A Research on CEO power and corporate performance model based on data analysis

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Abstract. Company performance can directly reflect the operation’s status, which has always been one of the central topics. Starting from the CEO power, this paper introduced the corporate innovation strategy and ownership concentration, established the corresponding research model, and studied the relationship between them. In the model design, the company performance was taken as the dependent variable, CEO power and corporate innovation strategy and ownership concentration was taken as independent variables, then the data processing software was used to establish a regression model. Through the model test, it is found that there is a positive correlation between CEO power and corporate performance, and the corporate innovation strategy can play an intermediary role in this relationship while ownership concentration can play a moderating role. This paper further improved the relevant research of corporate performance, and had certain reference significance for the operation.

1. Introduction
Through the existing research, we can clearly understand that there is a significant relationship between the heterogeneity of the top management team and corporate performance. And the CEO, as the core of the top management team, usually has considerable power. So the author believes that there is an inevitable relationship between CEO power and corporate performance. However, the existing research conclusions on the relationship between CEO power and corporate performance are different. There are positive or negative correlation between CEO power and corporate performance (Cao et al., 2010). Besides, there are few studies on which factors CEO power affects corporate performance. This paper introduces the corporate innovation strategy into the middle of CEO power and corporate performance, and studies the role of ownership concentration in the relationship between CEO power and corporate performance.

2. Theory and hypothesis
2.1. CEO power and corporate innovation strategy
Finkelstein thinks that the core task of CEO is to deal with the uncertainty of various affairs. Adams et al. (2005) believe that CEO power is the power that the CEO has to continue to influence the key decisions of the enterprise, regardless of the potential opposition of other company personnel. Mueller and Barker believe that when the CEO is younger, holds more shares in the enterprise and has work experience in R&D, the enterprise will increase investment in innovation and R&D. CEO's academic experience determines CEO's attitude towards innovation. The essence of academic research is...
innovation (sunder et al., 2017). Therefore, based on the existing research and the author's thinking and analysis, the following hypotheses are put forward:

H1: CEO power is positively related to the innovation strategy.

2.2. Corporate innovation strategy and corporate performance

Corporate R&D investment is an important indicator to measure the company's innovation strategy. When the company's innovation strategy is more positive, the company's R&D investment will increase. On the contrary, if the company's innovation strategy is relatively conservative, the R&D investment will be small. If a company's innovation strategy is more active, the more funds it can use to develop new products or new production methods, the company is more likely to make a breakthrough in this aspect, so as to reduce the cost Therefore, this paper puts forward the following hypothesis:

H2: there is a positive relationship between corporate innovation strategy and corporate performance.

2.3. CEO power and corporate performance

Generally speaking, the greater the power of the CEO, the more personal will of the CEO is reflected in the company's decision-making, and the greater the impact on the company's performance. There is a significant positive correlation between CEO power and firm performance (Haleblian&Finikelstein, 1993). Upper echelons theory points out that the characteristics of TMT determine the strategic differences of enterprises, and ultimately affect organizational performance through strategic differences (Hambrick&Mason, 1984). As the core of the top management team, CEO's intention must be reflected through decision-making, which will have an important impact on the company's performance. Therefore, the following hypothesis is proposed:

H3: CEO power has a significant positive impact on corporate performance, and corporate innovation strategy plays an intermediary role in this process.

2.4. The moderating effect of ownership concentration

Ownership concentration is the performance of a company's ownership structure, which largely determines the distribution of corporate control and has an important impact on the company's operating performance. In 1932, Berle first pointed out that when the ownership concentration changes, the company's performance will change in the same direction; When Qian Hongguang and Liu Yan (2019) studied the data of mixed ownership companies, they found that their company performance and ownership concentration showed an inverted U-shaped pattern. Zhang duolei et al. pointed out in their own research that higher ownership concentration will weaken the relationship between CEO power and corporate investment herding behavior. Ownership concentration can reduce the cost of principal-agent, but also conducive to the unity of views of the management team, so as to make timely and rapid decisions in the face of complex and changeable market. The author thinks that the more concentrated the equity, the more balanced the power of CEO will be.

H4: ownership concentration plays a negative moderating role in the relationship between CEO power and corporate performance.

3. Research design

3.1. Sample selection and data sources

This paper takes the manufacturing enterprises listed in China A-share market from 2010 to 2019 as the research object. Finally, 13000 unbalanced panel data were obtained by eliminating the samples of ST and * ST companies and those with serious missing data. The data of this paper mainly comes from CSMAR database. Data processing software mainly uses EXECL and stata16.0.
3.2. Variable definition

CEO power (Power): the measurement of CEO power in this paper mainly refers to the four part power model proposed by Finkelstein and the conclusion of Adams and other scholars. CEO power is divided into organizational power, expert power, ownership power and reputation power. The four parts of power are recorded as 0 or 1 respectively, and then the four parts of power are added to get the average value to get the CEO power.

Corporate innovation strategy (RD): referring to the research of Olson et al. (2006), this paper selects enterprise innovation investment as the proxy variable of enterprise innovation strategy.

