THE RELATIONSHIP BETWEEN TOP MANAGEMENT TEAM AGE HETEROGENEITY, ENVIRONMENTAL DISCLOSURE AND FIRM VALUE

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Abstract

Environmental disclosure is an important way for firms to demonstrate their commitment to environmental responsibility. The purpose of this study is to investigate the relationship between Top Management Team (TMT) age heterogeneity, environmental disclosure, and firm value. The research method is multivariate linear regression with panel data. The data come from the listed companies of six high energy-consuming industries in China, spanning the period of 2008-2020, and the model is a mediated model with moderation. The results of the study show that TMT and age heterogeneity has a significant negative impact on environmental disclosure (R^2 = 0.2433) and also on firm value (R^2 = 0.342). Environmental disclosure mediates the negative effect of TMT and age heterogeneity on firm value (R^2 = 0.343). The negative effect of TMT and age heterogeneity on environmental disclosure is weaker among those firms that are on the government regulatory list (R^2 = 0.257). Therefore, firms should reduce TMT and age heterogeneity appropriately, and the government can put more firms on the regulatory list, and these measures can help to improve firms' environmental disclosure.

Keywords: Top Management Team (TMT), Age Heterogeneity, Environmental Disclosure, Firm Value

Introduction

In recent years, stakeholders are becoming increasingly concerned with the way in which companies interact with the environment, and the extent to which they are engaged in environmental protection and pollution prevention (Monteiro & Guzman, 2010). In response, companies attempt to enhance trust and credibility with stakeholders by disclosing a higher level of environmental information (Hassan & Ibrahim, 2012). Many studies have shown that environmental disclosure does have a positive impact on firm value (Plumlee et al., 2015).

In addition, a number of countries have issued policies requiring enhanced environmental disclosure in order to improve the environment and combat climate warming. However, there are still some companies whose environmental disclosures are not of high quality.

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According to the upper echelon theory, the decisions of the enterprise and the operating performance are related to the overall characteristics of the top management team (Finkelstein et al., 2008). the core elements of top management teams can be divided into team composition, team structure, and team processes. The age, seniority, expertise, education level, cognitive base, and personality of the executive team all have an impact on the firm's performance, and each dimension can be examined in terms of average and heterogeneity.

Western scholars have found that heterogeneous teams usually lead to diverse information and full discussions, which are often favorable to the company (Prudêncio et al., 2021). However, this finding cannot be easily generalized in Eastern countries. In China, for example, when there are both older and younger people in the management team, the elders are usually honored and the younger people are just obedient. Therefore, the situation in China is likely to be the opposite of the West in terms of the effects of age heterogeneity in the top management team. Based on the above analysis, this study wishes to explore the following questions in the Chinese context: whether TMT age heterogeneity has a negative effect on environmental disclosure, whether there is also a negative effect on firm value, and whether environmental disclosure partially mediates the relationship between TMT age heterogeneity and firm value, and in addition, whether government regulation can attenuate the negative effect.

Firms in high energy-consuming industries were selected for this study because they have a greater impact and are more relevant in terms of environmental pollution and carbon emissions.

Objectives

This paper has three objectives:

1. To test whether TMT age heterogeneity has a negative impact on environmental disclosure.

2. To test whether environmental disclosure has a mediating effect between TMT age heterogeneity and firm value.

3. To test whether government regulation has a moderating effect in the intermediation model described above.

Literature Review

Theoretical Basis

In 1984, Hambrick and Mason proposed the famous upper echelons theory, and illustrated the basic framework of "Team Characteristics-Decision Processes-Management Outcomes". Over the ensuing decades, the theory has evolved into one of the most important theories in the field of strategic management. The most important contribution of this theory is the replacement of latent psychological characteristics with demographic variables, which effectively solving the problematic variable measurement and data acquisition problems in upper echelon research, an idea that is still valuable in large-sample business research today.

In recent years, many management researchers have studied the issue of heterogeneity in the composition of top management teams, expanding in new areas and new countries (Plečnik & Wang, 2021).

Scholars have found that the TMT heterogeneity can sometimes have a negative impact. One plausible explanation is social classing theory (Tajfel & Forgas, 2000). The theory is based on the idea that individuals tend to socially categorize themselves differently from others through attribute differences, creating social identity and assigning positive evaluations to the group they belong to (in-group), while rejecting or discriminating against other groups (out-group). In diverse groups, the process of social categorization can increasingly reinforce stereotypes and prejudices, reduce team cohesion and exacerbate conflict, which in turn negatively affects firm performance (Turner, 2010).

Based on this theory, TMTs with a high degree of age heterogeneity in China are likely to develop this type of categorization and may lead to some negative effects.

