



TECNOLOGIE IA, IMPRESE E DOMANDA DI LAVORO

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66th Annual Conference - Italian Economic Association
University of Naples Parthenope

24 October 2025



AI, PRODUCTIVITY, AND LABOR MARKET DYNAMICS



- The academic and institutional **debate** increasingly focuses on the **diffusion of Artificial Intelligence (AI) technologies** and **their implications** for labor markets and socio-economic dynamics.
- **AI systems can replicate** cognitive human functions (learning, reasoning, interacting) and can **support or replace** decision-making across economic and production processes
- Adoption of AI may:
 - **Boost productivity and innovation** (Brynjolfsson et al. 2021)
 - **Create new jobs and foster growth** (Cockburn et al. 2019; Noy and Zhang 2023)
 - **Displace workers**, altering existing production structures and increasing inequality (Acemoglu and Restrepo 2018)
- Little is known about firms' **AI investment decisions**, their **diffusion across occupations**, and **micro-level labor market impacts** (Alekseeva et al. 2021; Babina et al. 2024).



AI, Digitalization and Labor Market Evidence

- The fourth industrial revolution is reshaping firms and skill demand (Bessen, 2017; Acemoglu and Restrepo, 2020).
- AI can act as **complement** or **substitute** for human labor (Autor and Salomons, 2018).
- **Mixed evidence on employment effects:**
 - No major impact (Graetz and Michaels 2015).
 - Job losses in routine, low-skill tasks (Acemoglu and Restrepo 2020).
 - Job creation in tech and innovation sectors (Aghion et al., 2020; Babina et al., 2024).
- **Risk of labor market polarization:** gains for high-skilled, losses for low-skilled workers (Brynjolfsson and McAfee 2014).



Firm-Level Studies

- *AI Adoption and Firm Behavior*
 - **AI use still limited:** 6–9% of firms globally; about 6% in Italy (Zolas et al., 2020; Istat 2021; INAPP, 2024)
 - **Adoption higher in ICT sectors and large firms**
 - Driven by digital readiness, management quality, and organizational capabilities
- *AI, Innovation, and Employment:*
 - **Positive or neutral effects** depending on technology and skill mix (Babina et al. 2024; Caselli et al., 2024)
 - **Evidence remains fragmented and context-specific**



- **AIM:** To examine the **relationship between digitalization, investment in AI technologies, and firms' labor demand** using micro-level data from **RIL-Inapp** survey (*“Rilevazione Imprese e Lavoro”*)

Key Findings:

- **AI investment shows no significant correlation** on the share of **new hires** (*effective demand*).
- A **slight increase** in **job vacancies** (*potential demand*)—mainly among medium-large firms.

Main Contributions:

- Provides **microeconomic evidence** on the implication of AI investment for labor demand.
- Highlights the need for **policy frameworks** supporting upskilling and inclusive technological diffusion.



- ***Rilevazione su Imprese e Lavoro (RIL)*** survey: longitudinal component. A survey conducted by Inapp on a **representative sample (30,000)** of incorporated and partnership **firms** operating in the **private non-agricultural sector**
- Rich information on corporate governance and managerial practices; work organization and HR policies; workforce composition; industrial relations; investment decisions and competitive strategies
- We use **RIL-2018** for the digitalization processes started during 2015–2017, and **RIL-2022** for the adoption of AI technologies during 2019–2021
- **From RIL-2022:** Firms were asked *whether they invested in tangible/intangible assets or purchased services related to the following technologies:* (i) Internet of Things/Augmented Reality; (ii) 3D Printing; (iii) Robotics; (iv) Cloud computing and Big data; (v) Web applications/e-commerce tools; (vi) Cybersecurity; (vii) AI



Dependent Variables

- The share of newly hired employees over total workforce (***Domanda effettiva***)
- The share of firm's vacancies over the average employment (***Domanda potenziale***).
Alternative measure: the Eurostat's definition (number of job vacancies / (employees + job vacancies))

Independent Variables

- Adoption of AI technologies (2019–2021) and Introduction of other digital and Industry 4.0 technologies
- **Control variables:** firm size, internationalization, managerial skills, COVID-19 effects, organizational restructuring, etc.
- **Sample Characteristics:** Firms with ≥ 10 employees; Longitudinal balanced sample of about **7,300 firms** after data cleaning



DESCRIPTIVE STATISTICS



Labor demand by firm's size (average values)

	Share of new hires		Share of job vacancies		Share of job vacancies*	
	t=2021	t-1=2017	t=2022	t-1=2018	t=2022	t-1=2018
[10-49]	22.3%	17.6%	4.4%	2.1%	3.5%	1.8%
[50-249]	24.9%	18.2%	3.1%	1.5%	2.6%	1.3%
[250-)	21.9%	17.7%	3.5%	2.0%	3.0%	1.7%
Total	22.7%	17.7%	4.2%	2.0%	3.4%	1.7%

Investments in new technologies by firm's size (average values)

	AI	Big data	IoT and AR	Robotic
	t=2019-2021	t-1=2015-2017		
[10-49]	1.0%	5.9%	9.6%	4.7%
[50-249]	2.1%	13.7%	17.4%	12.6%
[250-)	10.6%	29.7%	39.9%	22.6%
Total	1.3%	7.4%	11.2%	6.1%

- We estimate the following regression equation:

$$Y_{it} = \alpha + \beta_1 AI_{it=2019-21} + \beta_2 Dig\ Tech_{i,t-1=2015-17} + \beta_3 M_{it-1} + \beta_4 Y_{it-1} + \varepsilon_{it}$$

