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# Diversified Investment Strategy and the Operation of Internal Capital Market: The Moderating Effect of Corporate Governance Mechanism

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**ABSTRACT** This paper aims to examine the relationship between diversified investment and the operation of the internal capital market, and then further investigate the impact of corporate governance mechanism on the relationship between them. Using a sample of group-affiliated firms listed on the Shanghai and Shenzhen Stock Exchanges in China, from 2010 to 2017, we find that the operation of internal capital market Granger-causes the diversified investment and both of them have a non-linear relationship. Moreover, we also find that four factors of corporate governance mechanism (the type of ownership, the fraction of independent directors, managerial ownership, and whether the CEO is also the chairman of the board) have different moderating effects on the relationship between diversified investment and the operation of internal capital market. In addition, we conclude that the internal capital market plays a central role in the diversified investment strategy and improving corporate governance mechanism helps strengthen the relationship between diversified investment and the operation of the internal capital market.

**INDEX TERMS** Diversified investments, internal capital markets, corporate governance mechanism, business groups, affiliated firms.

## I. INTRODUCTION

The investment strategy of business group has attracted substantial interest from academic researchers. Owing to managers' personal incentives, such as building a business empire, increasing compensation, and getting a job promotion, managers are more likely to implement diversified investments [1], [2]. According to the researches on diversification premium, diversified investments have more advantages compared with specialized investments; for instance, diversified investments can improve the efficiency of resources allocation, achieve economies of scale and decrease the probabilities of financial distress [3]–[5].

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Under the circumstances of the imperfect external capital market and the lack of investor protection, internal capital markets are particularly important for the development of business group, and diversified business groups have more benefits arising from multiple relationships among affiliated firms [6]–[8]. Considering the existing researches, the evidences on the relationship between diversified investment and the operation of internal capital market have been mixed. Some studies find that the operation of internal capital market results from the implementation of diversified investment [9], [10], while D'Mello *et al.* [11] argue that the operation of internal capital market is the main explanatory factor of diversified investment, and moreover Staglianò *et al.* [12] find that both of them don't have significant correlation. These prior studies are based primarily on the theoretical discussion and analysis, but few studies have

empirically examined the relationship between them. Therefore, designing and conducting an empirical study to further and deeply investigate this relationship has great significance for the academic field and to some degree fills the gap in the literature.

Meanwhile, the efficient corporate governance mechanism can facilitate the exchange of information and resources, improve the performance of affiliated firms, and even make investors more confident [13].<sup>1</sup> Despite its significant contribution to business groups, the general understanding of corporate governance mechanism in emerging countries has thus far been inadequate. China, the largest emerging economy, has poor legal and regulatory institutions. For instance, Cai *et al.* [14] and Cai and Zheng [15] suggest that China has experienced unprecedented economic growth, but the investor protection is among the worst worldwide. With an increasing number of business groups, the presence of internal capital market is more suitable for the management of modern business activities. Business groups are more competitive than stand-alone firms in emerging economies because emerging economies have relatively weak institutional systems. Business groups also become the main driving force of economic growth. The affiliated firm can easily get access to capital, technology and information through both formal and informal links established by transaction activities with other affiliated firms in a business group [8], [16], [17]. Chinese business groups are usually owned by families and characterized by pyramidal ownership structure, which leads to a serious agency problem [18]–[20]. The lack of well-established financial markets, law markets and labor markets may make it more difficult for firms to create a good corporate governance environment, especially for affiliated firms implementing diversified investments [21]–[23]. In such a context, it is urgent to focus on the influence of corporate governance mechanism on the relationship between diversified investment and the operation of internal capital market.

Some scholars argue that the diversified investment strategy is closely associated with the firm performance, and it can facilitate risk sharing as well as increase market power [24], [25]. In addition, prior scholars have examined the existence of active internal capital market within a business group [26]. The internal capital market may act as a more efficient mechanism to substitute for the function of external capital market because of the advantages of mitigating financial constraints and improving the debt-bearing capacity of affiliated firms, especially in emerging economies [3], [27]. As for the traditional methods evaluating the operational efficiency of internal capital markets (i.e., the sensitivity of Tobin's Q and the cash flow sensitivity of cash), the sensitivity of Tobin's Q is not applicable to the Chinese capital market that is characterized by information asymmetries and agency conflicts. Besides, the cash flow sensitivity of cash cannot provide the evidence of relative operational efficiency of internal capital markets among affiliated firms, and using cash flow return on investment to evaluate the investment opportunity is inappropriate. Taking small profits but quick

turnover as an example, it reduces the return on revenue, but it accelerates the turnover of cash flow and improves the return on total assets.

We not only try to use the method (DEA-C<sup>2</sup>R model) from the perspective of capital inputs and economic outputs to evaluate the operational efficiency of internal capital markets, but also analyze diversified investments in a more scientific and systematic way. Prior researchers mainly focus on the related diversified investment and usually use the number of industry segments operated by the business group to evaluate its extent [3], [28], [29]. There is no doubt that the related diversified investment is the most common diversification strategy because the related diversification is associated with synergistic economics and delivers a competitive advantage to the firm. In addition, unrelated diversified investment is also an important investment strategy, which is often regarded as a main means to achieve financial synergy. Thus, we analyze diversified investments from two perspectives (related and unrelated). Using Entropy and Herfindahl indexes to evaluate the extent of related and unrelated diversified investments provides valuable reference information for future researchers.

Based on prior theories, the contributions of the study from our perspective are attempted to summarize in several ways. First, although several existing studies focus on Chinese business groups, to the best of our knowledge, this paper is the first to empirically examine the relationship between diversified investment and the operation of internal capital market, which extends the literature on the role of internal capital market in the diversified investment strategy. Furthermore, even though corporate governance has enormous practical importance, the exploration of corporate governance still needs to be further deepened, especially in emerging countries. This paper further investigates the moderating effect of corporate governance mechanism on the relationship between diversified investment and the operation of internal capital market in order to shed more light on the puzzle of the internal corporate governance. Additionally, from a new perspective of capital inputs and economic outputs, using DEA-C<sup>2</sup>R model evaluates the operational efficiency of internal capital market. The prior scholars point out that DEA-C<sup>2</sup>R model can evaluate the relative efficiency among decision making units (DMUs) and the results are more objective and unbiased [30], [31]. Considering the diversified investment strategy, Atallah *et al.* [32] and Selçuk [24] argue that Entropy and Herfindahl indexes are more informative measures that take the relative importance of each investment segment into account. Thus using Entropy and Herfindahl indexes evaluates the extent of diversified investment from two perspectives (related and unrelated), which provides valuable information for managers to make rational investment decisions.

Our comprehensive and robust evidences provide theoretical and practical implications for researchers and managers. The empirical study shows that the operation of internal capital market Granger-causes the diversified investment and

there is non-linear relationship between them, which is a sound scientific basis for future researches and implies that managers need to pay more attention to the operation of internal capital market in order to invest in diversified projects more reasonably. Taking into account the corporate governance mechanism in the context of China capital market, the empirical evidences further show that the four factors of corporate governance mechanism (the type of ownership, the fraction of independent directors, managerial ownership and whether the CEO is also the chairman of the board) have different moderating effects on the relationship between diversified investment and the operation of internal capital market. This direct evidence implies that the importance of corporate governance mechanism should arouse more attention of researchers and managers.

