{f}f} + \theta_f \frac{1-\theta_c}{\theta_c}, & f \in \mathcal{F}_c \end{cases}$$

where we have defined two composite factors

$$\overline{f}: \qquad \mathcal{F}_{\overline{f}} \equiv \mathcal{F} \backslash \{f\}$$

$$\overline{c}_f :: \qquad \mathcal{F}_{\overline{c}_f} \equiv \mathcal{F}_c \backslash \{f\}$$

back

Labor Share and Equipment Price

Labor $X_n \equiv X_\ell + X_h$ as composite of both high and low skilled labor

Factor f share of income $\theta_f \equiv \frac{W_f X_f}{\sum_{f'} W_{f'} X_{f'}}$ and we have $\theta_n \equiv \theta_\ell + \theta_h$

Labor Share and Equipment Price

Labor $X_n \equiv X_\ell + X_h$ as composite of both high and low skilled labor

Factor f share of income $\theta_f \equiv \frac{W_f X_f}{\sum_{f'} W_{f'} X_{f'}}$ and we have $\theta_n \equiv \theta_\ell + \theta_h$

Labor-Equipment Elasticity of Substitution:

$$\sigma^*_{ne} \equiv 1 + \frac{\partial \ln \left(\theta_n / \theta_e\right)}{\partial \ln W_e} \equiv \frac{\theta_\ell}{\theta_n} \sigma_{\ell e} + \frac{\theta_h}{\theta_n} \sigma_{he}$$

Labor Share and Equipment Price

Labor $X_n \equiv X_\ell + X_h$ as composite of both high and low skilled labor

Factor f share of income $\theta_f \equiv \frac{W_f X_f}{\sum_{f'} W_{f'} X_{f'}}$ and we have $\theta_n \equiv \theta_\ell + \theta_h$

Labor-Equipment Elasticity of Substitution:

$$\sigma^*_{ne} \equiv 1 + \frac{\partial \ln (\theta_n / \theta_e)}{\partial \ln W_e} \equiv \frac{\theta_\ell}{\theta_n} \sigma_{\ell e} + \frac{\theta_h}{\theta_n} \sigma_{he}$$

Response of the Labor Share:

$$\frac{1}{1-\theta_n} \frac{d \ln \theta_n}{d \ln W_e} = \sigma^*_{ne} - 1 - \left(\frac{\theta_\ell}{\theta_n} (\sigma_{\ell h} - 1) - (\sigma_{eh} - 1) \right) \frac{\sigma_{\ell e} - \sigma_{he}}{\sigma_{\ell h}}$$

back (main) back (appendix)

Macro Elasticities: Many Factors

Shock to equipment price, holding factor wedges and other factor supplies constant

Let $\boldsymbol{W} \equiv (W_f)_{f \in \mathcal{F}/\{\ell,e\}}$ be vector of factor prices, and define matrix and vectors ($\sigma_{ff} \equiv 0$):

$$\boldsymbol{\Sigma} \equiv (\sigma_{ff'})_{f,f' \in \mathcal{F}/\{\ell,e\}} \qquad \boldsymbol{\sigma}_{f\cdot} \equiv (\sigma_{ff'})_{f \in \mathcal{F}/\{\ell,e\}} \qquad \boldsymbol{\sigma}_{\cdot f} \equiv (\sigma_{f'f})_{f \in \mathcal{F}/\{\ell,e\}}$$

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Response of skill premium:

$$\frac{d\ln \boldsymbol{W}}{d\ln W_e} = \left(\mathbf{1}\,\boldsymbol{\sigma}_{\ell\cdot}' - \boldsymbol{\Sigma}\right)^{-1}\left(\boldsymbol{\sigma}_{\cdot e} - \sigma_{\ell e}\right)$$

back

Macro Elasticities: Many Factors

Shock to equipment price, holding factor wedges and other factor supplies constant

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$$\boldsymbol{\Sigma}^{*} \equiv (\sigma^{*}_{ff'})_{f,f' \in \mathcal{F}/\{\ell,e\}} \qquad \boldsymbol{\sigma}^{*}_{f\cdot} \equiv (\sigma^{*}_{ff'})_{f \in \mathcal{F}/\{\ell,e\}} \qquad \boldsymbol{\sigma}^{*}_{\cdot f} \equiv (\sigma^{*}_{f'f})_{f \in \mathcal{F}/\{\ell,e\}}$$

Response of skill premium:

$$\frac{d \ln \boldsymbol{W}}{d \ln W_e} = \left(\mathbf{1}\, \boldsymbol{\sigma}'_{\ell\cdot} - \boldsymbol{\Sigma}\right)^{-1} \left(\boldsymbol{\sigma}_{\cdot e} - \sigma_{\ell e}\right)$$

back

Labor Share and Equipment Prices

Labor-Equipment Elasticity of Substitution:

$$\sigma_{ne}^{*,\omega} \equiv 1 + \frac{\partial \ln (\theta_n/\theta_e)}{\partial \ln \overline{W}_e} \equiv \frac{\theta_\ell}{\theta_n}\sigma_{\ell e}^{\omega} + \frac{\theta_h}{\theta_n}\sigma_{he}^{\omega}$$

