

The Effect of Analyst Following on Corporate Inefficient Investment Using Regression Analysis

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Abstract. Contemporarily, analyst following and inefficient investment are the general concern of the company's management, which is necessary to investigate the relationship between them. We select 2012-2017 Chinese A-share listed companies as the research object to obtain sample data, design a regression model which contains seven variables and use Stata software to analysis it, get the impact of analyst following on corporate inefficient investment. Based on the analysis, analyst following will reduce the level of corporate inefficient investment, which is still valid after a series of robustness tests. Besides, the results of heterogeneity analysis show that the impact of analyst following on corporate inefficiency investment is more obvious in companies with high leverage and low audit quality. This article provides suggestions for corporate governance and has practical significance for improving the level of enterprise resource allocation.

Keywords: analyst following; corporate inefficient investment; external supervision; audit quality; firm leverage

1. Introduction

Corporate investment efficiency is important to companies, since the scarcity of resources determines that companies must optimize their resource allocation and improve investment efficiency. Therefore, investigation the factors that affect the efficiency of corporate investment have attracted widespread attention from the public and academic. There have been some studies that have examined the impact of media reports, industrial policy, government support, etc. on corporate investment efficiency [1, 2]. However, few scholars investigate the impact of analysts following on corporate investment efficiency. Therefore, this article aims to provide suggestions for companies to optimize resource allocation and improve investment efficiency through research analysts following on the impact of corporate inefficient investment.

Analyst following, a vital external information intermediary, is to provide privately collected information [3]. It is closely related to plenty of corporate behaviors, e.g., corporation decision, innovation strategy and expected cash risk [4-6]. As an important corporation behavior, analyst is probable to play a role on corporate investment. It is found that a reduction in analyst following reduces capital expenditures and institutional monitoring, suggesting that it is through these two direct channels which analyst following affects firm productivity [7]. Furthermore, firms and managers could benefit from finding and investing productive projects under the help of analysts, especially in opaque firms, financially constrained firms and firms with weaker investor protection [7]. Consequently, we anticipate that analyst following may have a binding effect on corporate inefficient investment.

The reasons for selecting the Chinese sample as the target for research are listed as follow. First, in China, the capital market is still in the development stage, and problems e.g., information asymmetry of listed companies are common, which has also led to the widespread problems of over-investment and under-investment in companies [8]. The efficiency of corporate investment is an important factor

that affects the long-term development of a company. Therefore, Chinese companies are an important sample of investment efficiency research.

Second, according to Xue and Coomes, the supervision of Chinese financial system was weak for a long time [9]. Due to the inefficiency of Chinese financial supervision, the arbitrage opportunities are universally existed. This gives financial analysts an environment to carry out further research by investigate the relationship between financial supervision policies and investment efficiency. It is also found out the relationship with the concern of analyst following and inefficient investment. Further research may help all of researchers to have more precise view of those factors may influence the investment efficiency.

This paper's contribution to the literature will come from those views. First, the correlation between inefficient investment and financial analyst following is presented. From the baseline regression results, analyst following may have negative influence on the inefficient investment. This conclusion is still valid after a series of robustness tests, including considering some omitted variables and using province fixed effects model. Besides, according to the results of heterogeneity analysis, the impact of analyst following on corporate inefficiency investment is more obvious in companies with high leverage and low audit quality. Investigations in these fields will help sort out the relationship between analyst following and inefficient investment. This may provide investors a brand-new view to assess firms.

The research contributions of this paper are as follows. First, on the corporate side, some studies suggest that firms involving high corporate social responsibility will cause more inefficient investment [10]. In addition, others argue that CEOs who have strong relationship with independent board members will cause higher inefficient investment [11]. We examine the impact of analyst following on inefficient investment, which is a supplement to the influence of external supervision on company investment.

