**Asian Economic and Financial Review**
*ISSN(e): 2222-6737*
*ISSN(p): 2305-2147*
*DOI: 10.55493/5002.v15i7.5500*
*Vol. 15, No. 7, 1157-1174.*
*© 2025 AESS Publications. All Rights Reserved.*
*URL: www.aessweb.com*

# Corporate social responsibility and R&D investment in Chinese firms with financial constraints as a mediator

**Cheng Yingxiang**[1]
**Neilson Teruki**[2+]
**Shairil Izwan Bin Taasim**[3]

[1,2,3]*Faculty of Humanities, Management, and Science, Universiti Putra Malaysia Bintulu, Sarawak Campus, Malaysia.*
[1]*Email: chengyingxianggood@gmail.com*
[2]*Email: neilson@upm.edu.my*
[3]*Email: shairil@upm.edu.my*

*(+ Corresponding author)*

**Article History**
Received: 17 March 2025
Revised: 19 June 2025
Accepted: 7 July 2025
Published: 25 July 2025

**Keywords**
Corporate social responsibility
Emerging market
Financial constraints
R&D investment
Stakeholder theory
Sustainable development.

**JEL Classification:**
M14; O00; Q01.

## *ABSTRACT*

This study explores the effects of corporate social responsibility (CSR) on Research and development (R&D) investment with a specific focus on the role of financial constraints as a mediating factor. Using 23962 firm-year observations from Chinese A-share listed companies from 2011 to 2020 as a sample, this study explores the internal links between CSR, financial constraints, and firms' R&D investment. This study empirically examines the relationship between CSR and R&D investment using a double-fixed-effect Ordinary Least Squares (OLS) regression method. It validates the relationship with robustness checks, including alternative periods, alternative measures, and Two-stage Ordinary Least Squares (2SLS) regression for endogeneity concerns. The results show that CSR promotes R&D investment. Furthermore, using the Sobel test, this study examines the mediating effects of financial constraints on the relationship between CSR and R&D investment. The empirical results verify that CSR promotes R&D investment by alleviating firms' financial constraints. This suggests that firms can obtain more financing support by fulfilling CSR and providing financial support for fostering R&D investment. The findings offer valuable perspectives for corporate decision-makers, policymakers, and scholars, emphasizing CSR's pivotal role in shaping R&D investment and promoting sustainable economic progress in China's dynamic market environment.

**Contribution/ Originality:** This study contributes to the literature by enhancing the understanding of the internal links between CSR, financial constraints, and R&D investment. It provides new evidence supporting the argument that CSR has a favorable influence on R&D investment.

## 1. INTRODUCTION

Research and Development (hereafter, R&D) investment refers to expenditures on R&D activities. It is critical in driving innovation within firms. Increased financial commitment to R&D enables organizations to explore new ideas, technologies, and processes essential for developing innovative products and services. Corporate social responsibility (hereafter, CSR) refers to enterprises' obligation to address various stakeholders' needs during management, including shareholders, creditors, government, society, and employees. Despite the growing focus on innovation due to increasing market competition and substantial scholarly attention, the interplay between CSR initiatives and R&D investment in Chinese enterprises remains underexplored.

Previous studies predominantly adopt a static perspective, overlooking the dynamic nature of corporate development. Zhu, Zhu, and Kong (2014) propose that combining corporate social responsibility and R&D innovation behavior is an inevitable requirement for realizing enterprises' sustainable development, and the


*© 2025 AESS Publications. All Rights Reserved.*

combination of these can enhance corporate performance. Zhang, Wang, and Quan (2024) explore the relationship between CSR and financialization from the perspective of the corporate life cycle and find that institutional capital influences firms' CSR initiatives. Nonetheless, little research exists on how CSR influences capital structure or other financial characteristics.

Yu and Li (2021) first link the financial characteristics of CSR and firms' innovation by exploring how the financial capital level of CSR impacts technological innovation in private firms. Similarly, Dai and Wu (2024) also document that CSR can enhance firms' innovation. While this line of research has explored the direct influences of CSR on firms' ultimate innovation performance, the process of how CSR influences firms' innovation factors, including R&D investment, is neglected. Additionally, the causal link between CSR and R&D investment has yet to be explored. This study aims to contribute to the literature by examining the impact of CSR on firms' financial constraints, the effect of financial constraints on R&D investment, and the influence of CSR on R&D investment.

This research demonstrates how corporate social responsibility (CSR) enhances research and development (R&D) investment by improving firms' financial conditions. Firstly, this study empirically explores the relationship between CSR and R&D investment using a double-fixed-effect ordinary least squares (OLS) regression baseline model and validates the relationship through various methods, including alternative periods, alternative measures, and two-stage ordinary least squares (2SLS) regression to address endogeneity concerns. Secondly, this study examines the impact of CSR on alleviating firms' financial constraints. Thirdly, it investigates the effects of financial constraints on firms' R&D investment. Lastly, using the Sobel test, this study verifies that CSR increases R&D investment by alleviating firms' financial constraints, acting as a mediator in the relationship between CSR and R&D investment.

The contributions of this research are as follows. Firstly, this study contributes to the literature by enhancing the understanding of the internal links between CSR, financial constraints, and R&D investment. This study is the first to propose that CSR fosters R&D investment by alleviating financial constraints underlying stakeholder theory, providing new evidence for the argument about the favorable role of CSR in R&D investment. Secondly, the findings of this study indicate that fulfilling CSR can help enterprises obtain more financing support, reduce financing constraints, provide financial support for R&D investment, promote the willingness to invest in R&D, and foster corporate innovation. These highlight CSR's important role in promoting firms' financial growth and long-term sustainability. Lastly, the findings provide valuable perspectives for corporate decision-makers, policymakers, and scholars, emphasizing CSR's pivotal role in shaping R&D investment and promoting sustainable economic progress in China's dynamic market environment.

## 2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

### *2.1. CSR and R&D Investment*

Two contrasting viewpoints exist regarding the relationship between CSR and R&D investment. Some scholars believe that increased investment in R&D and innovation will encourage enterprises to allocate more capital, technology, and personnel toward the development of products or processes with social responsibility attributes, such as producing environmentally friendly products through technological innovation and developing advanced clean production processes, thereby yielding positive economic and social benefits.

Zeng, Chen, and Zhou (2020) document that CSR enhances innovation capabilities by optimizing resource allocation and synchronization. Brammer and Millington (2008) use charitable donations as a measure of CSR to examine its impact on R&D investment, finding that companies actively involved in charity can increase R&D spending. MacGregor and Fontrodona (2008) document that CSR implementation and innovation could form a virtuous cycle, with CSR initiatives driving product and process innovation. Bocquet, Le Bas, Mothe, and Poussing (2013) also argue that companies that adopt CSR as a strategic orientation are more innovative in products and processes.



© 2025 AESS Publications. All Rights Reserved.

Nonetheless, from the perspective of resource finiteness, R&D investment, which involves high input and high risk, exists at an optimal level and the most appropriate input intensity to ensure that firms' innovation performance is maximized (Kang, 2013). According to this view, under limited resources, excessive R&D investment would crowd out the sources of firms' other necessities, which is detrimental to firms' innovation. Using non-probability sampling, Tsai, Tsang, and Cheng (2012) report that CSR does not necessarily promote product or service innovation. Gallego-Álvarez, Manuel Prado-Lorenzo, and García-Sánchez (2011) address no bi-directional relationship between CSR practices and innovation.