Research Hypotheses

As the TMT literature developed, many characteristics of the TMT have been studied, such as functional background, educational background, age, and tenure (Zimmerman, 2008). Published research offers support for the claim that a heterogeneous TMT makes better strategic decisions and is positively related to a variety of desirable outcomes, at least in established firms (Hambrick et al., 1996).

However, it is important to note that there may be different results in some particular contexts. For example, in China, heterogeneity in many aspects of TMT can lead to the good results, but age heterogeneity may be an outlier. Under the influence of Confucianism, Chinese people are usually very respectful to their elders. In Chinese companies, top management teams with greater age heterogeneity are usually dominated by the opinions of the older ones, and the younger ones tend not to raise objections. In this case, decisions are not adequately communicated and discussed and lead to the undesirable consequences (Feng & Zou, 2020).

Environmental disclosure has long not been a priority for many companies over the past few years, and older managers typically do not discuss it as a priority. Younger managers, on the other hand, have fewer opportunities to speak and usually do not express environmental disclosure as a priority in meetings, As a result, environmental disclosure has been neglected in many companies. Therefore, hypothesis 1 is as follows:

Hypothesis 1: TMT age heterogeneity has a significant negative effect on environmental disclosure.

Firm Value (FV) is an economic measure reflecting the market value of a business (Gamayuni, 2015). Tobin's Q is a common measure of firm value (Mak & Kusnadi, 2005). In China, age heterogeneity has been found to have a negative impact on firm value (Zhu et al., 2008). Older managers believe that their current success comes from their years of

experience, and they tend to be conservative and unwilling to risk change. Whereas younger managers usually focus on learning and observing, especially in non-state-owned firms where younger managers are usually in the role of successors, younger managers generally do not strongly disagree with the opinions and decisions of their elders. So the value of firms with high age heterogeneity in TMT is usually low. The object of this study is the high energy consumption industry, and its negative effect should be revisited. So, hypothesis 2 is as follows:

Hypothesis 2: TMT age heterogeneity has a significant negative effect on firm value.

Existing studies have shown that environmental disclosure mediates the relationship between multiple explanatory variables and firm value. Dai et al. (2016) studied the relationship between institutional investors, quality of environmental disclosure and firm value. Wang et al. (2019) studied the relationship between heterogeneous institutional investor portfolios, relationship between environmental information disclosure and firm value. In these studies, the mediating role of environmental disclosure has been verified.

Since environmental disclosure is positively related to firm value (Plumlee et al., 2015), if hypothesis 1 about the negative effect of TMT age heterogeneity on environmental disclosure is valid, then it can be hypothesized that TMT age heterogeneity may be responsible for some of the reduction in firm value by affecting environmental disclosure and reducing stakeholder trust. Accordingly, Hypothesis 3 on the mediating effect of environmental disclosure is formulated.

Hypothesis 3: Environmental disclosure has a mediating role in the negative effect of TMT age heterogeneity on firm value.

Enterprises are the mainstay of the social economy, but their behavior is also influenced by the government. In 2007, the former State Environmental Protection Administration (SEPA) of China established a list of specially supervised enterprises based on their environmental pollution, and then updated annually. Scholars have found that the environmental performance of many firms varies greatly after they are included in the list. Wu et al. (2021) found that firms' green patents and patents for green inventions increase significantly after they are included in the national key monitoring list. Combining the previous hypotheses and government regulation, hypothesis 4 is as follows:

Hypothesis 4: The negative impact of TMT age heterogeneity on environmental disclosure is weaker in firms with government-regulated compared to firms without government regulation.

Conceptual Model

Based on the above research hypotheses, the conceptual model of this study is shown in Figure 1. The overall model presented is a mediated model with regulation.

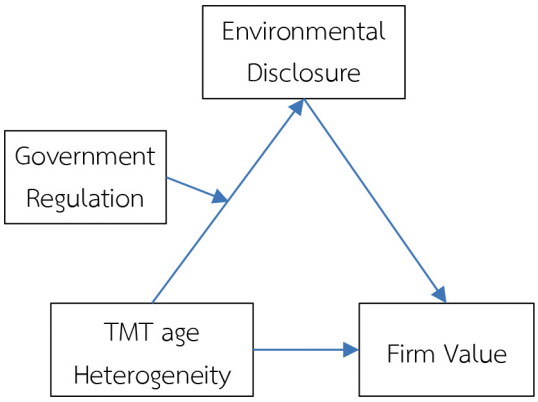

Figure 1 The conceptual model of this study

Methodology

Research Stages

Based on the three research objectives, this study was divided into three research stages. The first stage analyzes the impact of TMT age heterogeneity on corporate environmental disclosure, the second stage investigates the mediating role of environmental disclosure between TMT age heterogeneity and firm value, and the third stage analyzes the moderating effect of government regulation.

