

Capital Eco-Environment Protection Group Innovative Financing Research

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Abstract: The infrastructure industry has been playing an important role in China's economic development. However, the industry has faced the problem of difficult and expensive financing. As a leading enterprise in the infrastructure industry, Capital Eco-Environment Protection Group has provided new ideas for the financing of enterprises in China's infrastructure industry through the research and analysis of its REITs(Real Estate Investment Trust) financing mode. This paper conducts a thorough study on the REITs financing structure of Capital Eco-Environment Protection Group, and analyzes its financing effect from three aspects of stock market, financial performance and production efficiency. The study finds that REITs not only increase the wealth of shareholders, but also reduce the asset-liability ratio of enterprises and improve the profitability of enterprises. At the same time, REITs also improve the production efficiency of enterprises and inject new vitality into the development of China's infrastructure industry. Therefore, the REITs financing model of Capital Eco-Environment Protection Group provides a useful reference for the financing of enterprises in China's infrastructure industry.

Keywords: Infrastructure Industry; Capital Eco-Environment Protection Group; REITs

1. Foreword

In China's economic development, the infrastructure industry occupies an important position. However, the problem of funding gap in the process of urbanization construction has always existed, and it is difficult to meet the investment and operation needs of infrastructure projects simply by relying solely on government finance and government debt. Therefore, the addition of private capital is

crucial to supplement the development of the infrastructure industry. However, due to the small scale of private channels, relatively dispersed and difficult to withstand project risks, it has not become the main financing force in the infrastructure industry. In 2014, China proposed for the first time to adopt PPP financing in the field of infrastructure mode, and the investment in PPP projects increased rapidly. However, due to the long cycle of PPP projects and large investment, the project participants are often large enterprises such as central enterprises and state-owned enterprises, which violates the original intention of PPP financing mode. This has also gradually reduced the number of PPP financing projects after 2017. Reits was born in the United States in the 1860s. In the past 30 years, REITs have had a rapid scale growth in European and American countries with their advantages of low risk, stable return and low correlation with other investment varieties. However, it is rarely heard of in China. In 2020, the China Securities Regulatory Commission and the National Development and Reform Commission issued a number of documents. The first batch of pilot public offering of REITs emerged under the background of the trade friction between China and the US in 2019 and the spread of the global epidemic in 2020. In 2021, China will launch a pilot public offering of Reits in the infrastructure sector. Capital Eco-Environment Protection Group issued Fuguo Capital Water Reits provides new ideas for financing many enterprises in China's infrastructure industry.

2. Literature Review

In terms of the relationship between infrastructure construction and economic development, foreign scholars Aschauer believe that the development of infrastructure plays a significant role in the economic development of a country. [1]; Yakuma C S analyzes the panel data of economic

development in Latin America between the economic growth and the investment development of infrastructure [2]. In China, Pan Yaru and Luo Liangwen found that the development of infrastructure construction has significant positive effect on economic development throughout the country [3]; Chao Xiaojing promotes China's economic development mainly through the conversion of new and new kinetic energy, optimization and upgrading of industrial structure and economic and social operation efficiency [4]. Meanwhile, Liu Fengqin believed that the current infrastructure construction development and economic development derailment, and the traditional infrastructure construction investment could not meet the requirements of high-quality economic development. Most of the financing of the domestic infrastructure industry is dominated by the government for [5], but Hu Xiaofeng pointed out that the current government financing of the infrastructure industry is mostly debt financing, but such financing mode is not widely applicable to [6] when the government assumes high risks. Guo Jian analyzed the financing mode of foreign infrastructure industry, and found that foreign countries mainly used BOT and PPP mode to finance [7]. Zhao Guofu and Wang Shouqing, through the application of BOT financing mode in the infrastructure industry, pointed out that BOT can help improve the efficiency of project construction [8]. For the PPP mode, Dimitrios Sideris Research found that using the PPP financing model can effectively introduce social capital, So as to improve the operation efficiency of the project [9]; Domestic scholars Li Peng and others also pointed out that the PPP financing model can disperse the risk of government investment and at the same time can also make full use of private capital investment [10]; But Zheng Lianghai pointed out that the PPP financing model needs to solve the property rights, budget, leverage, regulations and other problems [11]; Scholar Sun Wei also pointed out that the PPP financing model also exposed the investment subject cooperation is not deep enough, Lack of social capital power and other defects [12]. Reits generally refers to real estate trust funds, Reits, Cashman George D Through the research and analysis of the listed REITs, we found that the government policies, Per capita

