

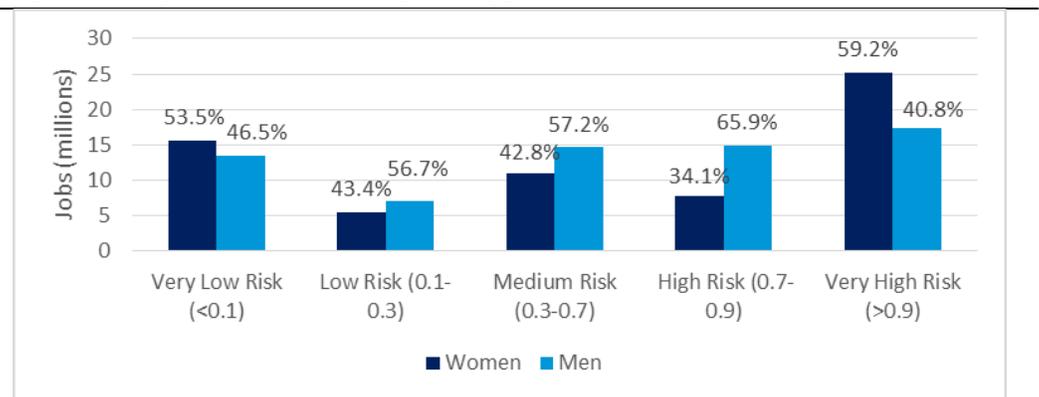
Women in an Automated World



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- **Increasing automation will change the composition of the US workforce.** 49% of workers are in professions that face a high risk (greater than 70% probability) of computerization, defined as automation by computer-controlled equipment. 32% of US workers are in professions that face a very high risk (greater than 90%).
- **Women face greater risk of job loss due to computerization, and “lower risk” jobs typically dominated by women pay less than low risk male-dominated jobs.** Our analysis revealed that women hold nearly 60% of jobs facing very high risk of computerization. Women also hold a greater percentage of jobs in very low risk professions (less than 10% chance of automation); the median annual income of those jobs is \$27,000 less than that for low risk men’s jobs.
- **Developing “non-computerizable” skills minimizes exposure to automation risk over the long term and enables migration towards emerging sectors.** Programs aiming to develop social and critical thinking skills offer a way for women to transition to lower risk jobs and access low risk male-dominated STEM fields.
- **There are a range of options available to investors who wish to influence this trend.** Education technology (EdTech) funds and gender lens investing offer opportunities to investors concerned with the potential impact of automation on women. We offer a brief overview of the relevant investment approaches.

Figure 1: Computerization risk categories by gender in the US



Source: Frey and Osborne, Bureau of Labor Statistics, Cornerstone Capital Group

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Will current trends in automation impact men and women differently across the US economy?

What is driving the conversation?

The World Economic Forum (WEF) forecasts that two-thirds of jobs lost globally to disruptive changes in technology from 2015 to 2020 will be concentrated in the Office and Administrative job family. Women occupy 72.2% of office and administrative support positions in the United States. We sought to understand whether current trends in automation can be expected to impact men and women differently across the US economy.

Oxford University’s Carl Benedikt Frey and Michael A. Osborne published a study in 2013 that assigned 702 US occupations a probability of computerization (stated as between 0 and 1), with computerization defined as job automation by computer-controlled equipment. Thresholds of 0.3 and 0.7 were used to differentiate between low, middle and high risk occupations. Occupations from each risk category are shown in Figure 2 below.