Based on stakeholder theory, companies enhance their reputation and build stronger relationships with stakeholders by integrating social and environmental considerations into their strategies, leading to greater access to capital and other resources. This, in turn, allows firms to allocate more funds toward R&D activities. Additionally, CSR practices often encourage innovation, particularly in sustainability and eco-friendly technologies, where firms are driven to invest more in R&D to develop new technologies that meet market and societal demands. Furthermore, empirical evidence suggests that companies with strong CSR commitments recognize the long-term value of innovation in achieving both business success and broader social goals, such as fostering an environment conducive to technological advancement and maintaining a competitive edge.

Based on the analysis above, we propose the following research hypothesis.

*$H_1$: CSR has a positive correlation with firms' R&D investment.*

### *2.2. CSR and Financing Constraints*

Financing constraints refer to the limitations that firms face in accessing funds, and due to the imperfections of the capital market, firms will be confronted with high costs when raising external finance, resulting in the inability to invest sufficient funds in desired projects. Gu, Li, and Peng (2018) posit that financing constraints mainly include four dimensions: financing availability, financing cost, financing speed, and financing frequency. Generally, the proxy variable method is divided into two approaches: measuring financing constraints through a single indicator or a multivariable index. Past studies have shown that company size (Lian, 2010), dividend payout ratio (Fazzari, Hubbard, Petersen, Blinder, & Poterba, 1988), and interest coverage ratio (Carpenter & Guariglia, 2008) are common univariate indicators. According to Kaplan and Zingales (1997), markets are inherently imperfect due to issues such as information asymmetry and principal-agent problems, resulting in significant cost differences between self-financing and external financing.

Firms with active CSR initiatives obtain a good social reputation and improve social acceptance, alleviating financing constraints. Firstly, by actively assuming social responsibility, the extent of information asymmetry between the enterprise and the market, investors, and creditors is alleviated, reducing external concerns about the enterprise's risk and making it easier to obtain external financing. Secondly, under the influence of traditional Confucianism in the Chinese nation, people attach more importance to cultivating virtues and maintaining morality. Enterprises that actively undertake social responsibility will gain more social recognition, and it is easier for them to gain the trust of the outside world so that they can obtain financing at a lower cost. Finally, enterprises that actively fulfill their social responsibility can obtain more affirmation and support from the regulatory level, improve the pass rate of financing applications, and obtain financing more easily, conveniently, and quickly. Meanwhile, Li, Zheng, Zhang, and Cui (2020) find that a good reputation has a long-term impact on firms, influencing the regulatory approval of their refinancing applications and enhancing the frequency and sustainability of their financing.

Based on the above, this study puts forward the following hypothesis.

*$H_2$: CSR alleviates firms' financial constraints.*



© 2025 AESS Publications. All Rights Reserved.

### 2.3. Financing Constraints and R&D Investment

Financing constraints are a common issue faced by R&D investments. Some researchers have found that, compared to ordinary investment projects, R&D projects encounter more difficulties in obtaining external financing, which hampers corporate R&D spending and activities. Fazzari et al. (1988) use R&D investment-cash flow sensitivity to represent financing constraints. R&D activities face a significant funding gap when a company's internal funding channels are blocked without external funding. Decisions and choices must be made based on limited internal cash flow, leading to cautious and highly sensitive decisions regarding R&D spending. Studies have shown that, compared to external financing, companies tend to rely more on internal funds due to difficulties in collateralizing R&D projects, the confidentiality of intellectual property, and high uncertainty. Internal financing channels include cash flow, cash holdings, and equity issuance, with cash holdings being a more reliable source, as it ensures the stability of R&D investment expenditure.

In terms of funding sources for corporate innovation, Zeng (2013) finds that internal financing plays a dominant role in supporting R&D innovation expenditures. Furthermore, external financing modes differ significantly across different types of ownership. For small and medium-sized enterprises, the effect of financing constraints is even more pronounced, as they generally have a shorter operating history and lack credit proof, guarantees, or collateral (Yu & Kang, 2017). Harhoff (1997) analyzes the characteristics of R&D investment, finding that R&D is an accumulative activity with high risks and long cycles, with highly uncertain outcomes and returns. This makes financing constraints more restrictive for R&D activities. Carpenter and Petersen (2002) and Zhou, Lu, and Yang (2017) empirically document that in advanced high-tech company samples, R&D activities negatively correlate with the degree of financing constraints.

Financing constraints mainly affect the improvement of firms' R&D investment through the channels of missed investment opportunities, increased agency conflicts, and undermined growth rates (Wang & Wang, 2021). Firstly, based on the information asymmetry theory, firms reduce their investment in innovation activities with high risk and high capital demand when they face higher financing constraints, which may cause them to miss many good R&D opportunities. Secondly, it is easy to trigger moral hazards and adverse selection among managers, leading to the abandonment of relevant innovation activities when enterprises face high financing constraints. From the perspective of principal-agent theory, most managers need to be responsible to all stakeholders and must prioritize the return on investment when carrying out investment activities.

Therefore, the following research hypothesis is proposed.

*$H_3$: Financing constraints inhibit firms' R&D investments.*

### 2.4. Financing Constraints' Mediation Effects

Based on the above analysis, CSR influences financing constraints, which inhibit R&D investment. Therefore, CSR can promote R&D expenditure by alleviating enterprises' financing constraints.

Consequently, we set up the following hypothesis.

*$H_4$: Financing constraints mediate the relationship between CSR and R&D investment.*

## 3. METHODOLOGY

### 3.1. Models

#### 3.1.1. Relationship Between CSR and R&D Investment

To empirically examine the relationship between CSR and R&D investment, we set up Model (1) as follows.

$$RD_{i,t} = \beta_0 + \beta_1 CSR_{i,t} + \mu_i Controls_{i,t} + \sum Industry + \sum Year + \varepsilon_{i,t} \quad (1)$$

CSR assesses a firm's social responsibility performance, including dimensions of environmental, social, and governance practices. The measurements of CSR include the reputation index method (Li & Peng, 2010;



© 2025 AESS Publications. All Rights Reserved.

Moskowitz, 1972; Preston & O'bannon, 1997) the objective evaluation method (Calabrese, Costa, Menichini, & Rosati, 2013) and the Kinder, Lydenburg & Domini scores (KLD Score) social performance evaluation method (Hart & Sharfman, 2015; Mattingly & Berman, 2006; Sharfman, 1996). This study uses the KLD Score to measure CSR. The CSR value is a comprehensive score based on the KLD calculation method. Specifically, the CSR value equals the sum of scores assessed by the Stock Exchange of China according to their environmental, social, and governance practices. RD denotes firms' R&D investment in the given year.

Controls are a set of control variables. This study controls leverage (LEV), equity ratio (ER), and financial risk coefficient factor (RC) to account for firms' financial condition, since corporate risks can increase managers' willingness to make decisions regarding high-risk innovation activities (Ji & Fan, 2021). In addition, this study controls firm age (AGE) and enterprise growth (GROWTH) to control for firms' life stages since firms in different life stages have different propensities for innovation; for instance, Coad, Segarra, and Teruel (2016) document that young undertake riskier innovation activities to pursue faster growth. Furthermore, this study controls for ownership concentration (FIRST) and firms' nature (SOE) to account for controlling shareholders' decisions, as controlling shareholders can influence innovation strategies through their control rights. Moreover, this study considers board independence (INDE), dual position (DUAL), and SOE of property rights to account for firms' governance factors, since effective management governance enhances R&D investment and promotes innovation (Peng & Han, 2016). The specific clarifications of each variable are shown in Table 1.