GDP and the robustness of banks are the reasons for the rapid development of Reits [13]; Wang Zhuanglin's study of American REITs found that it has high benefits, The characteristics of lower risk and low tax costs, Therefore, it is widely popular with [14] abroad; In terms of domestic REITs, Although foreign scholar David Parker believes that China's REITs market will have great potential for [15]; Domestic research on Reits can also be traced back to 2007, when the People's Bank of China and the China Securities Regulatory Commission jointly set up the Reits special research team, But by the end of 2020, There are also no domestic REITs and markets that meet international standards, But during the past decade or so, Domestic scholars also have a series of research results on REITs, Fan Chenguang integrated the BOT and Reits financing mode and found that the integrated financing mode effectively introduced social capital [16]; Rong Chen, according to the way of raising funds, The Reits' transaction structure is divided into two modes: "pure equity Reits" and "stock + debt Reits", And the latter is more popular because of its characteristics of tax avoidance [17]; Through the research of various international REITs, Wang Minghan believes that the income performance of REITs is linked to the underlying assets [18]. In the study of Reits of infrastructure industry, Du Ruchang believes through the analysis of "PPP + Reits" that public offering REITs is suitable for the new financing model of infrastructure industry [19]; Zhai Yinghui believes that the introduction of REITs of infrastructure industry can effectively solve the difficult and expensive financing problem of the infrastructure industry [20].

3. Introduction of the Financing Structure of the Capital Eco-Environment Protection Group

Beijing Capital Eco-Environment Protection Group Co., Ltd. formerly known as Beijing Capital Co., Ltd. was established in 1999. The actual controller of the company is the State-owned Assets Supervision and Administration Commission. It was listed on the Shanghai Stock Exchange in 2000. Capital Eco-Environment Protection Group is a leading enterprise in China's water environmental protection industry, actively

promoting the market-oriented reform of enterprises, and is currently the fifth largest water environmental operation and management company in the world. On August 27, 2020, Capital Eco-Environment Protection Group deliberated and passed the Proposal on the Application and issuance of Public Infrastructure REITs, and agreed to carry out the declaration and issuance of public infrastructure securities investment funds. On June 7, 2021, Wells Fargo Capital Water REITs officially took effect. The REITs is a public raised infrastructure securities investment fund, using a contractual closed operation mode. The duration of the fund is 26 years. The basic assets include two sub-projects, Shenzhen project and Hefei project, among which Shenzhen project includes BOT franchise project of Shenzhen Fuyong, Songgang and Gongming Water Purification Plant and PPP project of Hefei 15 River Pollution Water Treatment Plant. The initial offering is conducted in three ways: a combination of private placement to strategic investors, inquiry placement to offline investors and pricing offering to public investors. The transaction entities involved include the fund manager, the fund custodian, the original equity holders and the infrastructure project operators. Among them, Wells Fargo Fund Management Co., Ltd., as the fund manager, is responsible for operating

the funds raised by the fund, managing the infrastructure projects, and operating in a professional and prudent manner. Capital Eco-Environment Protection Group, as the external operation management organization and the original equity holder of the fund, is responsible for asset operation and management; the establishment, issuance, operation and withdrawal liquidation of the special plan are handled by the plan manager; China Merchants Bank Co., Ltd. acts as the fund trustee to ensure the safety of the funds and ensure the use of the funds comply with the instructions. The implementation stage of public offering REITs mainly includes the following contents. After the establishment of the project, the first stock infrastructure securities investment fund, asset-backed special plan and private equity investment fund will be established. Securities investment fund subscription asset support special plan share, asset support special plan subscription private equity share, private equity subscription project equity, project company all equity in the private equity, the transaction structure by design basic asset support special plan adopts the way of equity and creditor's rights to Hefei and Shenzhen pioneered the complete control of the two subsidiaries. The overall transaction structure is shown in Figure 1

