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Labour productivity and wage dynamics:

the role of *within-firm* labour market segmentation in high-tech and low-tech firms

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Descriptive analysis

Empirical strategy

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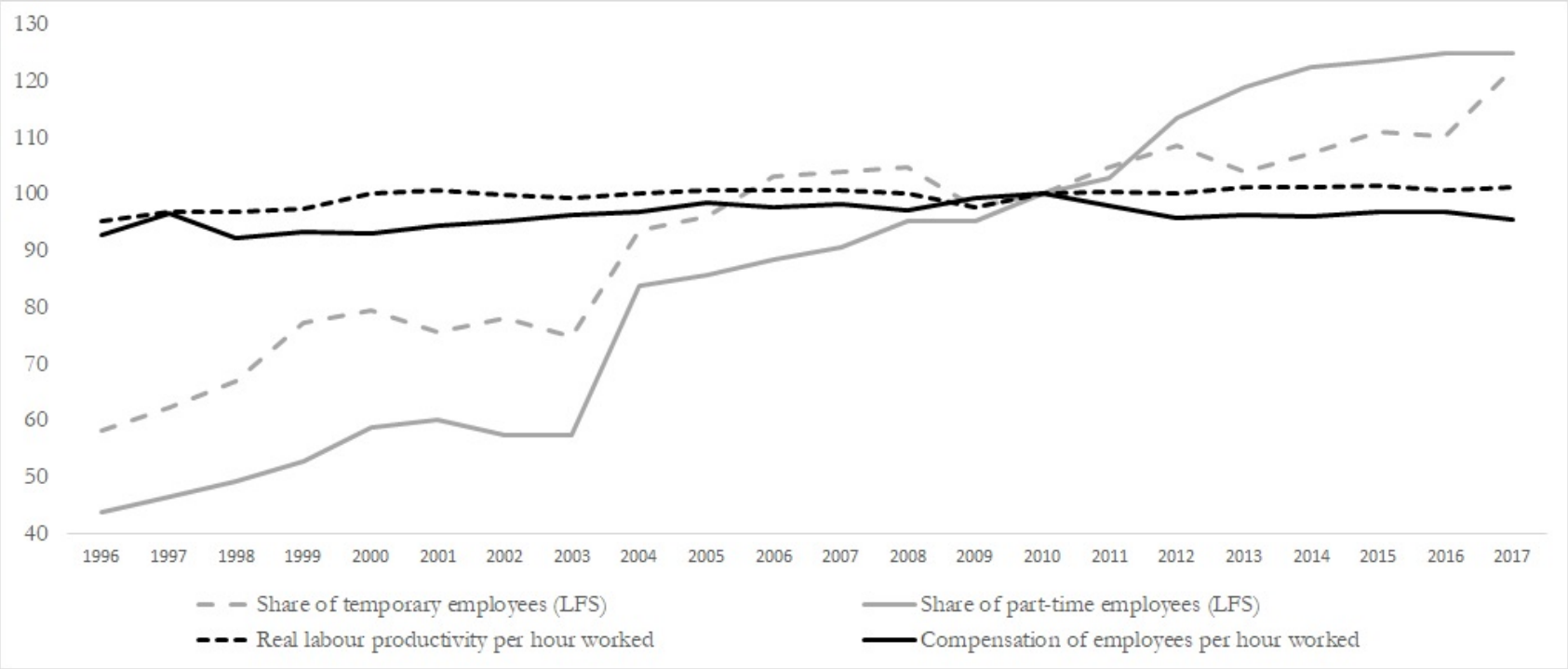
Motivation of the study

Figure: Temporary and part-time employment, labour productivity and labour compensation (Eurostat, 2010=100)



Two major trends

1. The diffusion of short-term and part-time work arrangements has increased inequalities of intensity of work (Bloise et al., 2018) and earnings (Blau e Kahn, 2009);
2. Flat labour productivity (Bugamelli et al. 2018) and higher wage dispersion (Bloise et al. 2018).

Motivation of the study

- Increasing fragmentation of production processes and work re-organization at the plant level;
- Labour market reforms opening to external (temporary employment) and internal (part-time) numerical flexibility;
- Temporary employment from 7.3% (2003) to 13.4% (2018) and part-time employment from 8.4% (2003) to 18.4% (2018);
- Increased *within-firm* labour market segmentation –>

  Dualism between workers with open-ended contracts and those in temporary employment depicting a pattern of internal (within firms) segmentation with the coexistence of workers covered by different contractual arrangements;

Conceptual background

- Segmented labour markets (Piore, 1975; Doeringer and Piore, 1971)
- *Internal (within-firm) labour market segmentation* is defined on the **dispersion of the intensity of work**:

  1. Intensity of work is **the number of days worked over the year by each employee within a firm**;
  2. Dispersion of intensity of work is **the dispersion (coefficient of variation) of the days worked by each employee within a firm over the year**;

  $\Rightarrow$

  Highly segmented firms are those where two clusters of workers coexist: a first cluster of workers showing high-intensity of work in the same firm over the year and a second cluster of workers registering fragmented work relationships – typically those covered by short-term and part-time contractual arrangements.

