

Media Coverage, CEO Age and Corporate Performance in Big Data Environment

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Abstract. This study analyzes the influence of CEO age on corporate performance under the big data environment and the role of media coverage in this relationship by taking the A-share listed companies from 2009 to 2019 as research objects. Our results show that in the low-speed developing enterprises, the older the CEO, the higher the level of corporate performance. Positive and neutral media reports positively affect corporate performance, whereas negative media reports negatively affect corporate performance. Media reports (including positive, negative, and neutral media reports) weaken the influence of CEO age on corporate performance

1 Introduction

In today's era of big data, in addition to newspapers, television, radio, and other traditional media, the influence of network media is gradually emerging[1]. These media have a wide range of user traffic and convenient communication platform, which has brought great market attention to listed companies and considerable pressure to CEO career concerns. Network media reports are all-inclusive, but they are also mixed[2]. Similar to big factual news, fake news attracts traffic. The credibility of online media is not as good as that of paper media. Therefore, besides the formal legal and institutional supervision, the effect of media coverage on the governance of listed companies is worth analyzing.

Enterprises in the big data environment are under the magnifying glass of various media. As soon as the wind blows and grass-roots action occurs, they should expect overwhelming network reports[3]. For example, the recent report of Evergrande's major asset restructuring has brought an unprecedented crisis to the enterprise[4]. If an enterprise fails to handle this kind of emergency properly, then it may suffer from unimaginable consequences. Therefore, enterprises and CEOs should pay attention to media reports.

2 Theoretical analysis and research hypothesis

2.1 CEO age and firm performance

Hambrick and Mason (1984) believed that the performance level of an organization depends on the management background and composition characteristics of its top management personnel to some extent[5]. As the top administrative personnel, the CEO can significantly affect the strategic decision-making and policy-making, and ultimately, the business performance of the whole enterprise. By contrast, the studies of Child and Mellons (1992), Sun Kai et al. (2019) showed that the younger the average age of the executives, the better the company performance[6].

Different from the above two views, Jian Ming (2006) found that when the age of executives is lower than 56, it does not correlate with corporate performance[7]. However, when the age of executives is higher than or equal to 56, it has a significant role in promoting corporate performance.

The above research results provide no consistent conclusion on the relationship between CEO age and firm performance. CEO experience and CEO career focus are the keys to explain this relationship. In improving enterprise performance, CEOs' experience plays a major role[8]. Older CEOs have considerable experience and richer social capital, which are helpful for the improvement of enterprise performance. For younger CEOs, even if they have a strong internal drive to improve their career concerns by improving corporate performance, their unchangeable qualifications and

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resources may still limit them. Consequently, achieving the management performance of older CEOs will be difficult for them.

Accordingly, we put forward the following hypothesis: H1: CEO age has a positive effect on firm performance.

2.2 Media coverage and corporate performance in the big data environment

With the explosive growth of information in recent years, media, as a communication tool in the big data environment, has played a critical role in the current era. Consequently, the significance of the influence of media reports on enterprises is increasing. On the one hand, media coverage brings the role of information communication to enterprises[9]. On the other hand, media coverage plays the role of supervision and governance. Li Peigong and Shen Yifeng (2010) divided media coverage into positive, neutral, and negative media reports[10]. They believed that these different types of media reports could reflect various governance effects[11]. Accordingly, the current study aims to analyze the influence of media coverage on corporate performance by using these three types of media reports.

2.2.1 Positive media report and enterprise performance

Positive media reports in the big data environment are usually positive affirmation or praise of enterprises, and we media and network media repeatedly present these reports. Moreover, they can promote the improvement of corporate reputation and release favorable signals to the public. Consequently, enterprises can obtain enough resources to supplement their deficiencies. Nguyen (2006) found that the more positive the media coverage of a company, the greater Tobin's q value of the company[12].

Accordingly, we put forward the following hypothesis:

H2a: Positive media reports have a positive effect on enterprise performance.

2.2.2 Media neutral reporting and corporate performance in the big data environment

In the big data environment, media-neutral reporting has no clear media sentiment tendency[13]. It is not alert and exposed. It is a normal and balanced way of reporting. Neutral media reports are composed of "multiple sources." They do not pick the trouble and act following the wind. In a chaotic situation, they can enlighten the stakeholders to be rational. After the media present these reports, on the one hand, the exposure of listed companies has been improved, which is conducive to investors and regulators to pay attention to these companies[14-17]. At this time, these reports play a positive role in reporting. On the other hand, they exert market pressure on these companies, forcing the management to consider their behavior carefully.

