Research Article

Empirical Research on Seasoned Equity Offerings, Board Member Characteristics, and Corporate Investment Efficiency

Dapeng Zhu¹ and Yongli Li²

¹School of Accounting, Harbin University of Commerce, Harbin 150028, China
²School of Economics and Management, Harbin Institute of Technology, Harbin 150001, China

Correspondence should be addressed to Yongli Li; liyongli@hit.edu.cn

Received 29 November 2021; Revised 27 December 2021; Accepted 5 March 2022; Published 20 March 2022

1. Introduction

Seasoned equity offering (SEO) refers to the behavior of listed enterprises to refinance through equity, including the issuing of rights (i.e., private and public placements), new shares, and convertible bonds. As an important direct financing approach of listed companies, SEO plays a significant role in boosting high-quality economic development. Ever since the issuance of the Provisional Regulations on the Administration of Share Issuance and Trading of April 22, 1993, SEO has promoted the high-quality development of numerous enterprises for almost three decades. The refinancing amount in China’s A-share market was as high as 13 trillion Yuan, which is 3.5 times that of the initial public offering (IPO) fundraising amount. On February 14, 2020, the China Securities Regulatory Commission officially issued a series of supporting policies (the New Refinancing Regulation) to optimize the refinancing on the main board and GEM. The new refinancing regulation is more flexible and broader, relaxing the regulation on the issue price, issue scale, and restricted period of private placement, which favors activating the refinancing market and giving full play to the financing functions of the capital market. The adjustment of refinancing policy has remarkably revitalized the market. Throughout 2020, the issue scale of the market evidently increased. There were a total of 390 companies releasing the SEO plan, and the fund raised was over 910 billion Yuan, which far exceeded the number and amount of...
2019. It is estimated that the refinancing market will grow steadily, complement IPO issuance effectively, and jointly give full play to financing for excellent enterprises.

SEO of listed companies is an important means to replenish funds after IPO, and the purpose of some enterprises’ refinancing is to expand their business scale, extend the upstream or downstream of industrial chains, or improve their market share. It can create technological innovation or raise money for research and development. To improve the enterprise’s financial situation, the acquisition of the target company improves the company’s profitability and asset quality. As a major decision of the enterprise, refinancing should be proposed by the board of directors, approved by the general meeting of shareholders, and submitted to the regulatory authorities for examination and approval. Only after the examination and approval of the China Securities Regulatory Commission can it be implemented. Refinancing expands the share capital of listed companies, and refinancing participants will generally obtain discount subscriptions, which cause large fluctuations in the stock price during the refinancing process. After the completion of SEO, there is a decline in performance of certain companies.

SEO can create cash flow, meet the capital demand, and support the development of listed companies. However, due to the agency conflicts and information asymmetry, some companies may be caught in overinvestment after the rights offering. Whether listed companies will rationally use these refinancing funds to increase corporate value and shareholder interests have become a concern in public and academic circles.

The top management team is a key leader of the company’s daily operations and strategic decisions. SEO decision is important and hence would certainly be impacted by the top management team, especially the board of directors of listed companies. If they can effectively resolve principal-agent problems arising between shareholders and the management team and reduce the information asymmetry, it would solve the problem of underinvestment, guarantee the interests of shareholders and other stakeholders more thoroughly, and ensure steady development of the enterprise after SEO. This study can measure the variable of board heterogeneity to a certain degree, and observe its effect on the relationship between SEO and corporate investment efficiency.

In this study, the effect of board member characteristics on the investment efficiency of listed companies after SEO is studied, which provides a basis of decisions for the use of fund by listed companies after SEO. Furthermore, the role of the board of directors in the satisfaction of capital demand and proper use of refinancing funds after the SEO is discussed, which regards certain guiding significance for optimizing the structure of the board of directors and giving full play to their role in listed companies. In this study, the effect of characteristics for refinancing decision makers on the drive and restriction of investment efficiency after SEO is analyzed from an internal viewpoint, which provides capital market investors with references for investment decisions, enables them to understand the impacts of the top management teams’ characteristics on SEO, allows them to select more suitable refinancing listed companies for investment, and improves the investment efficiency and rate of return.

2. Literature Review

2.1. Literature on SEO and Investment Efficiency. SEO is an important approach for Chinese listed companies to replenish the fund, and features inter alia a large financing scale and positive signal to the market. However, due to the imperfect market order, incomplete regulatory system, and characteristics of the capital market, owners are usually concerned about whether management can make proper use of the refinancing fund. Scholars have explored the impact of SEO on the investment efficiency of enterprises, but the research mainly focuses on overinvestment. According to the analysis based on the information asymmetry and principal-agent theories, it is insisted that information asymmetry and agency problems are the primary causes of overinvestment.

