

New Technology Does Not Just Replace Workers — It Also Creates New Opportunities

How automation and augmentation technologies shape employment across Europe: evidence from three decades of data

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The Issue

Rapid advances in robotics, software, and artificial intelligence are reshaping the world of work. Public debate often centres on the fear that machines will replace human workers. But new technologies also create tasks that only people can do well—enhancing rather than eliminating jobs. Understanding both forces is essential for effective policy.

KEY FINDINGS

- **Technology has two faces:** it can *automate* existing tasks (replacing workers) or *augment* occupations (creating new opportunities).
- **Augmentation boosts jobs:** occupations complemented by new technologies saw employment *grow* over 30 years.
- **Automation reduces jobs:** occupations exposed to replacing technologies experienced significant employment *decline*.
- **AI has the strongest effects** in both directions—the largest gains and the steepest losses.

What We Did

We built the first **Europe-specific measures** of how much each occupation is exposed to job-replacing (automation) and job-enhancing (augmentation) technologies. Using AI-based text analysis, we matched descriptions of what workers do to patent texts describing new inventions.

We linked these measures to actual employment changes across **seven EU countries** (Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain) over 1993–2023, covering over 3,200 occupation-industry combinations and 112 regions.

What We Found

Workers in occupations complemented by new technologies experienced employment **growth**, while those targeted for replacement saw significant **job losses**. These effects are **causal**—confirmed using breakthrough innovations from two decades earlier as a natural experiment.

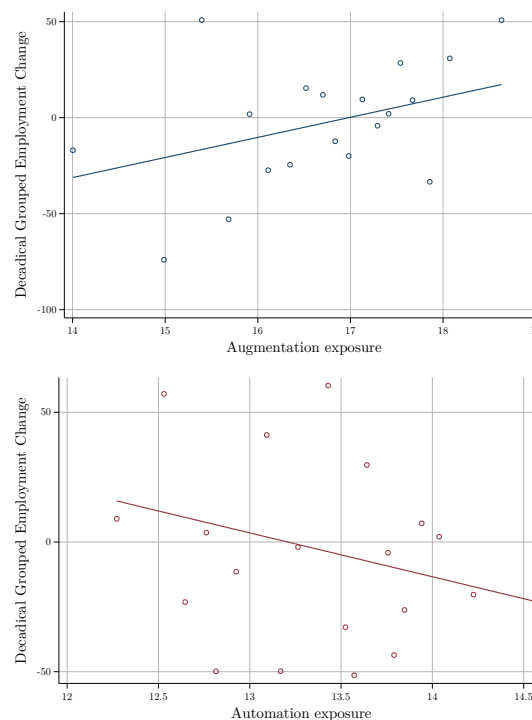


Figure 1: Conditional correlations between augmentation (top) and automation (bottom) exposure and ten-year employment change. Europe, 1993–2023.

These opposing forces also play out at the **regional level**: areas whose industrial mix tilts toward complementary innovation posted stronger employment growth, while automation-heavy regions stagnated.

Who Is Most Affected?

The impact of technology is not evenly distributed. **Middle-wage workers** face the highest automation exposure, while **high-wage workers** benefit most from augmentation. This helps explain *job polarisation*—growth at the top and bottom of the wage scale, with hollowing out in the middle.

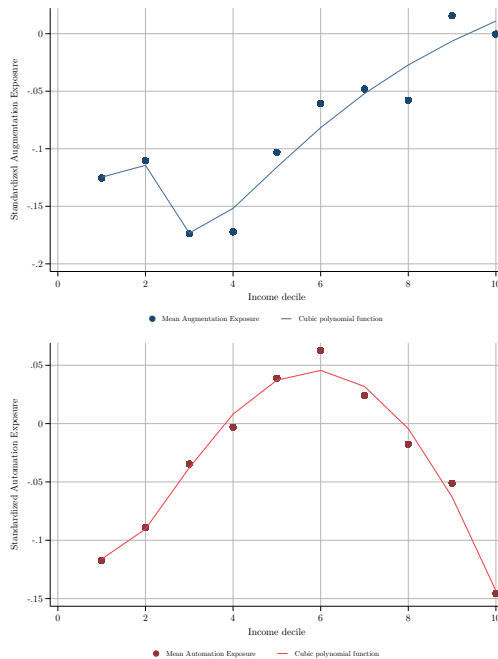


Figure 2: Augmentation (top) and automation (bottom) exposure across income deciles. EU7, 2023.

Policy Implications

1. Steer Innovation Toward Augmentation

Public R&D funding and tax incentives should prioritise technologies that enhance what workers can do. The balance between augmenting and automating innovation has measurable employment consequences.

2. Invest in Skills for the AI Era

AI shows the strongest effects in both directions. Training programmes should help workers develop competencies that complement AI—creativity, problem-solving, interpersonal skills—rather than competing with it.

3. Support Vulnerable Workers and Regions

Middle-wage, routine-task workers face the highest displacement risk. Targeted transition support should focus on communities where automation outpaces augmentation.

4. Monitor Technology Exposure

Our European measurement framework can serve as an early-warning system for tracking which occupations and regions are shifting toward automation dominance.

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