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Artificial Intelligence: Threat or Opportunity for Humanity?

Artificial Intelligence and the Future of Work. How it will affect Businesses and Employees.

EDITED BY: Michelaki Despoina
Pervolianaki Niki
SCHOOL: UNIVERSITY OF CRETE

Introduction

Productivity is a measure of performance of the output of the product with the input or resources required to produce it(Kenton, n.d). The input may be labor, equipment or money. Economists see productivity as a key source of economic growth. The Nobel laureate economist Robert Solow, in his research paper "A Contribution to the Theory of Economic Growth" used the neoclassical model of production function, known as Solow-Swan Growth Model, to explain how economic growth is driven by different factors focusing on an economy's long term potential. The key feature of this model is that technological advancement is considered an exogenous factor which affects the productivity of capital and labor. Solow concludes that while capital investment and labor contribute to growth, technological innovation is the primary engine for long-term economic expansion.

This is further explained in "Technical Change and the Aggregate Production Function" in which Solow assumes that technological innovation increases the efficiency and the productivity of productive coefficients. These changes may include new machineries, improved production techniques, better management practices or innovations that lead to mass production with the same or lesser inputs.

The aggregate production function describes the relationship between total output (generally GDP) and the inputs used to produce the output (capital, labor and technology). The most used form is a Cobb- Douglas production function expressed as:

$$Y = A^* K^{\alpha} * L^{\beta}$$

where

- Y is the total output or GDP
- A is the level of technology or the Total Factor of Technology
- K is the capital
- L is the Labor
- a, β are the elasticities of capital and labor respectively indicating their contributions to output.

Technical changes have an impact on the production function through changes to A in this context. An increase in A, means that more output can be produced with equal amounts of capital and labor depending on technology innovation.

Historically, technological advances have improved the abilities of workers to increase efficiency, improve quality of work and enable them to do new tasks. For example, the advent of mechanization during the First Industrial Revolution has led to a significant shift of agricultural workers to other sectors of the economy, creating new roles in both the blue collar and the clerical sectors.

The concurrent rise of the service sector created a surge in demand for skilled labor, which offered not only better remuneration but also safer and less physically demanding work conditions. This equilibrium between automation of conventional roles and the creation of novel tasks persisted until the late 20th century. However, a new technological frontier has been created by the dawn of the 21st century: Artificial Intelligence(AI). The foundations of AI are interdisciplinary scientific fields such as logic, statistics, cognitive psychology,

decision theory, neural science, cybernetics and computers. The essence of AI is its ability to replicate the mental processes of humans by using computing methods.

Insights from international organizations, governments, and industry experts suggest significant impacts of AI on the work landscape, which has begun shaping novel employment structures. AI is predicted to be a revolutionary force across numerous sectors, as indicated by projections from the European Union, China, and the United States, and its influence is anticipated to parallel the economic advancements brought about by general-purpose technologies of the 19th and 20th centuries, like the steam engine, electricity, electronics, and the Internet.