Response of the Labor Share:

$$\frac{1}{1-\theta_n}\frac{d \ln \theta_n}{d \ln \overline{W}_e} = \sigma_{ne}^{*,\omega} - 1 - \left(\frac{\theta_\ell}{\theta_n}(\sigma_{\ell h} - 1) - (\sigma_{eh} - 1)\right)\frac{\sigma_{\ell e}^{\omega} - \sigma_{he}^{\omega}}{\sigma_{\ell h}}$$

back

Macro Elasticities: Many Factors

Shock to equipment prices, holding other factor wedges and supplies constant

Let $\boldsymbol{W} \equiv (W_f)_{f \in \mathcal{F}/\{\ell,e\}}$ be vector of factor prices, and define matrix and vectors ($\sigma_{ff} \equiv 0$):

$$\boldsymbol{\Sigma}^{\omega} \equiv (\sigma^{\omega}_{ff'})_{f,f' \in \mathcal{F}/\{\ell,e\}} \qquad \boldsymbol{\sigma}^{\omega}_{f\cdot} \equiv (\sigma^{\omega}_{ff'})_{f \in \mathcal{F}/\{\ell,e\}} \qquad \boldsymbol{\sigma}^{\omega}_{\cdot f} \equiv (\sigma^{\omega}_{f'f})_{f \in \mathcal{F}/\{\ell,e\}}$$

Macro Elasticities: Many Factors

Shock to equipment prices, holding other factor wedges and supplies constant

Let $\boldsymbol{W} \equiv (W_f)_{f\in\mathcal{F}/\{\ell,e\}}$ be vector of factor prices, and define matrix and vectors ($\sigma_{ff} \equiv 0$):

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Response of skill premium:

$$\frac{d\ln \boldsymbol{W}}{d\ln \overline{W}_e} = \left[\mathbf{1}\ (\boldsymbol{\sigma}^{\omega}_{\ell\cdot})' - \boldsymbol{\Sigma}^{\omega}\right]^{-1} (\boldsymbol{\sigma}^{\omega}_{\cdot e} - \sigma^{\omega}_{\ell e})$$

back

Macro Elasticities: Many Factors

Shock to equipment prices, holding other factor wedges and supplies constant

Let $\boldsymbol{W} \equiv (W_f)_{f\in\mathcal{F}/\{\ell,e\}}$ be vector of factor prices, and define matrix and vectors ($\sigma_{ff} \equiv 0$):

$$\boldsymbol{\Sigma}^{*,\omega} \equiv \left(\sigma^{*,\omega}_{ff'}\right)_{f,f'\in\mathcal{F}/\{\ell,e\}} \qquad \boldsymbol{\sigma}^{*,\omega}_{f\cdot} \equiv \left(\sigma^{*,\omega}_{ff'}\right)_{f\in\mathcal{F}/\{\ell,e\}} \qquad \boldsymbol{\sigma}^{*,\omega}_{\cdot f} \equiv \left(\sigma^{*,\omega}_{f'f}\right)_{f\in\mathcal{F}/\{\ell,e\}}$$

Response of skill premium:

$$\frac{d\ln \boldsymbol{W}}{d\ln \overline{W}_e} = \left[\mathbf{1}\,(\boldsymbol{\sigma}^{\omega}_{\ell\cdot})' - \boldsymbol{\Sigma}^{\omega}\right]^{-1}\,(\boldsymbol{\sigma}^{\omega}_{\cdot e} - \sigma^{\omega}_{\ell e})$$

back

Decomposition of Capital-Skill Complementarity

Homogenous Equipment Price:

$$\frac{d\ln\left(W_h/W_\ell\right)}{d\ln W_e} = -\frac{1}{\sigma_{h\ell}}\left[\overbrace{\sum_i \Lambda_{\ell i}\left(\sigma_{\ell e,i}-\sigma_{he,i}\right)\theta_{ei}}^{\text{within-firm complementarity}}\right.$$

$$\left.+\underbrace{\sum_i \left(\varepsilon-\sigma_{he,i}\right)\left(\Lambda_{hi}-\Lambda_{\ell i}\right)\theta_{ei}}_{\text{cross-firm complementarity}}+\underbrace{\left(\eta-\varepsilon\right)\sum_s\left(\Lambda_{hs}-\Lambda_{\ell s}\right)\theta_{es}}_{\text{cross-sector complementarity}}\right]$$

Decomposition of Capital-Skill Complementarity

Homogenous Equipment Price:

$$\frac{d\ln\left(W_h/W_\ell\right)}{d\ln W_e} = -\frac{1}{\sigma_{h\ell}}\left[\overbrace{\sum_i \Lambda_{\ell i}\left(\sigma_{\ell e,i}-\sigma_{he,i}\right)\theta_{ei}}^{\text{within-firm complementarity}}\right.$$

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Heterogenous Equipment Price:

$$\frac{d\ln\left(W_h/W_\ell\right)}{d\ln \overline{W}_e} = -\frac{1}{\sigma_{h\ell}}\left[\overbrace{\sum_i \Lambda_{\ell i}\left(\sigma_{\ell e,i}-\sigma_{he,i}\right)\theta_{ei}\omega_{ei}}^{\text{within-firm complementarity}}\right.$$

$$\left.+\underbrace{\sum_i\left(\varepsilon-\sigma_{he,i}\right)\left(\Lambda_{hi}-\Lambda_{\ell i}\right)\theta_{ei}\omega_{ei}}_{\text{cross-firm complementarity}}+\underbrace{\left(\eta-\varepsilon\right)\sum_s\left(\Lambda_{hs}-\Lambda_{\ell s}\right)\theta_{es}\omega_{es}}_{\text{cross-sector complementarity}}\right]$$

back (theory 1) back (theory 2) back (results)

Macro Elasticities: CES Firm-Level Technology

Micro-level elasticity of substitution for CES firm-level technology:

$$\sigma_{ff',i} = \begin{cases} \sigma, & f \neq f' \\ \sigma \frac{\theta_{fi}-1}{\theta_{fi}}, & f = f' \end{cases}$$

