

Integrating ESG into Corporate Valuation: A Case Study of Yangtze Power's Modified DCF Approach

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Abstract: Against the backdrop of the global transition to a low-carbon economy, corporate valuation must incorporate ESG factors. The traditional DCF model is insufficient to fully capture enterprises' sustainable development performance. In the context of China's emerging capital market, incorporating ESG factors into the China-specific valuation frameworks can help accurately assess long-term corporate value, guide capital flows towards high-quality enterprises, and promote high-quality economic growth. This study refines the DCF model by adjusting growth rates and discount rates to reflect ESG considerations. Through empirical data analysis and comparative study, this paper revalued Yangtze Power using the modified DCF model. Results showed that the modified DCF model produced valuations more aligned with the company's actual stock price, demonstrating that ESG-integrated DCF models can more accurately reflect true corporate value. This study provides new perspectives and methods for improving traditional corporate valuation approaches.

Keywords: ESG Integration, DCF Model, Corporate Valuation, Sustainable Finance, Yangtze Power

1. Introduction

In the context of global climate change and China's "dual-carbon" strategy, corporate valuation frameworks are undergoing a paradigmatic shift. The 2022 "top-level design" proposed by the China Securities Regulatory Commission (CSRC) emphasizes integrating Environmental, Social, and Governance (ESG) factors into valuation logic [1]. As critical clean energy providers, hydropower enterprises' ESG performance not only influences ecological security but also aligns with national energy transition goals. Existing studies primarily focus on ESG-performance correlations, highlighting that superior ESG practices enhance enterprise value through reduced financing costs and risk resilience [2, 3]). While scholars have adjusted discount rates or cash flows to incorporate ESG, sector-specific research on hydropower remains limited [4]. Although domestic studies confirm ESG's positive impact on state-owned enterprise valuations, the unique ESG value mechanism of hydropower enterprises—characterized by natural monopoly and ecological externalities—remains underexplored [5]. This study addresses this gap by constructing an ESG-integrated valuation model using Yangtze Power as a case. The theoretical contribution lies in expanding traditional valuation frameworks through ESG risk premiums and policy dividend adjustments, enriching China-specific valuation theories. Empirically, an improved DCF model quantifies ESG's impact using financial reports, ESG disclosures, and industry data from 2019-2023. This research provides theoretical

support for ESG governance optimization and practical guidance for green asset identification, advancing China's green finance strategy.

2. Determination of enterprise value via traditional valuation models

In the field of corporate valuation, traditional valuation models, particularly the Discounted Cash Flow (DCF) model, are grounded in the principle of expected future cash flows. These models determine enterprise value by forecasting future cash flows and discounting them to present value using an appropriate discount rate. The DCF model typically employs a two-stage framework, assuming corporate cash flows follow distinct phases: a high-growth period and a stable-growth period. The enterprise value is calculated by summing the present values of cash flows from both phases:

$$EV = \sum_{t=1}^n \frac{FCFE_t}{(1+R_e)^t} + \frac{FCFE_{n+1}}{(R_e - g)(1+R_e)^n} \quad (1)$$

However, traditional valuation models have significant limitations. First, they rely excessively on historical financial data for future earnings predictions while ignoring non-financial factors like ESG. Second, the determination of the discount rate involves both market-based estimations and subjective judgments, which may introduce valuation biases. Additionally, the conventional two-stage model assumes a uniform transition from high growth to stable growth, which may not align with the diverse growth trajectories observed across different industries and firms. Given these limitations, traditional valuation models may not fully capture the true value of an enterprise. Integrating ESG factors into the valuation framework can enhance accuracy and provide a more comprehensive assessment of corporate value.

3. ESG-integrated corporate valuation model

ESG's role in assessing enterprise true value manifests through three primary mechanisms: mitigating systematic risks, optimizing capital costs, and enhancing long-term cash flow potential. These impacts influence valuation results by adjusting key parameters within the DCF model. For this case study focusing on A-share listed company Yangtze Power, ESG ratings provided by China Securities Index (CSI) and corporate financial reports were selected as data sources, considering both accessibility and completeness of information.