- Y_{it} represents:
 - i) the share of workers hired with an employment contract during 2021 compared to the average number of employed people;
 - ii) the share between vacancies in 2022 and the average number of employed people;
 - iii) the share between vacancies in 2022 and the total number of job positions (Eurostat definition)
- AI : a dummy variable equal to 1 if the firm invested in AI technologies during 2019–2021, and 0 otherwise.
- $Dig\ Tech_{i,t-1=2015-17}$: A vector of digital technologies adopted in 2015–2017, including three distinct dummies for prior adoption of Information technologies (Big Data, Internet of Things), and Production technologies (Robotics)



$$Y_{it} = \alpha + \beta_1 AI_{it=2019-21} + \beta_2 Dig\ Tech_{i,t-1=2015-17} + \beta_3 M_{it-1} + \beta_4 Y_{it-1} + \varepsilon_{it}$$

- M_{it-1} : vector of control variables (managerial, workforce composition, and production characteristics)
- Y_{it-1} : The share of hires and vacancies in past periods controls for: **unobserved heterogeneity linked to pre-existing dynamics in innovation capacity and internal labor markets** (e.g., a firm's latent propensity to innovate or hire skilled workers).
- ε_i denotes the idiosyncratic error term, assumed to have zero mean and finite variance
- **Both Ordinary Least Squares (OLS) and Propensity Score Matching (PSM)** (Rosenbaum and Rubin 1983) estimation to further reduce potential bias in OLS estimates



MAIN RESULTS – OLS ESTIMATES




	Share of new hires			Share of job vacancies		
	[1]	[2]	[3]	[4]	[5]	[6]
IA₂₀₁₉₋₂₁	0.015	0.014	0.014	0.010**	0.009**	0.007*
	(0.019)	(0.019)	(0.016)	(0.004)	(0.004)	(0.004)
Big Data₂₀₁₅₋₁₇		0.020	0.012		0.004*	0.003
		(0.013)	(0.011)		(0.002)	(0.002)
IoT e AR₂₀₁₅₋₁₇		0.001	-0.000		-0.000	-0.001
		(0.011)	(0.009)		(0.002)	(0.002)
Robotics₂₀₁₅₋₁₇		-0.017*	-0.007		0.001	0.002
		(0.009)	(0.008)		(0.002)	(0.002)
Share of hirings_{t-1}			0.504***			
			(0.035)			
Share of vacancies_{t-1}						0.259***
						(0.042)
Other controls	Sì	Sì	Sì	Sì	Sì	Sì
Costant	0.235***	0.236***	0.140***	0.082***	0.083***	0.070***
	(0.045)	(0.045)	(0.041)	(0.011)	(0.011)	(0.011)
N of Obs.	7,343	7,343	7,343	7,343	7,343	7,343
R2	0.185	0.185	0.353	0.051	0.051	0.078

MAIN RESULTS – PSM ESTIMATES



	Share of new hires		Share of job vacancies	
	[1]	[2]	[3]	[4]
IA₂₀₁₉₋₂₁	0.006	0.016	0.012**	0.010*
	(0.023)	(0.020)	(0.005)	(0.006)
Big Data₂₀₅₋₁₇	-0.013	-0.002	0.015**	0.003
	(0.034)	(0.026)	(0.008)	(0.009)
IoT e AR₂₀₁₅₋₁₇	-0.062	-0.047	-0.013	-0.016**
	(0.040)	(0.029)	(0.008)	(0.007)
Robotics₂₀₁₅₋₁₇	0.017	0.018	0.006	0.005
	(0.027)	(0.023)	(0.007)	(0.007)
Share of hirings_{t-1}		0.480***		
		(0.141)		
Share of vacancies_{t-1}				0.195**
				(0.080)
Other controls	Si	Si	Si	Si
Costant	0.181	-0.034	0.091*	0.001
	(0.211)	(0.192)	(0.046)	(0.040)
N of Obs.	468	468	464	464
R2	0.113	0.366	0.090	0.114

- AI investment does not affect future hiring rates, even when controlling for prior technology adoption and potential reverse causality.
- However, AI adoption is positively associated with the share of job vacancies, with effects between +0.7% and +1%, depending on the specification.
-  These effects suggest that AI diffusion stimulates the search for new professional profiles at least in the short run (see Acemoglu & Restrepo, 2019).
- PSM confirms OLS findings: AI investment is positively and significantly related to demand for new employees (+1.2% / +1%), but not correlated with the share of actual new hires
- Using alternative measures of labor demand (vacancy rate over total positions): AI adoption increases the vacancy rate by +0.6% to +0.8%.
- The **positive AI–labor demand link** appears to be **driven by larger firms**, reflecting the **structural dualism** of the Italian production system.



KEY CONCLUSIONS



- **AI adoption** remains **limited among Italian firms**: only about 1% invested in AI (2019–2021). Higher diffusion of complementary digital technologies: Big Data (7%), IoT (11%), Robotics (6%).
- **AI investment does not significantly affect hirings**. When combined with advanced digital technologies, it is associated with a **higher share of job vacancies (+1%)**.
- These findings suggest that **AI stimulates latent labor demand** rather than expanding total employment.
- **The employment impact of AI depends on its integration within broader digital ecosystems** (e.g., Cloud, IoT, Big Data analytics), rather than on stand-alone AI applications.



POLICY IMPLICATIONS

- Promote **complementary digitalization strategies** that enhance firms' capacity to absorb and integrate AI.
- Support **skill upgrading and re-skilling programs** to align workers with AI-complementary roles.
- **Encourage organizational and managerial innovation** to fully exploit productivity and employment potential.

FUTURE RESEARCH

- Evaluate the net employment effects of widespread AI adoption — balancing job creation and displacement.
- Investigate impacts on wages, firm dynamics, and inequality in the medium term.





THANKS FOR YOUR ATTENTION



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