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A Comparative Case Study of Systematic Risk Differences Between State-Owned and Private Construction Enterprises in China

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Abstract. The construction industry contributes to China's economic development. However, firms with different ownership structures may differ in systematic risk due to differences in financing capacity, access to resources, and financial stability. This study explores whether systematic risk differs between state-owned and privately owned construction firms in China. It also looks at whether firm size, cash-flow stability, and profitability stability may help to explain this difference. China State Construction Engineering Corporation (CSCEC) and Hongrun Construction Group are selected as representative cases. The Capital Asset Pricing Model (CAPM) is used to estimate equity beta from five years of monthly stock and market returns. In addition, the three firm characteristics are also compared between the two companies. The study finds that CSCEC has a much lower beta than Hongrun Construction, indicating a lower level of systematic risk. CSCEC is also much larger and has more stable cash flows than Hongrun Construction. The profitability stability of the two firms is relatively similar, with Hongrun showing slightly lower stability than CSCEC. These differences are consistent with the possibility that larger firm size and more stable cash flows may be linked to lower systematic risk. This study provides case-based evidence on differences in systematic risk between firms with different ownership structures in China's construction industry.

Keywords: CAPM, Systematic Risk, Ownership Structure, Construction Enterprises

1. Introduction

The construction industry is important to economic development and infrastructure investment. At the same time, construction companies are exposed to various sources of risk, including changes in economic conditions, investment cycles, financing conditions, and market fluctuations. Among these risks, systematic risk is particularly important because it reflects a company's exposure to market-wide factors that cannot be eliminated through diversification. Therefore, measuring and understanding systematic risk is important for investors and corporate decision-makers. Ownership structure may influence how companies respond to market risks. Differences in ownership may be associated with differences in firms' organizational and financial characteristics. These differences may affect their ability to respond to changes in the external market environment and may therefore

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be associated with different levels of systematic risk. However, previous research has paid more attention to overall corporate risk and risk-taking, while comparisons of systematic risk between Chinese construction companies with different ownership structures remain relatively limited. The Capital Asset Pricing Model (CAPM) provides a widely used framework for measuring systematic risk through the Beta coefficient [1, 2]. In this framework, a higher Beta indicates greater sensitivity to market movements. Yet, Beta alone cannot explain why companies may have different levels of systematic risk. In this context, firm-specific characteristics may also help explain these differences. Accordingly, this study compares China State Construction Engineering Corporation (CSCEC), a state-owned construction enterprise, and Hongrun Construction, a private construction enterprise. Using monthly data from 2021 to 2025, the study estimates and compares their Beta coefficients using CAPM. In addition, it examines three financial characteristics: firm size, cash-flow stability, and profitability stability, to explore possible explanations for differences in systematic risk.

2. Literature review

2.1. Ownership structure and corporate risk

Ownership structure may influence firms' financial conditions and corporate governance. In China, there may be differences between state-owned enterprises (SOEs) and private enterprises in terms of obtaining formal financing and facing financing constraints. Specifically, Bai et al. point out that private firms obtain significantly less funding through formal channels like bank loans than SOEs, leading private firms to rely more on alternative financing such as trade credit [3]. Similarly, Gao et al. found that SOEs are less likely to face credit rationing than non-state-owned enterprises in China [4]. The role of ownership structure extends to corporate governance as well. Zhang et al. find that state-owned shareholders can participate in the governance of private-holding companies through the appointment of directors, supervisors, and senior management, which may influence corporate governance mechanisms [5]. These differences in financing ability and corporate governance may affect how firms respond to market shocks and may therefore be related to differences in systematic risk. However, existing studies mainly discuss financing conditions and corporate governance, with less attention paid to whether firms with different ownership structures exhibit different levels of systematic risk. This leaves the relationship between ownership structure and systematic risk less explored. This study compares the Beta of a Chinese SOE and a private construction enterprise and examines firm characteristics that may help explain the observed difference.

2.2. Systematic risk and the CAPM model

Systematic risk refers to the component of a firm's stock risk arising from market-wide factors that affect firms across the economy. Because systematic risk is driven by market-wide factors, it cannot be eliminated through diversification. As a measure of systematic risk, Beta captures the sensitivity of a firm's stock return to changes in the overall market return [1]. A Beta of 1 indicates that a stock tends to move in line with the market, while a Beta above or below 1 indicates greater or lower sensitivity to market movements, respectively. A higher Beta therefore reflects greater exposure to systematic market risk, whereas a lower Beta indicates lower exposure.