3.1. Model adjustment: discount rate modification

The discount rate represents the ratio used to convert future cash flows into present value. For equity valuation, the discount rate typically corresponds to the cost of equity capital (R_e), which is determined using the Capital Asset Pricing Model (CAPM):

$$R_e = R_f + \beta(R_m - R_f) \quad (2)$$

Here, R_f represents risk-free rate of return; R_m denotes the market risk premium, and β measures the firm's systematic risk relative to the market. Prior research suggests that ESG factors contribute to systematic risk mitigation through three primary mechanisms: expanding the investor base (stakeholder theory), reducing principal-agent costs (principal-agent theory), and meeting policy and societal expectations (social responsibility theory) [6, 7]. Given these effects, the β coefficient is adjusted to reflect ESG-driven risk differentials more accurately, assisting investors in identifying "ESG excess returns" or "ESG risk premiums. Incorporating ESG Ratings into Beta Coefficient Modification, the formula is expressed as:

$$\beta_{\text{revised}} = \frac{\text{Industry Average ESG Score}}{\text{Enterprise ESG Score}} \times \beta \quad (3)$$

If an enterprise's ESG rating exceeds the industry average, its β coefficient decreases, indicating lower risk exposure. Conversely, lower ESG ratings increase β , indicating higher risk. As the β coefficient modification directly impacts the cost of equity capital (R_e) in the CAPM model, enterprises with outstanding ESG performance exhibit a lower R_e , resulting in a higher present value for discounted future cash flows.

3.2. Growth rate modification

The growth rate measures an enterprise's potential to expand future cash flows and its long-term growth capacity. Empirical studies indicate that ESG ratings correlate positively with corporate financial performance, particularly Return on Assets (ROA) and Return on Equity (ROE) [8]. High ESG-rated firms exhibit lower operational uncertainties, greater stakeholder trust, and long-term competitiveness, contributing to sustained revenue growth. These attributes are often associated with higher ROA and ROE. Yang Hang argued that a correlation exists between enterprises' ESG practices and their future earnings and growth [6]. Specifically, higher ESG ratings correspond to greater future earnings and growth, leading to higher revenue growth rates during the forecast period and higher perpetual growth rates in the stable period. Following the above logic, this paper incorporates ESG scores into the modification of the two growth rates. The formulas are as follows:

$$g_{\text{revised}} = \frac{\text{Enterprise ESG Score}}{\text{Industry Average ESG Score}} \times g \quad (4)$$

Revised Revenue Growth Rate

$$= \frac{\text{Enterprise ESG Score}}{\text{Industry Average ESG Score}} \times \text{Pre-revision Revenue Growth Rate}$$

The traditional DCF model is limited by overreliance on historical data, subjective discount rates, and neglect of industry specifics, while the ESG-adjusted DCF incorporates sustainability factors for a more holistic valuation, supporting subsequent empirical analysis.

4. Case application: valuation revision analysis of Yangtze Power

4.1. Case selection

The case enterprise selected in this paper is Yangtze Power. As a leading enterprise in the hydropower industry, Yangtze Power has always adhered to the sustainable development concept, integrating the ESG concept into all aspects of corporate operations. The company has established a sound ESG management mechanism, forming a governance structure with a clear division of labor and distinct hierarchies. This enables effective management of ESG-related risks and strongly promotes the continuous improvement of corporate governance standards.

4.2. Calculation of Free Cash Flow

As this assessment targets the per-share equity value of Yangtze Power, when applying the two-stage model, Free Cash Flow to Equity (FCFE) — rather than Free Cash Flow to Firm (FCFF) — should be used for cash flow. The calculation of FCFE is as follows:

$$\begin{aligned} \text{FCFE} = & \text{Net Profit} + \text{Depreciation and Amortization} - \text{Increment of Working Capital} - \text{Long} \\ & - \text{term Capital Investment} - \text{Increase in Long-term Operating Assets} \\ & + \text{Increase in Long-term Operating Liabilities} \end{aligned}$$

This subsection analyzes the calculation methods of FCFE for Yangtze Power, including a review of historical data and forecasting of future cash flows.