The research questions

1. R1: Is there a relationship between *within-firm* labour market segmentation and labour productivity and wage dynamics?

2. R2: How does this relationship change across technological groups?

   ⇒ Empirical evidence on the relationship between temporary employment and labour productivity (Cappellari et al., 2012; Boeri and Garibaldi, 2007; Lucidi and Kleinknecht, 2009) and wages (Stancanelli, 2002; Kahn, 2016; Bosio, 2014; Comi and Grasseni, 2012; etc.);

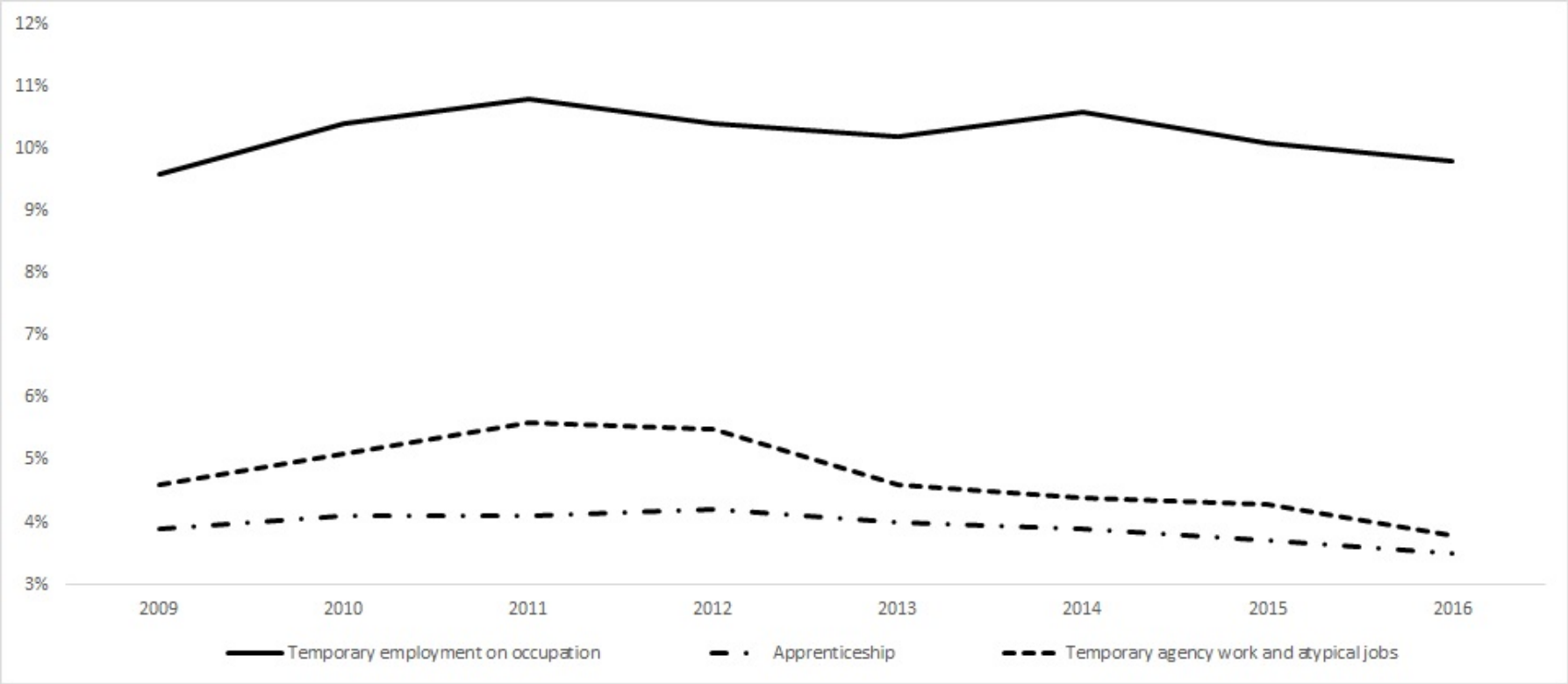
   ⇒ Few studies link internal labour market segmentation with firm performances making use of a *linked employer-employee database*

The linked employer-employee database

- Four sources of data:
  1. Italian administrative data on workers' careers (SISCO) - workers' flows over 2009-2017;
  2. Archive of Italian firms (ASIA);
  3. AIDA archive provided by Bureau Van Dijk containing detailed information on investments, capital, value added and labour costs of almost all the Italian corporations operating in the private sector, except for the agricultural and financial industries;
  4. Archive of Italian firms and their employees (ASIA-OCCUPAZIONE) in order to compute the entire stock of employees within a firm;
- The final dataset contains more than 25,000 Italian firms per year observed over 2009-2017 (firms with more than 5 employees) and the information concerning each employee within the firm (type of employment contract, age, education, gender, citizenship).

