Financialization of Enterprises and Technological Innovation of New Energy Enterprises

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ABSTRACT

Under the goal of "carbon peak" and "carbon neutralization", China began to attach great importance to the transformation of energy, and new energy enterprises have become key development enterprises. Technological innovation is the key to the development of new energy enterprises, but the low economic efficiency makes them less motivated to carry out technological innovation. Instead, idle funds are used for short-term financial investment. Based on the theory above, this research attempts to explore the impact of enterprise financialization on technological innovation of new energy enterprises. According to the Wind database, this research selects Shanghai and Shenzhen A-share listed companies from 2011 to 2020 as the original sample and uses the random effect model in STATA to make an empirical analysis. The results show that enterprises financialization has a "crowding-out" effect on technological innovation of new energy enterprises, and the higher the return on asset is, the stronger the technological innovation capability is. The enterprise scale and the R&D investment ratio also have a significant indigenous impact on the technological innovation of enterprises.

Keywords: *Technology innovation, Enterprise financialization, New energy enterprises, Random effect model, Return on asset*

1. INTRODUCTION

New energy enterprises are one of the important areas of strategic emerging industries with broad development prospects, and technological innovation of enterprises is particularly important for new energy enterprises [1]. The study found that new energy enterprises are more dependent on innovation output, but their technological innovation may not bring certain benefits in the short term, so it requires external investment. The use of idle funds for short-term financial investment by enterprises is helpful to cope with the possible shortage of funds in the future, so as to better promote the technological innovation of enterprises [2]. However, excessive corporate financialization will crowd out many resources for technological innovation, which will seriously hinder the technological innovation of enterprises [3].

New energy enterprises' technological innovation activities need to bear high cost and high risk. Externality and high investment of technological innovation make some enterprises lack innovation motivation. According to the data, the overall performance of China's new energy listed enterprises' technological innovation is low, and the economic benefits are not prominent, so the enthusiasm for technological innovation is not high. Overall, new energy enterprises have problems such as low level of technological innovation, large gap within the industry, and unbalanced development among regions, which seriously hinder their smooth and sound development [4].

The existing literature focuses more on manufacturing and high-tech enterprises to study the impact of financialization on technological innovation. Few scholars focus on the new energy industry. In response to this, this research takes new energy enterprises as the research object and uses the random effect model in STATA to study the impact of enterprise financialization on technological innovation of new energy enterprises.

There are two main marginal contributions of this research: Firstly, based on the empirical evidence of listed companies in China's new energy enterprises, the root cause of insufficient technological innovation motivation of China's enterprises is obtained, which provides theoretical guidance for new energy enterprises to play the main role of technological innovation; second,

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it is of great theoretical significance to explore the internal influence mechanism between the financialization of new energy enterprises and the enterprises' technological innovation, so as to provide the basis and thinking direction for promoting the reform and development of China's new energy industry.

2.RESEARCH BACKGROUND AND THEORETICAL ANALYSIS

2.1. Literature review

Enterprise financialization refers to a phenomenon that enterprises invest in financial assets or allocate more and more financial assets, which will lead to the fact that the operating profit of enterprises is not from the actual production field, but from financial assets [5]. According to the existing research, there are two main reasons for the financialization of enterprises. The first category is the motivation of capital's "reservoir", that is, enterprises use financialization as a means of liquidity reserve to smooth all kinds of risks in the process of enterprise innovation transformation, and play the role of financial buffer. The other is "speculative arbitrage" motivation, that is, enterprise financial investment is a short-sighted behavior of managers and speculative profit-seeking means [6].

Some scholars also studied the appropriateness of enterprise financialization. Wang Shaohua et al. believed that the relationship between the degree of enterprise financialization and enterprise innovation was in an inverted U shape [7]. Suddenness, risk and uncertainty in the process of technological innovation are inevitable. Therefore, the existence of "speculative arbitrage" may reduce its investment in technological innovation, and may allocate more assets to short-term, high-reported financial products, resulting in a significant crowding-out effect on enterprise innovation activities [7].

