Analysis on the Relationship between Green Finance and Green Development of Guangdong Province

Weihua Huang, Yiru Wang and Haiye Chen

International Business School of Jinan University, Zhuhai, Guangdong, China

*Corresponding author e-mail: thwhsc@jnu.edu.cn, 1481772141@qq.com,
b1094745084@qq.com

Abstract. Policies about sustainable development are carrying out in China. From two perspectives to study whether green finance promoted the green economy development in Guangdong or not by grey correlation analysis. The results of using Guangdong's green financial data were not supported this hypothesis, while the results of using national financial data were supported this hypothesis. The reason is that Guangdong even Guangdong, Hong Kong and Macao Greater Bay area is one of the most developed regions in China, which shows a gatherring effect, and the resources of the whole country flow into Guangdong continuously. That play an important role in green development in Guangdong.

1. Introduction
Guangdong has made a lot of efforts to protect ecology and promote sustainable economic and social development to keep up with China government’s requirement. Guangdong is a province lacking in energy resources. The per capita energy reserves are only 5 tons of standard coal, compared with 1194 tons of the national per capita energy reserves. Guangdong, Hong Kong and Macao Greater Bay Area (GBA) contributes about 90% GDP of Guangdong according to the data of 2018. It is also one of the fastest growing regions in China. The faster the economic develops, the more energy it consumes. Sustainable green development is an inevitable choice for Guangdong to maintain sustainable economic growth. To judge whether a region is green growing or not, it mainly depends on the consumption of non renewable resources and the emission of environmental pollutants in the process of economic development. As one of the innovation pilot areas of green financial reform in China, Guangdong is actively guiding green financial resources to invest in green industries, developing various green financial instruments and carrying out green financial innovation.

2. Literature review
McKinnon revealed that financial repression affected output growth in developing countries [1], and it has since been widely accepted that financial development is an important endogenous variable in economic growing. Financial development promotes economic growth in two ways. First, investment increases enterprise capital, expands the scale of production, so as to improve the level of output, and economic growth. Second, financing instruments allow consumers to purchase and manage risk. Thus increase consumption and economic growth level [2]. Smulders and De Nooij find green technology innovation is necessary to maintain long-term economic growth [3]. Both broad and narrow sense of
green finance significantly promote economic growth [4] through investment first and then through consumption [5]. However, the improvement of investment efficiency and savings conversion efficiency in the financial system after the 1990s was extremely limited [6]. The development scale of green finance and the low efficiency of resource allocation have hindered the macro economy develop to some extent. Therefore, green finance has a negative effect on economic development [7]. Green industries may crowd out others because of its externality. They claim big investment with big risk. Green products can’t affect consumption because of higher prices. Then it may not lead to green economic growth [2].

According to above literature review, some of the results of the studies on green finance and green growth are quite different. As a region with scarce resources, it’s necessary for Guangdong to prefer green growing route. So does the implementation of green finance achieve any effect in Guangdong?

3. Methodology

3.1. Indicators
Green development is a resource-saving and environment-friendly sustainable development model. Therefore, the indicators adopted in this paper mainly include: 1. the per capita GDP (PCGDP) demonstrates development level. The larger the better. 2. The proportion of the tertiary industry in GDP (PTIGDP) reflects the degree of industrial upgrading. The larger the better. 3. Energy consumption per unit of GDP (ECGDP) and total water consumption per ten thousand yuan of GDP (TWCGDP) are selected as the main resource consumption indicators. The smaller the better. 4. Because of inadequate data of other green finance, the green financial indicators only include green credit, green bonds, loan balance of financial institutions (LBFI), green credit ratio (GCR), total bonds issuance (TBI), green bonds ratio (GBR).

3.2. Data sources
The original data are taken from the Guangdong statistical yearbook and the national statistical yearbook, as well as public information such as Guoyan web, government gazette etc. The data includes various economic development indicators and national green credit indicators from 2016 to 2019, besides green credit indicator of Guangdong from 2016-2018.