The remainder of this paper is organized as follows: Section II outlines our literature reviews and research hypotheses. Section III describes the research design, including sample selection and variables employed. Section IV presents the results of empirical research (e.g., descriptive statistics, granger causality test, model specification, etc.). The final section concludes the paper.

## II. LITERATURE REVIEWS AND RESEARCH HYPOTHESES

### A. LITERATURE REVIEWS

With the surging wave of corporate acquisitions in developed countries, the corporate diversification has become one of the most important strategic decisions since the late 1960s. After decades of exploration and practice, some business groups have altered the investment preferences to refocus on their core businesses because of the change of external capital market and the imperfection of internal governance mechanism [33], [34]. However, most of the Chinese business groups still continued preferring the diversified investment strategies [28]. In a competitive business environment, diversification strategy is the basic strategy for firms. In terms of organizational coordination and control mechanisms, managers' ways of doing business, and organizational learning capacity and learning needs, investigating diversification strategies from related and unrelated perspectives is more appropriate [35]. Considering the impact of diversification on the firm bankruptcy risk, diversification can decrease the expected bankruptcy costs and be preferred by self-interested managers; that is to say, diversified firms have a lower likelihood of bankruptcy and liquidation [2]. Compared with the single-segment firms in emerging markets, the values of diversified firms are higher [5], [24]. These evidences provide support for the diversification premium. The diversification premium is one of the reasons why firms tend to implement diversified investments. In addition, catering theory also provide a powerful explanation of why a great number of firms make diversification decisions in spite of the observed discount when managers pay more attention to the investor preference [29]. The empirical research conducted by Smith and Coy [29] further shows that the direct reason of observed discount is firm-level mispricing instead of

diversification. Taking the advantages of diversification into consideration, a large number of business groups will still prefer investing in diversified projects.

According to prior studies, the internal capital market plays a critical role in business group because of the poor functioning external capital market, for instance, helping mitigate information asymmetries between managers and outside investors. The operation of internal capital market can help diversified affiliated firms transfer funds from poorly performing divisions to better performing divisions, which improves the efficiency of diversified investments [36]. Reaping the benefits of an efficient internal capital market is an advantage of the business group investing in diversified projects [3], which gives us an implication that there may be a close connection between diversified investments and internal capital markets. Making a comparison between affiliated firms and stand-alone firms, the accounting performance of affiliated firms is much better than that of stand-alone firms and it increases with the extent of firm diversification [27].

In many developing countries, business groups are typically structured as pyramids or have a large proportion of family ownership, which leads to a number of divisional managers who are employed in business groups. There are some scholars who provide the positive evidences, for instance, suggesting that the informal links between the chief executive officer and the divisional managers of business groups (e.g., sharing the similar careers, education backgrounds and beliefs) can improve the efficiency of resources allocation and increase the firm value [37]. The basic structure of corporate governance in China roughly accord with the theoretical framework of corporate governance in developed countries, and effective corporate governance can lead to better strategy decision and higher firm value [38]. However, to get more resources from headquarters, divisional managers may increase their bargaining power by engaging in rent-seeking activities [37], [39], [40]. Rent-seeking behavior may have a negative influence on the corporate governance mechanism. China is moving away from state control toward a free market orientation and firms are facing a series of reforms, thus implying that agency conflicts caused by separating cash-flow rights from voting rights are more serious, particularly in business groups with complex ownership structures [41].

Corporate governance mechanism of emerging countries, to a certain extent, is similar to that of developed countries, but there are also some differences between them because legal and market supervision mechanisms of emerging countries need to be further improved. In the context of rapid economic growth, the government involvement has a strong effect on the development of Chinese business groups; for instance, the state-owned and non-state-owned firms have different preferences for investment strategies [14]. The fraction of independent directors is also an important factor to reveal the corporate governance mechanism. Due to the impact of historical and cultural traditions, the media and the public usually argue that having independent directors on the board is just to comply with the relevant provisions.

Therefore, whether independent directors play a significant role on the board or not remains an open question. In addition, we also take into account managerial ownership and whether the CEO is also the chairman of the board to further reveal the corporate governance mechanism.

## B. RESEARCH HYPOTHESES

### 1) DIVERSIFIED INVESTMENT AND THE OPERATION OF INTERNAL CAPITAL MARKET

The implementation of diversified investments may increase the friction between business groups and external capital markets, because the external capital markets are generally characterized by information asymmetries [32]. Diversified investments are more likely to lead to higher capital needs, but it is harder to obtain the financial support from the imperfect capital markets for business groups. In other words, due to the underdeveloped institutional environment in China, the external financing can be very costly or even unavailable [42]. In such a context, it is urgent to create efficiently functioning internal capital markets for Chinese business groups. Most of all, a diversified business group manages and controls different business units that generate unrelated cash flows to invest in projects, which is the key explanatory factor for the presence of the operation of internal capital market [10].

Besides, in order to mitigate financial constraints and improve the efficiency of capital allocation, diversified business groups in emerging economies with less efficient capital markets and poor legal protection produce a demand for the operation of internal capital markets [40], [43]. With this in mind, we argue that the implementation of diversified investment is conducive to the operation of internal capital market and has a significant influence on its trend change. Thus, the diversified investment may Granger-cause the operation of internal capital market.

By contrast, it is also argued that the operation of internal capital markets positively gives impetus to diversified investments [11]. Generally, the efficient operation of internal capital markets can mitigate financial constraints, reduce transition costs and provide financial support for diversified investments. The efficient operation of internal capital markets can also improve the quality of segment disclosures, and then the group-affiliated firms with high-quality segment disclosures have a higher debt capacity, thus arguing that internal capital markets can help affiliated firms obtain bank loans [44], [45]. In addition, the group reputation resulting from the efficient operation of internal capital market enables affiliated firms to gain access to more external investors [46]. Furthermore, the operation of internal capital market can benefit the whole business group by facilitating risk-sharing. Especially when the external capital market is underdeveloped the advantage of internal capital market will be more obvious. The operation of internal capital markets can strengthen the core competencies that help business groups complete cross-industry mergers and acquisitions, which creates conditions for the diversified investments [47].

In view of the latter discussion, the operation of internal capital market contributes to implementing the diversified investment and has a significant impact on its trend change. Thus, we argue that the operation of internal capital market may Granger-cause the diversified investment.

Overall, the Granger causality between the diversified investment and the operation of internal capital market is still uncertain. Hence, we put forward the following hypotheses.

*Hypothesis 1a:* The diversified investment (i.e., related and unrelated diversified investments) Granger-causes the operation of internal capital market.

*Hypothesis 1b:* The operation of internal capital market Granger-causes the diversified investment (i.e., related and unrelated diversified investments).

