



Routinization of Italian provinces: A firm level analysis of labour share

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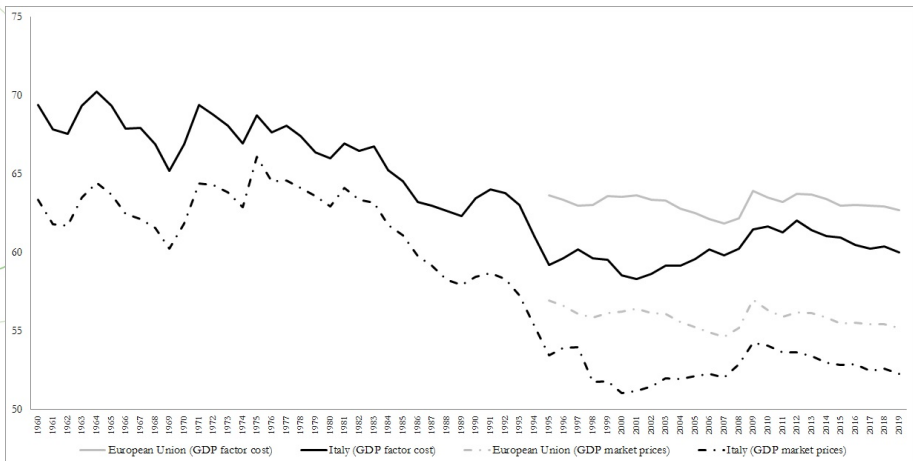
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The declining trend of labour share

Figure: Trend in labour share (AMECO)



Motivation

- Labour share has declined in OECD countries (OECD, 2015; IMF, 2007; European Commission, 2007; ILO, 2012) – in Italy from 66.9% in 1970 to 50% in 2018 (AMECO);
- The declining trend of labour share is reflected in an increasing profit share in total income (Elsby et al., 2013; Karabarounis and Neiman, 2014; Piketty, 2015);
- The increase in the capital share has been remarkable in most OECD countries (Arpaia et al., 2009; Checchi and Garcia-Penalosa, 2010; Stockhammer, 2013; Schlenker and Schmid, 2013; Van der Hoeven, 2014; ILO, 2015);
- Increasing economic inequality in the developed world, mainly because labour income is much more evenly distributed than non-labor income (Checchi and García-Peñalosa, 2010; Atkinson, 2009; Glyn, 2009);

The level of analysis

- Many empirical studies on the determinants of labour share are based on country data (European Commission, 2007; Checchi and Garcia-Peñalosa, 2010; Damiani et al., 2018);
- Some studies use **industry-level data** (Azmat et al., 2012; Bentolila and Saint-Paul, 2003; Hutchinson and Persyn, 2012; Elsbey et al., 2013; Alvarez-Cuadrado et al., 2014; Bassanini and Manfredi, 2012; Pianta and Tancioni, 2008; Bogliacino et al., 2017);
- Only few studies have focused on **firm-level data** (Growiec, 2012; Siegenthaler and Stucki, 2014; Autor et al. 2017; Hounghonon and Da-Costa, 2017; Adrjan, 2018) stressing the role of technological change as well as institutional forces (union coverage, level of bargaining, temporary jobs) that can influence the distribution of revenues between workers and the ownership;

The level of analysis

- Firm-level analysis: controlling for composition biases due to changes in the sectoral composition of the economy (Arpaia et al., 2009; Serres et al., 2001; Young, 2010; Elsby et al., 2013) or, by changes in the composition of firms rather than by within-firm changes in labour shares (Siegenthaler and Stucki, 2014);
- Autor et al. (2017) underline that the reallocation between firms is a central factor in the fall of the labour share instead of a within-firm phenomenon;
- At the country level, several measurement issues need to be addressed such as accounting for the contribution of intangibles to income or the imputation of labour and capital income earned by entrepreneurs, unincorporated business, self-employment;
- Adequate time span since factors shaping labour changes occur in the medium-long term and should be distinguished by short-term business cycle effects (Siegenthaler and Stucki, 2014);

The level of analysis

- More recently, **level of local labour market** on the basis of the idea that the effects of technology adoption on labour at the plant or firm level might be offset at the industry or within local labour markets (Ciarli et al., 2017).
- Initial industrial specialization and composition of skills in routinised and non-routinised jobs affect from the one hand the rate of adoption of technologies (Autor and Dorn, 2013; Goos et al., 2014) and, on the other hand, can influence the **bargain power of workers** (Guellec and Paunov, 2017).
- As Adrjan (2018) → local labour market with a greater proportion of groups that might be expected to have lower bargaining power in the labour market are associated with a lower labour share → firms can take advantage of weaker attachment to the labour force of these workers less able to influence rent-sharing policies.