3.3. Grey relation analysis
Since the data about green finance and green development are not abundant, in order to quantify the relationship between them, the grey correlation analysis method is available. This method is suitable for cases with small sample, insufficient information, insufficient panel data or time series data. In an economic system, the relationship between the affected factors and the influencing factors can be found by the following ideas.

First. An affected factor is the factor reflecting the behavior characteristics of the system, named reference sequence, and the data sequence composed of this indicator is denoted as $x_0$. The influencing factors are the factors that affect the system behavior, named comparison sequences, and the multiple data sequences composed of these indicators are denoted as $x_i, i$ from 1 to $j$.

Second. The unit of all factors in the system are normally different, the original data should be dimensionless. The method is to find the average value of each sequence, then divide the original data at each moment by the average value. The resulting quotients form a new data sequence, that is, the mean sequence $x_0(k)$ and $x_i(k)$. Then, the absolute difference between the sequence $x_0(k)$ and $x_i(k)$ (from $1$ to $j$) is obtained by the following formula at each moment $k$ to form the difference sequence.

$$X_{in}(k) = |x_0(k) - x_i(k)|$$  (1)

Third. Find the Two-stage maximum and minimum of the difference sequence, as follows:
Then. Get the correlation coefficient by the following formula, where $\rho$ is the discrimination coefficient, generally between 0 and 1, usually 0.5.

$$
\xi_{oi}(k) = \min_{oi} + \rho \max_{oi}
$$

Finally. There are $k$ values of correlation coefficient to every influencing indicator, which cannot properly describe the influence level of the influencing factor. Therefore, the mean value and standard deviation (SD) of the correlation coefficient should be required to reflect the correlation degree and deviation degree.

Repeat above process to get correlation degrees of influencing factors to each affected indicator.

### 3.4. Results and analysis

According to the data of Guangdong during 2016 and 2018, the relationship between green finance (no green bonds) and green growth in Guangdong is measured. Refer to table 1 for results.

**Table 1. The relationship between green credit and green development of Guangdong**

| Correlation degree | Green credit | LBFI | GCR |
|--------------------|--------------|------|-----|
| ECGDP              | 0.474289768  | 0.719816588 | 0.569555904 |
| Standard deviation | 0.169462599  | 0.242678499 | 0.140629251 |
| TPIGDP             | 0.481428922  | 0.775708352 | 0.598056595 |
| Standard deviation | 0.136216455  | 0.182175078 | 0.107209547 |
| TWCGDP             | 0.477279206  | 0.673338796 | 0.55058541 |
| Standard deviation | 0.193049247  | 0.282901098 | 0.17501597 |
| Per capita GDP     | 0.48467593   | 0.868757985 | 0.641180924 |
| Standard deviation | 0.115949728  | 0.103727312 | 0.122582797 |

As shown in table 1, loan balance of financial institutions (LBFI) rather than green credit or green credit ratio (GCR) has the highest correlation with all of the four affected factors. That means green finance has less relevance to green growth of Guangdong. The reason is that the data period is too short, only cover three years, to show the effect of financial input. Time lag in monetary transmission may take a long time for variables related to economic growth to change after loan placement.

Guangdong province, as a leading developing province, has strong aggregation effect to attract talents, capital and other key elements. Then there may be an obvious correlation between the national green financial development and the economic green development of Guangdong province. China's green bonds issuance have not been discovered for a long time. Table 2 shows the results after considering green bonds and green credit (continuous data from 2016 to 2019):
Table 2. The relationship between national green finance and green development of Guangdong

