How Shareholders' Right of Speech Affects the Performance of Green Innovation--Big Data Practice Based on R Language Brucer Package

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Abstract: Objective: In the internal governance of enterprises, the impact of shareholders' voice on the performance of green innovation is worth empirical research. Process: This paper takes a large number of data of listed companies from 2010 to 2020 as the research object, uses 28940 data, uses R studio environment to build a time fixed effect model, and uses OLS and other methods to the relationship between shareholder voice and corporate green innovation performance. Conclusion: The improvement of shareholders' discourse power is not conducive to improving the green innovation output performance of enterprises; Shareholders' discourse power affects the green innovation performance of enterprises through its role in enterprise growth. The growth of enterprises is conducive to improving the green innovation performance of enterprises. After a series of robustness tests, the conclusion is still valid.

Keywords: Shareholders' Right Of Speech, Green Innovation Performance, Enterprise Growth, Equity Concentration.

1 INTRODUCTION

In the R language environment, the traditional analysis of economic big data is more the OLS linear regression in the application base package. However, when exporting the results, it is often unable to obtain good visualization results. In actual operation, you will use different software to analyze mediation/regulation effects - Mplus, LISREL, the PROCESS plug-in of SPSS, etc. Among them, the most popular is probably the PROCESS macro for SPSS and SAS, because it is simple to operate, quick to use, and has a wide variety of models. Of course, if you want to conduct more complex path analysis and latent variable modeling, you still need to use Mplus. The bruceR:: PROCESS() function uses the mediation package for mediation effect analysis, the interactions package for simple slope analysis, and the lavaan package for chain multiple mediation analysis. The mediation with adjustment calls both mediation and interactions packages.

BruceR:: PROCESS() function does not refer to the official script provided by Hayes (after all, there are 5300 lines of code officially), but strict comparison is made during development to ensure the accuracy of the results. This paper will use bruceR package to analyze the real big data in China.

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This requirement highlights the country's emphasis on innovation and R&D from the macro level. As one of the key subjects to implement the government's policy objective of "green innovation performance", listed companies take business innovation and technological change as their core competitiveness [1]. Green innovation performance is an important part of their capital destination and plays a decisive role in improving the economic efficiency of enterprises. In recent years, as "innovation is the first productive force" and "the concept of sustainable development" are increasingly valued by enterprises, the research on green innovation performance and enterprise development has become the research direction of many scholars. However, previous studies have paid more attention to the relationship between green innovation performance and operating profit, profitability and innovation performance, while the research on internal factors of green innovation performance of enterprises is less. At the same time, due to the concentration of equity in some listed companies, shareholders with large equity shares often make biased decisions in order to safeguard their own interests, which affect the level of green innovation performance of enterprises, or affect market performance by changing green innovation performance to achieve profits [2]. Based on the above analysis, this paper selects relevant data from 2010 to 2020 to explore the relationship between equity concentration, enterprise growth and green innovation performance of listed companies through theoretical analysis and empirical testing, focusing on the intermediary role of enterprise growth in the process of equity concentration affecting market performance, with a view to providing strong empirical evidence for the research on influencing factors of market performance, And put forward targeted policy recommendations. At the same time, there are many researches on the external factors that affect the performance of green innovation in the current academic circle, but there are few researches on the internal factors of green innovation in enterprises.

This paper will call bruceR package to study the internal factors that affect the green innovation of enterprises.

2 LITERATURE REVIEW AND RESEARCH HYPOTHESIS

2.1 Equity Concentration and Green Innovation Performance

Equity concentration is often used as a key indicator to reflect the equity distribution of a company [3]. Some scholars believe that excessive equity concentration will inhibit the efficiency of green innovation performance transformation. Some scholars found that ownership concentration has a significant negative impact on green innovation performance. Many scholars have studied the regulatory effect of equity concentration, and some scholars have found that equity concentration negatively regulates the impact of equity incentive intensity on R&D expenditure. Some scholars also found that ownership concentration has no significant direct effect on R&D investment, but it plays a significant positive regulatory effect in the process of manager autonomy positively affecting R&D investment intensity. Innovative R&D activities are inherently risky, and the benefit of enterprise input and output is faced with greater uncertainty, which will affect the business performance and total profit of the enterprise, and ultimately determine the amount of dividends for equity investors [4]. With the improvement of equity concentration, the higher the risk of enterprise technological innovation undertaken by major shareholders, the more they tend to operate conservatively, maintain the current business situation of the enterprise, and are unwilling to carry out innovation and change and invest in

research and development activities. Some scholars pointed out that the investor protection environment in China is not perfect. Under the imperfect weak investor protection environment, large shareholders are likely to increase the value of their own corporate resources through other more convenient ways, such as maximizing private benefits through a large number of related party transactions, which is "more efficient" than the benefits obtained by investing in research and development activities, That is to say, the higher equity concentration restrains the R&D expenditure of enterprises. Some scholars believe that equity concentration will weaken the green innovation performance of enterprises [5]. Some people also get the conclusion that the high concentration of equity will inhibit the performance of green innovation through analysis. R&D activities are characterized by high investment and high risk, and the time span is relatively long [6]. Driven by the pursuit of short-term income goals and risk aversion, major shareholders are reluctant to carry out R&D activities. Based on the above analysis, this paper proposes hypothesis 1:

H1: Equity concentration has a negative effect on corporate green innovation performance.

