Paper Title: The Economic impact of AI and Automation in terms of Unemployment, Inequality and Economic Growth

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Abstract

The advent of automation and artificial intelligence (AI) has significantly transformed the global economic landscape over the past few decades. Advances in AI technologies have created new markets and potential for improvement in vital areas such as health, education, energy, economic inclusion, social welfare, and the environment. Since last few decades, artificial intelligence (AI) and robotics have made significant advances. Future advancements are projected to be even more dramatic, with many observers predicting that new technologies will change work around the world. On the other hand, On the other hand, the impact of technological advancements, automation and artificial intelligence (AI) became the main keyword of future discussions. Advances in automation by using the increasing capability of AI (i) changing the direction of the labour market by changing the quantity and type of jobs and hence disrupt labour market (ii) AI automation can decrease the share of labour income (iii) by reducing the aggregate demand, it slows down the economic growth. AI has potential to deliver the supply-side driven expansion but due to slow wage and productivity growth, economies will fail to reap the benefit of it. This chapter examines the profound impact of artificial intelligence (AI) and automation on the labour market, income distribution, and economic growth in the long run.

Key Words: AI, growth, labour, unemployment, aggregate demand, income distribution, wage, automation,

Introduction:

The world has undergone an enormous technological transformation in recent decades, which has transformed many facets of human existence. Artificial intelligence (AI) and automation are two of the most transformational inventions of this century. As a branch of computer science, AI enables robots to simulate human intelligence and do activities that previously needed human understanding. Advances in mechanization in the late nineteenth and early twentieth centuries automated much of the physical labour performed by humans. Advances in information technology in the mid- to late twentieth century automated much of the standardized data processing that used to be performed by humans. However, each of these past episodes of automation left large areas of work that could only be performed by humans. Some propose that advances in AI are merely the latest wave in this long process of automation, and may in fact generate less economic growth than past technological advances (Gordon 2016). Others, by contrast, emphasize that AI critically differs from past inventions: as artificial intelligence draws closer and closer to human general intelligence, much of human labour runs the risk of becoming obsolete and being replaced by AI in all domains. In this view, progress in artificial intelligence is not only a continuation but the culmination of technological progress; it could lead to a course of history that is markedly different from the implications of previous waves of innovation, and may even represent what James Barrat (2013) has termed “Our Final Invention.” No

matter what the long- run implications of AI are, it is clear that it has the potential to disrupt labour markets in a major way, even in the short and medium run, affecting workers across many professions and skill levels (Acemoglu, Daron. 1998). Concerns about automation, mechanisation, and man-machine substitution goes back to the industrial revolution, and perhaps far further. The present AI issue fits neatly into that long-term trend. Concerns include fears that AI would accelerate the automation of jobs, causing mass technological unemployment, and that its economic benefits would accrue to only a few, driving up inequality (Frey and Osborne, 2017; Korinek and Stiglitz, 2017). The COVID-19 pandemic is expected to give a further impetus to the digitization and automation of the global economy (Bloom and Prettner, 2020; Schrage, 2020). On the one hand, AI and automation AI is expected to boost economic growth by increasing productivity, innovation, and efficiency across various industries. According to different estimates, AI could add an average of 1.7% to 1.2% of additional GDP growth per year until 2030, resulting in 16% higher cumulative GDP compared with today (Mckinsey & Company Report). The industries that will benefit the most from AI are Information and Communication, Manufacturing and Financial Services. On the other hand, it poses various macro-economic problems such as increasing the unemployment, slowing wage growth due to low productivity, widening inequality among labour and world economies and hence it will also slow down the economic growth in long run. Besides it, there are three sustainable goals which is interconnected with this problem and may face negative impact. (i)The first sustainable development goal is “No Poverty”, (ii) the eighth sustainable development goal is “Decent Work and Economic Growth” and (iii) The tenth sustainable development goal is “Reduced Inequalities” much related to these macro-economic problems. Growing labour force while the number of jobs is decreasing and slower economic growth is the main reason for widening inequalities and the main threat to economic, social, and political stability.

