

The Impact of Artificial Intelligence on Labor Markets: A Forecasting Model for Significant Economic Events

Andrew Jack Bond^{1,2}, Cadence Reign Rand^{1,2}

¹Penn State Behrend

²Economic Research Institute of Erie

ajb7887@psu.edu, crr5666@psu.edu

Abstract

This study introduces a scalable, regionally adaptive framework for forecasting the impact of artificial intelligence (AI) on labor markets, designed to inform policy responses at local, national, and global levels. Recognizing the limitations of deterministic models and unstructured speculation, an ensemble of advanced large language models (LLMs) is used to classify over 1,000 occupations from the Standard Occupational Classification (SOC) system using structured prompts and task-level data from O*NET.

Rather than estimating continuous levels of AI disruption, our method applies quantization—discretizing occupations into five categories: High Displacement, Displacement, Neutral, Growth, and High Growth. This approach leverages the deep reasoning capabilities of LLMs to consistently evaluate job characteristics such as task automation potential, social complexity, and creative requirements. Cross-validation across multiple frontier LLMs ensures robustness and minimizes individual model bias.

These classifications serve as inputs to a stochastic Monte Carlo simulation that models employment outcomes over a five-year period under varying AI adoption scenarios. Simulations incorporate regional employment trends and assign randomized impact factors within each job category to generate a distribution of plausible labor market trajectories. Stochastic modeling was used as it better captures the uncertainty inherent in real-world labor markets, producing a more robust range of possible outcomes.

Preliminary results reveal significant geographic variation in occupational vulnerability to AI across U.S. regions, underscoring the need for flexible and proactive policy design. Targeted interventions, particularly in regions with high concentrations of automatable jobs, will be essential to mitigating displacement risk while leveraging AI's economic potential.

This research offers a repeatable framework for labor market forecasting that is more informative, enabling decision-makers to prepare for and adapt to the evolving dynamics of AI-driven transformation.