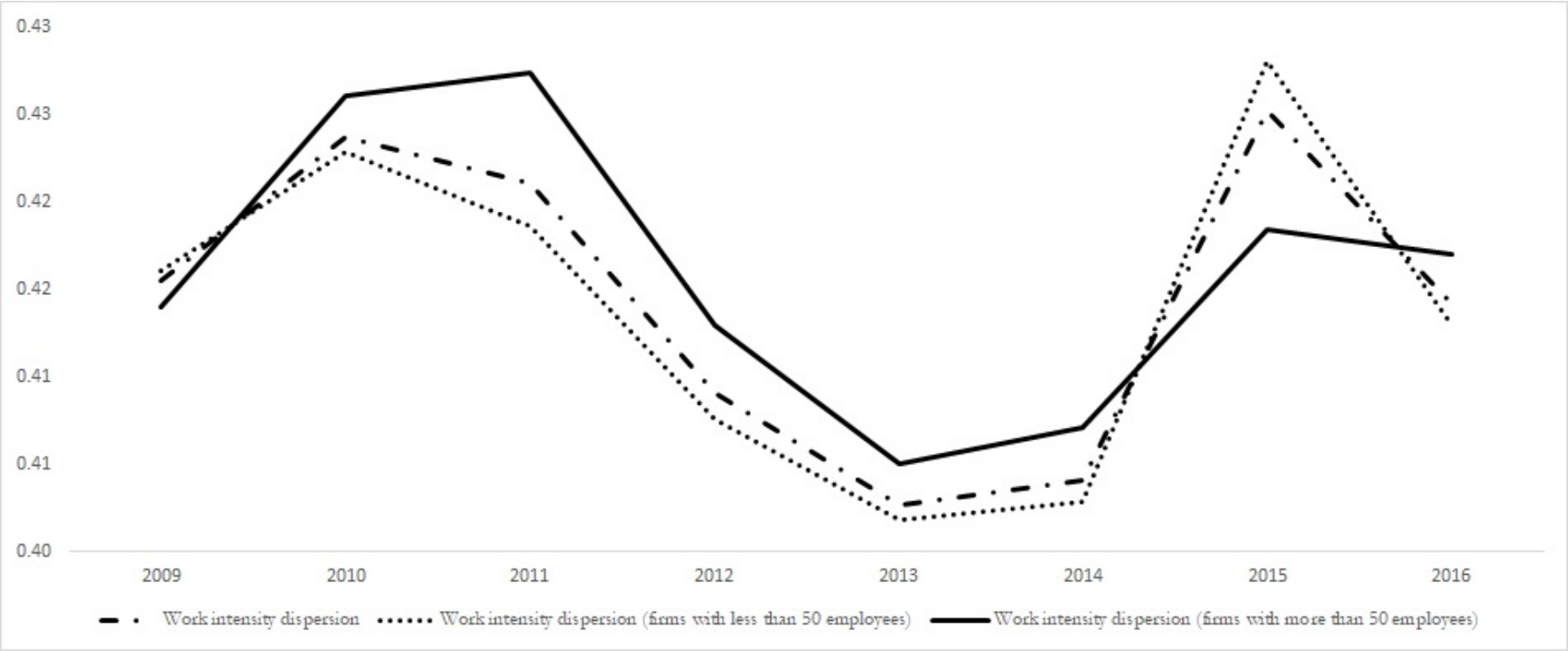
Trends in employment

Figure: Share of workers by contractual arrangement (data SISCO-AIDA-ASIA) (tempo determinato, parasubordinati, interinali, apprendistato)