Macro-level elasticities of substitution assuming single sector ($\varepsilon = \eta$):

$$\sigma_{ff'} = \sigma + (\varepsilon - \sigma) \sum_i \left(\Lambda_{f'i} - \Lambda_{fi}\right) \theta_{f'i}$$

$$\sigma^*_{ff'} = \sigma + (\varepsilon - \sigma) \sum_i \left(\Lambda^*_{f'i} - \Lambda^*_{fi}\right) \theta_{f'i}$$

back

Macro Elasticities: CRESH Firm-Level Technology

Macro-level elasticities of substitution assuming single sector ($\varepsilon = \eta$):

$$\sigma_{ff'} = \sigma_{f'} \left[1 - \sum_i \left(\Lambda_{f'i} \frac{\sigma_{f'}}{\overline{\sigma}_i} - \Lambda_{fi} \frac{\sigma_f}{\overline{\sigma}_i} \right) \theta_{f'i} \right] + \varepsilon \sum_i \left(\Lambda_{f'i} - \Lambda_{fi} \right) \theta_{f'i}$$

$$\sigma^*_{ff'} = \sigma_{f'} \left[1 - \sum_i \left(\Lambda^*_{f'i} \frac{\sigma_{f'}}{\overline{\sigma}_i} - \Lambda^*_{fi} \frac{\sigma_f}{\overline{\sigma}_i} \right) \theta_{f'i} \right] + \varepsilon \sum_i \left(\Lambda^*_{f'i} - \Lambda^*_{fi} \right) \theta_{f'i}$$

back

Within and Between-Firm Substitution: Examples

Response of the skill premium to an equipment price shock with uniform factor prices

$$\frac{d \ln \left(W_h / W_\ell\right)}{d \ln W_e} = -\frac{\sigma_{\ell e} - \sigma_{he}}{\sigma_{\ell h}}$$

Within and Between-Firm Substitution: Examples

Response of the skill premium to an equipment price shock with uniform factor prices

$$\frac{d\ln\left(W_h/W_\ell\right)}{d\ln W_e} = -\frac{\sigma_{\ell e} - \sigma_{he}}{\sigma_{\ell h}}$$

Only within-firm: homogenous firms with a CRESH production function:

$$\frac{d\ln\left(W_h/W_\ell\right)}{d\ln W_e} = -\frac{\sigma_{\ell e,i} - \sigma_{he,i}}{\sigma_{\ell h,i}} = -\frac{\sigma_\ell - \sigma_h}{\sigma_\ell \sigma_h}\sigma_e$$

Within and Between-Firm Substitution: Examples

Response of the skill premium to an equipment price shock with uniform factor prices

$$\frac{d\ln\left(W_h/W_\ell\right)}{d\ln W_e} = -\frac{\sigma_{\ell e} - \sigma_{he}}{\sigma_{\ell h}}$$

Only within-firm: homogenous firms with a CRESH production function:

$$\frac{d\ln\left(W_h/W_\ell\right)}{d\ln W_e} = -\frac{\sigma_{\ell e,i} - \sigma_{he,i}}{\sigma_{\ell h,i}} = -\frac{\sigma_\ell - \sigma_h}{\sigma_\ell \sigma_h}\sigma_e$$

Only cross-firm: heterogenous firms with CES production functions ($\sigma_f \equiv \sigma$) and single sector:

$$\frac{d\ln\left(W_h/W_\ell\right)}{d\ln W_e} = -\frac{(\varepsilon - \sigma)\sum_i \left(\Lambda_{hi} - \Lambda_{\ell i}\right)\theta_{ei}}{\sigma + (\varepsilon - \sigma)\sum_i \left(\Lambda_{hi} - \Lambda_{\ell i}\right)\theta_{hi}}$$

back

Summary Statistics

		All firms						Reduced Sample					
	Source	Obs. (Nb)	Mean	Sd	p25	p50	p75	Obs. (Nb)	mean	sd	p25	p50	p75
Output	FICUS	475,438	15,681,216	299,923,380	741,636	1,687,545	4,967,409	96,841	49,643,200	336,116,805	4,667,909	10,301,318	28,229,455
Value Added	FICUS	475,438	4,329,647	71,316,215	319,909	672,364	1,698,909	96,841	14,590,585	128,657,845	1,585,636	3,307,591	8,502,182
Low-Skill Working Hours	DADS	475,438	72,655	594,771	8,877	20,350	50,306	96,841	213,750	588,840	40,789	82,043	198,556
Low-Skill Hourly Wage	DADS	475,438	12	3	10	12	13	96,841	13	3	11	12	14
Low-Skill Wage Bill ($W_\ell X_\ell$)	DADS	475,438	962,397	9,096,444	103,932	239,494	597,769	96,841	2,904,784	8,639,068	489,212	1,007,062	2,494,455
High-Skill Working Hours	DADS	475,438	40,354	444,336	3,454	6,824	17,212	96,841	129,998	558,184	15,113	32,657	82,727
High-Skill Hourly Wage	DADS	475,438	23	9	17	21	26	96,841	25	7	20	23	27
High-Skill Wage Bill ($W_h X_h$)	DADS	475,438	1,028,991	12,120,242	66,437	155,623	399,760	96,841	3,383,120	15,825,433	360,887	775,668	1,972,223
Equipment Stock ($W_e X_e$)	BRN	475,438	16,577,251	332,594,816	340,187	924,150	3,185,276	96,841	57,803,739	475,338,376	2,958,942	7,636,314	24,890,984
Exports - Total	Customs	475,438	3,648,894	52,623,201	0	0	170,442	96,841	14,217,365	80,351,406	112,017	1,034,075	5,637,990
Imports - Total	Customs	475,438	2,269,708	34,576,308	0	0	235,696	96,841	8,955,206	66,861,640	260,961	1,004,400	3,836,091
Imports - Intermediate products	Customs	475,438	1,678,365	24,086,984	0	0	128,939	96,841	6,586,778	43,398,599	151,553	676,140	2,756,554
Imports - Equipment products	Customs	475,438	531,716	11,940,700	0	0	932	96,841	2,160,954	21,786,515	3,627	69,098	488,002

back

Data: Skill Groups, Wages, and Employment

Skill groups: assign workers to skill groups based on occupation

Caliendo et al. (2015), Caluccio et al. (2015)