2.2 Equity Concentration and Enterprise Growth

The smaller the equity concentration of the company, the lower the noise of the relevant variables used in the internal contract, and the more accurate and reliable they are, the more they will provide good incentive and supervision signals to the board of directors and senior management, so as to improve the growth of the enterprise [7]. Effective internal control can improve the accuracy of internal management reports or internal data information by reducing unintentional accounting errors or intentional accounting manipulation, inhibit the earnings management problems of the company, and enhance the competitive advantage of the enterprise [8]. One of the functions of low equity concentration is to supervise and feedback organizational activities. With the daily activities of the enterprise running together, equity concentration can guide various departments, provide products that satisfy customers, and enable the enterprise to maintain a better competitive advantage. Optimizing the internal environment of the enterprise and strengthening the construction and implementation of risk assessment can improve the internal communication status of the organization and improve the growth of the enterprise. Therefore, this paper proposes the following assumptions:

H2: Equity concentration is not conducive to the growth of enterprises.

2.3 Enterprise Growth and Enterprise Green Innovation Performance

Generally speaking, Chinese enterprises have such defects as high survival pressure, poor resource base and strong financing constraints, which often lead to insufficient motivation for enterprises to carry out green innovation. However, for high growth enterprises, green innovation is the main way to obtain competitive advantages and maintain their own long-term development. Especially in the case of increasingly fierce external competition, enterprises also have enough motivation to carry out green innovation to ensure their growth ability [9]. To be specific, first of all, green innovation means that the enterprise has obtained new innovation impetus. Even if the enterprise decides to invest in innovative projects with high uncertainty, it shows that they have the potential of marketization and can bring potential competitive advantages to the enterprise; Secondly, with the increasingly frequent international and domestic exchanges of knowledge and technology, the innovation support that enterprises can

obtain has been greatly improved compared with the past. Many enterprises can grow rapidly and become listed companies in a short time, which is based on the rapid flow of innovation resources; Thirdly, the improvement of education level has made the quality of technical innovation personnel generally improve [10]. The promotion of innovation and entrepreneurship at the national policy level has made many graduates who have received better education in colleges and universities and researchers in major scientific research institutes have a strong combination of industry, education and research, which has made the innovation level of all kinds of enterprises can be improved as a whole. Based on the above theoretical analysis, this paper proposes the following research assumptions:

H3: Enterprise growth has a positive effect on green innovation performance, and it plays an intermediary role in the relationship between ownership concentration and green innovation performance.

3 RESEARCH DESIGN

3.1 Sample Selection and Data Source

This paper selects the basic data and green innovation data of listed companies in the manufacturing industry of Shanghai and Shenzhen Stock Exchanges from 2010 to 2020 as samples. CSMAR database is the data source of this study, and data processing is conducted through R studio software.

At the same time, this paper has carried out the following processing: 1% and 99% percentile winsorize for all continuous variables to eliminate the influence of abnormal values; Some missing data shall be supplemented appropriately. These data are missing because the missing value itself represents that the item is 0, so the missing value is added as 0; Some industries, such as financial industries, which are not suitable for measuring the innovation ability of enterprises with the number of patents, have been eliminated. According to the above standards, 28940 observations were finally obtained in this paper.

3.2 Model Building

In this paper, the fixed effect model is used to empirically demonstrate the f fixed effect model, namely the fixed effect regression model (FEM for short), which is a panel data analysis method. It refers to the experimental design that the experimental results only want to compare the differences between specific categories or categories of each autovariable and their interaction effects with specific categories or categories of other autovariables, and do not want to infer from this to other categories or categories not included in the same autovariable. Fixed effect regression is a variable method that varies with individuals but not with time in spatial panel data.

In order to test the negative effect of H1 ownership concentration on enterprise green innovation performance, this paper constructs the following model 1:

$$GI = \alpha + \beta_1 FSR + \gamma Controls + \varepsilon. \quad (1)$$

In order to test the mediating role of H2 and H3 enterprise growth in equity concentration on enterprise green innovation performance, this paper constructs the following models 2 and 3:

$$GI = \alpha + \beta_1 GROW + \gamma Controls + \varepsilon \quad (2)$$

$$GI = \alpha + \beta_1 GROW + \beta_2 FSR + \gamma Controls + \varepsilon \quad (3)$$

3.3 Variable Definition

3.3.1 Interpreted variable

In order to measure the green innovation performance of enterprises, this paper selects the number of green patents measuring the green innovation achievements of enterprises in the CSMAR database as the green innovation performance of enterprises.

3.3.2 Explanatory variable

This paper chooses the largest ownership concentration as a substitute variable for the concentration of corporate shareholders' discourse power.

3.3.3 Intermediary variable

This paper uses the asset to debt ratio in the enterprise financial data to quantify the alternative variables of enterprise growth.

