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The impact of technology on labor markets

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Decades ago, renowned economists John Maynard Keynes and Wassily Leontief foretold a time when artificial intelligence would produce “technological unemployment.” In their view, labor would become less important and workers would be replaced by machines. Science fiction writers often capitalize on plots where robots take over tasks traditionally performed by humans. In such a scenario, what would be the implications on today’s labor market? According to “Robots and jobs: evidence from US labor markets” (National Bureau of Economic Research working paper no. 23285, March 2017) by Daron Acemoglu and Pascual Restrepo, the use of industrial robots may reduce employment and wages in the U.S. economy.

An industrial robot does not need a human operator. The authors’ review of the literature shows that, in the United States, the number of robots increased from 1993 to 2007 and, by 2007, amounted to 1 robot for every thousand workers. There are an estimated 1.5–1.75 million robots in operation, with the number expected increase to 4–6 million by 2025. Industries employing many robots include the automotive industry, electronics industry, metal products industry, and plastic and chemical industry. The Acemoglu and Restrepo study analyzed the effect that industrial robot usage had on labor markets from 1990 to 2007.

The model used in the study built on prior research but extended the framework to account for the varying share of tasks performed by robots across industries. The model regressed the change in employment and wages on the exposure to robots (exposure to robots is calculated as the national penetration of robots into each industry times the employment share of that industry in the local labor market). The analysis showed a negative and positive effect on wages and employment from increasing the number of robots into the economy. The negative effect is that robots displace current workers from their occupations. The positive effect is the price-productivity effect. Increasing the number of robots decreases the cost of production, thus expanding the industry and increasing the demand for labor.

The analysis also considered gender, industry, occupation, education, and wage percentiles. It found that the employment impact for men is 1.5–2 times greater than for women, and the effects are concentrated in manufacturing industries. Negative effects are seen in all occupations except for managerial positions. Not surprisingly, large decreases are found within blue-collar jobs that have routine manual operations, such as assembly workers, transportation workers, and machinists. The negative impacts slightly diminish as a worker’s education level increases, and no impact exists for workers with graduate degrees. The authors note an unexpected finding in that no positive impact was found with workers who had more than a college degree. The authors suggest that this finding may indicate that industrial robots may not be complementing any particular occupation group. The study found the effects on wages similarly were concentrated around the bottom half of the distribution.

The authors acknowledge that because relatively few robots currently exist, robots have caused the loss of only a limited number of jobs. As the use of robots is anticipated to spread, however, future employment and wages would likely be affected. Little evidence exists of the equilibrium impacts that this spread may cause. This study is viewed by the authors as a first step in evaluating how robots influence labor market equilibriums. The authors provide an empirical methodology to address the lack of research in this area. Their research concludes by stating that if the spread of robots continues, there could be sizable future declines in the employment–population ratio.