The Capital Asset Pricing Model (CAPM) provides a theoretical framework for relating expected return to systematic risk [1, 2]. Under the CAPM, investors are compensated for bearing systematic risk, while firm-specific risk can be diversified away. Beta captures this systematic component of risk by measuring the extent to which a stock's return co-moves with the market. Empirically, Beta

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can be estimated as the coefficient on the market's excess return in a regression of a firm's excess stock return on the market's excess return. This coefficient reflects the historical sensitivity of a firm's stock returns to market-wide movements, providing a basis for comparing firms' exposure to systematic risk.

2.3. Firm-level factors and systematic risk

Although Beta provides a measure of systematic risk, it does not by itself explain why firms may exhibit different levels of systematic risk. Prior studies have shown that firm characteristics and business conditions may be associated with differences in firms' financial and risk characteristics [6]. In this context, this study considers firm size, cash-flow stability, and profitability stability as potential explanatory characteristics when examining the difference in Beta between the two firms. Larger firms may be better able to withstand external shocks, while smaller firms may face greater financial challenges and have fewer resources to respond to adverse conditions [7]. In addition, cash-flow stability provides another indication of a firm's ability to manage financial pressures. More stable operating cash flows may be associated with greater financial flexibility and a stronger ability to manage financial pressures [8]. Liu et al. find that lower cash-flow volatility is associated with greater financial flexibility, including lower reliance on external financing and greater debt capacity [9].

Profitability stability reflects the consistency of firm profits. Related evidence from the Chinese A-share market shows that profit instability is associated with differences in future stock returns [10]. This evidence, however, concerns future stock returns rather than systematic risk or Beta and does not establish a link between profitability stability and Beta. Accordingly, profitability stability is considered as a firm characteristic in this study, rather than as an established determinant of systematic risk. Thus, firm size, cash-flow stability, and profitability stability are treated as potential explanatory characteristics. Their patterns are compared with the observed difference in Beta between the two firms in the results section.

3. Methods

3.1. Research design

The research is conducted in two steps. In Step 1, the Capital Asset Pricing Model (CAPM) is used to estimate the beta coefficient of each company. The resulting beta coefficients are then compared to examine whether the two companies differ in their levels of systematic risk.

Based on this comparison, Step 2 conducts a descriptive comparison of three firm characteristics: firm size, cash-flow stability, and profitability stability. The analysis explores whether differences in these characteristics may help explain the observed difference in systematic risk. This descriptive comparison is intended to explore possible explanations rather than to establish causal relationships.

3.2. Sample selection and data sources

Two companies are selected as case companies. Both companies are listed on the Chinese A-share market and operate in the construction and infrastructure-related industries. They have relatively similar business areas but different ownership structures, making them suitable for comparative case analysis.

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Based on this selection, the two selected companies are China State Construction Engineering Corporation (CSCEC) and Hongrun Construction. CSCEC represents a state-owned construction enterprise, while Hongrun Construction represents a private construction enterprise. The sample period covers January 2021 to December 2025. For the CAPM analysis, monthly stock prices are collected for each company, with the CSI 300 Index used as the market benchmark. Stock price and market index data are obtained from Investing.com. The risk-free rate is based on China 10-Year Bond Yield data from Investing.com and is converted from an annual rate to a monthly rate using the effective monthly rate formula. These data are then used to estimate the CAPM regression and beta coefficient.

For the financial analysis, annual financial data are collected from the annual reports of the two companies and converted to a consistent unit before calculation and comparison. The main financial variables include total assets, net income, and operating cash flow. Total assets are used to measure firm size, while operating cash flow is used to measure cash-flow stability. Net income and total assets are used to calculate return on assets (ROA), which is then used to measure profitability stability.

3.3. Variable definitions and measurement methods

This study uses four key indicators: systematic risk, firm size, cash-flow stability, and profitability stability. Systematic risk is measured by beta, while the other three indicators are used to describe the financial characteristics of the two companies. These financial characteristics are compared with the beta results to explore possible explanations for the observed difference in systematic risk. The measurement methods and data sources are described below.

3.3.1. Systematic risk: beta

Systematic risk is measured by the beta coefficient estimated from the CAPM regression. Monthly stock prices are obtained from Investing.com and measured using unadjusted closing prices. Based on these data, monthly stock returns are calculated as follows:

$$R_{i,t}=\frac{P_{i,t}-P_{i,t-1}}{P_{i,t-1}} \tag{1}$$

where $R_{i,t}$ is the monthly return of company i, and $P_{i,t}$ is its monthly closing price.

The monthly stock return is then used in the CAPM regression:

$$R_{i,t}-R_{f,t}=\alpha_i+\beta_i(R_{m,t}-R_{f,t}) \tag{2}$$

where $R_{f,t}$ represents the risk-free rate and $R_{m,t}$ refers to the market return. The CSI 300 Index, obtained from Investing.com, is used as the market benchmark. The risk-free rate is based on the China 10-Year Bond Yield data obtained from Investing.com.

