

The Economics of Industry 4.0

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Viewed over the sweep of history, concerns about technological unemployment have always proved overblown. Over the last two-hundred years, technology has created more jobs than it has destroyed and it has substantially increased labour productivity and living standards.

European countries that tend to report lower levels of tertiary educational attainment; poorer scores in maths, science and reading skills; invest less in information and communication technologies; and have a weaker focus on communicative skills in their workplaces, are the ones with a higher share of jobs at high risk.

Discussions of workplace automation tend to focus primarily on the substitution (or displacement) effect between capital and labour. The substitution effect describes the extent to which machines substitute for humans in productive activity (Brynjolfsson and McAfee 2014; Ford and Cummings 2015). Other things being equal, labour-saving technologies raise unemployment by displacing existing workers. However, other things have historically never been equal. Namely, this argument neglects to consider the compensation (or income) effect of automation. As cheaper capital substitutes for labour, goods and services become cheaper, too, raising real incomes across the economy. In the long run, this process tends to boost demand for new goods and services and leads to the creation of new industries and jobs, lowering unemployment and raising the value of each hour of human labour.

Viewed over the sweep of history, concerns about technological unemployment, a term coined by John Maynard Keynes in 1930 but outlined for the first time by David Ricardo in 1821, have proved unwarranted. In fact, over the last two-hundred years, technology has created more jobs than it has destroyed and the nineteenth century transition towards ever more complex manufacturing processes and mechanised power marked the beginning of an era characterised by the “creative destruction” of firms and productive processes, high labour productivity, declining working week hours and steadily rising real wages.

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Recent data from the Bank of England draw a clear picture of how technology has enriched workers in the UK, the country where the Industrial Revolution began. Since 1750, labour productivity growth has been around 1.1% per year, while real wages have risen by 0.9% per annum. At the same time, the employment rate as a proportion of total population is today around 47-48%, slightly higher than early 19th century levels. The composition of the labour force is however much different, since children and the elderly no longer work but women have joined paid employment in large numbers since the 1970s. These patterns are also true for other industrialised economies (Haldane, 2015).

The occupational approach

Worries about the potential impact of automation have prompted considerable interest in the economics discipline. One of the more controversial recent academic papers, which investigates the impact of automation on the U.S labour market, was published in 2013 by two Oxford scholars, Carl Benedikt Frey and Michael Osborne. The paper found that almost half of all persons employed in the U.S are currently working in occupations that could be entirely performed by machines within the next two decades.

Based on Frey and Osborne’s data, Bowles (2014) calculates the probability of job automation across occupations in the EU. His findings illustrate that – on average – 53% of current EU jobs will be significantly affected by the new technologies. However, Bowles argues that automation will affect primarily low-wage and low-skilled sectors and that the consequences will be felt more strongly in southern and central EU Member States, such as Romania (61.93%), Portugal (58.94%), Croatia (57.91%), Poland (56.29%) and Italy (56.18%).

Examining Bowles’ EU results alongside some of the latest cross-country education data (Eurostat, 2016; OECD, 2016: Volume I) suggests that the risk of automation on European jobs may be compounded by low educational attainment. It should come as no surprise, then, if a large majority of those European countries that tend to report lower levels of tertiary educational attainment and poorer scores in maths, science and reading skills, are also the ones that are slated to suffer the most from disruptive automation. On the other hand, wealthier northern European nations such as Sweden, the UK, Denmark and the Netherlands look better placed to face the challenges and opportunities posed by it.

Existing studies suggest that, on average, high-skilled workers (the group most likely to have attended university) specialise in non-routine tasks and that the correlation between skill content and routine intensity is indeed negative (Autor 2013; 2015). The lower workers' skills, the higher the probability that those workers perform relatively high routine occupations. At the same time, the share of medium-routine or high-routine intensity jobs, such as machinery mechanics, shops salespersons, bank tellers, assembly-line workers and food preparation assistants, is higher in southern and central European countries, nations that tend to invest less in tertiary education (Marcolin et al. 2016). Because routine-based jobs are easier to replicate by machines, those jobs are more vulnerable to automation. To put it succinctly, high-skilled workers are more likely to see their jobs complemented by new machines, whereas less educated ones might see theirs substituted for by automation.

The task-based approach

Assuming that technology will replace only certain specific tasks, rather than entire occupations, yields less dramatic results.

Estimates by Frey and Osborne (2013) and Bowles (2014) should be analysed with caution. Their occupation-based approach might overestimate the real impact of new technologies on national labour markets, because any job is composed of discrete tasks, some of which are more easily replaceable by machines than others (Autor and Hendel, 2013; Pfeiffer and Suhan, 2015). By relaxing the assumption that machines will replace entire occupations, and assuming that new technologies will automate only certain specific tasks, Arntz et al. (2016) argue that the average percentage of jobs at risk is much lower across OECD countries. Focusing on Europe, the authors

calculate that the share of jobs at high risk (>70% likelihood of automation) within the 16 European OECD countries investigated does not exceed 9%, on average. Interestingly enough, according to Arntz et al.'s (2016) statistics, Austria and Germany top the list with around 12-13% of workers at high risk of being replaced by machines. These two countries seem to have a higher share of low- and medium-skilled workers who perform jobs with low degrees of communication, which are also associated with more automatable tasks.

However, even with a different methodology, Arntz et al. (2016) clarify that education systems and worker skills still play a large role in determining the impact of automatability on jobs. In this case, the substitution effect appears to be lower in those OECD countries with a strong focus on highly qualified workers and whose private and public sectors invest more in information and communication technologies (ICT). The study also shows nations with a stronger focus on communicative tasks in their workplace organisation, such as the United Kingdom, Ireland and Scandinavian countries, at lower risk of automation.

Old jobs, new jobs, and their policy implications

There is greater uncertainty as to whether and to what extent old jobs that become automated will be replaced by new occupations. It is of course in the nature of innovation that new industries and occupations are unpredictable, but the historical record gives reasons for optimism. Studies that look at both previous waves of substitution and compensation effects (Graez and Michaels, 2015; Gregory et al., 2015), do not find any reduction in the demand for labour. Contrary to conventional wisdom, Gregory et al. (2015) show how the computerisation of labour has generated 11.6 million new jobs, on net, across 27 European countries between 1999 and 2010.

Still, there are no grounds for complacency from public authorities. Educational reform, with a view to introducing more creativity and dynamism in learning, and more competition and diversity across school systems, is necessary in order to prepare workers for the coming wave of automation. Sweden and the UK's recent experiments with greater private-sector involvement in school provision and administration offer auspicious results (Sahlgren, 2010).

Equally, the pace of automation will be quicker and more disruptive, the more firms stand to benefit from substituting machines for workers. Thus, Member States would do well to consider lowering the price of hiring and firing labour so as to allow it to properly compete with capital. It is no coincidence that those countries which data suggest are better-placed to cope tend to have more flexible and dynamic labour markets. Removing tax and regulatory barriers to part-time work and self-employment will also help to align employment markets with changing work patterns.

All of the above face political barriers in the form of entrenched vested interests, but the gains to be had from meaningful reform dwarf any short-term political cost.

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