Institutional Environment, Cluster Development and Innovative Financing Constraints——an Empirical Study Based on Listed Companies in China's New Materials

Jingjing Wang¹,*, Shengsen Duan²,†

¹Department of Economic and Social Development, Gansu Normal University for Nationalities, Hezuo, China
²School of Business Administration, Qilu University of Technology, Jinan, China

*Corresponding author e-mail: zhongyang83@163.com, †304452024@qq.com

Abstract. This paper takes a sample of a listed company in China's new materials industry as an example to empirically analyze the impact of external institutional environment and the development of internal enterprise clustering on the innovation and financing constraints of an enterprise. The study finds that the higher the degree of cluster development, the stronger the enterprise's ability to innovate, and the lower the level of innovative financing constraints; in areas where the marketization process is low, the level of government intervention is high, and the environment of the rule of law is poor, the firm's innovative financing constraints are lower, and Private companies’ innovation financing constraints are generally higher than state-owned enterprises. The conclusions of the study provide empirical evidence for the improvement of independent innovation capabilities in strategic emerging industries and the development of innovative financing policies.

1. Introduction

Innovative financing constraints will directly constrain R&D expenditures of enterprises and have a serious impact on innovation investment and innovation behaviors of firms. They are the barriers to innovation projects that are second only to innovation costs (Lausen & Salter, 2006) [1], resulting in a large number of innovation projects being forced abortion. Does China's industry, especially strategic emerging industries, have innovative financing constraints? If so, how can it be alleviated? The above issues are directly related to the improvement of the competitiveness of enterprises and the ability of independent innovation of the country, and have important research value.

Most of the existing literature is based on information asymmetry theory, from the perspective of the external financial market environment to explore the influencing factors of innovative financing constraints. Such as Rajan and Zingales (1998) [2], Demirguc-Kunt and Maksimovic (1998) [3], Love (2003) [4], Khurana et al. (2006) [5] pointed out that financial innovation and financial market development can effectively reduce information asymmetry and agency problems, and open up external financing channels, thereby reducing the company's financing constraints. Other literature further supplements and refines the above points, pointing out that under the conditions of backward capital markets, the grouping of enterprises (Khanna & Palepu, 2000) [6], FDI (Héricour & Poncet, 2009) [7], and relationship financing factors (Bergemann & Hege, 2005) [8] have a direct substitution
effect on the external capital market with low capital allocation efficiency and can effectively alleviate the financing constraints of the company.

The above studies provide important references for further exploration of the mitigation approach for innovative financing constraints, but there are still two deficiencies: Firstly, existing research neglects to seek innovative financing constraints from the enterprise's internal innovation perspective, i.e., from the perspective of the company's internal innovation. In fact, the characteristics of corporate innovation behavior are likely to be an important internal cause of innovation financing constraints. Because of intangible assets and highly uncertain output, external investors need an additional risk premium. This undoubtedly increases financing costs (Eng & Shackell, 2001) [9]. Moreover, from the perspective of externality research, the research conclusions are often external and cannot give concrete policy advice from the perspective of innovative subjects. Secondly, the inspection of corporate financing constraints is mostly conducted using investment-cash flow sensitivity models (Fazzari et al., 1988) [10] or cash-cash flow sensitivity models (Almeida et al., 2004) [11]. In theory, however, the existence of investment-cash flow sensitivity and cash-flow sensitivity can only show that there is a correlation between the current investment and operating activities of the enterprise and the company's internal resources, and cannot exclude investment and operating activities and external sources. The relationship between funds, so the conclusion that the two types of models of business operations and investment activities "mainly" rely on internal cash flow is debatable. It can be seen from the internal perspective of innovation behaviors that the mitigation approach for innovative financing constraints is a new and worthy digging topic.