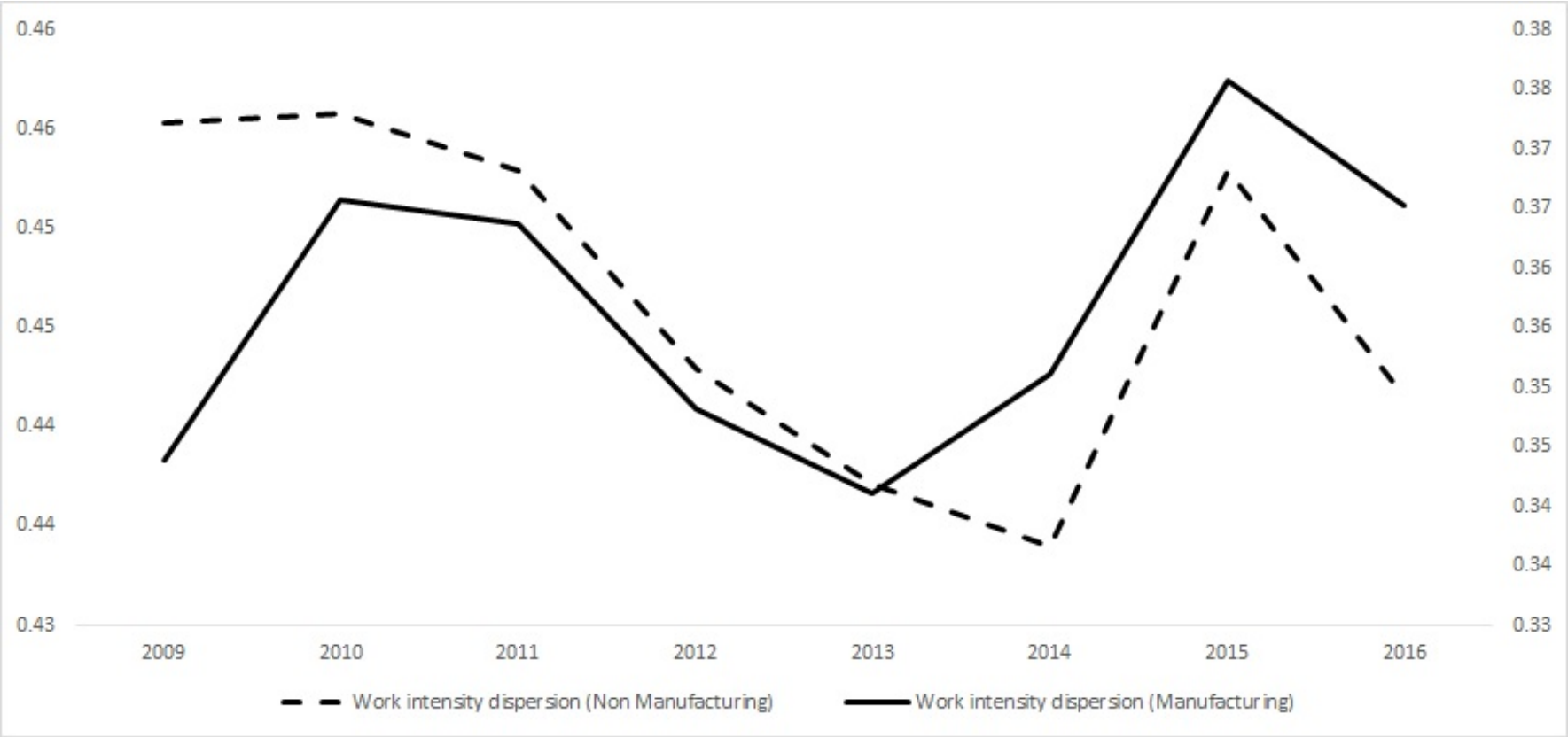
Trends in dispersion of working days

Figure: Dispersion of working days in Small and Medium-Large Firms (data SISCO-AIDA-ASIA)

