wiiw The Vienna Institute for International Economic Studies

FIW

Seminar in International Economics
29 October 2015

Where does the surplus go? Disentangling the capital-labor distributive conflict

Dario Guarascio (with Francesco Bogliacino and Valeria Cirillo)
Sapienza University of Rome and Scuola Superiore St. Anna, Pisa

This seminar series is an activity in the framework of FIW ('Forschungsschwerpunkt Internationale Wirtschaft'), which is a project designed to build a center of excellence in research on International Economics, funded by the Austrian Ministry of Science, Research and Economy (BMWFW).

Where does the surplus go? Disentangling the capital-labor distributive conflict

Dario Guarascio [1 3] Francesco Bogliacino [2] Valeria Cirillo [3]

[1]Sapienza University of Rome

[2]Universidad Nacional de Colombia

[3]Scuola Superiore St.Anna, Pisa

FIW-Seminars
The Vienna Institute for International Economic Studies
29, October 2015

Outline

- Motivation
- Theoretical framework and conceptualization
- The empirical model
- Data and preliminary evidence
- Identification strategy
- Results:
  1. The baseline model
  2. Hetereogeneity of the impact
- Conclusions and final remarks

Motivation (1)

- The capital-labor conflict emerged (again) as a key driver of distributive patterns (both at the functional and at the personal level) (*OECD, 2012; Bogliacino and Maestri, 2012; IMF, 2015*)
- A large body of literature has documented a structural change in factor shares during the second half of the XX century, towards higher profit incomes (*Schlenker and Schmid, 2013; Arpaia et al., 2009; Checchi and Garcia-Penalosa, 2010; ILO, 2013, van der Hoeven, 2014*)
- Technology is increasingly regarded as one of the crucial engines behind the unbalanced distributive patterns observed in almost all the economies (*Franzini and Pianta, 2015*)

Motivation (2)

- Disentangling the capital-labor conflict highlighting the role of technological change and international fragmentation of production (*in line with theoretical insights from the range theory of wages*)
- Challenging the *Skill Bias Technological Change* view of technology creating rents *'per se'* (*Howell, 1999*)
- Developing an econometric model able to account for: i) distributive conflict ii) role of technology and fragmentation (offshoring) as elements shaping the bargaining process iii) heterogeneity of the effects looking at technological intensity, degree of opennes and skills iv) structural heterogeneity and industry-specific technological trajectories (*Dosi, 1982, 1988*)

Theoretical framework and conceptualization

- Wages and profits are determined within a two-step bargaining scheme where 'Schumpeterian rents' play a key role (expanding on *Schumpeter, 1942; Van Reenen, 1996 and Bogliacino, 2014*)
- Strict connection between **theoretical representation** (two step bargaining process with rents generation) and **empirical strategy** (Lag structure, IV-OLS and 3SLS model with non-linear and interaction terms)
- Industry-level analysis and Input-Output tables (*enhancement of the SID database, Pianta et al., 2011; Cirillo and Perani, 2015*) to account for, demand, structural inter dependencies and international fragmentation of production

Theoretical framework and conceptualization

- **Model set up:**
- Wage setting is determined by total employment, sectoral production together with international organization of production and technical change (*Keynes, 1936; Schumpeter, 1942; Van Reenen, 1996; Pianta and Tancioni, 2008*).
- Once bargained, wage represent a constraint for profits which, in turn, depend upon various demand sources (as in standard Post-Keynesian framework (*Kaldor,1958; Pianta and Tancioni, 2008*))
- Relationships' stability tested accounting for: industries' technological clusters (*Revised Pavitt categories, Bogliacino and Pianta, 2015*); degree of openness (*cluster analysis*); high medium and low skilled workers (*ISCED classification*)