The model is estimated using OLS regression with year-fixed (ΣYear) and industry-fixed (ΣIndustry) effects. The year effect is fixed to account for temporal changes, such as economic cycles or regulatory shifts, and the industry effect is fixed to capture sector-specific variations. Error term ($\varepsilon_{i,t}$) captures unobserved factors influencing R&D investment, and this study adjusts the standard errors to account for heteroskedasticity, serial correlation, and cross-sectional dependence. CSR has a positive (negative) influence on R&D investment if $\beta 1$ is positive (negative). Specifically, we use a two-dimensional cluster at both the firm and year levels, following the approach recommended by Petersen (2008) for estimating standard errors in panel data applications within corporate finance.

### *3.1.2. Relationship between CSR and Financial Constraints*

To explore the relationship between CSR and financial constraints, this study establishes Model (2) as follows.

$$FC_{i,t} = \alpha_0 + \alpha_1 CSR_{i,t} + \mu_i Controls_{i,t} + \sum Industry + \sum Year + \varepsilon_{i,t} \quad (2)$$

The financing constraint (FC) is a comprehensive index calculated using the Fee, Hadlock, and Pierce (2009) model, with the value of FC ranging from 0 to 1. As the value of FC increases, the financing constraints enterprises face gradually increase. Controls are the same control variables obtained from Equation 1. Year and industry effects are fixed in this model. If $\alpha 1$ is negative, it suggests that CSR alleviates firms' financial constraints, as Hypothesis H2 addresses.

### *3.1.3. Relationship between Financial Constraints and R&D Investment*

To explore the relationship between financial constraints and R&D investment, this study sets up Model (3), specifically as follows.

$$RD_{i,t} = \gamma_0 + \gamma_1 FC_{i,t} + \mu_i Controls_{i,t} + \sum Industry + \sum Year + \varepsilon_{i,t} \quad (3)$$

Controls are the same control variables obtained from Equation 3. Year and industry effects are fixed in this model. If $\gamma_1$ is negative, it suggests that alleviating firms' financial constraints can promote firms' R&D investment, as Hypothesis H3 addresses.



© 2025 AESS Publications. All Rights Reserved.

### 3.1.4. Mediating Effect of Financial Constraints

To confirm that financial constraints mediate the relationship between CSR and R&D investment, this study establishes Model (4), specifically as follows.

$$RD_{i,t} = \beta_0' + \beta_1' CSR_{i,t} + \beta_2' FC_{i,t} + \mu_i' Controls_{i,t} + \sum Industry + \sum Year\ \varepsilon_{i,t}' \quad (4)$$

Model (4) will be examined using the Sobel test. Controls are the same control variables obtained from Equation 1. Year and industry effects are fixed in this model. If β1′ is reduced in magnitude or becomes insignificant compared to β1 in Equation 1, this suggests that FC mediates the effect of CSR on R&D investment, as Hypothesis H4 addresses. If β2′ is significant, it confirms that FC directly impacts RD. A full mediation occurs if β1′ becomes insignificant, while a partial mediation occurs if β1′ is still significant but weaker than in Equation 1.

## 3.2. Data

The data covers Chinese A-share market-listed companies spanning 2011 to 2020, comprising 23,962 firm-year observations. Our sample period started in 2011, when Chinese stock exchanges started to require A-share listed companies to disclose the fulfillment of their social responsibilities in their annual financial reports in 2010. It ended in 2020 due to the abnormal effects of COVID-19 on our data availability. We exclude *ST and ST enterprises because of their different accounting foundation. The CSR data used in this study is obtained from the Hexun website database, and other data are from the Chinese Stock Market and Accounting Research (CSMAR) database. All continuous variables are winsorized at the 1st and 99th percentiles.

The definitions of all the variables used in this study are listed in Table 1.

**Table 1.** Definitions of variables.

| Variables | Definition |
|---|---|
| Response variable | |
| RD | Ln (R&D investment expenditure). |
| Explanatory variable | |
| CSR | Composite score in the CSR report in the Hexun database. |
| Mediating variable | |
| FC | Financial constraint comprehensive index. The specific calculation is shown in Appendix 1. |
| Control variables | |
| INDE | The proportion of independent directors relative to the total board size. |
| LEV | Total liabilities/Year-ending total assets. |
| SOE | State-owned companies are listed as 1; otherwise, they are listed as 0. |
| AGE | Difference between the observation year and the establishment year. |
| GROWTH | Operating income growth rate. |
| DUAL | 1 If the chairman of the board and the general manager are the same person; otherwise, 0. |
| RC | $e^{O-Score}/ (1 + e^{O-Score})$. O-score is the measure of financial risk coefficient, which is computed using the methodology in Ohlson (1980). |
| FIRST | Number of shares held by the largest shareholder/Total shares. |

## 3.3. Descriptive Statistics

The descriptive statistics outline the key characteristics of the dataset, encompassing dependent, independent, mediating, and control variables, as shown in Table 2. The dependent variable, R&D (RD), exhibits a mean value of 17.804 with minimal dispersion, as indicated by a standard deviation of 1.570. The independent variable, Corporate Social Responsibility (CSR), shows higher variability (SD = 15.794) and a wide range, suggesting considerable heterogeneity across firms. The mediating variable, Financial Constraints (FC), demonstrates moderate dispersion (SD = 0.272) with values ranging from 0.002 to 0.923, implying varying levels of financial constraints among firms.

Among the control variables, Board Independence (BI) exhibits substantial variation (SD = 5.614), indicating diversity in corporate governance practices. Leverage (LEV) and Firm Age (AGE) show relatively consistent distributions, with standard deviations of 0.204 and 5.760, respectively. Binary variables such as firms' nature



© 2025 AESS Publications. All Rights Reserved.

(NATURE) and the combination of chairman and general manager positions (CP) suggest that 42.6% and 24.1% of firms belong to specific categories. Firm Growth (GROWTH) demonstrates notable variability, reflecting differing growth trajectories across firms. First, the shareholders' percentage (FSP) displays a broad range, indicating significant size differences, while risk level (RISK) remains low on average, with minimal dispersion. This summary provides a foundational understanding of the dataset's structure and variability, which is essential for subsequent empirical analysis.