2. Theoretical analysis and research hypothesis

There are major differences in the process of marketization, government intervention, and the level of the legal system in each region. Different degrees of marketization mean that government intervention in different regions will be different, which will lead to different degrees of innovation financing constraints. In areas with a high level of marketization, the degree of government involvement in business operations, innovation, and bank lending is relatively low, and the company's innovative financing contract can be conducted more through the market; in areas with a low degree of marketization, the government has developed for local economic development, social employment, fiscal revenue and other goals, there is a strong motivation to intervene in corporate innovation loan decisions. Although such government interventions on finance and resources are inefficient in the long run (Hillman et al., 2004) [12], as Bhagat and Welch (1995) [13], Bergemann and Hege (2005) [8], Claessens et al. (2008) [14] studied that the existence of "relationship financing" or "financial linkage" can indeed ease the innovation financing constraints of companies.

In addition, because the government's participation in resource allocation has become a reasonable institutional arrangement in the context of the transitional system, the nature of property rights will also have an important impact on the innovation and financing constraints of enterprises. Based on the research in the context of China's transition system, state-owned enterprises and private enterprises are faced with different forms and degrees of financing constraints. Under the same conditions, private enterprises are more prominent in terms of financing constraints than state-owned enterprises (Luo Dang and Yan Liming, 2008; Qu Wenzhou et al., 2011) [15] [16]. On the one hand, enterprises in transition economies in China tend to shoulder national wills and political tasks. The government will often provide financing to support its own enterprises by reducing taxes, additional investments, or financial subsidies, without paying attention to the company's own situation to compensate for extra burden. On the other hand, due to the fact that state-owned commercial banks are the core financial system, the sameness in property rights makes it easier for state-owned enterprises to obtain debt financing; moreover, the “soft budget constraints” that exist in state-owned enterprises generally prevent banks from worrying about loan repayment. Visible, for business operations and innovation. As a result, the government intervention of state-owned enterprises will reduce the cost of financing contracts to a certain extent, and thus will face less innovative financing constraints than private enterprises.
Based on the above analysis of institutional environment, the nature of property rights and innovative financing constraints, this article puts forward the following assumptions:

Hypothesis 1: In areas where the marketization process is lower, government intervention is higher, and the legal environment is worse, the financing constraints of enterprise innovation are smaller.

Hypothesis 2: The nature of property rights has an important influence on the innovation financing constraints of enterprises, and private enterprises' innovation financing constraints are higher than state-owned enterprises.

Hypothesis 3: The development of clustering helps improve the company's ability to innovate.

Hypothesis 4: The development of clustering is conducive to ease the innovation financing constraints of companies.

When receiving the paper, we assume that the corresponding authors grant us the copyright to use the paper for the book or journal in question. Should authors use tables or figures from other Publications, they must ask the corresponding publishers to grant them the right to publish this material in their paper.

3. Research design

This paper selects panel data of listed companies in the new materials industry from 2007 to 2010 as research samples for five years. The reasons are: (1) compared with traditional materials, new materials have higher technology intensity and added value of products; new materials Independent innovation has the characteristics of short development cycle, high investment, and high risk; moreover, due to the insufficient disclosure of research information disclosure by new listed companies, the information asymmetry of new materials' independent innovation is extremely high. Therefore, compared with other high-tech industries, the new materials industry may face a higher problem of innovative financing constraints. (2) At present, China's new materials industry has initially formed a clustering development trend. The Ministry of Science and Technology of China has approved 36 regional new material industrial bases and is distributed in six regions in China. Among them, the Yangtze River Delta Region has the highest concentration of bases and accounts for the bases. 27% of the total. Using this as a sample can more accurately test the impact of clustering development.

3.1. Sample selection and statistics

In order to guarantee the quality of data, this paper removes companies that have been tampered with by ST and PT in any time of the time window and companies with serious vacancies in variable data. Through the above principle of rejection, this paper finally selected a total of 121 samples of new material listed companies and 591 company-year balanced panel data from the three types of new functional materials, high-performance structural materials, and advanced composite materials. Sample companies involved in new energy (13.4%), electronic information (9.0%), rare earth (41.8%), chemical industry (16.4%), biomedical (3.0%), ecological environment (4.5%), construction (9.3%), aviation Applications such as aerospace and automotive (3.1%). The company's financial data comes from the CSMAR database. Innovation investment and output data are collected manually according to the company's annual report R&D information disclosure.