For instance, Jensen and William had integrated the elements of the agency, property right, and financial theories to develop the enterprise ownership structure theory. They studied the nature of agent costs arising from debt and external equity. It was insisted that the refinancing of listed companies was the decision of operators based on their own interests. For shareholders, refinancing is disadvantageous. Such a behavior enlarges the agency conflict and contributes to the phenomenon of overinvestment [1]. Myers and Majluf not only lay the theoretical foundation for the negative effect of refinancing announcement, but also raise doubts about insiders’ established intention of expected capital inflow and whether the project investment is carried out in a value-added way [2]. Jensen argued that the payment to shareholders reduced the power of managers, and when the company must acquire new capital, it would more likely be supervised by the capital market. He proposed the free cash flow hypothesis, insisting that when the company lacked opportunities for growth, if the cash flow of the existing asset exceeds the scale of moderate investment, managers may have the motivation of over investment with the free cash flow [3]. Cronqvista and Nilssonb examine how firms choose between a right offering and private equity placement. Family controlled firms avoid issue methods that dilute control benefits, or subject them to more monitoring. Control considerations also affect issue methods that dilute control benefits, or subject them to more monitoring. Control considerations also affect security designs. Private placements reduce contracting and ex post holdup costs in new product market relationships [4]. Walker and Yost indicate that, regardless of the stated use of funds, firms increase capital expenditure, research, and development following SEO. In addition, firms increase their long-term debt following SEO, even when the stated reason for the capital was to pay down debt [5]. Harford et al. found that enterprise tended to reduce the refinancing risks by increasing cash holdings and saving cash from the cash flow. The increase of cash reserves could reduce under-investment, while refinancing enterprises may tend to over-invest after holding a large amount of cash [6].
2.2. Literature on the Influence of the Top Management Teams’ Characteristics on Investment Efficiency. The management, as top managers of the enterprise, refers primarily to members of the board of directors and board of supervisors, and the chief executive officer (CEO), who possess the resource allocation and decision-making power, with a major impact on the operation, fundraising, and investment activities of the enterprise. Hambrick and Masons proposed the high-tier team theory from the “top management view,” insisting that top managers would make a highly individualized interpretation and decision, according to the organizational context. Top managers decide on the formation of organizational strategies and affect the behaviors of other members of the organization, as a significant influencing factor of corporate performance [7]. Thereafter, much literature appeared on the impacts of individual manager characteristics, including gender, age, and educational, functional, overseas, and financial backgrounds regarding the financial decision-making activities of enterprises in the academic circle.

The sex difference of top managers is usually reflected by different values, attitudes, risk preferences, etc. Some scholars insist that female top managers can effectively inhibit the overinvestment of enterprises. For instance, Carter et al. find significant positive relationships between the fraction of women on the board and firm value [8]. Lückerath-Rovers finds that firms with women directors perform better than those without women on their boards [9]. Isidro and Sobral find that greater female representation on corporate boards of large European firms can increase firm value indirectly [10]. Shin et al. find that female directors show a positive correlation with investment efficiency, based on the same data of listed companies from 2006 to 2014 in South Korea, and female directors were risk-averting, conservative, and discrete, so they can influence the investment efficiency by reducing overinvestment [11]. Hoang et al. finds that female-managed firms are less likely to operate in industries with high levels of risk [12]. Ullah et al. finds that female directors on corporate boards are positively associated with firm value [13]. Some scholars propose opposite viewpoints. For instance, David insisted that there is no explicit and unified relationship between sex diversity and corporate performance for service/wholesale/retail sectors [14]; Adams and Ferreira argued that for companies who excel at corporate governance, sex diversity of directors may lead to over-regulation, and have a negative impact on corporate performance [15]; Hussein and Kiwia also found that sex diversity of directors may fail to improve corporate performance, based on the sample data of 250 American companies from 2000 to 2006 [16]. Darmadi finds that both accounting and market performance have significant negative associations with gender diversity [17]. Zhi Jin et al. find that the association between female directors and investment efficiency is negative and significant in examining the role of female directors in board governance [18]. Midavaine finds that gender diversity encourages firms invest more. The findings also illustrate that female CEOs (FCEOs) enhance firm value [19].

The age of top managers usually impacts their attitude towards risks. Vroom and Pahl [20] and Wiersema and Bantel [21] argue that the cognitive views of top managers (reflected by the demographic characteristics of the team) were related to the team’s tendency to change the corporate strategy. There was a significant negative correlation between age and risk bearing/value. Younger top managers would look at new opportunities with a more positive attitude, have stronger adaptability, and a creative spirit. Older top managers are more conservative with investment risks and have a declining understanding of new technology and awareness of decision-making projects, as they prefer a steady working environment as opposed to changes. Vincent and Mueller finds that research and development (R&D) spending is greater at firms where CEOs are younger and have greater wealth invested in firm stock [22]. Chowdhury and Fink find that not only do older CEOs invest in less R&D, they also do so suboptimally [23]. Andreou et al. find that firms with younger CEOs are more likely to experience stock price crashes [24].

Educational background usually reflects on the decision-making power of top managers. Bantel and Jackson insist that the higher the education level of top manager, the richer the knowledge reserve, and the stronger the adaptability to the environment and ability to obtain and analyze information, which is conducive to strategic change and performance of the company [25]. Thahnyi et al. demonstrated that a higher mean of elite education and international experience were related to the international diversification of the company, and emphasized the importance of top management teams in international decision-making [26]. Giannetti et al. studied the influence of directors with foreign experience on the corporate performance in the emerging market, and found that top managers with foreign experience usually possessed a strong learning ability, high professional knowledge levels, and high business operation levels. Which could create more advanced management approaches, further alleviate agency conflicts, and improve innovation [27]; Filatotchev et al. insists that export orientation and performance relied not only on the development of R&D and technology transferability but also on the founder’s international background, global network, and other entrepreneurial characteristics. Both export orientation and performance are positively correlated to the existence of “returned” entrepreneurs [28]. Walt and Ingley explored the appointment of directors of various professional backgrounds, levels of independence, age, gender, and ethnicity. This study develops a taxonomy describing what is meant by diversity on the board and its implications for decision-making [29].

The abovementioned literature research also shows that the investment efficiency of enterprises is impacted by the inherent problems of corporate system, such as principal-agent relationships, corporate operations (e.g., cash holdings), and governance-level factors (e.g., board member characteristics).

Existing literature proves that scholars have conducted numerous studies on the impact of equity refinancing for investment efficiency, especially regarding different
refinancing methods. However, due to the differences in refinancing systems of various countries, its impact on investment efficiency is also inconsistent. The characteristics of senior executives have a greater impact on investment efficiency, while board member characteristics have less impact on investment efficiency after refinancing. What is the role of SEO, as an important decision of listed companies? What are the functions of the board of directors’ characteristics when refinancing listed companies? Further discussion is carried out in this study.