**Table 2**. Descriptive statistics (N=23962).

| Variable Kind | Variable | Mean | Median | Min. | Max. | SD |
|---|---|---|---|---|---|---|
| Dependent variable | RD | 17.804 | 17.852 | 13.033 | 21.821 | 1.570 |
| Independent variable | CSR | 23.234 | 21.340 | -4.310 | 74.420 | 15.794 |
| Mediating variables | FC | 0.437 | 0.441 | 0.002 | 0.923 | 0.272 |
| Control variables | BI | 37.410 | 33.330 | 0.000 | 80.000 | 5.614 |
| | LEV | 0.449 | 0.446 | 0.072 | 1.010 | 0.204 |
| | NATURE | 0.426 | 0.000 | 0.000 | 1.000 | 0.495 |
| | AGE | 17.316 | 17.000 | 2.000 | 53.000 | 5.760 |
| | GROW | 0.158 | 0.096 | -0.621 | 2.505 | 0.408 |
| | CP | 0.241 | 0.000 | 0.000 | 1.000 | 0.428 |
| | FSP | 36.192 | 34.520 | 0.164 | 89.990 | 15.076 |
| | RISK | 0.001 | 0.000 | 0.000 | 0.039 | 0.005 |

### *3.4. Multicollinearity Tests*

#### *3.4.1. Variance Inflation Factor Test*

The Variance Inflation Factor (VIF) test aims to check the correlation between two or more independent variables. By estimating the VIF after every regression model, a supplementary check for multicollinearity was performed. According to Gujarati and Porter (2004), if the VIF value is more than 10, a multicollinearity problem exists. Table 3 presents the VIF test results between the variables used in this study, the mean value of which is 1.13, implying that multicollinearity issues do not exist.

**Table 3.** VIF of the regression.

| Variable | VIF | Tolerance |
|---|---|---|
| NATURE | 1.27 | 0.79 |
| LEV | 1.24 | 0.81 |
| RISK | 1.2 | 0.83 |
| CP | 1.11 | 0.90 |
| CSR | 1.11 | 0.90 |
| AGE | 1.07 | 0.93 |
| FSP | 1.07 | 0.94 |
| GROW | 1.04 | 0.96 |
| BI | 1.02 | 0.98 |
| Mean VIF | 1.13 | 0.88 |

#### *3.4.2. Pearson Correlation Test*

The Pearson correlation analysis provides insights into the relationships between the variables in the dataset. The Pearson coefficients should be comparatively low among all the variables, or less than 0.80 (Kennedy, 2004). The Pearson correlation matrix for all the variables used in this study is lower than 0.80, as shown in Table 4, indicating that the multicollinearity problem does not exist.



© 2025 AESS Publications. All Rights Reserved.

**Table 4.** Pearson correlation matrix.

| Variable | RD | CSR | FC | BI | LEV | NATURE | AGE | GROW | CP | FSP | RISK |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RD | 1 | | | | | | | | | | |
| CSR | 0.127*** | 1 | | | | | | | | | |
| FC | -0.361*** | -0.151*** | 1 | | | | | | | | |
| BI | 0.039*** | -0.017*** | 0.006 | 1 | | | | | | | |
| LEV | 0.125*** | -0.044*** | -0.652*** | -0.008 | 1 | | | | | | |
| NATURE | 0.049*** | 0.135*** | -0.330*** | -0.063*** | 0.259*** | 1 | | | | | |
| AGE | 0.055*** | -0.081*** | -0.146*** | 0.008 | 0.109*** | 0.105*** | 1 | | | | |
| GROW | 0.049*** | 0.108*** | -0.032*** | 0.003 | 0.022*** | -0.065*** | -0.060*** | 1 | | | |
| CP | -0.012* | -0.067*** | 0.167*** | 0.116*** | -0.118*** | -0.293*** | -0.056*** | 0.021*** | 1 | | |
| FSP | 0.045*** | 0.173*** | -0.107*** | 0.047*** | 0.012* | 0.157*** | -0.128*** | 0.019*** | -0.045*** | 1 | |
| RISK | -0.111*** | -0.265*** | -0.151*** | 0.015** | 0.327*** | 0.008 | 0.055*** | -0.118*** | -0.004 | -0.110*** | 1 |

**Note:** ***, **, and * denote significance at 1%, 5%, and 10%, respectively.



© 2025 AESS Publications. All Rights Reserved.

A Pearson correlation matrix is used to measure the direction and strength of linear relationships between independent and dependent variables. The dependent variable, RD, shows a positive and significant correlation with CSR (0.127, $p < 0.01$), suggesting that firms with higher CSR engagement tend to invest more in R&D. Regarding the independent variable, CSR is negatively correlated with FC (-0.151, $p < 0.01$), indicating that firms with stronger CSR commitments tend to experience fewer financial constraints. Additionally, RD negatively correlates with FC (-0.361, $p < 0.01$), implying that financial constraints hinder R&D investment. These correlations provide preliminary evidence of relationships among the variables, which warrant further investigation through regression analysis to establish causal relationships.

## 4. RESULTS AND DISCUSSIONS

### *4.1. Relation Between CSR and R&D Investment*

*$H_1$: CSR has a positive correlation with firms' R&D investment.*

Table 5 shows the baseline linear relationship between CSR and R&D investment. Columns (1) and (2) indicate that CSR has a significantly positive association with R&D (0.022, $p < 0.01$; 0.020, $p < 0.01$). This suggests that higher levels of CSR fulfillments are associated with increased R&D investment, indicating that companies with a stronger commitment to social responsibility tend to invest more in R&D. The results provide strong empirical evidence for our Hypothesis H1. In addition, the results suggest that several control variables significantly influence R&D investment. Specifically, NATURE positively correlates with RD (0.250, $p < 0.01$), indicating that state-owned firms tend to invest more in R&D due to government support and policy incentives. AGE exhibits a negative and significant relationship with RD (-0.018, $p < 0.01$). Meanwhile, GROWTH is positively associated with RD (0.104, $p < 0.01$), suggesting that younger firms tend to invest more in R&D than older firms, possibly due to their need for innovation-driven growth. RISK demonstrates a strong negative relationship with RD (-51.313, $p < 0.01$), indicating that firms facing higher risk levels are significantly less likely to invest in R&D.

**Table 5.** Relationship between CSR and R&D investment.

| Variable | (1) RD | (2) RD |
|---|---|---|
| CSR | 0.022*** | 0.020*** |
| | (16.55) | (14.54) |
| BI | | 0.004 |
| | | (1.09) |
| LEV | | 2.044*** |
| | | (15.10) |
| NATURE | | 0.250*** |
| | | (4.08) |
| AGE | | -0.018*** |
| | | (-3.67) |
| GROW | | 0.104*** |
| | | (3.36) |
| CP | | -0.033 |
| | | (-0.80) |
| FSP | | 0.003* |
| | | (1.90) |
| RISK | | -51.313*** |
| | | (-11.57) |
| _cons | 15.848*** | 14.681*** |
| | (45.31) | (40.95) |
| Industry-fixed | Yes | Yes |
| Year-fixed | Yes | Yes |
| N | 19344 | 16695 |
| Adjusted R-squared | 0.168 | 0.245 |

**Note:** T-statistics are shown in parentheses. *** and * denote significance at 1% and 10%, respectively. Model (1) is estimated both without and with control variables in columns (1) and (2), respectively, using industry and year-fixed effect OLS regression.



© 2025 AESS Publications. All Rights Reserved.

### *4.2. Robustness*

#### *4.2.1. Alternative Period*

To examine whether the correlation between corporate social responsibility and innovation performance holds consistently over a shorter and potentially different economic context, this study estimates Equation (1) using a different sample period (2015-2020) compared to the original period (2011-2020). Columns (1) and (2) of Table 6 report the relationship between Corporate Social Responsibility and R&D investment using a different sample period (2015-2020) compared to the original period (2011-2020). In both columns (1) and (2), the results without and with controls suggest that CSR has a significantly positive effect on IP, with coefficients of 0.024 ($p < 0.001$) and 0.023 ($p < 0.001$), respectively. These results are consistent with the findings from the broader time frame (2011-2020), reinforcing the conclusion that CSR positively influences innovation performance.