3.2. Page Numbers Model Design and Variable Definition

The study of Harrison et al. (2004) [17] is a classic literature in the field of financing constraints theory, but the dependent variable in their model measures all the new investment of the enterprise. It is obvious that using this formula to directly test the innovation financing constraints of the enterprise is not precise. Therefore, this article replaces the general investment I/K with the R&D investment intensity (I'/S), which is a commonly used measure of corporate innovation investment; accordingly, the “patent application authorization” level, which is a commonly used index to measure innovation output, is used (Y '/S) instead of the general net output level Y/K; in addition, using the existing literature, this paper adds a set of control variables (including the size of the company, the corporate
governance effect, and the growth of the company) to a certain degree. Deduct the influence of other unknown factors. After the above process, the test model (1) of the theoretical hypothesis in this paper is obtained. According to Harrison's research, if the regression coefficient of the debt-to-asset ratio $d$ is significantly positive in the model, it indicates that the firm's innovation behavior is constrained by the financing constraints.

$$\left( \frac{I'}{S} \right)_{i,t+1} = \beta_1 \left( \frac{I'}{S} \right)_{i,t} - \beta_2 \left( \frac{I'}{S} \right)_{i,t}^2 + \beta_3 \left( \frac{Y'}{S} \right)_{i,t} - \beta_4 \left( \frac{CF}{S} \right)_{i,t} + \beta_5 \Omega d_{i,t} + \sum \theta \text{Cont}_{i,j} + \eta_{i,t} + \lambda_t + \epsilon_{i,t+1}$$  \hspace{1cm} (1)

In order to verify the impact of the transitional institutional environment on innovation financing constraints, this paper further introduces the market environment-related dummy variable Sysdum on the basis of model: (1) To obtain the empirical research model of this paper. (2). among them, Sysdum mainly includes the three aspects of Mardum, Govdum, and Lawdum. The data comes from the market index system compiled by Fan Gang et al. (2011) [18]. If the regression fitting coefficient of the interaction item Sysdum with the financing constraint is significant, it means that the institutional environment factors can affect the innovation financing constraints of the enterprise. This paper also uses the subsamples of state-owned enterprises and private enterprises to conduct regression simulations on model. (2) Respectively, to compare and analyze the effects of different property rights on innovation financing constraints under the transitional institutional environment. If the regression coefficient $d$ of private-subsidy sample financing constraints is significantly positive and larger than the coefficient of the state-owned sub-sample, it means that private enterprises' innovation financing constraints are higher than state-owned enterprises under the same conditions.

$$\left( \frac{I'}{S} \right)_{i,t+1} = \beta_1 \left( \frac{I'}{S} \right)_{i,t} - \beta_2 \left( \frac{I'}{S} \right)_{i,t}^2 + \beta_3 \left( \frac{Y'}{S} \right)_{i,t} - \beta_4 \left( \frac{CF}{S} \right)_{i,t} + \beta_5 \Omega d_{i,t} + \sum \theta \text{Cont}_{i,j} + \beta_6 \text{Sysdum}_{i,t}$$  \hspace{1cm} (2)

Similarly, in order to verify the impact of cluster development on innovation financing constraints, it is necessary to further introduce clustering development-related variables in model (1) to obtain a test model (3).

$$\left( \frac{I'}{S} \right)_{i,t+1} = \beta_1 \left( \frac{I'}{S} \right)_{i,t} - \beta_2 \left( \frac{I'}{S} \right)_{i,t}^2 + \beta_3 \left( \frac{Y'}{S} \right)_{i,t} - \beta_4 \left( \frac{CF}{S} \right)_{i,t} + \beta_5 \Omega d_{i,t}$$  \hspace{1cm} (3)

We introduce a clustered dummy variable Cludum in Model One: If the company is in a cluster with a higher level of development, the value is set to 1; otherwise, the value is set to 0. If Cludum's regression coefficient is significantly positive, it indicates that the degree of clustering development has a positive role in promoting enterprise innovation. If the regression coefficient of the interaction term of the financing constraint and the degree of clustering is significantly negative, it means that the development of clustering can help ease the innovation financing constraints.