3. Theoretical Analysis and Hypotheses

Due to the principal-agent problem, shareholders, and operators, as rational and economical, would pursue maximum profits and make self-benefiting investment decisions. To seek extrabenefits, top managers may make investment decisions that harm the interest of investors with their power. In the case of highly centralized equity, controlling the shareholders of refinancing companies can transfer the raised fund or profits to major shareholders, by way of asset restructuring, related party transactions, occupation of listed funds, and so forth, through their power of control. Thus, the capital for investment may be reduced and listed companies may also reduce the capital investment. Agency conflict may force shareholders or top managers to choose projects that may increase their own value but reduce the value of the enterprise or abandon projects that may increase the value of the enterprise but reduce their own value, which may result in inefficient investments. According to the free cash flow theory, the uneven benefit distribution of the company may also urge managers to remake investments with the excess free cash flow to seek profits or take up position-related consumption, which would lead to the improper use of fund and underinvestment. Thus, the large cash flow brought about by SEO may not be utilized completely and rationally.

Since most objects of equity refinancing are major shareholders, the shareholding ratio of major shareholders is further increased after equity refinancing, and the phenomenon of “one dominant share” is more serious, resulting in ignoring the voice of minority shareholders; this aggravates the tunneling behavior of major shareholders. In addition, the SEO review process is lengthy. After the review and approval process is completed, some investment opportunities are missed and the investment of raised funds lags, resulting in the failure of investment projects to meet expectations and the decline of investment efficiency. Therefore, hypothesis 1 is put forward, as follows:

H1: SEO reduces corporate investment efficiency.

Upper Echelons Theory holds that due to the complexity of internal and external environments, managers cannot have a comprehensive understanding of all its aspects. Even within the scope of the manager’s field of vision, they can only selectively observe the phenomenon. Thus, managers’ existing cognitive structure and values determine their ability to interpret the relevant information. The heterogeneity of the board of directors reflects the corporate governance level. Different characteristics of board members, such as *inter alia* their sex, age, and educational, overseas, and functional background, may influence their decision-making for investments. The influence mechanism is shown in Figure 1.

Therefore, hypothesis 2 is put forward, as follows:

H2: characteristics of the board of directors influence the investment efficiency of refinancing companies.

The age of board members usually means an increase in experience. The older a board member, the more experience, which may help improve the management ability. However, the growth in age also means a more conservative board. Elders may not be as ambitious as youngsters, which may influence the corporate operation. After SEO, the enterprise obtains a large amount of money and must invest in major projects. Concurrently, the pre-investment decision-making has already been made before SEO, and the post-investment management is still necessary. The management’s experience is more important than brevity, but the high age heterogeneity of board members would also slow down investment progress and impact investment efficiency. Therefore, the following hypotheses are proposed:

H2a1: the age heterogeneity of board members inhibits the investment efficiency of refinancing enterprises.
H2a2: the older the mean age of board members, the higher the investment efficiency of refinancing enterprises.

Sex diversity of the board of directors may increase disagreements in major investment projects and impact investment efficiency. Females are more risk-averse than males, which is beneficial for risk control, but may lower efficiency. In terms of investment, slow progress may be made in investment decision-making due to cautiousness, and females may tend to avert conflicts and be less proficient in monitoring the tunneling by major shareholders and duty encroachment.

Moreover, due to China’s vast territory and complex social structure, the influence of the gender equality ideology also varies significantly in different regions. There are also obvious differences in the concept of gender equality in different regions, resulting in the role of female board members being disadvantaged in some companies.

Therefore, the following hypotheses are proposed:

H2b1: sex heterogeneity of the board of directors inhibits the investment efficiency.
H2b2: female directors inhibit the investment efficiency of refinancing enterprises.

The overseas experience of board members would create overseas experience, but may be unable to adapt to the Chinese conditions and lower the investment efficiency. Thus, the following hypothesis is proposed:
H2c: the overseas background of board members has a negative impact on the investment efficiency of refinancing enterprises.

4. Research Design

4.1. Data Source and Sample Selection. The data mainly consists of personal characteristics of top managers, which is taken from the CSMAR database, and of company characteristics, which is taken from the CSMAR and Choice databases. The research samples are A-shares from 2009 to 2020, excluding ST and *ST, financial enterprise, and private placement samples of back-door listings. After combination with the data of personal characteristics of top managers, 22,660 observed items are obtained. Considering the impact of extreme value, 1% and 99% winsorization is carried out for major continuous variables.

4.2. Variable Definition

4.2.1. Explained Variable. Investment efficiency (Inveffi): currently, there are three types of predominant models for the measurement of corporate investment efficiency: the investment—cash flow sensitivity model, cash flow—investment opportunity cross-sectional discriminant model, and residual measurement model. As explained by Richardson [30], the residual measurement model can directly measure whether the enterprise launches over- or under-investment, with relatively robust results. Therefore, it has been widely applied to the measurement of investment efficiency by both domestic and foreign scholars.

Richardson’s model is applied as follows:

\[ \text{Inveffi}_{it} = \alpha + \beta_1 \text{Growth}_{it-1} + \beta_2 \text{Lev}_{it-1} + \beta_3 \text{Cash}_{it-1} + \beta_4 \text{Age}_{it-1} + \beta_5 \text{Size}_{it-1} + \beta_6 \text{Return}_{it-1} + \beta_7 \text{Invest}_{it-1} + \sum \text{Year} + \sum \text{Industry} + \epsilon_{it}. \]

(1)

The investment efficiency is judged by the sign of the residual of the investment model. If it is positive, it shows overinvestment (OverInv), and the actual investment level of the enterprise is greater than expected, or it shows underinvestment (UnderInv). Investment efficiency (Inveffi): the absolute value of the residual is taken. The greater the absolute value of the residual, the lower the investment efficiency.