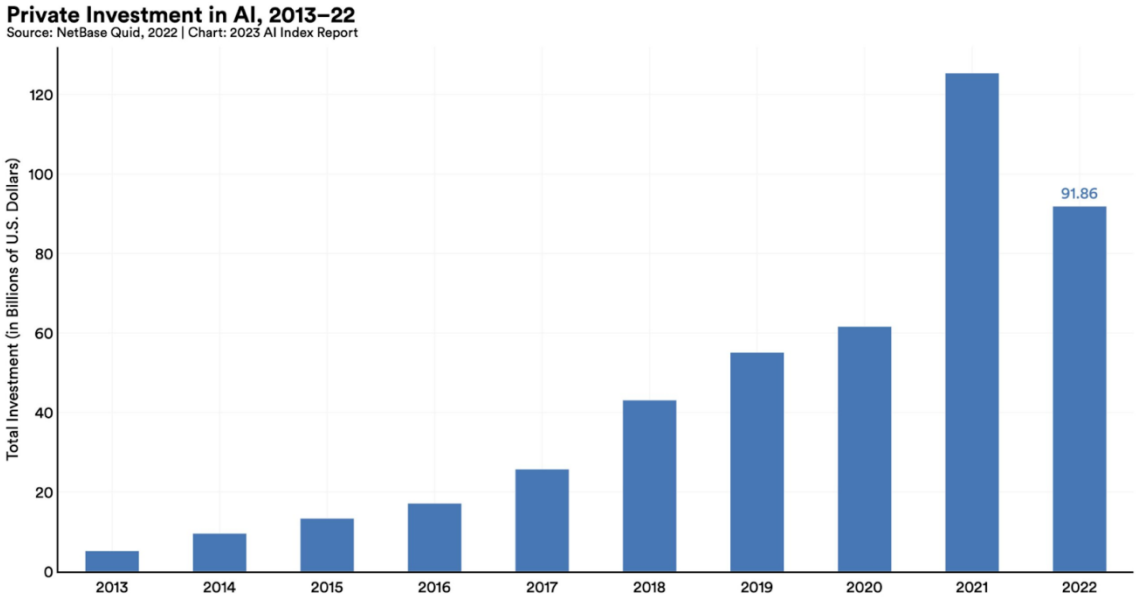

Figure 1

Source: HAI Stanford University

Figure 1 shows the Private global Investment in AI from 2013 to 2022. The total number of AI-related funding events as well as the number of newly funded AI companies likewise from 2021 to 2022 decreased. Still, during the last decade as a whole, AI investment has significantly increased. In 2022 the amount of private investment in AI was 18 times greater than it was in 2013.

Artificial Intelligence and The Modern Productivity Paradox

However, despite its promise, there seems to be a paradox: while adoption of AI is widespread and their capacity rapidly increases, productivity growth has not increased as anticipated. The paradox came into being in the late 20th century, when rapidly increasing Information Technology(IT) and computing developments did not appear to be compatible with expected productivity gains. This observation was particularly notable during the 1980s

and early 1990s, when many companies had invested heavily in IT but productivity growth remained stagnant or grew slightly. This observation was pointed out by Robert Solow in his article in the New York Times “We’d better watch out” emphasizing that “we see computers everywhere except in the productivity statistics”. This suggests that, while technological innovation theoretically should drive productivity, the path to realize the gains is quite complex.

Since then, many researchers have tried to explain the reasons behind this paradox. Most of the studies conducted showed disappointing results about the performance of technological innovation on productivity. According to Brynjolfsson(1993), the various explanations that have been proposed to explain the paradox can be grouped into four categories:

- Mismeasurement of outputs and inputs
- Time lags due to learning and adjustment
- Redistribution and dissipation of profits
- Mismanagement of information and technology

There is a peculiar correlation between the productivity paradox of information technology and electrification. In the United States, electricity came on stream in 1890 at factories but it's taken almost 30 years to get fully implemented. That indicates that General Purpose Technologies(GTPs) need to be complemented and these complements take years or decades to develop, which results in a time lag from the introduction of technology to its productivity benefits. AI and Machine Learning(ML) should be considered to be GTPs because they are widespread, improved over time creating complementary innovations that do not immediately deliver productivity gains as is the case for other GTPs.

In order to avoid mismeasurement, AI should be considered as an intangible asset because it can be acquired by means of investment and is a constant productivity coefficient that may reduce its value. According to the neoclassical production function, an increase of AI would probably increase labor productivity and total output but the effects of AI are more complex. In order to correctly capture the impact of AI on productivity we should take into account not only tangible assets but also intangible assets. Because AI capital is a new category of capital, national statistics agencies are required to measure relative prices of AI and non-AI capital differences in marginal product. Therefore, traditional measurement toolkits like GDP and productivity can become more difficult to measure and interpret.

