



# ARTIFICIAL INTELLIGENCE AND WAGES ACROSS THE ITALIAN REGIONS

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- **Profound transformation of labor markets** due to **Artificial Intelligence (AI)**
- **AI's pervasive application in many areas**, ranging from automation and machine learning to robotics and natural language processing, is ushering in a new era of productivity and innovation
- **AI and the challenges for labour markets:** in terms of employment, wages, job displacement, and skills development
- The **relationship** between **occupational exposure to Artificial Intelligence (AI)** and **wages** has become **increasingly important**, particularly when considering the **geographical dimensions**
- **Theoretical debates:**
  - ✓ **Optimistic:** Enhanced productivity, new job creation and increase wages (Acemoglu and Restrepo 2018; Brynjolfsson and McAfee 2014)
  - ✓ **Pessimistic:** Job displacement and increased inequality (Autor et al. 2003; Benzell et al. 2015)



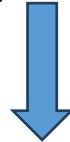
# KEY EMPIRICAL LITERATURE



- **Mixed Evidence:** AI can be a **complement** or a **substitute** for labour (Autor and Salomons 2018; Bessen 2017).
- **Job Displacement:** Jobs involving manual or cognitive routine tasks are at high risk of automation. Displacement effects particularly relevant in sectors like manufacturing, retail, and transport, potentially leading to substantial job losses and disproportionately affecting low-skill workers (Frey and Osborne 2017)
- **Job Creation:** AI is expected to generate new employment opportunities, particularly in sectors requiring higher cognitive tasks such as technology, healthcare, and education (Gonzales 2023; Aghion et al. 2022)
- **The effect of AI on employment is uncertain:** The impact of industrial robots on labour demand in the short term is mainly negative, but in the long run, its impact on employment is mainly that of job creation (Wang et al. 2022)
- **AI in a geographical context:** the exposure to AI technologies is highly heterogenous across occupations, sectors, countries and regions (Georgieff and Hye 2022)



- To date, very **few studies have explored the link between AI and employment/wages at a regional level** or by also considering the geographical dimension (Guarascio and Reljic, 2025)



- This paper aims to **explore the relationship between occupational exposure to AI and wages**, emphasizing the role of **geographical dimension** in shaping this dynamic
- Valuable insights into **how AI-driven labor market transformations may contribute to regional wage disparities** and broader economic inequalities
- **Why Italy?** It is an interesting case study, in consideration of its structural geographical discrepancies



- **How?**

RIF estimates and OB-Decomposition by using administrative data and occupations' survey data (2010-2022)

- **Research Objectives**

Assess the effect of AI on employees' wages across the entire wage distribution. How does the potential exposure or complementarity of occupations with AI affect wage outcomes across the three macro-regions? Does geographic location help to leverage complementarities with AI?

- **Key Findings**


**Wage premium** associated to AI, especially **for top occupations and in the North regions**

A U-shape trend is evident



# THE POTENTIAL AI OCCUPATIONAL INDEX



- Following Arntz et al. (2016), **we propose an index that combine both task and skill dimensions and that measure the POTENTIAL COMPLEMENTARITY of occupations to AI**
- The AI index is constructed using five sections of the ICP questionnaire referring respectively to: **knowledge, skills, work styles, work activities, and work condition.**
-  the index **accounts especially for potential complementarity between AI and labor**
- To classify occupations, we use the *Indagine Campionaria delle Professioni* (ICP) conducted by Inapp in collaboration with the National Institute of Statistics (ISTAT)
- The ICP-Inapp is the Italian equivalent of the American O\*NET



# THE POTENTIAL AI OCCUPATIONAL INDEX



- Following the methodology proposed by Barbieri et al. (2022), we compute our index
- For each question, we calculate the average of the responses given by each worker and then we aggregate it at 5-digit occupational level.
- To improve the interpretability of the results, all scores were standardized in their range of variation through the following formula:

$$X = \left( \frac{Y - \min}{\max - \min} \right) * 100 \quad (1)$$

- $Y$  is the original answer (from 1 to 5)
- Max and min are the maximum and the minimum value reported for the question
- The **standardized value of the AI index is in the range [0 -100]**



**As first step**, for Italy and for each macro area (North, Centre and South) we estimate:

$$RIF(Y_i; Q_\tau) = \alpha_\tau + \beta_{i\tau} All_o + \sum_{k=1}^n \gamma_{k\tau} X_{ki} + \varepsilon_i$$

