

The Impact of Digital Finance Development on Urban Carbon Emissions under the Dual Carbon Goal

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Abstract: Digital finance is an important tool for promoting the transition to a "low-carbon economy" in cities, and the application of digital finance can reduce carbon emissions in cities and provide a basis for the early realization of the "dual-carbon" goal. Under the background of "30-60" carbon peak and carbon neutral, the construction of international carbon trading system and system is accelerating. This project is based on the implementation of China's "30-60" dual-carbon strategy, focusing on some of the current problems faced by China, considering the impact of digital finance on urban carbon emissions, and focusing on the three aspects of technological innovation, industrial structure, and innovation effects, to conduct some attempts to explore the roles and opportunities of China's digital finance in support of carbon peaking and carbon neutrality. The role and opportunities of China's digital finance to support carbon peak and carbon neutralization are discussed.

Keywords: Digital finance, Low carbon economy, Technological innovation, Industrial structure, Environmental governance.

1. Introduction

The increase in carbon emissions across the country has led to the problem of global warming becoming more acute, and it has become an important development goal for countries to keep carbon emissions at a low level. China has proposed to achieve the goal of carbon peaking by 2030 and carbon neutrality by 2060, and the "dual-carbon" goal has become China's vision for reducing carbon emissions in the future. At the 29th Plenary Session, General Secretary Xi Jinping emphasized that the 14th Five-Year Plan period is an important stage for improving the quality of the ecological environment and realizing quantitative transformation, as well as for realizing a green transformation of the economy and society in a comprehensive way, with carbon reduction as the main focus, and with synergies between pollution reduction and carbon reduction. In the next five years, as the direction of various policies and regulation becomes clearer, various banks will become more and more active in promoting the development of green finance, and thus the market competition in this regard will also become bigger and bigger. So far, 28 of the world's 224 regions have set the goal of achieving carbon neutrality by around 2020. As far as countries and regions are concerned, Europe has already accomplished "carbon neutrality" in 1979 and has proposed the goal of "zero greenhouse gas" by 2050. The United States had already accomplished carbon peaking in 2007, and the Clean Energy Revolution and Environmental Justice Plan promulgated after Biden took office also put forward the development strategy of achieving zero carbon emissions by 2035 and carbon neutrality by 2050. Japan completed its commitment to carbon emissions in 2008 and will be carbon neutral by 2050, and has also set specific development targets for reducing emissions in 14 priority sectors, including marine resources, electric vehicles, and hydrogen energy. To date, 28 of the world's 224 countries and regions have set a goal of achieving carbon neutrality by around 2020. As far as countries and regions are concerned, Europe has already accomplished "carbon neutrality" in 1979, and has proposed a goal of "zero greenhouse gas" by 2050. The United States

had already accomplished carbon peaking in 2007, and the Clean Energy Revolution and Environmental Justice Plan promulgated after Biden took office also put forward the development strategy of achieving zero carbon emissions by 2035 and carbon neutrality by 2050. Japan completed its commitment to carbon emissions in 2008 and will be carbon neutral by 2050, and has also set specific development targets for reducing emissions in 14 priority sectors, including marine resources, electric vehicles, and hydrogen energy. General Secretary Xi Jinping, based on the strategic idea of "peak carbon and carbon neutrality", clearly defined the direction of carbon neutrality in 2030 and 2060 at the UN General Assembly meeting on September 22 this year, and in the Government Work Report in 2021, it was clearly pointed out that from 2021-2025, energy consumption per unit of GDP will be reduced by 13.5 percentage points, fall by 13.5 percentage points and CO₂ emission reduction by 18 percentage points, pointing out the way forward for the country's carbon emission reduction, and at the same time, it also has an important guiding significance for the country's energy structure adjustment, technology iteration and innovation, and industrial upgrading.

2. The Dampening Effect of Digital Financial Development on Urban Carbon Emissions

2.1. Inverted U-Shaped Relationship between the impact of Digital Finance on Urban Carbon Emissions

Digital finance, because it retains the characteristics of traditional finance, can be studied before studying the impact of digital finance on urban carbon emissions. First, some scholars believe that the development of finance can well curb urban carbon emissions. They believe that traditional finance is undergoing green transformation and the development of green finance can well inhibit urban carbon emissions. Second, some scholars believe that the development of finance will promote urban carbon emissions and aggravate

the carbon emission problem. They believe that the development of finance will bring technological progress effects, which will change people's life and consumption patterns and promote urban carbon emissions. Finally, some scholars believe that there is an inverted U-shaped relationship between financial development and urban carbon emissions, and that the development of finance will bring economic scale effect and technological progress effect, and in the case of a very low level of financial development, the development of finance will bring the effect of technological progress, which will have an inhibitory effect on urban carbon emissions. In the case of a high level of financial development, the development of finance will bring economic scale effect, and there is a promotion effect on urban carbon emissions. But in the case of a very high level of financial development, the development of finance will inhibit the city's carbon emissions, which is also the "double threshold effect" of digital finance [1]. The characteristics of digital finance are the same as those of traditional finance, and its impact on urban carbon emissions is basically the same.