This stability across different sample periods strengthens the evidence that CSR fosters innovation performance, and this relationship is not driven by specific time-related factors in the 2011-2020 range.

#### *4.2.2. Alternative Measure*

To make our main results more robust, we use the two subset indicators of environmental responsibility and social responsibility (ES) as a proxy measure of corporate responsibility instead of CSR, establishing the model as follows.

$$RD_{i,t} = \beta_0 + \beta_1 ES_{i,t} + \mu_i Controls_{i,t} + \sum Industry + \sum Year + \varepsilon_{i,t} \quad (3)$$

Columns (3) and (4) of Table 6 report the relationship between R&D investment and corporate social responsibility, using environmental and social scores as alternative measures of CSR. The results indicate that ES significantly positively affects R&D investment, both with and without controls. The coefficients are 0.027 ($p < 0.001$) in column (3) and 0.018 ($p < 0.001$) in column (4). These findings are consistent with those observed when using CSR as the measure, confirming that firms with higher ES scores tend to invest more in R&D. This suggests that the positive relationship between CSR and R&D investment remains robust, whether measuring CSR through traditional CSR metrics or ES scores. The robustness check using ES scores instead of CSR confirms that the positive relationship between corporate social performance and R&D investment is robust to the choice of CSR measurement.

#### *4.2.3. Endogeneity Concerns*

We conduct a 2SLS regression using the instrumental variable approach for the test to address sample selection error and endogeneity due to reverse causation. The first-stage regression model is conducted as Equation (4), using the $CSR_{i,t-1}$ as the instrumental variable, as well as the control variables in Equation 1, to obtain predicted values of $CSR_{i,t}$, which are free from endogeneity biases and can then be used in the second-stage regression analysis. The 2SLS regression using the instrumental variable aims to capture CSR's stable, persistent component, thereby improving the causal interpretation of CSR's impact on R&D investment.

$$CSR_{i,t} = \beta_0 + \beta_1 CSR_{i,t-1} + \mu_i Controls_{i,t} + \sum Industry + \sum Year + \varepsilon_{i,t} \quad (4)$$

Columns (5) and (6) of Table 6 present the first and second-stage regression results. In column (5), the coefficient of lagged CSR (0.541, t=85.22) is positive and highly significant ($P<0.001$), suggesting that past CSR activities strongly predict current CSR levels. This confirms the relevance of $CSR_{i,t-1}$ as a strong instrument for CSR. Column (6) reports the second-stage result of the correlation between predicted current CSR and IP. The coefficient on predicted CSR is positive and statistically significant (0.024, $p<0.001$), indicating that higher levels of CSR are associated with improved R&D investment. These results are consistent with the baseline results.



© 2025 AESS Publications. All Rights Reserved.

The 2SLS regression confirms a robust relationship between a firm's social responsibility initiatives and R&D investment. This also implies that higher levels of CSR are associated with improved R&D investment. The strong instrument relevance indicated by the first stage and the overall significance in the second stage bolster the credibility of these findings, affirming CSR's role in fostering a conducive R&D investment environment for firms.

### *4.3. Mediating Effect of Financial Constraints on CSR and R&D Investment*

#### *4.3.1. Relation between CSR and Financing Constraints*

*$H_2$: CSR alleviates firms' financial constraints.*

This study employed panel data to examine the correlation between CSR and financial constraints. It specified financial constraints (FC) as the dependent variable. In the given equation, CSR is incorporated to examine hypothesis H2, while all other parameters mentioned as controls are incorporated as independent variables that remain constant (Gujarati, 2021).

Table 7 exhibits the findings of Hypothesis H2. Columns (1) and (2) present the estimations of the model (2) without and with controls. In columns (1) and (2), CSR is negatively and significantly associated with FC, with coefficients of -0.002 and -0.003, respectively. These coefficients are statistically significant at the 1% level, with t-values of -10.23 in column (1) and -20.37 in column (2). This intense negative relationship suggests that higher levels of corporate social responsibility are associated with lower financial constraints. This could indicate that increased CSR activities might reduce a company's financial constraints (Cheng, Ioannou, & Serafeim, 2014), possibly through enhanced reputation, capital access, or reduced costs. As a result, hypothesis H2 is supported.

In addition, Table 7 also reports the relationships between FC and other variables. Specifically, BI has a coefficient of -0.000 (t=-0.24), indicating no significant relationship between BI and FC. Thus, board independence does not significantly impact financial constraints in this model. LEV has a strongly negative and highly significant relationship with FC, with a coefficient of -0.870 (t=-57.86). This suggests that higher leverage is associated with reduced financial constraints, possibly because firms with higher leverage may have better-established creditworthiness or greater access to debt markets, which can alleviate financial constraints. The variable NATURE has a significantly negative coefficient of -0.065 (t = -9.33), suggesting that the firm's nature negatively influences FC. This could imply that state-owned firms might be linked to reduced financial constraints, consistent with Behr, Norden, and Noth (2013) and Cull, Li, Sun, and Xu (2013). The coefficient for AGE is -0.002 (t=-3.24). This indicates a negative relationship between a firm's age and financial constraints, suggesting that older firms experience fewer financial constraints, possibly due to more established relationships with financial institutions and a stronger market presence.



© 2025 AESS Publications. All Rights Reserved.

**Table 6.** Robustness tests.

| Variable | Alternative sample period | | Alternative measure | | 2SLS regression | |
|---|---|---|---|---|---|---|
| | (1) RD | (2) RD | (3) RD | (4) RD | (5) CSR | (6) RD |
| L.CSR | | | | | 0.541*** | |
| | | | | | (85.22) | |
| CSR | 0.023*** | 0.024*** | | | | 0.024*** |
| | (14.02) | (13.40) | | | | (15.98) |
| ES | | | 0.027*** | 0.018*** | | |
| | | | (8.81) | (5.98) | | |
| BI | | 0.004 | | 0.004 | -0.010 | 0.010*** |
| | | (0.92) | | (0.97) | (-0.57) | (4.39) |
| LEV | | 2.352*** | | 1.930*** | -1.493*** | 1.564*** |
| | | (16.08) | | (13.95) | (-2.64) | (21.50) |
| NATURE | | 0.257*** | | 0.279*** | 1.526*** | -0.020 |
| | | (3.99) | | (4.41) | (6.50) | (-0.65) |
| AGE | | -0.011** | | -0.017*** | -0.040** | 0.000 |
| | | (-2.17) | | (-3.46) | (-2.11) | (0.11) |
| GROW | | 0.095** | | 0.154*** | 3.557*** | 0.084** |
| | | (2.43) | | (4.97) | (13.01) | (2.37) |
| CP | | -0.063 | | -0.044 | -0.321 | 0.035 |
| | | (-1.38) | | (-1.02) | (-1.32) | (1.12) |
| FSP | | 0.001 | | 0.005*** | 0.050*** | 0.000 |
| | | (0.81) | | (2.85) | (6.94) | (0.09) |
| RISK | | -37.253*** | | -62.897*** | -590.584*** | -37.409*** |
| | | (-7.43) | | (-13.79) | (-21.93) | (-10.20) |
| _cons | 16.685*** | 13.396*** | 16.190*** | 15.022*** | 9.252*** | 16.331*** |
| | (40.68) | (20.02) | (45.32) | (42.10) | (11.03) | (146.71) |
| Industry-fixed | Yes | Yes | Yes | Yes | No | No |
| Year-fixed | Yes | Yes | Yes | Yes | No | No |
| N | 12205 | 9888 | 19344 | 16695 | 13,875 | 13,875 |
| Adjusted R-squared | 0.134 | 0.228 | 0.136 | 0.219 | 0.408 | 0.043 |

**Note:** Columns (1) and (2) report the results of Equation 1 using a different sample period (2015-2020) without and with controls. Columns (3) and (4) present the results of Equation (2) estimated without and with controls. (1) to (4) use OLS regression with year and industry-fixed effects. Columns (5) and (6) present the results of the 2SLS regression. Column (5) presents the results of the first-stage regression. Column (6) presents the results of the second-stage regression. T-statistics are shown in parentheses. ***, ** denote the significance at 5%, and 10, respectively.