- High-skilled: Managers, Middle managers and professionals, Qualified workers
- Low-skilled: Clerks, Blue-collar

Change in firm-skill-specific wages:

- Estimate firm-level wage changes by running worker-level wage regression on stayers:

$$w_{ji,t} - w_{ji,t-1} = \beta_t' \boldsymbol{X}_{jit} + FE_{fit} + e_{jit} \qquad \Delta w_{fit} \equiv \sum_{\tau=0}^{4} \widehat{FE}_{fi,t-\tau}$$

  Worker-j characteristics $\boldsymbol{X}_{jit}$: age, sex, 2-digit occupation category belonging to skill type f

- Find firm-level change in demand for each skill type by deflating wage bill change with wage change

back

Data: Equipment Data

Equipment investment: infer using change in the book value of two asset types in FICUS-BRN

- Machinery, equipment and tools (AR - Installations techniques, matriel et outillage industriels)
- Other tangible fixed assets (AT - Autres immobilisations corporelles)

Sources of equipment investment: use imports information in customs data:

- BEC codes: Imported Capital goods–except transport equipment (41) & Parts and accessories (42)
- Define domestic equipment investment as the BRN total minus the customs total

Prices:

- Imported: unit values at firm-year-origin-product level
- Domestic: INSEE series at sector-year-asset level (transport, hardware, & other machinery)

back

Data: Equipment Stocks and Prices

Firm-level Price Index for Equipment Investment:

- Sato-Vartia index $\mathbb{P}^e_{it}$ aggregates price change across origin/products (domestic $\equiv$ one product)
- Quantity of equipment investment $Q^e_{it} = I^e_{it}/P^r_{it}$ with $P^e_{it} \equiv \prod_{\tau=1}^{t} \mathbb{P}^e_{i\tau}$

Perpetual Inventory Method:

$$X^e_{it} = \begin{cases} \frac{1}{\delta^e_{st}} \frac{\sum_{\tau=0}^{T_i-1} Q^e_{i\tau}}{T_i}, & \text{if } t = 0, \\ (1-\delta^e_{st})Q^e_{it-1} + Q^e_{it}, & \text{if } t > 0, \end{cases}$$

with δ^e_{it} sector-specific deprecation rate (KLEMS), $T_i - 1$ number of periods firm in data

User Cost of Equipment:

$$W_{eit} = P^e_{it}\left(R^e_t + \delta^e_{st} - \frac{p^e_{s,t+1} - p^e_{s,t-2}}{3}\right)$$

back

Instruments: RER Shocks As Cost Shifters

Instrument for Firm-level Prices: shifts marginal costs & uncorrelated with demand shocks $\Delta\phi_{it}$

$$\Delta RER_{it} = \sum_{c} \frac{M_{ci,t-5}}{M_{i,t-5}} \Delta \ln \left(NER_{ct} \cdot \frac{CPI_{ct}}{CPI_{FR,t}} \right)$$

- $M_{ci,t}$: imports of firm i from country c in period t
- NER_{ct} : nominal exchange rate (euros per country c currency)
- CPI_{ct} : consumer price index in country c in period t

Real depreciation of country c currency relative to euro raises ΔRER_{it} and lowers Δp_{it}

back

Instruments: Transport Cost Shocks as Equipment Price Shifters

Instrument for Equipment Prices: shifts costs of importing equipment goods

Hummels et al. (2014)

$$\Delta ETC_{it} = \sum_{c} \sum_{k \in \mathcal{K}_e} \frac{M^e_{cki,t-5}}{M^e_{i,t-5}} \Delta \ln TC_{ckt}$$

- $M^e_{cki,t-5}$: equipment imports of firm i in equipment k from country c in period t
- $\Delta \ln TC_{ckt}$: change in transport costs predicted due to oil/jet fuel price shocks

Transport costs TC_{ckt} predicted based on:

- Distance to country of origin c
- Product k fequencey of the modes of transport
- Elasticity of mode of transport charges to oil/fuel prices

back

Instruments: World Supply Shocks as Value Added Shifters

Instrument for Firm-Level Value Added: shifts from revenues

Hummels et al. (2014)

$$\Delta WES_{it} = \sum_{c} \sum_{k \in \mathcal{K}_I} \frac{M^I_{cki,t-5}}{M^I_{i,t-5}} \Delta \ln Exp_{ckt}$$

- $\Delta \ln Exp_{ckt}$: growth of exports of country c in product k in period t to all countries except France
- $M^I_{cki,t-5}$: intermediate good imports of firm i from country c in period t

Productivity growth in origin uncorrelated with demand/factor augmenting productivity shocks

back

Instruments: Shift-Share Instruments for Local Wages

Generalized Bartik IV: shifts firm-level skill premium

$$\Delta SSW_{it} = \sum_r \sum_s \left(\frac{X^r_{ni,t-5}}{X_{ni,t-5}}\right) \cdot \left(\frac{X^r_{ns,t-5}}{X^r_{n,t-5}}\right) \cdot \left(\frac{X^r_{hs,t-5}}{X^r_{\ell s,t-5}}\right) \cdot \Delta \ln GO_{st}$$