Second, some studies state that analyst coverage has effects on corporate governance. Companies that information available or disclose more information have high analyst coverage. It will promote the company's production efficiency [12]. Besides, analyst will be as a supervisor to make sure the managers act in the best interests of investors. Few analysts will encourage company to do more risk-taking investments [13]. However, little evidence is provided regarding the allocation of resources. From the perspective of resource allocation, we study the impact of analysts' attention on inefficient investment and expand the research scope.

The reminder of this paper is organized as follows. Section 2 summarizes literature review and hypothesis development. Section 3 introduces sample, measurement and model specification. Section 4 explains empirical results. Eventually, Section 5 draws the conclusion and gives advice to government and firms.

2. Literature Review and Hypothesis Development

Investment efficiency could be normally explained that inputs a fixed investment then the effectiveness of the output is investment efficiency. According to Bhushan's research, multiple dimensions of factors may affect the inefficient investment [14]. Analyst followings was considered as a brand-new factor that connected with inefficient investment. This paper will deeply discuss the correlation between inefficient investment and analyst followings.

Hypothesis 1 is proposed as the analyst following will mitigate the inefficient investment. It could be explained as the social supervision is attracted by the analysts followed the target firm. Xue and Coomes claimed that Chinese finance market supervision had systematical issue. It may provide some arbitrage opportunities for investors. Analyst following may have a similar substitute function to supervision mechanism. For this view, this may mitigate the inefficient investment.

H1. Analyst following restrains corporate inefficient investment.

Since shareholders only bear limited liability for debts, the existence of agency problems, information asymmetry problems and debt financing will increase the conflict of interest between

shareholders and creditors. Consequently, it may lead to over-investment or under-investment in the company. High-leverage company has a higher moral hazard, and managers tend to choose to invest in high-risk projects, as the goal is to maximize shareholder wealth rather than maximize corporate value [15]. Besides, for creditors, it is difficult for them to judge whether a high-leverage company has good investment opportunities. Therefore, even if a high-leverage company has an investment project with a positive net present value, it may be difficult to find new creditors and lose quality investment projects [16]. Therefore, for high-leverage companies, the phenomenon of inefficient investment is more serious, and the supervision effect of analysts' attention may be more obvious. Based on the above analysis, we propose hypothesis 2.

H2. The effect of analyst following on corporate inefficient investment is more pronounced in high-leverage firms.

Audit committee tries to promote financial information transparency by excellent audit quality, so that firms with higher audit quality are often supervised by more attention [17]. In this case, it is relatively un conspicuous for those firms with high audit quality to develop the effect of analyst following. Besides, analyst is able to aware of the flaws caused by firms with lower audit quality and lower economic level. If the prices are undervalued, analysts easily discover and correct it. Therefore, we suppose the following hypothesis.

H3. The effect of analyst following on corporate inefficient investment is more pronounced in firms with low audit quality.

3. research design

3.1 Sample and Data

Our article selects China's A-share listed companies from 2012 to 2017 as the research object, and the annual data on corporate inefficient investment and analyst following are all from the CSMAR database. Our sample excludes firms labeled ST and financial firms; we also exclude samples with missing values for variables and then winsorize the first and 99th percentiles of our observations. After the above processing, 5895 company annual samples were obtained.

3.2 Measurement of corporate inefficient investment

This paper refers to the research of Richardson and Wang et al. We set the following expected investment model to measure the investment level of the corporate, and then use the regression residual to measure the investment efficiency of the corporate [18, 19]. Model 1 is set as follows:

$$\begin{aligned} Invest_{i,t} = & \beta_0 + \beta_1 TobinQ_{i,t-1} + \beta_2 Size_{i,t-1} \\ & + \beta_3 LEV_{i,t-1} + \beta_4 Cash_{i,t-1} + \beta_5 Age_{i,t} \\ & + \beta_6 RET_{i,t-1} + \beta_7 Invest_{i,t-1} \\ & + \sum Industry + \sum Year + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where, $Invest_{i,t}$ represents the new investment expenditure of the i -th company in year t ; $TobinQ_{i,t-1}$ is the company's Tobin Q value; $Size_{i,t-1}$ is the size of the company; $LEV_{i,t-1}$ is the company's asset-liability ratio; $Cash_{i,t-1}$ represents the level of cash holdings; $Age_{i,t-1}$ is the company's listing years at the beginning of the year; $RET_{i,t-1}$ represents the stock return rate at the beginning of the year. $\sum Industry$ and $\sum Year$ are the fixed effects of controlling industry and year. Finally, inefficient investment ($Ine_Inv_{i,t}$) is defined as the absolute value of the above regression residual. The larger the value of $Ine_Inv_{i,t}$, the higher the inefficiency investment.

