ARTICLE

THE RELATIONSHIP BETWEEN OWNERSHIP STRUCTURE, FINANCIAL CONSTRAINTS AND RATIO OF COSTS OF RESEARCH AND DEVELOPMENT COMPANY LISTED ON THE TEHRAN STOCK EXCHANGE

Mahdiyeh Amiri[1], Zohreh Hajiha[2*], Habib Piri[3]

[1,3]*Department of Accounting, Zahedan Branch, Islamic Azad University, Zahedan, IRAN*
[2]*Co-Author, Associate Professor of Accounting, Islamic Azad University, East Tehran Branch, Tehran, IRAN*

ABSTRACT

The aim of this study was to investigate the relationship between ownership structure, financial constraints and the ratio of R & D spending companies listed in the Tehran Stock Exchange. This research is study, library, scientific analytical and based on panel data analysis (panel data). The data of 102 financial companies listed on the Tehran Stock Exchange during the period 1389 to 1393 (512 firm - years). To analyze the results of the study is used Eviews 7 software. The results showed that the three hypotheses regarding the approval of the financial constraints and the ratio of R & D spending is reversed, also between Institutional ownership structure and the ratio R & D spending and Finally, the ownership structure of management than R & D spending significant inverse relationship exists. Also according to the analysis made in connection with the fourth research hypothesis to the conclusion that between Shareholder ownership structure split and the ratio of R & D spending, there is no significant relationship.

INTRODUCTION

Research and development (R & D) are any consistent and creative activities done to increase knowledge of man, culture, society and use this knowledge for new applications (Black et al., 2014). The role of research and development on economic growth, is to the extent that it is referred to as an important variable in the economy, also companies are divided into the developed or underdeveloped on the basis of research funds of GDP. Research and development expenditure in addition to stimulating economic growth and development are enhancing the firm's profits as well. Operating cash flows arising from cash and cash equivalents of companies can be decreased or increased by factors such as investment in research and development. As well as additional cash investment in R & D could increase or reduced agency costs. Institutional investors considering their influence and force in the company to control the company always want to symbolize the intrinsic value of their own assets.

Allocation of a portion of cash flows from operating activities in new companies to research and development expenditure on research and development from the premise of the thoughts of management of institutional investors.

Companies have different motives to their cash holdings. If for any reason the company fails to timely access to the needed cash, the company is having "financial constraints" (Almdya et al., 2013). Existence of financial constraints in the long run may harm the ability of profitability, growth and thus the company's financial situation and cause falling behind the competition and even provide elimination from the market for the company. Therefore access to cash in companies with financial constraints is a crucial issue. So it is expected that in case of fluctuations in operating cash flows, cash reserves at companies with financial constraints get affected [11].

For division of the company in terms of financing constraints, financial constraints, must be defined. The fullest and clearest definition in this case, is that companies are in range of financing that are facing a gap between internal costs and external costs allocated. Determining the amount of cash reserves for many companies is of special importance. It should be noted that the higher the strength the liquidity of an asset is, its efficiency is reduced. With regard to the fact that the company can finance its operations and investment projects through the capital market, a company that has convenient access to the capital markets should not attempt to preserve cash (Olson and Asvad, 2013).

The aim of our research in this study is to answer the main question that Whether there is a significant relationship between the control level of financial constraints and the ratio of R & D spending in companies listed in Tehran Stock Exchange?

Cash and financial constraints derived from it may be the beginning and end of the activity cycle. Cash is the main element of current assets in the balance sheet. The decision of manager depends on the amount of cash available to fund cash management that are expected to be available in the future. In fact, considering that the lack of liquidity in a company can have wide consequences for the system, liquidity is important for any institution beyond any other issue [7].

In the knowledge-based management, the management of company should have sufficient knowledge of the conditions to predict company's future cash flows. And according to these forecasts should make investment and financing so that with a glimpse to the future of the company, the management could guarantee the company's growth. Also additional cash investment in R & D spending can help to enhance the qualitative and quantitative development of companies.

Therefore considering how to handle cash management, along with issues related to ownership percentage of institutional ownership and management structure to increase investment, in spending of research and development, are of the importance and necessity of this research.

Liquidity management or the ability to raise funds and timely fulfillment of commitment is necessary for the survival of companies. Therefore, liquidity management, considering financial constraints governing the companies is among the issues that are being performed by managers [9].