In this chapter, first I present both perspectives and the related empirical evidence. Starting with a discussion of the traditional capital-labour (machine-labour) substitution. With the help of some models that try to combine the two approaches and allow for both labour augmenting and depleting effects depending on the assumptions made on the elasticity of substitution between capital and labour in total production. Part of the debate has moved beyond the narrow focus on employment substitution effects and also focusing on more comprehensive perspective that takes into account the productivity effects of AI on economic growth. The chapter also review some papers on the impact the distributional implications of AI on income distribution. Finally, I discuss theories and empirical evidence that supports that AI and automation impact the labour markets, growth and inequality adversely which may be different from previous technological advancements.

The Traditional Views on AI & Automation

Every decade has a different critical debate topic, but the global economy faced with the same macroeconomic issues and concluded with the same result: unemployment. Aside from being a macroeconomic issue, unemployment is critical since it has both social and economic consequences. There are political issues. It has been the core of the economy because of its importance. Several research and became an indication of welfare, particularly after the Great Depression. Autor (2015) summarizes very well the mechanisms of substitution and complementarity between men and machines: "Focusing only on [jobs] lost misses a central economic mechanism by which automation affects the demand for labour: raising the value of the tasks that workers uniquely supply". There are two effects of the AI and Automation, on the one hand, there is complementarity and on the other hand there is substitution effect. Workers are more likely to benefit directly from automation if they supply tasks that are complemented by automation, but not if they primarily (or exclusively) supply tasks that are substituted. Under complementarity between AI and supply task, benefit is positive but if it substitutes with labour then effect will be negative on employment. In line with Baumol's (1967) "cost disease" hypothesis, rising productivity in technologically leading sectors may boost employment nevertheless in lagging activities where humans exhibit a comparative advantage in comparison to robots". Demand side theory also plays an important role where automation and AI decreases the aggregate demand for labour as technology rapidly encroaches on human jobs - the “robocalypse” scenario.

Karabarbounis and Neiman (2014) find some evidence that undermines the complementarity hypothesis. They show how the share of labour in value-added has declined since the 1980s and attribute this to a relative decline in the price of capital goods, induced mainly by ICT technology. This motivates firms to replace more human labour with machines. Still, it did not prevent Brynjolfsson & McAffee (2011, 2014) from debating debate arguments for and against the complementarity is hypothesis. Because automation increases the demand for capital and the rental rate, it encourages capital accumulation. It is thus possible to have periods of fast automation during which the labour share declines and capital accumulation accelerates even if the elasticity of substitution between capital and labour is less than one. This implies that rather than being the cause of the decline in the labour share (as argued by Piketty (2014)), capital accumulation may be a response to automation and lessen its negative impact on the labour share (when the elasticity of substitution is less than one). There is an old problem called “Technological Unemployment” propounded by J. M. Keynes. Keynes pointed out the “discovery of means of economising the use of labour” that caused productivity gain-based reduction in employment (Keynes, 1930). Besides, Simon (1965) expressed that “machines will be capable, within twenty years, of doing any work a man can do” in his seminal book named as “The Shape of Automation for Men and Management” (Simon, 1965). Following these ideas, technological unemployment became one of the main debate topics between macroeconomists and revived in the second decade of the 21st century. United Nations Development Program (UNDP) emphasized the increase in inequality between nations and pointed out the technical change as the driver of this inequality.

Especially, the UNDP report stated that this technological change affected the functional distribution of income and increase primary income inequality with increasing returns to capital and productivity (UNDP, 2013). Besides, many of the workers are substituting by automation in (Iscan, 2021) many industries even in the health sector that affected income inequality. As a stunning example, Nawrocki et. al. (2018) and Thrall et. al. (2018) stated that AI is providing a new set of tools in radiology for interrogating image data and may

increase the productivity. This foresight for the use of AI in radiology brings debates about the job market of the radiologists. Similarly, the situation may be the same for the physiotherapist because of AI-assisted rehabilitation and has the potential to affect job markets. There are many similar examples. These effects have the potential to limit the wage growth and decline the share of labor in income that will cause a decline in prosperity eventually. Be aware that all of these studies have empirical data that dates back several decades, long before AI raised alarm. These studies therefore more thoroughly examine the overall impact of "technological progress" on labour markets. Some of it gives assurances regarding the positive effects of computers on employment, but it makes no mention of the effects of AI specifically.