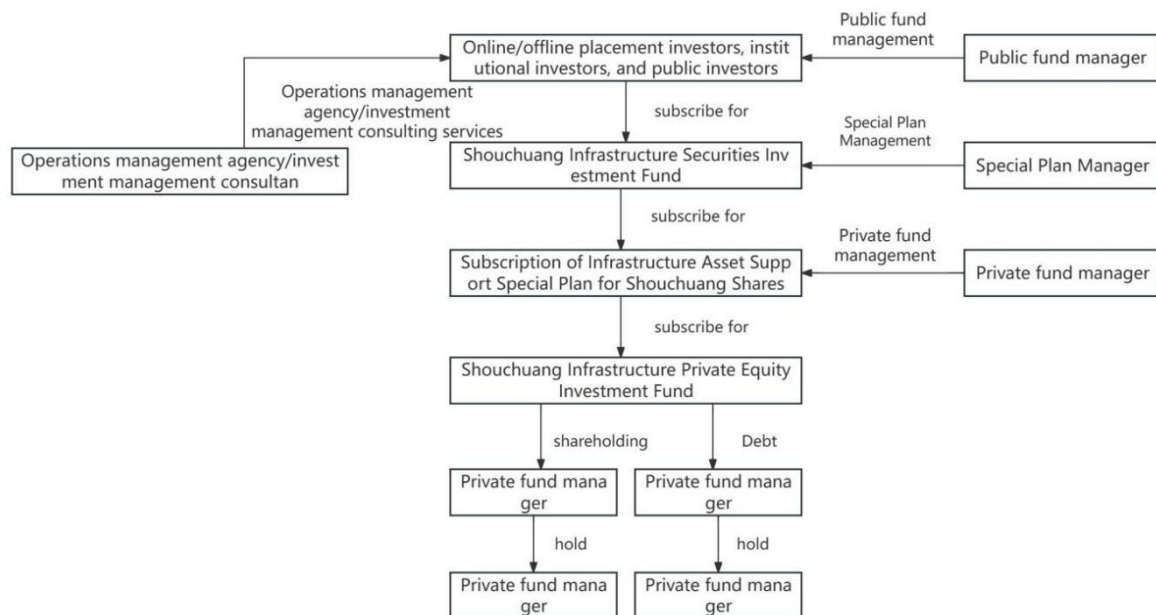


Figure 1. The First Public Offering REITs Architecture

The first public offering REITs issued a total of 500 million fund shares, and the final raised

funds totaled 1.835 billion yuan. After deducting the necessary operating expenses,

all the remaining funds were invested in the target project, part of the financial liabilities of the project company in the form of shareholder loans, and part of the company acquired 100% of the equity of the project company.

In the first REITs holding strategy, the self-holding strategic placement ratio is as high as 51%, while the external strategic investors get a 25% share. The REITs have attracted investors from different fields, including Three Gorges Capital, Shougang Fund, Wells Fargo Fund Asset Management, Everbright Securities Asset Management, China Insurance Investment Fund, ICBC Credit Suisse Investment, Galaxy Securities, CICC Fortune Securities and China Merchants Wealth Asset Management. These investors cover industrial capital, insurance capital, brokerage proprietary and asset management products and other fields.

This REITs adopts the four-level transaction structure of "public fund- -special plan- -private fund- -project company", which has the following advantages:

(1) Adopt the transaction structure of public fund + ABS can reduce costs and reduce execution resistance. According to Chinese laws and policies, public offering REITs that directly invest in a company's equity cannot enjoy the tax exemption treatment of public offering equity funds that similarly invest in stocks and bonds. In the structure of public offering REITs, when the company transfers the equity of public offering funds, and the equity transfer faces the problem of income tax payment. Therefore, the nested mode of "public offering funds + ABS" in the structure can make the implementation of public offering REITs less difficult and the transaction structure cost is lower.

(2) It is conducive to tax planning and easier to obtain stable during cash flow. In the case of loan funds, the company's operating income is deducted from the loan interest; meanwhile, the company establishes a closer capital structure in the tax system and reduces the capital proportion of the company to deduct more income tax.

(3) Nested private equity funds makes direct investment possible. This is mainly for the following two reasons: first, asset compliance requirements. According to the notice on strengthening urban sewage treatment plant

pollution reduction verification accounting work, the original rights and interests of creditor's rights and usufruct at the same time assets, packaged assets become the underlying assets will violate the principle of legal ownership clarity for account regulation, and nested private equity funds can perfectly solve this problem. The second is the regulatory support for the nesting of private funds. According to the Notice on Improving the Central Control System of Urban Sewage Treatment Plants in Our City, private funds can be used in the nesting of public offering REITs to realize the problem that funds are not allowed to directly invest in the equity in REITs in legal terms.

4. Capital Eco-Environment Protection Group Financing Effect Analysis

4.1 Analysis of the Financing Effect of the Stock Market

Event analysis is a method of analyzing the impact of a specific event on the company through financial market data. The method usually contains a full event window, including estimation, event, and post hoc windows. When selecting the event window, considering that the event may have been leaked before the announcement, it usually includes the time of the event and the time of the event before and after the event is called the estimation window. This paper uses the event analysis method to study the stock performance before and after the first REITs financing. Based on the effective assumption of the market, the stock price fluctuation of an enterprise can fully reflect the changes of the relevant information of the enterprise, so the financing effect of the first REITs can be analyzed by calculating the cumulative excess returns.