Figure 2: Oxford study – risk of computerization

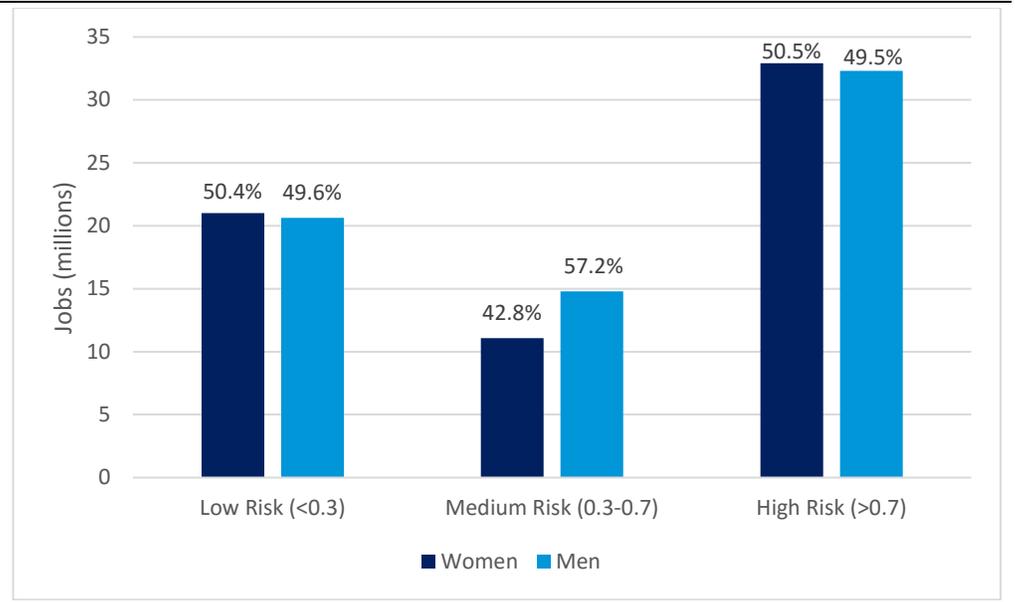
Jobs	Probability of computerization (0-1)
Low Risk Jobs (<0.3)	
Registered nurse	0.009
Mechanical engineer	0.011
Kindergarten teacher	0.15
Financial analyst	0.23
Middle Risk Jobs (0.3-0.7)	
Actor	0.37
Customer service representative	0.55
Maintenance and repair worker	0.64
Janitor and cleaner	0.66
High Risk Jobs (>0.7)	
Bartender	0.77
Security guard	0.84
Waiter and waitress	0.94
Cashier	0.97

Source: Frey and Osborne, “The Future of Employment: How Susceptible Are Jobs to Computerisation?” Oxford University, September 2013.

The automation risk landscape

We collected data on total employment and gender distribution for the 702 US jobs examined in the Oxford study to determine the number of working men and women in each occupation. We then summed these results across the low, middle and high risk categories. Figure 3 below captures the distribution of US employment across these three categories by gender.

Figure 3: Risk of computerization by gender in the US – three categories



Source: Frey and Osborne, Bureau of Labor Statistics, Cornerstone Capital Group

65.2 million jobs, or 49% of total US employment, are at high risk of automation

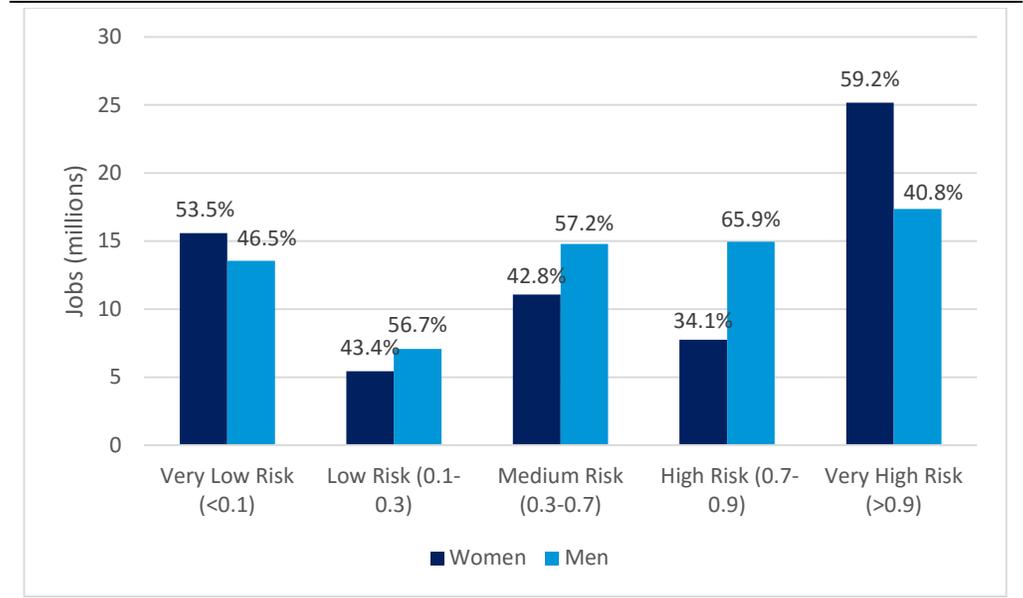
We found that high risk jobs are evenly distributed between men and women overall. Men and women hold 49.5% and 50.5%, respectively, of the 65.2 million jobs across 319 high risk occupations. Significantly, these 65.2 million high risk jobs account for 49% of total US employment.

