

Is Economic Singularity near?

Impact of Automation on Labour Markets

Shraddha Nayak

Abstract

With the rise in automation and artificial intelligence there has been a growing concern about distribution of income between labour and capital. Rapid growth in technological innovation has brought automation to different aspects of production processes and is soon expected to reach a point, termed as ‘singularity’ where labor will become economically superfluous in the sense that it will contribute nothing to global economic growth. This paper widely discusses the prospects of such a situation on the labor market.

Keywords: automation, income distribution, economic singularity, economic growth

JEL Classification: D33

Introduction

Singularity originally is a mathematical term defining a point where certain values of an equation tend to infinity, causing the equation to have no solution and reach infinitesimal. The concept of ‘economic singularity’ describes a situation where the labour time required to produce commodities will rapidly tend towards zero, due to full automation. It also introduces a situation where machines not just automate existing tasks performed by the workers but also start creating new tasks which were previously the job of humans as they require cognitive abilities and intelligence.

Artificial intelligence (A.I.) is an ideal example of such labour replacing technological change, as when deployed in the ordinary production of goods and services, it will potentially impact economic growth and income shares. A.I. may also help in solving more complex problems which require scaling creative effort and change the process by which we create new ideas and technologies. In extreme cases, some researchers have argued that A.I. can become rapidly self-improving, leading to “singularities” that feature unbounded machine intelligence and/or unbounded economic growth in finite time. Mathematician Irving Good (1965) described this situation as follows:

“Let an ultraintelligent machine be defined as a machine that can far surpass all the intellectual activities of any man however clever. Since the design of machines is one of these intellectual activities, an ultraintelligent machine could design even better machines; there would then unquestionably be an “intelligence explosion,” and the intelligence of man would be left far behind. Thus the first ultraintelligent machine is the last invention that man need ever make.”

In this brief passage the idea is centered on ever accelerating progress of technology which will cross a point ‘singularity’ after which productivity develops at a pace too rapid for the labor to keep up and therefore requires zero human intervention.

Historical perspective on Automation and Employment

The concern of unemployment due to technological change is not a recent phenomena. Economist Joseph Schumpeter in his book *Capitalism, Socialism and Democracy* (1942), introduced the idea of ‘creative destruction’, how technological innovation creates enormous wealth, but also undesired labour market disruptions. History confirms Schumpeter’s thesis that there will always be winners and losers from technological advancements in the market. This idea can be ideally illustrated by the example of ‘Luddites’ in England. Skilled knitters in England saw their jobs were threatened by the spread of machines that could produce textiles at a lower cost and therefore started responding with violent revolts. The British parliament unrelentingly sent troops to suppress the Luddite riots and stationed 12,000 men against the rioters (Mantoux, 2006, p. 403-8).

It has been argued that despite the concerns over the mechanisation of employment, unskilled workers have hugely benefited from the Industrial Revolution. Clark (2008) finds that real wages over the period 1760 to 1860 rose faster than GDP per capita. Real wages nearly doubled between 1820 and 1850, according to the evidence provided by Lindert and Williamson (1983). On the other hand, Feinstein (1998) finds a much more moderate increase, with average working-class living standards improving by less than 15 percent between 1770 and 1870. Finally, Allen (2009) finds that over the first half of the nineteenth century, the real wage stagnated while output per worker expanded. After the mid nineteenth century, however, real wages began to grow in line with productivity. These theories may deduce that not only were capital owners were gainers of the Industrial Revolution but at the the same time the average living standards of unskilled workers largely improved.

Manufacturing technologies of nineteenth century were mainly “deskilling” – i.e. they substituted for skills through the simplification of tasks. Work that had previously been performed by artisans was now decomposed into smaller, highly specialised sequences, requiring less skill, but more workers, to perform (Braverman, 1974). Key innovations in manufacturing sector emerged, in particular the adoption of the assembly line created vast employment opportunities for low-skilled workers and enabled corporations such as the Ford Motor Company to manufacture the Model-T at a sufficiently low price for it to become the people’s vehicle. In the past, workers adapted by making their skills complementary to the arrival of new technologies. Despite an increasing amount of automation being added humans were still required to work, and there was little or no substitution of labor with capital. Therefore, innovations benefitted ordinary people both as producers and consumers.