4.1.1 Identification of the event window period

According to Capital Eco-Environment Protection Group announcement, the REITs release date is June 21, 2021, while the announcement release date is June 1, 2021. In order to ensure the accuracy of the study results, 1 June 1, 2021 is taken as the event date, and 10 trading days are selected as the event window. In terms of the estimation window, the first 210 trading days prior to the first 11 trading days, that is, [-210, -11], were

selected to ensure the validity of the results with sufficient data volume. In the study, start from the announcement date, including the announcement date and the following day, in order to fully consider the impact of the data.

To minimize the interference of other factors, a shorter time interval, namely [-10, 10], was chosen as the event window. As shown in Figure 2.

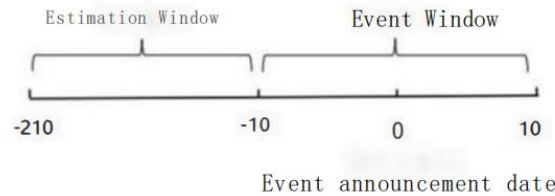


Figure 2. Number Axis of the Event Window

4.1.2 Actual and normal return

Step 1: Calculate the real yield rate

Through the price of individual stocks in the above event window and the market index, the daily yield of individual stocks R_{it} and the daily yield of the market R_{mt} are calculated

$$R_{it} = (P_t - P_{t-1}) / P_{t-1} \quad (1)$$

$$(2)$$

$$R_{mt} = (P_t - P_{t-1}) / P_{t-1}$$

Where P_t refers to the closing price of the stock on the t-day, P_{t-1} is the closing price of the stock on t-1 day

Step 2: Calculate the normal yield rate

Select the market model, and construct the daily yield rate of individual stock and the daily market return rate calculated by the above steps

Counting model

$$R_{it} = c_i + \beta_i R_{mt} + u_{it} \quad (3)$$

Among them: R_{it} is the real yield of the t day of the first environmental protection stock, R_{mt} is the market yield of the t day;

The c_i , β_i are the model parameters; the u_{it} is the disturbance term. Linear regression

using stata was used to produce the first environmental normal yield fit model

First environmental protection:

$$R_{it} = 0.6721R_{mt} - 0.0009$$

4.1.3 Excess yield and cumulative excess yield

$$AR_{it} = R_{it} - R_{it}' \quad (4)$$

$$CAR_{it} = \sum_{t=-i}^i AR_{it} * CAR_{it}[-i, i] \quad (5)$$

AR_{it} represents the excess yield of the pioneering environmental protection enterprise; R_{it} represents the actual rate of return of the pioneering environmental protection enterprise in t; R_{it}' indicates the normal yield of the pioneering environmental protection enterprise in t; CAR_{it} indicates the correlation of the event, the single sample T-TEST is used to test the significance level of the above results. As shown in Table 1, the one-sample T-test p-value of the cumulative excess yield (CAR) of Capital Environmental REITs financing events is less than 0.05, indicating that the REITs financing events have a significant impact on the stock price fluctuations of Capital Environmental Protection.

Table 1. One-sample Test

one-sample test						
t		free degree	Significance (double-tailed)	Test value =0 mean difference	Difference value with 95% confidence interval	
					lower limit	superior limit
CAR	4.082	20	0.001	0.0138268	0.006761	0.020892

By downloading the two sets of data of the Shanghai Composite Index and the first environmental protection enterprise, after the above steps, the linear regression formula of

the normal return rate of the first environmental protection is $Y = 0.6721X - 0.0009$, $R^2 = 0.1964$.

After calculation, the normal return rate,

excess return rate (AR) and cumulative excess return rate (CAR) in the window period of the

first environmental protection enterprise are shown as follows:

Table 2. Cumulative Excess Yields in the Window Period

normal income rate	excess return AR	Cumulative excess yield rate of CAP	time
0.21%	4.91%	1.32%	T=-10
-0.63%	1.93%	3.25%	T=-9
-0.30%	-0.02%	3.23%	T=-8
0.41%	-0.41%	2.83%	T=-7
-0.05%	-0.60%	2.23%	T=-6
-0.44%	-0.53%	1.70%	T=-5
0.18%	-0.84%	0.86%	T=-4
0.35%	-0.02%	0.84%	T=-3
-0.54%	-0.11%	0.73%	T=-2
-0.67%	-0.98%	-0.26%	T=-1
-0.82%	1.49%	1.23%	T=0
0.24%	-1.24%	-0.01%	T=1
0.00%	2.02%	2.01%	T=2
0.17%	1.15%	3.16%	T=3
0.24%	0.41%	3.57%	T=4
0.04%	-0.04%	3.53%	T=5
-0.13%	0.45%	3.98%	T=6
0.67%	-0.99%	2.99%	T=7
-0.20%	-1.09%	1.89%	T=8
-0.62%	-0.03%	1.86%	T=9
0.26%	-0.92%	0.94%	T=10