In summary, based on the above two motivations and the inherent problems in the process of technological innovation, this research will analyze whether the impact of enterprise financialization on technological innovation is manifested as "crowding-out effect" or "promotion effect", which has important guiding significance for understanding the motivation and economic consequences of financial assets allocation in new energy enterprises.

2.2. Mechanism of enterprise financialization on enterprise technological innovation

The characteristics of large capital demand, large innovation risk and small short-term income of enterprise technology innovation make enterprise innovation face high uncertainty. Lu Xin et al. pointed out in the study that the bank-led financial system in China leads to serious financing constraints on enterprise technology innovation investment [8]. Based on this, most enterprises' investment funds for technological innovation come from internal financing of enterprises. In other words, in order to cope with the uncertainty in the future, enterprises will put some funds into financial assets to increase their liquidity, realize capital preservation and appreciation, and improve short-term solvency, so as to promote better development and technological innovation of enterprises. Such financial investment is based on the capital "reservoir" motivation [9], which can promote the output of technological innovation.

On the other hand, enterprise financial investment may also have a negative impact on its technological innovation, which is manifested as the crowding-out effect. Wang Hongjian et al. showed that more resources for financial or real estate investment will be chosen to use by non-financial enterprises, so that more and more funds are introduced into the main business and occupy the resources for technological innovation [10]. Some other scholars found that managers' "shortsightedness" behavior will also lead to funds that should be invested in technological innovation for investment in financial assets to meet their short-term performance evaluation, thus having a negative impact on technological innovation.

To sum up, if the financialization of new energy enterprises is based on speculative arbitrage motivation, then most of the funds will be used for investment in financial assets, so that the funds for enterprise innovation will be reduced, and ultimately inhibit enterprise innovation, which shows a "crowding-out" effect; if enterprise financialization is a capital reserve activity to reduce financing constraints, it can put more capital into financial assets with high returns and low constraints under the condition of good external financing environment, thus promoting technological innovation of enterprises, which is manifested as a "reservoir" effect. Referring to the above theory, this research will further explore the mechanism of enterprise financialization on technological innovation of new energy enterprises.

3. RESEARCH DESIGN AND SAMPLE SELECTION

3.1. Research design

Referring to the research design of Wang Hongjian et al. [11], the following model is used to test the research hypothesis:

$$\text{Patent} = \beta_0 + \beta_1 Financial + \sum \alpha_i X_i + \varepsilon \quad (1)$$

In the above model, $Patent$ is a predicted variable, which represents the level of enterprise innovation technology, and is represented by the natural logarithm of the total number of patent authorizations of new

energy enterprises. $Financial$is the explanatory variable, which is the financialization of new energy enterprises. This research selects the measurement method of enterprise financial asset holdings, that is, the sum of trading securities, available-for-sale securities, held-to-maturity investment, and investment property in proportion of the total assets at the end of the period represents the financialization of new energy enterprises.

In the model, if the β_1 coefficient is significantly negative, it shows that the financialization of new energy enterprises is negatively correlated with technological innovation, which supports the "crowding-out effect" under arbitrage motivation; if it is positive, it shows that there is a positive correlation between the financialization of new energy enterprises and enterprise technological innovation, which supports the "smoothing effect" under the capital reserve.