### 2) THE IMPACT OF CORPORATE GOVERNANCE MECHANISM

From the perspective of corporate governance mechanism, the business groups can be divided into the state-owned and non-state-owned business groups according to the types of ownership.<sup>2</sup> Taking China's economic environment into consideration, the state-owned business groups can obtain the more government support in the context of macroeconomic regulation and control [48], and they can involve considerable government intervention. Especially, the central government requires them to act as the leading players, and thus they often have more potential investment opportunities and better access to external financing [49]. Generally, we think that the state-owned business groups prefer implementing the diversified investments because they are associated with fewer financial constraints. In addition, the internal capital markets of state-owned business groups may be more efficient than that of non-state-owned business groups because of the support of central governance. Consequently, the relationship between diversified investment and the operation of internal capital market may be strengthened among state-owned business groups.

However, there are also some scholars who hold the opposite views. For example, He *et al.* [40] make the point that the operational efficiency of internal capital market in non-state-owned business group is higher, which is beneficial to the diversified investment. China is transiting from a centrally planned economy to a market-oriented economy so that the operational flexibility of non-state-owned business groups may be higher than that of the state-owned business groups. Additionally, the top managers of non-state-owned business group mainly come from the market of professional managers, and thus they are more rational to make decisions for achieving the goal of maximizing their own interests and the firm value [15]. In other words, the relationship between diversified investment and the operation of internal capital market may be strengthened among non-state-owned business groups. We thus propose the following hypotheses.

*Hypothesis 2a:* The type of ownership has a moderating effect, the relationship between diversified investment and



the operation of internal capital market is more pronounced among state-owned business groups.

*Hypothesis 2b:* The type of ownership has a moderating effect, the relationship between diversified investment and the operation of internal capital market is more pronounced among non-state-owned business groups.

The board of directors acts as an engine for effective monitoring function and advising function. To comply with the relevant provisions, the firms generally appoint independent directors to make the board of directors look more independent [50], [51].<sup>3</sup> In fact, there are different opinions about their roles on the board of directors. On the one hand, some scholars argue that independent directors can't well play a supervisory role. Independent directors may argue that diversification cannot prevent a loss, because diversification adds bureaucratic and control costs to the headquarters and branches. They even argue that the diversified strategy can make the possibilities of business failure increase [34]. When the proportion of independent directors is higher their suggestions on the business decisions are more inconsistent, which is bad for the diversified implementation. In other words, due to the impact of historical and cultural traditions, the appointment of independent directors may not improve the internal corporate governance and even make the corporate governance worse, which has a negative effect on the operating performance [52]. Thus independent directors may have a negative influence on the relationship between diversified investment and the operation of internal capital market.

On the other hand, there are some scholars who argue that independent directors can provide better supervision and improve the internal corporate governance. They are generally involved in major corporate affairs (e.g., related-party transactions) and need to make an independent judgement to protect the interests of small and medium shareholders [53]. They probably do their best to stop the unfair related-party transactions, which improves the efficiency of internal capital market. Independent directors with professional knowledge background can make the investment decisions more scientific and cautious, and also ensure the effective monitoring and advising mechanisms [41]. Hence, independent directors may have a positive influence on the relationship between diversified investment and the operation of internal capital market. The above arguments lead to the following hypotheses.

*Hypothesis 3a:* Independent directors can weaken the relationship between diversified investment and the operation of internal capital market; and when the fraction of independent directors on the board is greater, this relationship can be weaker.

*Hypothesis 3b:* Independent directors can strengthen the relationship between diversified investment and the operation of internal capital market; and when the fraction of independent directors on the board is greater, this relationship can be stronger.

Generally speaking, the top managers are responsible for the firm development and the behaviors of staff members,

and they have a decisive influence on the firm performance. Designing an effective incentive mechanism to encourage them to work hard becomes one of the important issues in corporate governance [15], [38]. Thus, let the top managers hold equity stakes, which will be viewed as a better choice. Besides, compared with paying them higher wages, the incentive mechanism of profits sharing by holding equity stakes is considered to be more practical and feasible. The managers holding equity stakes will prefer managing the daily operation of business groups and achieving the purpose of building the business empire. Managers are motivated to expand the firm size, which is conducive to the implementation of diversified investment strategy. The expansion of firm size is also positively associated with the operational efficiency of internal capital market [21]. Hence the managerial ownership may have a positive effect on the relationship between diversified investment and the operation of internal capital market. Considering these arguments, we put forward the following hypothesis.

*Hypothesis 4:* The managerial ownership can strengthen the relationship between diversified investment and the operation of internal capital market; and when the managerial ownership is greater, this relationship will be stronger.

In addition to the factors mentioned above, whether the CEO is also the chairman of the board may have an impact on the relationship between diversified investment and the operation of internal capital market. Scholars have a tendency to think that more practical and reasonable decisions are likely to be made if the CEO is not the chairman of the board [50]. By contrast, it will be more likely to weaken the supervision of the board of directors and cause the failure of internal control systems if the CEO is also the chairman of the board based on the agency theory [37], [54]. The CEO duality is negatively associated with the firm performance [51], and the firm performance is closely correlated with the investment strategy and the daily operation of the firm. Moreover, the concentration of power in the hands of a CEO may cause the opportunistic and inefficient behaviors that increase the conflicts of interest and diminish the board's governance function [41]. Therefore, whether the CEO is also the chairman of the board impacts on the relationship between diversified investment and the operation of internal capital market. Considering the arguments above, we posit the following hypothesis.

*Hypothesis 5:* Whether the CEO is also the chairman of the board has a moderating effect, and the relationship between diversified investment and the operation of internal capital market is more pronounced when the CEO is a different person from that of the chairman.

The research hypotheses discussed above are summarized in Figure 1 below.

### III. RESEARCH DESIGN

#### A. SAMPLE SELECTION

The data are collected from annual reports of firms listed on the Shanghai and Shenzhen Stock Exchanges in China

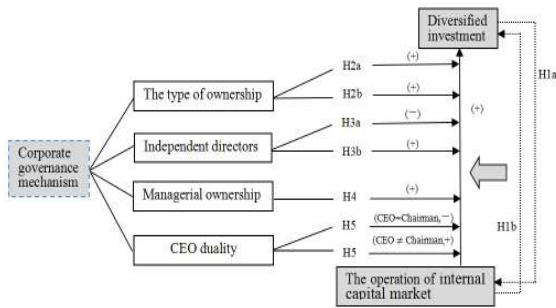


FIGURE 1. The summary of research hypotheses.

during 2010-2017. We exclude the data from firms in the financial industry, because the financial reporting environment for financial institutions is significantly different from that of other industrial firms. We then exclude the data of ST and \*ST firms (*Special Treatment*, that is, the financial situations of these firms are abnormal). To eliminate the influence of outliers, all continuous variables are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles. These sample data used in our analyses are downloaded from the China Stock Market and Accounting Research (CSMAR) database.

We identify a firm’s group affiliation based on whether its ultimate controller has more than one listed firm [36]; that is, the ultimate controller can exercise “controlling influence” over the listed firm.<sup>4</sup> After gathering the listed firms that are controlled by one ultimate controlling shareholder, we obtain the sample data that consist of 277 business groups (2216 group-year observations) covering 985 affiliated firms (7880 firm-year observations). Judging by the Guidelines for the Industry Classification of Listed Companies (2014 Revision) issued by the China Securities Regulatory Commission, we identify whether the business groups implement the diversified investment strategies. To be specific, if there is not less than two listed firms controlled by a business group and there is a listed firm of which the first two industrial classification codes are different from that of other listed firms, we then define this business group as implementing the diversified investment strategy.