3.3.4 Control variable

According to the experience of previous research, in order to control the impact of different enterprise characteristics on innovation output, this paper uses enterprise scale; Book to market ratio; Asset liability ratio and total asset turnover ratio are the control variables of this model.

3.4 Code

In the R language environment, the bruceR code is called and the adjustment effect is checked as follows:

```
# Intermediary Analysis
PROCESS(total,y="grow",x="RD",meds = "fsr",
      covs = c("ROA","dar","mcr","size"),
      ci="boot",nsim = 1000,seed = 1)
# Robustness Check
PROCESS(total,y="RD",x="tsr",meds = "grow",
      covs = c("ROA","dar","mcr","size"),
      ci="boot",nsim = 1000,seed = 1)
```

4 EMPIRICAL RESULTS

4.1 Regression Results

First of all, this paper uses the fixed effect model for empirical estimation. Columns (1) and (2) of Table 1 respectively examine the impact of the implementation of shareholders' discourse and enterprise growth on the innovation output and innovation efficiency of enterprises. It can be seen from Table 3 (1) that the coefficient of fsr is -0.086, which is significantly positive at the level of 5%, indicating that the implementation of the concentration of shareholders' right of speech significantly inhibits the total number of green patents of enterprises. In (3), the coefficient of growth is -0.393, which is not significant, indicating that the growth of enterprises presents a negative full intermediary role. Therefore, the assumption is supported by data.

Table 1: Regression Analysis Table.

	（1）RD	(2)grow	（3）RD
(Intercept)	10.348 (12.590)	33.467 *** (0.082)	10.348 (12.591)
ROA	-62.207 (41.050)	6.573 *** (0.268)	-59.627 (41.476)
mcr	-15.638 (60.581)	5.340 *** (0.395)	-13.542 (60.773)
Size	-8.744 (12.006)	1.585 *** (0.078)	-8.122 (12.091)
fsr	-0.086*** (0.008)	-0.000 *** (0.000)	-0.000 (0.008)
Grow			-0.393 (0.902)
R^2	0.000	0.046	0.000
Adj. R^2	0.000	0.046	0.000
Num. obs.	28940	28940	28940

Note. * p < .05, ** p < .01, *** p < .001.

4.2 Robustness Check

In this paper, the method of replacing explanatory variables is used to test the robustness. This paper changes the quantitative method of shareholders' voice from the shareholding ratio of the largest shareholder to the shareholding ratio of the top ten shareholders. The results are as follows, and the assumption is valid, indicating that the conclusion is robust.

Table 2: Robustness Check Table.

	（1）RD	(2)grow	（3）RD
(Intercept)	250.784 *** (8.802)	10.348 (12.590)	250.784*** (8.802)
ROA	86.948 ** (28.945)	-54.590 (41.400)	86.944 ** (28.946)
mcr	-68.038 (43.195)	158.405 * (61.782)	-68.027 (43.201)
Size	-369.271 ***	-6.233 (60.865)	369.271***

	(42.554)		(42.555)
tsr	-0.078 *** (0.002)	-1.249 *** (0.090)	-0.078 (0.622)
Grow			-0.000 (0.004)
R^2	0.064	0.000	0.064
Adj. R^2	0.064	0.000	0.064
Num. obs.	28940	28940	28940

Note. * p < .05, ** p < .01, *** p < .001.

5 CONCLUSIONS

The report of the 20th National Congress of the Communist Party of China has repeatedly emphasized that we should further promote the energy transformation and adhere to the core position of innovation in China's overall modernization drive. In this macro context, there are obvious differences in existing research on the internal relationship between shareholders' voice and green innovation of enterprises. The academic and practical circles have not reached a consensus on whether the shareholders' right of discourse has aggravated the exclusion of internal resources from green innovation or promoted the integration of internal resources and green innovation. Therefore, this paper conducts research on the impact of shareholders' discourse power on green innovation of enterprises, and empirically tests the impact and mechanism of shareholders' discourse power on green innovation of enterprises using fixed effect model and intermediary effect model. The research conclusions are as follows: First, shareholders' discourse power inhibits green innovation of enterprises. After excluding the interference of endogenous problems and a series of robustness tests, the conclusion is still robust. Secondly, further research found that shareholders' right of discourse inhibits the performance of green innovation by reducing the growth of enterprises.

6 POLICY SUGGESTIONS

Based on the above research, this paper puts forward the following suggestions:

1.Controlling shareholders' equity concentration is an important part of deepening the reform of listed enterprises, which should give full play to the characteristics and advantages of the integration of multiple ownership capital, form collaborative innovation forces with small and medium-sized shareholders as the platform, improve the level of green innovation of enterprises, and achieve the organic unity of economic and social benefits;

2.Heterogeneity characteristics such as subordination level and functional positioning have an important impact on environmental technology R&D of listed enterprises. The introduction of small and medium-sized equity should fully consider the characteristics of enterprises themselves, and promote enterprise reform in a hierarchical and classified manner;

3.Environmental institutional pressure is an important driving force for green innovation of enterprises. External governance measures such as increasing environmental subsidies and increasing analysts' attention should be taken to foster a good external environment for green

innovation incentives and transparent information disclosure, and guide and encourage enterprises to conduct green innovation research and development.

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