Corporate performance (Per): based on previous studies, this paper selects ROA as the index to measure the company performance.

Ownership concentration (SR): Based on various factors, this paper selects the sum of the top ten shareholders’ shareholding ratio as the index to measure the degree of ownership concentration.

In addition to the above main variables, this paper also selects some control variables, including: enterprise size (Size); company growth (Growth); asset liability ratio (Lev) and independent director ratio (Nidia).

3.3. Model design

In order to test the relationship between CEO power, corporate performance, corporate innovation strategy and ownership concentration, this paper constructs the following experimental model based on previous research.

\[
RD_{it} = \alpha_0 + \alpha_1 Power_{it} + \sum \alpha_j Controls_{j,it} + \epsilon_{it} \quad (1)
\]
\[
Per_{it} = \alpha_0 + \alpha_1 RD_{it} + \sum \alpha_j Controls_{j,it} + \epsilon_{it} \quad (2)
\]
\[
Per_{it} = \alpha_0 + \alpha_1 Power_{it} + \alpha_2 RD_{it} + \sum \alpha_j Controls_{j,it} + \epsilon_{it} \quad (3)
\]
\[
Per_{it} = \alpha_0 + \alpha_1 Power_{it} + \alpha_2 SR_{it} + \alpha_3 Power_{it} \times SR_{it} + \sum \alpha_j Controls_{j,it} + \epsilon_{it} \quad (4)
\]

Model 1 is constructed to test the influence of CEO power on corporate innovation strategy; Model 2 is constructed to test the influence of corporate innovation strategy on corporate performance; Model 3 adds CEO power to model 2 to test the mediating effect of corporate innovation strategy between CEO power and corporate performance; model 4 adds Power_{it} \times SR_{it} to test the moderating effect of ownership concentration on CEO power and corporate performance. Among them, i represents company i, t represents year t, and j is the number of control variables.

4. Empirical results and analysis

4.1. Descriptive statistics and correlation analysis

From the descriptive statistics in Table 1, it can be seen that the maximum value of company performance is 1.193 and the minimum value is -1.403. This also shows that there are still large gaps in the operations of different companies; The value range of CEO power is [0,1]; the maximum value of the company’s R&D investment is 25.03, and the minimum value is only 5.094, which shows that different companies have different attitudes towards innovation strategies. But the average value of R&D investment is 17.9, which shows that the company pay more attention to innovation, and start to increase investment in innovation.

From the correlation coefficients between the variables shown in Table 2 it can be seen that there is a significant positive correlation between company performance, CEO power, and company innovation strategy, and the correlation will be further tested in regression analysis.
Table 1. Descriptive statistic.

| Variable | N   | Mean | Std. Dev. | Min. | Max. |
|----------|-----|------|-----------|------|------|
| Per      | 13,000 | 0.046 | 0.072 | -1.403 | 1.193 |
| Power    | 13,000 | 0.337 | 0.313 | 0 | 1 |
| RD       | 13,000 | 17.900 | 1.432 | 5.094 | 25.030 |
| SR       | 13,000 | 58.840 | 13.84 | 8.810 | 101.200 |
| Growth   | 13,000 | 0.300 | 7.075 | -0.982 | 58.720 |
| Lev      | 13,000 | 0.387 | 0.225 | 0.008 | 10.500 |
| Nidia    | 13,000 | 0.368 | 0.0529 | 0 | 0.800 |
| Size     | 13,000 | 22.000 | 1.167 | 18.390 | 27.470 |

Table 2. Correlation matrix.

|       | Per   | Power | RD     | SR     | Growth | Lev     | Nidia   | Size     |
|-------|-------|-------|--------|--------|--------|---------|---------|----------|
| Per   | 1.000 | 0.038*** | 1.000  | 0.082*** | 0.211*** | 0.016*  | 0.015*  | 0.00300  |
| Power | 0.038*** | 1.000  | -0.025*** | 1.000  | 0.049*** | 0.036*** | 0.00500 | 0.700***  |
| RD    | 0.082*** | -0.025*** | 1.000  | 0.253*** | -0.120*** | 0.020**  | 0.00300 | 0.438***  |
| SR    | 0.211*** | 0.049*** | 0.036*** | 1.000  | 0.00500 | 0.00300 | 0.00400 | 0.438***  |
| Growth| 0.016* | 0.0100 | 0.026*** | 0.00300 | 0.700*** | 0.00400 | 0.028*** | -0.021**  |
| Lev   | -0.432*** | -0.055*** | -0.253*** | -0.120*** | 0.020**  | 0.00300 | -0.0110 | 1.000     |
| Nidia | -0.015* | 0.175*** | -0.015* | 0.066*** | -0.00300 | -0.0110 | -0.00300 | 0.00400  |
| Size  | -0.00300 | -0.065*** | 0.700*** | 0.00400 | 0.028*** | 0.438*** | -0.021**  | 1.000     |

*** p<0.01, ** p<0.05, * p<0.1

4.2. Analysis of regression results

In order to ensure the validity of the regression results, this paper narrows the data at the 1% and 99% levels to eliminate the influence of extreme values. From the model 1 in Table 3, we can see that the coefficient of CEO power on the company's innovation strategy is significantly positive (β=0.0856, p<0.01), indicating that the greater the CEO’s power, the more active the company’s innovation strategy will be, as evidenced by H1; From Table 3 Model 4, we can see that the coefficient of company innovation strategy on company performance is significantly positive (β=0.0056, p<0.01), indicating that the more active the company’s innovation strategy, the better the company’s performance, H2 is proven; from model 3, we can see that the regression coefficient of CEO power is significantly positive (β=0.0061, p<0.01), so assume that the first half of H3 is proven.

