Research on the Relationship between Financial Correlation and Financing Constraints of Small and Medium Power Plants

Li Zhang
Management School of Shanghai University, Shanghai 200444, China
18817960053@163.com

Abstract. This paper takes small and medium-sized power plants as research objects, and empirically studies the relationship between financial linkages and financing constraints of small and medium-sized power plants. Based on the inductive analysis of the impact of financial associations of power plants in different industrial cycles on the financing constraints of small and medium-sized power plants, it is found that there are still more than 50% of small and medium-sized power generation small and medium-sized power plants still have financial correlation, and financial linkages. There is a significant slow release effect on the financing constraints of small and medium-sized power plants. For power plants in different life cycles, the impact of financial linkages on their financing constraints is different. For small and medium-sized power plants in mature and declining periods, the mitigation effect is more obvious.

1. Introduction
In the perfect capital market described by Modigliani and Miller [1], the company's external funds are a perfect substitute for internal funds because there is no market friction. Therefore, the financing structure has nothing to do with the company's value, and the company's investment decisions are independent of its financing decisions. However, there are many imperfect factors in the real capital market (such as information asymmetry, agency cost, etc.), resulting in external capital costs far higher than internal capital costs. At this point, the company faces external financing constraints, and the company's investment decisions rely heavily on its financing structure. As a representative of developing countries, China's financial market is in a process of transition from immature to mature, from underdeveloped to develop. Therefore, the impact of financial development on the company's external financing constraints is particularly important. Based on this, the paper uses small and medium-sized power plants as the representative to study the relationship between financial linkages and financing constraints. From the perspective of corporate investment-cash flow sensitivity, it empirically examines the impact of financial correlation on corporate financing constraints.

2. Research on the Relationship between Financing Constraints and Small and Medium-sized Power Generation Small and Medium Power Plant Investment
Figure 1 depicts the impact of external financing constraints on company investments. The horizontal axis represents the company's investment and the vertical axis represents the company's weighted
average cost of capital. In the neoclassical investment model, the company's capital supply curve (S) is a horizontal line and is also the company's capital cost line. The company's cost of capital is equal to the actual interest rate adjusted for market risk. The capital demand curve (D) is a downward-sloping curve, meaning that the decline in capital costs will increase the company's desired investment level. The location of D is a function of the investment opportunities available to the company, and an increase (decrease) in investment opportunities will cause D to move to the right (left). The optimal capital investment ($I^*$) appears at the intersection of D and S. At this point, the marginal return of capital investment is equal to the market interest rate. A decline in the market interest rate, an increase in available investment opportunities, or a simultaneous occurrence of both will result in an increase in the pool of desirable capital [2]. The opportunity cost of internal funds is considered to be equal to the external capital cost, and the external capital cost is equal to the market interest rate. This approach means that when the company does not have external financing constraints, the availability of internal funds does not have a direct impact on the company's investment decisions. The company's investment decisions only depend on the company's investment opportunities and market interest rates.

![Figure 1. The impact mechanism of financing constraints on company investment](image)

When the company faces external financing constraints, the company's capital investment level ($I'$) will be less than the optimal investment level ($I^*$) without external financing constraints, resulting in potential underinvestment problems, unless the company's internal funds (W) are greater than or equal to $I'$, In addition, higher marginal information costs will result in a steeper upward-sloping supply curve ($S'$), which means that the company's investment dependence on internal funds will increase. Therefore, the level of investment in a company that finances constraints is heavily dependent on the amount of cash flow within the company [4]. At the same time, the higher the degree of financing constraints, the greater the slope of the $S'$ curve, the lower the actual capital investment level of the company, and the more serious the underlying investment will be. As can be seen from Figure 1, increasing the company's actual capital investment level can be achieved through two ways: one is to increase the amount of internal funds of the company (W); the other is to alleviate the degree of external financing constraints of the company and reduce the slope of the $S'$ curve. This article will focus on how to ease the degree of external financing constraints of the company, thereby promoting the company's actual investment level and overall economic growth.

3. Research on the Relationship between Financial Association and Financing Constraints

3.1. Concept and development of financing constraints

Because information asymmetry makes the cost of raising external funds higher than the cost of using internal funds, so that the financing of small and medium-sized power plants abandons external
financing, they are forced to use internal financing. The proposal of financing constraint theory is a questioning and supplement to the MM capital structure theory. The main difference between the two is whether there is an alternative understanding and explanation for the internal and external funds of small and medium-sized power plants, which will lead to the financing constraints [5].