Attracting investors in the capital market of our country is very important according to the managers considering the novelty of our capital markets compared to developed countries. And in order to achieve these we need to identify the relation of factors such as: Financial constraints, level of institutional ownership control

The level of managerial ownership control, and the company's controlling of minor shareholder and its impact on the ratio of research and development expenditure can help achieve the company's ultimate goal [3]

MATERIALS AND METHODS

Review of literature

[12] in a study examined the relationship between earnings and cash flows and stock returns with attention to specific characteristics of companies.

The results showed that profit provided more relevant information to predict stock returns for large corporations, companies with high debt levels and firms with no growth. And changes in profit provide more relevant information for small companies with low debt levels and firms with no growth.

Spritzer and Jones (2015), in study examined the relationship between accounting profit and operating cash flow with systemic risk. The results show that accounting earnings information during the period of investigation compared to information on operating cash flow in the process of predicting systematic risk involve increasing information content.

Aghaei et al (2014) in a study examined the effect in operating cash flow shocks on asset and capital structure of listed companies in Tehran Stock Exchange. Sample findings suggest that there is a significant relationship between changes in cash flow from operations and asset restructuring and corporate capital.

[1], in a study examined the relationship between abnormal operating cash flow with stock returns of companies listed in Tehran Stock Exchange began. The results of the hypothesis test showed that there is a significant and negative relation between abnormal operating cash flows with future stock returns.

[8] in a study examined the impact of financial constraint on the relationship between institutional investors and their investment cash flow sensitivity.

Research hypotheses

First hypothesis: There's a significant relationship between R & D expenditure and financial constraints of companies.

The second hypothesis: There's a significant relationship between the structure of institutional ownership and financial constraints of companies.

The third hypothesis: There's a significant relationship between managerial ownership structure and financial constraints of companies.

The fourth hypothesis: There's a significant relationship between ownership structure of minor shareholder and financial constraints of companies.

Research methodology

The research is correlational in nature and content, and to discover correlations between variables ex post facto method will be used. The study population consisted of all companies listed on the Stock Exchange

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of Tehran. According to the official website of Tehran Stock Exchange all the companies in time of study were 520 companies in 37 industrial groups.

Therefore in this study, all companies listed in Tehran Stock Exchange in a period of six years, from 2010 to 2014, are population of the study. In this study, the sample is an appropriate representative of the target population, screening method is used for sample selection. For this purpose, the following criteria were considered and if a company has met all criteria it was selected as one of the sample companies.

1. Considering the information required since 2010, companies which up to March 2007 have been listed in Tehran Stock Exchange and by the end of 2014 their name is not removed from the list.
2. During the period in question, their shares should be actively traded on the exchange.
3. To enhance the comparability of companies that are surveyed, financial period should have ended 29 of March and during the financial period it should not been changed.
4. The company must not be a part of financial inters mediation because disclosure of information in these companies is different.
5. The information required is available.

Research variables

• The research includes a dependent variable that refers to the ratio of research and development expenditure ($\Delta Ln(R \& D)_{i,t}$):
How it is calculated is as follows:
$R \& D_{i,t}$ = (Sales) / (research and development expenditure)

• Institutional ownership structure ($CIns_{i,t}$): how it is calculated is as follows:
Institutional ownership structure = (total number of issued stock) / (total shares held by institutional owners)

• Managerial ownership structure ($CM_{i,t}$): how it is calculated is as follows:
(Total number of issued stock) / (total shares held by directors) = managerial ownership structure
Structure of ownership of minor Shareholders ($C(SZ)_{i,t}$) which is calculated as follows:
(Total number of issued stock) / (number of shares in the hands of micro Shareholders) = level of micro stakeholders

• Financial constraints ($Cons_{i,t}$):
In this study, to estimate the level of financial constraints, Whited Wu index (2006) is used. This index measures financial constraint through a group of variables reflects the characteristics of companies and its calculation method is as follows:

$$wwindex = -0.091CF_{i,t} - 0.062DIVPOS_{i,t} + 0.021TLTD_{i,t} - 0.044LNTA + 0.102ISG_{i,t} + 0.035SG_{i,t}$$

DIVPOS: is a dummy variable and for the companies that did not have any divided shares during the period is equal to 1 and otherwise will be equal to 0.
CF: is operating cash flow to total assets.