Automation in the 21st Century

How automation is different this time? In the 21st century, automation has brought undeniable benefits to consumers, but its impact on the employment has arguably been more troublesome than anything seen in the past. The substitution properties between technologically advanced capital input and conventional input such as labor depends upon the following insight: If technological inputs and conventional inputs like labor are elastic substitutes in production, then growth in automation will displace workers and lead to technological unemployment while if they are inelastic substitutes, then rapid improvements in automation will be irrelevant to the economy. The nature of innovation or technological advancement in this age has changed and is causing more disruptions in labour market than previous technological revolutions as it is fundamentally changing the substitutional properties between labor and technologically advanced capital input from inelastic to elastic.

Technology in this age is enabling the automation of tasks that once quintessentially belonged to humans, like cognitive tasks and non-routine judgments, through technologies like artificial intelligence and superintelligent computers. These advancements in technology have helped the consumers, as the general value of commodities has fallen but have adversely affected workers. Many countries have witnessed significant declines in labour's share of GDP caused by the decrease in the relative price of investment goods, which in turn is driven by advances in computer-driven technologies, leading companies to substitute labour for capital in production

In his book *Capital in the Twenty-first Century*, Thomas Piketty argues that labour's share of GDP tends to fall when the rate of return on capital is greater than the rate of economic growth. As a result, a wealth gap will emerge between owners of capital and those who rely on their labour. As we saw in the above section in the past, technological enhancements brought a rise in productivity and real wages but the nature of innovation has changed now. Although technology can raise productivity and boost wages, it can also take the form of capital that substitutes for labour. In that case, productivity growth will simply enhance capital's share of income, and thus lead to concentration of wealth with the capital owners which is precisely the current situation. The view that a widening gap between productivity and pay is due to increased usage of labour-substituting capital is favoured by Erik Brynjolfsson and Andrew McAfee(2014), arguing that the reason why wages have failed to keep pace with productivity is that ordinary workers are unable to adapt to an ever increasing pace of technological change and therefore as their skills are getting obsolete they are being replaced.

This macroeconomic concern of rise in automation and artificial intelligence displacing labour and therefore creating a situation of mass unemployment leading to abundance of leisure has been far realised by J.M. Keynes in his essay, "The Economic Prospects for Our Grandchildren" (1930). He wrote:

"Suppose that a hundred years hence we are eight times better off than today. Assuming no important wars and no important increase in population, the economic problem may be solved. This means that the economic problem is not—if we look into the future—the permanent

problem of the human race. . . .Must we not expect a general “nervous breakdown”? Thus for the first time since his creation man will be faced with his real, his permanent problem—how to use his freedom from pressing economic cares, how to occupy the leisure, which science and compound interest will have won for him, to live wisely and agreeably and well.”

In his essay, Keynes predicted widespread technological unemployment as a result of mankind failing to find sufficient new uses for its labour as machines replace workers in old occupations and industries.