3.3 Measurement of analyst following

Analysts usually have better analytical capability and can obtain more corporate information through information collection channels, e.g., surveys and interviews. Therefore, they can deliver more

accurate corporate information to market investors in the form of research reports. Skinner has found that if there are a large number of analysts in the company after it goes public, then this company will also have more information to be excavated and disseminated [20]. The natural logarithm of the number of analysts following is used to measure the analyst following. The higher natural logarithm of the number of analysts following means higher analyst following.

3.4 Model specification

Following Richardson's research, we add $Size_{i,t}$, $LEV_{i,t}$, $ROA_{i,t}$, $TobinQ_{i,t}$, $Age_{i,t}$ and $Inst_{i,t}$ as the control variables, and industry and year fixed effects are controlled, then get the Model 2.

$$\begin{aligned} Ine_Inv_{i,t} = & \alpha_0 + \alpha_1 AF_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 LEV_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 TobinQ_{i,t} + \alpha_6 Age_{i,t} \\ & + \alpha_7 Inst_{i,t} \\ & + \sum Year + \sum Industry + \varepsilon_{i,t} \end{aligned} \quad (2)$$

Model 2 is used to test the relationship between analyst following and corporate inefficient investment. The sign of α_1 is expected to be negative, which means analyst attention can effectively suppress inefficient investment.

4. Empirical Results

4.1 Descriptive Statistics

Table I indicates the descriptive data of our major variables. We note that the average of $Ine_Inv_{i,t}$ is 0.117 and its standard deviation is 0.105. The average of $AF_{i,t}$ is 1.880, with 1.027 of standard deviation.

Table 1. Descriptive statistics

Variables	N	Mean	Std. dev.	Min	Median	Max
$Ine_Inv_{i,t}$	5895	0.117	0.105	0.003	0.103	0.826
$AF_{i,t}$	5895	1.880	1.027	0	2.079	3.689
$Size_{i,t}$	5895	22.216	1.230	19.681	22.010	26.001
$LEV_{i,t}$	5895	0.382	0.198	0.021	0.368	0.909
$ROA_{i,t}$	5895	0.048	0.049	-0.157	0.043	0.214
$TobinQ_{i,t}$	5895	2.422	1.968	0.199	1.881	11.979
$Age_{i,t}$	5895	1.911	0.515	1.099	1.946	3.178
$Inst_{i,t}$	5895	0.385	0.234	0.014	0.391	0.879

This table reports the descriptive statistics of the variables. The sample includes 5895 observations. We estimate the mean, standard deviation, minimum, median, and maximum for every variable.

Table 2. VIF tests

	VIF	1/VIF
$AF_{i,t}$	1.383	0.723
$Size_{i,t}$	2.288	0.437
$LEV_{i,t}$	1.821	0.549
$ROA_{i,t}$	1.488	0.672
$TobinQ_{i,t}$	1.548	0.646
$Age_{i,t}$	1.353	0.739
$Inst_{i,t}$	1.314	0.761
Mean	VIF	1.599

This table reports the VIF test results. The sample includes 5895 observations.

Besides, for potential multicollinearity through variables a variance inflation factor (VIF) test is performed, Table II represented the results. All the VIFs of all the explanatory variables are lower than 10, which may suggest that no multicollinearity among those variables.