Theoretical framework and conceptualization

- **Related literature and previous evidence:**
- Both wages and profits are driven by the 'Schumpeterian' effect of new products - rent sharing mechanism (*Van Reenen, 1996*)
- Conflict matters and new products' positive effect on wages depends on industries' technological characteristics (*Pianta, 2001; Pianta and Tancioni, 2008*)
- Fragmentation (offshoring) impact on wages can go in different directions: i) skill composition effect (+) ii) offshoring as an 'organizational innovation' (+) iii) offshoring working as a 'threat' weakening workers bargaining power (−) (*Antras et al., 2006; Kramarz, 2008; Fosse and Maitra, 2012; Hummels et al., 2012*)

The model specification (1)

- **The wage equation (expanding on *Van Reenen, 1996*). A 'Schumpeterian' log linear specification (derived from the Dasgupta and Stiglitz 'patent race' model) augmented with (non linear) terms for surplus sharing (*Bogliacino, 2014*):**

$$\log(W_{ijt}) = \log(L_{ijt-1}) + \log(Y_{ijt-1}) + \Phi(\log(R\&D_{ijt-1}), (OFF_{ijt-1})) + \nu_{ij} + \epsilon_{ijt}$$

- Using a second order Taylor expansion for the Φ function we have:

$$\log(W_{ijt}) = \log(L_{ijt-1}) + \log(Y_{ijt-1}) + \log(R\&D_{ijt-1}) + \log(OFF_{ijt-1})$$
$$+\log^2(R\&D_{ijt-1}) + \log^2(OFF_{ijt-1}) + \log(R\&D_{ijt-1}) * (OFF_{ijt-1}) + \nu_{ij} + \epsilon_{ijt}$$

- Differencing to get rid of the fixed effects ν_{ij}, we obtain the empirical specification:

$$\log \Delta(W_{ijt}) = \beta_1 \Delta \log(L_{ijt-1}) + \beta_2 \Delta \log(Y_{ijt-1}) + \beta_3 \Delta \log(R\&D_{ijt-1}) + \Delta \log(OF$$
$$+\beta_4 \Delta \log^2(R\&D_{ijt-1}) + \Delta \log^2(OFF_{ijt-1}) + \Delta \log(R\&D_{ijt-1}) * (OFF_{ijt-1}) + \epsilon_{ijt}$$

1. **Wages** are explained by market forces (employment and production), technology and offshoring (linear, squared and interacted)
2. **Non linear terms** $\rightarrow$ technology shock (creative distruction due to new products as in *Bogliacino, 2014*); offshoring strongly unbalancing bargaining forces as in (*Kramarz, 2008*)
3. **Interaction term** $\rightarrow$ innovation impact softened (or magnified) by offshoring

The model specification (2)

- **The profit equation (Keynesian perspective), actual profits are driven by demand:**

$$\log(P_{ijt}) = \beta_1 \log(I_{ijt}) + \beta_2 \log(C_{ijt}) + \beta_3 \log(EXP_{ijt}) - \log(W_{ijt-1}) + \eta_{ij} + \epsilon_{ijt}$$

- Differencing to get rid of the fixed effects η_{ij}, we obtain the empirical specification:

$$\log \Delta(P_{ijt}) = \beta_1 \Delta \log(I_{ijt}) + \beta_2 \Delta \log(C_{ijt}) + \beta_3 \Delta \log(EXP_{ijt}) - \Delta \log(W_{ijt-1}) + \epsilon_{ijt}$$

1. **Profits** are determined by investments and demand (disaggregated in domestic consumption - government and households' consumption - and exports)
2. **Wages** have a negative impact on profits $\Rightarrow$ magnified, softenend and shaped by the rent-sharing dynamics operating at the first step

Data and preliminary evidence

- **The Database:** Sectoral Innovation Database (SID), University of Urbino (recent efforts for enlargement):
  1. 38 sectors both manufacturing and services for the major EU countries
  2. Data from CIS2, CIS3, CIS4 and CIS6 for innovation variables - Conversion matrix to overcome CIS structural break in industries classification (*Cirillo and Perani, 2015*)
  3. Covering a time span from 1995 to 2011
  4. Data from OECD STAN and WIOD-SEA for production variables (Nace two digits, 1995-2011)

