Does Artificial Intelligence Really Improve the World's Economy? Evidence from Cross Country-level Data

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Abstract. The rapid development of artificial intelligence (AI) raises important questions about whether AI has an impact on the countries' economies or not. Some believe that AI could increase productivity and boost economic activities. However, AI also potentially replaces human's jobs, increases unemployment and other severe impacts on economic activities. Therefore, understanding the impact of AI on overall country's economic growth remains a challenge. This study emphasizes the impact of AI on countries' economic growth in two ways: first, we look at the relationship between AI and economic growth with correlation analysis. Second, we conduct a regression method to assess the impact of AI on economic growth. This study uses data from 160 countries from 2020 to 2023. The Government AI Readiness Index by Oxford Insights is used as a proxy for AI variable and Real gross domestic product (GDP) growth is used as a proxy for economic growth. This study reveals that, contrary to current belief, there is no relationship between AI and economic growth. This study also does not find any impact of AI on economic growth. In conclusion, it seems that the disadvantages of AI outweigh the advantages so there is still no evidence to support the significant impact of AI on economic growth.

Keywords: Artificial Intelligence, Economic Growth, Correlation, Regression.

1 Introduction

Artificial intelligence (AI) has become an increasingly crucial role in people's daily lives and economy and is undoubtedly by now having an impact on our world in many sectors. AI seems to guarantee to boost productivity and growth, but its effects on overall economies and societies are still unclear [1]. The development of AI has affected for an increase in consumption, an improvement in productivity of the labors, improve the efficiency and accuracy for risk management, but at the same time create problems such as of the loss of jobs in developed countries, a large reeducation and new acquisition of skills, a widening of the gap within social structures [2]. [3] conducts a survey to the members of its European panel and the panelists think that AI is expected to enhance global growth to 4–6% per year. However, most panelists also mention a great degree of uncertainty regarding their predictions.

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AI also has negative effects on economic growth, due to the severe costs on the development. [4] conclude that, based on existing literature, there are two categories of the labor market implications of AI: a doomsayer's perspective and an optimist's perspective. Doomsayers consider that labor substitution by AI will create unemployment. It is undeniable that advanced technology mostly improves productivity, but still AI will reduce some employment opportunities. [1] suggest that about 40 per cent of global employment is exposed to AI, where in advanced economies about 60 per cent of jobs are exposed to AI, and emerging market economies is exposed by AI about 40 percent and low-income countries is exposed by AI about 26 per cent.

On the other hand, some believe that AI has positive impact to compensate for the substitution effect. Some optimistic believers predict that AI will create approximately 90 million jobs by 2025, suggesting a strong confident labor market impact [3]. [3] also report that The World Economic Forum in October 2020 suggests that AI would eliminate 85 million jobs worldwide by 2025, but it also creates 97 million new employments.

To understand how AI could impact the economy, we can use the economists' approach to explain potential growth model. The Economics theory explains the model of potential gross domestic product (GDP) as a function of capital, labor and productivity. The most common model is the so-called Cobb Douglas production function, as the following equation:

$$Y = A\, L^{a}\, K^{1-a} \qquad (1)$$

Where Y stands for output, L stands for labor, K stands for capital and A for productivity. Y (or, in our case: GDP) can increase if there is more available capital and/or if there are more available workers and/or productivity increases. in the case of AI, the growth of the economy could be significantly affected by AI in all factors of production: capital, labor and productivity. AI can promote growth by replacing L ([5], [6] and [7]), which is a limited resource, with capital, an unlimited resource [8]. AI applications may replace L and it still can increase Y. therefore, L is no longer needed. AI can perform jobs currently done by laborers without complaining, which might reduce labor demand, causing lower wages and in the end, lower hiring by companies. AI may also reduce the number of K needed for production, lowering the cost of production and increasing Y. AI may also boost productivity and increase Y.

Undeniably, AI has the potential to significantly impact economic growth. However, the impact of AI on economic growth is not clear across countries. Some countries may experience more significant changes and growth by the AI, while others may face challenges or disruptions because of the AI. The main motivation for this study is to contribute to the body of knowledge about the impact of AI on economic growth with quantitative approach. This study gives some new insights into the debate of the implication of AI on Economic growth in simple way.

2 Method

In this study, two variables are used. The first variable is Artificial Intelligence (AI). The Government AI Readiness Index by Oxford Insights is used as a proxy for AI variable. The second variable is Economic Growth (EG) and Real GDP growth is used as a proxy for economic growth. The Government AI Readiness Index by Oxford Insights is an index that is used to compare the current state of government AI readiness in countries and regions across the world. This study collects data from 160 countries from 2020 to 2023.