4.2.2. Explaining Variable

SEO: this has three forms: rights offering, issuing new shares, and convertible bonds. If the company chooses any of the three refinancing methods within a year, it will be defined as a refinancing company, and in terms of the measurement of refinancing behavior, it is valued as 1 in this paper, with a nonrefinancing company as 0.

4.2.3. Control Variable. In this study, enterprise size, financial leverage, return on investment (ROA), cash holdings, sales growth rate, and establishment year are selected as the control variables from the company level, while major shareholder shareholding ratio, board size, and director’s pay are selected as the control variables from the governance level. In addition, the impact of the year and industry on the regression results is controlled. The variable definition is shown in Table 1.

4.3. Modelling. Considering the possible endogeneity problem between SEO and overinvestment, the explained variables are lagged by one period in this study; thus, the influence of refinancing behavior on the following year’s investment tendency of the enterprise is observed.

To verify hypothesis 1: SEO would lower the investment efficiency of the enterprise. Model (1) is established in this study, and regression analysis is conducted on the full sample.

\[ \text{Inveffi}_{it} = \alpha_0 + \alpha_1 \text{SEO}_{it-1} + \alpha_2 \text{Size}_{it} + \alpha_3 \text{Lev}_{it} + \alpha_4 \text{ROA}_{it} + \alpha_5 \text{Cash}_{it} + \alpha_6 \text{Growth}_{it} + \alpha_7 \text{Estage}_{it} + \alpha_8 \text{Shrcri}_{it} + \alpha_9 \text{BoardSize}_{it} + \alpha_{10} \text{BoardPay}_{it} + \alpha_{11} \text{Indu} + \alpha_{12} \text{Year} + \epsilon, \]

(2)

where $\alpha$ is a constant, $\alpha_i$ is the regression coefficient. If SEO$_{it-1}$ regression coefficient is positive, the investment efficiency of refinancing companies decreases.
To verify hypothesis 2: the board heterogeneity of refinancing companies would impact the investment efficiency. Refinancing companies are selected for analysis, and model 2 is established. Board represents the characteristics of board members, and five variables, including AgeH, AgeM, Sex, Women and Oversea, are substituted in model equation (3) for regression analysis.

\[
\text{Inveff}_{i,t} = \beta_0 + \beta_1 \text{Board}_{i,t} + \beta_2 \text{Size}_{i,t} + \beta_3 \text{Lev}_{i,t} \\
+ \beta_4 \text{ROA}_{i,t} + \beta_5 \text{Cash}_{i,t} + \beta_6 \text{Growsh}_{i,t} \\
+ \beta_7 \text{Estage}_{i,t} + \beta_8 \text{Shrcr}_{i,t} + \beta_9 \text{BoardSize}_{i,t} \\
+ \beta_{10} \text{BoardPay}_{i,t} + \beta_{11} \text{Indu} + \beta_{12} \text{Year} + \epsilon. \tag{3}
\]

5. Empirical Analysis
5.1. Descriptive Statistics and Correlation Analysis. Samples are screened according to the requirements stated previously, and 23,963 samples from 2009 to 2020 are obtained. To eliminate the interference of outliers, 1% and 99% winsorization has been conducted for all continuous variables. First, basic descriptive statistics are conducted for related variables involved in model I. These results are shown in Table 2.

SEO companies account for 14.4%, mainly in the form of issuing new shares. Issuing new shares accounts for 12.9%. Rights offering accounts for 5%. Issuing convertible bonds accounts for 1.1%. Issuing new shares, especially private placement, makes it easier to obtain funds than rights offering, and is becoming more favored by the capital market. Convertible bonds also play a role in the refinancing market because of their flexibility in combining equity and debt. Since rights offering can only possess original shareholders, according to the shareholding proportion allotment, they lead to more restrictions and are used less by companies.

SEO listed companies from 2009 to 2020 are studied in model 2, and 6,034 variables are obtained. Refer to variable statistics in Table 3.

5.2. Regression Results and Analysis. The regression results of model 1 are shown in Table 4, which empirically tests the impact of SEO on the investment efficiency of enterprises. The correlation between SEO (1) and investment efficiency
variables is positive and significant at the 1% level, indicating that refinancing inhibits investment efficiency, which verifies \(H1\). Among the three SEO methods, the relationship between issuing new shares (2) and investment efficiency variables is positive and significant at the 1% level, indicating that issuing new shares inhibits the SEO. The correlation between rights offering (3) and investment efficiency variables is positive, suggesting that it inhibits investment efficiency, but not significantly. The correlation between the convertible bond (4) and investment efficiency variables is negative, indicating that it promotes the investment efficiency, but not significantly.

The regression results of the verification of \(H2a\) by model 2 are shown in Table 5, which empirically verifies the impact of the age characteristics of board members on the investment efficiency of refinancing companies. According to the empirical results, the correlation between age heterogeneity and investment efficiency variables is positive and significant at the 1% level, suggesting that the higher the age heterogeneity of refinancing companies, the lower the investment efficiency. This verifies \(H2a1\). The correlation between the mean age and investment efficiency variables is negative and significant at the 1% level, indicating that the older the age of directors in refinancing companies, the higher the investment efficiency. This verifies \(H2a2\).

The regression results of the verification of \(H2b\) by model 2 are shown in Table 6 and empirically verify the impact of sex characteristics of board members on the investment efficiency of refinancing companies. They suggest that the correlation between sex heterogeneity of the board and investment efficiency of refinancing companies is positive and significant at the 5% level. This means that sex heterogeneity of the board inhibits investment efficiency of refinancing companies, which proves \(H2b1\). The correlation between females and investment efficiency variables is positive and significant at the 5% level, suggesting that the more females, the lower the investment efficiency. This proves \(H2b2\).