Data and preliminary evidence

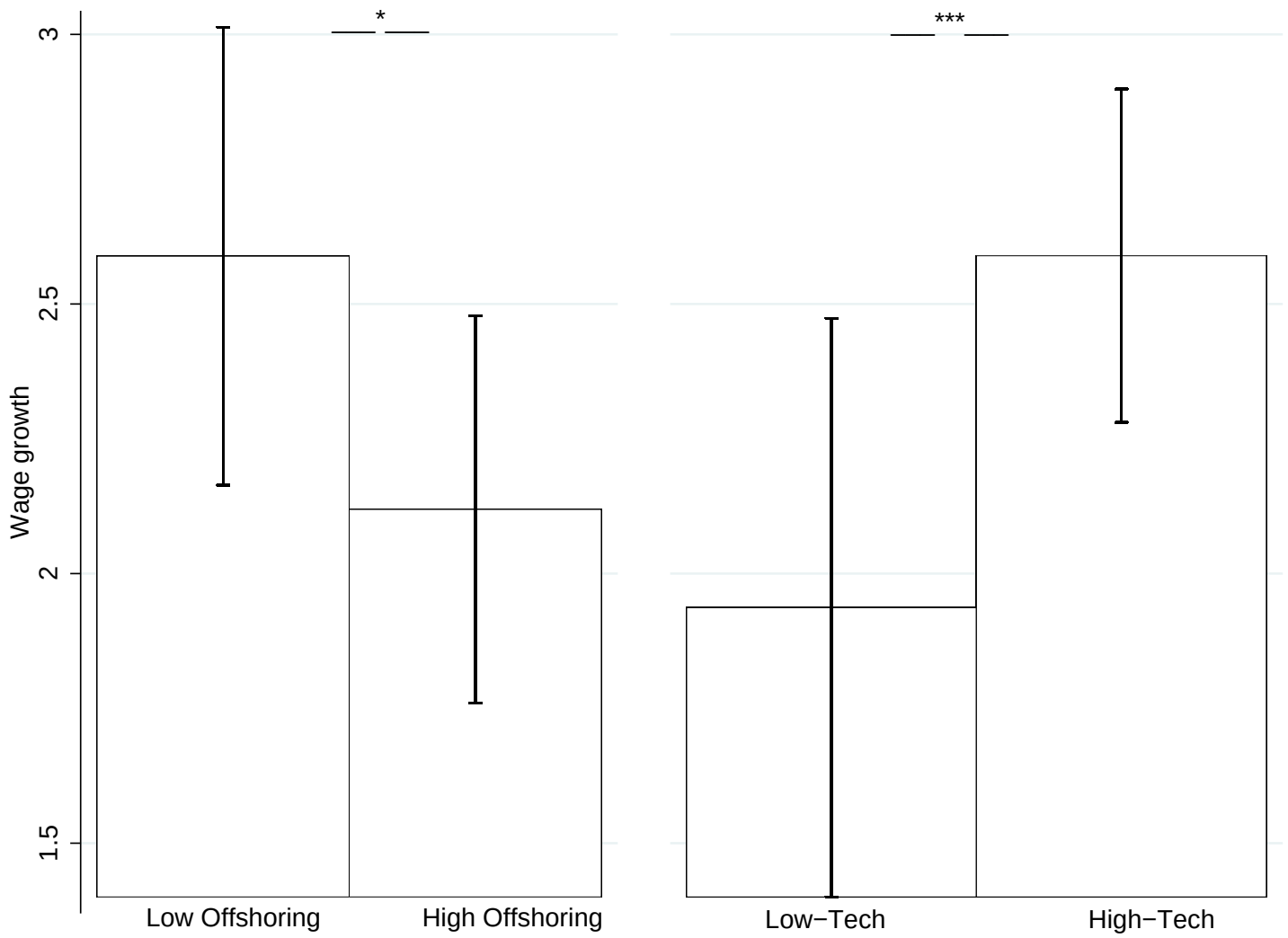
Table 1: List of Variables

Variables	Unit	Source
In-house R&D expenditure per employee	*Thous. euros/employee*	*SID-CIS*
New Machinery expenditure per employee	*Thous. euros/employee*	*SID-CIS*
Rate of gr. of profits (total)	*Annual rate of growth*	*SID-WIOD*
Rate of gr. of wages (hourly)	*Annual rate of growth*	*SID-WIOD*