For instance, China Resources Group is a big business group with many subsidiary firms that implement investment strategies in different industries, and thus China Resources Group should be a diversified business group. The subsidiary firms have both related and unrelated diversified investments so that we can evaluate the extent of related and unrelated diversified investments respectively and examine the relationship between the operation of internal capital market and the diversified investment (including related and unrelated diversified investments).

**B. VARIABLES AND MEASUREMENT**

**1) DIVERSIFIED INVESTMENT**

Following prior studies (e.g., [32]), the diversified investments can be classified into two groups: the related diversified investments and the unrelated diversified investments.

Specifically, we measure the extent of related diversified investment by calculating the Entropy index  $\sum_{j=1}^n p_j \ln(1/p_j)$ , where  $p_j$  is the percentage of firm sales generated by affiliated firm  $j$ , and  $\ln(1/p_j)$  is the natural logarithm of the inverse of its sales percentage. The summation is over the  $n$  affiliated firms within a business group. In addition, the extent of unrelated diversified investment is measured by the Entropy index  $\sum_{k=1}^n p_k \ln(1/p_k)$ , where  $p_k$  is the percentage of firm sales attributed to industry segment  $k$  and the summation is over the  $n$  industry segments within a business group.

To ensure the robust results in this study, we also use Herfindahl indexes to measure the extent of diversified investments. The formula  $\sum_{j=1}^n \left( s_j / \sum_{j=1}^n s_j \right)^2$  is used to measure the extent of related diversified investment, where  $s_j$  refers to the sales of affiliated firm  $j$  and  $n$  is the number of affiliated firms within a business group. The formula  $\sum_{k=1}^n \left( s_k / \sum_{k=1}^n s_k \right)^2$  is another Herfindahl index to measure the extent of unrelated diversified investment, where  $s_k$  refers to the sales of industry segment  $k$  and  $n$  is the number of industry segments within a business group.

**2) THE OPERATION OF INTERNAL CAPITAL MARKET**

The operation of internal capital market is the same as an operational platform that headquarters pool the limited resources from the poor-performing branches and reallocate them more effectively to the branches with better investment opportunities but lack of the available resources [27], and then the branches can utilize resources to invest in risky projects and reap the rewards. Following prior empirical studies, some scholars use DEA-C<sup>2</sup>R model (i.e., Charnes-Cooper-Rhodes model of Data Envelopment Analysis) to measure the relative efficiency of inputs and outputs [30], [31].<sup>5</sup> From the perspective of inputs and outputs, this study attempts to use DEA-C<sup>2</sup>R model to evaluate the operational efficiency of internal capital markets.

To be more specific, the listed firms within a business group are called decision making units (DMUs). We select four types of input indexes in each DMU, including Long-term Investment on Stocks, Net Value of Fixed Assets, Construction in Process and Intangible Assets. Moreover, we select three types of output indexes in each DMU, including Growth Rate of Total Assets, Return on Net Assets and Firm Value (Earnings Per Share). There are 787 decision making units (DMUs) after analyzing the results provided by empirical statistics. We use the Deap-xp1 software to evaluate the operational efficiency of internal capital markets. The results consist of six indexes, including Overall Efficiency (OE), Technical Efficiency (TE), Scale Efficiency (SE), Decreasing Returns to Scale (DRS), Increasing Returns to Scale (IRS) and Constant Returns to Scale (CRS). These variables are defined as follows: OE is the best technical efficiency frontier to measure the efficiency of resources

allocation, and thus the operational efficiency of internal capital market can be calculated as  $ICMOE = \frac{\sum_i^n OE_i}{n}$ , where  $n$  refers to the number of affiliated firms in a business group. TE is the pure technical efficiency score to measure the maximal output under a certain condition. SE is measured as the ratio of OE divided by TE. DRS means that the output increases by less than that proportional change in inputs. IRS means that the output increases by more than that proportional change in inputs. CRS means that the output increases by that same proportional change as all inputs change.

### 3) MODERATING AND CONTROL VARIABLES

From the perspective of corporate governance mechanism, we select four moderating variables, including the type of ownership, the fraction of independent directors, managerial ownership and whether the CEO is also the chairman of the board (i.e., CEO duality).<sup>6</sup>

Following Wang and Oliver [50], we conclude that some contextual factors may affect the hypothesized relationships. Thus, we control for cash flows, firm profitability, firm size and dividend policy in our regressions. To control for year and industry fixed effects, year dummies and industry dummies are also included in our regressions. The definitions for variables are summarized in Table 1.

## IV. EMPIRICAL RESEARCH

### A. DESCRIPTIVE STATISTICS

Table 2 presents the descriptive statistics of the main variables. The median and median values of all the variables are positive. The mean of *REDIV* is 0.6040, and the mean of *UNDIV* is 0.4786, thus indicating that the mean of *REDIV* is greater. Not surprisingly, the skewness of *ICMOE* is positive, which means that the tail on the right side of distribution is longer. The measure of cash flows, *Cashflow*, has a standard deviation of 80.7567, suggesting that the data are spread out over a wider range of values. The minimum of *Profit* is -0.0143, and thus we argue that some affiliated firms are considerably less profitable. The minimum and maximum of *Size* are 18.9771 and 27.3791 respectively. The difference between maximum and minimum is 8.4020. The minimum of *Dividend* is zero, and thus we argue that some affiliated firms don't pay dividends.

Table 3 reports the counting statistics of the results evaluated by DEA-C<sup>2</sup>R model. In Table 3a, it shows that there are 926 firms that values of *OE* are less than the mean and these firms account for about 94% of our empirical sample. Furthermore, there are also many firms that values of *TE* and *SE* are less than the mean. We can know from the above statistics that the inefficient phenomena of resources allocation exist widely in business groups.

In Table 3b, the results show that the number of *IRS* is far more than that of *DRS* and *CRS*. Thus we argue that it is possible to reduce the unit cost after expanding the scale; that is, firms are more likely to achieve economies of scale after implementing diversified investments.

### B. GRANGER CAUSALITY TEST

Augmented Dickey-Fuller test can be used to test whether there is a unit root in a sample of time series data. If the results show that the "Test statistic" is less than the "Critical value", we can reject the null hypothesis that there is a unit root and argue that this time series is stationary. However, if the presence of a unit root is not rejected, then we should apply the difference operator to the series.

In Table 4, the observed test statistic is less than the critical value (i.e., the threshold value), and the observed P-value is less than the pre-specified significance level (i.e., the 5% level). Thus the null hypothesis of unit root should be rejected, and the time series of variables are stationary. These results show that the sample data can be used to conduct a Granger causality test.

We assume first that there are two variables  $X$  and  $Y$ . In theory, if variable  $X$  can contribute to explaining the trend change of variable  $Y$ , we argue that variable  $X$  Granger-causes variable  $Y$ . Conversely, variable  $Y$  Granger-causes variable  $X$  if variable  $Y$  can contribute to explaining the trend change of variable  $X$ . Second, based on P-values of Granger causality test, we can obtain the significance levels and then determine whether variable  $X(Y)$  can contribute to explaining the trend change of variable  $Y(X)$ . Finally, we use Granger causality for testing causal dependency between two variables.

