The relationship between management changes and corporate debt costs based on engineering management

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Abstract. This paper takes the companies with management changes in the construction industry of Shanghai and Shenzhen in 2013-2017 as a sample, and uses the PSM-DID method to explore the impact of management changes on debt costs. The results show that the corporates' debt costs for management changes are significantly higher than companies that have not experienced management changes. Further research found that when management change types are abnormal changes and management successors are external successors, management changes result in higher debt costs. This research provides a basis for the management decision-making of engineering management and gives useful suggestions for its engineering management.

1. Introduction
Funding is the blood of the company. The financing efficiency and cost of funds will affect the cost of corporate capital, which in turn will affect the value of enterprises. The construction industry's asset-liability ratio reached 76.3% in 2017, ranking third among all industries. How to obtain low-cost debt financing is an urgent problem on engineering management. The management is the actual decision maker of the company, and management risk is an important factor affecting corporate risk. When management changes occur, the analysis of the uncertainty of management changes will lead to higher risk of default for the company's assessment, which will increase the debt financing costs.

Because of the objective existence of information asymmetry, executives have self-interested motives. So creditors will restrict executive behavior through strict debt contracts. However, there are few studies on the relationship between management changes and corporate debt financing costs. Zhang Rui (2018) only conducted a theoretical analysis, arguing that CEO changes affect the quality of internal control and contribute to debt financing costs [1]. Yihui Pan. et al (2016) studied the relationship between management changes and corporate default risk by analyzing the relationship between “three price differences” – CDS spreads, bank loan spreads and corporate bond yield spreads and management tenure [2]. Based on the above literature, management changes will make the future management decisions uncertain, which will affect the company's default risk, and in turn affects its debt cost.

Based on this, this paper uses the PSM-DID method proposed by Heckman et al (1997, 1998) [3] to empirically test the impact of management changes on corporate debt financing costs. And this paper also examines the differences in the impact of different types of change and successor sources on debt costs. The research enriches the management change theory and provides a basis for the management decision-making of listed companies in China.
2. Theoretical analysis and Hypothesis proposed

According to agency theory, corporate creditors and managers have principal-agent relationships (Jenson, 1988). To compensate for the corporate uncertainty, creditors will increase the company's necessary rate of return. Shijing (2014) believes that executive change will decline the quality of the company's financial reports [4]. Liu Xin (2015) through empirical evidence Changes in executives can cause strategic changes in the enterprise [5]. Therefore, the management change will increase the management risk, and the creditors will increase the requirements for the necessary rate of return of the enterprise and increase the debt cost. In summary, this paper proposes the first hypothesis:

H1: Management changes are positively related to corporate debt costs

Management changes are divided into normal changes and abnormal changes. According to the signal transmission theory, the abnormal change of management conveys a signal that the business management has undergone greater changes, which makes the company's management risk increase more. Based on this, this paper proposes the second hypothesis:

H2: Abnormal management changes will lead to higher corporate debt costs.

When the successor comes from the outside, his corporate strategy and management model adopted will disrupt the internal behavioral patterns, so that the future uncertainty of the enterprise will increase. For internal successors, managers generally follow the previous business style of the company, and the future uncertainty of the company changes little. Based on this, this paper proposes the third hypothesis:

H3: External successor managers will lead to higher corporate debt costs.

3. Research Design

3.1. Sample selection and data sources

This paper takes the listed companies with senior management changes in the construction industry of Shanghai and Shenzhen in 2013-2017 as the research sample and conducts the following screenings: (1) Excluding companies with multiple executive changes in a year; (2) Bilateral 1% reduction of continuous variables Tail processing. Finally, a total of 201 sample data were obtained. The data comes from the CSMAR database.

3.2. Variable definitions

3.2.1. Explained variable.

This paper refers to the definition of debt cost of Hu Guoliu (2017) [6], and measures the debt cost in the following way.

\[
\text{Debt cost} = \frac{\text{distribution of dividends} \times \text{profit or interest paid by interest payments}}{\text{dividend payouts for the year}} - \frac{\text{change in dividends payable}}{\text{change in interest payable}} + \frac{\text{short term borrowings}}{\text{(short term borrowings)}} + \frac{\text{long term borrowings}}{\text{long term borrowings due within one year}} + \frac{\text{bonds payable}}{\text{bonds payable}}
\]

3.2.2. Explanatory variables.

Management change (TURNOVER). The management change is a dummy variable. When the listed company changes management in a certain year, the variable takes a value of 1, otherwise it is 0. Management changes are divided into normal changes (NOR_TURNOVER) and abnormal changes (ABN_TURNOVER). And management successor sources can be divided into internal succession (IN_TURNOVER) and external succession (OUT_TURNOVER).

