Research progress on the impact of artificial intelligence on the labor market

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Abstract. The application and development of artificial intelligence has exerted an important influence on the labor market. The existing literature mainly studies the impact of artificial intelligence on the total amount of employment and the employment structure. This paper argues that AI has the potential to reshape the labor market in many ways, with the potential to realize the leisure age of Keynes. AI can increase productivity and efficiency through automation of everyday tasks and may replace work through automation of everyday tasks. Governments need to adopt aggressive policies to address the potential trade-off between automation and unemployment. Investing in education and training programs is critical due to skill changes caused by AI. Therefore, this paper also provides further policy suggestions on how to deal with the possible employment shock caused by AI.

Keywords: artificial intelligence; improve productivity; education and training; employment impact.

1. Introduction

After recent decades of development, the application scope of "artificial intelligence" has been continuously expanded, not only playing an important role in science and engineering, but also triggering major changes in the national economic structure (Damioli et al, 2021). In recent years, as the growth rate of the working-age population slows down, China has faced the pressure of labor supply shortage and rising labor costs, which has provided the impetus for the development of artificial intelligence technology in China (Cheng et al, 2019). Existing research also shows that advances in artificial intelligence technology have had a huge impact on China's labor market (Ford, 2015). The rapid development of Artificial Intelligence (AI) including machine learning, natural language processing and robotics, has reshaped many aspects of society and the labour market. The impact of AI has been addressed in many areas of the economy and society (Peters, 2017; Makridakis, 2017). There is also a growing literature on the impact of AI, such as the impact of labor employment and income distribution, industrial structure upgrading, capital structure optimization and technological innovation (Aghion et al, 2017; Acemoglu & Restrepo, 2018b; Cockburn et al, 2018; Roy etal, 2020). Among them, the research on the impact of AI on the labor market is particularly prominent. In the development process of human society, every kind of scientific and technological progress will bring deep economic and social changes, and the impact of the development of new technology naturally has two sides, and this dual impact will often cause heated discussions (Autor, 2015; Susskind, 2017; Kujur, 2018; Gregory et al, 2019). Artificial intelligence technology will also have a positive and negative impact on the labor market. In the process of using it to promote economic development, human beings should also minimize the adverse impact of artificial intelligence on the economy and society. Compared with previous technological innovations, the most remarkable feature of artificial intelligence is that it makes machines intelligent, so that they can complete self-learning. Deep learning has enabled machines to transform some of the unconventional tasks previously performed by workers into routine tasks that can be performed by machines. Artificial intelligence is no longer just a machine to expand human capabilities, it will also do the work of the human brain, impact previously unaffected industries, and do more work instead of labor (Schwab, 2017). Since AI becomes more sophisticated and been widely applied, numerous tasks can be automated as a result of improved productivity. AI is creating new employment but causing frictional unemploy- ment among workers with different skill sets, thereby impacting the labour supply and demand in the related industries. Accordingly, in this paper, I investigate the potential

effect of AI on the labour market and assess whether the resulting changes might ultimately lead to an "age of leisure" as John Keynes envisaged.

2. AI's Potential to Reshape the Labour Market

2.1 Comparative Statics Analysis: Labour Supply and Demand

In the first place, AI is capable of performing routine tasks involving assembly line work, data processing, clerical work, and quality control. By automating these repetitive tasks, humanswill be able to focus on creative, analytical and interpersonal activities. AI may replace the low- skilled workers in the highly repetitive assignments and, therefore, reduce the demand for low- skilled labours (Acemoglu and Restrepo, 2022; Frank et al., 2019). The study by McKinsey (2017) predicts that at least 20% of labour tasks will be automated in the near future.

Automation of Job was perceived as an immediate threat to jobs, yet in the long run it did not necessarily result in reduction in employment. For example, employment in the agricultural sector has sharply declined from 70 percent to under five percent as the heavy-duty machinery has re- placed farmers (Autor, 2015). The automation of certain tasks will create new job opportunities in areas such as bioengineering, statistical learning, and robotics engineering applicable to medicine and manufacturing, among others. There will be more demand for professionals who are capable of managing, updating, and maintaining AI systems, and technical skills such as programming and data analytics will become more in demand (Bessen, 2018). I demonstrate in the Figure 1 that AI increases the demand for labour in industries related to AI. The result of such a positive demand shock is an increase in employment (Q1 to Q2) and wage rates (W1 to W2). Thus, humans may continue to adapt to AI automation through transitions between different occupations.

It is likely that the widespread adoption of AI will disrupt certain industries, resulting in a skill transition from low-skilled to high-skilled employment. Tkinson & Wu (2017) analyzed the employment changes in the US labor market between 1850 and 2015 that the previous technological change created far more jobs than the proportion of jobs lost, so it is unnecessary to worry that AI will reduce jobs. Aghion et al (2020) is also optimistic about the employment effect caused by artificial intelligence. Using the comprehensive micro data of the French manufacturing industry from 1994 to 2015, they found that the promotion effect of automation technology on labor force is greater than its substitution effect on labor force, and the application of machines will eventually promote employment. Roy et al (2020) In a comparative analysis of the development level and impact of AI technology in different countries, he proposed that although AI will reduce some jobs, it will often create more job opportunities and play a greater role in promoting the employment of the labor force. When artificial intelligence replaces human labor in various sectors, frictional unemployment may arise in low-skilled industries that are easily automated. As illustrated in Figure 2, the additional labour supply from the AI-industry will partially offset this unemployment. As a result, the labour supply shifts to the right to reach a new equilibrium.