Sample Selection

China is the world's most populous country with the most developed manufacturing industry, and it also has the largest total carbon emissions in the world. The effectiveness of China's environmental management has a huge impact on the overall global environmental quality and is well worth studying.

High energy-consuming industries are the top priority in terms of resource consumption, environmental pollution and carbon emissions. The marginal benefits of hig energy-consuming industries in environmental improvement are relatively large, and solving the problems of high energy-consuming industries can greatly improve the overall situation. Therefore, listed companies in China's high energy-consuming industries are selected for this study.

In the Statistical Bulletin of the National Economic and Social Development of the People's Republic of China, high energy-consuming industries refer to the following six industries: petroleum processing, coking and nuclear fuel processing industry (C25), chemical raw materials and chemical products manufacturing industry (C26), non-metallic mineral products industry (C30), ferrous metal smelting and rolling processing industry (C31), non-ferrous metal smelting and rolling processing industry (C32), electric power and heat (D44), with industry codes in parentheses. Considering the use of panel data can avoid the bias of cross-sectional data and improve the credibility of the test results. China started to require firms to disclose environmental information in 2008, and to regulate it in detail from 2021, so the time period of data used in this study is 2008-2020. Excluding the data from 2021 can better reflect the performance of firms in a more natural state. In addition, the sample data in this study is unbalanced panel data because some companies have changed industries.

Data Source

The primary data used in this study comes from China Stock Market & Accounting Research Database (CSMAR), and the study involves more than twenty data tables on different topics in the CSMAR database, including annual table of basic information of listed companies, personal information documents

of executives, management governance capability, financial indicator documents, development capability, and statements related environmental disclosure, etc.

Firstly, the listed companies in high energy-consuming industries and their top management team members were identified by timeframe and industry code, then years in which the industry codes of listed companies did not belong to high energy-consuming industries were deleted, and finally the data in the years labeled with ST, *ST, S*ST, and other operational anomalies were eliminated.

Variable Measurement

1. TMT age heterogeneity (Hage)

With reference to existing relevant studies, the top management team in this study is defined as general manager/president, vice president, chief financial officer/chief accountant, and other executives, excluding full-time chairman, directors, independent directors, supervisors, etc. The standard deviation method was used to calculate age heterogeneity. The units of age heterogeneity calculated using standard deviation are the same as the units of age and are therefore easier to understand.

2. Environmental Disclosure (ED)

Environmental Disclosure is an emerging field, and academics have not yet formed a unified view on the assessment of the level of environmental information disclosure.

Synthesizing previous research results and government regulations, this paper proposes a new evaluation system for environmental disclosure. Experts in the field of environmental management were repeatedly consulted on the specific content and scoring criteria for each item, and equal weighting was adopted, resulting in the evaluation system shown in Table 1.

Table 1 ED Evaluation System

ID	Content
E1	Environmental Management System
E2	ISO Certification
E3	Disclosure Report Carrier
E4	Resource Consumption
E5	Pollution Emission
E6	Carbon Emission
E7	Pollution Emission Reduction
E8	Carbon Emission Reduction
E9	Environmental Investment
E10	Environmental Cost

Each item has a full score of 2 points and is scored according to the specific rules of each item during the evaluation, for example, carbon emissions, quantitative disclosure scores 2 points, qualitative only scores 1 point, none disclosure 0 points. The scores of the 10 items are finally added up.

3. Firm Value (FV)

This study draws on the common practice of using Tobin's Q to measure firm value in most studies. In CSMAR, there are four ways to calculate Tobin's Q. This study uses Tobin's Q C for regression and Tobin's Q D for robustness testing.

4. Government Regulation (Gov)

This is a dummy variable borrowed from Zhang & Wu's study (2020) for measuring government regulation and is taken as 1 if the firm is on the national regulatory list and 0 otherwise.

5. Control Variables

Drawing on related studies, the control variables in this study include firm size (Compsize), firm age (Comppage), gearing ratio (Complev), firm growth (Compgrow), equity concentration (Comptop10), average age of top management team members (Aage), industry dummy variables, and year dummy variables.

Results

Descriptive Statistics

The descriptive statistics of this study are shown in Table 2. In subsequent regression analyses, the raw data for some variables were replaced with reduced tails of (1, 99) to avoid the effect of extreme values.