Time indication variable (TIME). The time indicator variable is a dummy variable. If the debt cost occurs in the year after the management change, the variable takes a value of 1, otherwise it is 0.

Control variables. This paper selects the ROA, P/B, asset-liability ratio (LEV), equity concentration (PFIR), the number of board meetings (MEETING), board size (BORDSIZE), and audit opinion (AUDIT) as control variables, while controlling annual effects (Year) and industry effects (Industry).
3.3. Research design

3.3.1. Propensity score matching
In order to eliminate the influence of endogeneity, this paper uses the propensity score matching method (PSM) to deal with companies with management changes.

\[
\text{TURNOVER}(1 \text{ or } 0) = \alpha_0 + \alpha_1 \text{ROA}_{i,t-1} + \alpha_2 \frac{P}{B}_{i,t-1} + \alpha_3 \text{LEV}_{i,t-1} + \alpha_4 \text{PFIR}_{i,t-1} + \alpha_5 \text{BOARDSIZE}_{i,t-1} + \alpha_6 \text{MEETING}_{i,t-1} + \alpha_7 \text{AUDIT}_{i,t-1} + \sum \text{year} + \sum \text{Industry} + \epsilon_{i,t-1}
\]

3.3.2. Difference in Difference
In order to further eliminate the influence of endogeneity, this paper uses the DID method to test the impact of management changes on the company’s debt cost. The basic model is as follows:

\[
\text{Cost} = \beta_0 + \beta_1 \text{TURNOVER}_j + \beta_2 \text{TIME}_{ij} + \beta_3 \text{TURNOVER}_j \times \text{TIME}_{ij} + \beta_4 \text{ROA}_{i,t-1} + \beta_5 \frac{P}{B}_{i,t-1} + \beta_6 \text{LEV}_{i,t-1} + \beta_7 \text{PFIR}_{i,t-1} + \beta_8 \text{BOARDSIZE}_{i,t-1} + \beta_9 \text{MEETING}_{i,t-1} + \beta_{10} \text{AUDIT}_{i,t-1} + \sum \text{year} + \sum \text{Industry} + \epsilon_{i,t-1}
\]

In addition, in order to further examine the differences in management's change types and successor sources to debt costs, this paper designs two extension models. This paper testing H2 by observing the coefficient of the interaction term \(\text{NOR}_j \times \text{TIME}_{ij}\) and \(\text{ABNOR}_j \times \text{TIME}_{ij}\) and testing H3 by observing the coefficient of the interaction term \(\text{IN}_j \times \text{TIME}_{ij}\) and \(\text{IN}_j \times \text{TIME}_{ij}\).

4. Empirical analysis

4.1. Descriptive statistics and correlation analysis
Tables 1 and 2 are the descriptive statistics and correlation analysis. The average annual debt cost rate of the enterprise is 0.0710, and the maximum value is 5.0031. Table 2 shows that the average annual debt cost rate of the enterprise is significantly related to the ROA, the P/B, the debt ratio, the size of the board of directors, the number of board meetings, and the audit opinion. The correlation between the explanatory variables is not large, and there is no serious multi-common Linear problem.

| Variable | Obs | Mean  | Std. Dev. | Min  | Max  |
|----------|-----|-------|-----------|------|------|
| Cost     | 201 | 0.0710| 0.4668    | -2.9974| 5.0031|
| ROA      | 201 | 0.0513| 0.0435    | -0.0213| 0.2795|
| P/B      | 201 | 5.7208| 14.6683   | 0.0000| 174.0642|
| Lev      | 201 | 0.6415| 0.1594    | 0.3249| 0.9322|
| PFIR     | 201 | 34.1884| 14.7756   | 3.89  | 88.55 |
| Boardsize| 201 | 8.6264| 1.6778    | 5     | 18   |
| Meeting  | 201 | 9.9535| 4.2984    | 3     | 44   |
| Audit    | 201 | 0.9535| 0.2112    | 0     | 1    |

