The AIFE Engine: A Computational Framework to Quantify and Forecast the Great Labor Reallocation

Qiu, Zichun (School: Shanghai Starriver Bilingual School)
Yan, Liqian (School: Shanghai Starriver Bilingual School)
Chen, Yintong (School: Shanghai Starriver Bilingual School)

Artificial intelligence is transforming labor markets around the world, yet we do not completely understand its effects on individuals. Previous research has used aggregated data and proxies, which fails to isolate the impact of AI on different tiers of the workforce. Thus, we investigated whether AI penetration in firms has a causal effect on the displacement of routine labor and the complementarity of creative and complex work. Our dataset includes over 100 million different job postings from 2015 to 2024. Using this dataset, we developed a knowledge distillation system that trains an efficient student model using accurate LLM outputs as the teacher. The results were validated against 9,500 human labels. Each job posting was then categorized as routine, complex or creative and given an intensity score, producing a massive panel across 72 countries. Our results show that one unit increase in AI intensity reduced routine labor demand by 2.1 percentage points and increased creative labor demand by 1.8 percentage points. The effects strengthened over three years after adoption and were twice as large in countries with higher income. To prove the causality of our preliminary results, we used econometric methods such as event study and instrumental variable. We also created a forecasting system using semantic embedding features and a temporal deep learning model. Compared to established baseline models, the model reduced prediction errors by 18-31%. We conclude that AI adoption is driving a structural reallocation of labor demand, as it substitutes for routine labor and complements complex and creative labor.

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