- $X^r_{ni,t}$: firm i employment in region r at time t (firm exposure to local wage shocks)
- $X^r_{ns,t}$: region r employment in sector s at time t
- $X^r_{fs,t}$: region r employment of skill-type f in sector s
- $\Delta \ln GO_{st}$: growth in French gross output of sector s

National expansion in a sector that is skill intensive in a given region raises local skill premium

back

Estimation Results: Demand Elasticity ε with Alternative IV

	OLS	2SLS				
	(1)	(2)	(3)	(4)	(5)	(6)
ε	0.978	2.325	2.696	2.084	2.330	2.108
	(0.010)	(0.589)	(0.860)	(0.396)	(0.593)	(0.496)
Observations	72,202	44,020	53,171	44,020	44,020	43,579
Year FE	-	-	-	Yes	-	-
Year-Sector FE	Yes	Yes	Yes	No	Yes	Yes
Controls	No	No	No	No	Yes	No
Exp/GO$\geq$ 5%	Yes	Yes	No	Yes	Yes	Yes
IV	-	RER ($\mathcal{K}_I$)	RER ($\mathcal{K}_I$)	RER ($\mathcal{K}_I$)	RER ($\mathcal{K}_I$)	RER + SSW
KP F stat	-	13.06	8.34	16.76	12.92	8.67

Only use intermediate inputs in the construction ΔRER_{it}

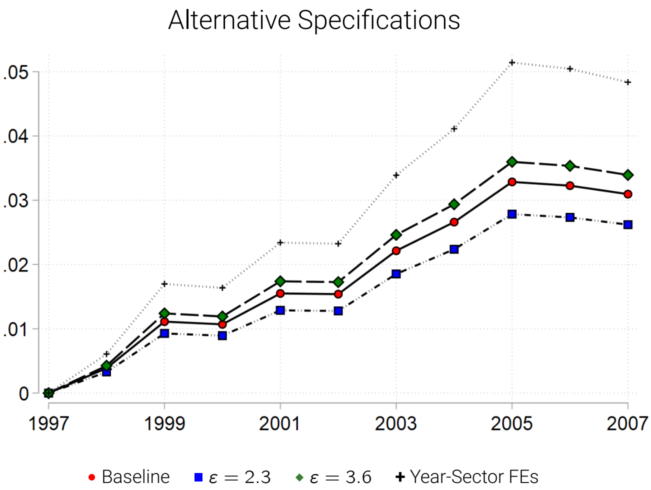
back

Estimation Results: Joint Estimation of ε and σ_f

	(1)	(2)	(3)
	$\Delta x_e - \Delta x_\ell$	$\Delta x_e - \Delta x_h$	Δq
$\Delta w_e - \Delta w_\ell$	-0.922		
	(0.147)		
$\frac{\varepsilon}{\varepsilon-1}\Delta r - \Delta x_e$	-0.0705		
	(0.0467)		
$\Delta w_e - \Delta w_h$		-0.817	
		(0.128)	
Δp			-1.927
			(0.418)
Observations		**26,845**	
Year FE		**Yes**	
σ_ℓ		**0.922**	
σ_h		**0.817**	
σ_e		**0.992**	
ε		**1.93**	
$\Pr[\sigma_\ell \leq \sigma_h]$		**0.015**	

back

Aggregation Results: Predicted Skill Premium/Uniform Shock



back

Measuring Wedges

Firm-specific wages $W_{fi} \equiv W_f T_{fi}$ ($f \in \{\ell, h\}$) give us wedges T_{fi} subject to multiplicative factor

Shadow wage $\widehat{W}_{ft} \equiv \widehat{W}_{\ell t} W_{ft}$ in euros $\Rightarrow$ observed wages $\widehat{W}_{fi,t} \equiv \widehat{W}_{f,t} T_{fi,t}$ for $f \in \{\ell, h\}$

Assumption: two residuals (uniform wedge shocks) $\overline{\overline{T}}_{f,t} \equiv \frac{1}{I} \sum_i T_{fi,t}$

- Observed unweighted mean wage rate

$$\overline{\overline{W}}_{f,t} \equiv \frac{1}{I} \sum_i \widehat{W}_{fi,t} = \widehat{W}_{f,t} \times \overline{\overline{T}}_{f,t} \qquad f \in \{\ell, h\}$$

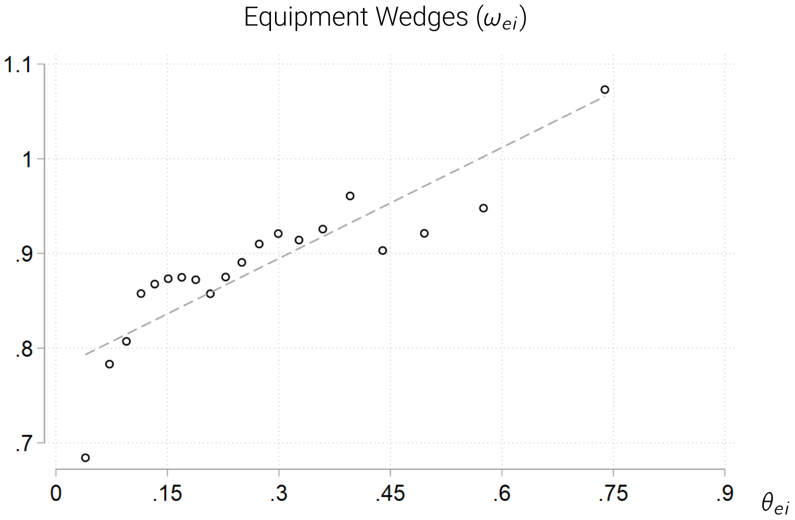
- Observed wedge shocks

$$\widehat{T}_{fi,t} \equiv \frac{\widehat{W}_{fi,t}}{\overline{\overline{W}}_{f,t}} = \frac{T_{fi,t}}{\overline{\overline{T}}_{f,t}} \qquad f \in \{\ell, h\}$$