Therefore, even if they only transmit the company's information to the public, the diffusion of information still plays a role in reducing information asymmetry and alleviating the principal-agent problem.

Accordingly, we put forward the following hypothesis:

H2b: Neutral media reports have a positive effect on enterprise performance.

2.2.3 Negative media reports and corporate performance in the big data environment

Restricted by the reputation of the media and relevant laws, the negative media reports on enterprises are often authentic and credible[18]. The enterprises that are negatively reported by the media must have some problems[19]. When the media present "serious" issues, it implies that the enterprise has increasing violations and accelerates the speed of spreading bad news through the reports of network media and we media. This situation leads to the dissatisfaction or non-cooperation of enterprise stakeholders. It aggravates the difficulties in financing, production, turnover, sales, and other aspects of enterprises. It also causes a short-term "herding effect" and reduces company performance.

However, scholars also believed that negative media reports could effectively inhibit the opportunistic behavior of managers and reduce agency costs. Under great pressure, managers will maintain their reputation and actively take action to meet market expectations. Therefore, in the long run, negative media reports may not necessarily reduce corporate performance.

This study believes that negative media reports are easy to bring a domino effect. Especially in today's big data era, the widespread of paper media, network media, and we media can trigger the internal and external environments that are not conducive to the development of enterprises. These environments may also not conducive to the improvement of enterprise performance.

Accordingly, we put forward the following hypothesis:

H2c: Negative media reports have a negative effect on corporate performance.

2.3 Media attention, CEO age, and corporate performance in the big data environment

Media reports can easily affect CEOs, as the top management personnel, in the process of improving enterprise performance[20]. Especially in today's big data environment, as long as a stir in the wind and grass exist, all kinds of media are coming, which brings great pressure to enterprises and CEOs[21-24]. However, existing research has not reached a consensus regarding this relationship.

Positive media reports can enhance the reputation of CEOs and increase the probability of officials getting direct or indirect administrative incentives[25]. Satisfactory company performance will improve the managers' reputation and is conducive to their future career development. For the sake of career consideration,

managers will choose to cater to the media, give up the behavior that damages the interests of investors, regulate their behavior, and strive to improve enterprise performance. Therefore, to avoid future reputation damage, the management will actively develop corporate governance, reduce self-interest behavior, and support the improvement of corporate performance.

Neutral media reports are likely to come from negative media reports. Many enterprises' crisis public relations transform negative media reports of enterprises into neutral media reports. Therefore, CEOs are also concerned about this kind of report. In general, neutral media reports are critical in resolving enterprise crisis and improving enterprise performance.

Negative media reports lead to the increase of public opinion pressure, which restricts the behavior of the management[26]. For the sake of their interests, CEOs are especially concerned about the negative media reports[27]. Negative reports will increase the sensitivity of stakeholders to the financial information disclosed by the company and other aspects[28]. The salary and promotion of the management are usually closely related to the performance of the enterprise[29-30].

Therefore, whether the media reports are positive, neutral, or negative, they play a critical role in the relationship between CEO and firm performance. In this study, we argue that for the consideration of career concerns, the younger the CEOs, the higher the degree of attention they attach to reputation, and the higher the internal drive to improve company performance. On the contrary, the older the CEOs, the less attention they attach to reputation and future career, and the media will face more difficulty playing a role in promoting the company's performance.

Accordingly, we put forward the following hypotheses:

H3a: Positive media reports weaken the effect of CEO age on corporate performance. H3b: Neutral media reports weaken the effect of CEO age on firm performance.

H3c: Negative media reports weaken the effect of CEO age on corporate performance.

3 Research design

This study focuses on media attention. Firstly, we investigate the effect of CEO age on enterprise performance. Secondly, following the media attitude, we divide media reports into positive, neutral, and negative media reports and explore their influence on the relationship between CEO age and corporate performance.

3.1 Data source and sample description

In this study, we select the A-share listed companies of the Shenzhen Stock Exchange and Shanghai Stock Exchange from 2009 to 2019 as the research objects. We obtain the financial data from the 'guotai' database and the data of media coverage from the China research data service platform.

After excluding the samples with incomplete financial data and zero or incomplete media reported data, we have a total of 23,360 valid sample data. To avoid the influence of extreme values, we tail all the continuous variables at the company level at 1% level.

3.2 Variable selection

3.2.1 Explained variables

Enterprise performance evaluation system includes financial and non-financial indicators. In practice, scholars generally choose financial indicators for the measurement. Moreover, they use return on total assets, return on net assets, and Tobin's q as variables to measure enterprise performance. In the current study, we measure the enterprise performance by using the rate of return on total assets.