2.2. Digital Finance to Curb Carbon Emissions in Cities by Promoting Technological Innovation

Most scholars believe that technological progress in individual cities will bring about an increase in urban carbon emissions, which is often brought about by promoting industrialization and transformation. But technological progress, instead of bringing about an increase in carbon emissions, has served to curb carbon emissions. Digital financial development plays a role in curbing carbon emissions by driving technological innovation in cities. Digital finance is a product of the combination of traditional finance with the Internet, artificial intelligence and blockchain, which not only retains the original characteristics of traditional finance, but also makes up for the shortcomings of traditional finance, so that digital finance has the characteristics of universality, stability and innovation. The emergence of digital finance has greatly improved the convenience and flexibility of staff engaged in the financial services industry and customers handling business [2]. The development of digital finance can promote the city's technological innovation, drive enterprises to carry out green transformation, provide technical support in the development and use of green energy, reduce the cost of energy development, and improve its development efficiency. At the same time, the development of digital finance can drive the technological innovation of enterprises, solve the problem of information asymmetry in enterprises, broaden their financing channels and reduce the cost of financing [3]. Due to its universality, the combination of this feature and the fact that digital finance can drive technological innovation can play a very good role in "poverty alleviation" for undeveloped regions, and can drive the development of technological innovation in the region, thus enabling its economic growth and rapid development [4].

2.3. The Role of Digital Finance in Curbing Urban Carbon Emissions by Facilitating the Digital Transformation of Businesses

Currently, the production mode of enterprises is mainly carried out through financing, which is an essential part of the production mode of enterprises. However, the production of

many "high-carbon" enterprises contributes to the carbon emissions of cities, making it impossible for them to carry out green transformation. First, the emergence of digital finance can drive these enterprises to carry out digital transformation, solve the problem of information asymmetry, and curb the carbon emissions generated by enterprise production. The upgrading of enterprise structure cannot be separated from the financial support, the emergence of digital finance can directly provide financial support for the transformation and upgrading of enterprises, and can directly force back those who are unwilling to carry out the transformation of the traditional financial structure, to force them to withdraw from the market, for those who are willing to carry out the digital transformation and upgrading of the enterprise to provide financing space, to promote the transformation of more enterprises into green enterprises, and to play a role in suppressing urban carbon emissions. Secondly, the emergence of digital finance, due to its inclusive nature, can not only promote the digital transformation of well-developed regions, but also take into account the undeveloped regions, provide financial support and services for these undeveloped regions, and promote the digital transformation of enterprises in the region. Finally, digital finance can solve the problem of information asymmetry through the Internet, blockchain and cloud computing, and enterprises can use these technologies to analyze consumer preferences, formulate relevant development strategies, and carry out their own digital transformation and upgrading, so as to curb carbon emissions in cities [5].

2.4. Digital Finance Promotes the Innovation Effect of Firms and Thus Carbon Emissions in Cities

The entrepreneurial activities of enterprises are closely linked to their economic development, and the development of entrepreneurial activities of enterprises also leads to a series of carbon emission problems. First, entrepreneurial activities will increase the energy consumption of related enterprises, especially high-carbon enterprises, whose large consumption of fossil energy will greatly increase the carbon emissions of the city. Second, digital finance has a positive correlation with entrepreneurial activities, i.e., digital finance can stimulate the entrepreneurial activities of enterprises. The internet, artificial intelligence and blockchain technologies of digital finance have enriched the ways for entrepreneurs to obtain information, provided enterprises with more novel, convenient and flexible ways of capital circulation and enterprise management, provided entrepreneurs with more channels for financing and ways of obtaining information, and solved the problem of poor information among entrepreneurs, thus introducing more entrepreneurs to enter into the enterprise for entrepreneurial activities, so that the amount of enterprise financing increases rapidly, and the carbon emissions produced also increase. Finally, the development of digital finance can improve the ability of entrepreneurs to master finance and the digital economy, tap the innovation potential of entrepreneurs [6] and solve the problem of diseconomies of scale of traditional finance.

3. Problems of Digital Finance in Addressing Urban Carbon Emissions

3.1. Differential Impact of the Degree of Digital Finance Development on Urban Carbon Emissions

As digital finance has the characteristics of traditional finance, the impact of digital finance on urban carbon emissions still satisfies the inverted "U" model. The development of digital finance to different levels will have different impacts on urban carbon emissions. For underdeveloped cities, the financial level is in an underdeveloped state, at this time, we should consider to what extent the digital financial level should be developed, and the digital financial level should be controlled in the interval of the inhibition of urban carbon emissions. As for the developed cities, the financial level is at a higher level, and they should vigorously improve the digital financial level, and raise the digital financial level to a higher level, so that it has the inhibiting effect on urban carbon emissions. Therefore, the local government should formulate relevant policies to control the level of technological innovation, industrial structure and entrepreneurial activities in the region, so as to control the digital finance in a reasonable space.