Table 2 Descriptive Statistics

Variables	Average	STD
Hage	5.902	2.345
ED	4.655	3.621
FV	2.156	1.656
Gov	0.277	0.448
Compsize	21.67	1.509
Compage	16.657	5.758
Complev	46.2	21.7
Compgrow	22.4	203.5
Comptop10	57.949	17.044
Aage	47.623	3.64

Correlation Analysis

The Pearson correlation coefficients between the variables in this study are shown in Table 3, and the absolute values of the correlation coefficients between the variables are less than 0.5, so there is no need to worry about multicollinearity in this study.

Table 3 Correlation Analysis

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Hage	1									
(2) ED	-0.090	1								
(3) FV	0.155	-0.119	1							
(4) Compsize	-0.252	0.441	-0.501	1						
(5) Compage	-0.046	0.173	-0.105	0.188	1					
(6) Complev	-0.210	0.098	-0.397	0.436	0.105	1				
(7) Compgrow	0.038	-0.024	0.059	0.048	-0.079	-0.015	1			
(8) Comptop10	0.006	0.089	0.002	0.203	-0.189	-0.087	0.112	1		
(9) Aage	-0.071	0.185	-0.149	0.258	0.301	0.124	-0.066	0.095	1	
(10) Gov	-0.042	0.399	-0.157	0.266	0.307	0.025	-0.032	0.007	0.214	1

Regression results of the first stage

The first stage of this study is to analyze the effect of TMT age heterogeneity on corporate environmental disclosure, corresponding to hypothesis 1.

The dependent variable is corporate environmental disclosure and the independent variable is TMT age heterogeneity. Model 0 is the null model containing the basic control variables and and Model 1 is the addition of the independent variables to the null model. The Hausman test shows that the coefficients of the fixed effects model and random effects model in each model in this section are significantly different and both should be used as fixed effects models. The regression results are shown in Table 4.

The regression results show that TMT age heterogeneity has a significant negative effect on corporate environmental disclosure (β = -0.052, p = 0.012).

In terms of robustness testing, the first stage of the study used a reduced sample size by compressing the time frame of the sample from 2008 to 2020 to 2010 to 2020, and the regression results were still significant. Therefore, hypothesis 1 can be judged to be valid.

Table 4 The Effect of Age Heterogeneity of TMT on Environmental Disclosure

VARIABLES	Model 0 ED	Model 1 ED
Independent Variable		
Hage		-0.052**
		(0.012)
Control Variables		
Compsize	0.416***	0.412***
	(0.000)	(0.000)
Compage	0.278***	0.277***
	(0.000)	(0.000)
Complev	-0.005	-0.004
	(0.141)	(0.153)
Compgrow	-0.000	-0.000
	(0.640)	(0.700)
Comptop10	-0.020***	-0.020***
	(0.000)	(0.000)
Aage		0.004
		(0.812)
Industry	Control	Control
Year	Control	Control
Constant	-6.580***	-6.367***
	(0.000)	(0.001)
R-squared	**0.2423**	**0.2433**

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

Regression results of the second stage

The second stage of this study analyzes the mediating role of environmental disclosure in the relationship between TMT age heterogeneity and firm value, involving hypotheses 2 and 3. This study follows the classical three-step approach proposed by Baron and Kenny (1986) to analyze the mediating effects by establishing three regression equations (X→Y, X→M, X→M→Y), where X→M corresponds to exactly model 1 above, and here the main effect model of X→Y is named model 2 and the mediating effect model of X→M→Y is named model 3. According to the Hausman test, it was found that a fixed effects model should be chosen for both Model 2 and Model 3. The specific regression results are shown in Table 5. Due to space limitations, control variables are not shown in detail.

Table 5 Analysis of the Mediating Effect of Environmental Disclosure

VARIABLES	Model 1 (X→M) ED	Model 2 (X→Y) FV	Model 3 (X→M→Y) FV
Independent Variable			
Hage	-0.052**	-0.017**	-0.016**
	(0.012)	(0.021)	(0.027)
ED			0.010*
			(0.054)
Control Variables	No more display	No more display	No more display
Constant	-6.367***	7.830***	7.882***
	(0.001)	(0.000)	(0.000)
R-squared	0.2433	0.342	0.343

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

Table 5 shows that in model 2, the coefficient of TMT age heterogeneity is significant (β = -0.017, p = 0.021). In model 3, the coefficients of the independent variable (β = -0.016, p = 0.027) and mediating variable (β = 0.10, p = 0.054) are also significant.

The robustness test here uses the replacement variable method by replacing the Tobin's Q value from Tobin's Q C to Tobin's Q D. The conclusions are still the same, so it can be decided that both hypotheses 2 and 3 are valid.