© 2025 AESS Publications. All Rights Reserved.

As well as, the relationship between GROW and FC is negligible, with a coefficient of -0.000 (t=-0.03), indicating no significant effect on FC. CP is positively and significantly associated with FC, with a coefficient of 0.031 (t=5.35). This suggests that combining the positions of general manager and chairman of the board of directors may be linked to higher financial constraints (Nahar Abdullah, 2004), which could occur if growing firms have greater financing needs that outpace their internal funding capabilities. FSP shows a negative and significant relationship with FC, with a coefficient of -0.001 (t=-3.69). This indicates that firms whose first shareholders hold more shares tend to have lower financial constraints, likely due to greater access to capital markets and diversified funding sources. The coefficient for Risk is -0.033 (t=-0.06), indicating that this variable does not significantly influence FC in the model. The adjusted R-squared values are 0.123 for model (1) and 0.532 for model (2), indicating that model (2) explains a much larger proportion of the variance in FC.

In summary, CSR is negatively and significantly associated with FC, suggesting that CSR efforts might help reduce financial constraints faced by firms. Other significant relationships include leverage, nature, age, first shareholders' shareholding, and current position, highlighting the diverse factors influencing financial constraints. Notably, leverage and first shareholders' shareholding have strong negative impacts on financial constraints, indicating that larger first shareholders and more leveraged firms typically face fewer financial constraints.

**Table 7.** Correlation between CSR and financing constraints.

| Variable | (1) FC | (2) FC |
|---|---|---|
| CSR | -0.002***<br>(-10.23) | -0.003***<br>(-20.37) |
| BI | | -0.000<br>(-0.24) |
| LEV | | -0.870***<br>(-57.86) |
| NATURE | | -0.065***<br>(-9.33) |
| AGE | | -0.002***<br>(-3.24) |
| GROW | | -0.000<br>(-0.03) |
| CP | | 0.031***<br>(5.35) |
| FSP | | -0.001***<br>(-3.69) |
| Risk | | -0.033<br>(-0.06) |
| _cons | 0.428***<br>(8.23) | 0.825***<br>(25.43) |
| Industry-fixed | Yes | Yes |
| Year-fixed | Yes | Yes |
| N | 23452 | 20461 |
| Adjusted R-square | 0.123 | 0.532 |

**Note:** T-statistics are shown in parentheses. ***, ** denote the significance at 5%, and 10, respectively. Both estimations of the model (2) without and with controls are presented in columns (1) and (2) using industry and year-fixed effect OLS regression.

### *4.3.2. Relationship between Financial Constraints and R&D Investment*

*$H_3$: Financing constraints inhibit firms' R&D investment.*

Table 8 exhibits the findings of Hypothesis H3. In both versions of Model (3), without and with controls, FC has a strong negative and highly significant relationship with IP, with coefficients of -2.493 and -2.937, respectively, both statistically significant at the 1% level. This suggests that firms experiencing greater financial constraints tend to perform worse in R&D investment, potentially due to limited access to necessary resources for innovation efficiency. This finding is consistent with Sasidharan, Lukose, and Komera (2015). As a result, hypothesis H3 is supported.



© 2025 AESS Publications. All Rights Reserved.

Similar results are obtained from model (1) for the relationships between R&D investment and control variables. Other key factors influencing R&D investment include firm nature, age, growth rate, and risk exposure, with firm age and risk having notably negative impacts. In contrast, firm nature and growth rate are positive contributors. The findings underscore the critical role of financial health and firm characteristics in driving innovation outcomes, with financial constraints emerging as a major barrier to improved performance.

In summary, Model (3) results highlight a significant negative relationship between financial constraints and R&D investment, suggesting that financial constraints substantially hinder firm performance in R&D investment.

**Table 8**. Relationship between financial constraint and R&D investment.

| Variable | (1) RD | (2) RD |
|---|---|---|
| FC | -2.493*** | -2.937*** |
| | (-30.05) | (-30.00) |
| BI | | 0.006* |
| | | (1.84) |
| LEV | | -0.619*** |
| | | (-4.68) |
| NATURE | | 0.018 |
| | | (0.31) |
| AGE | | -0.025*** |
| | | (-5.70) |
| GROW | | 0.138*** |
| | | (4.83) |
| CP | | 0.047 |
| | | (1.28) |
| FSP | | 0.002 |
| | | (1.54) |
| RISK | | -59.001*** |
| | | (-13.95) |
| _cons | 17.029*** | 17.443*** |
| | (54.07) | (40.05) |
| Industry-fixed | Yes | Yes |
| Year-fixed | Yes | Yes |
| N | 20068 | 17402 |
| Adjusted R-squared | 0.317 | 0.355 |

**Note:** T-statistics are shown in parentheses. ***, ** denote the significance at 5%, and 10, respectively. Both estimations of the model (3) without and with controls are presented in columns (1) and (2) using industry and year-fixed effect OLS regression.

### *4.3.3. Mediating Effect of Financial Constraints on CSR and R&D Investment*

*H4: Financing constraints mediate the relationship between CSR and R&D investment.*

Based on the previous analysis, CSR alleviates firms' financial constraints, and financial constraints inhibit firms' R&D investment. The stepwise approach suggests that financial constraints are a channel through which CSR influences R&D investment. In the following step, this study uses the Sobel-Goodman Mediation Tests to verify the mediation effect.

Table 9 reports the results from the Sobel-Goodman Mediation Tests. The analysis of indirect, direct, and total effects provides a detailed examination of whether FC mediates the relationship between CSR and R&D. The Sobel, Aroian, and Goodman tests all indicate a significant indirect effect of CSR on R&D through FC, with the z-values for all tests approximately 3, demonstrating strong statistical significance ($p < 0.001$) for the mediation effect.

In addition, both the a_coefficient (0.372, p=0.000) and b_coefficient (4.220, p=0.000) are significantly positive, indicating that CSR significantly affects R&D through FC. The indirect effect (z=3.295, p=0.001) is statistically significant, reinforcing the conclusion that FC mediates the CSR–R&D relationship. The direct effect of CSR on R&D, after accounting for the mediation by FC, is insignificant (0.503, p=0.615), indicating that once FC is accounted for, CSR no longer directly impacts R&D investment. The total effect (c) is also insignificant (p=0.498), confirming that FC fully mediates the relationship between CSR and R&D.