3.2.2 Explanatory variables

We measure the CEO age by using age and the natural logarithm of age.

We express media coverage through positive, neutral, and negative media reports. We measure media reports by using the number of times the media reported them. In the big data environment, many types of media exist. In this study, we select the paper media. Given that the government or authoritative units often have the right to issue paper media, the public perceives the news released by the paper media as highly authentic and trustworthy.

3.2.3 Control variables

In the selection of control variables, we consider the following financial and governance factors of the selected companies:

- (1) Debt paying ability.
- (2) Growth.
- (3) Company size.
- (4) Year.
- (5) Industry

To avoid the interference caused by outliers, we subject all continuous variables to 1% winsorize tailing. Tab.1 lists the definitions and explanations of the main variables in this study.

Table.1 variable definition table

Variable type	Variable name	Variable symbol	Variable description
Explained variable	Company performance	ROA	Return on total asset=profit/asset
Explanatory variable	CEO career concern	Age	CEO age
		lnage	Natural logarithm of CEO's age

Adjustment variable	Positive media coverage	Mediapos	Number of positive media report
	Neutral media coverage	Medianeu	Number of neutral media report
	Negtive media coverage	Medianeg	Number of negative media report
Contral variable	Debt paying ability	level	Leverage=liability/asset
	Growth abilitih	growth	Net profit growth rate
	Company size	lna	Natural logarithm of total asset
	Year	year	The sample has 11 years of data
	industry	ind	

To verify the effect of CEO’s age on firm performance, combined with the existing literature, we set a regression model as follows:

3.3 Model setting

3.3.1 Proposed model of the influence of CEO age on firm performance

$$ROA = \alpha_0 + \alpha_1 age + \alpha_2 level + \alpha_3 growth + \alpha_4 lna + \Sigma year + \Sigma ind + \varepsilon \tag{1}$$

To verify the effect of positive, neutral, and negative media reports on corporate performance in the big data environment, we set a regression model as follows:

3.3.2 Proposed model of the influence of media coverage on enterprise performance in the big data environment

$$ROA = \alpha_0 + \alpha_1 mediapos + \alpha_2 level + \alpha_3 growth + \alpha_4 lna + \Sigma year + \Sigma ind + \varepsilon \tag{2}$$

$$ROA = \alpha_0 + \alpha_1 medianeu + \alpha_2 level + \alpha_3 growth + \alpha_4 lna + \Sigma year + \Sigma ind + \varepsilon \tag{3}$$

$$ROA = \alpha_0 + \alpha_1 medianeg + \alpha_2 level + \alpha_3 growth + \alpha_4 lna + \Sigma year + \Sigma ind + \varepsilon \tag{4}$$

To verify the role of positive, neutral, and negative media reports on the relationship between CEO age and corporate performance in the big data environment, we set a regression model as follows:

3.3.3 Role of media coverage in the relationship between CEO age and corporate performance in the big data environment

$$ROA = \alpha_0 + \alpha_1 age + \alpha_2 mediapos + \alpha_3 age.mediapos + \alpha_4 level + \alpha_5 growth + \alpha_6 lna + \Sigma year + \Sigma ind + \varepsilon \tag{5}$$

$$ROA = \alpha_0 + \alpha_1 age + \alpha_2 medianeu + \alpha_3 age.medianeu + \alpha_4 level + \alpha_5 growth + \alpha_6 lna + \Sigma year + \Sigma ind + \varepsilon \tag{6}$$

$$ROA = \alpha_0 + \alpha_1 age + \alpha_2 medianeg + \alpha_3 age.medianeg + \alpha_4 level + \alpha_5 growth + \alpha_6 lna + \Sigma year + \Sigma ind + \varepsilon \tag{7}$$

total assets is 0.3498, and the minimum value is -1.0174. This finding shows great differences in the performance and economic strength of China’s listed companies. The average age of the CEOs is 49 years old, the maximum value is 65 years old, and the minimum value is 33 years old. The maximum number of positive media reports is 1706, the minimum is 5, and the average value is 143. The maximum number of neutral media reports is 1113, the minimum is 1, and the average value is 74. The listed companies have at least 5 negative reports, and the average number of negative reports is 103.