As seen from Table 5, we conduct the Granger causality test. In rows (1), (2) and (3) of part A, the P-values are 0.4531, 0.1760 and 0.3564, respectively. Thus, *REDIV* and *UNDRV* do not Granger-cause *ICMOE*. In row (1) of part B, the P-value is 0.0101, thus *ICMOE* is conducive to explaining the trend change of *REDIV* and it further shows that *ICMOE* Granger-causes *REDIV* (that is, this finding is consistent with the hypothesis 1b). In rows (2) of part B and (1) of part C, the P-values show that *UNDRV* does not Granger-cause *REDIV*, and *ICMOE* does not Granger-cause *UNDRV*. In row (2) of part C, the P-value is 0.0810, which shows that *REDIV* Granger-causes *UNDRV*.

### C. MODEL SPECIFICATION

Following earlier studies, the operation of internal capital market positively impacts on the diversified investment [11], [47], but the diversified investment is more likely to cause the agency problems and information asymmetries, which can decrease the operational efficiency of internal capital market [1]. Finally, the inefficient operation of internal capital market has a negative influence on the diversified investment. Therefore, we argue that the relationship between diversified investment and the operation of internal capital market is not simply linear, and then we introduce the quadratic term of the operation of internal capital market ( $ICMOE^2$ ) into the following equation (1) to confirm this conjecture.

$$REDIV_{i,t} = a_0 + a_1ICMOE_{i,t} + a_2ICMOE_{i,t}^2 + a_3Cashflow_{i,t} + a_4Profit_{i,t} + a_5Size_{i,t} + a_6Dividend_{i,t} + \varepsilon_1 \quad (1)$$

TABLE 1. Definitions of variables.

Variables	Definitions
<i>REDIV</i>	It refers to the related diversified investment and it is calculated as $\sum_{j=1}^n p_j \ln(1/p_j)$ , where $p_j$ is the percentage of firm sales generated by affiliated firm $j$ , and the summation is over the $n$ affiliated firms within a business group.
<i>UNDIV</i>	It refers to the unrelated diversified investment, and it is calculated as $\sum_{k=1}^n p_k \ln(1/p_k)$ , where $p_k$ is the percentage of firm sales attributed to industry segment $k$ , and the summation is over the $n$ industry segments within a business group.
<i>ICMOE</i>	It refers to the operational efficiency of internal capital market, and it is calculated as $\frac{\sum_{i=1}^n OE_i}{n}$ , where $OE_i$ is the resources allocation efficiency of affiliated firm $i$ , and $n$ refers to the number of affiliated firms within a business group.
<i>OE</i>	It is the best technical efficiency frontier to measure the efficiency of resources allocation.
<i>TE</i>	It is the pure technical efficiency score to measure the maximal output under a certain condition.
<i>SE</i>	It is measured as the ratio of OE divided by TE.
<i>DRS</i>	The output increases by less than that proportional change in inputs.
<i>IRS</i>	The output increases by more than that proportional change in inputs.
<i>CRS</i>	The output increases by that same proportional change as all inputs change.
<i>Ownership</i>	It is a dummy variable that the state-owned business group is defined as 1, otherwise 0.
<i>Independent</i>	It is the fraction of independent directors on the board of directors.
<i>Incentive</i>	It is measured by the percentage of common shares owned by managers, which reflects the incentive mechanism for managers.
<i>CEO duality</i>	It is a dummy variable that takes the value of one if the CEO is also the chairman of the board, otherwise 0.
<i>Cashflow</i>	This is the ratio of operating cash flows divided by total assets.
<i>Profit</i>	It refers to the gross profit margins, which is calculated as $(sales - costs)/sales$ .
<i>Size</i>	The natural logarithm of total assets.
<i>Dividend</i>	It is the ratio of cash dividends over total assets.

where firm and time are indexed by  $i$  and  $t$ , respectively;

$a_i$  ( $i = 1, 2, 3, 4, 5, 6$ ) is the coefficient vector for the related variables;

*REDIV* is related diversified investment;

*ICMOE* is the operational efficiency of internal capital market, and  $ICMOE^2$  is the quadratic term of *ICMOE*;

*Cashflow* is operating cash flows divided by total assets;

*Profit* is gross profit margins (i.e.,  $(sales - costs)/sales$ );

*Size* is the natural logarithm of total assets;



**TABLE 2. Descriptive statistics of the main variables.**

Variables	Median	Mean	Standard deviation	Minimum	Maximum	Skewness	Kurtosis	Observations
<i>REDIV</i>	0.5731	0.6040	0.4621	0.0322	2.5080	0.9234	4.1191	7880
<i>UNDIV</i>	0.4600	0.4786	0.4362	0.0171	2.1173	0.8687	3.6447	7880
<i>ICMOE</i>	0.2675	0.2837	0.1060	0.0124	0.7541	1.4362	6.8770	7880
<i>Cashflow</i>	0.0281	0.1529	80.7567	-2.7302	7.6494	12.2438	17.3302	7880
<i>Profit</i>	0.2172	0.2531	0.1664	-0.0143	0.9261	1.0860	4.1004	7880
<i>Size</i>	22.2320	22.4010	1.2155	18.9771	27.3791	0.4702	3.4534	7880
<i>Dividend</i>	0.0030	0.0052	0.1881	0.0000	0.1859	15.0131	82.9667	7880

Notes: This table reports the descriptive statistics of related variables. As shown in Table 1: *REDIV* refers to the related diversified investment. *UNDIV* refers to the unrelated diversified investment. *ICMOE* refers to the operational efficiency of internal capital market. *Cashflow* is the ratio of operating cash flows divided by total assets. *Profit* is calculated as  $(sales - costs) / sales$ . *Size* is the natural logarithm of total assets. *Dividend* is the ratio of cash dividends over total assets.

**TABLE 3. Results evaluated by DEA-C<sup>2</sup>R model.**

Table 3a			
Variables	<i>OE</i>	<i>TE</i>	<i>SE</i>
< <i>Mean</i>	926	816	919
≥ <i>Mean</i>	59	169	66
<i>Mean</i>	0.4234	0.3160	1.2115
Total	985	985	985

Table 3b			
Variables	<i>DRS</i>	<i>IRS</i>	<i>CRS</i>
Counting statistics	94	781	110

Notes: As defined in Table 1: *OE* is the best technical efficiency frontier to measure the efficiency of resources allocation. *TE* is the pure technical efficiency score to measure the maximal output under a certain condition. *SE* is measured as the ratio of *OE* divided by *TE*. *DRS* means that the output increases by less than that proportional change in inputs. *IRS* means that the output increases by more than that proportional change in inputs. *CRS* means that the output increases by that same proportional change as all inputs change.

*Dividend* is the ratio of cash dividends over total assets; and  $\varepsilon_1$  is the error term.