Regression results of the verification of \(H2c\) by model 2 are shown in Table 7, which verify the impact of overseas background of board members on the investment efficiency of refinancing companies. According to the empirical results, the correlation between overseas background heterogeneity and investment efficiency of invested companies is positive and significant at the 10% level, suggesting that the overseas background of directors inhibits investment efficiency of refinancing companies. This verifies \(H2c\).

| Table 2: Descriptive statistics of model 1. |
|--------------------------------------------|
| Variable | Mean | Std. dev. | Min | Max |
| Inveffi | 0.041 | 0.051 | 0.001 | 0.324 |
| SEO | 0.144 | 0.351 | 0 | 1 |
| NS | 0.129 | 0.335 | 0 | 1 |
| RO | 0.005 | 0.069 | 0 | 1 |
| CB | 0.011 | 0.103 | 0 | 1 |
| Size | 22.341 | 1.278 | 19.83 | 26.207 |
| Lev | 0.454 | 0.201 | 0.06 | 0.898 |
| ROA | 0.035 | 0.064 | -0.255 | 0.211 |
| Cash | 0.166 | 0.112 | 0.014 | 0.585 |
| Growth | 0.158 | 0.43 | -0.592 | 2.783 |
| Estage | 2.885 | 0.319 | 1.792 | 3.497 |
| Shrcr | 33.937 | 14.785 | 8.538 | 74.095 |
| BoardSize | 8.684 | 1.752 | 5 | 15 |
| BoardPay | 14.014 | 1.904 | 0 | 16.3 |

| Table 3: Descriptive statistics of model 2. |
|--------------------------------------------|
| Variable | Mean | Std. dev. | Min | Max |
| Inveffi | 0.051 | 0.055 | 0.001 | 0.317 |
| AgeH | 0.154 | 0.051 | 0.052 | 0.283 |
| AgeM | 50.888 | 3.61 | 42.429 | 60 |
| Sex | 0.218 | 0.161 | 0 | 0.494 |
| Women | 0.147 | 0.128 | 0 | 0.556 |
| Oversea | 0.147 | 0.16 | 0 | 0.494 |
| Size | 22.173 | 1.254 | 19.826 | 25.971 |
| Lev | 0.418 | 0.199 | 0.056 | 0.876 |
| ROA | 0.044 | 0.058 | -0.217 | 0.199 |
| Cash | 0.185 | 0.125 | 0.017 | 0.621 |
| Growth | 0.223 | 0.416 | -0.535 | 2.439 |
| Estage | 2.785 | 0.378 | 1.609 | 3.466 |
| Shrcr | 34.391 | 14.833 | 8.544 | 74.976 |
| BoardSize | 8.581 | 1.658 | 5 | 15 |
| BoardPay | 14.199 | 0.848 | 10.309 | 16.217 |
Table 4: Regression results of the relationship between SEO and investment efficiency.

|            | (1) Inveffi | (2) Inveffi | (3) Inveffi | (4) Inveffi |
|------------|-------------|-------------|-------------|-------------|
| SEO        | 0.006***    | 0.006***    | 0.008       | -0.002      |
|            | (0.001)     | (0.001)     | (0.006)     | (0.002)     |
| NS         | 0.006***    |             |             |             |
|            | (0.001)     |             |             |             |
| RO         | -0.001***   | -0.001***   | -0.001***   | -0.001***   |
|            | (0.002)     | (0.002)     | (0.002)     | (0.002)     |
| CB         | -0.005**    | -0.004*     | -0.005**    | -0.005**    |
|            | (0.006)     | (0.006)     | (0.006)     | (0.006)     |
| Size       | -0.009***   | -0.009***   | -0.01***    | -0.01***    |
|            | (0.003)     | (0.003)     | (0.003)     | (0.003)     |
| Lev        | 0.031***    | 0.031***    | 0.031***    | 0.031***    |
|            | (0.002)     | (0.002)     | (0.002)     | (0.002)     |
| ROA        | -0.008***   | -0.008***   | -0.008***   | -0.008***   |
|            | (0.001)     | (0.001)     | (0.001)     | (0.001)     |
| Cash       | 0****       | 0****       | 0****       | 0****       |
|            | (0)         | (0)         | (0)         | (0)         |
| Growth     | 0.08***     | 0.08***     | 0.077***    | 0.076***    |
|            | (0.011)     | (0.011)     | (0.011)     | (0.011)     |
| Estage     | -0.002**    | -0.002**    | -0.002**    | -0.002**    |
|            | (0.015)     | (0.015)     | (0.015)     | (0.015)     |
| Shrcr      | 0           | 0           | 0           | 0           |
|            | (0)         | (0)         | (0)         | (0)         |
| Year       | -0.001***   | -0.001***   | -0.001***   | -0.001***   |
| Industry   | Controlled  | Controlled  | Controlled  | Controlled  |
| _cons      | 0.08***     | 0.08***     | 0.077***    | 0.076***    |
|            | (0.011)     | (0.011)     | (0.011)     | (0.011)     |
| Observations | 23963         | 23963         | 23963         | 23963         |
| R – squared | 0.116        | 0.116        | 0.115        | 0.114        |

Standard errors are shown in parentheses ***p < 0.01, **p < 0.05, and *p < 0.1.

