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# The Impact of Green Finance on Industrial Structure Transformation from the Perspective of Sustainable Development

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## Abstract

The industrial structure of China is going through a change towards the service-oriented industries and has proven a great influencer for the economic development of the country. As the world is moving towards the sustainable approach, a sustainable touch has been introduced in the financial system, which refers to green finance. This study explored the impact of green finance on the industrial structure transformation and upgrading in China using the panel dataset for the time period from 2008 to 2019. The data has been collected from the Statistical Yearbook of the country, Wind Database, and CSMAR database. This study undertakes empirical data using the SYS-GMM Model after going through an entropy weight model. The study accesses the overall as well as the regional analysis of this relationship among the explanatory and explained variables in the presence of some control variables. The findings of the study imply that financial development through green finance is promoting industrial structure transformation and upgrading. The findings validate that the green bond, green investment, and carbon finance have strengthened and augmented the industrial structure upgrading. Hence the government should incorporate these financial processes in the banking processes and policymakers should implement policy measures that would support the easy functioning of these financial instruments.

**Keywords:** Green Financing, Industrial Transformation, Structure Transformation, Sustainable Development, Industrial Structure of China, Structural Change.

## Introduction

Structural change is a process that augments the country's economy towards the pathway of development (Matsuyama, 2008). China is one of the countries, which is very concerned and passionate about the development of its nation being a strong economic power hence a lot of structural changes happened lately in China through reforms and regulations. Over the past few years, the industrial structure of China evolved and shifted from the manufacturing sector to the services sector. These changes bring development to the economy as they move towards the tertiary and secondary industries from primary industries, while one of the major

reasons behind this shift was the extensive increase in the population base of the country as well (Brondino, 2019). Ren, et al (2022) states that the extensive growth in population in China demanded the government to bring certain sustainable employment structural changes into the country through the development of tertiary and secondary industries because sustainable employment serves as a foundation for the national development. Although the secondary and tertiary are economically efficient; however, they are considered as the pollution emitter industries. The green industries are a very great alternative for catering to this issue (Muganyi et al., 2021). The shift towards green industries is possible through green finance, also recognized as environmental finances or sustainable finance as it has positive implications for industrial structure optimization. The country recently emphasizes the speed of economic growth at the expense of quality, which results in environmental deterioration. The industrial structure of China comprises of a maximum number of industries producing coal, steel, and cement, and only a few industries are based on green or environmental protection (Chen et al., 2011).

China recognized the significance of green finance in 2016 and then in their 13<sup>th</sup> five-year plan included it as a national strategy to build green financial systems through developing green credits and bonds utilizing green funds. Peng et al (2018) state that green financing initiatives have got a significant spotlight in China during the past decade, the majority of the financial institutions issued a credit on the basis of the corporation's commitment to sustainability and green initiatives. In addition to that, the government has also established several oversights and standard procedures to ensure compliance of the financial industry towards sustainable financing and made it mandatory for them to make such disclosures in their annual reports (Dong et al., 2020). Moreover, Wang et al (2021) state that the development of green financing initiatives has promoted a shift in the industrial sector focus from relying on traditional sources of energy to renewable energy sources, which in turn caused significant improvements in sustainability across the economy. The increasing influence of green financing initiatives across the Chinese economy has made it a considerable topic for debate among the policymakers and researchers; however, the majority of the studies have been conducted on the positive outcomes brought about by green financing in China, while very few studies have considered its implications and the underlying mechanism for the transformation of the Chinese industrial structures. Therefore, in order to address the prevailing gap, this study aims to evaluate the impact of green finance on upgrading and transforming the industrial structure of China through the lens of sustainable development. In terms of implications, the study has conducted a logical evaluation of the relationship between green finance, industrial structural transformation, and sustainable development, while both theoretical and empirical evaluations have been performed on the evaluation of the industrial structure transformation, which would provide a strong foundation for the future researchers and academicians on further exploration of this topic. The study has also brought about research methods innovation, where the industrial transformation and the connotation of green finance initiatives are explored simultaneously, whereas it provides empirical results for the different regions and the countrywide implications simultaneously as well, which will help the policymakers in understanding and bringing greater coordination in regional development.