Macroeconomic Concerns

As different occupational classifications exist across countries it is difficult to conduct meaningful direct comparisons. Nevertheless, several studies have estimated the proportion of jobs at risk to automation in next two decades. These studies follow two different methodologies, one task based approach and another occupation based approach. This paper focuses on occupation based approach. The occupation based approach was first applied by Frey and Osborne (2013), where they classified 702 occupations by how susceptible they are to automation. They examined, 47% of the US workforce is at risk of automation over the next 10 to 20 years. Recent data from the World Bank suggests the risks are higher in many other countries for instance, China 77% and India 69%. Adopting similar methodologies, Bowles (2014), Chang and Huynh (2016), World Bank (2016), and Ng (2017) find that in the European Union, and particularly in developing countries, an even higher share of jobs is at high risk of automation in the next decades. Bowles (2014) estimates that 54 per cent of all jobs are at risk; for the five ASEAN countries, Chang and Huynh (2016) find that 56 per cent of total employment is at risk; and for Malaysia, Ng (2017) estimates that 54 per cent of all jobs are at risk. International Labor Organization (ILO) provides unwavering data on the responsiveness of automation in different countries they find that 54% of EU jobs are at risk of automation, spanning 35% in UK, 37% of jobs in Finland, 51% in Germany 47% in Sweden and 62% in Romania.

It is clear from the above data that differences across countries exist but there is unison on the sectors and types of workers that are most at risk. The employment share risk varies substantially across a wide range of sectors. The U.S. Bureau of Labor Statistics (BLS) compiles future employment projections. The agency in its most recent analysis forecasts that the information sector is anticipated to shrink in jobs. Manufacturing is another sector expected to lose jobs. Sectors exposed to low automation risk are education and training; human health and social work; and agriculture, forestry and fishing. Although, we know that fields such as health care and education have been slow to embrace the technology revolution, they are now starting to embrace new models.

Analysing the types of workers getting affected by automation suggests that in both developed and developing countries, workers with low and medium levels of education face greater risks of job automation (McKinsey Global Institute 2017), given that they make up the bulk of the workforce in the sectors that are potentially most affected. Skills and competencies like creative and social intelligence are developed through higher education, and these skills then help to perform complex level of cognitive tasks which are difficult to automate. Empirical evidence also support this claim, in a study of the speed of automation and its effects on manufacturing employment in OECD countries, Graetz and Michaels (2015) find that the increasing use of robots between 1993 and 2007 was analogous with a scaling down in the