4.2.1. Calculation of historical cash flow

Table 1: 2019–2023 Free Cash Flow to equity of Yangtze Power unit: RMB 10,000

Time	2019	2020	2021	2022	2023
Net Profit	2156745	2650626	2648544	2164930	2795640
Depreciation and Amortization	1205955	1163790	1142031	1103894	1912067
Increment of Working Capital	-8902057	-167322	2830823	-1886759	241884
Long-term Capital Expenditure	271683	362786	347388	487068	1223256
Increase in Long-term Operating Assets	735097.46	3152895.28	-260292.47	101396.51	24159972.42
Increase in Long-term Operating Liabilities	-1340039.54	-113450.13	-758488.91	-1183957.42	-3442.45
Total Operating Revenue	4987409	5778337	5564625	5206048	7811157
Free Cash Flow to Equity	9917937	352606.59	114167.56	3383161.07	-20920847.87

Substitute the relevant data from Yangtze Power’s balance sheets and income statements during 2019–2023 into the above formula. From the historical data, Yangtze Power’s total operating revenue showed a steady upward trend from 2019 to 2022. Moreover, its FCFE remained positive during 2019–2022, demonstrating sound corporate operations. Notably, the FCFE in 2023 was negative, primarily due to the increase in fixed assets and construction-in-progress within long-term operating assets. Although this affects cash flow in the short term, it benefits the company’s long-term development.

4.2.2. Forecast of future Free Cash Flow

This paper adopts the percentage-of-sales method to forecast Yangtze Power’s future cash flow. Taking operating revenue as a reference, the percentage-of-sales method assumes that changes in certain accounts are proportional to revenue fluctuations. Given the recent stable development of China’s hydropower industry and the gradual slowdown in Yangtze Power’s operating revenue growth, the forecast period is set as 2024–2028, after which the enterprise enters the perpetual growth stage. Table 2 presents the proportion of items for calculating FCFE relative to operating revenue.

Table 2: Proportion of each item to operating revenue

Time	2019	2020	2021	2022	2023
Net Profit	0.4324	0.4587	0.4760	0.4158	0.3579
Depreciation and Amortization	0.2418	0.2014	0.2052	0.2120	0.2448
Increment of Working Capital	-1.7849	-0.0290	0.5087	-0.3624	0.0310
Long-term Capital Expenditure	0.0545	0.0628	0.0624	0.0936	0.1566
Increase in Long-term Operating Assets	0.1474	0.5456	-0.0468	0.0195	3.0930
Increase in Long-term Operating Liabilities	-0.2687	-0.0196	-0.1363	-0.2274	-0.0004

4.3. Estimation of cost of equity capital

When applying the percentage-of-sales method, it is essential to determine the proportion of each financial item relative to sales revenue during the forecast period. Based on the financial statements disclosed by Yangtze Power Group, the average revenue growth rate from 2019 to 2023 was calculated to be 10.64%, indicating a stable growth trend. Given the current steady development of the hydropower industry, Yangtze Power's strong market competitiveness, and its sound operational performance, it is reasonable to project that the company's revenue will continue to grow at this rate from 2024 to 2028.

With regard to profitability, the ratio of net profit to revenue during the period from 2019 to 2023 experienced a slight downward fluctuation. To ensure a conservative estimation, it is assumed that Yangtze Power's net profit margin will at least remain at the current level of 35.8% throughout the forecast period. Similarly, the ratio of depreciation and amortization to revenue has shown a high degree of stability in recent years. As depreciation and amortization typically grow in proportion to business expansion, the historical average of 22.11% from 2019 to 2023 is used as a reliable estimate for the forecast period.

Expanding operations also necessitate increases in working capital to support timely payment of operational costs and ensure smooth enterprise functioning. Given the relative stability of this ratio in recent years, the incremental working capital ratio is assumed to remain at its current level of 3.1%. As for long-term capital expenditure, which depends largely on the enterprise's investment and development strategy, the historical average ratio of 8.6% to revenue from 2019 to 2023 is adopted for the forecast period.

The increase in long-term operating assets, a key factor for companies in the hydropower industry, is driven primarily by infrastructure investment and industrial upgrades. According to Table 2, this ratio remained stable from 2019 to 2022 but rose significantly in 2023 due to large investments in fixed assets and construction-in-progress, signaling an acceleration in strategic upgrades. To maintain prudence in forecasting, this study uses the average ratio of 16.64% from 2019 to 2022.

Finally, the ratio of increases in long-term operating liabilities to revenue showed no consistent trend from 2019 to 2023, with all observed values being negative. This pattern may indicate that the company is optimizing its debt structure or reducing its reliance on long-term operating liabilities. Accordingly, this analysis employs the average ratio of -13.05% from the same period as the estimate for the forecast period.