The impact of AI and automation on unemployment/labour market:

Frank et al. (2019) classify current literature on the labour market implications of AI into two broad categories: a doomsayer's perspective and an optimist's perspective. Doomsayers believe that labour substitution by AI will harm employment. Frey and Osborne (2013) estimate that 47% of total US employment is at risk of losing jobs to automation over the next decade. Their research reveals that a substantial share of employment in service occupations – where most US job growth has occurred over the past decades – are highly susceptible to computerisation. Bowles (2014) uses Frey and Osborne's (2013) framework to estimate that 54% of EU jobs are at risk of computerisation. Acemoglu and Restrepo (2017) provide a historical example of excessive automation negatively affecting the labour market due to weak productivity and reinstatement effects, finding that areas in the US most exposed to industrial automation in the 1990s and 2000s experienced large and robust negative effects on employment and wages.

Job Displacement: Automation and AI technologies can replace certain human tasks and jobs, leading to job displacement. Jobs that involve repetitive and routine tasks are most vulnerable. This can result in unemployment or underemployment for some segments of the workforce, particularly those lacking the skills required to adapt to new job demands.

Job Creation and Transformation: While some jobs may be lost due to automation, new job opportunities can also emerge in industries related to AI development, data analysis, robotics, and more. However, these new jobs often demand higher skill levels, which can lead to a mismatch between the skills of the displaced workers and the requirements of the new roles.

Income Inequality: AI and automation can contribute to income inequality. Highly skilled workers with expertise in AI-related fields may benefit from increased demand for their skills, leading to higher wages and income concentration among a small group. On the other hand, lower-skilled workers may face stagnant wages or job losses, exacerbating income inequality.

Global Economic Shifts: The impact of AI and automation on employment and inequality can vary widely between different countries and regions. Developed economies with a strong focus on technology and innovation may experience more significant shifts in employment patterns compared to developing economies that rely on labor-intensive industries.

Upskilling and Reskilling: To address the challenges of job displacement, investments in upskilling and reskilling programs become crucial. Governments, businesses, and educational institutions must work together to ensure the workforce is equipped with the necessary skills to adapt to the changing job market.

Impact of AI on income distribution/Inequality:

While these technologies offer significant potential for enhancing productivity and driving economic growth, they also present challenges that can exacerbate existing disparities between different segments of society. The majority of the literature on this predicts a negative impact of AI on income equality. For instance, in a dynamic general equilibrium model with robots representing a separate form of capital that is complement to traditional capital, Berg et al. (2017) simulate different degrees of advancements in automation on the distribution of income. All scenarios eventually lead to an increase in inequality with the worst outcome when robots only substitute for unskilled labour. The most widely debated source of technology-driven income inequality is the increase in labour income inequality. Evidence suggests that labour market polarisation plays an important role in this. We observe polarising labour markets because tasks that are not easily performed by AI tend to be found on opposite ends of the skills spectrum while AI tends to replace humans in tasks that correspond to the 'mid-skill' category (Autor et al., 2003). Acemoglu and Autor (2011) and Autor and Salomons (2017) show suggestive evidence from the US on how job polarisation translates into wage polarisation or even a polarisation in working conditions. This highlights the need for appropriate policy responses to prevent income inequality due to AI proliferation. Below are some key factors contributing to the impact of AI and automation on income distribution and inequality.

Job Displacement and Polarization: One of the most immediate effects of AI and automation is the displacement of certain job categories. Routine and repetitive tasks are increasingly being automated, leading to job losses for workers in these fields. This can disproportionately affect low-skilled workers who may find it challenging to transition into new roles or industries. As a result, income distribution may skew towards those with the necessary skills to thrive in the rapidly changing job market, while leaving others behind.