Specifically, the variables and their measurement methods are shown in Table 1.
Table 1. Definition and Measurement of Study Variables.

| Variable meaning                  | Variable | Variable measurement                                      |
|-----------------------------------|----------|----------------------------------------------------------|
| Innovation investment             | I'/S     | New ratio of R&D investment and sales revenue            |
| Innovation output                 | Y'/S     | The ratio of new patent application authorizations to sales revenue |
| Internal cash flow                | CF/S     | The ratio of the net cash flow generated by the company's operating activities to sales revenue |
| Financing constraints             | Ωd       | Corporate debt ratio                                    |
| Clustering degree                 | Cludum   | If the company belongs to the Yangtze River Delta industrial cluster, the value is set to 1; otherwise the value is 0 |
| Marketization                     | Mardum   | If the index value of the location of the company is located at the bottom 20%, the value is assigned to 1, otherwise it is 0. |
| Government intervention           | Govdum   | If the index value of the location of the enterprise is located at the bottom 20%, the value is assigned to 1, otherwise it is 0. |
| Legalization                      | Lawdum   | If the location index value of the enterprise is located at the bottom 20%, the value is assigned to 1, otherwise it is 0. |
| Regional - industry fixed effect  | η        | The area is distributed in the east, middle and west regions; the industry mainly includes three types: new functional materials, high-performance structural materials, and advanced composite materials. |
| Dynamic effect of time change     | λ        | The age of the business                                  |
| Company Size                      | Size     | The logarithm of the total assets of the company         |
| Corporate governance effect       | First    | The proportion of the largest shareholder in the company |
| Business growth                   | Growth   | Enterprise's main business revenue growth rate           |

4. Empirical results and analysis

4.1. The existence of innovative financing constraints

Whether it is a mixed effect model, a fixed effect model, or a random effect model, the regression coefficients of \((I'/S)\) and \((I'/S)^2\) are all significant at the 1% level, and the sign of the coefficient is similar to that of Harrison et al. (2004). The research of [17] is consistent, which shows that the empirical research model used in this paper is reliable.

Through the redundant fixed effects test of panel data from 2006 to 2010, we found that the statistical significance of \(F\) statistic and LR statistic is less than 0.05, which shows that compared with the mixed effect model, the fixed effect model is more appropriate. Appropriate; and Hausman test results also found that the statistical significance of the \(W\) statistic is less than 0.05, which also means that compared to the random effects model, the selection of a fixed effect model is more appropriate. Therefore, this paper uses the panel data fixed effect model to test the proposed theoretical hypothesis. At the same time, in order to eliminate the influence of heteroskedasticity caused by "short time series and many cross-section samples", the model was estimated using the fixed panel generalized least squares method (EGLS).

From the fixed effect model, it can be found that the newly-added innovative investment of the new material company in the current period is significantly positively correlated with the previous period's debt-to-asset ratio. According to the aforementioned model analysis, this implies that the innovative investment in the new material industry in China is subject to credit constraints. As a representative of the constraints of foreign financing, the excessive debt burden of the new material company will lead to shrinking solvency and financing space, and can only be forced to postpone innovation investment.
4.2. The Influence of Institutional Environment on Innovation Financing Constraints

It can be seen that the regression coefficient of innovation financing in the process of marketization, government intervention, and the rule of law is negative, and both are significant at the level of 1% or 5%, indicating that the macro market environment can significantly affect the innovation of the enterprise in the market. The higher the progress of the process, the lower the level of government intervention, and the better the rule of law environment, the stronger the ability of independent innovation of enterprises.

The coefficient of regression of debt-to-asset ratio remained stable, but the regression coefficients of the cross terms of market environment-related indicators and debt-to-financing ratio were all significantly negative, indicating that the lower the marketization process, the higher the level of government intervention, and the worse the rule of law environment, The smaller the innovation financing constraint, the less hypothesis 1 is verified. The probable reason is that the backwardness of the market and the rule of law leads the government to grasp most of the financial resource allocation rights. Enterprises will actively seek rent-seeking in order to survive, and establish “relationship financing” by establishing political connections or financial connections. Moreover, as Allen et al. (2005) [19], Jie Weimin, and Fang Hongxing (2011) [20] have pointed out, in the backward market conditions, political connections or financial linkages often replace the market as a “password transmission mechanism”. The role of the company in establishing links with the government and the financial sector is often seen as having strong operational and financing capabilities, thus alleviating information asymmetries in the course of business operations or financing.