3.2. Financial Association Concept

The establishment of financial linkages will help financial institutions to have a deep understanding of the credibility of small and medium-sized power plants, thereby establishing long-term relationships and addressing the financing dilemma of small and medium-sized power plants. China's capital market has not yet developed. The financing of small and medium-sized power plants is mainly through indirect financing by banks, and the financing costs are relatively high. At the same time, China's commercial banks are dominated by large state-owned and joint-stock commercial banks, urban commercial banks have begun to take shape, community commercial banks have not yet developed, and small and medium-sized power plants are mainly sourced from large commercial banks. State-owned small and medium-sized power plants have high reputation and low risk in the banking institutions because they have national credit as guarantees. Small and medium-sized power plants, especially small and medium-sized power plants lacking government support and attention to the industry, have high risks for banks. Therefore, the inclusion of financial institution personnel in the small and medium-sized power plant executives makes the reputation of small and medium-sized power plants open to banking institutions. These people are “a kind of implicit guarantee of reputation” for financial institutions. Moreover, as the interests of financial institutions entering the senior management of small and medium-sized power plants are related to the long-term interests of small and medium-sized power plants, they will promote the cooperation between financial institutions and small and medium-sized power plants, and if necessary, alleviate the small and medium-sized power plants. Crisis.

3.3. Relationship Research

Hypothesis 1: On the basis of controlling other variables, the establishment of financial associations has an impact on alleviating corporate financing constraints; and the stronger the degree of linkage of financial linkages, the weaker the role of financing constraints.

![The 4 Life Cycle Stages and their Marketing Implications](image)

Figure 2. Industry life cycle and characteristics
Industry refers to the collection of production of physical products and provision of labor services. The industry also has the same evolutionary law as individuals, and it has to go through all the processes from birth to decline. According to the industry life cycle theory, the industrial life cycle refers to the process of changing the behavior of manufacturers from stage to stage and common law. The industry life cycle is usually divided into four stages: germination, growth, maturity and decline. The following is a schematic diagram of the industry life cycle.

1) The mitigation effect of IPO on corporate financing constraints. Under normal circumstances, the role of IPO in alleviating corporate financing dilemma is very obvious, and this effect will be delayed. For enterprises in the formation period and growth period, the amount of funds to meet the operational and investment needs of enterprises is relatively small for mature and recession enterprises. For example, in the growing transportation industry, information technology industry and social service industries, the capital demand will be lower than that in the mature machinery manufacturing industry. Therefore, the role of IPO can significantly alleviate the financing problems of such enterprises, and the financing constraint effect is weak. IT listed companies and cultural listed companies in the formation and growth period are examples.

2) For the mature enterprises, most of them are large enterprises. Although the output value and sales volume show a stable or weak decline trend, the industries in this cycle have been fully competitive, and the enterprises that survived and listed successfully are mostly large-scale. The market with the sales market share is at the forefront of the industry, so the demand for funds to maintain normal operations and investment will be greater. The quantitative effect and time effect of IPO financing will be lower than that of small and medium-sized enterprises in the first two periods. Under the existing Chinese financial system, after completing the IPO for a period of time, these companies will rely on the bank's rationing. Therefore, the agent problem of financing constraints will be more significant, and the financing constraints will be more obvious. To this end, the following two major assumptions can be made:

Hypothesis 2: The financing constraints of small and medium-sized power plants listed during the maturity or recession period are stronger than those of small and medium-sized power plants in the formation or growth period.

Hypothesis 3: When a company is in a mature or recession period, the greater its financial relevance, the weaker the financing constraint.

4. Empirical research
According to the three hypotheses proposed in the article, the following models are constructed.

\[ d = \alpha + \beta_1 CF + \beta_2 Finl + \beta_3 CF \times Finl + \beta_4 Contr + \varepsilon \]  \hspace{1cm} (1)

Model (1) introduces the financial association degree variable \( Finl \), which describes the degree of financial association of the enterprise. At the same time, the \( CF \times Finl \) interaction variable was introduced to investigate the impact of the two variables on financing constraints.

\[ d = \alpha + \beta_1 CF + \beta_2 Finl + \beta_3 ID + \beta_4 CF \times Finl + \beta_5 CF \times ID + \beta_6 CF \times ID \times Finl + \beta_7 Contr + \varepsilon \]  \hspace{1cm} (2)