- Observed numeraire $\overline{\overline{W}}_{\ell,t} \equiv W_{\ell,t} \equiv 1 \Rightarrow \overline{\overline{W}}_{h,t} \equiv W_{h,t}$

back

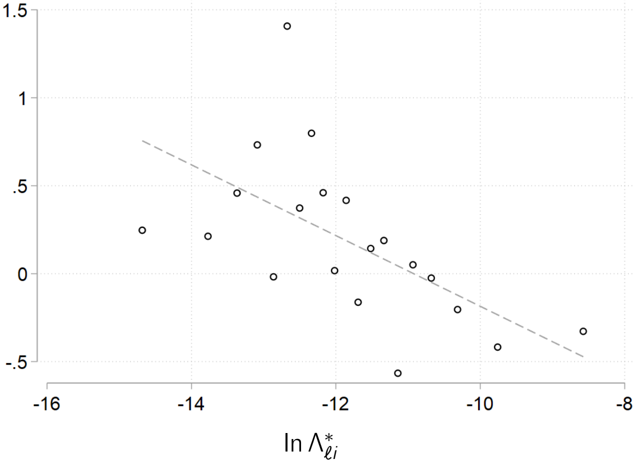
Aggregation Results: Heterogenous Price Shocks



back

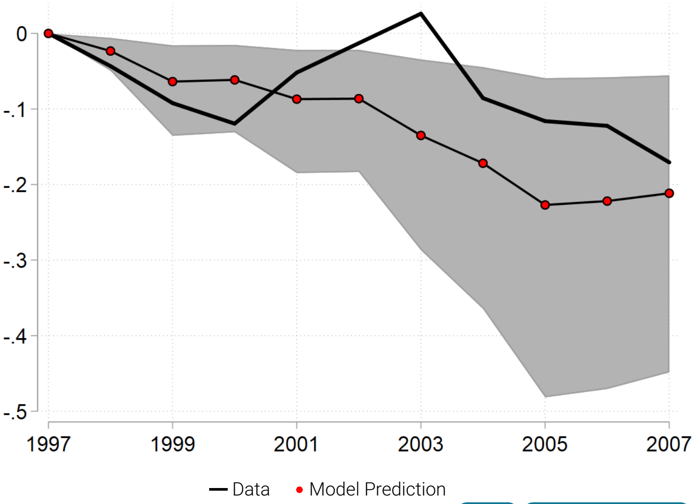
Aggregation Results: Heterogenous Price Shocks

Difference in the Change in Labor Wedges ($\omega_{hi} - \omega_{\ell i}$) by Low-Skilled Aggregate Payment Share ($\Lambda^*_{\ell i}$)



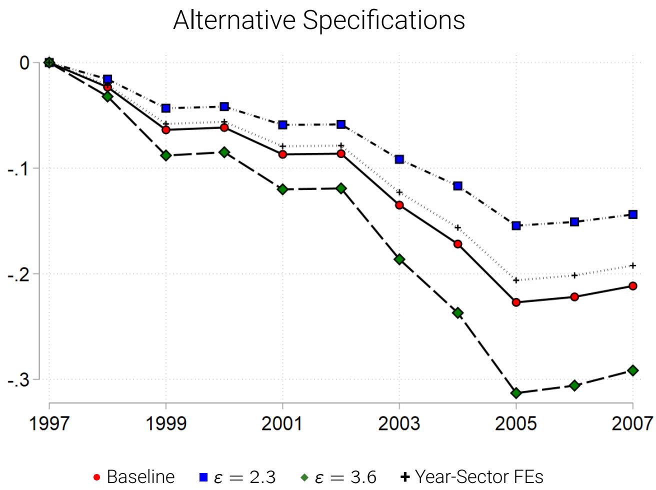
back

Aggregation Results: Predicted Labor Share/Uniform Shock



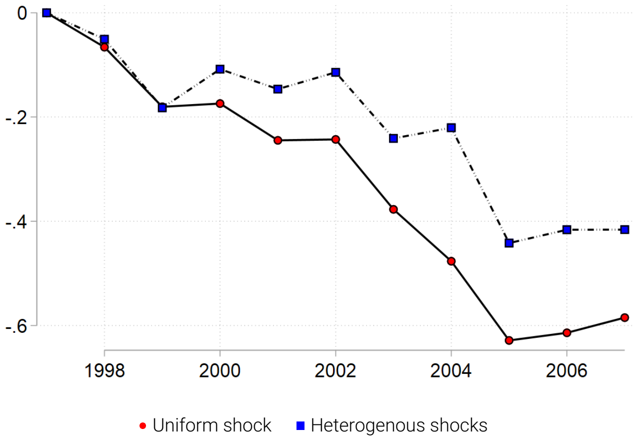
Theory | Alternative Specifications | Aggregate Elasticities | back