According to the method proposed by Wen Zhonglin et al., this paper examines the mediating effect of the company's innovation strategy. The specific steps are: (1) Use the mediating variable company innovation strategy to regress CEO power. This step is completed in Table 3 Model 1 Use company performance to regress CEO power, this step is completed in Table 3 Model 3; (3) Use company performance to regress CEO power and company innovation strategy, this step is completed in Table 3 Model 4. The coefficient of CEO power in model 4 is β1=0.0057 (p<0.01), and the coefficient of CEO power in model 3 is β2=0.0061 (p<0.01). Because β1<β2, the company’s innovation strategy lies between CEO power and company performance play a part of the mediating role in the positive relationship, H3 is proved.

Model 2 is a regression model with only control variables. According to the research of Wen Zhonglin et al., this paper first uses model 6 to test the moderating effect of ownership concentration, and the coefficient is 0.0008, which is significant at the 1% level, indicating that there is a positive relationship between ownership concentration and corporate performance. Model 7 adds the interaction term of CEO power and ownership concentration (power * RS) on the basis of model 6, and the coefficient is -0.0003, which is significant at the 5% level. It shows that the more ownership concentration, the weaker the positive effect of CEO power on corporate performance. H4 is proved.
### Table 3. Regression results.

| Variable   | Model 1   | Model 2   | Model 3   | Model 4   | Model 5   | Model 6   | Model 7   |
|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
|            | RD        | Per       | Per       | Per       | Per       | Per       | Per       |
| Power      | 0.0856*** | 0.0061*** | 0.0057*** | 0.0049*** | 0.0225*** | (2.94)    | (2.60)    |
|            | (3.11)    | (3.17)    | (10.25)   | (7.33)    | (2.63)    |           |           |
| RD         |           |           | 0.0056*** | 0.0055*** |           |           |           |
|            |           |           | (10.25)   | (7.33)    |           |           |           |
| RS         |           |           |           |           | 0.0008*** | 0.0009*** |           |
|            |           |           |           |           | (17.87)   | (13.75)   |           |
| Power*RS   |           |           |           |           |           | -0.0003** |           |
|            |           |           |           |           |           | (-2.14)   |           |
| Growth     | -0.0017   | 0.0002    | 0.0002    | 0.0002*** | 0.0002    | 0.0002    | 0.0002    |
|            | (-1.05)   | (1.44)    | (1.44)    | (2.77)    | (1.53)    | (1.22)    | (1.20)    |
| Lev        | -0.4170***| -0.1712***| -0.1709***| -0.1689***| -0.1686***| -0.1637***| -0.1639***|
|            | (-4.02)   | (-19.82)  | (-19.74)  | (-61.51)  | (-19.74)  | (-20.43)  | (-20.39)  |
| Nidir      | -0.1003   | -0.0221** | -0.0284***| -0.0220** | -0.0278***| -0.0406***| -0.0404***|
|            | (-0.61)   | (-2.10)   | (-2.63)   | (-2.10)   | (-2.58)   | (-3.82)   | (-3.80)   |
| Size       | 0.8958*** | 0.0142*** | 0.0143*** | 0.0092*** | 0.0094*** | 0.0136*** | 0.0136*** |
|            | (69.59)   | (15.49)   | (15.64)   | (12.90)   | (7.68)    | (15.75)   | (15.73)   |
| Constant   | -1.6340***| -0.1922***| -0.1938***| -0.1832***| -0.1848***| -0.2227***| -0.2287***|
|            | (-6.19)   | (-10.53)  | (-10.66)  | (-15.35)  | (-10.14)  | (-12.94)  | (-12.87)  |
| Observations| 13,000    | 13,000    | 13,000    | 13,000    | 13,000    | 13,000    | 13,000    |
| R-squared  | 0.493     | 0.231     | 0.231     | 0.237     | 0.237     | 0.253     | 0.253     |
| F          | 1936      | 105.3     | 96.97     | 806.0     | 106.9     | 188.3     | 161.5     |

*** p<0.01, ** p<0.05, * p<0.1

### 5. Conclusions

This paper studied the relationship between CEO power, corporate innovation strategy and corporate performance by using ownership concentration, which was taken as a moderating variable. The results found that: the more concentrated CEO power, the more active the company's choice of innovation strategy will be. At the same time, more active innovation strategies would lead to better companies’ performance. Besides, CEO power not only has a direct beneficial effect on company performance, but also has an indirect impact on company performance through the intermediary effect of the company’s innovation strategy. Then, the ownership concentration could reduce the role of CEO power in promoting company performance.

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