Rate of gr. of domestic demand	*Annual rate of growth*	*SID-WIOD*
Rate of gr. of exports	*Annual rate of growth*	*SID-WIOD*
Rate of gr. of offshoring (F&H index)	*Simple difference*	*WIOD I-O Tabs*

Data and preliminary evidence

Fig.1: Mean annual rate of change of wages by intensity of offshoring and R&D

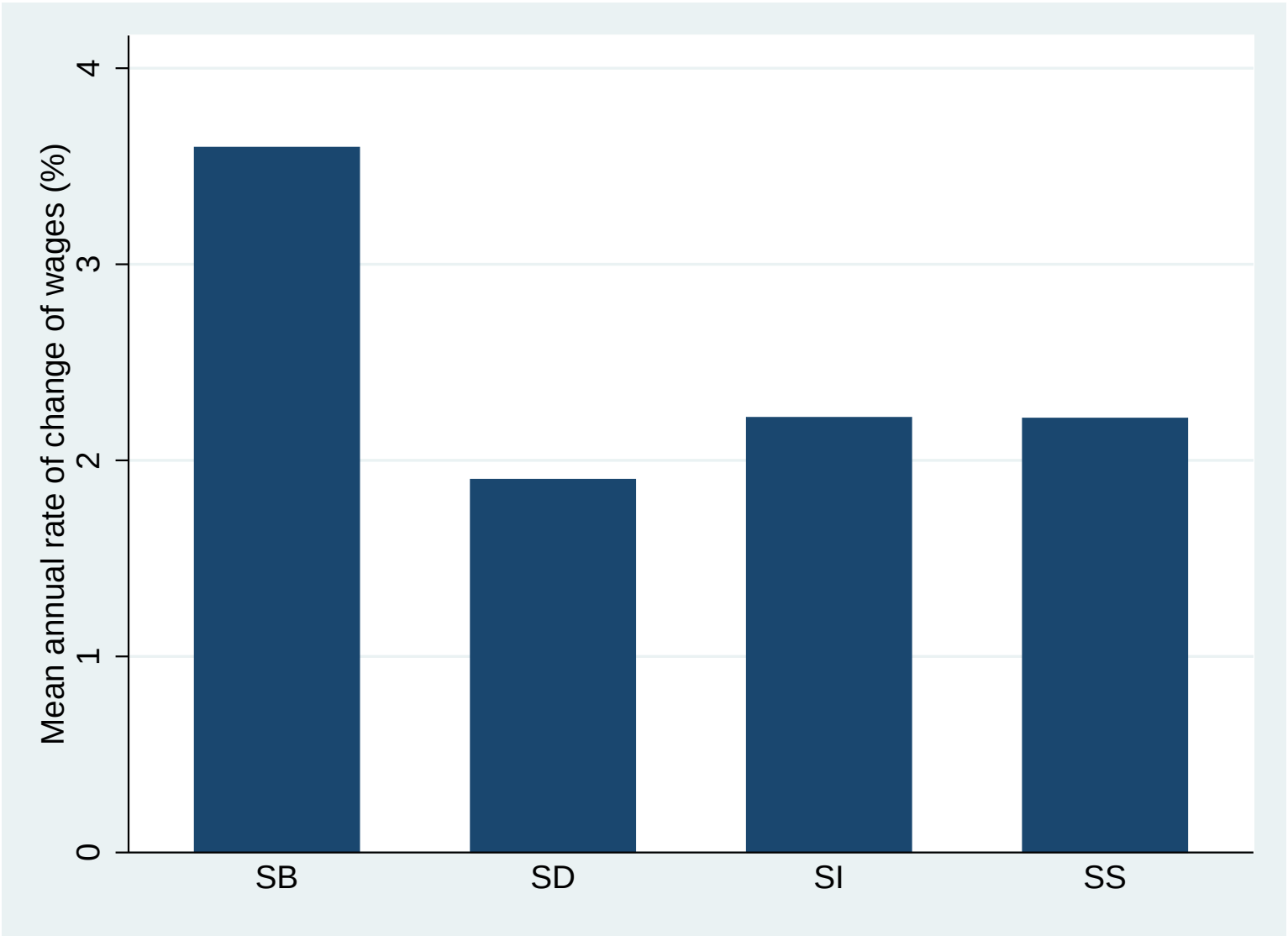
(GER, IT, FR, SP, UK 1996-2010)