The fluctuation trend of the excess return rate (AR) and cumulative excess return (CAR) of the pioneering environmental protection enterprises during the REITs financing period is shown in Table 2. June 1, 2021 is the announcement date of the analysis of the data during the observation period, the average value of normal yield is -0.08%, indicating that the average performance of the enterprise during the observation period is slightly lower than the market average level; the average value of excess yield is 0.22%, indicating that the performance of the company is slightly lower than the market average during the observation period; but the overall performance is still above the market level, and the sum of the cumulative excess yield is 1.99%, indicating that the stock earnings performance of the enterprise is slightly higher than the market average during the whole observation period.

From the perspective of time, it can be found that the cumulative excess yield of the enterprise fluctuates before and after the announcement, but the overall performance is

good. At the moment of T=0, a major REITs financing plan was announced, the excess return of the company was 1.49%, and the cumulative excess return reached 1.23%, indicating that the company announced that the event had an impact on the society. In the following period of time, the excess yield AR showed a certain upward trend, which may be due to the investors' optimistic expectations of the corporate financing plan. In addition, the cumulative excess yield CAR also reached a relatively high value at time T=6, which may be due to the REITs financing program starting to receive substantial results during this period, thus triggering investor optimism.

To sum up, from the perspective of social response, the first pilot project of public offering REITs for first environmental protection enterprises has achieved positive social effects. The event study method shows that the disclosure of good information has improved the confidence of stock holders and had a positive impact on the society. Investors recognize the content of the REITs pilot announcement. Through the analysis of the

mature foreign REITs market system, they are full of confidence in the REITs itself. The evaluation shows that enterprises can optimize assets and reduce financial risks through the subsequent REITs financing behavior, so as to achieve the effect of improving enterprise strength and increase enterprise competitiveness. At the same time, compared with private and public offering REITs, the assets are more transparent and have higher requirements for the information disclosure of the underlying assets and projects, which need to face independent audit and public audit results, as well as the supervision of the media and other public. The first environmental protection initiative to set up investment trust funds to integrate high-quality assets is welcomed by investors, and it is also good news for enterprises. Getting the support of investors in the capital market helps to improve the wealth of shareholders of enterprises.

4.2 Analysis of the Financing Effect of Enterprise Financial Performance

In the financial performance analysis, the financial index method is the most commonly used method. This paper through rigorous, stable, rational, official language style, the Wells Fargo first water REITs before and after the listing, the original rights of Capital Eco-Environment Protection Group solvency (such as current ratio, quick ratio, asset-liability ratio) and profitability (such as return on equity, return on total assets, capital) of the financial index changes. At the same time, these indicators are compared with the changes of the corresponding indicators before and after the issuance of PPP asset securitization of Capital Eco-Environment Protection Group in March 2017, aiming to explore the difference in the financing effect in a rigorous and rational way.

Table 3. Solvency Indicator of Capital Eco-Environment Protection Group

Before and after the issuance of REITs				
	2020/12/31	2021/3/31	2021/6/30	2021/9/30
current ratio	0.65	0.70	0.70	0.85
quick ratio	0.62	0.66	0.66	0.80
asset-liability ratio	64.81%	65.09%	63.99%	63.91%
Before and after the issuance of PPP asset securitization, Capital Eco-Environment Protection Group solvency				
	2016/9/30	2016/12/31	2017/3/31	2017/6/30
current ratio	1.69	1.24	1.25	0.64
quick ratio	0.47	0.60	0.59	0.67
asset-liability ratio	67.89%	65.65%	66.99%	67.63

According to the data in Table 3, it is clearly clear that the issuance of Rich Capital Water REITs has a significant impact on the solvency of Capital Eco-Environment Protection Group. Especially in terms of the asset-liability ratio, the asset-liability ratio was as high as 65.09% before the adoption of public offering REITs financing. However, after the adoption of this financing model, the asset-liability ratio in the second quarter and the third quarter showed an obvious downward trend. At the same time, the current ratio and the quick ratio also improved significantly in the third quarter. These data fully show that Rich Country Capital Water REITs, a public REITs financing model, has effectively helped Capital Eco-Environment Protection Group to reduce its debt ratio and achieve the goal of

deleveraging and asset-light. This financing method not only increases the liquidity of enterprises, reduces the financial risks, but also provides a better business environment for enterprises.