Furthermore, AI and automation tend to polarize the labor market. While some workers benefit from higher wages and increased demand for specialized skills, others experience stagnant or declining wages due to the reduced demand for their labor. This polarization can lead to a widening income gap between high-income earners and low-income workers.

Skill-Biased Technological Change: AI and automation tend to complement and augment the skills of certain workers while substituting for others. This phenomenon, known as skill-biased technological change, rewards individuals with skills that align with the new technology and its applications. Consequently, workers with high levels of education, technical expertise, and problem-solving abilities often see their incomes rise, while those lacking such skills may face wage stagnation or declines.

Concentration of AI-Related Profits: AI and automation are often associated with tech companies and industries at the forefront of these innovations. As these industries experience significant growth, the profits generated are often concentrated among a small number of high-tech firms and their shareholders. This concentration of wealth and capital can contribute to income inequality, as the benefits of AI and automation may not be evenly distributed across the broader population.

The Gig Economy and Precarious Work: AI and automation have also facilitated the growth of the gig economy, where workers engage in short-term, on-demand work. While this offers flexibility for some individuals, it can also lead to increased job insecurity and reduced access to traditional employee benefits. The gig economy may further widen income disparities, as gig workers often lack the stability and protections associated with regular employment.

Access to Education and Training: The adoption of AI and automation places a premium on education and training. Workers with access to quality education and opportunities for upskilling and reskilling are better positioned to thrive in the changing job market. However, individuals without such access may find it challenging to participate in the workforce or obtain well-paying jobs, further contributing to income inequality.

How AI impact on Economic Growth:

Just like the long-term empirical evidence on technological innovation suggests that unemployment remains relatively stable, the so-called Kaldor (1961)(1961) Facts or long-run evidence on economic growth suggests that growth rates and the share of capital in overall income remains relatively stable. More recent research however suggests that this is not necessarily the case. Karabarbounis and& Neiman (2014)(2014) show how the share of labour in value-added has declined since the 1980s. They attribute this to a relative decline in the price of capital goods, induced mainly by ICT technology. This has motivated firms to replace more human labour with machines. That research provided a first hint that "this time may be different", though not directly related to AI. Here we ask the question if AI could reinforce that "difference"? Will it have a structural impact on economic growth rates and will it increase the share of capital in incomes at the expense of wages?

Job Displacement: One of the significant concerns is that the widespread adoption of AI and automation may lead to the displacement of certain jobs. While new jobs and industries might be created as a result of these technologies, there could be a transitional period during which some workers face unemployment or underemployment. This can have short-term negative effects on economic growth, as displaced workers may take time to retrain and transition into new roles.

Income Inequality: AI and automation can contribute to income inequality if the benefits are not evenly distributed across the population. Those who possess the skills required to work with or develop AI technologies may see their incomes rise significantly, while others in lower-skilled roles may not experience the same level of wage growth. Widening income inequality can lead to reduced consumer spending and overall economic growth.

Skill Gap and Education Challenges: The increasing reliance on AI and automation demands a workforce with the skills to operate and maintain these technologies. If there is a lack of skilled workers, it can hinder the adoption and utilization of AI, impacting productivity and growth.

Resource Reallocation: Automation can lead to the reallocation of resources, which may cause disruptions in certain industries. For example, if manufacturing becomes highly automated, there may be a shift of resources away from labour-intensive manufacturing sectors, potentially affecting regions or countries that heavily rely on these industries.

Ethical and Regulatory Concerns: The deployment of AI and automation raises ethical concerns around data privacy, security, and potential biases in algorithms. In response, governments and regulatory bodies may impose stricter regulations on these technologies, leading to higher compliance costs for businesses and potential restrictions on certain AI applications, which could impact innovation and growth.

It's important to remember that the overall impact of AI and automation on the economy will depend on various factors, including how policymakers, businesses, and societies respond to these technological advancements. By investing in education and training, implementing appropriate policies, and fostering an environment that encourages innovation, the negative effects of AI and automation can be mitigated, and the potential for economic growth can be harnessed.