Table 5: Regression results of the relationship between age characteristics of board members and investment efficiency of refinancing companies.

|            | (1) Inveffi | (2) Inveffi |
|------------|-------------|-------------|
| AgeH       | 0.052***    |             |
|            | (0.014)     |             |
| AgeM       | -0.001      | -0.001***   |
|            | (0)         | (0)         |
| Size       | -0.001      | 0           |
|            | (0.001)     | (0.001)     |
| Lev        | -0.006      | -0.006      |
|            | (0.005)     | (0.005)     |
| ROA        | 0.008       | 0.013       |
|            | (0.015)     | (0.015)     |
| Cash       | -0.026***   | -0.023***   |
|            | (0.006)     | (0.006)     |
| Growth     | 0.034***    | 0.034***    |
|            | (0.003)     | (0.003)     |
| Estage     | -0.002      | -0.002      |
|            | (0.002)     | (0.002)     |
| Shrcr      | 0           | 0           |
|            | (0)         | (0)         |
In this study, a variable substitution method is used to conduct the robustness test. The measurement method of investment efficiency (Inveffi) is consistent with model (1). The growth indicator is replaced with the Tobin Q value. Thereafter, the obtained investment efficiency index (Inveffi) replaces the original explained variable for the robustness test to be conducted. After the substitution of variables, the regression coefficient and its significance show no significant change, and the results are still robust.

The test results verifying the robustness of hypothesis 1 are shown in Table 8. The correlation between SEO (1) and investment efficiency variables is positive and significant at the 1% level, indicating that SEO inhibits investment efficiency. This verifies H1 and is consistent with previous results. Therefore, the Robustness test passed.

The test results verifying the robustness of hypothesis 2 are shown in Table 9. The correlation between age heterogeneity and investment efficiency variables is positive and significant at the 1% level. This suggests that the higher the
Table 7: Regression results of the relationship between overseas background of board members and investment efficiency of refinancing companies.

| Inveffi | Coef. | St. err. | t-value | p value | 95% conf interval | Sig |
|---------|-------|----------|---------|---------|-------------------|-----|
| Oversea | 0.009 | 0.005 | 1.95 | 0.051 | 0.000 | * |
| Size    | −0.001 | 0.001 | −1.61 | 0.108 | −0.003 | 0 |
| Lev     | −0.006 | 0.005 | −1.22 | 0.224 | −0.017 | 0.004 |
| ROA     | 0.008 | 0.015 | 0.53 | 0.593 | 0.022 | 0.038 |
| Cash    | −0.026 | 0.006 | −4.45 | 0 | −0.038 | −0.015 | ** |
| Growth  | 0.034 | 0.003 | 11.58 | 0 | 0.028 | 0.04 | * ** |
| Estage  | −0.001 | 0.002 | −0.60 | 0.546 | −0.006 | 0.003 |
| Shrcr   | 0 | 0 | 0.64 | 0.521 | 0 | 0 |
| BoardSize | −0.001 | 0 | −2.86 | 0.004 | −0.002 | 0 | ** |
| BoardPay | 0.002 | 0.001 | 1.93 | 0.054 | 0 | 0.004 | * |
| Industry | Controlled | Controlled | Controlled | Controlled | Controlled | Controlled |
| Constant | 0.092 | 0.019 | 4.86 | 0 | 0.055 | 0.129 | ** |

Mean dependent var | 0.051 | SD dependent var | 0.055 |
R-squared | 0.114 | Number of obs | 6034 |
F-test | 8.329 | Prob > F | 0.000 |
Akaike crit. (AIC) | −18424.098 | Bayesian crit. (BIC) | −17974.852 |

***p < 0.01, **p < 0.05, and *p < 0.1.

Table 8: Regression results of the relationship between SEO and investment efficiency (robustness test).

| (1) Inveffi | (2) Inveffi | (3) Inveffi | (4) Inveffi |
|------------|------------|------------|------------|
| SEO        | 0.008***   | (0.001)    |            |
| NS         |            | 0.009***   | (0.001)    |
| RO         |            |            | 0.007      | (0.006)    |
| CB         |            |            |            | −0.001     | (0.003)    |
| Size       | −0.001***  | −0.001***  | −0.001**   | −0.001**   |
| Lev        | 0.007***   | 0.007***   | 0.007***   | 0.007***   |
| ROA        | 0.055***   | 0.055***   | 0.055***   | 0.055***   |
| Cash       | −0.009***  | −0.009***  | −0.009***  | −0.009***  |
| Growth     | 0.002***   | 0.002***   | 0.002***   | 0.002***   |
| Estage     | −0.009***  | −0.009***  | −0.009***  | −0.009***  |
| Shrcr      | 0***       | 0***       | 0***       | 0***       |
| BoardSize  | −0.001***  | −0.001***  | −0.001***  | −0.001***  |
| BoardPay   | 0**        | 0**        | 0**        | 0**        |
| _cons      | 0.116***   | 0.115***   | 0.111***   | 0.111***   |
| Observations | 22472     | 22472     | 22472     | 22472     |
| R – squared | 0.057      | 0.057      | 0.054      | 0.054      |

Standard errors are shown in parentheses ***p < 0.01, **p < 0.05, *p < 0.1.
age heterogeneity in refinancing companies, the lower the investment efficiency, which verifies H2a1. The correlation between the mean age and investment efficiency variables is negative and significant at the 1% level. This indicates that the older the age of directors in refinancing companies, the higher the investment efficiency. This verifies H2a2. The correlation between sex heterogeneity of the board and investment efficiency of refinancing companies is positive and significant at the 5% level. This means that sex heterogeneity of the board inhibits the investment efficiency of refinancing companies, which proves H2b1. The correlation between females and investment efficiency variables is positive and significant at the 5% level, suggesting that the more females, the lower the investment efficiency. This proves H2b2. The correlation between overseas background heterogeneity and investment efficiency for invested companies is positive and significant at the 1% level, suggesting that the overseas background of directors inhibits the investment efficiency of refinancing companies. This verifies H2c and is consistent with the previous results. The Robustness test is passed.