4.2 The effect of analyst following on corporate inefficient investment

Table III lists the results of our baseline regression. Column (1) represents the regression results without control variables. The coefficient of $AF_{i,t}$ is -0.012 and is significantly negative at the 1% level. Column (2) reports the results with control variables, and the coefficient of $AF_{i,t}$ is also negative and significant. The results support H1 that analyst following may reduce the level of ineffective investment. The results for the control variables are largely consistent with the previous research.

Table 3. The influence of analyst following on corporate inefficient investment

Dependent variable=	$Ine_Inv_{i,t}$	
	(1)	(2)
$AF_{i,t}$	-0.012*** (-11.78)	-0.003** (-2.38)
$Size_{i,t}$		-0.022*** (-17.45)
$LEV_{i,t}$		0.045*** (6.80)
$ROA_{i,t}$		-0.071*** (-2.96)
$TobinQ_{i,t}$		0.006*** (8.75)
$Age_{i,t}$		0.001 (0.58)
$Inst_{i,t}$		-0.013*** (-2.70)
Constant	0.103*** (11.98)	0.546*** (20.38)
Year	Yes	Yes
Industry	Yes	Yes
Observations	5895	5895
Adjusted R^2	0.463	0.525

This table reports influence of analyst following on corporate inefficient investment. Column (1) represents the regression results without control variables and column (2) reports the results with control variables. $Ine_Inv_{i,t}$ measures firm's inefficient investment, which is calculated as the absolute value of the residual error of the Eq. (1). The other variables are defined in Appendix. The superscripts *, **, and *** indicate significance at the 10 %, 5%, and 1% confidence levels, respectively.

4.3 Robustness checks

4.3.1 The inclusion of some omitted variables

To exhibit the influence of other factors that can potentially affect firm inefficient investment performance, we present table IV and conduct robustness tests by including omitted variables. Considering the omitted variables, we add $Top_{i,t}$ and $INDP_{i,t}$ in table IV. $Top_{i,t}$ is the degree of ownership concentration, which equals to the shareholding ratio of the largest shareholder. $INDP_{i,t}$ is the proportion of independent directors, which equals to the proportion of independent directors in the number of directors on the board. Columns (1) to (2) of Table IV report the results of adding the omitted variables. Column (1) shows the results of adding $Top_{i,t}$ and column (2) shows the results of

adding $Top_{i,t}$ and $INDP_{i,t}$. To summarize the results, the coefficients of $AF_{i,t}$ are negative and significant in all columns. Therefore, our baseline results still hold.

Table 4. Robustness checks: The inclusion of some omitted variables

0	<i>Ine_Inv_{i,t}</i>	
	(1)	(2)
$AF_{i,t}$	-0.002** (-2.02)	-0.002** (-2.07)
$Size_{i,t}$	-0.023*** (-17.50)	-0.023*** (-17.73)
$LEV_{i,t}$	0.046*** (6.83)	0.046*** (6.91)
$ROA_{i,t}$	-0.073*** (-3.06)	-0.069*** (-2.89)
$TobinQ_{i,t}$	0.006*** (8.64)	0.006*** (8.26)
$Age_{i,t}$	0.002 (0.95)	0.002 (1.03)
$Inst_{i,t}$	-0.016*** (-3.18)	-0.015*** (-2.94)
$Top_{i,t}$	0.013* (1.80)	0.011 (1.45)
$INDP_{i,t}$		0.065*** (3.61)
Constant	0.548*** (20.45)	0.531*** (19.57)
Year	Yes	Yes
Industry	Yes	Yes
Observations	5895	5895
Adjusted R ²	0.525	0.526

This table reports the results of the inclusion of some omitted variables. Column (1) shows the results of adding $Top_{i,t}$. And column (2) shows the results of adding $Top_{i,t}$ and $INDP_{i,t}$. $Ine_Inv_{i,t}$ measures firm's inefficient investment, which is calculated as the absolute value of the residual error of the Eq. (1). The other variables are defined in Appendix. The superscripts *, **, and *** indicate significance at the 10 %, 5%, and 1% confidence levels, respectively.