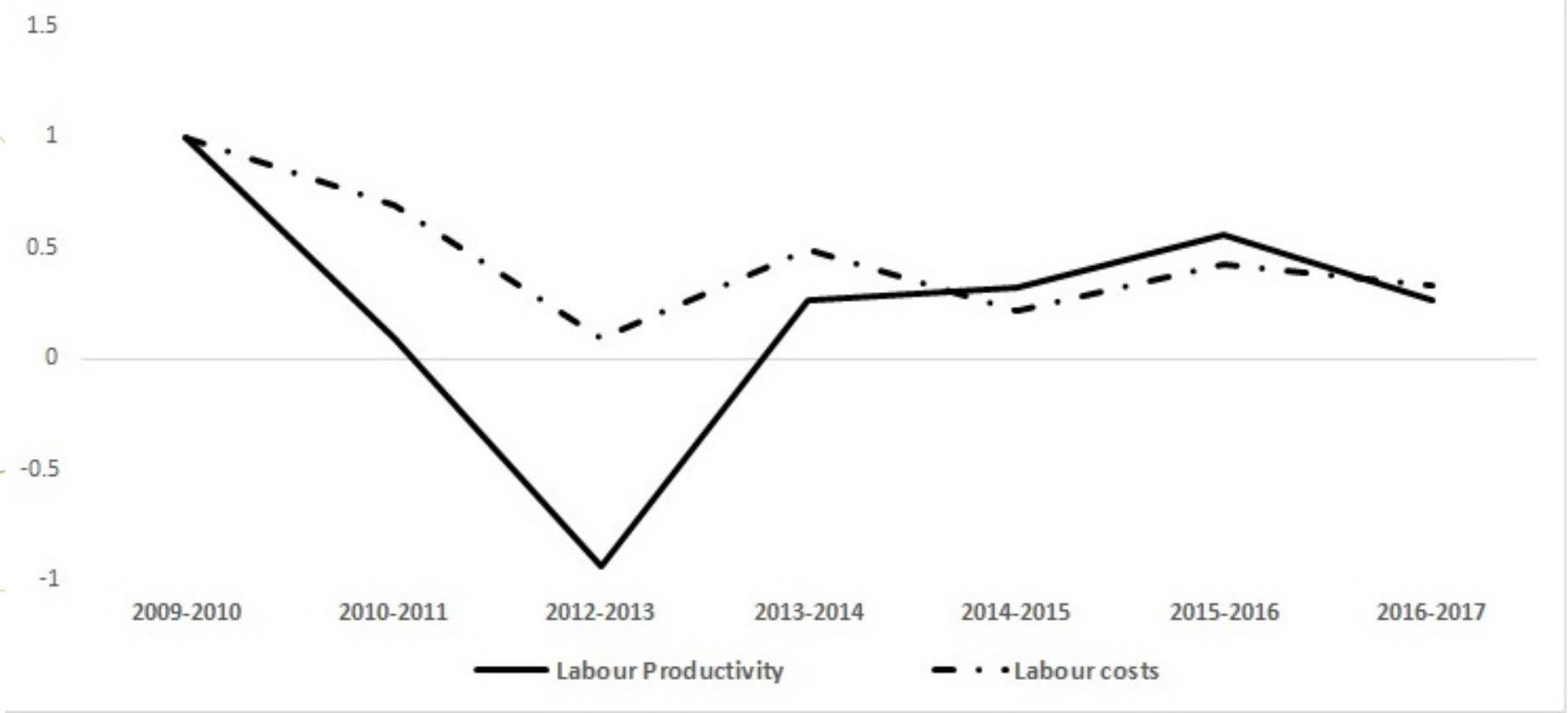


Trends in dispersion of working days

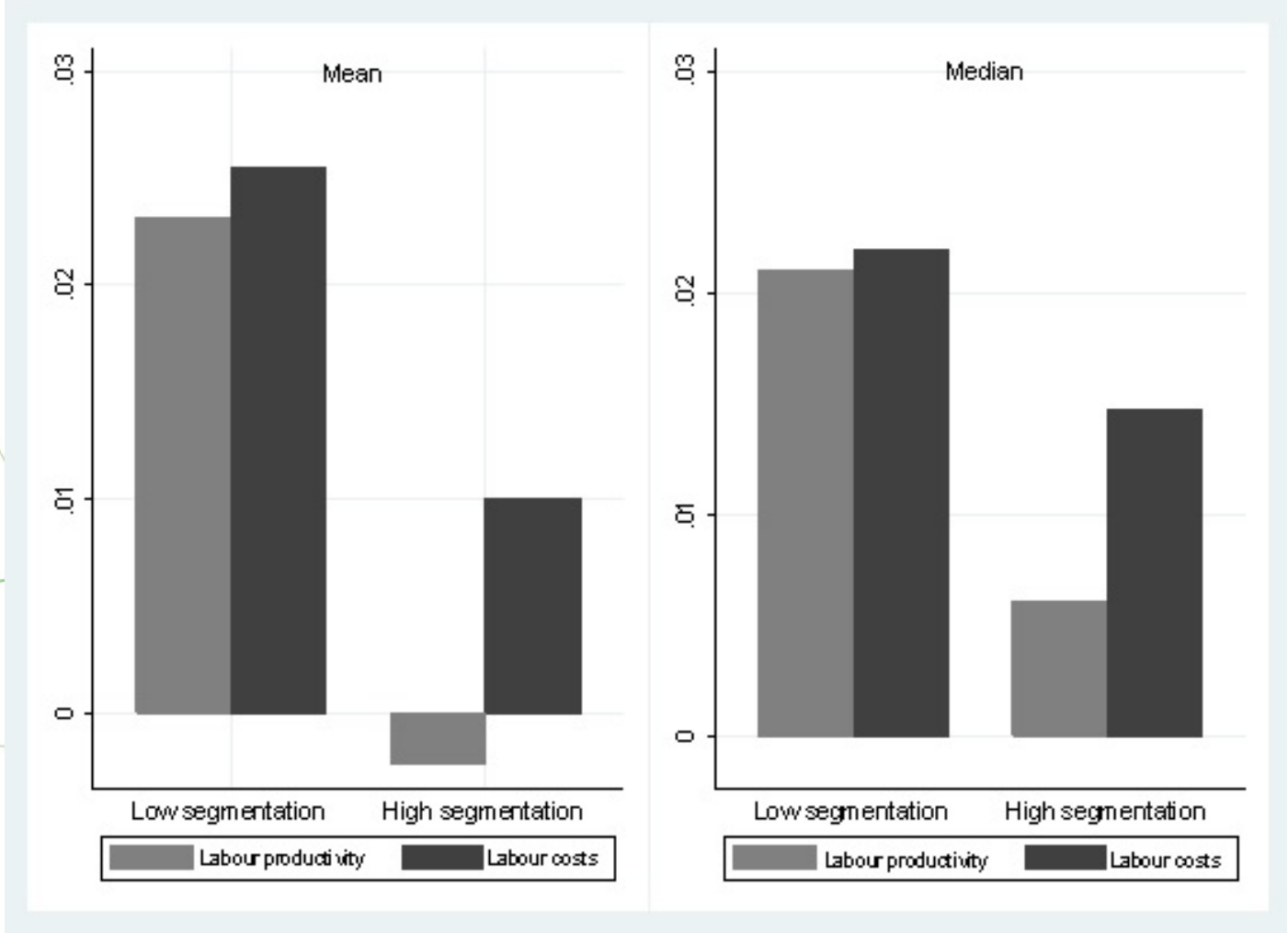
Figure: Dispersion of working days in Manufacturing and Non-Manufacturing Firms (data SISCO-AIDA-ASIA)