The determinants of labour share: the role of technical change

- 1 Neoclassical framework, technological change and its impact on prices of capital relative to labour which can push firms to substitute capital for labour:
 - Change in relative capital price affect factor shares when the capital-labour elasticity is greater than one (Karabarbounis and Neiman, 2013; Bentolila and Saint-Paul (2003) → if capital and labour are substitutes, a higher capital intensity reduces the labour share; if capital and labour are complements, capital can even increases the labour share;
 - Capital-labour elasticity of substitution greater than unity does not find support in the empirical literature (Chirinki, 2008; Lawrence, 2015; Oberfield and Raval, 2014; Antras, 2004; Hamermesh, 1990);

The determinants of labour share: the role of technical change

- 1 Neo-Schumpeterian approach, increase firms' market share and market power through the introduction of digital innovation → reduction in labour share:
 - Pianta and Tancioni (2008) technical change, product and process innovation on wages and profits [▶ Other studies](#)
 - Guellec and Paunov (2017) relationship between digital innovation, market structures and the distribution of income [▶ Other studies](#)
 - Barkai (2016) detects a negative relationship between labour share and markups confirming the link between labour share and rent sharing;
 - Autor et al. (2017) show for US and other developed countries that the decline in labour share is stronger in those industries with stronger market concentration associated to more technology-intensive industries;

Other studies

- In **Pianta and Tancioni (2008)** profits are driven by the ‘Schumpeterian’ effects of new products; wages pushed upwards by new products, in highly innovative sectors, whereas process innovation drive them downward in low-tech industries.
- **Guellec and Paunov (2017)** → new digital innovation – allowing for economies of scale and low costs of innovation – increases creative destruction and high market rents for investors and top managers, but they reduce wages.
- “Winner-take-all market” structures affect the distribution of income facilitating higher market concentration and higher market rents → labour share reduction;

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The determinants of labour share: the role of globalisation

- In high-income countries a negative relationship between the intensification of competition and the entry of labour-abundant countries having a wage-compressing effect on workers' remuneration (ILO, 2008; IMF, 2007);
- Redistribution from labour to capital occurring through offshoring (Epstein and Burke, 2001);
- Bogliacino et al. (2017) identify the impact of demand, innovation and offshoring on capital and labour remuneration detecting a negative relationship between offshoring and low-skilled workers' remuneration;
- Guerriero and Sen (2012) find a positive effect of international trade on labour share;
- Autor et al. (2017) underline that sectors not exposed to import have also recorded a reduction in labour share as traded sectors, therefore the role of international trade on labor remuneration needs to be qualified in terms of skills;

The determinants of labour share: the role of institutional factors

- Decline in union density is linked to weakening of workers' bargaining power negatively affecting workers' ability to negotiate a larger share of labour compensation (OECD, 2015);
- Damiani et al. (2018) liberalization of temporary contracts and labour share in some EU countries → strong negative relationship between legislative innovations that favour the extensive use of temporary contracts and labour share;
- OECD (2011) and Bogliacino and Maestri (2014), institutional reforms in the labour markets appear to be responsible for most of the change in wage inequality and factors remuneration;

Local labour markets and the role of agglomeration

The geographical dimension allows to account for agglomeration externalities deriving from firms' localization in specific areas.