$$CF_{i,t} = \frac{\text{cash flow}_{i,t}}{Total\ Assets}$$

T LTD: leverage (the ratio of total long-term debt to total assets)

$$TLTD_{i,t} = \frac{\text{Total long term debt}_{i,t}}{Total\ Assets}$$

LNTA: company size
$$LNTA_{i,t} = Ln\ (Total\ Assets_{i,t})$$
ISG: Industrial sales growth industry in which the company is located in.
SG: Sales growth

$$SG_{i,t} = \frac{\text{sale}_{i,t} - \text{sale}_{i,t-1}}{sale})$$

Therefore, according to the study of Chang (2004), if a company does not pay the stock dividend of the year t, the company will be classified as a company with financial constraints. Because when their ability to access external financing is reduced they can stop paying dividends, to compensate part of the lack of financial resources. However, these criteria should be used with caution, because the payment of a dividend cut in order to maintain the liquidity of the shares on the market can have a negative effect.
Therefore variable of financial constraints is a dummy variable that if the company did not pay dividends in the considered year is equal to 1, otherwise it will be zero. In this research by using Whited Wu index, each participant is calculated with a number. Then calculate the median for all companies and firms that are higher than the median of the total Companies; have financial limitations and companies that are lower than the median of the total companies are companies without financial constraints.

The study included two control variables that include:

• **Corporate Governance Index ($^{\triangle}CG_{i,t}$):** that is measured as follows:
The percentage of outside director's board to all board members
Member of the outside directors is a member in the company that is not an executive (Shahzad et al., 2010).

• **Cash flow ratio ($CF_{i,t}$):**

Cash flows are calculated as follows:
$$CF_{it} = (INC_{it} - TAX_{it} - INTEP_{it} - PSDIV_{it} - CSDIV_{it}) / A_{i,t-1}$$
In which:
CF : Cash Flow firm i in year t
INC_{it} : Operating profit before amortization of company i in year t
TAX_{it} : The total tax paid by the company i in year t
$INTEP_{it}$: Interest expense paid by the company i in year t
$PSDIV_{it}$: The interest paid by shareholders of the company i in year t
$CSDIV_{it}$: Ordinary shareholders profit of company i in year t
$A_{i,t-1}$: The total book value of assets of the company i in year t
Model of the study is as follows:
(Equation (1)

$$\triangle Ln(R \& D)_{i,t} = \alpha_0 + \beta_1 Cons_{i,t} + \beta_2 CIns_{i,t} + \beta_3 CM_{i,t} + \beta_4 C(SZ)_{i,t} + \beta_5 \triangle CG_{i,t} + \beta_6 CF_{i,t} + \varepsilon_{i,t}$$
In these models we have:
i, represent the Company (cross-sectional units) and t represents the year.

$\varepsilon_{i,t}$ = Random error of company i in year t.

RESULTS

Hypothesis testing

Table 1: illustrates the descriptive statistics of Research variables

Variable	The number of observations	Mean	Standard deviation	Lowest	Highest	Skewness	kurtosis
The ratio of R & D spending	512	0/3270	0/3672	0/0000	2/7159	3/123	14/890
Financial constraints	6412	0/4526	0/4981	0/0000	1/0000	0/191	-1/970
Institutional ownership structure	512	0/7079	2/8419	0/0116	70/7600	24/593	607/177
Managerial ownership structure	512	0/2842	0/1252	0/0000	0/6919	-0/003	-0/212
micro shareholder structure	512	0/1218	0/0536	0/0000	0/2965	-0/002	-0/211
Corporate governance index	512	0/6654	0/5411	0/8955	2/8780	1/223	1/666
Cash flow ratio	512	0/1549	0/1304	0/0009	1/3310	2/337	12/172

According to the [Table 1] average ratio of research and development expenditure of companies is respectively 0/3270 and the minimum is 0/0000 and maximum amount is equal to 2/7159. The rate of skewness and kurtosis should be 0 and 3 for the variable to have a normal distribution that shows that the variably does not have a normal distribution. According to the description given in [Table 1], average of financial constraints, level of institutional ownership control, the level of managerial ownership control and the controlling micro, shareholder corporate governance index and the ratio of cash flow sample of companies during the period of study, all have positive averages.