| Correlation degree | Green bonds | TBI | GBR | Green credit | LBFI | GCR |
|--------------------|-------------|-----|-----|--------------|------|-----|
| ECGDP              | 0.60933696  | 0.685514243 | 0.686359695 | 0.571025854 | 0.615598374 | 0.710094058 |
| SD                 | 0.218986628 | 0.278345978 | 0.19534484 | 0.249650362 | 0.160822788 | 0.160028322 |
| TPIGDP             | 0.637192686 | 0.651462851 | 0.766972449 | 0.586574668 | 0.635172677 | 0.751317937 |
| SD                 | 0.237703995 | 0.2576456 | 0.264292245 | 0.278638601 | 0.116192793 | 0.162082367 |
| TWCGDP             | 0.775510562 | 0.592259793 | 0.701129817 | 0.650727445 | 0.861819421 | 0.78662513 |
| SD                 | 0.218876204 | 0.19340746 | 0.239622631 | 0.24740476 | 0.042866922 | 0.151739987 |
| Per capita GDP     | 0.589272484 | 0.613426727 | 0.67523672 | 0.563428787 | 0.595118003 | 0.692100243 |
| SD                 | 0.19813315 | 0.197571037 | 0.193004103 | 0.217130631 | 0.168824777 | 0.237632341 |

It can be seen that the highest and second influencing indicators relevance to green growth are green credit ratio (GCR) or green bonds ratio (GBR), except the loan balance of financial institutions (LBFI) is most related to the total water consumption per ten thousand yuan of GDP (TWCGDP). While the influence of green finance on ECGDP and TWCGDP are negative, the influence on TPIGDP and per capita GDP are positive. That is to say, whether enterprises raise money from financial institutions by green credit or from capital market by green bonds, it contributes to the economic green growth of Guangdong province. The core is green, green credit or green bonds. Therefore, it is helpful for Guangdong to develop green credit and green bonds nationally to promote the ratio of green finance. However, the highest correlation with per capita GDP is the loan balance of financial institutions.

4. Conclusion

Based on the above analysis, the LBFI plays a key influence on per capita GDP of Guangdong measured by both provincial and national data. This indicates that the economic growth model of Guangdong province has not changed. Increasing of per capita is driving by LBFI rather than green finance. The reason is the proportion of green economy in China is still low. Green economy doesn’t play an important role in Guangdong yet even though Guangdong is one of the fastest developing provinces. The analysis indicates national green finance indicators are more significant than the green finance indicators of Guangdong to lead to green economic growth. The development of green finance in China is very helpful to the development of green economy in Guangdong province. The reason is GBA even Guangdong province have gathering effect. Resources from all over the country, including capital, human resources and other elements especially green financial resource, have kept coming in and making monetary expansion, increasing technology investment and reducing energy consumption, increasing per capita income, promoting industry shift from primary industry to secondary industry, and then from the second industry to tertiary industry. All of these increased the proportion of green economy in Guangdong. And this changing is still going on. There is a big room to develop green finance and sustainable green economy for Guangdong.

Acknowledgements

This work was financially supported by the National Education Sciences Plan of China (Grant No. BGA190051).

References

[1] McKinnon R I. Money and capital in economic development[M]. Washington D.C.Bookings Institution Press, 1973.

[2] Xu zhangyong, Zhu rui,The impact of financial development on green total factor productivity and the analysis of its path:an empirical study from western China, Journal of Shanxi University(Philosophy&social science), vol. 43, (2020), pp. 17 - 29.

[3] S. Smulders, M. De Nooij, The impact of energy conservation on technology and economic
growth, Energy Economics, (2003). 2559 - 79.
[4] Qiu haiyang, Research on the economic growth effect of green finance, Economic research reference, vol. 2814, 2017, pp. 53 - 59.
[5] Chai jingxia, Analysis on mechanism and path of green finance affecting macroeconomic growth, ecological economy, vol. 34, 2018, pp. 56 - 60.
[6] Fu qiang, The measure and mechanism of segmentation's effect on regional economic growth, Economic Research Journal, 2017, pp. 47 - 60.
[7] Ning wei, She jinhua, Empirical study on the dynamic relationship between green finance and macroeconomic growth, Seeker, pp. 62 - 66, 2014.
[8] Yi, L; Lin, L; Julong, D, The grey target method for risk evaluation of tubing in natural gas well, Materials and Corrosion, vol. 53, 2002, pp. 274 - 276.