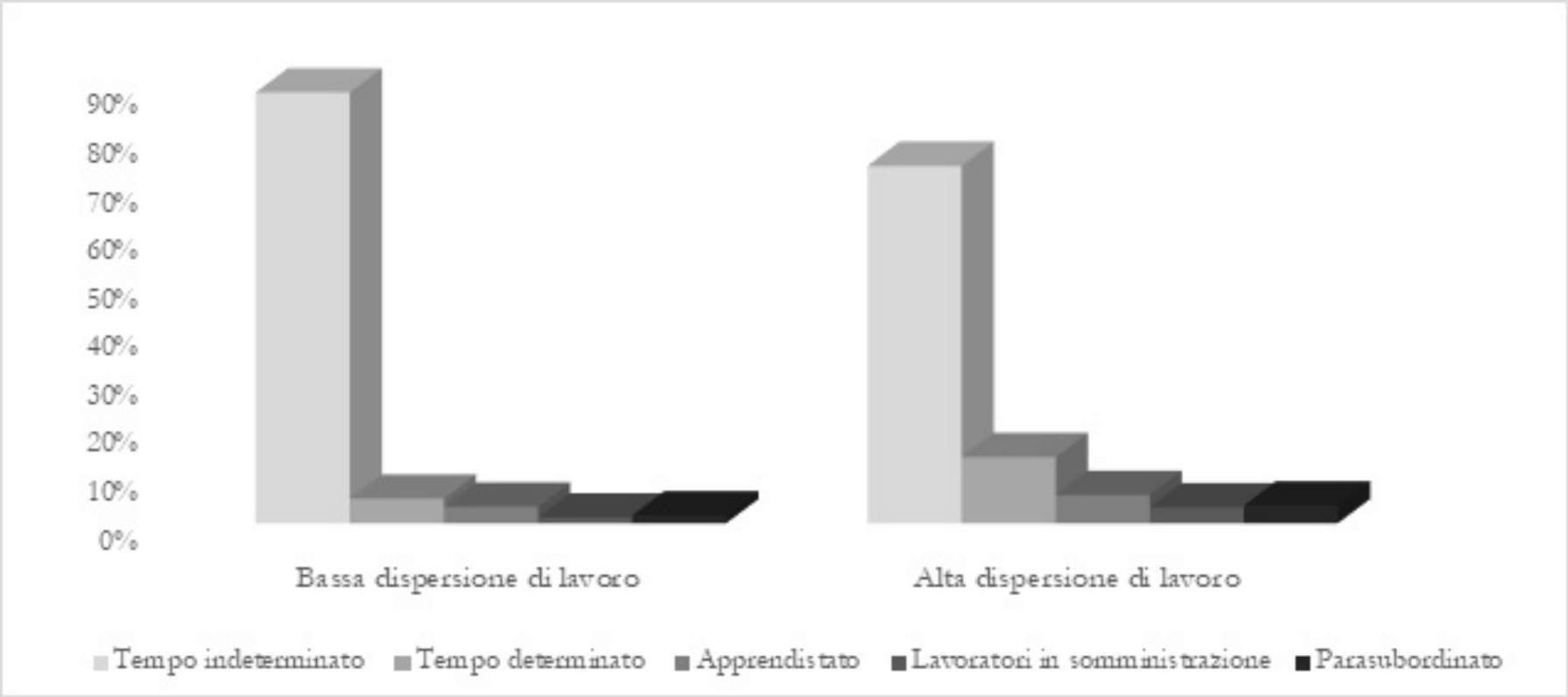
Trends in labour productivity and labour costs