X is the controlled variable. This research controls Roa (return on asset), MBIG(Main Revenue Growth Rate), Lnsize (Enterprise Scale), NPG (Net Profit Growth Rate), and Rd(R & D Investment Ratio). The detailed definition of specific variables is shown in Table 1

Table 1. Variable definition

Types of Variables	Symbol	Variable Name	Variable Definition
Predicted Variable	Patent	Enterprise Technology Innovation	natural logarithm of the total number of patent authorizations
Explanatory Variable	Financial	Enterprise Financialization	enterprise financial asset holdings (trading securities + available-for-sale securities + held-to-maturity investment + investment property) / total assets at the end of the period
Controlled Variable	Roa	Return on Asset	net profit/ total assets at the end of the period
	MBIG	Main Revenue Growth Rate	(current operating revenue - prior period operating revenue) / prior period operating revenue
	Lnsize	Enterprise Scale	Natural logarithm of total assets at end of period
	NPG	Net Profit Growth Rate	(current net profit - prior period net profit)/ prior period net profit
	Rd	R&D Investment Ratio	R&D investment / operating revenue

3.2. Sample selection

According to the Wind database, this research selects Shanghai and Shenzhen A-share listed companies from 2011 to 202 0 as the original sample. Then through CSMAR database screening, samples of undisclosed financial assets and samples of missing variables were eliminated. Finally, a total of 780 annual observations were selected from 94 new energy enterprises.

4. EMPIRICAL PROCESSES

4.1. Descriptive statistics

Table 2 is the descriptive statistics of the variables in this research. The mean value of technological innovation ($Patent$) of new energy enterprises is 3.751, indicating that the average number of patents in the sample companies reaches 43, which is in line with the international patent output level. Therefore, it has research significance. The average value of enterprise financialization ($Financial$) is 0.018, indicating that financial asset investment accounts for 1.8% of total assets on a verage. The mean value of other controlled variables is basically equivalent to the median, indicating that it presents a normal distribution.

Table 2. Descriptive statistics of variables

Variables	N	Mean	Std. Dev.	Min	P25	P50	P75	Max
$Patent$	780	3.751	1.457	0.000	2.833	3.829	4.804	6.796
$Financial$	780	0.018	0.031	0.000	0.000	0.005	0.022	0.182
Roa	780	0.041	0.051	-0.160	0.016	0.038	0.068	0.162
$MBIG$	780	0.256	0.486	-0.564	0.004	0.153	0.362	2.537
$Lnsize$	780	23.035	1.330	20.266	22.147	22.869	23.836	26.647
NPG	780	0.085	4.342	-26.719	-0.228	0.143	0.581	21.126
Rd	780	4.215	2.112	0.080	3.090	3.980	5.110	12.120

Correlation analysis refers to the analysis of two or more variables that are related to measure the correlation between two variables. The correlation between independent variables and dependent variables can be preliminarily tested by analyzing the values of the results. Table 3 shows the correlation coefficient matrix.

Table 3. Correlation coefficient matrix

	Patent	*Financial*	*Roa*	*MBIG*	*Lnsize*	*NPG*	*Rd*
Patent	1.000						
Financial	0.037	1.000					
Roa	0.035	0.129***	1.000				
MBIG	0.019	-0.048	-0.108***	1.000			
Lnsize	0.559***	0.060*	-0.044	0.021	1.000		
NPG	-0.007	0.037	0.445***	0.004	0.020	1.000	
Rd	0.176***	-0.115***	0.015	-0.011	-0.070**	-0.090**	1.000

Note: *, **, and *** indicates significant aboriginality at 0.1, 0.05, and 0.01 level respectively.

The results in Table 3 show that the correlation coefficient interval between *Patent* and *Financial* and controlled variables is -0.115 – 0.559, and the correlation coefficient between *Lnsize* and *Patent* is the highest, which is 0.559. *Roa*, *Rd* and core variables all show a certain degree of correlation.

4.2. Multicollinearity test

The model estimation will be distorted if there is a high correlation between the explanatory variables in the linear regression model. Therefore, the multicollinearity test is done, see Table 4.

Table 4. Correlation coefficient matrix

Variables	VIF	1/VIF
Financial	1.04	0.962017
Roa	1.27	0.786629
MBIG	1.02	0.979919
Lnsize	1.02	0.975831
NPG	1.24	0.805007
Rd	1.03	0.970872
Mean VIF	1.10	

The results show that the VIF values of each index and the overall mean are between 1.02 and 1.27, all less than 10. Combined with the results of Table 3, the correlation coefficients between all indicators are less than 0.6, which comprehensively reflects that there is no multicollinearity between variables, and the model is well constructed.