4.3.2 Province fixed effects

To mitigate the influence of other unobservable factors that can potentially affect firm inefficient investment, we conduct robustness tests by including —fixed effects. Columns (1) to (2) of Table V report the results. The column (1) reports the results without control variables. The column (2) reports the results of adding control variables. To summarize the results, the coefficients are negative and statistically significant in all columns. Therefore, our baseline results still hold.

Table 5. Robustness checks: Province fixed effects

Dependent variable=	<i>Ine_Invi,t</i> (1)	(2)
$AF_{i,t}$	-0.012*** (-11.81)	-0.002** (-2.20)
$Size_{i,t}$		-0.023*** (-18.39)
$LEV_{i,t}$		0.046*** (7.00)
$ROA_{i,t}$		-0.072*** (-3.07)
$TobinQ_{i,t}$		0.006*** (8.91)
$Age_{i,t}$		0.005** (2.18)
$Inst_{i,t}$		-0.012*** (-2.65)
Constant	0.103*** (11.00)	0.570*** (20.91)
Year	Yes	Yes
Industry	Yes	Yes
Province	Yes	Yes
Observations	5895	5895
Adjusted R ²	0.488	0.550

This table reports the results of robustness checks on province fixed effects. Column (1) shows the results without control variables and column (2) shows the results with control variables. *Ine_Invi,t* measures firm's inefficient investment, which is calculated as the absolute value of the residual error of the Eq. (1). The other variables are defined in Appendix. The superscripts *, **, and *** indicate significance at the 10 %, 5%, and 1% confidence levels, respectively.

4.4 Heterogeneity analysis

4.4.1 Firm leverage

In order to study if the role that analyst coverage plays on inefficient investment is related to the firm leverage, we split the sample into subsamples, separately, high-leverage and low-leverage. In detail, after calculating average leverage of each firm and compare them, data which is larger (smaller) than the median is regarded as high-leverage (low-leverage). We then reconduct the baseline analysis within subsamples and report the results in Table VI. The coefficients of $AF_{i,t}$ are negative and significant at the 1% level in column (1) but nonsignificant in column (2), which indicates that the negative impacts of analyst coverage on inefficient investment is more conspicuous for high-leverage firms. These results support H2.

Table 6. Heterogeneity analysis: Firm leverage

Dependent variable=	<i>Ine_Invi,t</i>	
	High-Leverage	Low-Leverage
$AF_{i,t}$	-0.005*** (-2.74)	-0.001 (-0.76)
$Size_{i,t}$	-0.015*** (-7.89)	-0.033*** (-19.99)
$LEV_{i,t}$	0.018 (1.37)	0.055*** (5.77)
$ROA_{i,t}$	-0.042 (-1.01)	-0.096*** (-3.87)
$TobinQ_{i,t}$	0.012*** (7.19)	0.004*** (5.82)
$Age_{i,t}$	-0.013*** (-3.68)	0.021*** (8.23)
$Inst_{i,t}$	-0.010 (-1.33)	-0.011** (-2.10)
Constant	0.441*** (10.69)	0.722*** (20.82)
Year	Yes	Yes
Industry	Yes	Yes
Observations	2951	2944
Adjusted R ²	0.527	0.579

This table reports the heterogeneity analysis on firm leverage. The subsamples showed in table VI are divided in terms of the average return of firm leverage on every firm and then figure out the median from all the mean values. The columns (1) and (2) report the subsample analysis on firm leverage. The variable Ine_Invi,t analyzes the deviation from the optimal level of investment, which is the absolute value of the residual error of the Eq. (1). The other variables are defined in Appendix, and t– statistics are reported in parentheses. The superscripts *, **, and *** indicate significance at the 10 %, 5%, and 1% confidence levels, respectively.