Two channels through which externalities can affect labour share:

- 1 Localization (or specialization) externalities:** firms located in highly specialized areas benefit from the local presence of other firms belonging to the same industry (Marshall, 1890; Combes, 2000; Rosenthal and Strange, 2004; Beaudry and Schiffauerova, 2009; Basile *et al.*, 2016).
- 2 Human capital spillover:** aggregate human capital has a positive effect on firm's productivity (Marshall, 1890; Moretti, 2004)
- 3 Institutional factors**

Data

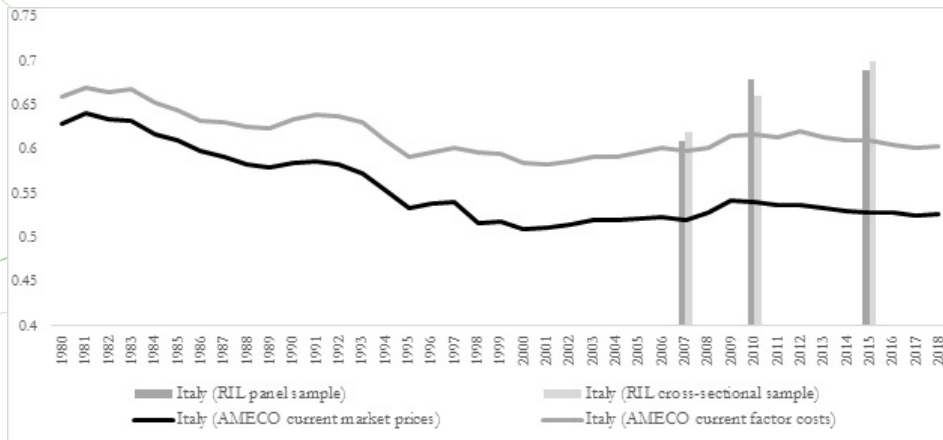
- *Rilevazione Longitudinale su Imprese e Lavoro* - INAPP for 2007, 2010 and 2015 on a representative sample of Italian firms;
- Each waves of the survey interviews around 30.000 firms operating in non-agricultural private sector;
- A subsample of the included firms (around 30%) are followed over time, making the RIL dataset partially panel over the period under study;
- Merge RIL data with AIDA archive provided by the Bureau Van Dijk (balance sheets of almost all the Italian corporations operating in the private sector, except for the agricultural and financial industries);

Data

- 1 Labour-share** is measured for each firm by the ratio of gross remuneration of employees to total value added
 - Total value added calculated as the difference between sales and costs plus the change in inventories
- 2 RSH** is computed at province level merging *Labour Force Survey* (RCFL-Istat) with the *Occupational Information Network (O*NET)* for each 3-digit occupation in RCFL-Istat dataset (ISCO-08/ISCO-88);
 - RTI transformed into a dummy variable that assumes 1 if the routine intensity of each occupation is higher than the value corresponding to that of the 66th percentile of the weighted distribution of RTI, and equals to 0 otherwise;
 - From RTI, we compute the RSH measure equal to the fraction of provincial employment (people declaring to work in that province including self-employment) that falls in *routine-task intensive* occupations;
 - The final sample used in the empirical analysis is of approximately 9.000 panel firms for 2007, 2010 and 2015.

The declining trend of labour share

Figure: Trend in labour share (RIL and AMECO)



Descriptive statistics. Longitudinal sample.

	2007		2010		2015	
	Mean	Std dev	Mean	Std dev	Mean	Std dev
Balance sheets variable						
labour share	0.612	0.241	0.68	0.319	0.695	0.353
total value added	1194242	6713159	971828.6	5361756	654917.4	4739364
total labor cost	677721.6	3399844	554898.6	2859773	382292.1	2859139
ln (value added per empl)	10.796	0.682	10.730	0.627	10.514	0.869
ln (labor cost per empl)	10.256	0.475	10.290	0.525	10.158	0.877
ln (n of employees)	1.907	1.200	1.676	1.184	1.489	1.078
ln (physical capitale per empl)	9.853	1.547	9.944	1.731	9.876	1.882
Technology variables						
RSH	0.293	0.028	0.342	0.044	0.336	0.049
process innov	0.342	0.475	0.24	0.427	0.219	0.414
product innov	0.531	0.499	0.35	0.477	0.286	0.452
N of Obs	2,882		2,964		2,777	

Source: our calculations on RIL-INAPP data and Labour force Survey. RIL Sampling weights applied

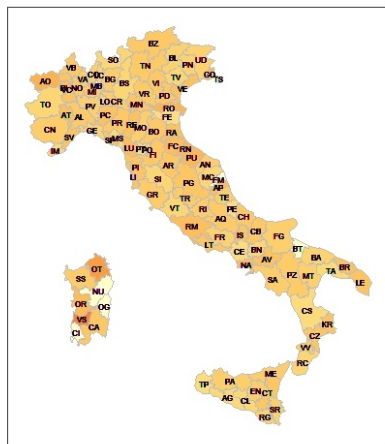
Descriptive statistics. Cross sectional sample.