### **Literature Review**

The previous literature on this phenomenon helps us to understand the standpoint of green finance and its relation with the industrial structure and the significance of industrial structure transformation. This section here is divided into some sub-sections which are as follows:

#### **Evolution of Green Finance**

Green finance is a sustainable approach towards the financial system, which is explored at first as a systematic structure. Anderson (2016) worked on it and described it as environmental finance focused on the sustainable development of the economy through environmental protection. Labatt and White (2002) stated that this is an emerging concept, which is coined at the end of the twentieth century. It is something that has the potential to improve environmental quality and operate as a risk-averse system. It can be regarded as an interdisciplinary area that links the environment, economy, and finance under one roof to get favorable outcomes (Cowan, 1999). Lindenberg (2014) is of the view that this concept does not have a consensus on a single definition as the publications do not have a keen interest in this and thus what has been proposed to differ. According to him, it is something that is comprised of a green financial system, financing of public green policies, and financing of green investments.

The issues of environment emerging in a financial sector can be resolved via coherent application of financial tools that indorses sustainable development (Scholtens and Dam, 2007). This statement was further supported by the study of Sachs, et al (2019) who also illustrated that through new policies and instruments based on green finance environmental issues can be tackled. They highlighted the significance of green finance in their research work and illustrated green bonds, green banking, community-based green funds, and carbon emissions instruments.

#### **Green Finance and Industrial Structural Transformation**

The first-ever statement about the role of the financial institution towards optimization of the industrial structure was given in 1982. According to Schumpeter (1982), optimization of industrial structures is prompted because of the reallocation of capital that can be done through financial institutions and these institutions direct the capital flow towards new emerging industries via credit expansion. The industrial structure of China is under the phase of transmission from industry-oriented to industry service-oriented. This evolution of industrial structure is subject to many relationships, interactions, and influences among several industrial sectors. Gu, et al (2021) in their study investigated the impact of green finance on industrial transformation. Their research work was policy effect based which has been done through the VAR model and DEA model. Based on their results they declared green finance as the necessary factor for promoting industrial transformation.

#### **China's financial sector and upgrading**

The financial sector of China is such that the state-owned or government banks have more power relative to private banks. Another fact is that it is more demanded by individuals living in rural areas and among small and medium-sized enterprises. The market power there is in the hands of four big banks namely the Industrial and Commercial Bank of China, Bank of China, Agricultural Bank of China, and China Construction Bank. The share of these banks is higher as its bank loan market share is approximately 50 % and banking market capital is 93 %. Although these are the big name, however, the quality of their assets is weak, and they are

contributing less in the market being less profitable. Fu and Haffernan (2009) deliberated that the inefficiency of the financial sector of China raised from the year 1985 to 2002. He witnessed that the extent of inefficiency is higher in the state-owned bank which leads to moral hazards.

Porter (2011) described the upgrading of industrial structure as moving from the 'primary, secondary, tertiary' to 'secondary, tertiary, primary' to finally upgrading to tertiary, secondary, primary. As the industrial structure of China is transforming it has to incur many reforms. The country is facing many challenges regarding the implementation of reforms and these are refining the credit scoring system and leveraging the interest rates to reflect market forces. Raymond (1969) carried out an in-depth analysis of green finance on the industrial structural upgrading incorporating factors such as capital and technology and concluded that financial development is beneficial for the upgrading of industrial structure. Pradhan, et. al (2018), empirically an analysis of time series data of the time period 2001 to 2012 in Asian countries. According to their study financial development results in enhancing the financial environment and upgrading the industrial structure.