According to Autor, et al (2014), Solow's paradox has long since been solved: computers are everywhere in productivity statistics, and IT powered machines will progressively replace workers, which will eventually lead to a much reduced role for workers in the future. Karabarbounis, et al. (2014) discusses a significant global trend: decreasing the share of national income that goes to employment relative to capital. Over the last few decades, many countries have seen a decrease in their labor share of income. As such, it indicates that this trend is a global phenomenon and not unique to some economies. The authors argue that the reduction in relative prices of investment goods, such as machinery and technology, is a major driver for labor market share loss. Businesses invest more in capital that can replace labor as the price of these goods falls. The shift towards capital investment reduces the proposition of income paid to labor.

From the above, it is implied that AI is considered a type of capital. The adoption of artificial intelligence as a factor of production (capital) has reduced its cost. In some other cases, however, a technological advance creates new productive possibilities where, given their previous absence, it is essentially equivalent to a decrease in the price of capital (from infinite to some finite number). In each of the above versions, the declining price of capital leads to the substitution of labor by capital in the production process. The sign of the cross-type elasticity of demand for a particular type of labor, in terms of a decrease in the price of capital, is related to whether that type of work is mixedly substitutive or combinedly complementary to capital in the production process. If the first is true and if the production scale effect of the falling price of capital is relatively small, then capital and this particular type of work are a mixed substitute, so the automation of production will lead to a decrease in jobs. Thus, the use of artificial intelligence in production can have either positive or negative effects on demand for work, different for different types of work/different categories of workers. Capital and a particular type of labor are mixed, complementary, or not, factors, depending on many different things, all of which correspond to the particular characteristics of a given industry or production process. In general, unskilled labor and capital are more likely to serve as substitute components in production than skilled labor or capital. According to Chari et al(2012), skilled labor and capital are complementary inputs to production. As a result, technical advancements, particularly the usage of artificial intelligence, are more likely to enhance the employment of skilled people than unskilled workers. (Smith et al,2017)

"The imbalance between rich and poor is the oldest and deadliest disease in all democracies". This is a quote made by the Greek philosopher Plutarch and reflects the impact of technological innovation. Automation, robots and artificial intelligence are evolving at an incredibly fast pace which raises concerns that in a few years these technologies will make labor unnecessary (Bryonjolsson et al, 2014). For instance, postings about AI- related jobs significantly increased around 2016. This suggests that AI is starting to influence the labor market. As mentioned above, the reduction of labor share is a global phenomenon. However, how far is it correct that it is entirely due to the replacement of labor by capital? During the previous industrial revolutions, capital redefined human labor and increased productivity. In the age of artificial intelligence we are again witnessing the same pattern as new tasks emerge. The striking difference between the current era and the past is the speed with which innovations are evolving. The gap created by the speed of technological innovation translates into a potential mismatch between the skills of the workforce and the demands of new technologies, leading to a sharp increase in the inequality between skilled and unskilled labor. (Acemoglu et al, 2018)

The question that arises is what should we do to promote the abundance of the age of artificial intelligence while trying to reduce inequality or at least mitigate the negative effects? Today's capitalist model of the economy promotes securing a decent living earned through a good job. The lack of work has a negative effect not only on individuals but also on entire communities. Short term solutions include the introduction of a Minimum Guaranteed Income and a negative income tax. Although the algorithms are getting more sophisticated, they can't be entirely independent. It means that even in areas where automation has occurred, humans are still capable of offering a lot. Even in chess, where humans can't beat a computer by themselves, human and digital collaboration is capable of doing so. To increase the value

of labor, support should be given to lifelong learning and specialization. (Bryonjolsson et al, 2014)

Conclusion

The intersection of these ideas reveals a complex and evolving relationship between technology, productivity, labor markets, and wages. As AI, IT, and automation continue to advance, it is crucial for policymakers, businesses, and workers to adapt by investing in education and retraining, in technical skills and management. Finally, a legal framework throughout the world should be legislated as the European Union has recently done. By addressing the productivity paradox, supporting labor market transitions and implementing the required legislation, society can harness the full potential of AI mitigating its risks. By following these suggestions, the AI threat will become the new “Creative Destruction”, as Joseph Schumpeter has mentioned.

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