	2007		2010		2015	
	Mean	Std dev	Mean	Std dev	Mean	Std dev
Balance sheets variable						
labor share	0.623	0.281	0.667	0.341	0.709	0.354
value added	1306185	13800000	992856.9	22100000	1046927	14600000
labor cost	723407.6	6304041	601064.8	15500000	634684.3	10100000
ln (value added per empl)	10.689	0.846	10.678	0.811	10.518	0.931
ln (labor cost per empl)	10.204	0.607	10.210	0.645	10.146	0.893
ln (n of employees)	1.790	1.242	1.574	1.205	1.573	1.200
ln (physical capitale per empl)	9.715	1.674	9.740	1.933	9.515	2.106
Technology variables						
RSH	0.294	0.029	0.337	0.043	0.327	0.051
process innov	0.299	0.458	0.216	0.412	0.212	0.409
product innov	0.482	0.5	0.316	0.465	0.298	0.457
N of Obs	9,374		11,811		15,370	

Source: our calculations on RIL-INAPP data and Labour force Survey. RIL Sampling weights applied

Spatial distribution of RSH index

Figure: Share of routinary occupations in 2007 e 2014



RSH 2007
0.00 0.25 0.50 0.75 1.00



RSH 2014
0.00 0.25 0.50 0.75 1.00

Econometric analysis

$$\text{LabourShare}_{it} = \alpha + \beta \text{RSH}_{pt} + \theta \text{INNOV}_{it} + \omega \text{INNOV}_{it} * \text{RSH}_{pt} + \gamma \log(k)_{it} + \delta F_{it} + \phi W_{pt} + \eta_i + \epsilon_{it}$$

- where LabourShare_{it} is measured as the ratio of total labor costs to value added;
- i is the firm subscript and t is the time subscript for years 2007, 2010 and 2015;
- RSH_{pt} is the share of employees performing routinary tasks in the province p ;
- INNOV_{it} is a dummy for the introduction of process/product innovation;
- $\log(k)_{it}$ is the (log of) physical capital per employee;
- The vector F_{it} includes a wide set of firm level control variables for the workforce composition, industrial relations and productive characteristics;
- The vector W_{pt} is a vector of province level characteristics aimed at controlling other potential local confounding factor;
- The parameter η_i formalizes time-invariant firm-specific unobserved heterogeneity;
- ϵ_{it} is an idiosyncratic error term with finite variance.
- **Controls include:**
 - Firm level controls: employment composition (female, contractual arrangement, share of trained, net job turnover, executive, blue collar, white collar), mergers acquisitions, multinationals, second level bargaining, log of n of employees, year, sector of activity, nuts2-regions .
 - Province level productive characteristics: average incidence of product and process innovation, average incidence of mergers acquisitions, average incidence of firm level bargaining. Province level workforce characteristics: employment composition by education, age, contractual arrangements, gender, sector.

Econometric analysis

- Pooled OLS regression with robust and clustered standard errors;
- Controlling for firms' unobservable factors influencing both the dynamics of labour share and the local agglomeration of routinized tasks→ (within) fixed effect FE regressions;
- Some endogeneity problems might be related to no random selection of firms in local labor market;
- Short-panel (T=3) and key explanatory variables reflecting institutional and technological features (path dependency);
- We refrain from using instruments to identify the causal effect of the agglomeration of routinized task and address these selection issues through:
 - i) inclusion of a rich set of firm-level and province-level explanatory variables;
 - ii) controlling for firm-specific time invariant unobserved heterogeneity;
 - iii) performing separate regressions for the subsamples of firms operating in manufacturing sector and with different size.