4.4.2 Audit quality

To further investigate if analyst coverage effects inefficient investment differently in firms with various standard of audit quality, we construct subsamples built on the accounting firms. Specifically, if the auditors are employed on one of the four outstanding and international accounting firms, it is deemed to the high audit quality subsample. Otherwise, the firms are belonged to the low audit quality subsample. Similar to the previous section, the subsample analysis is performed based on the baseline model. The results are presented in Table VII, where the coefficients of $AF_{i,t}$ are insignificant in column (1). However, data are negative and statistically necessary at the 5% level in column (2), illustrating that the negative influence of analyst coverage on inefficient investment is more striking for firms with lower levels of audit quality. Consequently, analyst coverage has a more effective and noticeable impact on improving firm inefficient investment in firms with lower audit quality. Overall, the results are consistent with H3.

Table 7. Heterogeneity analysis: Audit quality

Dependent variable=	<i>Ine Inv_{i,t}</i>	
	High audit quality	Low audit quality
<i>AF_{i,t}</i>	0.007 (1.03)	-0.002** (-1.97)
<i>Size_{i,t}</i>	-0.015** (-2.56)	-0.030*** (-21.48)
<i>LEV_{i,t}</i>	-0.083** (-2.08)	0.058*** (8.86)
<i>ROA_{i,t}</i>	-0.249* (-1.69)	-0.048** (-2.08)
<i>TobinQ_{i,t}</i>	0.004 (0.63)	0.005*** (7.56)
<i>Age_{i,t}</i>	-0.025** (-2.05)	0.006*** (2.86)
<i>Inst_{i,t}</i>	0.019 (0.66)	-0.018*** (-3.83)
Constant	0.483*** (3.51)	0.706*** (24.03)
Year	Yes	Yes
Industry	Yes	Yes
Observations	361	5534
Adjusted R ²	0.285	0.570

This table reports the heterogeneity analysis on audit quality. The subsamples showed in table 7 are divided according to whether the auditor comes from one of the four outstanding and international accounting firms. The columns (1) and (2) report the subsample analysis on audit quality. Industry and year fixed effects are contained in the analysis. The variable *Ine_Inv_{i,t}* analyzes the deviation from the optimal level of investment, which is the absolute value of the residual error of the Eq. (1). The other variables are defined in Table 7, and t– statistics are reported in parentheses. The superscripts *, **, and *** indicate significance at the 10 %, 5%, and 1% confidence levels, respectively.

5. Conclusion

In summary, we investigate the impact of analyst following on corporate inefficient investments based on robustness check and heterogeneity analysis. According to our results, analysts following can reduce corporate inefficient investment. Besides, it happened more in high-leverage firms and firms with low audit quality. The inefficient investment of these companies will be more significant.

These results have several implications for policy makers and listed firms. First, our research suggests that analyst following can play a key role in external supervision, which can restrain the corporate inefficient investment. Therefore, we advise that policy makers take analyst following into account when making policies and listen to policy advice. It also has positive impact on the management of the corporate. Second, for practical reasons, analyst following cannot work for all companies, i.e., the government should take different measures for different companies. Specifically, as for high-leverage firms, the government should make analyst following as an important tool of external supervision and impose restrictions on the activities of companies and prohibit them from engaging in very risky investments. These results offer a guideline for firms to reduce corporate inefficient investment.

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Table 8. Appendix. Definitions of variables

0	Definitions
$Ine_Inv_{i,t}$	Inefficient investment, the deviation from the optimal level of investment, which is the absolute value of the residual error of the Eq. (1).
$AF_{i,t}$	Analyst following, natural logarithm of the number of analyst following.
$Size_{i,t}$	Firm size, the natural logarithm value of the book value of total assets of firm i in year t .
$LEV_{i,t}$	Firm financial leverage, calculated as the book value of total debt divided by the book value of total assets of firm i in year t .
$ROA_{i,t}$	Return on assets, calculated as net profit divided by the book value of total assets of firm i in year t .
$TobinQ_{i,t}$	Tobin's Q, the ratio of total market value of equity to total book value of equity on firm i in year t .
$Age_{i,t}$	The listing age, calculated as the natural logarithm of the current year minus the year of listing of firm i in year t .
$Inst_{i,t}$	Institutional investor ownership, the shareholding ratio of institutional investors of firm i in year t .

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