The test of the normal distribution of the dependent variable

In this study to estimate the parameters of the model, ordinary least squares method is used. Therefore, it is necessary to test the normal distribution of this variable.
So it is necessary that the normal distribution of the dependent variable is controlled before obtaining the parameters and to find a proper method to normalize them if they are not.
$$\begin{cases} H_0 : Normal\ Distrbuton \\ H_1 : Not\ Normal\ Distribution \end{cases}$$

Table 2: Results of normal distribution of the dependent variable before and after normalization

	Variable	(N)	(K-S)	(Sig)
Before normalization	The ratio of R & D	512	4/616	0/000
After normalization	The ratio of R & D	512	670	0/761

Given that in [Table 2] for the variable of ratio of R and D the importance level of K-S is less than 0/05, so the H_0 hypothesis for normal distribution of these variables is rejected at 95% confidence level. Which means ratio of R and D do not have a normal distribution. So before the test this variable must be normalized. In this study Johnson Transformation is used to normalize the data and analyzed by Minitab 16 software. Results of the K-S test after normalization are according to the Table.

According to [Table 2], since after normalization the importance level (sig.) of Kolmogorov-Smirnov test for the dependent variable is higher than 0/05, (0/761), so the H_0 hypothesis is accepted at 95% confidence level, which means ratio of R and D has a normal distribution after the normalization.

The correlation between the variables of the research

In this part by using Pearson correlation test we examine the relation of variables and their correlation. According to Pearson test, institutional ownership structure had a significant negative correlation with ownership structure management and micro shareholder structure.

Table 3: Matrix of Pearson correlation coefficients between variables

	The ratio of R & D spending	Financial constraints	Institutional ownership structure	managerial ownership structure	micro shareholder structure	Corporate governance index	Cash flow ratio
The ratio of R & D spending $(P-Value)$	1						
Financial constraints $(P-Value)$	0/005 (0/899)	. 1					
Institutional ownership structure $(P-Value)$	0/033 (0/411)	-0/039 (0/341)	1				
Managerial ownership structure $(P-Value)$	-0/032 (0/311)	0/033 (0/376)	-0/154 (0/000)	1			
micro shareholder structure $(P-Value)$	-0/032 (0/433)	0/033 (0/416)	-0/154 (0/000)	-0/283 (0/000)	1		
Corporate governance index $(P-Value)$	-0/011 (0/795)	-0/047 (0/248)	-0/042 (0/297)	-0/042 (0/304)	-0/042 (0/219)	1	
Cash flow ratio $(P-Value)$	-0/009 (0/826)	-0/034 (0/398)	-0/016 (0/688)	0/000 (0/991)	0/000 (0/187)	-0/063 (0/118)	1

Managerial ownership structure also is positively correlated with micro shareholder ownership structure.

Examining the co-linearity between variables

Co-linearity means there is a linear relationship between the explanatory and independent variables. In this study the co-linearity relationship between independent variables is examined using Pearson's correlation coefficient. As seen in the Table, financial constraints, institutional ownership structure, ownership structure management and micro shareholder structure have a direct correlation and this correlation is very strong. Therefore due to the problem of co-linearity between these variables, enabling simultaneous arrival of these variables in a model is not possible and we need to check and test them in separate models. Other variables do not have problem of co-linearity and simultaneous arrival of them in the model will not cause co-linearity problem.

Testing research hypotheses

The aim of this study was to investigate the relationship between financial constraints and the company's research and development expenditure and statistical hypothesis is defined as follows: This hypothesis is estimated using model (1) with panel data and if the coefficient is significant at a confidence level of 95% it was approved.

$$\begin{cases} H_0 : \beta_1 = 0 \\ H_1 : \beta_1 \neq 0 \end{cases}$$

To be able to determine whether using panel data in estimating the model will be efficient or not, the Chow test or F tie is used and in order to determine which method (fixed effects or random effects) is to better estimate (fixed or random detection of differences in cross-sectional units) the Hausman test is used. The results of these tests are presented in the Table.