We then disaggregated the 702 occupations into five categories to see how greater granularity would affect the profile of automation risk:

- Very low risk (<0.1)
- Low risk (0.1 – 0.3)
- Medium risk (0.3 – 0.7)
- High risk (0.7 – 0.9)
- Very high risk (>0.9)

The results are shown in Figure 4.

Figure 4: Risk of computerization by gender in the US – five categories



Source: Frey and Osborne, Bureau of Labor Statistics, Cornerstone Capital Group

Women hold almost 60% of the jobs facing very high risk of computerization in the US—7.8 million more than men

Our analysis yielded several noteworthy results. At a broader level, 42.5 million, or nearly a third of the 132.7 million jobs included in our study, fall in the very high risk category. We also found that jobs dominated by women are relatively more concentrated at either end of the risk spectrum. Critically, women hold almost 60% of the jobs facing very high risk of computerization in the US. This equates to 7.8 million more women than men who face a very high risk of job displacement through computerization.

In addition, women have a labor force participation rate of 56.8%, which is lower than the 69.2% rate for men¹. The fact that women hold 60% of the very high risk jobs despite there being fewer women than men in the labor force suggests that the risk of automation to employed women is substantial.

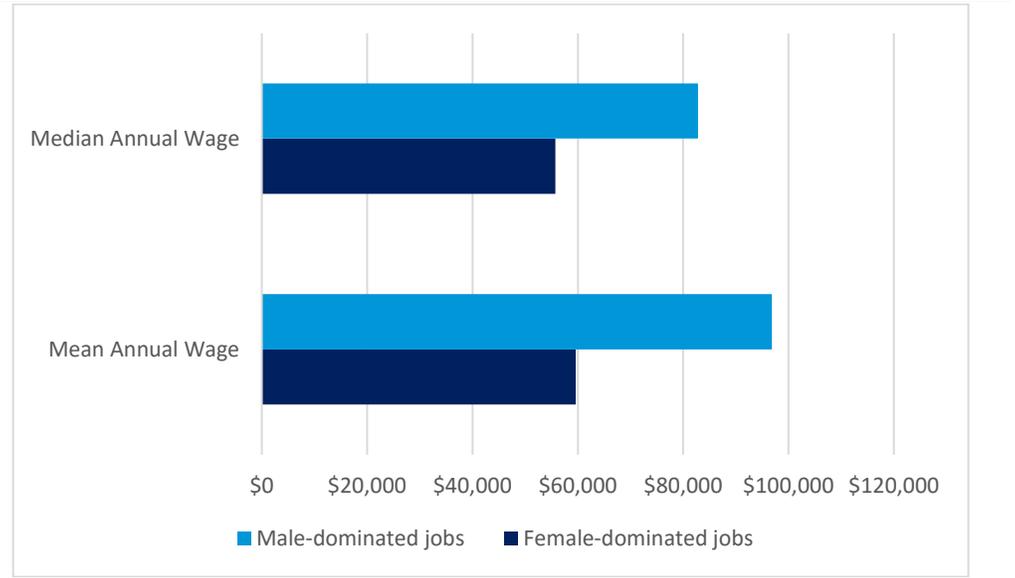
Women’s high risk jobs are concentrated in the office and administrative support sector, while transportation and logistics and production occupations comprise the bulk of high risk jobs held by men. It is reasonable to expect that occupations with the highest probability of computerization will be automated first. We see this playing out as a nascent office and administration automation sector followed by a growing transportation automation movement.