- $Y_i$  is the outcome variable, the (log) of weekly real gross wage (Full-time equivalent)
- $Q_\tau$  is  $\tau$ th-quantile (10th, 50th and 90th )
- $All_o$  identifies the dummy for the potential AI complementarity of occupation  $o$  performed by employee  $i$ . The dummy is equal to 1 if the occupation exhibits an index above the median and 0 otherwise
- $X_{ki}$  is the vector of  $n$  control variables (gender, age, experience, educational level, citizenship, sector of activity, firm's size, and type of contract)

**As second step**, we estimate a model with the interaction term between AI index and macro-area

$$RIF(Y_i; Q_\tau) = \alpha_\tau + \beta_{i\tau} All_o + \delta_{oj\tau}(All_o * GEO_j) + \eta_j GEO_j + \sum_{k=1}^n \gamma_{k\tau} X_{ki} + \varepsilon_i$$

**As third step**, we apply to the RIF-regression the Oaxaca–Blinder (OB) decomposition method to identify the effect of unobserved characteristics on the wage gap between high and low AI exposed occupations

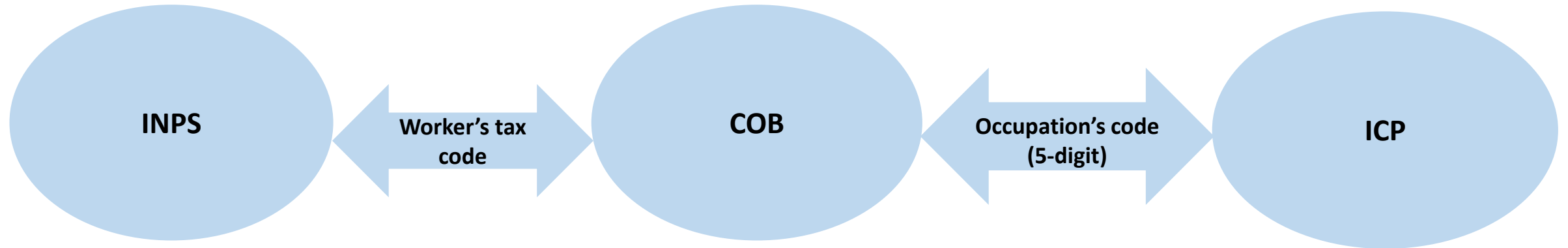


## An original dataset built linking two administrative archives with a survey on individuals

- **INPS archive:** administrative dataset on population of employees. It records **information on annual gross wages, age, gender, occupation, annual weeks worked, the type of contract**, on the sector of activity, and on the geographical localization (the province) of the work the workplace. From this INPS archive, it's extracted a dataset based on a random sample of all employees born on four different days of each month of any year.
- **COB (*Sistema delle Comunicazioni Obbligatorie - Mdl*) archive:** administrative dataset on work arrangements. It records detailed educational and occupational information (5-digit), and from year 2009, each job relationship that started, transformed or ended (for firing, dismissal, retirement, or transformation (e.g. from a fixed-term to an open-ended arrangement) of the contractual arrangement within the same firm) for all individuals working in Italy as employee or through apprenticeship, temporary agency work arrangements, and para-subordinate collaborations.
- **ICP (*Indagine Campionaria delle Professioni - Inapp*) survey:** a survey last run in 2013 that involves 16,000 workers recording detailed information on all the 5-digit occupations (i.e. 811 occupational codes). Tasks and skills variables are specific to the Italian economy, allowing for the definition of the structure of the labor market and the industrial relations characterizing the Italian economy



# THE DATASET



- From INPS-COB dataset, we extract a **representative sample** obtained drawing data from four birth dates for each month and year
- **The period:** from 2010 to 2022
- **Sample selection: All employees**, except the armed forces, **aged between 16 and 64**.
- In case of multiple contracts associated with the same individual in the same year, **we consider the longest contract only**.
- The **final sample** covers around **19,600,000 employees**



The effect of AI complementarity across the wage distribution and in three macro-areas

	10th Percentile	50th Percentile	90th Percentile	N. Observations
AI index	<b>0.013***</b> (0)	<b>0.012***</b> (0)	<b>0.045***</b> (0)	18,521,399
<b>North:</b> AI Index	<b>0.023***</b> (0)	<b>0.013***</b> (0)	<b>0.045***</b> (0)	13,630,060
<b>Centre:</b> AI Index	<b>0.026***</b> (0)	<b>0.014***</b> (0)	<b>0.044***</b> (0)	5,082,320
<b>South:</b> AI Index	<b>0.017***</b> (0)	<b>0.011***</b> (0)	<b>0.029***</b> (0)	6,166,005
Worker's controls	YES	YES	YES	
Firm's controls	YES	YES	YES	