On the other hand, the PPP asset securitization implemented by Capital Eco-Environment Protection Group in March 2017 has played a certain role in improving the solvency of enterprises. However, compared with water REITs, the effect of PPP asset securitization is slightly less effective. After the issuance of PPP asset securitization, the asset-liability ratio of the enterprise did not decline, but increased somewhat. Although its quick ratio has increased, the increase is less than the quick ratio after the issuance of Fuguo First Water REITs. By comparing and analyzing the

three financial indicators of current ratio, quick ratio and asset-liability ratio, it can be clearly seen that the financing mode of public

offering REITs, such as Wells Fargo Capital Water REITs, has more advantages in the financing effect.

Table 4. Profitability Indicators of Capital Eco-Environment Protection Group

Fuguo first water REITs issued before and after the Capital Eco-Environment Protection Group profitability				
	2020/12/31	2021/3/31	2021/6/30	2021/9/30
Return on equity	6.45%	1.15%	5.39%	7.21%
all capital earnings rate	1.78%	0.34%	1.55%	2.11%
mercantile rate of return	4.28%	0.88%	2.85%	4.04%
The profitability of Capital Eco-Environment Protection Group was created before and after the issuance of PPP asset securitization				
	2016/9/30	2016/12/31	2017/3/31	2017/6/30
Return on equity	1.60%	2.15%	1.16%	1.46%
all capital earnings rate	0.38%	0.56%	0.30%	0.42%
mercantile rate of return	1.06%	1.09%	0.77%	88.00%

According to the data in Table 4, the issuance of Wells Fargo Capital Water REITs has produced a significant improvement in the profitability of Capital Eco-Environment Protection Group. Among them, the return on equity index showed the most significant increase, gradually increasing from 1.15% in the first quarter of 2021 to 5.39% in the second quarter and 7.21% in the third quarter. This suggests an increase in after-tax profits. In addition, the return on investment also rose from 0.88% in the first quarter of 2021 to 2.85% in the second quarter and 4.04% in the third quarter. According to the calculation formula of return on investment (average annual net cash flow / total investment), it can be inferred that after adopting the public offering REITs financing scheme, the average annual cash flow increase multiple of Capital Eco-Environment Protection Group is much greater than the increase multiple of its total investment, which further confirms that the financing scheme is a beneficial choice. Compared with the improvement effect of Fuguo Capital Water REITs, the PPP asset securitization issued by Capital Eco-Environment Protection Group has a slightly inferior improvement effect on its profitability. Its return on equity and return on investment increased by 25.9% and 14.3%, respectively, while both indicators increased by 33.8% and 41.8%, respectively, after the issuance of Wells Fargo Capital Water REITs. This further shows that the adoption of public offering REITs financing model can significantly increase the after-tax profit and

annual cash flow of Capital Eco-Environment Protection Group.

After the above analysis, it can be concluded that compared with the financing method of PPP asset securitization, the financing method of Capital Eco-Environment Protection Group is more effective for improving the financial situation of enterprises. This choice will help companies invest more money into new sewage treatment projects, which will activate and revitalize a large amount of existing assets. Therefore, from the perspective of finance and asset operation, the public offering of REITs is a more ideal and efficient financing method.

4.3 Analysis of the Financing Effect of the Enterprise's Production Efficiency

In order to accurately evaluate the effects of the first REITs, 00000000 uses the data envelope analysis (DEA) model to study its impact on the efficiency of Capital Eco-Environment Protection Group. When evaluating enterprise productivity, we used data envelope analysis (DEA) and DEA-Malmquist index. DEA is a research method of operational research and economic production boundary, which is widely used in the measurement of enterprise production efficiency. The Malmquist index was originally proposed by Malmquist in 1953 and began to measure changes in productivity in 1982. In 1994, Rolf Fare et al. combined the Malmquist index with the data envelope analysis (DEA), which was widely used in the measurement of production efficiency in the financial, industrial, medical and other sectors.

The basic principle is to control the constant input or output, determine the frontier of relatively effective production with the help of linear planning and statistical data, and judge the effectiveness by judging the difference of the decision data from the front.