Regression results of the third stage

The third stage investigates the moderating effect of government regulation, corresponding to hypothesis 4. Since this study focuses on how to improve the effectiveness of environmental disclosure, this stage focuses on the moderating effect of government regulation on the segment X→M in the model.

In this section, the interaction term method is first used to analyze the moderating effect, and according to the results of Hausman's test, the fixed effect model should be used

for model 4, and the specific regression results are shown in Table 6.

Table 6 Regression Results for the Moderating Effect of Government regulation

Variables	Model 4 ED
Moderate variabel	
Gov	0.897***
	(0.000)
Independent Variable	
Hage	-0.062***
	(0.006)
Interaction item	
Gov*Hage	0.065*
	(0.064)
Control Variables	No more display
Constant	-6.020***
	(0.001)
R-squared	0.257

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

Table 6 shows that the coefficient of the interaction term between TMT age heterogeneity and government regulation is significant (β = 0.065, p = 0.064), and a moderating effect can be judged.

In the third stage, the robustness test uses grouped regressions to divide all the data previously analyzed into focused and unfocused regulatory groups according to whether or not they are included in the regulatory list, and then regresses the samples of two groups separately, and the results remain consistent. Therefore, hypothesis 4 is valid.

Discussion

The empirical results in the first stage of this study indicate that TMT age heterogeneity has a significant negative effect on corporate environmental disclosure in China's high energy-consuming industries. In China, there is a hierarchy of seniority, and in teams with large age heterogeneity, there are both older and younger managers. Usually the older managers are more vocal and authoritative. The younger managers have relatively fewer opportunities to express themselves. According to the theory of social categorization, Chinese firms form a categorization between older and younger people, and such teams are not sufficient in discussion and communication, and will be relatively passive in fulfilling their environmental responsibilities, thus environmental disclosure is unsatisfactory.

The second stage of mediation analysis includes main effects analysis and mediation effects analysis. The results of the main effect analysis show that TMT age heterogeneity has a significant negative effect on firm value. Once again, this indicates that there are adverse consequences when TMT age heterogeneity is large in Chinese firms. The reason is still that TMTs with greater age heterogeneity form social categorization, have insufficient team communication and discussion, and may not make the most reasonable business decisions, which in turn negatively affects firm value. The mediation effect analysis shows that corporate environmental disclosure has a mediating effect in the negative effect of TMT age

heterogeneity on firm value, suggesting that teams with greater TMT age heterogeneity perform relatively poorly in environmental disclosure, which affects stakeholders' trust in the firm and ultimately reduces some of the firm's value.

The third stage analyzes the moderating effect of the degree of government regulation. The results indicate that government regulation has a moderating role in the negative effect of TMT age heterogeneity on environmental disclosure. The negative effect of TMT age heterogeneity on environmental disclosure is attenuated in firms that are included in the regulatory list compared to firms that are not included in the regulatory list. Therefore, it is necessary for the government to including more firms in the regulatory list.

Conclusion

Based on the above analysis, this study can draw the following conclusions. In China's energy-intensive industries, TMT age heterogeneity has a significant negative effect on corporate environmental disclosure as well as a significant negative effect on firm value, corporate environmental disclosure mediates the negative effect of TMT age heterogeneity on firm value, and government regulation moderates the negative effect of TMT age heterogeneity on corporate environmental disclosure.

Based on the above findings, it is suggested that Chinese firms should appropriately reduce age heterogeneity when optimizing the structure of executive team members. For example, older managers can be allowed to withdraw from the top management team and move to board positions. At the same time, it is not appropriate to allow younger managers to join the top management team too early, especially the heirs of family firms. In this way the age heterogeneity of the top management team will be relatively small, which is favorable to both environmental disclosure and firm value. In addition, it is also recommended that the government should strengthen regulation and guidance on corporate environmental disclosure, which would be more effective.

There are many shortcomings in this study, the research model is relatively simple, the measurement system of environmental disclosure can be improved, the empirical research method is relatively traditional, and it only focuses on high energy-consuming enterprises in China. In the future, more tpyes of variables can be entered into the modeling, the measurement of environmental disclosure can be more accurate, new empirical methods can be used, and the situation of other countries and other industries can be studied. It is hoped that scientific and reliable conclusions can be obtained in the future, and evidence can be provided for theories such as upper echelon theory and social categorization theory.

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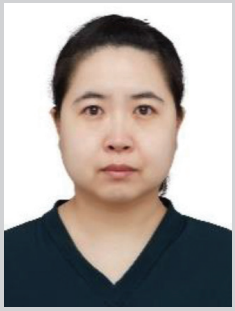

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