| Variable | COST | ROA | P/B  | LEV  | PFIR | BOARDSIZE | MEETING | AUDIT |
|----------|------|-----|------|------|------|-----------|---------|-------|
| ROA      |      | 1   |      |      |      |           |         |       |
| P/B      | 0.182***|      | 1    |      |      |           |         |       |
| LEV      | 0.0371***| 0.2406***| 1    |      |      |           |         |       |
| PFIR     | 0.3495***| 0.3553***| -0.15***| 1    |      |           |         |       |
| Boardsize| 0.0627***| 0.0621***| -0.0493***| 0.0832***| 1 |            |         |       |
| MEETING  | 0.0627***| 0.0621***| -0.0493***| 0.0832***| 1 |            |         |       |
| AUDIT    | 0.0627***| 0.0621***| -0.0493***| 0.0832***| 1 |            |         |       |
4.2. The impact of management changes on corporate debt costs

Table 3. Regression result.

| variable | Logit  | M1      | M2      |
|----------|--------|---------|---------|
| TIME     | 0.0117*** (5.20) | 0.0117* (5.20) |
| ABN_TURNOVER | 0.0052 (1.22) | 0.0052 (1.22) |
| NOR_TURNOVER | 0.0042 (0.86) | 0.0042 (0.86) |
| ABN_TURNOVER*TIME | 0.0151*** (2.53) | 0.0151*** (2.53) |
| NOR_TURNOVER*TIME | -0.005 (0.73) | -0.005 (0.73) |
| OUT_TURNOVER | 0.0069 (1.24) | 0.0069 (1.24) |
| IN_TURNOVER | 0.0038 (0.97) | 0.0038 (0.97) |
| OUT_TURNOVER*TIME | 0.0158** (1.99) | 0.0158** (1.99) |
| IN_TURNOVER*TIME | 0.0087 (1.56) | 0.0087 (1.56) |
| ROA      | -1.95546*** (-3.15) | -1.95546*** (-3.15) |
| PB       | 0.00233* (1.71) | 0.00233* (1.71) |
| LEV      | 0.27466*** (2.30) | 0.1373*** (2.06) |
| PFIR     | 0.00085 (0.27) | -0.0003*** (-2.97) |
| MEETING  | -0.00206 (2.73) | 0.0007*** (2.71) |
| BOARDSIZE | -0.03617* (-1.75) | -0.0013* (-1.89) |
| AUDIT    | -0.49998*** (-2.54) | 0.0044 (0.59) |
| _Cons    | -0.83359* (-1.68) | -0.0197 (-1.27) |
| Year     | Control | Control | Control |
| Industry | Control | Control | Control |
| Adj R²   | 0.0274 | 0.1312 | 0.131 |
| P        | 0.000 | 0.000 | 0.000 |

Note: ***p<0.01, **p<0.05, *p<0.1

Table 4. Balance test result.

| Variable | Treated | Control | %bias | t-test | p>|t |
|----------|---------|---------|-------|--------|-----|
| ROA      | Unmatched | 0.0376 | 0.0467 | -16.6 | -6.11 | 0.000 |
|          | Matched  | 0.0376 | 0.0398 | -4.1  | -1.15 | 0.249 |
| PB       | Unmatched | 8.9226 | 8.8931 | 0.1   | 0.05  | 0.958 |
|          | Matched  | 8.9226 | 8.8403 | 0.4   | 0.10  | 0.924 |
5

Lev
Unmatched
0.4629
0.4266
18.8
6.71
0.000
Matched
0.4629
0.4558
3.7
1.03
0.302
PFIR
Unmatched
34.993
33.958
6.9
2.47
0.014
Matched
34.993
34.670
2.2
0.61
0.542
Meeting
Unmatched
9.8811
9.9742
-2.2
-0.76
0.445
Matched
9.8811
9.9019
-0.5
-0.14
0.886
Boardsize
Unmatched
8.7071
8.6032
6.1
2.18
0.029
Matched
8.7071
8.7018
0.3
0.09
0.929
Audit
Unmatched
0.9725
0.9839
-7.8
-2.97
0.003
Matched
0.9725
0.9766
-0.5
-0.14
0.886

Table 5. PSM analysis results of management changes affecting corporate debt costs.

| Variable   | Unmatched | Matched |
|------------|-----------|---------|
| Cost       | ATT       |
| Processing group | -3.7136   | -3.7127 |
| Control group | -3.4165   | -3.5895 |
| Mean difference | 0.2971    | -0.1231 |
| Standard error | 0.0627    | 0.0625  |
| T-test     | 4.74      | 1.97    |

Table 6. The impact of management changes on corporate debt costs.