4.3.1 Evaluation indicators

The DEA model consists of three parts: comprehensive efficiency, pure technical efficiency, and scale efficiency. Among them, the comprehensive efficiency is the result of pure technical efficiency and scale efficiency. Enterprise management and technology level have an impact on the pure technical efficiency, while the actual operation scale of the enterprise has an impact on the scale

efficiency.

CCR model = BBC model scale efficiency

BCC Model = CCR model / scale efficiency

Given that pioneering REITs may have incomplete competition and resource constraints during their operation, these factors may affect their operation at an optimal scale. Therefore, this paper decided to adopt the BCC model to study the financing efficiency of pioneering REITs. After combining the reading of relevant literature and the specific situation of pioneering REITs, we summarized and summarized the input variables and output variables, as shown in Table 5.

Table 5. Summary of DEA Evaluation Indicators

	Variable name	Variable description
The input variable	general assets	Reflect the size of the enterprise
	asset-liability ratio	To measure the management ability of enterprises to use creditors' funds
	cost of financing	The expenses incurred in raising the funds needed for production and operation shall reflect the purpose of the financing of the enterprise
Output variable	Return on equity	Reflects the ability of an enterprise to obtain net income from its own capital
	turnover of total capital	Reflect the quality of asset management and utilization efficiency

4.3.2 Data source

The DEA-Malmquist model has the following requirements in terms of the data source:

- (1) The panel model shall use data for more than 5 years, taking 2016-2022 as an example, to ensure that the model can fully express the required information.
- (2) When selecting data, the time lag of financing effect should be taken into account, so the interval of retention time is needed.
- (3) The number of decision units selected by the model is required to be more than twice the sum of the input and output variables to ensure the accuracy and reliability of the model.

The research data of this paper comes from the iFinD database, and takes the listed enterprises

with the PPP concept in the sewage treatment plant as the research object, and eliminates the missing data and the delist enterprises. Finally, 15 valid samples were obtained, and the specific list is shown in Table 5. In the DEA analysis, although there is no strict requirement on the correlation between input and output variables, the data must be non-negative. Referred to the treatment of domestic and foreign scholars, such as J. Zhu, W. Cook, Silva Portela, and K Krstens, I. van de Woyestyne and domestic scholars Qin Peigang etc., conducted the non-negative treatment of input and output variables according to (6).Data sources are presented in Table 6.

Table 6. Data Sources of the DEA

order number	stock code	corporate name	time to market	order number	stock code	corporate name	time to market
1	300275.SZ	Meanson	2011-11-2	8	300437.SZ	Clear water source	2015-4-23
2	300332.SZ	Trench environment	2012-6-28	9	601200.SH	Shanghai environment	2017-3-31
3	300422.SZ	Bosch	2015-2-17	10	300929.SZ	Hua Qi environmental protection	2021-1-20

4	603588.SH	high-energy environment	2014-12-29	11	002973.SZ	Overseas Chinese Bank shares	2020-1-3
5	603603.SH	Botian environment	2017-2-17	12	300388.SZ	Energy saving national zhen	2014-8-1
6	603568.SH	Weiming environmental protection	2015-6-23	13	603759.SH	Haitian shares	2021-3-26
7	002663.SZ	Pbon shares	2012-3-16	14	603903.SH	Holding shares	2017-3-14

$$X_{ij} = 0.1 + 0.9 * \frac{X_{ij} - \min X_{ij}}{\max X_{ij} - \min X_{ij}} \quad (5)$$

$$I = 1, 2, 3, \dots, X_{ij} \in [0, 1]$$

4.3.3 Analysis of the results

It can be found through Table 7 and Table 8, REITs products have the ability to invigorate enterprise assets, accelerate capital turnover and improve enterprise efficiency. According to the analysis results of Deap 2.1 software, the corporate efficiency has been significantly improved since the launch of REITs in 2021.

From the perspective of the BCC model, after the issuance of the first REITs, the comprehensive efficiency, pure technical efficiency and scale efficiency of enterprises all show a gradual upward trend. According to the analysis of the DEA-Malmquist model, the Malmquist value (Tfpch), representing the change in total factor productivity, increased from 1.077 in 2020 to 1.033 in 2022, indicating that the total factor productivity of enterprises has improved after the introduction of REITs products.