Aggregation Results: Predicted Labor Share/Uniform Shock



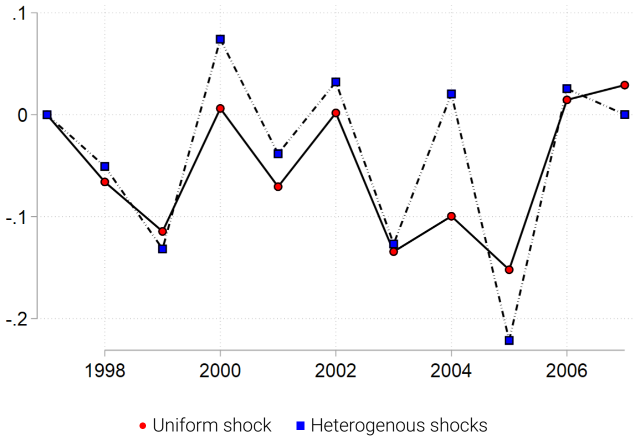
back

Aggregation Results: Cumulated Equipment Shocks



back

Aggregation Results: Annual Equipment Shocks



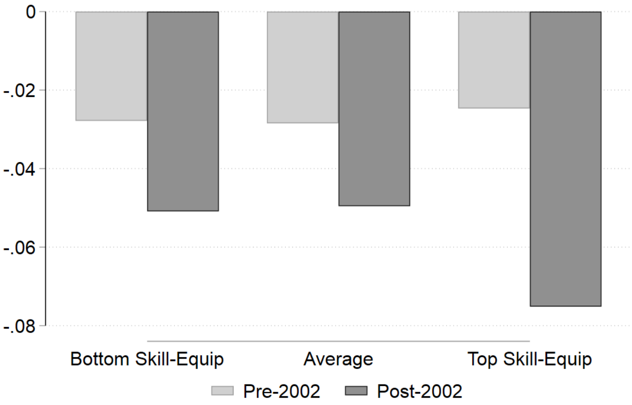
back

Aggregation Results: Average Annual Equipment Shocks

Note: bins defined over $(\Lambda^*_{hi} - \Lambda^*_{\ell i})\theta_{ei}$

back

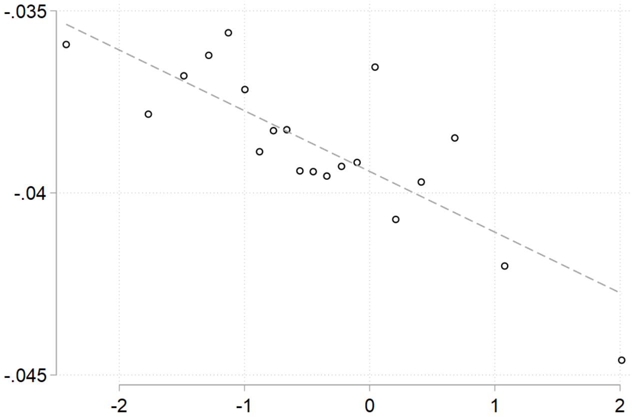
Aggregation Results: Average Annual Equipment Shocks



Note: bins defined over $(\Lambda^*_{hi} - \Lambda^*_{\ell i})\theta_{ei}$

back

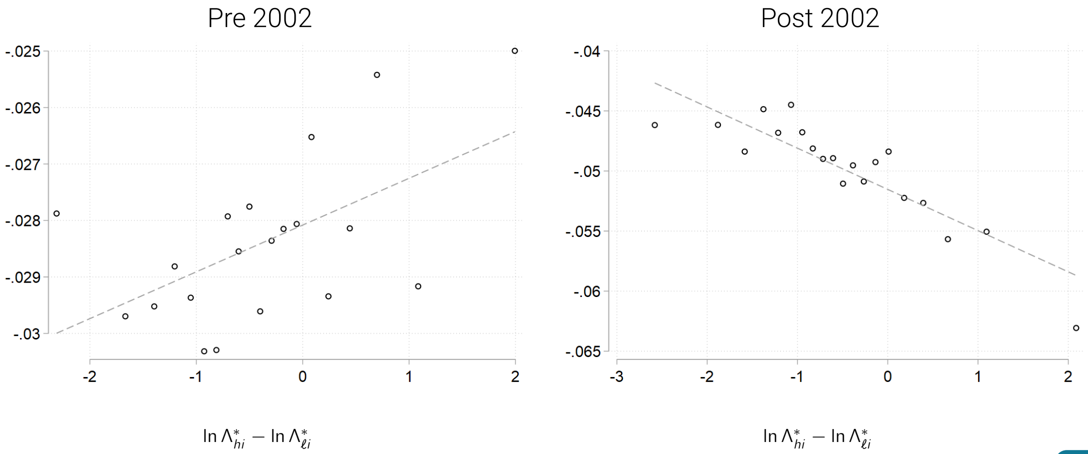
Aggregation Results: Equipment Shocks by Skill Intensity