| Result variable | Cost | Std.Dev. | t   | p>t   |
|-----------------|------|----------|-----|-------|
| Pre-test        |      |          |     |       |
| Treatment group | 0.008|          |     |       |
| control group   | 0.019|          |     |       |
| Difference      | -0.011| 0.004    | 3.05| 0.002***|
| Aft- experiment |      |          |     |       |
| Treatment group | 0.020|          |     |       |
| control group   | 0.020|          |     |       |
| Difference      | 0.000| 0.004    | 0.05| 0.963 |
| DID             | 0.011| 0.005    | 2.12| 0.034**|

Note: ***p<0.01, **p<0.05, *p<0.1

Using the PSM method to study the impact of management changes on corporate debt costs can alleviate the problem of selection bias. The Logit regression results in the first column of Table 3 indicate that the worse the company's past performance level, the higher the possibility of management change; the company that issued the non-standard audit opinion is more likely to have management changes. Other covariates have an impact on management changes, but not significantly. On the basis of Logit regression, the propensity score of each sample company is calculated, and the kernel matching method is used for matching. The results in Table 4 show that the standard deviation of each variable after PSM matching is less than 10%. The sample mean values of the treatment group and the control group were not statistically significant, and the matching effect was better. The results in Table 5 show that the estimated value of ATT is -3.7127, and the corresponding t value is 1.97, which is greater than the critical value of 1.96. Therefore, the enterprise change management will cause its debt cost to be significantly smaller than that of the unchanged enterprise, and Hypothesis 1 is initially verified. Table 6 shows that after the DID, the difference between the control group and the processing group is 0.011, and is significant at the level of 5%. The company that indicated that the management change occurred had a significantly higher debt cost than the company that did not have a management change. It was consistent with the conclusions drawn by the PSM method and verified Hypothesis 1.

4.3. The impact of management change types and successor sources on corporate debt costs
The management change types can be divided into normal changes and abnormal changes. The results in the second column of Table 3 show that the coefficient of ABN_TURNOVER*TIME is 0.0151 and
it is significant at the level of 0.01; the coefficient of NOR_TURNOVER*TIME is -0.005, but it’s not significant. It can be seen that the abnormal change of management makes the cost of corporate debt rise higher. The impact of management successor sources on debt costs is shown in the third column of Table 3. The coefficient of OUT_TURNOVER*TIME is 0.0158, which is significant at the level of 0.01; the coefficient of IN_TURNOVER*TIME is 0.0087, but it’s not significant. So it can be seen that the management of external sources will increase the debt cost of enterprises.

4.4. Robustness test
In order to make the results more robust, this paper conducted the following robustness test. Firstly, the paper rejects the largest 5% and the smallest 5% of the sample data. Secondly, the PSM was performed by means of nearest neighbor matching, and the significance was not significantly changed.

5. Analysis conclusion
Based on the management risk perspective, this paper discusses the impact of management changes on debt costs by PSM-DID method. Through empirical evidence, management changes are positively related to the company’s debt costs. When the management is abnormally changed and the successor is an external successor, the management changes result in higher debt costs. In the event of a management change, the listed company’s debt financing costs are higher, which will increase the risk of the company. Therefore, the construction companies must make a decision on management change cautiously. When a management change occurs, the successor can be selected internally to control the debt costs.

References
[1] Zhang, R. (2018) CEO Change and Debt Financing Costs. Modern Business, 14: 106-107.
[2] Pan, Y.H. Wang, Y. (2018) How management risk affects corporate debt. The Review of Financial Studies, 31:3491–3531.
[3] Heckman, J.J, H. Ichimura, and P.E. Todd. (1998) Matching as an Econometric Evaluation Estimator. Review of Economic Studies, 65(2): 261-294.
[4] Shi, J. (2014) Research on Government Control, Executive Change and Financial Report Quality--Based on Data of Listed Companies. Shandong University of Finance and Economics, DOI: 10.7666/d.D490725.
[5] Liu, J. (2015) The influence of CEO succession selection mechanism on corporate strategic innovation based on age perspective. Journal of Management, 12(5): 668-678.
[6] Hu, G.L. (2017) Directors’ Responsibility Insurance and Corporate Debt Costs – Empirical evidence based on A-share listed companies. Financial Economics Research 32, 55-64.
[7] Jiang, Y. (2015) Research on Credit Risk Assessment of Chinese Listed Companies Based on KMV Model. Journal of Central University of Finance and Economics, 9:38-45.