**D. THE RELATIONSHIP BETWEEN VARIABLES**

As shown in Table 6, first we discuss the coefficients of quadratic terms (i.e., *ICMOE*<sup>2</sup>). If we don't add *ICMOE*<sup>2</sup> to the regression model, the relationship between *REDIV* and *ICMOE* is positive and linear. After adding *ICMOE*<sup>2</sup> to regression model, the explanatory power of model for the variation of the related diversified investment (*REDIV*) increases by 0.1193 (i.e.,  $\Delta R^2 = 0.1193$ ,  $\Delta Adj. R^2 = 0.1385$ ) in column (2). Compared with the coefficient of *ICMOE* (0.0162,  $t_{stat} = 1.71$ ), the results show that

the coefficient of *ICMOE*<sup>2</sup> is greater and more significant ( $-0.2517$ ,  $t_{stat} = -2.70$ ). Hence we are more inclined to suggest that there is a non-linear relationship between *REDIV* and *ICMOE*.

Turning to the analysis for control variables, *Cashflow* is significantly and negatively correlated with *REDIV*. Thus, we argue that agency costs associated with free cash flows may have a negative impact on the related diversified investments. The coefficient of *Size* is insignificant, thus suggesting that economies of scale don't give impetus to the related diversified investments. There is a significantly positive correlation between *Profit* and *REDIV*. It shows that business groups with stronger profitability are more likely to implement the

TABLE 4. ADF test of third-order lags.

Indexes	Test statistics	Significance levels	Critical values	P-values	Test results
ICMOE	-7.8722	5%	-3.1300	0.0000	stationary
REDIV	-9.3100	5%	-3.1300	0.0000	stationary
UNDIV	-8.4948	5%	-3.1300	0.0000	stationary

Notes: ICMOE refers to the operational efficiency of internal capital market. REDIV refers to the related diversified investment. UNDIV refers to the unrelated diversified investment. The specific definitions of variables are given in Table 1.

TABLE 5. Granger causality test.

		Variables (1)	Variables (2)	Chi2	Prob>Chi2
Part A	(1)	ICMOE	REDIV	1.5852	0.4531
	(2)	ICMOE	UNDIV	3.4795	0.1760
	(3)	ICMOE	ALL	4.3869	0.3564
Part B	(1)	REDIV	ICMOE	9.1395	0.0101***
	(2)	REDIV	UNDIV	2.4508	0.2940
	(3)	REDIV	ALL	11.2930	0.0235**
Part C	(1)	UNDIV	ICMOE	4.3708	0.1127
	(2)	UNDIV	REDIV	5.0246	0.0810*
	(3)	UNDIV	ALL	8.0939	0.0880*

Notes: \* \* \*, \* \* , \* ,\* respectively indicate at the 1%, 5%, 10% significance levels. ICMOE refers to the operational efficiency of internal capital market. REDIV refers to the related diversified investment. UNDIV refers to the unrelated diversified investment. These variables are specifically defined in Table 1.

related diversified investments. Dividend is significantly and positively related to REDIV, and thus we argue that dividend policy has a significant impact on the related diversified investments.

E. TEST OF MODERATING EFFECT

From the above causal analysis, the results show that the operation of internal capital market Granger-causes the related diversified investment and there is a close correlation between them, and thus the diversified investment mentioned below refers to the related diversified investment. As expected, we find that REDIV is significantly positive correlated with ICMOE in both columns (1) ICMOE < mean and (2) ICMOE ≥ mean, and as a result the values of ICMOE are not grouped into two parts anymore. To test the moderating effect of corporate governance mechanism on the relationship between REDIV and ICMOE, we estimate the following regression models:

$$\begin{aligned}
 REDIV_{i,t} &= b_0 + b_1 Cashflow_{i,t} + b_2 Pr ofit_{i,t} \\
 &+ b_3 Size_{i,t} + b_4 Dividend_{i,t} + \varepsilon_2 \tag{2a}
 \end{aligned}$$

$$\begin{aligned}
 REDIV_{i,t} &= c_0 + c_1 ICMOE_{i,t} + c_2 Cashflow_{i,t} \\
 &+ c_3 Pr ofit_{i,t} + c_4 Size_{i,t} + c_5 Dividend_{i,t} + \varepsilon_3 \tag{2b}
 \end{aligned}$$

$$\begin{aligned}
 REDIV_{i,t} &= d_0 + d_1 ICMOE_{i,t} \\
 &+ d_2 ICMOE_{i,t} * Independent_{i,t} + d_3 Independent_{i,t} \\
 &+ d_4 ICMOE_{i,t} * Incentive_{i,t} + d_5 Incentive_{i,t} \\
 &+ d_6 Cashflow_{i,t} + d_7 Pr ofit_{i,t} + d_8 Size_{i,t} \\
 &+ d_9 Dividend_{i,t} + \varepsilon_4 \tag{3}
 \end{aligned}$$

where for firm i and time t all of the variables are as defined previously;

- REDIV : related diversified investment;
- ICMOE : the operational efficiency of internal capital market;
- Independent : the percentage of independent directors to total directors on the board;
- Incentive : the percentage of common shares owned by managers;
- Cashflow : the ratio of operating cash flows to total assets;
- Pr ofit : gross profit margins (i.e., (sales – costs)/sales);

TABLE 6. Test of the relationship between variables.

Variables	REDIV	
	(1) <i>ICMOE</i> < Mean	(2) <i>ICMOE</i> ≥ Mean
<i>ICMOE</i>	0.0162* (1.71)	0.0165* (1.74)
<i>ICMOE</i> <sup>2</sup>		-0.2517*** (-2.70)
<i>Cashflow</i>	-0.0002* (-1.93)	-0.0002* (-1.90)
<i>Size</i>	-0.0017 (-0.55)	-0.0031 (-1.27)
<i>Profit</i>	0.0006* (1.75)	0.0006* (1.74)
<i>Dividend</i>	0.3810*** (4.49)	0.3292*** (4.27)
Constant	0.1113*** (2.44)	0.1023** (2.03)
Observations	7408	472
R <sup>2</sup>	0.2861	0.4054
Adj. R <sup>2</sup>	0.2627	0.4012
F-value	12.27***	13.81***

Notes: This table presents the regression results of equation (1) using both year and industry fixed effects. \* \* \*, \* \* , \* , \* respectively indicate at the 1%, 5%, 10% significance levels, and t-statistics are reported in parentheses. Variable definitions are given in Table 1. The correlation matrix for variables suggests that multicollinearity should not be a concern in our study, but the correlation analysis is not reported for brevity.

*Size* : the natural logarithm of total assets;

*Dividend* : the ratio of cash dividends to total assets; and  $\epsilon_i$  ( $i = 2, 3, 4$ ) is the error term.