Furthermore, the proportion of mediation and effect ratios further supports the presence of mediation. These results indicate that firms engaging in CSR experience a change in their financial constraints. This demonstrates



© 2025 AESS Publications. All Rights Reserved.

that FC has a strong and significant positive impact on R&D investment, suggesting that financial resource availability is a critical determinant of firms' innovation activities.

The findings suggest that financial constraints fully mediate the relationship between CSR and R&D investment. In other words, CSR does not directly affect R&D investment. Instead, its impact operates through changes in firms' financial constraints. These results have important implications for corporate finance and innovation management, highlighting the necessity of financial resource availability in translating CSR initiatives into R&D investment.

**Table 9.** Mediation analysis of financial constraints.

| Effect | Estimate | Standard error | z-value (z) | p-value (P>z) |
|---|---|---|---|---|
| Sobel Test | 0.000 | 0.000 | 3.295 | 0.001 |
| Aroian | 0.000 | 0.000 | 3.259 | 0.001 |
| Goodman | 0.000 | 0.000 | 3.332 | 0.001 |
| a_Coe | 0.000 | 0.000 | 4.220 | 0.000 |
| b_Coe | 0.372 | 0.070 | 5.273 | 0.000 |
| Indirect effect | 0.000 | 0.000 | 3.295 | 0.001 |
| Direct effect | 0.000 | 0.001 | 0.503 | 0.615 |
| Total effect | 0.000 | 0.001 | 0.677 | 0.498 |
| Proportion of total effect mediated | 0.257 | | | |
| Indirect to direct effect ratio | 0.347 | | | |
| Total to direct effect ratio | 1.347 | | | |

**Note:** This table reports the results, including the Sobel test.

## 5. CONCLUSION

This study investigates the impact of corporate social responsibility on research and development investment, with financial constraints serving as a mediating factor. The empirical results suggest that corporate social responsibility promotes firms' R&D investment. This finding remains consistent after verifying the stability and validity of the baseline results using alternative periods, alternative measures, and two-stage least squares regression. Additionally, we find that financial constraints mediate the relationship between corporate social responsibility and R&D investment.

The findings of this study enhance the understanding of CSR by highlighting its potential role in alleviating financial constraints. By improving corporate reputation and fostering trust among stakeholders, CSR activities can facilitate access to external financing. This insight extends existing theories by positioning CSR not merely as a cost but as a strategic tool to mitigate financial barriers. These insights provide a solid theoretical foundation for further exploration of the relationship between CSR, financial constraints, and R&D investment, emphasizing CSR's potential to serve as a catalyst for sustainable innovation in competitive markets.

Regulators should develop policies to encourage firms to participate in CSR activities. By cultivating a strong CSR culture and strategically linking it to innovation performance, practitioners can not only fulfill their social and environmental responsibilities but also gain a competitive advantage in an increasingly purpose-driven marketplace. Practitioners should emphasize CSR as a strategic priority, fostering a robust CSR culture within their organizations to align with evolving stakeholder expectations. This involves integrating CSR objectives with innovation strategies to develop economically viable, socially responsible, and environmentally sustainable solutions.

While this study has its innovations, it also has limitations. Firstly, it employs a single dataset from the Chinese market, which is characterized by unique institutional, cultural, and economic factors. Therefore, to extend the generalizability of the findings to broader contexts, future studies should examine the dynamics of CSR and R&D investment in other regions or global markets. Secondly, although this paper investigates the mediating role of financial constraints through which CSR influences R&D investment in Chinese firms, other underlying causes or pathways that significantly contribute to the relationship between CSR and R&D investment remain to be



© 2025 AESS Publications. All Rights Reserved.

explored. Lastly, future research could incorporate corporate governance into the analysis of the relationship between CSR and firms' R&D investment. Corporate governance influences organizational priorities, resource allocation, and strategic decision-making. Exploring the interaction between governance mechanisms and innovation outcomes could shed light on how governance structures enhance or constrain the effectiveness of CSR in promoting innovation.

**Funding:** This study received no specific financial support.
**Institutional Review Board Statement:** Not applicable.
**Transparency:** The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
**Data Availability Statement:** Upon reasonable request, the supporting data for this study can be provided by the corresponding author.
**Competing Interests:** The authors declare that they have no competing interests.
**Authors' Contributions:** All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

## REFERENCES

Behr, P., Norden, L., & Noth, F. (2013). Financial constraints of private firms and bank lending behavior. *Journal of Banking & Finance*, *37*(9), 3472-3485. https://doi.org/10.1016/j.jbankfin.2013.05.018

Bocquet, R., Le Bas, C., Mothe, C., & Poussing, N. (2013). Are firms with different CSR profiles equally innovative? Empirical analysis with survey data. *European Management Journal*, *31*(6), 642-654. https://doi.org/10.1016/j.emj.2012.07.001

Brammer, S., & Millington, A. (2008). Does it pay to be different? An analysis of the relationship between corporate social and financial performance. *Strategic Management Journal*, *29*(12), 1325-1343. https://doi.org/10.1002/smj.714

Calabrese, A., Costa, R., Menichini, T., & Rosati, F. (2013). Does corporate social responsibility hit the mark? A stakeholder oriented methodology for CSR assessment. *Knowledge and Process Management*, *20*(2), 77-89. https://doi.org/10.1002/kpm.1406

Carpenter, R. E., & Guariglia, A. (2008). Cash flow, investment, and investment opportunities: New tests using UK panel data. *Journal of Banking & Finance*, *32*(9), 1894-1906. https://doi.org/10.1016/j.jbankfin.2007.12.014

Carpenter, R. E., & Petersen, B. C. (2002). Is the growth of small firms constrained by internal finance? *Review of Economics and Statistics*, *84*(2), 298-309. https://doi.org/10.1162/003465302317411541

Chen, H., Zhong, T., & Lee, J. Y. (2020). Capacity reduction pressure, financing constraints, and enterprise sustainable innovation investment: Evidence from Chinese manufacturing companies. *Sustainability*, *12*(24), 10472.

Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*, *35*(1), 1-23. https://doi.org/10.1002/smj.2131

Coad, A., Segarra, A., & Teruel, M. (2016). Innovation and firm growth: Does firm age play a role? *Research Policy*, *45*(2), 387-400. https://doi.org/10.1016/j.respol.2015.10.015

Cull, R., Li, W., Sun, B., & Xu, L. C. (2013). *Government connections and financial constraints*. Washington, DC: The World Bank.

Dai, W., & Wu, X. (2024). Corporate social responsibility, financing constraints and firm innovation. *Journal of Hubei University of Technology*, *39*(6), 40–45.

Fazzari, S. M., Hubbard, R. G., Petersen, B. C., Blinder, A. S., & Poterba, J. M. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity*, *1988*(1), 141-206. https://doi.org/10.2307/2534426

Fee, C. E., Hadlock, C. J., & Pierce, J. R. (2009). Investment, financing constraints, and internal capital markets: Evidence from the advertising expenditures of multinational firms. *The Review of Financial Studies*, *22*(6), 2361-2392. https://doi.org/10.1093/rfs/hhn059

Gallego-Álvarez, I., Manuel Prado-Lorenzo, J., & García-Sánchez, I. M. (2011). Corporate social responsibility and innovation: A resource-based theory. *Management Decision*, *49*(10), 1709-1727. https://doi.org/10.1108/00251741111183843

Gu, L., Li, J., & Peng, Y. (2018). Internal and external financing conditions, financing constraints and firm performance—new evidence from a survey of firms in Beijing-Tianjin-Hebei Region. *Economic Theory and Economic Management*, *7*, 88–99.