Table 7. Output Results of the DEA-BCC Model

a particular year	Pure technical efficiency (PTE)	technical efficiency (TE)	Scale efficiency (SE)	return of scale
2016	0.244	0.226	0.929	increase progressively
2017	0.326	0.320	0.982	increase progressively
2018	0.511	0.473	0.927	decrease progressively
2019	0.409	0.408	0.997	increase progressively
2020	0.502	0.497	0.990	decrease progressively
2021	0.511	0.498	0.974	decrease progressively
2022	0.478	0.412	0.864	increase progressively

Table 8. Output Results of the DEA-Malmquist Model

a particular year	Technical Efficiency Change (Effch)	Change in pure technical efficiency (Pech)	Technological Progress (Techch)	Scale efficiency change (Sech)	Change in total factor productivity (Tfpch)
2016-2017	1.414	1.337	0.652	1.057	0.921
2017-2018	1.480	1.567	0.683	0.945	1.011
2018-2019	0.862	0.802	1.180	1.075	1.017
2019-2020	0.828	1.226	0.826	0.994	1.007
2020-2021	1.218	1.019	1.024	0.983	1.026
2021-2022	1.002	0.934	1.247	0.887	1.033
mean	1.134	1.147	0.935	0.990	1.002

From the perspective of the increase of technical efficiency index, it increased from 0.859 to 1.218, which indicates that after the issuance of Capital REITs products, the technical efficiency of enterprises has been improved, and the financing of Capital Eco-Environment Protection Group has played a positive role.

From 2019 to 2020, the total factor productivity of Capital Eco-Environment Protection Group was 1.007, while from 2020

to 2021, the change index of scale efficiency was less than 1, but the change index of technological progress, pure technical scale efficiency and technical efficiency were all greater than 1. This shows that the technological progress change index, pure technical scale efficiency change index and technical efficiency change are the reasons for the increase of total factor productivity. Therefore, REITs financing is the main reason for the improvement of total factor

productivity of Capital Eco-Environment Protection Group.

The first sewage treatment project issuing REITs financing can realize asset-light operation, improve production efficiency, and revitalize enterprise assets. Long-term equity financing can make project financing form a closed loop of "fundraising, financing and withdrawal". After the initial sewage treatment project is mature, the original stakeholders are able to withdraw the funds and put the funds into the new project. This benign cycle is beneficial to enterprises, but also conducive to the sustainable development of the whole society, to achieve the rational allocation of resources.

5. Conclusion and Suggestion

5.1 Conclusion

Through in-depth study of the innovative financing mode and financing effect of Capital Eco-Environment Protection Group, this paper finds that REITs not only meet the capital needs of the project from the establishment period to the landing, but also bring the value of wealth to shareholders. Through the comparative analysis of the solvency and profitability before and after REITs of Capital Eco-Environment Protection Group, we found that the current ratio, quick ratio, return on equity, return on total assets and return on investment all showed an upward trend, while the asset-liability ratio showed a downward trend. This indicates that REITs have improved the balance sheet structure of Capital Eco-Environment Protection Group and enhanced the profitability of the enterprise. Moreover, through the BBC model study, we found that changes in technical efficiency and scale efficiency are the reasons for the increase in total factor productivity. Therefore, REITs have strongly promoted the improvement of the total factor productivity of The Capital Eco-Environment Protection Group, and improved the production efficiency of the enterprise. At the same time, the REITs of Capital Eco-Environment Protection Group also played a demonstration effect on financing in the infrastructure industry.

5.2 Countermeasures and Suggestions

5.2.1 Select high-quality underlying assets

The key to the successful issuance of public offering REITs and the realization of the ideal financing quota lies in the quality of its underlying assets. In order to ensure the successful issuance of public offering REITs and achieve the expected financing objectives, enterprises should choose projects with stable growth in cash flow in the future and paid by users as the underlying assets. In addition, attention should be paid to the time of the franchise to avoid the situation that the franchise period is earlier than the end of the closed period of public offering REITs.

5.2.2 Design of a reasonable transaction structure

The transaction structure design should be as simple as possible in the case of the enterprise itself. When designing the transaction structure, the enterprise meets the requirements of the enterprise itself, the simpler the design, the less transaction costs generated, the less tax generated, and the less agency problems generated. In addition, enterprises should introduce as much long-term funds as possible when looking for strategic investors, and increase the proportion of public investors as much as possible.

5.2.3 Strengthen supervision to ensure investors' returns

China's public offering REITs adopt a contractual structure, so it involves the participation of fund management teams and the interaction of multiple subjects, which may lead to the increase of agency problems. In order to prevent the emergence of moral hazard and other problems, the supervision intensity needs to be further strengthened. At the same time, the original shareholders should strengthen the internal supervision to avoid the encroachment of major shareholders on the interests of minority shareholders. Only by ensuring that the returns of investors are guaranteed can enterprises achieve their financing goals and maintain steady development.

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