$\ln \Lambda^*_{hi} - \ln \Lambda^*_{\ell i}$

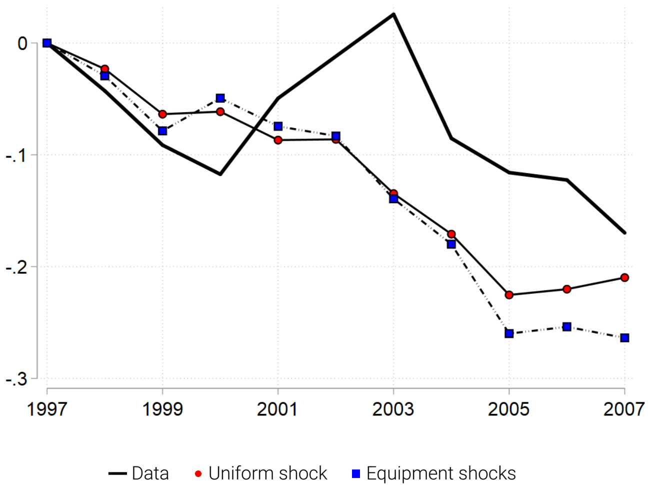
back

Aggregation Results: Equipment Shocks by Skill Intensity



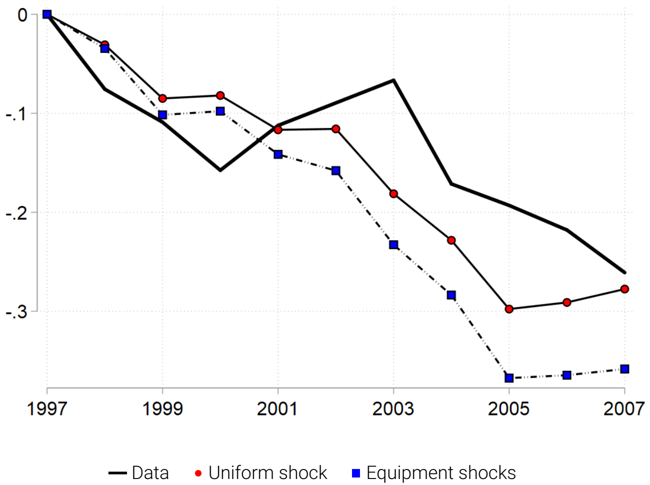
back

Aggregation Results: Predicted Labor Share/Heterogeneous Shock



back

Aggregation Results: Predicted Labor Share - Entire Economy



back

Aggregation Results: Predicted Responses to Equipment Price Shock

Decomposition of Predicted Skill Premium - Manufacturing

	Uniform Shock	Heterogeneous Shock
	$\Delta \ln W_h$	$\Delta \ln W_h$
Equipment	0.031	0.061
Within firm	0.027	0.034
Cross firm	0.034	0.061
Cross sector	-0.030	-0.034
Observed	-0.004	-0.004

Labor Share Theory back

Aggregation Results: Predicted Responses to Equipment Price Shock

Decomposition of Predicted Skill Demand - Manufacturing

	Uniform Shock	Heterogeneous Shock
	$\Delta \ln(X_h/X_\ell)$	$\Delta \ln(X_h/X_\ell)$
Equipment	0.033	0.064
Within firm	0.028	0.036
Cross firm	0.036	0.064
Cross sector	-0.031	-0.036

back

Aggregation Results: Predicted Responses to Equipment Price Shock

Decomposition of Predicted Skill Premium - Entire Economy

	Uniform Shock	Heterogeneous Shock
	$\Delta \ln W_h$	$\Delta \ln W_h$
Equipment	0.029	0.045
Within firm	0.016	0.020
Cross firm	0.010	0.021
Cross sector	0.003	0.004
Observed	0.007	0.007

Labor Share Theory back

Aggregation Results: Predicted Responses to Equipment Price Shock

Predicted Labor Share - Manufacturing

	Uniform Shock	Heterogeneous Shock
	$\Delta \ln \theta_n/(1-\theta_n)$	$\Delta \ln \theta_n/(1-\theta_n)$
Equipment	-0.210	-0.264
Observed	-0.171	-0.171

Back

Aggregation Results: Predicted Responses to Equipment Price Shock

Predicted Labor Share - Entire Economy

	Uniform Shock	Heterogeneous Shock
	$\Delta \ln \theta_n/(1-\theta_n)$	$\Delta \ln \theta_n/(1-\theta_n)$
Equipment	-0.278	-0.358
Observed	-0.261	-0.261

Back

Aggregation Results: Aggregate Elasticities

	(1)	(2)	(3)	(4)
$\frac{dw_h}{dw_e}$	**-0.054**	-0.045	-0.060	-0.084
	[-0.093, -0.013]	[-0.074, -0.012]	[-0.101, -0.011]	[-0.168, -0.013]
σ^*_{he}	**1.323**	1.217	1.450	1.274
$\sigma^*_{\ell e}$	**1.379**	1.263	1.515	1.359
$\sigma^*_{\ell h}$	**1.046**	1.013	1.091	1.020
$\frac{1}{1-\theta_n}\frac{d\ln\theta_n}{dw_e}$	**0.359**	0.244	0.494	0.325
	[0.091, 0.762]	[,]	[,]	[,]
σ^*_{ne}	**1.350**	1.239	1.482	1.315
	[1.090, 1.737]	[1.002, 1.549]	[1.150, 2.774]	[0.806, 2.357]
ε	**2.92**	2.321	3.627	2.92
η	**1**	1	1	1
σ_ℓ	**0.968**	0.969	0.967	1.001
σ_h	**0.841**	0.864	0.824	0.798
σ_e	**1.111**	1.092	1.126	1.014

Back

KORV Elasticities

KORV specification: composite factor X_c aggregates X_h and X_e

Krusell, Ohanian, Rios-Rull, & Violante (2000)

$$Y = CES\left(Z_\ell X_\ell,\ X_c;\ \widetilde{\sigma}_{\ell c}\right) \qquad X_c \equiv CES\left(Z_h X_h,\ Z_e X_e; \widetilde{\sigma}_{he}\right)$$

KORV Elasticities

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KORV elasticities based on different estimation/calibration strategies:

	Implied by our estimation	Calibrated in French manu.	Calibrated in US data
$\widetilde{\sigma}_{he}$	1.32	0.15	0.63
$\widetilde{\sigma}_{\ell c}$	1.40	0.92	1.56

Back