Based on the model (1), the model (2) introduces variable IDs indicating different stages of the industrial cycle to study the financing constraints of enterprises in different industrial cycles. At the same time, two interaction variables, \( CF \times ID \) and \( CF \times ID \times Finl \), are introduced to investigate the degree of corporate financial constraints in different industrial cycles and the degree of mitigation of financial constraints on financial constraints [6].
### Table 1. Variable symbols and descriptions

| Variable                        | Symbol | Interpretation                                                                 |
|---------------------------------|--------|--------------------------------------------------------------------------------|
| Cash                            | d      | Ratio of cash and cash equivalents at the end of the year to the beginning of the year |
| Cash flow                       | CF     | The ratio of the net cash flow from operating activities during the year to the net value of fixed assets at the beginning of the year |
| Financial relevance             | Finl   | Proportion of hiring financial institution personnel as corporate executives as a percentage of total executives |
| Degree of industrial development| ID     | The industry cycle of the industry in which the enterprise is located is in its infancy and the growth period is 0, and it is at the maturity or decline period. |
| Political relevance             | Pol    | The proportion of government employees employed as corporate executives as a percentage of total executives |
| Company listing age             | Year   | The listing age of the company as of December 2018 |
| Asset load ratio                | AsDb   | Proportion of total assets and total liabilities of enterprises at the beginning of the year |
| Company Size                    | CSize  | The logarithm of the company’s total assets at the beginning of the year |
| Cash balance at the beginning of the year | Bcash | Ratio of cash balance at the beginning of the year to net fixed assets at the beginning of the year |

### 4.1. Data source

This paper selects only 16 small and medium-sized power plants in 2018. The sample screening criteria are as follows: (1) Small and medium-sized power plants with complete data required for research variables, with special requirements for executive information and industry information; (2) Exclusions contain extremes Financial data for businesses. Under this standard, a total of 16 small and medium-sized power plants were obtained, and a total of 80 samples were observed. The source of financial data is the CSMAR database. The data is processed using the EViews 6.0 application software.

### 4.2. Empirical results

#### 4.2.1. Correlation analysis.

The paper studies the correlation between cash usage of power companies and corporate cash flow income, financial linkages and industrial development cycle factors. Therefore, it is necessary to perform correlation analysis on each variable first.

### Table 2. Model variable correlation test

| Variable | CF | Finl   | ID      | d      |
|----------|----|--------|---------|--------|
| CF       | 1  | 0.05874| 0.12582 | 0.87459|
| Finl     |    | 1      | 0.058974| -0.03587|
| ID       |    |        | 1       | 0.015782|
| d        |    |        |         | 1      |

#### 4.2.2. Descriptive statistics.

50% of the small and medium-sized power generation enterprises in the statistics are in the period of growth or maturity, indicating that the development environment and development prospects of small and medium-sized power plants are better; however, they face strong horizontal competition, financing level and financing ability. The requirements are also higher. In addition, the total number of enterprises in the formation period and growth period is equivalent to the total number of enterprises in the mature period and the recession period, which makes the research of data and models more effective and reasonable.
4.2.3. Regression analysis. The coefficient of CF in the model is significantly positive at the 99% confidence level, indicating that small and medium-sized power plants face significant financing constraints. The coefficient of the interaction variable of CF*Finl is significantly negative at the 99% confidence level, indicating that the addition of financial correlation variables can significantly alleviate the financing constraints of small and medium-sized power plants, and the higher the degree of financial correlation, the small and medium-sized power plants the weaker the financing constraints. Therefore, the hypothesis 1 is proved. The regression results of Model 2 are related to the CF coefficient greater than Model 1, indicating that the financing constraints of listed companies in the mature and recession periods are greater than those in the other two periods. The cross-variation of CF*ID is significantly positive at the 90% confidence level, indicating that the industry in which small and medium-sized power plants are located is in a mature or recession period, and the financing constraints faced by enterprises are more significant. This verifies the reasoning of Hypothesis 2. The interaction variable of CF*ID*Finl is significantly negative at the 90% confidence level, indicating that the introduction of financial linkages can effectively alleviate financing constraints when the small and medium-sized power plants are in maturity or recession. The coefficient of F*ID*Finl is $-8.478102^*$ which is significantly higher than the coefficient of $-2.057361$ of CF*Finl. It shows that small and medium-sized power plants in maturity and recession are better at using financial linkages to alleviate corporate financing constraints. And the higher the degree of financial association, the weaker the financing constraint. Hypothesis 3 is proved.

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