### Research Methodology

The impact of green finance on the industrial structure transformation and upgrading has been examined with the data of 2008 to 2019 in 22 provinces of China. The data has been collected for the indicators industrial structure upgrading and industrial structure reasonability from every province's Statistical Yearbook and the countries Statistical Yearbook. Moreover, for measuring green finance a green finance index has been formed. The data of indicators of the green finance index has been taken from the Wind database and the CSMAR database. The indicators for the green finance index are green credit, green investment, green insurance, green bonds, and carbon finance. The explained variable here is the industrial structure upgrading and industrial reasoning. Here industrial reasoning reflects the extent to which industrial structure is coordinated with the input structure and output structure while industrial structure upgrading is measured as the output of primary, output of secondary, and output of tertiary industry, government expenditure level, foreign direct investment, technical innovation, and economic development. To measure the green finance index an entropy weight method has been used to calculate the weight of every indicator irrespective of their mutual effect on each other. If the entropy value is large this means that the differentiation among indicators is low while if the entropy value is small this means that the differentiation among indicators is high. Hence the use of the entropy weight method thus provide an objective and feasible measure of the index for the better results of the analysis. For the empirical analysis of green finance's impact on the industrial structure transformation and upgrading, the SYS-GMM model has been used for the gathered panel data. The GMM model has been presented by Arellano and Bover (1995) for the first time which addresses all the unbiased and other estimation distortions of fixed effect and random effect models. To enhance the efficiency of the estimated parameter the differential GMM and Horizontal GMM are estimated simultaneously. The used SYS-GMM model in this study can be generally represented as:

$$y_{it} = \alpha y_{it-1} + \beta x_{it} + \mu_i + \varepsilon_{it}$$

Where

Here  $y_{it}$  represents the explained variable,  $\beta$  represents the coefficients,  $x_{it}$  represents the explanatory variables while  $y_{it-1}$  represents the lag term. Here the  $\mu_i$  and  $\varepsilon_{it}$  are the individual effector effect and the random disturbance term.

## Results

### Descriptive Statistics

Here table 1 illustrates the descriptive statistics of the main variables of this study. As shown in the table the mean value of the industrial reasonability is 8.1245, the standard deviation is 7.3856, the min value is 1.5746, and the max value is 35.837. Similarly, the mean value of industrial structure upgrading is 6.5783, the standard deviation is 2.5674, the min value is 0.6353 and the max value is 17.363. The average value of green finance is 0.4398, the standard deviation is 1.0765, min value is 0.0076 and the max value is 5.7363 across China. The mean value of technical innovation, economic development, government expenditure level, and foreign direct investment is 8.0765, 11.1468, 4.1297, and 7.5398 respectively. The standard deviation, min, and max value of these control variables are also shown in the table given below.

Table 1

#### *Descriptive Statistics*

Variable	Mean	Std. Deviation	Min	Max
Industrial reasonability (IR)	8.1245	7.3856	1.5746	35.837
Industrial structure upgrading (ISU)	6.5783	2.5674	0.6353	17.363
Green finance (GF)	0.4398	1.0765	0.0076	5.7363
Technical innovation (TI)	8.0765	2.8733	1.8267	3.8766
Economic Development (ED)	11.1468	0.3865	2.7363	17.837
Government expenditure level (GEL)	4.1297	0.1896	1.2733	20.837
Foreign Direct Investment (FDI)	7.5398	3.4685	2.0976	28.876

### System GMM Estimation Results

The impact of green finance has been estimated on the industrial structure transformation and upgrading in China using the System GMM model. The results of the empirical regression analysis are shown in table 2. The values in the tables are the regression coefficients of the explained, explanatory, and control variables along with the t-values of the variables. Here the coefficient of industrial reasoning is 0.302 and industrial structural upgrading is 0.456 and both are significant. According to the results, green finance is positively related to industrial structure transformation and upgrading which proved that green finance is a major contributor in upgrading and aggravating the industrial structure transformation in China. These results are in line with the studies that also validated this positive significant implication. All the other control variables namely technical innovation, economic

development, government expenditure level, and foreign direct investment are positively related to green finance.

The above is the nationwide results, however, the results are also segregated on the regional level. Here three regions have been taken into account being east, central and west. This segregation helps out to understand the role of sustainability in this process more thoroughly. As per results, green finance has a significant impact on IR and ISU in all the regions, however, green finance in the central region is more significantly and positively related to industrial structure transformation and upgrading.