4 Empirical results and analysis

4.1 Descriptive statistics and correlation analysis

4.1.1 Descriptive statistics of the main variables

Tab.2 shows the descriptive statistical results of the main research variables. The maximum value of return on

Table.2 Descriptive statistics of main variables

	Obs	Mean	Std. Dev.	Min	Max
ROA	23,360	.0814453	.0985101	-1.0174	.3498
Age	23,360	49.41718	6.187383	33	65
lnage	23,360	3.892175	.1288893	3.496508	4.174387
Media-pos	23,360	143.0667	231.4179	5	1706
Media-neu	23,360	74.65521	149.2447	1	1113
Media-neg	23,360	103.7184	200.4901	3	1505
level	23,360	.4209116	.2074373	.048805	.885989
growth	23,360	.2218597	6.815669	-39.39192	35.8597
lna	23,360	22.18211	1.349104	19.84417	26.52332

4.1.2 Correlation analysis

Before the regression analysis of the variables, we conduct a correlation analysis of the main variables. Tab.3 shows the results of the correlation analysis of the

main variables in this study. Overall, CEO age, positive, neutral, and negative media reports are all related to corporate performance. Likewise, the asset-liability ratio, net profit growth rate, and asset are related to enterprise performance.

Table.3 Correlation analysis of main variables

	ROA	Age	lnage	Mediapos	Medianeu	Medianeg	level	growth	lna
ROA	1								
Age	0.02*	1							
lnage	0.02*	0.99*	1						
Media-pos	0.13*	0.05*	0.06*	1					
Media-neu	0.10*	0.05*	0.05*	0.91*	1				
Media-neg	0.08*	0.05*	0.05*	0.90*	0.90*	1			
level	-0.03*	0.02*	0.02*	0.21*	0.20*	0.20*	1		
growth	0.42	-0.01*	-0.01*	0.02*	0.01*	0.01	-0.01*	1	
lna	0.09	-0.12*	0.13*	0.48*	0.00	0.44*	0.55*	0.00	1

4.2 Multiple linear regression

We obtain the following multiple regression results when verifying our proposed hypotheses.

Tab.4 takes the natural logarithm of CEO age and CEO age as explanatory variables and presents the regression result of Model (1). Columns (1), (2), and (3) show the relationship between CEO age and firm performance when the growth rate of net asset profit is

greater than the average level (0.22). The relationship between CEO age and enterprise performance is positive, but the relationship is not significant. Columns (3), (4), and (5) show the relationship between CEO age and corporate performance in enterprises with a net profit growth rate of less than 0.22. The finding indicates that CEO age is positively correlated with corporate performance in low-speed developing enterprises, supporting H1.

Table.4 CEO age and company performance

	(1) ROE	(2) ROE	(3) ROE	(4) ROE	(5) ROE	(6) ROE
age		0.000154 (0.93)			0.000467*** (2.66)	
lnage			0.00767 (0.98)			0.0217** (2.57)
Control variable	Control	Control	Control	Control	Control	Control
N	8922	8922	8922	14438	14438	14438

Tab.5 verifies the relationship between positive media coverage, CEO age, and corporate performance. Columns (1), (2), (3), and (4) show the relationship

between positive media reports, CEO age, and corporate performance of enterprises with a net asset profit growth rate of greater than 0.22. Positive media reports have a positive correlation with corporate performance in

enterprises with a net profit growth rate higher than the average level (0.22), but the correlation is not significant. Columns (5), (6), (7), and (8) show the relationship between positive media reports, CEO age, and corporate performance when the growth rate of net profit is less

than the average (0.22). For low-speed developing enterprises, positive media reports promote the improvement of enterprise performance. However, they also weaken the influence of CEO age on enterprise performance improvement.

Table.5 Positive media coverage, CEO age and company performance in the big data environment

	Control variables	Control	Control	Control	Control	Control	Control	Control
mediapos	0.0000228*** (4.62)	0.0000695* (1.94)	0.0000228*** (4.61)	0.000239* (1.76)	0.0000489*** (7.50)	0.000210*** (5.17)	0.0000489*** (7.50)	0.000668*** (4.34)
age	0.000146 (0.88)	0.000256 (1.38)				0.000430** (2.45)	0.000770*** (3.96)	
lnage			0.00707 (0.90)	0.0135 (1.53)			0.0198** (2.36)	0.0363*** (3.89)
Age*mediapos		-0.000000935 (-1.31)				-0.00000315*** (-4.01)		
Lnage*mediapos				-0.0000555 (-1.59)				-0.000158*** (-4.03)
N	8920	8920	8920	8920	14436	14436	14436	14436

Tab.6 verifies the relationship between media-neutral reporting, CEO age, and corporate performance. Columns (1), (2), (3), and (4) show the relationship between neutral media reports, CEO age, and corporate performance of enterprises with a net asset profit growth rate of greater than 0.22. The results show a positive correlation between neutral media reports and corporate performance when the growth rate of net profit is higher

than the average level (0.22), but the correlation is not significant. Columns (5), (6), (7), and (8) show the relationship between neutral media coverage, CEO age, and corporate performance when the growth rate of net profit is less than the average (0.22). For low-speed developing enterprises, media-neutral reporting promotes the improvement of enterprise performance. However, it also weakens the influence of CEO age on enterprise performance improvement.