There are two methods in this study. The first method is correlation method. The correlation method indicates the degree of strength of the relationship between two variables. Correlation shows the direction as well as the degree of the association between the two variables. In this study, correlation is calculated by the Pearson's Product moment correlation coefficient, as follows:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2]\,[n(\sum y^2) - (\sum y)^2]}} \quad \ldots\ldots\ldots\ldots (2)$$

Where x = The Government AI Readiness Index, y = Real GDP growth and n = the number of data pairs. The correlation gives a value between -1 and +1. When the correlation value is -1, it signs perfect negative correlation and if +1, it signs a perfect positive correlation and when the correlation value is zero, it shows no evidence of correlation.

The Common Effect Model (CEM) regression method is also used in this study as a second method. Regression method explains the causal relationship between one economic variable as the dependent variable and one or more independent variables. Regression method explains the cause and effect of one variable on the other. The model specification is as follows:

$$EC_{it} = \beta_o + \beta_1 AI_{it} + e_{it} \quad \ldots\ldots\ldots\ldots (3)$$

Where EC is Real GDP growth, AI is The Government AI Readiness Index, β_o and β_1 are the coefficients, e is the errors or disturbances, i is the country's data and t is the time from 2020 to 2023. This model is called simple linear regression model because it has only two variables.

Despite some potential problems that may occur due to the simplicity of the regression (for example: bias because of omitted other relevant variables), simple linear regression still has several advantages, i.e.: (1) Easy to interpret and explain, since it contains only one dependent variable and one independent variable. (2) Preprocessing of data is very little required and missing data can also be handled, and (3) Computationally inexpensive and hence can handle big data sets easily.

3 Results and Discussion

The result from correlation method, as seen in Table 1, shows the value of 0.045383 which means from the correlation value that AI and Economic Growth are positively related. However, the value is closer to zero, and the t-statistic is also not statistically significant. It can be concluded that there is no correlation between AI and Economic Growth. Or, in other words, there is no strength relationship between AI and Economic Growth. The low degree of association between AI and Economic Growth indicates that there is a tradeoff between benefits and pitfalls of AI that, in the end, cannot affect economic growth.

Table 1. The Value of the Pearson's Product moment correlation

Correlation	AI	EC
AI	1.000000 -----	
EC	0.045383 (1.149299)	1.000000 -----

Note : t-statistics is indicated in parentheses

The result of regression method is in line with the result from correlation method above. Based on Table 2, The regression method indicates there is no impact of AI on Economic Growth since the probability value (0.2509) is greater than the critical value of alpha 5% (0.05). Therefore, there is not enough evidence to support the claim that AI has an impact on economic growth. This insignificant result may raise a question as many people believe that there is significant impact of AI on economic growth.

Table 2. Outputs of CEM Regression

Explained Variable: Real GDP Growth (EG)	
Constant	1.103426 (0.1503)
The Government AI Readiness Index (AI)	0.018001 (0.2509)
Adjusted R^2	0.000500

Note: *p*-value is indicated in parentheses.

The main reason for these insignificant results may be due to the impact of AI varying from country to country. As a result, developed countries with advanced AI

technologies may face greater risks from AI, but in other side, they may also get more opportunities to leverage its benefits compared with emerging countries and developing countries.

As mentioned by [1], the impact of AI is also due to different levels of development or with different economic structures across countries. [1] suggest that developed countries are already at their mature industries level and typically on the service-driven economies, in which they have a higher concentration of employments in sectors that demand complex cognitive tasks. These countries are therefore more at-risk AI innovations, but, on the other side, developed countries are more likely to get benefit from AI.

In contrary, emerging and developing countries are still dependent on labor-intensive sectors and traditional industries. emerging and developing countries may not initially face a lot of AI disruptions due to their lack of infrastructure for the development of AI. Over time, the development of AI creates economic disparities, with developed countries receiving more benefit from AI than emerging market and developing economies.

4 Conclusion

AI is believed to be an engine to increase productivity and it can also improve economic growth. However, AI also has a highly disruptive effect on the economy as the AI may eliminate many human's jobs. Based on the results of this study, it can be concluded that consequences of the present of AI for economic growth remain hard to divine. There is no evidence to support the claim that AI has a significant impact on economic growth.

The main may be due to the impact of AI varying from country to country. Since our regression includes most of the countries in the world, we do not differentiate the countries based on the classification of their income level. Therefore, future studies are encourage to separate the data based on the classification of their income level or based on the regions. Although this study does not find solid evidence to support the impact of AI on economic growth based on cross countries dataset, we still believe that in some countries the AI is the prominent determinant of economic growth.

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