Table 2  
*Regression results*

Variables	Nationwide	East	Central	West
IR	0.302*** (3.45)	0.270*** (3.18)	1.201*** (2.87)	0.008*** (4.65)
ISU	0.456*** (4.23)	0.354*** (4.10)	1.323*** (3.89)	1.112*** (5.67)
GF	3.654*** (3.76)	2.765*** (5.87)	3.132*** (8.34)	1.876*** (2.45)
TI	4.876*** (4.76)	3.786*** (3.56)	7.876*** (8.54)	4.213*** (4.01)
ED	1.345** (2.54)	0.654** (1.76)	1.765*** (2.12)	1.987*** (3.09)
GEL	0.323*** (3.76)	0.765*** (2.98)	0.134** (4.98)	0.543*** (5.98)
FDI	0.0056** (0.41)	0.376*** (4.87)	-0.765** (1.47)	-0.345* (-1.54)

Note: \*\*\*, \*\*, \* indicates the significance level at the 1 percent, 5 percent, and 10 percent respectively. The value in the parenthesis is the t-values.

Moreover, all the variables show a different number of coefficients of control variables which means the situation or the impact is not similar throughout the country. For technical innovation, it is higher in the central region, then the west and then in the east, however, economic development is more in the west, then central following the east. On the contrary, the government expenditure level and foreign direct investment are more in the east, following west and then central region. All the variables are significantly related to green finance, economic development and foreign direct investment are significant at 5 percent while others are significant at 1 percent.

### Conclusion and Recommendation

In this study, the impact of green finance has been investigated on the industrial reasoning and the industrial structural upgrading based on panel data of 2008 to 2019 from the Statistical Yearbook, Wind database, and CSMAR database in China. The entropy weight method has been used to investigate the extent of this phenomenon. Moreover, the system GMM method has been taken in this regard to look at the relationship of green finance with the industrial structure transformation and upgrading. This study validates the positive effect of green finance that it helps in bringing the development in the industrial structure. Thus this new emerging concept, green finance as it proposed to bring eco-friendly, efficient, and

profitable returns to the financial system of a country is applied in this study. The findings are in line with this concept and previous literature. This study deliberated that the output per value in the tertiary industry is highest nowadays relative to secondary and primary industry, hence, it makes clear that the industrial structure transformation is taking place as it moves from secondary to the tertiary industry now. Moreover, the positive relationship between green finance and industrial structure transformation and upgrading shows that a sustainable approach is making the right course of action here. The green credit, green investment, green insurance, green bonds, and carbon finance all are promoting the development of green finance and are strengthening the process of industrial structure transformation. Moreover, china's financial system gets better as the incorporation of green finance led to the upgrading of industrial structure. The coefficient values of economic development, technical innovation, and foreign direct investment commence that incorporation of these will accelerate the upgrading of industrial structure.

Furthermore, although nationwide green finance proved to be a good fit for strengthening industrial structure, the similar is the case region-wise. Here the same relationship has been estimated for three regions east, central and west and the result are appeared to be significant in all the regions. However, there are some variations in the extent of its positive impact among these regions. Green finance comes up as a beneficial approach more in the central region as it is subject to more green financial activities and processes. These green financial instruments are more prevalent in the west after the central region and the East region is contributed least towards this in all these years.

One thing is clear from this study and that is the importance and significance of sustainable development and incorporation of green finance in the financial sector of China. Hence, the government of China should take some measures and policymakers should make policies that will favor the easy and less costly implementation of green financial activities. At first, they should enhance the development level of green technology innovation. Then there is a need to incorporate the coordination in green finance along with the establishment of the external exchange, Moreover, there is a need to increase the functioning of more green bonds and green investment by many state-owned banks as they are comprising of the major financial sector China and lagging behind inefficient production as compared to privates banks. The application of these bonds will enhance their output and in return lead to a big upsurge in financial development and growth which smooths out the way for industrial structure transformation and upgrading.

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