Table.6 neutral media coverage, CEO age and company performance in the big data environment

	(1) ROE	(2) ROE	(3) ROE	(4) ROE	(5) ROE	(6) ROE	(7) ROE	(8) ROE
medianeu	0.0000140* (1.71)	0.0000785 (1.38)	0.0000139* (1.70)	0.000320 (1.49)	0.0000259*** (2.65)	0.000243*** (4.00)	0.0000259*** (2.65)	0.000863*** (3.77)
age	0.000153 (0.93)	0.000233 (1.30)			0.000458*** (2.61)	0.000694*** (3.71)		
lnage			0.00754 (0.96)	0.0123 (1.44)			0.0212** (2.52)	0.0328*** (3.65)
Age*medianeu		-0.00000129 (-1.15)				-0.00000421*** (-3.62)		
Lnage*medianeu				-0.0000783 (-1.42)				-0.000213*** (-3.66)
N	8920	8920	8920	8920	14436	14436	14436	14436

Tab.7 verifies the relationship between negative media reports, CEO age, and corporate performance. Columns (1), (2), (3), and (4) show the relationship between negative media reports, CEO age, and firm performance when the growth rate of net asset profit is greater than 0.22. The result shows that the negative

media reports and corporate performance are negatively correlated, but not significantly, in enterprises with a net profit growth rate higher than the average level (0.22). Columns (5), (6), (7), and (8) show the relationship between negative media reports, CEO age, and corporate performance when the growth rate of net profit is less than the average (0.22). For low-speed developing

enterprises, the negative media reports are not good for promoting the improvement of enterprise performance.

However, they also weaken the influence of CEO age on enterprise performance improvement.

Tab.7 negative media coverage, CEO age and company performance in the big data environment

	(1) ROE	(2) ROE	(3) ROE	(4) ROE	(5) ROE	(6) ROE	(7) ROE	(8) ROE
medianeg	-0.0000643 (-1.09)	-0.0000805 (-0.19)	-0.0000646 (-1.10)	0.0000349 (0.02)	-0.000149** (-2.04)	0.0000811* (1.70)	-0.000149** (-2.04)	0.000341* (1.90)
age	0.000156 (0.94)	0.000153 (0.85)			0.000475*** (2.70)	0.000624*** (3.28)		
lnage			0.00777 (0.99)	0.00799 (0.93)			0.0220*** (2.62)	0.0291*** (3.18)
Age*medianeg		3.27e-08 (0.04)				-0.00000186** (-2.04)		
lnage*medianeg				-0.00000255 (-0.06)				-0.0000904** (-1.98)
Control variables	Control	Control	Control	Control	Control	Control	Control	Control
N	8920	8920	8920	8920	14436	14436	14436	14436

Low-speed developing enterprises are relatively mature, as shown in Tables 3 to 7. In general, previous studies showed that the older the CEOs, the higher the performance level of the enterprises. They also pay more attention to media reports, regardless of how the media presented them. However, for low-speed developing enterprises, the results show that the older the CEOs, the less attention they pay to the media, and the less motivation they have to improve their performance. In the early stage of the enterprise life cycle in high-speed developing enterprises, all aspects of the system are not sound in general. Although they pay attention to the media reports, the effect on enterprise performance is not evident compared with the constantly changing inside and outside environments.

5 Conclusion and enlightenment

This study can guide government regulators, the media industry, listed companies, and CEOs. The results of this study show that high-speed developing enterprises do not respond to media coverage enough. Even the negative media reports do not attract enough attention from enterprises and CEOs. In this case, the only way to restrict the listed companies is to use the supervision function of the government. The government should standardize the development of the media industry, strengthen the development of media supervision mechanisms, and encourage the media to release authentic reports. In the big data environment, the paper media, network platform, and we media have a wide range of information dissemination and great influence. When enterprises have obtained negative public opinions due to their actions, they should actively take measures to improve their illegal behaviors. They should explain and apologize for the negative effect immediately, control the situation as far as possible, and strive for public understanding and media support to minimize the loss caused by negative reports. As the top management

personnel, the CEO should pay attention to media reports about enterprises. They should treat these reports rationally, whether for the consideration of enterprise performance or personal reputation.

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