ARTIFICIAL INTELLIGENCE AS AN IMPORTANT DIRECTION FOR THE DEVELOPMENT OF THE GREEN ECONOMY.

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The global environmental impact of AI is still largely unknown. This study uses a balanced panel data set to examine the complex role of AI in increasing global green productivity between 2010 and 2024[1]. Studies show that AI indirectly contributes to green productivity by increasing the use of renewable energy, attracting skilled workers, and reducing stock market activity. Additional analyses confirm that financial development generally enhances the positive impact of AI on green productivity. These results provide valuable insights into the interrelationship between AI and the green economy.

Climate change is one of the most pressing threats facing humanity in the 21st century, with far-reaching implications for socio-economic development. The scientific community recognizes that human activities, particularly the burning of fossil fuels and deforestation, are causing unprecedented changes in the global climate system, contributing to rising global temperatures and accelerating environmental degradation. As temperatures continue to rise, the impacts of climate change are becoming increasingly clear and severe, posing serious threats to ecosystems, biodiversity, food security, water resources and human well-being.

As the world enters the digital era, AI has become a buzzword and a strategic investment target for governments around the world to achieve dominance in the digital economy. Countries such as China, Japan, the United States and others have put forward national strategic initiatives to strengthen AI, indicating that AI, with strong financial support, is ready to become a powerful engineer to drive future socio-economic transformation. The rapid development of machine learning algorithms, industrial robotics and other technologies has promoted the deep integration of AI into various socio-economic sectors. It has improved production efficiency and information
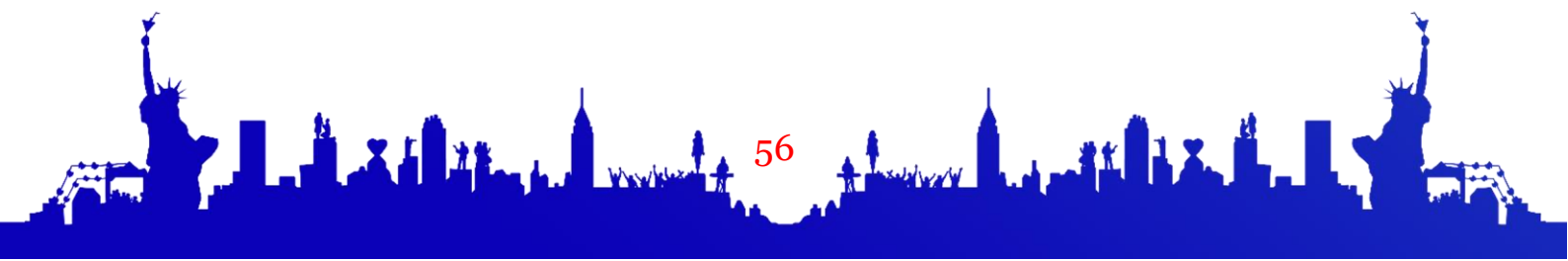
processing power, and rationalized resource configuration, making significant contributions to global sustainable development. [2] The application of AI shows great potential in reducing energy consumption, improving resource utilization efficiency, and developing green energy and emerging industries. [3] Therefore, considering the promising features of AI, this study departs from classical practices and identifies the relationship between AI and green productivity from a global perspective.

The contribution of this study includes two aspects. First, the novelty of this study is that it models the intrinsic relationship between AI and green productivity on a global scale for the first time[4]. In contrast, significant works have mainly focused on the impact of AI on various topics such as traditional productivity, income, and labor share. Green productivity has richer economic meanings because it goes beyond traditional productivity measures to include environmental protection and sustainability. It is worth noting that green productivity is consistent with the principles of sustainable development, which seeks to balance growth with environmental protection and social justice. By measuring productivity in a way that takes into account environmental sustainability, green productivity provides insight into whether economic growth is achieved in an environmentally sustainable manner in the long term. The driving force behind AI-based devices lies in energy consumption, but the regenerative effect of AI has been confirmed in the work of Wang et al.[5]. Therefore, it is crucial to comprehensively assess the relationship between smart and green productivity.

Thus, the second perspective is that the main mechanism analysis in this study is based on mediation and moderation. It is worth noting that the use of different verification methods lies in different economic foundations. First, intelligent algorithms have been widely used in the development of renewable energy. For example, intelligent algorithms can simplify the operation of energy storage systems such as batteries and pumped storage, collect excess renewable resources during low demand, and release them during peak demand or decline in renewable energy generation. Thus, the relationship between artificial intelligence and renewable energy cannot be ignored, especially in the current low-carbon era. Second, the impact of artificial intelligence on labor share and income gap has been well studied in past works [6]. In contrast to these efforts, this study finds that artificial intelligence supports green productivity by attracting high-skilled labor due to the agglomeration effect[2]. Furthermore, it is a common phenomenon that investors prefer to use AI methods to predict the
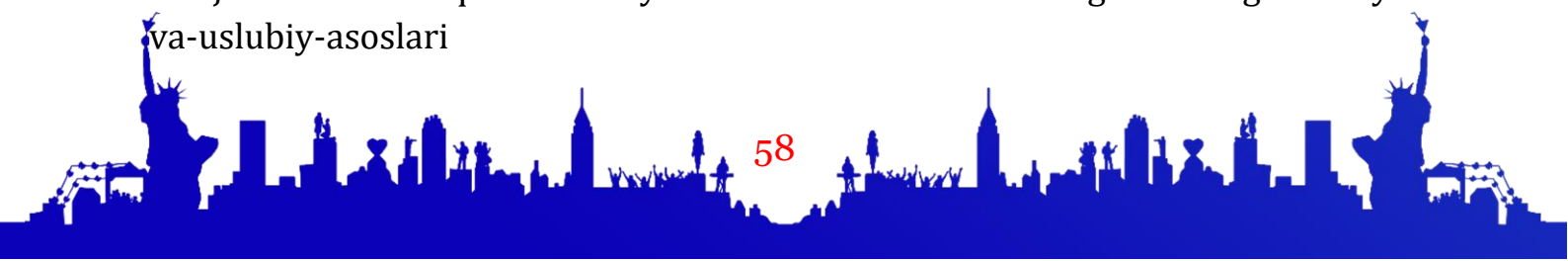
"future" by combining different forecasting models. This means that AI can influence green productivity by shaping investor sentiment in the stock market.

AI has the potential to revolutionize green productivity by optimizing resource allocation and increasing energy efficiency in various sectors. For example, AI can improve supply chain management, leading to more sustainable production processes and reduced carbon footprints[1]. The expected result is that firms can reduce costs by integrating intelligent algorithms into their operations and comply with increasingly stringent environmental regulations, thus gaining a competitive advantage in the global market.

Traditional economic models often do not take into account the rapid changes that AI will bring to production and consumption patterns. Incorporating AI into these models will provide a more complete understanding of the dynamics between technology and environmental sustainability. Furthermore, studying this connection can enrich the literature on the diffusion of innovation, particularly how AI technologies spread across industries and affect green practices[1]. It also allows us to explore potential feedback loops through which improvements in green productivity through AI can lead to further technological progress, creating a virtuous cycle of innovation and sustainability. This understanding is crucial for developing robust economic theories that capture the complexity of modern, technology-driven economies.

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