¹ FRED Research - <https://fred.stlouisfed.org/series/LNS11300002>

Female-dominated jobs with a low risk of computerization do not pay as well as those mainly held by men

A potential counterbalance to the higher percentage of women in the very high risk category is the higher percentage of women in the very low risk category. However, our analysis shows that female-dominated jobs² with a low risk of computerization do not pay as well as those mainly held by men. The average income levels of these very low risk jobs are plotted in Figure 5 below.

Figure 5: Average income of very low risk jobs



Source: Frey and Osborne, BLS, Cornerstone Capital Group

The \$55,700 median annual wage of the lowest risk female-dominated occupations is \$27,000 less than that of the lowest risk male-dominated jobs, and the \$59,600 mean annual wage is \$37,000 less. These discrepancies in earnings potential of 32.7% and 38.4%, respectively, suggest that female workers are not seeing the same benefit as men of holding a low risk job.

Enhancement vs. displacement

The WEF reports that overall employment gains due to technological advancement are not expected to outpace losses, and that women will be disproportionately affected

A common assertion is that automation will enhance labor rather than displace it. In the context of gender, however, this argument is less convincing. The WEF’s 2016 “The Future of Jobs” report assesses the impact of disruptive technologies on global employment, and notes that “while men will see approximately one job gained for every three lost over the next five years, women face more than five jobs lost for every one gained.” Future employment is unknown, of course, and the WEF’s view of net job losses for men and women may not transpire, particularly if new needs and industries arise as technology develops.

² We define female- and male-dominated occupations as those in which women account for more or less than 50% of employment, respectively.

Nonetheless, this analysis suggests not only that overall employment gains due to technological advancement are not expected to outpace losses, but that women will be disproportionately affected. Our analysis indicates that the enhancement trend holds for occupations in the low risk category. We note, however, that these occupations are often dominated by men. Following Watson’s appearance on Jeopardy in 2011, IBM partnered with Cleveland Clinic to develop WatsonPaths and Watson EMR Assistant, technologies that enhance physician interaction with data and electronic medical records. Our study shows that 62.1% of physicians and surgeons are men, and the Oxford study assigns this occupation a very low risk of computerization. Conversely, medical transcriptionists, 87.6% of whom are women, face high risk.

Similarly, lawyers face a very low risk of computerization and are seeing their profession enhanced by technologies that streamline document collation. Kira Systems is operating in this “e-discovery” space and has developed contract analysis software now being used by firms such as Deloitte and Chapman and Cutler. Currently, 65.5% of lawyers are men while 85.3% of paralegals and legal assistants are women. Paralegals and legal assistants were assessed as facing very high risk of computerization.

Figure 6 features complementary occupational pairings exhibiting this trend.

Figure 6: Complementary occupations in the US

Low risk job	Percent women	Probability of computerization	Complementary high risk job	Percent women	Probability of computerization
Physician and surgeon	37.9%	0.005	Medical transcriptionist	87.6%	0.89
Lawyer	34.5%	0.035	Paralegal and legal assistant	85.3%	0.86
Chief executive	27.9%	0.015	Executive secretary and administrative assistant	94.5%	0.86
Chef and head cook	19.6%	0.10	Waiter and waitress	70.1%	0.94
Financial analyst	43.0%	0.23	Bookkeeping, accounting and auditing clerk	89.8%	0.98

Source: Frey and Osborne, BLS, Cornerstone Capital Group

Alternative solutions must be identified if workforce migration toward low and medium risk occupations is to keep pace with ongoing technological advancement. Otherwise, the already significant number of US workers facing high risk of automation may continue to grow.

Are “non-computerizable” skills the answer?

The Oxford study uses a task model to analyze the skills and tasks required of each occupation with respect to “computerization bottlenecks.” These are technological limitations not yet surpassed but that could greatly increase the scope of automation once overcome. The three bottlenecks identified are:

- perception and manipulation;
- creative intelligence; and
- social intelligence.

The WEF has assessed the top ten skills needed to succeed in 2015 and 2020, as shown in Figure 7.