Based on the above information and data, the pre-adjustment Free Cash Flow to Equity (FCFF) for Yangtze Power from 2019 to 2023 was calculated, with the specific values presented in Table 3.

Table 3: Pre-adjustment Free Cash Flow to equity of Yangtze Power (2024–2028) unit: RMB 10,000

Time	2024	2025	2026	2027	2028
Operating Revenue	8642264.105	9561801.006	10579176.63	11704801.03	12950191.86
Net Profit	3093930.55	3423124.76	3787345.234	4190318.767	4636168.684
Depreciation and Amortization	1910395.787	2113661.899	2338555.525	2587377.833	2862674.834
Increment of Working Capital	267910.1872	296415.8312	327954.4756	362848.8318	401455.9475
Long-term Capital Expenditure	742970.7899	822022.882	909486.1166	1006255.439	1113321.018
Increase in Long-term Operating Assets	1438072.747	1591083.687	1760374.992	1947678.891	2154911.925
Increase in Long-term Operating Liabilities	-1127815.466	-1247815.031	-1380582.551	-1527476.534	-1690000.037
Free Cash Flow to Equity	1427557.147	1579449.227	1747502.625	1933436.904	2139154.591

4.4. Valuation results of Yangtze Power

This paper adopts the CAPM Model when calculating the cost of equity capital for Yangtze Power.

$$R_e = R_f + \beta(R_m - R_f)$$

This paper selects the ten-year government bond yield at maturity as the risk-free return rate (R_f), set at 1.9%. The annualized return rate of the Shanghai Composite Index is chosen as the market average return rate (R_m), which is 13.52%. Calculated through the Wind database, the β coefficient of Yangtze Power relative to the Shanghai Composite Index by the end of 2023 is 0.6. Substitute all the above data for calculating the cost of equity capital into the formula, and the result can be obtained as follows:

$$R_e = 1.9\% + 0.6 \times (13.52\% - 1.9\%) = 8.87\%$$

This paper posits that the growth rate of an enterprise in the perpetual development stage should align with the national economic development level. Thus, the perpetual growth rate is determined by using the average of China's nominal GDP growth rates during 2024–2028. According to the latest forecasts by the International Monetary Fund, China's GDP growth rates from 2024 to 2028 are 4.80%, 4.60%, 4.50%, 4.30%, and 4.20%, respectively. Through calculation, the average of these values is 4.48%.

Through the above analysis and calculations, substitute various parameter indicators into the formula to derive the pre-adjustment equity value (EV1) of Yangtze Power. Upon verification, the total share capital of Yangtze Power as of December 31, 2023, amounted to 24.468 billion shares. Consequently, the final earnings per share of Yangtze Power at the valuation benchmark were 16.36 RMB yuan.

$$\begin{aligned} EV1 &= \sum_{t=1}^n \frac{FCFE_t}{(1+R_e)^t} + \frac{FCFE_{n+1}}{(R_e - g)(1+R_e)^n} \\ &= \frac{1427557.147}{(1+8.87\%)} + \frac{1579449.227}{(1+8.87\%)^2} + \frac{1747502.625}{(1+8.87\%)^3} + \frac{1933436.904}{(1+8.87\%)^4} \\ &\quad + \frac{2139154.591}{(1+8.87\%)^5} + \frac{2139154.591(1+4.48\%)}{(1+8.87\%)^5 \times (8.87\% - 4.48\%)} = 40040951.85 \text{ RMB yuan} \end{aligned}$$

$$\text{Earnings per share} = \frac{40040951.85}{2446821.77} = 16.36 \text{ RMB yuan}$$

Based on the definition of the ESG rating adjustment coefficient in the preceding analysis, determining its specific value requires first obtaining the target enterprise's ESG score and the industry average ESG score. According to the Huazheng Data Platform, Yangtze Power's ESG rating score is 85.18, and the industry average ESG rating score is 74.77. Thus, the β adjustment coefficient is 0.53, the perpetual growth rate adjustment coefficient is 5.1%, the post-adjustment cost of equity (R_e) is 8.0%, and the post-adjustment revenue growth rate is 12.12%. Substituting these adjusted indicators into the formula yields the post-adjustment shareholder equity value (EV2) of Yangtze Power based on ESG ratings. The detailed calculation process is as follows:

Table 4: Post-adjustment Free Cash Flow to equity of Yangtze Power (2024–2028) unit: RMB 10,000

Time	2024	2025	2026	2027	2028
Operating Revenue	8757955.56	9819516.57	11009750.51	12344253.95	13840513.96
Net Profit	3135348.091	3515386.932	3941490.682	4419242.915	4954903.999
Depreciation and Amortization	1935969.695	2170630.619	2433735.041	2728730.626	3059482.937

Table 4: (continued)

Increment of Working Capital	271496.6224	304405.0137	341302.2657	382671.8725	429055.9329
Long-term Capital Expenditure	752916.722	844178.5502	946502.3207	1061228.863	1189861.53
Increase in Long-term Operating Assets	1457323.805	1633967.557	1832022.484	2054083.858	2303061.524
Increase in Long-term Operating Liabilities	-1142913.201	-1281446.912	-1436772.441	-1610925.141	-1806187.072
Free Cash Flow to Equity	1446667.435	1622019.518	1818626.21	2039063.807	2286220.877

$$\begin{aligned}
 EV2 &= \sum_{t=1}^n \frac{FCFE_t}{(1 + R_{\text{revised } e})^t} + \frac{FCFE_{n+1}}{(R_{\text{revised } e} - g_{\text{revised}})(1 + R_{\text{revised } e})^n} \\
 &= \frac{1446667.435}{(1 + 8.0\%)} + \frac{1622019.518}{(1 + 8.0\%)^2} + \frac{1818626.21}{(1 + 8.0\%)^3} + \frac{2039063.807}{(1 + 8.0\%)^4} + \frac{2286220.877}{(1 + 8.0\%)^5} \\
 &\quad + \frac{2286220.877(1 + 5.1\%)}{(1 + 8.0\%)^5 \times (8.0\% - 5.1\%)} = 63246418.03 \text{ RMB yuan}
 \end{aligned}$$

$$\text{Earnings per share} = \frac{63246418.03}{2446821.77} = 25.85 \text{ RMB yuan}$$

After calculation, the earnings per share of Yangtze Power are found to be 16.36 yuan before adjustment and 25.85 yuan after ESG rating adjustment. The actual stock price of Yangtze Power on December 31, 2023, was 22.31 yuan. The deviation rate of the post-adjustment stock price is 15.87%, lower than the 26.67% deviation rate of the pre-adjustment stock price. This preliminarily verifies that the DCF model adjustment based on ESG ratings proposed in this paper is effective.

5. Conclusion

This research focuses on the ESG-integrated enterprise valuation system. Taking Yangtze Power as an example, it deeply explores the impact of ESG factors on enterprise value and the optimization path of the valuation system. The research arrives at the following important conclusions:

ESG practices significantly impact enterprise value. By analyzing how ESG practices affect enterprises' systematic risks, future cash flows, and growth potential, it is found that sound ESG practices can reduce systematic risks, win positive responses from stakeholders, and generate excess returns. Meanwhile, excellent ESG practices demonstrate an enterprise's commitment to sustainable development, attract investors adhering to the concept of sustainable development, respond to the nation's call for green development, obtain more policy support, and enhance enterprise value comprehensively. Regarding valuation methods, the ESG-DCF model aligns better with reality compared to the traditional DCF model. Although the traditional DCF model is widely used, it overlooks the profound influence of factors like environment, social responsibility, and corporate governance on enterprise value. The ESG-DCF model, by incorporating quantitative ESG scores from Huazheng Company, scientifically adjusts key parameters such as the discount rate, revenue growth rate, and perpetual growth rate. This enables a more comprehensive and accurate reflection of enterprise value, with its valuation results better matching reality. The case study of Yangtze Power fully validates the above conclusions. As a leading enterprise in the hydropower industry, Yangtze Power maintains a top ESG rating, has established a robust ESG management mechanism, and effectively controls ESG-related risks. The research reveals that integrating ESG into the valuation system can significantly raise its valuation benchmark, highlighting the critical role of ESG factors in investment decision-making.

In summary, against the backdrop of the vigorous development of the domestic ESG system, integrating ESG into the valuation system is a future trend. This not only aligns with national strategic development needs but also provides a more precise and comprehensive perspective for enterprise valuation, facilitating enterprises' sustainable development and value enhancement.

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