Some Positive Aspects of AI:

At the 2023 World Economic Forum, tech entrepreneur Mihir Shukla noted: “People keep saying AI is coming but it is already here”. The use of artificial intelligence (AI) for day-to-day tasks has increased rapidly over the last decade and ChatGPT (developed by OpenAI) is a prime example of this, with the popular generative AI used by more than a billion users for everyday tasks like coding and writing. The speed and scale of AI uptake can be captured by a simple fact: it took ChatGPT just 60 days to reach its 100 millionth user; in contrast, Instagram took two years to reach the same milestone. A recent Stanford University report found that the number of AI patents increased 30-fold between 2015 and 2021 (HAI 2023), highlighting the rapid rate of progress made in the AI development sphere. AI-powered technologies can now perform a range of tasks, including retrieving information, coordinating logistics, providing financial services, translating complex documents, writing business reports, preparing legal briefs, and even diagnosing diseases. Moreover, they are likely to improve the efficiency and accuracy of these tasks due to their ability to learn and improve via the use of machine learning (ML).

AI is generally acknowledged to be an engine of productivity and growth. With its ability to process and analyse enormous volumes of data, it has the potential to boost the efficiency of business operations. The McKinsey Global Institute predicts that around 70% of companies will adopt at least one type of AI technology by 2030, and less than half of large companies may use the full range of AI technologies. Price Waterhouse Coopers predicts that AI could increase global GDP by 14% in 2030 (PwC 2017).

Research into the impact of AI on the labour market has expanded recently. Acemoglu and Restrepo (2018) provide a theoretical framework to understand the impact of new technologies on the labour market. They decompose the effect of new technologies on labour into three broad effects: a displacement effect, a productivity effect and a reinstatement effect (new technologies can serve as a platform to create new tasks in many service industries, where labour has a comparative advantage relative to machines, boosting labour demand). According to Lawrence et al. (2017), the large positive spillover effects of AI automation (the reinstatement effect), which would offset the detrimental direct effects of substitution in the labour market and be viewed as Schumpeterian "creative destruction," make it unlikely that AI automation will have a negative impact on the employment market. They think that rather than eliminating work, automation will likely transform it. Only 9% of jobs in the UK are predicted to be vulnerable to automation in the next ten years, according to Arntz et al. (2016), contrary to other studies that found more significant negative effects. They contend that rather than job substitution, job transformation is more likely to happen, with 35% of jobs expected to undergo significant change over the next 20 years.

Conclusion:

The literature on the employment and wage effects of the spread of AI is unclear as of yet: If machines only replace human labour, it could be detrimental, but if they complement human labour and boost overall productivity, it could be beneficial. The latter effect can raise labour productivity and lower output prices, which can lead to demand growth both within and between sectors. A reallocation of workers across sectors may result from wage effects that are also a result of increased productivity.

There are worries that AI machines will replace human workers. Although transitions can be difficult, historical evidence suggests that previous waves of innovation that replaced workers with machines ultimately led to the creation of more jobs (re-instatement) and higher incomes. The impact of technological progress on employment polarisation has raised concerns of increased inequality due to AI proliferation. Some empirical literature seems to confirm these concerns. Policies that create incentives for innovators to share their surplus or that shift taxes from human labour to capital may help to counteract the distortionary effects that automation may have for income equality but policy reforms change the structure of incentives that underlies individual decision making. Whether or not policy will be effective in mitigating the potential distortionary effects of automation is an empirical question. The literature on the long-run effects of automation and AI on global economies highlights the transformative potential of these technologies. While they can boost productivity and economic growth, they also pose challenges related to job displacement, income inequality, and labor market dynamics. Effective policy frameworks that promote a balanced approach to technological adoption while addressing societal concerns will be crucial in harnessing the full potential of automation and AI for sustainable economic development. Continued research is necessary to better understand the evolving impact of these technologies on global economies in the future.

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