The annual risk-free rate is converted into a monthly rate using the following formula:

$$R_{f,m}=(1+R_{f,a})^{1/12}-1 \tag{3}$$

where $R_{f,m}$ is the monthly risk-free rate and $R_{f,a}$ is the annual risk-free rate.

The beta coefficient βi is the slope of the regression line. Thus, a higher beta indicates greater sensitivity to market movements and, therefore, higher systematic risk.

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3.3.2. Firm size

Firm size is measured by the five-year average of total assets. For this calculation, total assets are collected from the annual financial statements of each company. The average is calculated as:

$$\text{Firm Size}=\frac{\sum_{t=1}^{5}\text{Total Assets}_t}{5} \tag{4}$$

where TA_t is year-end total assets of the company in year t. Accordingly, a higher average total asset value indicates a larger firm size.

3.3.3. Cash-flow stability

Cash-flow stability is measured by the standard deviation of the annual CFO-to-total-assets ratio. To calculate this measure, operating cash flow (CFO) and year-end total assets are collected for each year. The annual ratio is calculated as:

$$\text{CFO Ratio}_t=\frac{\text{CFO}_t}{\text{Total Assets}_t} \tag{5}$$

where CFO_t is operating cash flow and TA_t is year-end total assets in year t.
The standard deviation of the five annual ratios is then calculated:

$$\text{Cash flow Stability}=\text{SD}(\text{CFO Ratio}_t) \tag{6}$$

In interpreting this measure, a lower standard deviation indicates more stable operating cash flow. Because this measure is based on only five annual observations, it is used primarily for descriptive comparison. It is not intended to establish a causal relationship between cash-flow stability and systematic risk.

3.3.4. Profitability stability

Profitability stability is measured by the standard deviation of annual Return on Assets (ROA). ROA is calculated as net income divided by year-end total assets:

$$\text{ROA}_t=\frac{\text{Net Income}_t}{\text{Total Assets}_t} \tag{7}$$

where NI_t is net income and TA_t is year-end total assets in year t.
The standard deviation of the five annual ROA values is then calculated:

$$\text{Profitability Stability}=\text{SD}(\text{ROA}_t) \tag{8}$$

Therefore, a lower standard deviation indicates more stable profitability. Given that this measure is based on only five annual observations, it is used primarily for descriptive comparison. It is not intended to establish a causal relationship between profitability stability and systematic risk.

3.4. Analytical methods

The analysis is conducted in two steps. First, the systematic risk of the two companies is estimated using CAPM regression, and their Beta values are compared. Second, three financial indicators are

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compared between the two companies to explore possible explanations for the observed difference in systematic risk.

For the CAPM analysis, the monthly excess stock return is plotted against the market excess return for each company, and a linear regression line is fitted to the data. The slope of the regression line represents Beta. The Beta values of CSCEC and Hongrun Construction are then compared to identify differences in their systematic risk.

The three financial indicators are compared between the two companies. Specifically, firm size, cash-flow stability, and profitability stability are represented by five-year average total assets, the standard deviation of the CFO-to-total-assets ratio, and the standard deviation of ROA, respectively. The differences in these indicators are compared with the difference in Beta to examine whether the direction of the indicator differences is consistent with the difference in systematic risk.

4. Results

4.1. Comparison of systematic risk between the two companies

The CAPM regression results show differences in the systematic risk of the two companies. The scatter plots illustrate the relationship between market excess returns and stock excess returns. The regression line provides an estimate of the Beta coefficient for each company. And the relationship between market excess returns and CSCEC's stock excess returns is presented in Figure 1.

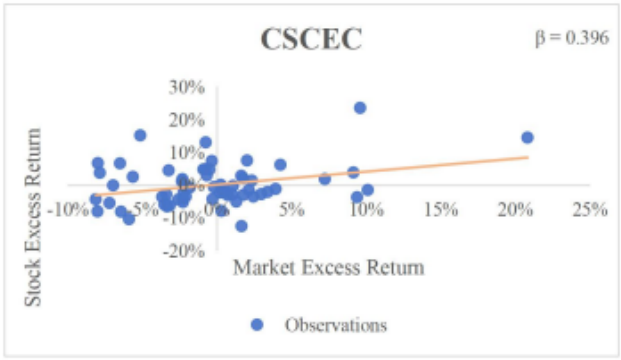

Figure 1. CAPM regression for CSCEC

The regression results show that the Beta of CSCEC is 0.396. This indicates that the stock return of CSCEC has a low sensitivity to changes in market returns.