Table 4: Chow and Hausman test results for the model (1)

Test	N	T	T value	df	P-Value
Chow	512	F	3/0932	(503،101)	0/0284
Hausman	512	χ^2	3/0705	6	0/0394

According to [Table 4] Chow test results and P-Value of (0/0284), testing the hypothesis is rejected at 95% and indicates that the panel data method can be used. Also according to Hausman test, and P-Value of (0/0394), which is less than 0/05, the test of hypotheses is rejected at 95% and hypotheses is confirmed. Therefore, the model is estimated using fixed effects.

To test the validity of the model and the assumptions of the classical regression it is required in addition to the lack of co-linearity between the independent variables in the model, some tests be done regarding the normality of the residuals of variance, independence of residuals and absence of clear error model (Linear model) will also be performed. To Testing normality of error terms, various tests can be used. One of the tests is Jarque bera test, which is used in this study.

Results of Jarque bera test indicate that the residue of the model at 95% have a normal distribution, the probability of this test (0/3412) is larger than 0/05. Another statistical assumption of the classical regression is residual variance consistency. If the variances are non-linear is not unbiased estimator and will not have the least variance. In this study we test the homogeneity of variances with Breusch–Pagan test. Considering the importance level of this test, which is smaller than 0/05 (0/0302), null hypothesis that there is a variance consistency is rejected and can be said is there is a problem of unequal variants. In this study, to address this problem in estimating, we used generalized least squares (GLS). Also in this study to test that the residuals are not correlated, which is one of the assumptions of regression analysis and is called correlation analysis, the Durbin-Watson (D-W) is used .According to preliminary results of model estimation of Durbin-Watson statistic amount were equal to 2/42 and between 1/5 and 2/5 we can conclude that the residuals are independent.

In addition, to test whether the model has a linear relationship and whether linear or non-linear relationship and is being properly explained, Ramsey test has been used. Given that the importance level of Ramsey test is (0/6238) and larger than 0/05, the null hypotheses of linearity of the model is accepted and model does not have a specification error. Summary of results of these tests are presented in Table 4-6.

Table 5: Test results of the modeling assumptions (1)

Jarque bera		Breusch–Pagan		Durbin-Watson		Ramsy	
χ^2	$P-Value$	F	$P-Value$	D		F	$P-Value$
1/3435	0/3412	1/0845	0/0302	2/42		3/4722	0/6238

According to [Table 5] Chow and Hausman test results as well as results of the statistical assumptions of classical regression model (1) research is estimated using panel data and fixed effects. The results are presented in table. The model is estimated using the software Eviews 7:

$$\Delta Ln(R \& D)_{i,t} = 1187.678 - 0.0042 Cons_{i,t} + 1187.380 CIns_{i,t} -$$

$$1077.067 CM_{i,t} - 1444.443 C(SZ)_{i,t} + 0.0211 \Delta CG_{i,t} + 0.1102 CF_{i,t} + \varepsilon_{i,t}$$

Table 6: first hypothesis test results using fixed effects

The dependent variable is the ratio of R & D spending - Views: 512, Year- Company				
Variable	Coefficient	T statistic	P-Value	Relation
Fixed part	1187/678	2/6090	0/0093	Positive
Financial constraints	-0/0042	-1/2199	0/0260	Negative
Institutional ownership structure	1187/380	1/6084	0/0094	Positive
managerial ownership structure	-1077/067	-1/0704	0/0389	Negative
micro shareholder structure	-1444/443	-3/0354	0/1525	meaningless
Corporate governance index	0/0211	1/0888	0/2767	meaningless
Cash flow ratio	0/1102	1/1788	0/0390	Positive

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Determining model score	0/2024
F ($P-Value$)	0/1933 (0/1098)

In considering the significance of the model according to [Table 6], the values of the F-statistic is smaller than 0/05 (0/1098) so with 95% confidence level, significance of the model is confirmed.

The coefficient of determination of the model suggests that 20/24 percent of ratio of R & D expenses is explained by variables in the model.

In examining the significant coefficients based on the results presented in [Table 4-7], since the probability of t-statistic for variable rate of financial constraints is smaller than 0/05 (0/0260), a significant relationship between financial constraints and the cost of R & development is confirmed at the level of 95%. The first hypothesis is accepted and we can say with 95% confidence there is a significant relationship between financial constraints and the ratio between R & D spending. A negative coefficient for this variable (-0/0042) implies the existence of an inverse relationship between financial constraints and the company's research and development expenditure, so that with 1 unit rise of financial constraints, the ratio of R&D expenses are also reduced 0/0042 units. Thus, according to the analysis made in connection with the first hypothesis it can be concluded that a significant inverse relationship exists between R & D expenditure and financial constraints.