2.2 AI Creates Jobs in the Non-AI Industries

Most scholars believe that although there is no need to worry too much about the possible mass unemployment caused by AI, its impact on the employment structure is still noteworthy (Betsey, 2018; Brynjolfsson et al, 2018). Generally speaking, AI has a different impact on the labor force with different education and skill levels, and the development and application of AI has a greater adverse impact on the labor force with lower education level and skill level (Borjas & Freeman, 2019). The reason is that technological advances are more likely to replace conventional tasks (Charnoz & Orange, 2017; Gaggl & Wright, 2017), and the general workforce is often concentrated in these areas. In contrast, the highly skilled labor force is less likely to be replaced by machines (Prettner & Strulik, 2017). As expected, there is a growing demand for technical skills, such as software development and statistical modeling. Nevertheless, as routine information processing tasks are gradually re- placed by artificial intelligence, jobs requiring unique human skills may become increasingly valu- able in

hybrid human-AI working environments, including creative skills (university professors and school teachers), teamwork (project managers), negotiation skills and communication skills (business consultants), and problem-solving skills (public relations managers) (Ernst et al., 2019).
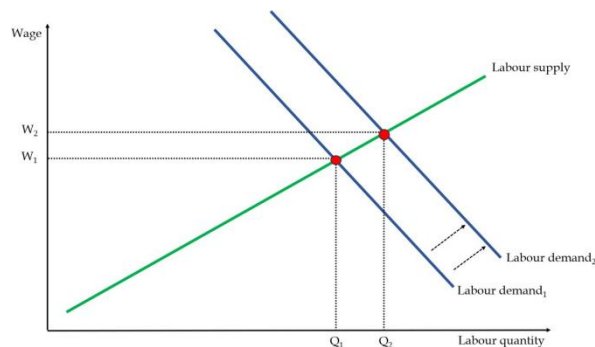

Figure 1: AI shock and job creation in the AI-related industries
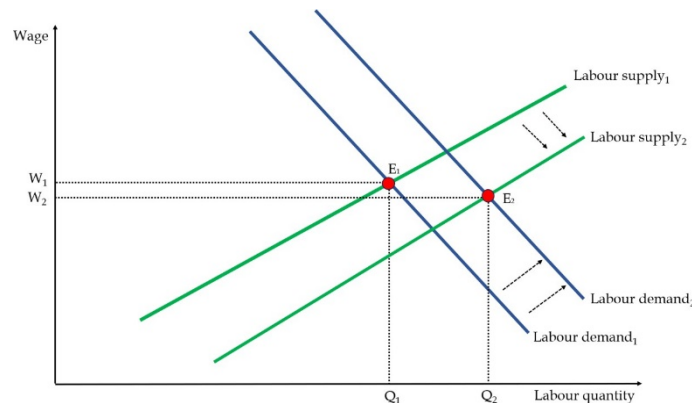

Figure 2: AI shock and comparative statics analysis for the AI-related industry

Consequently, to help workers transition into these new roles, there may be a need for widespread reskilling and upskilling programs (Autor, 2015, 2019). AI may require individuals to acquire new skills or adapt existing ones, ensuring that they remain competitive and relevant in the changing labor market (Healy et al., 2017).

2.3 Comprehensive impact of artificial intelligence on the employment of labor force in different industries

Artificial intelligence plays different roles in different industries, and there is a significant industrial heterogeneity in its impact on employment. Bessen (2019) believes that automation technology may not lead to mass unemployment, but it will have an important impact on the employment structure of the workforce. Automation has reduced manufacturing employment, increased non-manufacturing employment, and workers move across industries. Similarly, Mandel (2017) found that new jobs in industries such as e-commerce were enough to make up for the reduced number of jobs in the retail industry, and the labor force realized employment transfer between industries in this 1-152 process. Autor (2015) research points out that automation technology can create more employment opportunities for managers and workers engaged in manual labor, changing the types of jobs available in the job market, thus leading to changes in the industrial structure of the labor force. Susskind & Susskind (2018) proposed that the in-depth development of artificial intelligence will create more emerging industries, promote the employment transfer of labor force in traditional industries, and then accelerate the adjustment process of industrial structure. Autor & Salomons (2017) Considering the spillover effect of AI, it believes that increased productivity in an industry will reduce the number of employment in the industry, but the promotion effect on employment in other industries will often offset this adverse impact. In terms of the employment impact of manufacturing and services, most studies believe that AI reduces the number of