Labour market segmentation and firms' dynamics



Labour market segmentation



Econometric analysis

$$\Delta LabourProd_{i,t} = \beta_0 + \beta_1 WorkDisp_{i,t-1} + \beta_2 X_{i,t-1} + \gamma Z_j + \delta Y_r + \lambda t + \epsilon_{i,t}$$

$$\Delta LabourCosts_{i,t} = \beta_0 + \beta_1 WorkDisp_{i,t-1} + \beta_2 X_{i,t-1} + \gamma Z_j + \delta Y_r + \lambda t + \epsilon_{i,t}$$

- $\Delta LabourProd_{i,t}$ and $\Delta LabourCosts_{i,t}$ are annual changes in valued added per employee and labour cost per employee (first log differences);
- i is the firm subscript and t is the time subscript for years 2009-2016;
- $WorkDisp_{i,t-1}$ is the coefficient of variation of work intensity (number of days worked by employee in each firm over year)

$$\sigma^* = \frac{\sigma}{\mu}$$

- $X_{i,t-1}$ are time-variant firm level controls (share of women, share of employees per age classes, citizenship, share of employees per work arrangement, log of physical capital per hours worked, firm size);
- Z_j are sectoral fixed effects;
- Y_r are regional fixed effects;
- λt are time dummies;
- $\epsilon_{i,t}$ is an error term capturing the idiosyncratic component with

$$\mathbf{E}(\epsilon_i) = 0$$

$$\mathbf{Var}(\epsilon_i) = \sigma^2$$

- Robust standard errors (firm level);
- Pooled OLS; Panel fixed effects (FE) and IV-GMM;
- Robustness checks: p90/p10 for a subsample of firms having at least 10 employees.

Results - Pooled OLS

Table: Pooled OLS: Changes in Labour Productivity and Wages

	Δ Labour productivity		Δ wages	
	[1]	[2]	[3]	[4]
Dispersion of working days	-0.068***	-0.064***	-0.049***	-0.050***
	[0.006]	[0.006]	[0.004]	[0.005]
Share of employees with temporary contracts		-0.018**		-0.002
		[0.007]		[0.005]
Other controls	Yes	Yes	Yes	Yes
Constant	0.344***	0.345***	0.086***	0.088***
	[0.008]	[0.008]	[0.006]	[0.005]
N of Obs	126078	126005	128335	128278
R2	0.012	0.012	0.01	0.010

Source: data SISCO-AIDA-ASIA [2009-2016]. Note: Other controls include: (log of) physical capital per hours worked, firm size, share of women, share of Eu and non-EU workers, temporal fixed effects, sectoral fixed effects (ateco 2 digit), regions NUTS 2. Robust Standard Errors (clustered at the firm level) in brackets. *** p<0.01, ** p<0.05, * p<0.1

Results - Fixed Effects

Table: Fixed Effects: Changes in Labour Productivity and Wages

	Δ Labour Productivity		Δ wage	
	[1]	[2]	[3]	[4]
Dispersion of working days	-0.161***	-0.161***	-0.096***	-0.098***
	[0.013]	[0.013]	[0.009]	[0.009]
Share of employees with temporary contracts		-0.049**		-0.009
		[0.019		[0.012
Other controls	Yes	Yes	Yes	Yes
Constant	-0.126	-0.127	0.08	0.087
	[0.117]	[0.117]	[0.056]	[0.056]
N of Obs	126078	126005	128335	128278
R2	0.015	0.015	0.015	0.015

Source: data SISCO-AIDA-ASIA [2009-2016]. Note: Other controls include: (log of) physical capital per hours worked, firm size, share of women, share of Eu and non-EU workers. Robust Standard Errors (clustered at the firm level) in brackets. *** p<0.01, ** p<0.05, * p<0.1

Results - IV-GMM

Table: 2GMM-IV. Second stage estimates: Changes in Labour Productivity and Wages. Dispersion of working days and (log of) physical capital per hours worked instrumented with two lags.