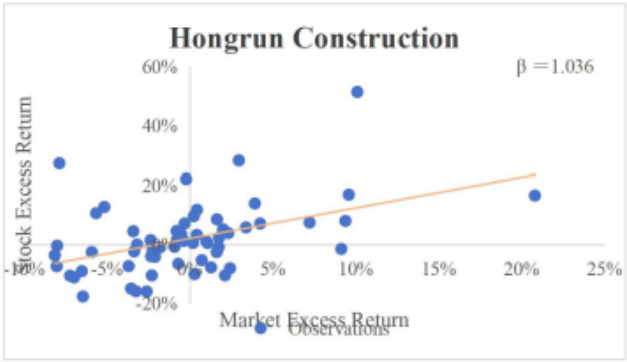

Figure 2. CAPM regression for Hongrun construction

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The relationship between market excess returns and Hongrun Construction's stock excess returns is presented in Figure 2.

The Beta of Hongrun Construction is 1.036. This indicates that, compared with CSCEC, its stock return is more sensitive to market movements. The difference in Beta shows that the two companies have different levels of systematic risk, with Hongrun Construction exhibiting greater sensitivity to overall market movements.

4.2. Comparison of firm characteristics

The three financial indicators are compared between the two companies to describe differences in firm size, cash-flow stability, and profitability stability.

Table 1. Comparison of firm characteristics and systematic risk

Company	Beta	Firm size (RMB billion)	Cash-Flow Stability (SD,%)	Profitability Stability (SD,%)
CSCEC	0.396	2938.883	0.186	0.667
Hongrun Construction	1.037	15.979	2.647	0.501

The comparison of profitability stability shows a different pattern. Hongrun Construction has a lower standard deviation of ROA, at 0.501%, compared with 0.667% for CSCEC. This difference indicates that Hongrun Construction had slightly more stable profitability over the five-year period.

The two companies also differ in cash-flow stability. CSCEC has a standard deviation of 0.186% for the CFO-to-total-assets ratio, compared with 2.647% for Hongrun Construction. The lower standard deviation indicates that CSCEC had more stable operating cash flow over the five-year period. Moreover, the profitability stability shows a different pattern. Hongrun Construction has a lower standard deviation of ROA, at 0.501%, compared with 0.667% for CSCEC. This indicates that Hongrun Construction had slightly more stable profitability over the five-year period.

4.3. Comparison of firm characteristics and systematic risk

The two companies have different ownership structures. CSCEC is a state-owned enterprise, while Hongrun Construction is a private enterprise. This difference provides the context for comparing their firm characteristics and systematic risk. Accordingly, the comparison focuses on firm size, cash-flow stability, and profitability stability, together with the difference in Beta.

For firm size, CSCEC has a much larger asset base than Hongrun Construction. In comparison, CSCEC has both a larger asset base and a lower Beta than Hongrun Construction, so the difference in firm size is in the same direction as the difference in Beta. For cash-flow stability, CSCEC has substantially more stable operating cash flow than Hongrun Construction, as indicated by its lower standard deviation of the CFO-to-total-assets ratio. CSCEC also has a lower Beta, so the difference in cash-flow stability is in the same direction as the difference in Beta. Regarding cash-flow stability, CSCEC has substantially more stable operating cash flow than Hongrun Construction, as indicated by its lower standard deviation of the CFO-to-total-assets ratio. Similarly, CSCEC has a lower Beta, so the difference in cash-flow stability is in the same direction as the difference in Beta.

5. Conclusion

This study examines differences in the systematic risk of CSCEC and Hongrun Construction, two Chinese construction companies with different ownership structures. According to the CAPM and

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monthly data from 2021 to 2025, the study estimates the Beta coefficients of the two companies and compares their firm size, cash-flow stability, and profitability stability. The results indicate that the two companies have different levels of systematic risk. CSCEC is substantially larger and shows greater cash-flow stability, while Hongrun Construction has a smaller scale and more variable cash flow. Profitability stability shows a less consistent difference between the two firms. Overall, the differences in firm size and cash-flow stability are in the same direction as the difference in Beta, while profitability stability shows a different pattern.

However, the study focuses on only two companies, which limits the representativeness of the findings. And the observed differences may also reflect company-specific characteristics rather than ownership structure alone. Besides, the five-year observation period may not fully capture changes in market conditions or long-term risk patterns. The three financial characteristics considered also do not cover all factors that may be associated with systematic risk, such as liquidity, corporate governance, and industry exposure. Given the comparative case-study design, the study does not provide statistical evidence that can be generalized to the entire Chinese construction industry.

Future research could expand the sample to include more state-owned and private construction companies. In addition, a longer observation period could provide a broader basis for comparison across different economic and market conditions. Moreover, additional statistical methods could be used to examine the relationships among ownership structure, firm characteristics, and systematic risk. The analysis could also incorporate additional financial and corporate governance variables to provide a more comprehensive explanation of differences in systematic risk.

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