It was further found that although the return of debt-to-asset ratio of both the whole sample, private sample, and state-owned sample was significantly positive, the regression coefficient of the private sample was larger than that of the state-owned sample, indicating that the degree of private enterprise's innovative financing constraint was higher than that of the state-owned enterprise. The theoretical expectations are consistent and Hypothesis 2 is verified. The above conclusions are consistent with the research of Lin Yifu et al. (2004) [21], Luo Dang’s, and Yan Liming (2008) [15] and Qu Wenzhou et al. (2011) [16]. Possible reasons include three aspects: Compared with state-owned large-scale enterprises, private enterprises have more serious information asymmetries with financial institutions such as banks during the financing process. Moreover, due to the small scale of financing, lack of collaterals and guarantees, and low growth factors, private factors have also resulted in insufficient financing capacity. In addition, private enterprises in China are also facing financing discrimination based on ownership (Huang, 2005) [22].

4.3. The Influence of Cluster Development on Innovation Financing and Constraint

After controlling for five variables of regional-industry fixed effect, time dynamic change effect, company size, governance effect and company growth, the regression coefficient of cluster development degree is positive and significant at 1% level. It shows that there is a positive correlation between the degree of cluster development and innovation investment, which is consistent with the theoretical expectation. Hypothesis 3 passes the test. The above conclusions also support the effectiveness of the “cluster innovation” model in industrial cluster theory from the side. Enterprises within the industrial cluster can emerge through self-organization and form an innovation cooperation network and form a collaborative innovation mechanism of production, study and research, which contributes to innovation output and results. Transformation, thereby promoting their own independent innovation ability and the overall development of industrial clusters.

To further examine the impact of cluster development on innovation and financing constraints, continue to introduce the interaction of cluster development and debt-asset ratio. The results show that the regression coefficient of the debt-to-asset ratio remains stable, and the regression coefficient of the interaction term is significantly negative at the 5% level, which indicates that the clustered development model is conducive to alleviating innovative financing constraints. Compared with individual enterprises, clustering endogenous cluster financing mechanisms can ease information
asymmetry between financial institutions and enterprises, and reduce credit costs and credit risks of financial institutions to some extent. At this point, hypothesis 4 also passes the test.

5. Conclusion

From the perspective of internal and external integration, this paper uses the listed companies in the new materials industry from 2007 to 2010 as a sample to empirically examine the impact of external institutional environment and internal cluster development on innovation financing constraints, and draws the following conclusions:

a. The innovation activities of listed companies in the new materials industry in China face significant external credit constraints, and a large number of companies are forced to postpone their investment in innovation because of their heavy debt burden, resulting in shrinking solvency and financing space.

b. Institutional environment Innovative financing constraints have a significant impact. In areas where the process of marketization is lower, government intervention is higher, and the environment of the rule of law is worse, the ability to innovate is relatively low, but innovative financing constraints are relatively small, and the degree of innovative financing constraints of private enterprises is generally high. For state-owned enterprises.

c. In the Yangtze River Delta region with a relatively high degree of cluster development, China's listed companies in the new materials industry have higher innovation capabilities and less restrictive innovation financing.

Related countermeasures and suggestions are as follows:

a. The enterprise's own efforts, like the development of external financial markets, can also effectively mitigate the objective of innovative financing constraints. Therefore, companies should take a more active approach from their own perspective. Attitudes and measures to address the financing constraints of innovation. On the one hand, we can actively reduce the information asymmetry between financial institutions to reduce external financing by actively strengthening R&D information disclosure. On the other hand, we can use the advantages of cluster development to strengthen cooperation with intra-cluster companies and pass credit advantages of cluster financing. Make up for the uncertainty and information asymmetry in the process of innovation financing.

b. The government's role under the transitional system environment should be treated rationally. Under the premise that the market effectiveness is yet to be improved, the government should properly intervene in the development of the industry, improve and optimize the related fostering and support policies, especially for strategic emerging industries. Because of its special status in the national economy, it is more necessary for the government to strengthen policy guidance and industry management, formulate specific strategic emerging industry financing channels, and cultivate industrial clusters with healthy competition and good cooperation atmosphere.