Figure 7: Top ten skills – 2015 and 2020

	2015	2020*
1.	Complex problem solving	Complex problem solving (-)
2	Coordinating with others	Critical thinking (+2)
3	People management	Creativity (+7)
4	Critical thinking	People management (-1)
5	Negotiation	Coordinating with others (-3)
6	Quality control	Emotional intelligence (new)
7	Service orientation	Judgment and decision making (+1)
8	Judgment and decision making	Service orientation (-1)
9	Active listening	Negotiation (-4)
10	Creativity	Cognitive flexibility (new)

Source: The Future of Jobs Report, World Economic Forum, January 2016.

*Numbers indicate move in ranking compared to 2015 and signs/color indicate up or down.

We relate these skills to our assessment by noting that female-dominated low risk occupations tend to require a greater degree of empathy and social intelligence. For instance, speech-language pathologist, preschool and kindergarten teacher, registered nurse and occupational therapist are among the ten low risk jobs with the highest percentage of female employment.

By contrast, male-dominated professions with a low risk of computerization are mainly in the Science, Technology, Engineering and Mathematics (STEM) field and call upon creative intelligence to a greater extent. The domination of STEM by men is a concern, with the WEF reporting: “Given women’s low participation in STEM professions, one of the fastest-growing areas of job creation, women

stand to gain only one new STEM job for every 20 lost across other job families, whereas the ratio for men is one new job for every four lost elsewhere.”

Consequently, many efforts are currently aimed at reversing this trend and increasing women’s participation in STEM. We note, however, that STEM education should ideally begin at an early age, and that not everyone can dedicate the time and resources needed to pursue a career in this field. Additionally, not everyone can be expected to take an interest in STEM.

We therefore see value in teaching skills that facilitate entry into a broader range of low risk professions. Educational programs that teach non-computerizable skills offer an alternative to programs that teach coding. We believe workers can prepare for technology’s increased presence in the workplace by developing this increasingly important skillset.

Next steps for investors

*We thank **Craig Metrick, CAIA**, and **Jennifer Leonard, CFA**, for their contributions to this section.*

Investors seeking to mitigate the impact of automation on women have a number of options available to them.

Investing in EdTech funds

Some education technology (EdTech) investment opportunities focus on STEM and/or women’s education, while others promote the development of ‘non-computerizable’ skills that ease the transition to lower risk jobs outside of STEM. Even those EdTech funds not focused solely on women’s education or STEM subjects could offer investors the opportunity to generate returns while actively preparing women for careers in STEM and other low risk jobs.

Because the EdTech sector is in an early stage of its life cycle, funds tend to concentrate on the venture stage of investing. As such, EdTech funds tend to be riskier than those focused on more established sectors. There are venture capital funds focused exclusively on EdTech, as well as those that look at technology or social impact areas (education, health/wellness) more broadly.

Gender lens investing

Another option is the use of a gender lens for investments. Gender lens investing evaluates opportunities according to objectives that may include:

- increasing access to capital for female entrepreneurs and businesses that have women in leadership positions;
- promoting gender equity in the workplace by investing in private sector companies with leading gender policies that also extend across their supply chains;
- supporting proxy votes and shareholder campaigns related to diversity and human capital issues that may benefit women in the workplace; and
- increasing the number of products and services that benefit women and girls by directing capital to socially responsible businesses developing these products and services.

Philanthropic investment opportunities

Another category of investments that could be of interest to those looking to mitigate the effect of automation is philanthropic investing, which tends to produce concessionary returns but generate significant impact. One example would be investments that fund organizations providing skills retraining to displaced workers. Though returns on these investments may be below market rate, investors have the potential to create significant impact for workers, especially women, displaced by automation. In addition, philanthropic organizations can receive tax benefits for so-called program-related investments (PRIs).

Investors should seek out investment advisors to help them identify specific investments in their focus areas of interest that align with their financial objectives.

Thematic research

Continued tracking of these issues through thematic research is important given ongoing trends in automation and their potential impact on women. For instance, our [report](#) on the factors and technologies driving automation in the Quick-Service Restaurant sector offers insight into our finding that food preparation and service workers, 63.4% of whom are women, face very high risk of computerization. 



Fiona Ewing recently completed an internship in the Research department of Cornerstone Capital Group, where she produced this original report while contributing to another major project. She is a rising senior at Dartmouth College, where she is pursuing a bachelor's degree in Economics with a minor in Chinese. Previously she interned with Clarion Partners, focusing on strategy and research.



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