7. Conclusion

With the state’s encouragement of direct financing by enterprises and the development of the capital market in China, SEO has become an important approach for listed companies to obtain the development fund. With an in-depth application of the modern enterprise management philosophy in China, extensive attention has been paid to the governance ability of company management. In this study, SEO listed companies in China’s A-share market from 2009 to 2020 are selected as the research sample, the influence of SEO on the investment efficiency of enterprises is verified,

| Table 9: Regression results of the relationship between board members’ characteristics and investment efficiency of refinancing companies (robustness test). |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                                 | (1) Inveffi     | (2) Inveffi     | (3) Inveffi     | (4) Inveffi     | (5) Inveffi     |
| Age $H$                        | 0.058***        |                 |                 |                 |                 |
|                                 | (0.014)         |                 |                 |                 |                 |
| Age $M$                        |                 | −0.001***       |                 |                 |                 |
|                                 |                 | (0)             |                 |                 |                 |
| Sex                            |                 |                 | 0.009**         |                 |                 |
|                                 |                 |                 | (0.004)         |                 |                 |
| Women                          |                 |                 |                 | 0.011**         |                 |
|                                 |                 |                 |                 | (0.005)         |                 |
| Overseas                       |                 |                 |                 |                 | 0.013***        |
|                                 |                 |                 |                 |                 | (0.005)         |
| Size                           | −0.001          | 0               | −0.001          | −0.001          | −0.001          |
|                                 | (0.001)         | (0.001)         | (0.001)         | (0.001)         | (0.001)         |
| Lev                            | 0.004           | 0.002           | 0.003           | 0.003           | 0.004           |
|                                 | (0.005)         | (0.005)         | (0.005)         | (0.005)         | (0.005)         |
| ROA                            | 0.077***        | 0.076***        | 0.076***        | 0.076***        | 0.077***        |
|                                 | (0.014)         | (0.014)         | (0.014)         | (0.014)         | (0.014)         |
| Cash                           | −0.031***       | −0.031***       | −0.031***       | −0.031***       | −0.032***       |
|                                 | (0.006)         | (0.006)         | (0.006)         | (0.006)         | (0.006)         |
| Growth                         | 0               | 0               | 0               | 0               | 0               |
|                                 | (0.001)         | (0.001)         | (0.001)         | (0.001)         | (0.001)         |
| Estage                         | −0.004*         | −0.003          | −0.004*         | −0.004*         | −0.004*         |
|                                 | (0.002)         | (0.002)         | (0.002)         | (0.002)         | (0.002)         |
| Shrcr                          | 0               | 0               | 0               | 0               | 0               |
|                                 | (0)             | (0)             | (0)             | (0)             | (0)             |
| BoardSize                      | −0.002***       | −0.002***       | −0.002***       | −0.002***       | −0.002***       |
|                                 | (0)             | (0)             | (0)             | (0)             | (0)             |
| BoardPay                       | 0.001           | 0.001           | 0.001*          | 0.001*          | 0.001           |
|                                 | (0.001)         | (0.001)         | (0.001)         | (0.001)         | (0.001)         |
| _cons                          | 0.082***        | 0.126***        | 0.091***        | 0.091***        | 0.103***        |
|                                 | (0.02)          | (0.02)          | (0.019)         | (0.019)         | (0.019)         |
| Observations                   | 6139            | 6139            | 6139            | 6139            | 6139            |
| $R$–squared                    | 0.056           | 0.057           | 0.054           | 0.054           | 0.055           |

Standard errors are shown in parentheses: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. 
and the effect of board characteristics on investment efficiency of refinancing companies is studied further. The empirical results have shown that the following:

1. SEO lowers investment efficiency. Among the three SEO methods, rights offering lowers investment efficiency, and so does the secondary public offering. However, the effect is not remarkable. Convertible bonds can enhance the investment efficiency remarkably. Conversely, for obtaining fund through SEO, listed companies can compare the three methods to improve the investment efficiency of SEO.

2. Age heterogeneity of board members inhibits the investment efficiency of refinancing companies. The older the mean age, the better the investment efficiency. This reflects the “experience” effect. While applying the SEO fund, younger directors shall listen to elder directors more often, to improve investment efficiency.

3. Sex heterogeneity of board members inhibits the investment efficiency of refinancing companies. Female executives lower investment efficiency. They must give full play to their roles more actively, supervise the tunneling by major shareholders, and observe duty encroachment, to enhance the investment efficiency of refinancing companies.

4. Overseas heterogeneity of board members inhibits the investment efficiency of refinancing companies. An overseas background broadens the horizon, but attention should be paid to whether the investment decisions adapt to the Chinese conditions. Strengths must be developed and weaknesses avoided, to give full play to their overseas experience.

Implications of the conclusion: firstly, among the three refinancing methods, additional issuance often leads to the decline of investment efficiency. Under the same conditions, from the perspective of investment efficiency, a better choice is to preferentially choose convertible bonds for SEO. Secondly, the age difference of the board of directors is too large, which sometimes creates more conflicts. Reducing such a difference appropriately and listening to the opinions of more experienced board members can improve investment efficiency. Thirdly, despite the continuous improvement of women’s status in China, there is still room for improvement in the role of female members within the board of directors, which requires an improvement in their ability to perform duties, rather than increasing their numbers. Finally, board members with overseas backgrounds have many roles to play within the company, but their role in the company’s investment efficiency is not satisfactory. The role of independent directors with overseas backgrounds is still worthy of in-depth consideration.

**Data Availability**

The data were collected from CSMAR database. Anyone who has registered in CSMAR can download the data we use in this work.

**Conflicts of Interest**

The authors declare that they have no conflicts of interest.

**Acknowledgments**

This study was supported by National Social Science Fund of China (No. 15BJY017).

**References**

[1] C. J. Michael and H. M. William, “Theory of the firm: managerial behavior, agency costs and ownership structure,” *Journal of Financial Economics*, vol. 3, no. 4, pp. 305–360, 1976.