Data and preliminary evidence

Fig.2: Mean annual rate of change of wages by Pavitt classes

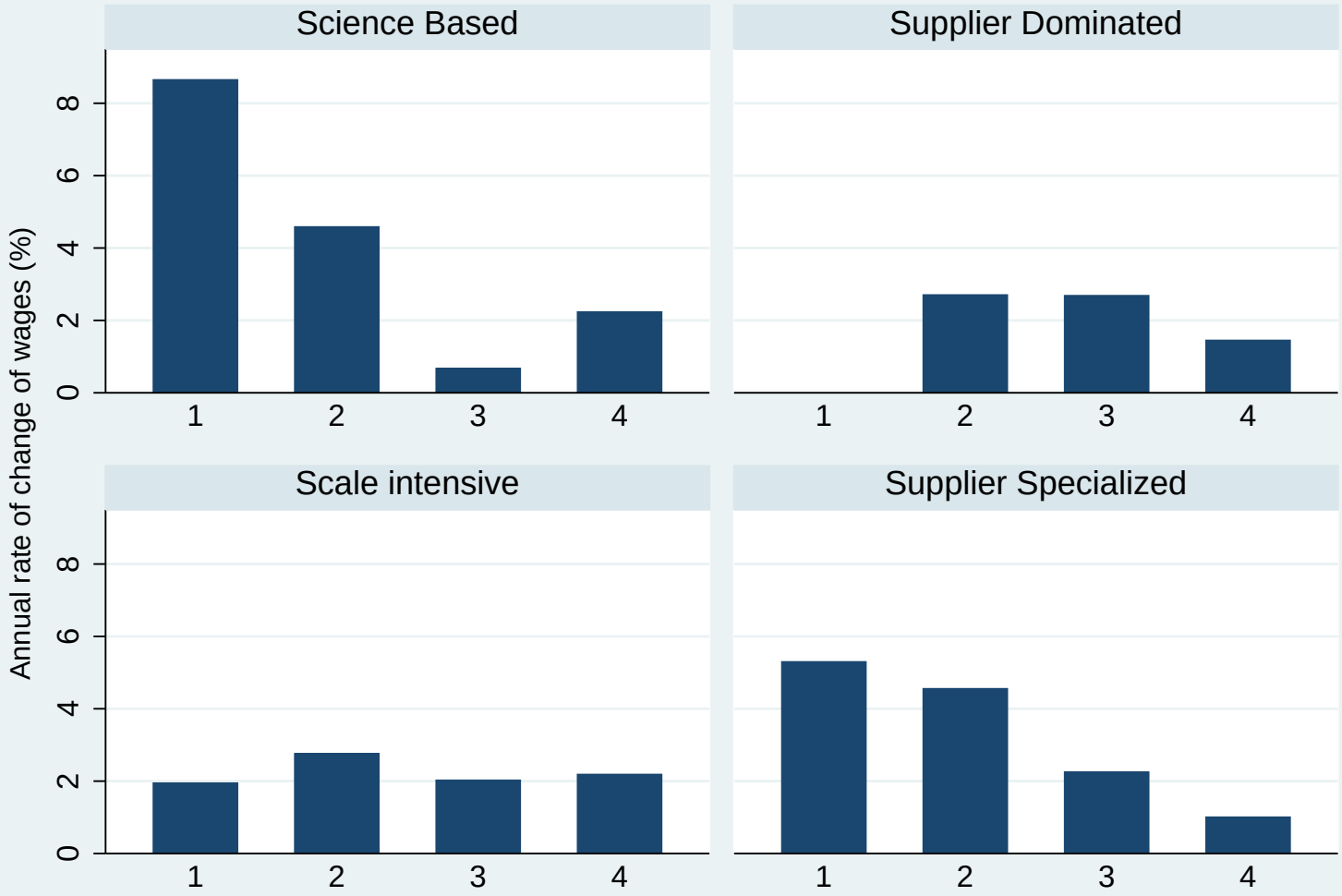
(GER, IT, FR, SP, UK 1996-2010)