4.3. Regression analysis

According to hausman test results, this research should use random effect model. Table 5 is the linear regression results. The results show that the P-value of *Patent* and *Financial* is 0.012, less than 0.05. Therefore, enterprise financialization is significantly related to technological innovation of new energy enterprises. It also shows that the coefficient β_1 is -3.023, which means that there is an indigenous linear negative correlation between enterprise financialization and technological innovation of new energy enterprises, showing a significant "crowding-out effect". In addition, the return on asset of enterprises, the enterprise scale and the R&D investment ratio also have a significant indigenous impact on the technological innovation of enterprises (P-value < 0.05), especially the *Roa* variable. Its correlation coefficient is positive 2.669, indicating that the higher the *Roa* is, the stronger the technological innovation ability of enterprises is.

Table 5. Linear regression results

Patent	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Financial	-3.023	1.197	-2.53	0.012	-5.368	-0.677
Roa	2.669	0.881	3.03	0.002	0.943	4.395
MBIG	-0.043	0.067	-0.64	0.525	-0.175	0.089
Lnsize	0.510	0.039	12.92	0.000	0.432	0.587
NPG	-0.006	0.008	-0.85	0.398	-0.021	0.008
Rd	0.100	0.021	4.75	0.000	0.059	0.142
_cons	-8.512	0.918	-9.28	0.000	-10.310	-6.714

4.4. Robustness test

Due to the lag of technological innovation, the explanatory variable and all controlled variables are lagged one stage to alleviate endogenous problems. The results of lag one stage are shown in Table 6. It can be seen that there is a linear negative correlation between enterprise financialization and technological innovation of new energy enterprises at the level of 10%, which is consistent with baseline regression results. This means that the research conclusion of this research is robust.

Table 6. Lag one stage regression results

Patent	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Financial	-2.590	1.388	-1.87	0.062	-5.311	0.130
Roa	4.181	0.960	4.36	0.000	2.299	6.062
MBIG	-0.024	0.073	-0.32	0.748	-0.167	0.120
Lnsize	0.459	0.045	10.23	0.000	0.371	0.547
NPG	-0.011	0.009	-1.17	0.242	-0.029	0.007
Rd	0.046	0.024	1.86	0.062	-0.002	0.094
_cons	-7.105	1.040	-6.83	0.000	-9.143	-5.066

5. CONCLUSION

This research selects Shanghai and Shenzhen A-share listed companies from 2011 to 2020 as samples, and uses random effect model to empirically analyze the impact of enterprise financialization on technological innovation of new energy enterprises, and draws the following conclusions:

Firstly, the financialization of new energy enterprises and technological innovation are negatively correlated on the whole. That is, the financialization of enterprises leads to the "crowding-out" effect. The higher the degree of financialization, the lower the level of technological innovation. Indeed, most of new energy enterprises put funds into financial assets to increase their liquidity and improve short-term solvency, so that the development of green economy can be accelerated. By analyzing data, new energy enterprises should take at least half of idle funds for technological innovation.

Second, there is a significant positive correlation between the financialization of new energy enterprises and the return on assets of enterprises. The higher the return on assets of enterprises, the stronger the technological innovation ability. The enterprises' scale and the R&D investment ratio also have a significant indigenous impact on the technological innovation of enterprises.

According to the conclusions above, it can be seen that the government should strictly control the degree of financialization of new energy enterprises, making their put more idle funds in technology innovation. When new energy enterprises apply for refinancing, the government should strengthen strict constraints on their share of financial assets, so as to bring long-term development to new energy enterprises and even the whole industry.

AUTHORS' CONTRIBUTIONS

This paper is independently completed by Yuxuan Zhang.

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