Pooled OLS and fixed effect estimates

	Pooled OLS			Fixed effect		
	[1]	[2]	[3]	[4]	[5]	[6]
RSH	0.123*	0.152**	0.192**	0.155**	0.143**	0.218**
	[0.072]	[0.072]	[0.084]	[0.070]	[0.071]	[0.091]
process innovation	-0.028***	-0.027***	-0.027***	-0.019***	-0.018**	-0.019***
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
product innovation	0.003	0.003	0.003	0.003	0.003	0.003
	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
share of blue collar	0.078**	0.080**	0.080**	0.025	0.027	0.028
	[0.038]	[0.039]	[0.039]	[0.033]	[0.033]	[0.033]
share of white collar	0.03	0.032	0.031	0.02	0.022	0.024
	[0.040]	[0.040]	[0.040]	[0.031]	[0.031]	[0.031]
ln (n of employees)	0.012***	0.012***	0.012***	0.005	0.005	0.005
	[0.003]	[0.003]	[0.003]	[0.011]	[0.011]	[0.011]
ln (physical capital pc)	-0.045***	-0.045***	-0.045***	-0.023***	-0.023***	-0.022***
	[0.002]	[0.002]	[0.002]	[0.005]	[0.005]	[0.005]
year 2010	0.060***	0.052***	0.047***	0.057***	0.042***	0.029**
	[0.006]	[0.012]	[0.013]	[0.006]	[0.012]	[0.014]
year 2014	0.091***	0.084***	0.076***	0.090***	0.076***	0.051***
	[0.007]	[0.013]	[0.017]	[0.007]	[0.014]	[0.019]
firm level controls	Yes	Yes	Yes	Yes	Yes	Yes
province productive controls	No	Yes	Yes	No	Yes	Yes
province workforce controls	No	No	Yes	No	No	Yes
constant	1.009***	1.011***	0.978***	0.768***	0.790***	0.718***
	[0.058]	[0.064]	[0.076]	[0.108]	[0.113]	[0.121]
Obs	8232	8232	8232	8232	8232	8232
R2	0.132	0.133	0.133	0.076	0.078	0.079

Pooled OLS and fixed effect estimates

	Labour productivity		Labour cost	
	OLS	FE	OLS	FE
RSH	-0.393** [0.196]	-0.456** [0.195]	-0.057 [0.135]	-0.184 [0.122]
process innovation	0.042*** [0.015]	0.039*** [0.013]	0.002 [0.01]	0.012 [0.009]
product innovation	-0.015 [0.015]	0.003 [0.012]	-0.015 [0.011]	0.004 [0.01]
share of blue collar	-0.776*** [0.108]	-0.014 [0.092]	-0.700*** [0.101]	0.019 [0.083]
share of white collar	-0.355*** [0.112]	0.061 [0.09]	-0.357*** [0.104]	0.078 [0.078]
firm level controls	Yes	Yes	Yes	Yes
prov level productive controls	Yes	Yes	Yes	Yes
prov level workforce controls	Yes	Yes	Yes	Yes
constant	10.333*** [0.181]	11.416*** [0.266]	10.492*** [0.156]	11.110*** [0.172]
N of Obs	8250	8250	8309	8309
R2	0.894	0.254	0.942	0.416

The role of innovations

	Pooled OLS			Fixed effect		
	[1]	[2]	[3]	[4]	[5]	[6]
RSH	0.300*** [0.101]	0.279*** [0.106]	0.314*** [0.109]	0.324*** [0.108]	0.319*** [0.115]	0.351*** [0.118]
RSH * process innov	-0.257** [0.109]		-0.226* [0.124]	-0.255** [0.106]		-0.201* [0.117]
RSH* product innov		-0.18 [0.113]	-0.056 [0.129]		-0.209* [0.111]	-0.1 [0.123]
process innov	0.057 [0.036]	-0.027*** [0.007]	0.046 [0.040]	0.064* [0.035]	-0.019*** [0.007]	0.047 [0.039]
product innov	0.003 [0.007]	0.061* [0.037]	0.021 [0.042]	0.003 [0.007]	0.071* [0.037]	0.036 [0.041]
firm level controls	Yes	Yes	Yes	Yes	Yes	Yes
prov level productive controls	Yes	Yes	Yes	Yes	Yes	Yes
prov level workforce controls	Yes	Yes	Yes	Yes	Yes	Yes
constant	0.944*** [0.078]	0.950*** [0.078]	0.939*** [0.079]	0.687*** [0.122]	0.683*** [0.123]	0.676*** [0.123]
Obs	8232	8232	8232	8232	8232	8232
R2	0.133	0.133	0.133	0.079	0.079	0.08