In examining the significant coefficients based on the results presented in the Table, Since the probability of t-statistic for variable coefficient of institutional ownership structure is smaller than 0/05 (0/0094), as a result, a significant relationship between institutional ownership structure and research and development expenditure at the level of 95% is confirmed. The second hypothesis is accepted and we can say with 95% confidence there is a significant relationship between institutional ownership structure and the ratio of R & D spending. The positive coefficient for this variable (1187/380) suggests the existence of a direct link between institutional ownership structure and research and development expenditures.

In examining the significant coefficients based on the results presented in the Table, Since the probability of t-statistic for variable coefficient of managerial ownership structure is smaller than 0/05 (0/0389), as a result, a significant relationship between managerial ownership structure and research and development expenditure at the level of 95% is confirmed. The second hypothesis is accepted and we can say with 95% confidence there is a significant relationship between managerial ownership structures and the ratio of R & D spending. A negative coefficient for this variable (-1077/067) implies the existence of an inverse relationship between managerial ownership structures and the company's research and development expenditure.

In examining the significant coefficients based on the results presented in the Table, Since the probability of t-statistic for variable coefficient of micro shareholder structure is larger than 0/05 (0/1525), as a result, a significant relationship between micro shareholder structure and research and development expenditure at the level of 95% is confirmed. The second hypothesis is rejected and we can say with 95% confidence there is a no significant relationship between micro shareholder structure and the ratio of R & D spending.

CONCLUSION

The results of the study regarding the three accepted hypothesis showed that there was inverse correlation between financial constraints and the ratio of R & D spending, also there is a significant inverse relationship between institutional ownership structure and the ratio of R & D spending and finally between managerial ownership structure and R & D spending.

Also according to the analysis made in connection with the fourth research hypothesis we come to the conclusion that there is no significant relationship between micro shareholders structures the ratio of R & D spending.

The results of the first hypothesis, the presence of a significant relationship between dependent and independent variables are consistent with the study of Aguilera and Jackson (2010), Block (2012) and Chrynkv and Aschalr (2009), but in terms of the type of relation it is consistent with the results of Lazvnyk (2008) and is in conflict with Paris and colleagues (2009) and Gosh and colleagues (2007).

The results of the second hypothesis of our research are consistent with the research findings of Driver et al (2008), Aghione et al (2005) and Aghion et al (2009) and are in conflict with research findings Bruner (2010) and Driver et al (2012).

The results of our research findings in third hypothesis are consistent with Mankada-Patrnv and et al (2010) and New et al (2010) and in conflict with Block (2012) and Aguilera and Jackson (2010).
The fourth hypothesis results of our research are consistent with the research findings of Lazvnyk (2008), Aghione (2005) and Paris (2009) and in conflict with research findings of Lerner and Wolf (2006) Vloylry (2011).

According to the research result the following recommendations can be mentioned

1. According to the results of the first hypothesis it is proposed research be conducted regarding the relationship between financial constraints and standardized cash flows and affecting the credibility of the company's business.

2. According to the results of the second research hypothesis it is proposed a research be conducted regarding the relationship between the level of institutional ownership and control of credit ratings and its impact on the intrinsic value of companies.

3. According to the results of the third research hypothesis it is proposed a research be conducted regarding the relation between the ratio of R & D spending and financial leverage and impact on adjusted profit of companies.

4. According to the results of the fourth research hypothesis it is proposed a research be conducted regarding the relationship between micro shareholder structure and the market value of equity and its impact on discretionary accruals of companies.

5. Since the increased level of financial constraints, the level of institutional ownership control, managerial ownership structure micro shareholder structure can have important effects on investment decisions; recommendations of Accounting Standards references to voluntary disclosure of the items mentioned above by management will be very helpful.

6. It is best that the financial analysts active in the capital market, and investment advisers in Stock Exchange, along with analysis and conventional techniques that they perform, to perform also specific analyzes based on the state of research and development expenditure and its influencing factors, and financial constraints, the level of institutional ownership control, managerial ownership structure micro shareholder structure, according to the accounting standards.

CONFLICT OF INTEREST
There is no conflict of interest.

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