© 2025 AESS Publications. All Rights Reserved.

Gujarati, D., & Porter, D. (2004). *Basic econometrics*. New York, NY, USA: Mcgraw-Hill Companies.

Gujarati, D. N. (2021). *Essentials of econometrics* (4th ed.). New York: Sage Publications.

Harhoff, D. (1997). *Are there financing constraints for R&D and investment in German manufacturing firms?* No. FS IV 97-45.

Hart, T. A., & Sharfman, M. (2015). Assessing the concurrent validity of the revised Kinder, Lydenberg, and Domini corporate social performance indicators. *Business & Society, 54*(5), 575-598. https://doi.org/10.1177/0007650312455793

Ji, W., & Fan, W. (2021). Does higher management shareholding contribute to innovation? —A study based on different ownership and industry backgrounds. *Accounting Friends, 14*, 46-53.

Kang, Z. (2013). Research on technology selection, input intensity, and enterprise innovation performance. *Research Management, 34*(6), 42–49.

Kaplan, S. N., & Zingales, L. (1997). Do investment-cash flow sensitivities provide useful measures of financing constraints? *The Quarterly Journal of Economics, 112*(1), 169-215. https://doi.org/10.1162/003355397555163

Kennedy, H. P. (2004). Enhancing Delphi research: Methods and results. *Journal of Advanced Nursing, 45*(5), 504-511. https://doi.org/10.1046/j.1365-2648.2003.02933.x

Li, W., Zheng, M., Zhang, Y., & Cui, G. (2020). Green governance structure, ownership characteristics, and corporate financing constraints. *Journal of Cleaner Production, 260*, 121008.

Li, X. E., & Peng, H. G. (2010). An empirical study on the relationship between corporate social responsibility disclosure and corporate reputation. *Economic System Reform*, (3), 74–76.

Lian, Y. (2010). Financing constraints and liquidity management behaviour. *Finance Research, 10*(364), 158–171.

MacGregor, S. P., & Fontrodona, J. (2008). Exploring the fit between CSR and innovation. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1269334

Mattingly, J. E., & Berman, S. L. (2006). Measurement of corporate social action: Discovering taxonomy in the Kinder Lydenburg Domini ratings data. *Business & Society, 45*(1), 20-46. https://doi.org/10.1177/0007650305281939

Moskowitz, M. (1972). Choosing socially responsible stocks. *Business and Society Review, 1*(1), 71-75.

Nahar Abdullah, S. (2004). Board composition, CEO duality and performance among Malaysian listed companies. *Corporate Governance: The International Journal of Business in Society, 4*(4), 47-61. https://doi.org/10.1108/14720700410558871

Ohlson, J. A. (1980). Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research, 18*(1), 109-131. https://doi.org/10.2307/2490395

Peng, Z., & Han, R. (2016). Financing constraints, corporate governance, and R&D expenditure: Based on panel data of listed companies in the equipment manufacturing industry. *Journal of Xiangtan University (Philosophy and Social Sciences Edition), 40*(3), 1–8.

Petersen, M. A. (2008). Estimating standard errors in finance panel data sets: Comparing approaches. *The Review of Financial Studies, 22*(1), 435-480.

Preston, L. E., & O'bannon, D. P. (1997). The corporate social-financial performance relationship: A typology and analysis. *Business & Society, 36*(4), 419-429. https://doi.org/10.1177/000765039703600406

Sasidharan, S., Lukose, P. J., & Komera, S. (2015). Financing constraints and investments in R&D: Evidence from Indian manufacturing firms. *The Quarterly Review of Economics and Finance, 55*, 28-39. https://doi.org/10.1016/j.qref.2014.07.002

Sharfman, M. (1996). The construct validity of the Kinder, Lydenberg & Domini social performance ratings data. *Journal of Business Ethics, 15*, 287-296.

Tsai, H., Tsang, N. K., & Cheng, S. K. (2012). Hotel employees' perceptions on corporate social responsibility: The case of Hong Kong. *International Journal of Hospitality Management, 31*(4), 1143-1154. https://doi.org/10.1016/j.ijhm.2012.02.002

Wang, Q., & Wang, J. (2021). Research on financing efficiency and influencing factors of equipment manufacturing industry. *Journal of Intelligent and Fuzzy Systems, 12*, 1-10.

Yu, D., & Li, X. (2021). Environmental regulation, financing constraints and corporate innovation. *Ecological Economics, 37*(4), 44-49.



© 2025 AESS Publications. All Rights Reserved.

Yu, H., & Kang, C. (2017). Research on financing mechanism of small and medium-sized enterprises based on the perspective of supply chain finance. *Nankai Economic Research*, *4*, 141–152.

Zeng. (2013). *Financing constraints, financing channels and corporate R&D investment—A dynamic panel data analysis based on listed companies in China*. China: Nanjing University.

Zeng, H., Chen, J., & Zhou, Z. (2020). The interactive intertemporal effects of innovative capability and corporate social responsibility: An informal institutional moderation effect perspective. *R&D Management*, *32*(5), 111–125. https://doi.org/10.13581/j.cnki.rdm.20190772

Zhang, J., Wang, Y., & Quan, X. (2024). Institutional investor ownership, life cycle and corporate social responsibility. *Corporate Governance*, *17*, 82–88.

Zhou, K., Lu, Y., & Yang, H. (2017). Financing constraints, innovation capability and collaborative innovation of enterprises. *Economic Research Malefactor*, *52*(7), 94-91 08.

Zhu, N.-P., Zhu, L., & Kong, Y. (2014). Research on the synergistic effect of technological innovation investment and social responsibility undertaking on financial performance. *Accounting Research*, *2*, 33-41.

**Appendix 1.** Calculation of the financial constraints Z index.

Following Fee et al. (2009) and Chen, Zhong, and Lee (2020), this study uses the following models to calculate the comprehensive Z index to measure firms' degree of financial constraints.

$$Z_{i,t} = a_0 + a_1 Size_{i,t} + a_2 Lev_{i,t} + a_3\left(\frac{CashDiv}{Ta}_{i,t}\right) + a_4 Mb_{i,t} + a_5\left(\frac{NWC}{ta}\right)_{i,t} + a_6\left(\frac{EBIT}{ta}\right)_{i,t} \quad \text{(a)}$$

Whereas Size equals the natural logarithm of total assets, Lev equals total debt scaled by total assets, and CashDivi is the cash dividends paid in the given year. Mb equals market value scaled by book value. NWC equals current assets minus current debt. EBIT is earnings before interest and taxes. Ta is the total assets.

Logistic regression is applied in the model (a) to estimate the annual probability of firms experiencing financing constraints. This probability is represented by the Financing Constraint Index (FC), which ranges from 0 to 1. A higher FC value indicates more severe financing constraints faced by the firm.

*Views and opinions expressed in this article are the views and opinions of the author(s), Asian Economic and Financial Review shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.*



© 2025 AESS Publications. All Rights Reserved.