Estimates by macrosector

	Manufacturing				No manufacturing			
	Pooled OLS		Fixed effect		Pooled OLS		Fixed effect	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
RSH	0.295**	0.452**	0.286*	0.536**	0.106	0.180	0.230**	0.240*
	[0.128]	[0.191]	[0.153]	[0.228]	[0.109]	[0.127]	[0.111]	[0.128]
RSH * process innov		-0.354*		-0.402**		-0.052		0.048
		[0.183]		[0.167]		[0.188]		[0.183]
RSH* product innov		0.083		-0.031		-0.154		-0.056
		[0.187]		[0.167]		[0.183]		[0.182]
process innov	-0.032***	0.086	-0.016	0.119**	-0.021**	-0.003	-0.024**	-0.039
	[0.009]	[0.061]	[0.010]	[0.057]	[0.01]	[0.059]	[0.010]	[0.059]
product innov	-0.012	-0.04	-0.013	-0.003	0.017*	0.066	0.010	0.028
	[0.010]	[0.062]	[0.010]	[0.057]	[0.010]	[0.058]	[0.009]	[0.058]
firm level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
prov level productive controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
prov level workforce controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
constant	0.738***	0.697***	0.599***	0.539***	1.171***	1.148***	0.908***	0.906***
	[0.112]	[0.119]	[0.160]	[0.171]	[0.099]	[0.101]	[0.151]	[0.151]
Obs	3990	3990	3990	3990	4242	4242	4242	4242
R2	0.134	0.135	0.084	0.087	0.148	0.148	0.093	0.093

Estimates by firm size

	Firms with less <20 employees				Firms with >= 20 employees			
	Pooled OLS		Fixed effect		Pooled OLS		Fixed effect	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
RSH	0.367*** [0.124]	0.486*** [0.153]	0.347** [0.144]	0.520*** [0.178]	-0.008 [0.106]	0.035 [0.141]	0.17 [0.109]	0.081 [0.131]
RSH * process innov		-0.350* [0.183]		-0.370* [0.191]		0.012 [0.160]		0.04 [0.146]
RSH* product innov		-0.015 [0.186]		-0.13 [0.190]		-0.082 [0.164]		0.111 [0.145]
process innov	-0.028*** [0.009]	0.086 [0.060]	-0.019* [0.011]	0.101 [0.063]	-0.028*** [0.009]	-0.032 [0.052]	-0.015 [0.009]	-0.028 [0.048]
product innov	0.008 [0.010]	0.013 [0.060]	0.003 [0.011]	0.045 [0.063]	-0.002 [0.009]	0.024 [0.053]	0.01 [0.009]	-0.027 [0.048]
firm level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
prov level productive controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
prov level workforce controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
constant	0.887*** [0.097]	0.850*** [0.101]	0.771*** [0.121]	0.723*** [0.125]	1.028*** [0.120]	1.015*** [0.122]	0.803*** [0.151]	0.834*** [0.155]
Obs	4570	4570	4570	4570	3662	3662	3662	3662
R2	0.145	0.146	0.079	0.081	0.162	0.162	0.101	0.102

Conclusions

- Declining trend of labour share and diffusion of technologies aimed to replace routinary jobs towards automation of production processes have motivated a new interest in analyzing the functional distribution of income in relation to technology and institutional changes;
- This paper contributes to the debate exploring for a representative sample of Italian firms the existence of a significant relationship between localization in a routinized local labour market, introduction of innovations and firm labour share;
- Measure of routinization of local labour markets (provinces) accounting for the share of employees in a routinary jobs (both cognitive and non-cognitive) and explore how this localization can affect firm labour share especially when firms introduce product and process innovations.

Conclusions

- In our understanding, the routinization of local labour market proxing a sort of specialization of provinces in routinary jobs can exert a **downward pressure on labour share due to the replaceability of workers employed in that areas**;
- This effect comes to light when firms introduce process innovations whose aim is to replace jobs instead of creating new positions through the introduction of product innovations.

Thank you!

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