Table 7 reports the grouped regression results for the type of ownership and whether the CEO is also the chairman of the board. In columns (1) and (3), we only add the control variables to the regression analyses, and we then introduce *ICMOE* into the regression analyses in columns (2) and (4). We find that the coefficient of *ICMOE* is positive and significant (0.0103,  $t_{stat} = 1.80$ ) in column (2), and the coefficient of *ICMOE* is also significantly negative (0.0101,  $t_{stat} = 1.70$ ) in column (4). Compared with the results in column (1), the explanatory power of model for the variation of the related diversified investment (*REDIV*) increases by 0.1722 ( $\Delta Adj. R^2 = 0.1702, \Delta F = 2.93, P < 0.01$ ) in column (2). Compared with the results in column (3), the explanatory power of model for the variation of the

related diversified investment (*REDIV*) increases by 0.0334 ( $\Delta Adj. R^2 = 0.0509, \Delta F = 0.83, P < 0.01$ ) in column (4). Compared with the coefficient of *ICMOE* in column (4), the coefficient of *ICMOE* in column (2) is greater. Thus, we can conclude that the type of ownership has a moderating effect and the relationship between diversified investment and the operation of internal capital market is more pronounced among state-owned business groups, which is consistent with the hypothesis 2a.

Similarly, we find that the coefficient of *ICMOE* is positive and significant (0.0121,  $t_{stat} = 1.91$ ) in column (6), and the coefficient of *ICMOE* is also significantly positive (0.0132,  $t_{stat} = 1.98$ ) in column (8). Compared with the results in column (5), the explanatory power of model for the variation of the related diversified investment (*REDIV*) increases by 0.0524 ( $\Delta Adj. R^2 = 0.0195, \Delta F = 1.50, P < 0.01$ ) in column (6). Compared with the results in

TABLE 7. Test of moderating effects (A).

Variables	Ownership = 1		Ownership = 0		CEO duality = 1		CEO duality = 0	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>ICMOE</i>		0.0103* (1.80)		0.0101* (1.70)		0.0121* (1.91)		0.0132* (1.98)
<i>Cashflow</i>	-0.0014** (-2.12)	-0.0013** (-2.10)	-0.0012* (-1.89)	-0.0013* (-1.87)	0.0006 (0.19)	0.0010 (0.24)	0.0021* (1.69)	0.0022* (1.68)
<i>Size</i>	-0.0005 (-0.42)	-0.0011 (-0.52)	-0.0018 (-0.61)	-0.0011 (-0.56)	-0.0023 (-0.70)	-0.0012 (-0.49)	-0.0017 (-0.52)	-0.0023 (-0.61)
<i>Profit</i>	0.0073* (1.97)	0.0084* (1.96)	0.0067* (1.84)	0.0019 (0.79)	0.0085* (1.75)	0.0086* (1.75)	0.0079* (1.76)	0.0078* (1.75)
<i>Dividend</i>	0.0145* (1.97)	0.0201* (1.99)	0.0910** (2.34)	0.0907** (2.41)	0.1013** (2.60)	0.1013** (2.61)	0.0102* (2.01)	0.0102* (2.02)
Constant	0.1117* (1.60)	0.1230* (1.61)	0.1108* (1.48)	0.1221* (1.80)	0.1112** (2.09)	0.1103* (1.60)	0.1117* (1.62)	0.1090* (1.56)
Observations	4352	4352	3528	3528	4128	4128	3752	3752
R <sup>2</sup>	0.3075	0.4797	0.3440	0.3774	0.3022	0.3546	0.3429	0.4500
Adj. R <sup>2</sup>	0.2811	0.4513	0.3132	0.3641	0.2934	0.3129	0.3320	0.4370
F-value	10.89***	13.82***	10.57***	11.40***	10.69***	12.19***	9.78***	13.09***

Notes: \*\*\*, \*\*, \* respectively indicate at the 1%, 5%, 10% significance levels, and t-statistics are reported in parentheses. Variable definitions are given in Table 1. The correlation coefficients of variables are less than 0.7, suggesting that multicollinearity should not be a concern in our study. These regression results are presented in line with the regression models (2a) and (2b) using both year and industry fixed effects.

column (7), the explanatory power of model for the variation of the related diversified investment (*REDIV*) increases by 0.1071 ( $\Delta Adj. R^2 = 0.1050, \Delta F = 3.31, P < 0.01$ ) in column (8). The coefficient of *ICMOE* in column (8) is greater than that in column (6). Thus, we can conclude that whether the CEO is also the chairman of the board has a moderating effect, and the relationship between diversified investment and the operation of internal capital market is more pronounced when the CEO is a different person from that of the chairman. The above results are consistent with the hypothesis 5, but its moderating effect is weaker than that of the type of ownership.

Table 8 reports the moderating effects about the fraction of independent directors and the managerial ownership. The coefficient of *ICMOE \* Independent* is -0.0106, but it is not significant ( $t_{stat} = -1.50$ ). Thus we argue that *Independent* can not weaken the positive relationship between diversified investment and the operation of internal capital market, even though the coefficient of *Independent* is significantly negative at the 10% level ( $-0.0240, t_{stat} = -1.83$ ). The coefficient of *ICMOE \* Incentive* is 0.0208, and it is significant ( $t_{stat} = 2.54$ ). Therefore, *Incentive* has a moderating effect, which can strengthen the

relationship between diversified investment and the operation of internal capital market. We also find that the coefficient of *Incentive* is 0.0145 and it is also significant ( $t_{stat} = 2.30$ ), thus meaning that it can be beneficial to the diversified investment strategy when managers hold shares. We conclude that the fraction of independent directors does not have a moderating effect on the relationship between diversified investment and the operation of internal capital market in spite of having a negative influence on the diversified investment, while the managerial ownership has a moderating effect on the relationship between diversified investment and the operation of internal capital market and it can strengthen this relationship. Therefore, the above results support the hypothesis 4, but don't provide the support for hypothesis 3a (or 3b).

F. CONTROLLING FOR SELF-SELECTION BIAS

The preceding results estimated from the ordinary least squares (OLS) regressions provide support for the relationship between diversified investment and the operation of internal capital market, which may suffer from severe self-selection bias, as the affiliated firms in business groups may be endogenously selected based on unobserved firm



TABLE 8. Test of moderating effects (B).

Variables	REDIV			
	(1)	(2)	(3)	(4)
<i>ICMOE</i>	0.0113* (2.01)	0.0040 (1.07)	0.0131* (2.04)	0.0114* (1.96)
<i>ICMOE * Independent</i>		-0.0106 (-1.50)		
<i>Independent</i>	-0.0240* (-1.83)	-0.0270* (-2.07)		
<i>ICMOE * Incentive</i>				0.0208** (2.54)
<i>Incentive</i>			0.0145** (2.30)	0.0092* (1.96)
<i>Cashflow</i>	-0.0051 (-1.31)	-0.0017 (-1.02)	-0.0103* (-1.98)	-0.075* (-2.17)
<i>Size</i>	-0.0142 (-1.50)	-0.0106 (-1.39)	-0.0104 (-1.39)	-0.0124 (-1.57)
<i>Profit</i>	0.0155* (1.76)	0.0160* (1.81)	0.0132* (1.79)	0.0148* (1.94)
<i>Dividend</i>	0.1091** (2.40)	0.1075** (2.29)	0.1107** (2.40)	0.1087** (2.30)
Constant	0.1401** (2.37)	0.1427** (2.41)	0.1520** (2.47)	0.1409** (2.37)
Observations	7880	7880	7880	7880
R <sup>2</sup>	0.4914	0.5872	0.4920	0.6201
Adj. R <sup>2</sup>	0.4871	0.5724	0.4728	0.5930
F-value	11.95***	13.71***	14.72***	15.04***

Notes: This table reports the results of regression model (3), and variables are defined in Table 1. \* \* \*, \* \*, \* , respectively indicate at the 1%, 5%, 10% significance levels, and t-statistics are reported in parentheses. The correlation coefficients of variables are less than 0.7, suggesting that multicollinearity should not be a concern in our study. We also control the time-varying influence and firm heterogeneity through year and industry fixed effects.

characteristics, leading to the bias of coefficient estimates. In order to address the potential selection bias issue, we apply the two-step Heckman’s procedure. In the first stage, we estimate a probit model with a bunch of variables that are more likely to influence our judgment about group-affiliated firms. We then construct an inverse mills ratio (IMR) based on the coefficients of the probit model and introduce it into the second-stage regression as an additional explanatory variable. The final results show that the coefficient of IMR is significantly negative, and the coefficients of other variables do not significantly change. Therefore, our results are not influenced by the potential self-selection bias.