manufacturing jobs while increasing the employment opportunities in the service sector (Dauth et al, 2017; Mann & Puttmann, 2017). Autor & Dorn (2013) believes that the manufacturing workforce is more likely to be replaced by machines, but it will eventually shift to the service sector in the hope of reemployment. With the continuous development of artificial intelligence technology, it will have a great impact on the routine and procedural work in the manufacturing industry, the employment of the labor force will accelerate the transfer from the manufacturing industry to the service industry, and the industrial structure of the labor force will be optimized and upgraded (Huang & Rust, 2020). Still, the impact of AI on manufacturing is not entirely negative, and with the continuous development of automation technology, many jobs and jobs in the service sector are at risk of being replaced (Chui et al, 2016; Berri-man & Hawksworth, 2017). Therefore, in the process of future development, it is necessary to correctly grasp the evolution direction of artificial intelligence technology and give full play to the positive role of artificial intelligence in the transformation and upgrading of industrial structure and human capital structure.

3.   AI as a Shock and Keynes "Age of Leisure"

In the event that AI is adopted on a large scale, it has the potential to profoundly affect productivity, output, and income per capita for workers. Laborers make a choice between leisure   and earning higher income in order to maximize their utility. An increase in income offsets the disutility of working longer hours.

Keynes' concept of an 'age of leisure' refers to a future state in which technological advances and improvements in productivity reduce overall working hours, creating more leisure time for individuals. The application of this concept to AI-driven labor markets, however, is dependent on a number of factors. The distribution of working and leisure hours is influenced by labor laws, regulations, and societal norms.

In contrast to Keynes' prediction, there is also evidence that increased productivity may not necessarily result in significantly fewer work hours. It is shown in OECD (2023) that, despite massive productivity improvements, the average annual work hours per capita only decreased by 3 percent in the United States and 8 percent in Germany. Labor supply elasticity may also affect working hours. There is a possibility that the AI shock could result in more jobs but at a lower real wage when labour supply is elastic. It is therefore possible that workers will not work fewer hours. Policy interventions should, therefore, be investigated to promote positive outcomes in terms of employment, leisure, and overall well-being (Agrawal et al., 2019).

4.   Discussion and Policy Implications

A comprehensive assessment of AI's impact on labor markets and leisure time must also take into account broader societal and policy implications. A number of factors influence the labor market and leisure time, including cultural norms, social preferences, and government regulations.

Fully understanding the impact of AI adoption on the labour market requires an examination of the relevant economic factors. It is important to examine how AI impacts productivity, wages, income distribution, and gender equality (Acemoglu and Restrepo, 2020, 2022; Cortes et al., 2020; Webb, 2019). There are trade-offs between increased automation and job losses that must be considered when evaluating the potential outcomes and challenges of AI-driven transformation of the labor market. AI's impact on the labor market and leisure time is influenced by broader societal and policy factors.

However, AI adoption could impose substantial short and medium-term adjustment costs, especially for lower-skilled workers in automatable routine tasks (Acemoglu and Restrepo, 2020). Retraining programs, hiring credits, relocation vouchers, income support, and social insurance will be necessary to help facilitate job transitions under AI. There may be a need for proactive govern-

ment policies to address this frictional unemployment and ensure a smooth transition for affected workers (Healy et al., 2017).

5. Conclusion and policy recommendations

It is clear that AI has the potential to reshape the labor market in many ways. AI may enhance productivity and efficiency by automating routine tasks as well as potentially displace jobs through the automation of routine tasks. There is a need for proactive government policies to address potential trade-offs between automation and job losses. Investing in education and training programs is essential due to the skill shifts caused by AI.

A number of factors, including labor unions, labor law regulation, societal norms, and policy decisions, are necessary to determine whether AI will usher in Keynes' 'age of leisure'. AI's impact on the labor market is likely to be multifaceted, and its impact on leisure time will depend on how these factors develop in the future. As AI is rapidly advancing, it is essential to ensure that its effects on the labor market are guided in a manner that promotes inclusiveness and better well-being for all employees. Therefore, this paper should propose the following policy suggestions for the impact of artificial intelligence. First, we need to promote the rapid development of emerging industries and amplify the job-creation effect of artificial intelligence. From the long-term development point of view, the future around the emerging industries of artificial intelligence will create a lot of jobs, encourage independent research and development of artificial intelligence, enhance the core competitiveness of related industries, will promote the rapid development of emerging industries, create a lot of new jobs, and to solve the possible problems in the process of artificial intelligence development of technical unemployment. Second, we should strengthen education and vocational skills training. Artificial intelligence is an important driving force leading the new round of science and technology revolution, although promoting the development of emerging industries related to artificial intelligence can create new jobs, but the development of new forms need to match certain knowledge literacy and skills, thus under the historical background of rapid innovation of artificial intelligence technology, strengthen learning education and skills training is the key. Third, we should improve institutional arrangements and guard against social risks. With the deepening of technological progress, the risk of unemployment faced by the labor force will also increase. Therefore, in addition to strengthening labor force education and vocational skills retraining, a series of social security systems such as unemployment insurance should be improved to ensure the basic survival level of the unemployed and prevent social risks.

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