Data and preliminary evidence

Fig.3: Mean annual rate of change of wages by degree of fragmentation

(GER, IT, FR, SP, UK 1996-2010)

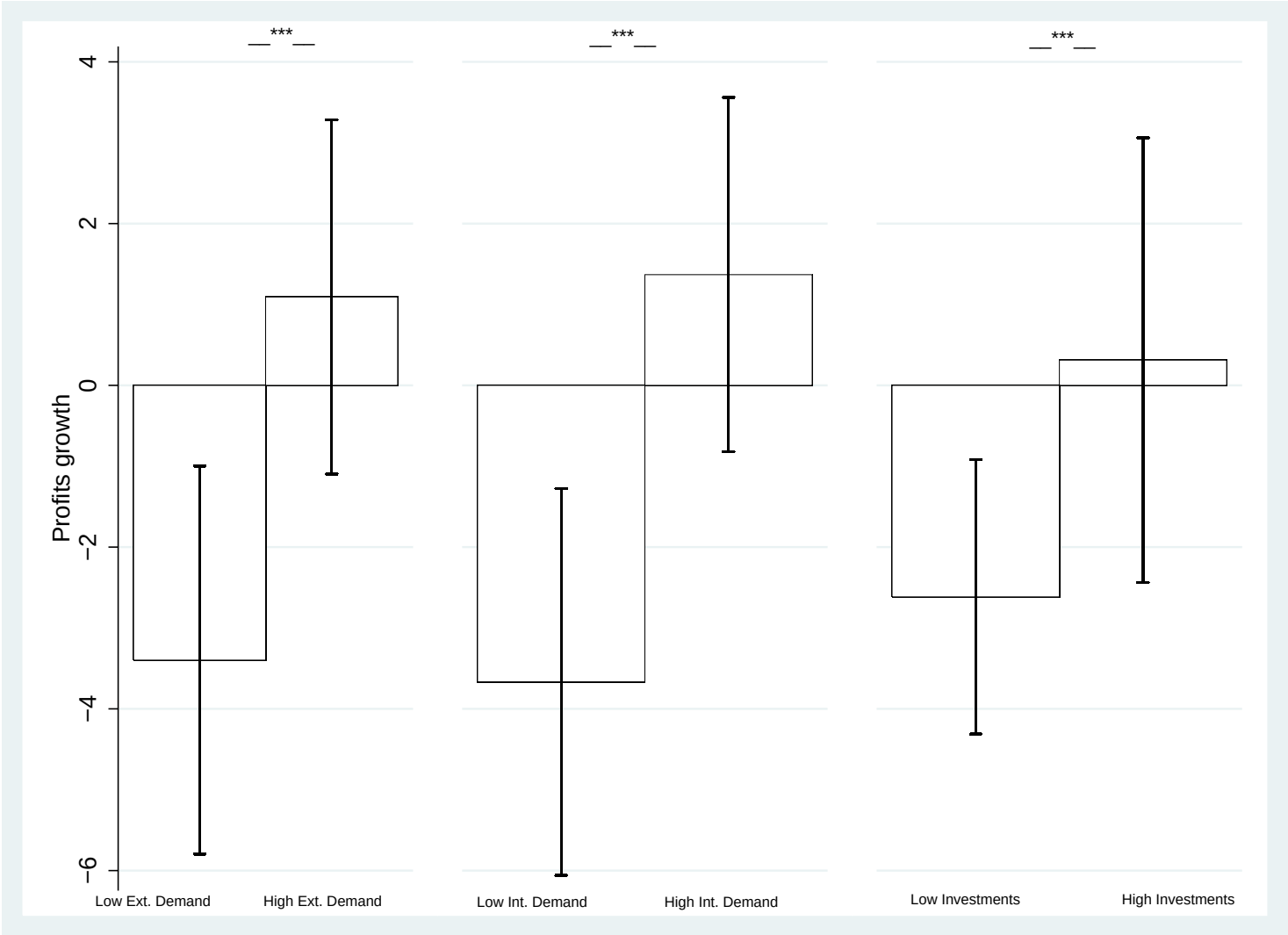


Legend: 1: Highly open industries; 2: Med−high open industries; 3: Med−low open industries; 4: Low open industries

Data and preliminary evidence

Fig.4: Mean annual rate of change of profits by typology of demand – internal, external – and investments intensity

(GER, IT, FR, SP, UK 1996-2010)



Identification strategy (1)

- **Stepwise procedure to investigate relationships' stability:**
  1. Separate WLS (obseravations weighted with sectoral employment) and IV-OLS estimations of both profits and wages equations
  2. 3SLS estimation using lagged values of R&D expenditure per employee, employment and gross output growth (wages equation); wages estimated at the first step, instrumented domestic consumption and exports (profits equation)
  3. Multicollinearity, heteroscedasticity, persistency and endogenity issues: lag structure (long lags of 4 years); country, sector & time dummies; robust std. errors; variables and value added lags to instrument variables suspected of endogeneity
  4. Further endogenity test: Alternative variables lag structure, main results and specification reliability confirmed