3.2. There is an Endogenous Problem of Digital Finance Affecting Urban Carbon Emissions

Technological innovation, industrial structure optimization and entrepreneurial activities affect the level of digital finance development, and at the same time, they are also affected by the development of digital finance, which creates an endogeneity problem. Since the model has an endogeneity problem, the endogeneity problem should be eliminated as much as possible while considering the impact of digital finance on urban carbon emissions. When the three influencing variables change, it leads to a change in the degree of the level of digital finance development, while the degree of the level of digital finance development will in turn affect the three core variables, making the results of the study not accurate and credible.

3.3. Digital Finance Does Not Take Into Account the Interactions between Neighboring Cities in Its Study of the Impact on Urban Carbon Emissions

Since digital finance is inclusive, the development of digital finance affects each city to varying degrees. But at the same time digital finance has diffusion, that is, the development of digital finance in neighboring cities will affect each other. The digital finance of neighboring cities will affect each other, which will affect the final research results. Therefore, this paper considers constructing a Durbin model to explore the impact of digital finance development on urban carbon emissions under the premise that digital finance in neighboring cities affects each other.

3.4. How to Consider the Negative Impacts of Entrepreneurial Activities on Urban Carbon Emissions

Digital finance can be influenced by the entrepreneurial

activities of companies, thus there is a positive contribution to the carbon emissions of the city. The increase in financing as well as other production by businesses, as well as the city's innovation index, leads to an influx of more entrepreneurs into the business, resulting in increasing carbon emissions in the city. Although the increase in the entrepreneurial activity index of enterprises will lead to the increase of carbon emissions in the city, the government cannot prevent or inhibit the innovation and upgrading of enterprises. Therefore, the entrepreneurial activity index of enterprises should be controlled at a level so that enterprises can innovate and upgrade and transform, and also the impact on urban carbon emissions should be controlled within a small range.

4. Suggestion

4.1. Improvement of Digital Financial Infrastructure

Digital finance is a new form of traditional finance, retaining its original features and improving its shortcomings, so China should focus on strengthening the development of digital finance, improving the infrastructure of digital finance, integrating digital finance with traditional finance, and solving the problems of traditional finance [7]. However, while improving the digital financial infrastructure, we should also consider the degree of development of digital finance and control the scope of digital financial development, which should play a role in both driving the development of regional economy and suppressing urban carbon emissions. How to control the level of digital finance within a reasonable range is a great challenge for the government, and if this problem can be solved, the realization of the "dual-carbon" goal will be further advanced.

4.2. Strengthening the Industrial Digital Transformation of Enterprises

Digital finance can effectively solve the problem of information asymmetry as well as the problem of resource mismatch [8]. It can effectively promote the digital transformation of enterprises. The digital transformation of industries provides enterprises with digital financial tools that can utilize the Internet, blockchain, and artificial intelligence technologies to obtain more comprehensive information, effectively match resources, and improve energy consumption efficiency, thus facilitating the transformation of enterprises into a "low-carbon economy" and solving the problem of urban carbon emissions.

4.3. Strengthening Support for Technological Innovation in Enterprises

The development of digital finance can reduce carbon emissions in cities by promoting technological innovation in enterprises, strengthening technological innovation in enterprises, especially providing digital technical support and financial support to low-carbon specialized enterprises [9], and promoting the development of low-carbon enterprises. The local government should formulate relevant policies to provide tax reduction or even tax exemption policies, technical support and auxiliary financial support for low-carbon enterprises, manage the use of technology by high-carbon enterprises, limit the extent of their carbon emissions, and appropriately increase their tax contributions to force them to transform into "low-carbon" enterprises.

4.4. Give Full Play to the Inclusive Nature of Digital Finance and Reduce the Differences in the Development of Digital Finance in Various Regions

Since digital finance is inclusive, it will have an impact on all regions, but the degree of impact on each region depends on the level of financial development, economic development and the degree of investment in science and education in the region, so the development strategy for each region should be formulated according to local conditions. In undeveloped regions, the focus should be on economic development, strengthening the infrastructure of digital finance, selecting talents, and promoting the digital transformation of enterprises. Other regions should also implement economic support to the region, so as to achieve a balanced development of the situation in each region. In developing regions, emphasis should be placed on green transformation, and efforts should be made to emphasize the transition to a "low-carbon economy" for high-carbon enterprises, so as to lay the foundation for the early realization of the "dual-carbon" goal.

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