

# Robots in the Workplace: Threat or Asset?

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**T**he latest breakthroughs in robotics and artificial intelligence have awakened fears that technological advances will lead to a large decrease in the overall level of employment and widespread unemployment. While there will be disruptions, and many occupations are at high risk of computerization over the next decade or two, the dynamic labor market continues to create opportunities for workers with the right skills and education.

The fear that technological advances will destroy jobs is not a new concern. In 1589 Queen Elizabeth I refused to grant a patent to a hand-knitting machine because she believed it would bring her subjects to “ruin by depriving them of employment, thus making them beggars.”<sup>1</sup> In 1933, John Maynard Keynes predicted widespread technological unemployment “due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour.”<sup>2</sup>

On the other hand, technological advances could lead to greater employment. “Economics 101” teaches that labor is hired based on the value of its marginal product and that technological improvements INCREASE the marginal product of labor. (For example, a carpenter with a hammer and saw is worth more than a

carpenter without those tools. A carpenter with power tools is even more valuable.) Technological progress leads to greater demand for labor and higher wages. While it is intuitive to think of technology as replacing workers and killing jobs, the increase in employment and incomes predicted by Econ 101 has played out over and over in history as technology has continued to advance along with employment and living standards. For example, the economy absorbed millions of women as the female labor force participation rate nearly doubled between 1950 and 2000. U.S. real (inflation-adjusted) median family income more than doubled in the same time period even as labor supply increased and technology advanced.

Of course, technology has replaced many jobs over the centuries and future advances are likely to replace even more. Intermediate economics teaches that the relationship between technology and labor is a bit more complicated than what’s taught in “101”. Technology can substitute for labor as well as complement. Computerization, for example, has led to a “substantial decline in employment in clerical, administrative support, and to a lesser degree, in production and operative employment.”<sup>3</sup> On the other hand, demand increased for other types of occupations. A

2003 task-based model of computerization based on the assumption that computers can substitute for labor for routine tasks but not cognitive and non-routine tasks helped explain the job-polarization observed in the data – increased demand for high wage/high skill jobs and for the lower skill jobs (such as home health aide) that were not easily automated. Some jobs in the “middle skill” category (such as bookkeeper) were the most easily replaced. This model also explained the observed increase in the education premium.<sup>4</sup>

Advances in Artificial Intelligence, Machine Learning, and Big Data have made these task-based models obsolete. For example, in 2010 Levy & Murnane wrote in *The New Division of Labor* that driving in traffic is not automatable. In the seven years since, the task has gone from one that is not automatable to one that has been automated. A more recent study by Frey and Osborne,<sup>5</sup> well aware of these advances, identified three areas where human labor still outperforms machines and is likely to do so for the at least the next decade or two –

1. Perception and manipulation,
  2. Creative intelligence, and
  3. Social intelligence.
- Using detailed information about all of the occupations in the economy, they assigned a probability of computerization to 702 occupations. (Recreational

**Table 1: Connecticut Employment Projections 2014 – 2024**

Risk of Computerization	Employment 2014		Numeric Change		Projected Employment	
	Level	% of Total	Level	% of Total	Level	% of Total
Low	712,179	38%	55,087	49%	767,266	39%
Medium	351,854	19%	25,736	23%	377,590	19%
High	786,622	43%	32,305	29%	818,927	42%
<b>Total</b>	<b>1,850,655</b>		<b>113,128</b>		<b>1,963,783</b>	

**Table 2: Portion of Projected 2024 Employment**

Minimum Education Required	Risk of Computerization		
	Low	Medium	High
No formal educational credential	1%	23%	76%
High school diploma or equivalent	25%	21%	53%
Postsecondary non-degree award	47%	31%	22%
Some college, no degree	0%	61%	39%
Associate's degree	44%	33%	23%
Bachelor's degree	83%	8%	9%
Master's degree	94%	6%	0%
Doctoral or professional degree	99%	1%	0%

therapists had the lowest probability of computerization, telemarketers had the highest.) The study found that 47% of total U.S. employment is in occupations with a high risk of being computerized (defined as more than a 70% probability of computerization) within the next decade or two. High probability occurred in a wide range of occupational areas including production, services, sales and construction. Applying this methodology to the Connecticut projections data shows that Connecticut’s portion is slightly lower for the 2014 base period (Table 1). Importantly, half the projected employment growth over the projections period is in occupations with a low probability of computerization (less than 30%).

In general, occupations that require more education have a lower probability of computerization (Table 2). There is a high probability of computerization for more than three-quarters of the projected 2024 employment for occupations requiring less than a high school diploma. On the other hand, less than ten percent of projected total employment for occupations requiring a bachelor’s degree has a high probability of computerization.

Despite the large disruptions in many particular industries and

occupations, there is no evidence yet that automation is about to cause a huge drop in employment and widespread unemployment. The national unemployment rate fell to 4.3% in May 2017 for the first time since 2001. The employment to population ratio is at 60.0%, lower than the level that prevailed before the great recession but a level that would have been a record high any time before the 1980s. Importantly, the number of job openings hit a record high in April 2017 – currently there are more than 6 million unfilled job openings in the country, and the Conference Board reports there are more than 72,000 online job postings here in Connecticut. The reasons that workers displaced by automation or unemployed for other reasons are not filling these openings<sup>6</sup> is beyond the scope of this article. But these openings and postings show that labor demand is strong.

The labor market is dynamic, with approximately 5 million American workers starting a new job each month (and nearly the same number leaving or losing a job each month<sup>7</sup>). Technology, automation, computerization, and to an increasing extent artificial intelligence, machine learning, and big data are contributing to that dynamism. Queen Elizabeth I wasn’t wrong

to believe that a new invention could destroy jobs. In addition, the wealth and opportunities made possible by technological advancement do not automatically accrue to those whose labor is displaced by it. Nevertheless, those opportunities are being and will be created and the evidence continues to suggest that those with the right education and training will be in the best position to benefit from those opportunities. ■

1 Frey, Carl Benedikt and Michael A. Osborne (2017), “The Future of Employment”, *Technological Forecasting & Social Change*.

2 Ibid.

3 Autor, David H. (2015), “Why Are There Still So Many Jobs? The History and Future of Workplace Automation.” *Journal of Economic Perspectives*.

4 Autor, David H. et. al. (2003), “The Skill Content of Recent Technological Change: An Empirical Exploration.” *Quarterly Journal of Economics*

5 Frey, Carl Benedikt and Michael A. Osborne (2017), “The Future of Employment”, *Technological Forecasting & Social Change*.

6 Theories include skills, geography, and wages.

7 The majority of separations are voluntary – leaving to take a new job or retire. The rate of layoffs and discharges is below pre-recession levels.