Identification strategy (2)

- **We are interested in structural relationships so we estimate the following equations separately:**

$$\begin{aligned} W &= \Phi(X) + Z'\beta + \varepsilon \\ \pi &= w'\alpha + R'\gamma + \eta \end{aligned}$$

- where, (X, Z) and (w, R) are matrices whose columns are covariates and (ε, η) is a n$*$T times two matrix with the random errors

- 3SLS estimation (combining SURE and 2SLS, full information technique): 1) Wages vs economic, technology and offshoring vars (lagged values); 2) Profits vs wages (estimated at the 1st step), investments and demand (instrumented with their lags, lagged sectoral value added, Pavitt and country dummies)

The WLS estimation (baseline (1) vs dummy var.(2)), wages equation:

	(1) Δ Wages/hour	(2) Δ Wages/hour
R&D (first lag)	0.55***	0.38***
	(0.08)	(0.07)
R&D sq. (first lag)	-0.01***	-0.00***
	(0.00)	(0.00)
Offshoring (first lag)	-0.18	-0.26*
	(0.17)	(0.14)
Offshoring sq. (first lag)	6.13*	3.35
	(3.50)	(2.84)
R&D*Offshoring	-0.02*	-0.01
	(0.01)	(0.01)
ΔGross Output (first lag)	0.14***	0.02
	(0.03)	(0.03)
ΔSectoral employment (first lag)	-0.01*	0.05
	(0.03)	(0.03)
Dummies		Yes***
N	413	413
$Adj.R^2$	0.23	0.35

The WLS (1) and IV-OLS estimation (2), profits equation:

	(1) **Δ Profits**	(2) **Δ Profits**
ΔWages/hour	-1.01***	-1.34***
	(0.25)	(0.31)
ΔInvestments	0.56	0.45
	(0.36)	(0.82)
ΔDomestic demand	0.18**	0.19
	(0.08)	(0.38)
ΔExports	0.03	0.93***
	(0.02)	(0.38)
Dummies	Yes***	Yes***
N	523	523
$Adj.R^2$	0.20	0.21

The 3SLS structural estimation (Std. errors in brackets, country and Pavitt dummies)

	Δ Wages/hour	Δ Profits
R&D (first lag)	0.59***	
	(0.12)	
R&D sq. (first lag)	-0.02***	
	(0.00)	
Offshoring (first lag)	-0.37	
	(0.25)	
Offshoring sq. (first lag)	7.60	
	(4.60)	
R&D*Offshoring	0.02	
	(0.05)	
ΔEmployment (first lag)	0.00	
	(0.02)	
ΔGross Output (first lag)	0.09*	
	(0.04)	
ΔWages/hour		-1.38***
		(0.53)
ΔInvestments (inst)		0.03
		(0.73)
ΔDomestic demand (inst)		0.06
		(0.28)
ΔExports (inst)		0.85***
		(0.20)
N	317	317

The baseline estimations: results' interpretation

- 'Innovation rents' (proxied by R&D expenditures) partly earned by wages (concave relationship between wages and R&D)
- Offshoring seems to push wages downward (confirming Kramarz, (2008)'s hypothesis) or, at least, to reduce the R&D positive impact
- Social conflict captured by wages negative and significant impact on profits (confirming Pianta and Tancioni, 2008)
- Profits fundamentally driven by international demand (3SLS supporting single equation IV-OLS results)

Heterogeneity of the impact (1) - 3SLS performed grouping industries using Pavitt categories

- **High (SCIENCE BASED & SUPPLIER SPECIALIZED) vs low tech (SCALE INTENSIVE & SUPPLIER DOMINATED) industries:**
  1. Innovation rents explain wages only in the high tech cluster
  2. Offshoring negative impact detected only in the high tech cluster
  3. Social conflict stronger in the high tech cluster
  4. Profits are driven by exports in the high tech cluster and by domestic demand in the low tech one (confirming Bogliacino and Pianta, 2013)

Heterogeneity of the impact (2) - 3SLS performed grouping industries according to their degree of opennes (cluster analysis)

- **Open vs closed industries cluster (cluster analysis performed on the whole sample using as reference vars. F&H narrow indicator and sectoral value added):**
  1. 'Innovation rents' explain wages only in the open cluster
  2. Offshoring negative impact detected only in the open cluster and interaction term negative and significant in both clusters
  3. Social conflict detected only in the closed cluster
  4. As expected, profits are driven by exports in the open cluster

Heterogeneity of the impact (3) - 3SLS performed considering high, medium and low skilled wages

- **Profits vs high, medium and low skilled wages (ISCED categorization):**
  1. **Profits vs high skilled wages:** Wages are pushed by R&D while offshoring's negative impact emerges only in the interaction term; social conflict weakened in case of high skilled
  2. **Profits vs medium skilled wages:** Results in line with the baseline model
  3. **Profits vs low skilled wages:** Wages are pushed by R&D and offshoring has, as expected, a strong and significant negative impact
  4. **General remark:** Social conflict weakened when skills are accounted for $\Rightarrow$ Once separate workers group are considered, horizontal differences in bargaining power hide the basic capital labor structure

Conclusions, novelties and final remarks

- Capital-labour conflict as a fundamental nexus to understand patterns of distribution across modern capitalist economies
- Technology (captured by R&D) and fragentation (offshoring) contribute to define the distributive arrangement by shaping the bargaining power of the parties involved
- The non-linear specification allows to frame better the complexity involved in the innovation-income distribution relationship
- Enrichment of the 'rent-sharing' literature (Dunne and Schmitz, 1996; Van Reenen, 1996; Card et al., 2011) including offshoring among wages determinants
- Heterogeneity emerging as a crucial element affecting the set of investigated relationships