	Δ Labour Productivity		Δ wage	
	[1]	[2]	[3]	[4]
Dispersion of working days	-0.030**	-0.030**	-0.026***	-0.025***
	[0.012]	[0.013]	[0.007]	[0.008]
Share of employees with temporary contracts		0.001		-0.003
		[0.011]		[0.006]
Other controls	Yes	Yes	Yes	Yes
Constant	0.348	0.349	0.04	0.04
	[0.231]	[0.231]	[0.049]	[0.049]
N of Obs	83460	83431	85065	85041
R2	0.01	0.01	0.007	0.007

Source: data SISCO-AIDA-ASIA [2009-2016]. Note: Other controls include: (log of) physical capital per hours worked, firm size, share of women, share of Eu and non-EU workers, temporal fixed effects, sectoral fixed effects (ateco 2 digit), regions NUTS 2. Robust Standard Errors (clustered at the firm level) in brackets. *** p<0.01, ** p<0.05, * p<0.1

Results by high-tech and low-tech firms

Table: Fixed effect estimates. Annual changes in labour productivity by OECD classifications

	Δ Labour Productivity			
	High and Med-high tech	Med-Low and Low tech	Knowledge Intensive Services	Less Knowledge Intensive Services
	[1]	[2]	[3]	[4]
Dispersion of working days	-0.098**	-0.107***	-0.250***	-0.191***
	[0.046]	[0.018]	[0.036]	[0.023]
Share of temporary employees	-0.251***	-0.134***	0.009	0.044
	[0.090]	[0.030]	[0.050]	[0.032]
Share of women	0.313***	0.142***	0.141**	0.035
	[0.098]	[0.054]	[0.059]	[0.044]
other controls	Yes	Yes	Yes	Yes
constant	-0.328**	0.113	-1.369***	-0.227*
	[0.151]	[0.117]	[0.342]	[0.129]
N of Obs	12970	56395	20843	34135
R2	0.03	0.014	0.018	0.019

Source: SISCO-AIDA-ASIA data [2009-2016]. Notes: Other controls include: (log of) physical capital per hours worked, (log of) total hours worked, share of non-EU and EU workers. Robust standard errors (by two-digit atheistic sector and enterprise) in brackets. *** p<0.01, ** p<0.05, * p<0.1

Results by high-tech and low-tech firms

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Table: Fixed effect estimates. Annual changes in wages by OECD classifications

Fixed effect estimates. Annual changes in wages by OECD classifications

	Δ Wages			
	High and Med-high tech	Med-Low and Low tech	Knowledge Intensive Services	Less Knowledge Intensive Services
	[1]	[2]	[3]	[4]
Dispersion of working days	-0.098***	-0.061***	-0.155***	-0.121***
	[0.024]	[0.012]	[0.026]	[0.018]
Share of temporary employees	-0.024	-0.055***	0.017	0.040*
	[0.045]	[0.018]	[0.037]	[0.021]
Share of women	0.126**	0.082***	0.103***	0.080**
	[0.056]	[0.030]	[0.039]	[0.034]
other controls	Yes	Yes	Yes	Yes
constant	0.115	0.122*	-0.014	-0.007
	[0.082]	[0.064]	[0.172]	[0.104]
Obs	13174	57765	21027	34569
Adj. R-Squ e	0.032	0.013	0.026	0.022

Source: SISCO-AIDA-ASIA data [2009-2016]. Notes: Other controls include: (log of) physical capital per hours worked, (log of) total hours worked, share of non-EU and EU workers, fixed time effects, two-digit atheistic sector of activity, NUTS 2 region. Robust standard errors (by two-digit atheistic sector and enterprise) in brackets. *** p<0.01, ** p<0.05, * p<0.1

Interpretations and Conclusions

- Highly internal segmented labour markets are negatively associated to labour productivity and wage growth;
- Highly internal segmented labour markets are characterized by weaker *tacit knowledge accumulation* mechanisms (Dosi et al., 2018);
- Highly internal segmented labour markets are characterized by lower investments in on-the-job human capital (Lotti e Viviano, 2012; Ricci e Waldmann, 2015; Ricci, 2018)
- In highly segmented labour markets workers have lower incentives to invest in specific human capital because the employment relationship does not last (Wasmer, 2006);
- Workers do not cooperate (Osterman, 2011) –> weakening of the knowledge-base of the firm

Conclusions

- The claim for numerical flexibility (by firms) grounds on a narrative of major competitive pressures from international labour markets and ”opportunities” to adapt work organization to structural changes related to the diffusion of new technologies as well as digitization;
- Highly internal segmented labour markets are also associated to detrimental dynamics of labour productivity and wages;
- Policy implications:
  ⇒ Labour market reforms increasing flexibility – spread of atypical and part-time jobs - risk eroding margins of competitiveness (labour productivity dynamics) and wages, if not associated to public policy interventions that favour investment choices in innovation and human capital re-orienting the cost competitiveness business model pursued by Italian companies instead of searching for ”High-Road” strategies (Osterman, 2018).

CREDITS

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