References

[1] Laursen K. and A. Salter. Open for Innovation: The Role of Openness in Explaining Innovation Performance among U.K. Manufacturing Firms [J]. Strategic Management Journal, 2006, 27 (2): 131-150.

[2] Rajan R. and L. Zingales. Financial Dependence and Growth [J]. American Economic Review, 1998, 88 (3): 559-586.

[3] Demirguc-Kunt A. and V. Maksimovic. Law, Finance, and Firm Growth [J]. Journal of Finance, 1998, 53 (6): 2107-2137.

[4] Love I. Financial Development and Financial Constraints [J]. Review of Financial Studies, 2003, 16 (3): 765-791.

[5] Khurana I., X. Martin and R. Pereira. Financial Development and the Cash Flow Sensitivity of Cash [J]. Journal of Financial and Quantitative Analysis, 2006, 41 (4): 787-807.

[6] Khanna T., K. Palepu. Is Group Affiliation Profitable in Emerging Markets? An Analysis of Diversified Indian Business Groups [J]. The Journal of Finance, 2000, 55 (2): 867-892.
[7] Héricour J. and S. Poncet. FDI and Credit Constraints: Firm Level Evidence in China [J]. Economic Systems, 2009, 33 (1): 1-21.
[8] Bergemann D. and U. Hege. The Financing of Innovation: Learning and Stopping [J]. The Rand Journal of Economics, 2005, 36 (4): 719-752.
[9] Eng L. and M. Shackell. The implications of long term performance plans and institutional ownership for firm's research and development investments [J]. Journal of Accounting, Auditing and Finance, 2001, 16 (2): 117-139.
[10] Fazzari S. M., R. G. Hubbard and B. C. Peterson. Financing Constrains and Corporate Investment [A]. Brookings Papers on Economic Activity, 1988, pp.141-195.
[11] Almeida H., M. Campello and M. Weishach. The Cash Flow Sensitivity of Cash [J]. Journal of Finance, 2004, 59 (4): 1777-1804.
[12] Hillman A. J., G. D. Keim and D. Schuler. Corporate Political Activity: A Review and Research Agenda [J]. Journal of Management, 2004, 30 (6): 837-857.
[13] Bhagat S. and I. Welch. Corporate Research and Development Investment: International Comparisons [J]. Journal of Accounting and Economics, 1995, 19 (1): 443-470.
[14] Claessens S., E. Feijen and L. Laeven. Political Connections and Preferential Access to Finance: The Role of Campaign Contributions [J]. Journal of Financial Economics, 2008, 88(3): 554-580.
[15] Luo Dangyan, Yan Liming. Private Control, Political Connection and Corporate Financing Constraints [J]. Financial Research, 2008, (12): 164-178.
[16] Qu Wenzhou, Xie Yaxi, Ye Yumei. Information Asymmetry, Financing Constraints, and Investment-Cash Flow Sensitivity: Empirical Research Based on Market Microstructure Theory [J]. Economic Research, 2011, (6): 105-117.
[17] Harrison, A. E., I. Love and M. S. McMillan. Global Capital Flows and Financing Constraints [J]. Journal of Development Economics, 2004, 75 (1): 269-301.
[18] Fan Gang, Wang Xiaolu, Zhu Hengpeng. China's Marketization Index - The Relative Process of Marketization in Different Regions in 2011 [M]. Beijing: Economic Science Press, 2011.
[19] Allen F., J. Qian and M. J. Qian. Law, Finance, and Economic Growth in China [J]. Journal of Financial Economics, 2005, 77 (1): 7-116.
[20] Xie Weimin, Fang Hongxing. Financial Development, Financing Constraints, and R&D Investment in Enterprises [J]. Financial Research, 2011, (5): 171-183.
[21] Lin Yifu, Liu Mingxing, Zhang Qi. Policy Burden and Corporate Soft Budget Constraint: An Empirical Study from China [J]. Management World, 2004, (8): 81-89.
[22] Huang Y. Selling China: Foreign Direct Investment during the Reform Era [M]. Cambridge: Cambridge University Press, 2005.