Source: Authors' elaborations from INPS-COB-ICP data, 2010-2022

- As expected, a **wage premium exists** for workers employed in highly complementary AI occupations, **especially at the top of the wage distribution and for employees in the North regions**
- However, a **U-shape relation**: the **positive effect of AI reduces at the median**:
  - i) AI exacerbate wage inequality between different groups of workers and lead to more polarized labour market (Acemoglu and Restrepo 2018)
  - ii) Wages are in general stagnant especially for median/middle-class employees (i.e. Brandolini et al. 2018)



The effect of AI complementarity and macro geographical area across the wage distribution

	10th Percentile	50th Percentile	90th Percentile
AI Index	<b>0.011***</b> (0)	<b>0.010***</b> (0)	<b>0.056***</b> (0)
Centre	<b>-0.006***</b> (0)	<b>-0.006***</b> (0)	<b>-0.005***</b> (0)
South	<b>-0.010***</b> (0)	<b>-0.010***</b> (0)	<b>-0.008***</b> (0)
All_Centre	<b>0.002***</b> (0)	<b>0.001***</b> (0)	<b>-0.013***</b> (0)
All_South	<b>0.001***</b> (0)	<b>-0.001***</b> (0)	<b>-0.039***</b> (0)
Worker's controls	YES	YES	YES
Firm's controls	YES	YES	YES
N. Observations	18,521,399	18,521,399	18,521,399

Source: Authors' elaborations from INPS-COB-ICP data, 2010-2022

- With respect to North, **for workers in Central Italy, we observe a lower wage premium** linked to the complementarity of AI and the U-shaped trend
- With respect to North, **for workers in South Italy, we observe a wage loss at the median and top distribution**

# MAIN RESULTS - OB DECOMPOSITION



<i>AI index</i>		10th Percentile	50th Percentile	90th Percentile
	<b>Italy</b>			
Total difference		-0.186*** (0.000)	-0.213*** (0.000)	-0.522*** (0.000)
Explained component		-0.053*** (0.000)	-0.087*** (0.000)	-0.233*** (0.001)
Unexplained component		-0.132*** (0.001)	-0.126*** (0.000)	-0.289*** (0.001)
	<b>North</b>			
Total difference		-0.323*** (0.001)	-0.231*** (0.000)	-0.509*** (0.001)
Explained component		-0.119*** (0.001)	-0.087*** (0.000)	-0.203*** (0.001)
Unexplained component		-0.205*** (0.001)	-0.145*** (0.000)	-0.306*** (0.001)
	<b>Centre</b>			
Total difference		-0.291*** (0.001)	-0.213*** (0.000)	-0.527*** (0.001)
Explained component		-0.030*** (0.002)	-0.064*** (0.000)	-0.250*** (0.001)
Unexplained component		-0.262*** (0.002)	-0.149*** (0.001)	-0.276*** (0.002)
	<b>South</b>			
Total difference		-0.170*** (0.001)	-0.138*** (0.000)	-0.360*** (0.001)
Explained component		-0.059*** (0.001)	-0.032*** (0.000)	-0.124*** (0.001)
Unexplained component		-0.110*** (0.002)	-0.106*** (0.001)	-0.236*** (0.002)



- This paper investigates the **relationship between potential AI complementarity and wages across the distribution** for a sample of Italian employees taking into account the regional dimension.
- We construct an **AI Index measuring highly and poorly complementary occupations**
- Our results suggest a **potential wage premium related to AI, particularly for high paid employees**
- **BUT AI could exacerbate wage inequality** between different groups of workers (low-wage and high-wage workers) and could contribute to a **more polarized labour market**.
- The **AI wage premium is not uniform: it varies geographically and in terms of wage level**



# AI AND WAGE INEQUALITY: A TALE OF TWO "ITALY"



- In **Northern regions**, AI adoption tends to **reward high-skilled workers**, particularly at the upper end of the wage distribution, reflecting a **production structure that effectively leverages AI-complementary skills**.
- In contrast, in **the South**, the same AI complementarities do not translate into wage premiums for middle- and high-income workers, suggesting a **possible failure to integrate AI effectively into the local economic**
- Interestingly, the **positive effect for low-wage workers** may point to a **marginal productivity gain or substitution effect**, whereby AI adoption in low-tech settings simplifies tasks and temporarily increases the value of basic labor



- The OB-RIF decomposition analyses show a high but **decreasing role of the unexplained component** on the wage gap except for the South
- Possible explanation: **increasing prevalence of AI in complementary occupations can lead to greater transparency, standardization, and a focus on observable skills, thereby reducing the influence of unmeasured factors** (the "unexplained" component) **on wage disparities.**
- It is crucial to invest in education and especially in workforce training
- A place-based strategy is needed that aligns skills, companies and institutions to make artificial intelligence an engine of inclusive growth.





THANKS FOR YOUR ATTENTION



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