**G. ROBUSTNESS TESTS**

In this section, we perform additional tests to check the robustness of our study results.

Firstly, we substitute Herfindahl indexes for Entropy indexes to examine whether there is a change in the extent of diversified investment. The results show that the extent of diversified investment does not significantly change and the regression results are roughly consistent with the above conclusions.

Secondly, we use the traditional methods (e.g., the cash flow sensitivity of cash) to evaluate the operational efficiency of internal capital markets. The results show that most of

them are less efficient, which is highly consistent with the preceding findings. After analyzing the regression results, we find that the relationship between variables is also the same as before.

Finally, we use the median to substitute for the mean in Table 6. The findings show that the non-linear relationship between diversified investment and the operation of internal capital market remains unchanged. The moderating effect of corporate governance mechanism is highly consistent with the preceding results. Thus, our conclusions are robust and convincing. To conserve space, we do not use tables to report the results.

## V. CONCLUSIONS

First of all, the empirical results show that the operation of internal capital market Granger-causes the diversified investment, which is consistent with Hypothesis 1b. Furthermore, we examine the influence on the relationship between diversified investment and the operation of internal capital market, and investigate the influence of corporate governance mechanism on this relationship. The findings show that corporate governance mechanism has a significant impact on the relationship between diversified investment and the operation of internal capital market. More specific findings are as follows: (1) The type of ownership has a moderating effect, and the relationship between diversified investment and the operation of internal capital market is more pronounced among state-owned business groups (that is, this finding is consistent with Hypothesis 2a). (2) The fraction of independent directors cannot weaken (or strengthen) the relationship between diversified investment and the operation of internal capital market (that is, this result does not support Hypothesis 3a (or 3b)). (3) The managerial ownership has a moderating effect, and it can strengthen the relationship between diversified investment and the operation of internal capital market (that is, this result supports Hypothesis 4). (4) Whether the CEO is also the chairman of the board has a moderating effect, and the relationship between diversified investment and the operation of internal capital market is more pronounced when the CEO is a different person from that of the chairman, thus suggesting that this result is consistent with Hypothesis 5, but its moderating effect is weaker than that of the type of ownership.

This study provides new research findings and perspectives for future researchers. For instance, the empirical results show that the operation of internal capital market Granger-causes the diversified investment, and thus future researchers can further analyze how to use internal capital markets efficiently to implement diversification strategies associated with the core businesses.

Furthermore, we investigate four factors of corporate governance mechanism in Chinese business groups, which opens the way to future research in this field. Thus the related scholars can further and deeply discuss the problems of corporate governance in other emerging countries.

Additionally, this study also examines the moderating effect of corporate governance mechanism on the relationship between diversified investment and the operation of internal capital market. Of course, researchers can also investigate its moderating effect on other relationships, for instance, the moderating effect of corporate governance mechanism on the relationship between diversified investment and the performance of business group.

Finally, as for how to improve the corporate governance mechanism, this paper provides some practical implications. Specifically, when the CEO is also the chairman of the board we have reason to believe that there is a less efficient corporate governance mechanism, but giving managers a fixed number of shares is a better way to motivate them. Facing the fierce competitive environment, the policymakers should attach importance to whether corporate governance mechanism is efficient or not in business groups, especially in non-state-owned business groups. Even though firms comply with the regulations of the China Securities Regulatory Commission (CSRC) to have fixed percentage of independent directors on the board, we find that independent directors may not play a critical role in making investment decisions and allocating capital. Therefore, how to improve the incentive system of independent directors may be another topic for future research.

Although this study bridges the operation of internal capital market and diversified investment by using the empirical method, it also has some limitations. For instance, the additional research is necessary to explore some areas such as the dynamic operation of internal capital markets and the benefits of diversified investments. In particular, our sample data are only from listed firms in China. The comparison of the relationship between them across countries may have new findings. Furthermore, this study focuses merely on the four factors of corporate governance mechanism, and thus it is unable to examine the influence of other factors (e.g., women directors, board size, and shareholders' rights). This certainly places another limitation for this study.

## NOTES

1. Corporate governance mechanism is a set of pre-defined rules to guide and coordinate the behaviors of shareholders, the board of directors, managers, and other stakeholders [19], [41].

2. When the ultimate controller of business group is central government, local government or other associated ministries, the business group is defined as the state-owned business group; otherwise the business group is defined as the non-state-owned business group.

3. Independent directors (also known as non-executive directors) should possess relevant expertise and experience. With the exception of serving on the board of directors, the independent director can not hold any other office of the firm. Meanwhile, they are not allowed to be involved in any relationships with the firms and the major shareholders

that disturb them from making decisions independently and objectively.

4. If a listed firm and an (several) unlisted firm are the same ultimate controller, this listed firm should also be group-affiliated firm, but the financial data of unlisted firms are difficult to collect in public websites. Thus we exclude the listed firm mentioned above when we collect the sample data. In other words, business group is an ultimate controller that controls two or more listed firms at the same time, and these listed firms are defined as group-affiliated firms. The ultimate controller can be a firm, financial institution, person, etc.

5. Data envelopment analysis (DEA) is a non-parametric approach that has many advantages, such as no requirement for a priori weights or explicit specification of functional relations among the multiple inputs and outputs. The basic result of DEA is an efficient frontier, as well as an efficient measure that reflects the distance from the current status to the frontier. The C<sup>2</sup>R (CCR) model of DEA is developed by Charnes *et al.* [30] and further improved by scholars (e.g., [31]), which is frequently used to estimate the relative efficiency of DMU<sub>s</sub>.

6. Due to the unique historical, social and organizational context in China, the different types of ownership greatly impact the operating strategy (e.g., [48]). Furthermore, researches on board structure focus on board composition and board leadership structure (e.g., [41]). The fraction of independent directors is usually used to measure the board composition, and meanwhile whether the CEO is also the chairman of the board is primarily used to reflect the board leadership structure. In addition, due to the separation of ownership from control, managerial ownership is an incentive mechanism for managers to maximize the firm value (e.g., [27]). Thus we select four factors of corporate governance mechanism (the type of ownership, the fraction of independent directors, managerial ownership and whether the CEO is also the chairman of the board) to examine their impacts on the relationship between diversified investment and the operation of internal capital market.

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