[2] S. C. Myers and N. S. Majluf, “Corporate financing and investment decisions when firms have information that investors do not have,” *Journal of Financial Economics*, vol. 13, no. 2, pp. 187–221, 1984.

[3] M. C. Jensen, “Agency costs of free cash flow, corporate finance, and takeovers,” *The American Economic Review*, vol. 76, no. 2, pp. 323–329, 1986.

[4] H. Cronqvista and M. Nilssonb, “The choice between rights offerings and private equity placements,” *Journal of Financial Economics*, vol. 78, no. 2, pp. 375–407, 2005.

[5] M. D. Walker and K. Yost, “Seasoned equity offerings: what firms say, do, and how the market reacts,” *Journal of Corporate Finance*, vol. 14, no. 4, pp. 376–386, 2008.

[6] J. Harford, S. Klasa, and W. F. Maxwell, “Refinancing risk and cash holdings,” *The Journal of Finance*, vol. 69, no. 3, pp. 975–1012, 2014.

[7] D. C. Hambrick and P. A. Mason, “Upper Echelons: the organization as a reflection of its top managers,” *Academy of Management Review*, vol. 9, no. 2, pp. 193–206, 1984.

[8] D. A. Carter, B. J. Simkins, and W. G. Simpson, “Corporate governance, board diversity, and firm value,” *The Financial Review*, vol. 38, no. 1, pp. 33–53, 2003.

[9] M. Lücke, “Women on boards and firm performance,” *Journal of Management & Governance*, vol. 17, no. 2, pp. 491–509, 2013.

[10] H. Isidro and M. Sobral, “The effects of women on corporate boards on firm value, financial performance, and ethical and social compliance,” *Journal of Business Ethics*, vol. 132, no. 1, pp. 1–19, 2015.

[11] Y. Z. Shin, J.-Y. Chang, K. Jeon, and H. Kim, “Female directors on the board and investment efficiency: evidence from Korea,” *Asian Business & Management*, vol. 19, no. 4, pp. 438–479, 2019.

[12] T. T. Haung, C. V. Nguyen, and H. T. V. Tran, “Are female CEOs more risk averse than male counterparts? Evidence from Vietnam,” *Economic Analysis and Policy*, vol. 63, pp. 57–74, 2019.

[13] I. Ullah, H. Fang, and K. Jebran, “Do gender diversity and CEO gender enhance firm’s value? Evidence from emerging economy,” *Corporate Governance: The International Journal of Business in Society*, vol. 20, no. 1, pp. 44–66, 2020.

[14] A. K. David, “more women in the workplace: is there a payoff in firm performance?” *Academy of Management Perspectives*, vol. 17, no. 3, pp. 148-149, 2003.

[15] R. B. Adams and D. Ferreira, “Women in the boardroom and their impact on governance and performance,” *Journal of Financial Economics*, vol. 94, no. 2, pp. 291–309, 2009.

[16] K. Hussein and B. M. Kiwia, “Examining the relationship between female board members and firm performance-a
panel study of US firms,” *African Journal of Finance and Management*, vol. 18, no. 2, 2009.

[17] S. Darmadi, “Board diversity and firm performance: the Indonesian evidence,” *Corporate Ownership and Control Journal*, vol. 8, pp. 450–466, 2011.

[18] Z. Jin, S. Song, and X. Yang, “The role of female directors in corporate investment in China,” *China Journal of Accounting Studies*, vol. 2, pp. 323–344, 2014.

[19] J. Midavaine, W. Dolfsm, and R. Aalbers, “Board diversity and R&D investment,” *Management Decision*, vol. 54, no. 3, pp. 558–569, 2016.

[20] V. H. Vroom and B. Pahl, “Relationship between age and risk taking among managers,” *Journal of Applied Psychology*, vol. 55, pp. 399–405, 1971.

[21] M. F. Wiersema and K. A. Bantel, “Top management team demography and corporate strategic change,” *Academy of Management Journal*, vol. 35, no. 1, pp. 91–121, 1992.

[22] L. B. Vincent and G. C. Mueller, “CEO characteristics and firm R&D spending,” *Management Science*, vol. 48, no. 6, pp. 782–801, 2002.

[23] J. Chowdhury and J. Fink, “How does CEO age affect firm risk?” *Asia-Pacific Journal of Financial Studies*, vol. 46, no. 3, pp. 381–412, 2017.

[24] P. C. Andreou, C. Louca, and A. P. Petrou, “CEO age and stock price crash risk,” *Review of Finance*, vol. 21, no. 3, pp. 1287–1325, 2017.

[25] K. A. Bantel and S. E. Jackson, “Top management and innovations in banking: does the composition of the top team make a difference?” *Strategic Management Journal*, vol. 10, no. 1, pp. 107–124, 1989.

[26] L. Tihanyi, A. E. Ellstrand, C. M. Daily, and D. R. Dalton, “Composition of the top management team and firm international diversification,” *Journal of Management*, vol. 26, no. 6, pp. 1157–1177, 2000.

[27] M. Giannetti, G. Liao, and X. Yu, “The brain gain of corporate boards: evidence from China,” *The Journal of Finance*, vol. 70, no. 4, pp. 1629–1682, 2015.

[28] I. Filatotchev, X. Liu, T. Buck, and M. Wright, “The export orientation and export performance of high-technology SMEs in emerging markets: the effects of knowledge transfer by returnee entrepreneurs,” *Journal of International Business Studies*, vol. 40, no. 6, pp. 1005–1021, 2009.

[29] N. Walt and C. Ingley, “Board dynamics and the influence of professional background, gender and ethnic diversity of directors,” *Corporate Governance*, vol. 11, no. 3, pp. 218–234, 2003.

[30] R. Scott, “Over-investment of free cash flow,” *Review of Accounting Studies*, vol. 11, pp. 159–189, 2006.