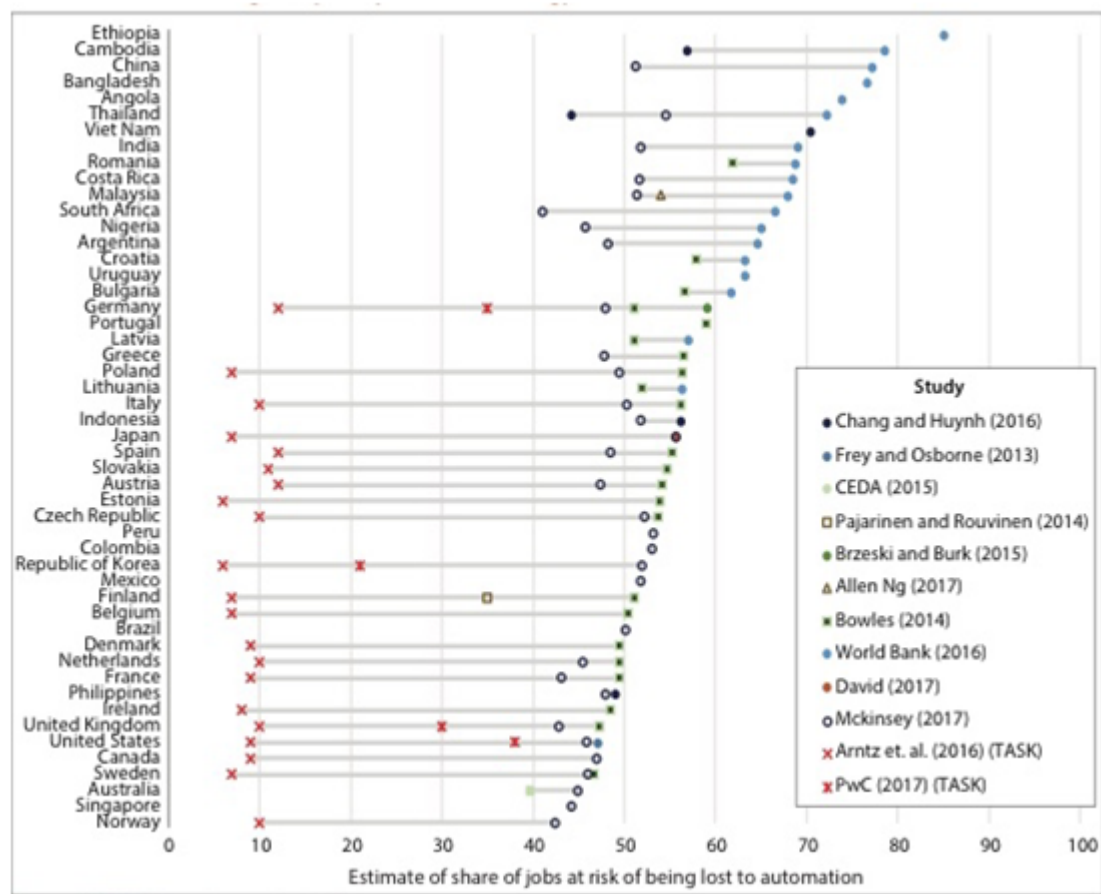


Figure 13: Range of estimates of the share of jobs at risk being lost due to automation, study and methodology
Source: UN/DESA, based on various studies

numbers of hours worked by low and middle-skilled workers, whereas high-skilled workers were not affected. A study conducted by Bruegel examined a strong negative correlation between a country's GDP per capita and the share of their workforce at risk of automation. Suggesting that, developing countries are likely to find a larger share of their jobs at risk, as lower wages keep many jobs that are possible to automate from being displaced.

Technological progress has two opposing effects on employment, one destruction effect as it substitutes for labour, requiring workers to reallocate their labour, while another the capitalisation effect, where new occupations and industries are created as the demand for other goods and services increase. This demand for goods and services was created by increase in the real income which in turn was a result of an increase in efficiency of production and lowering of prices, brought on due to automation. However this is a superficial or simplistic way of looking at the influence of automation on labor market today. Hod Lipson an engineer from Cornell University claims that “for a long time the common understanding was that technology was destroying jobs but also creating new and better ones. Now the evidence is that technology is destroying jobs and indeed creating new and better ones but also fewer ones”. According to studies, the number of new jobs created from the arrival of new technologies throughout the 2000s has been distinctively minor. These have largely been limited to skilled workers. Cities and nations with a large pool of skilled workers have thus benefited disproportionately from recent technological change. In his book, “The Lights in the Tunnel”, Martin Ford publishes a hefty warning “as technology accelerates, machine automation may ultimately penetrate the economy to the extent that wages no longer provide the bulk of consumers with adequate discretionary income and confidence in the future. If this issue is not addressed, the result will be a downward economic spiral”.

Conclusion and the way forward

So, the conclusion as of today is that ‘the economic singularity is not near for another century or so’ given that technological progress encompasses just routine tasks that are easy to automate but not non routine tasks like cognitive or manual skills that are less or not easily programmed. Keynes prediction of a world of leisure may prove correct if consequences of technological advancements on labor market are left unchecked.

Government and International organisations like United Nations should not adopt passive policy stance as public policy. Proactive policies are needed to better address the consequences of technological advancements, by playing a crucial role in determining the degree of diffusion of automation in the market and controlling the effects of it. Policies are needed to redistribute income, as technological changes distort income distribution. It is important to recognise the bottlenecks to automation, like perception and manipulation, creative intelligence, social intelligence and work on developing skills associated to them in order to protect against jobs being eliminated due to automation. Policymakers need to leverage education as a very important tool in preparation for the effects of accelerated technological change.

Famous author Elbert Hubbard said “One machine can do the work of fifty ordinary men, No machine can do the work of one extraordinary man.” With technology accelerating at an exponential rate Hubbard may be wrong. We need to be exceptional for technology to not cease our livelihood.

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