

# The Impact of Green Technology Innovation of New Energy Companies on Earnings Sustainability in China—Based on the Regulatory Effect of Green Finance Development

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## Abstract

Taking Chinese A-share new energy listed companies from 2008 to 2020 as a sample, study the impact of green technology innovation on earnings sustainability, and the role of the development of green finance in its impact mechanism. The following conclusions were drawn: 1) The green technology innovation of new energy companies and earnings sustainability are significantly positively related, strengthening green technology innovation is an important way to improve the earnings sustainability of new energy companies. 2) The green finance development has a significant external adjustment effect, the higher the level of green finance development, the stronger the role of new energy companies' green technology innovation on earnings sustainability. 3) Compared with the sustainability of the cash flow surplus, the green technology innovation of new energy companies plays a more significant role in improving the sustainability of the accrued surplus. Based on the findings of the study, relevant recommendations are put forward.

## Keywords

New Energy Companies, Green Technology Innovation, Earnings Sustainability, Green Finance Development

## 1. Introduction

The new energy industry is a key strategic emerging industry in China. Accelerating green technology innovation in new energy companies is an important

support to achieving the goal of “double carbon” and building a green, low-carbon cycle development economic system. Green technology innovation mainly includes pollution prevention and control, recycling, green products, green processes, green recycling, and other technological innovations (Aguilera & Ortiz, 2013). Green technology innovation is expected to reduce environmental pollution, but it is also expected to generate economic benefits (Zhang & Zhang, 2013). There are different views on how green technology innovation affects the economic efficiency of companies. Some researchers argue that green technological innovation can significantly improve corporate economic performance (Zhu et al., 2015) and that green technological innovation has a significant positive impact on corporate financial performance (Xie et al., 2019a). However, some researchers argue that green and economic benefits may be difficult to achieve in a win-win situation (Endrikat et al., 2014) and that green technological innovation will increase corporate investment in environmental protection, which incurs additional costs, take up limited resources, and have a negative impact on firm performance (Aguilera & Ortiz, 2013). In addition, some researchers argue that there is a non-linear relationship between green innovation and firm economic benefits, with both the process and outcome of environmental governance showing a U-shaped relationship with firm financial performance (Zhang et al., 2020).

Earnings sustainability is the extent to which an enterprise’s current surplus continues into the next period (Sloan, 1996; Richardson et al., 2005), reflecting the sustainability of the enterprise’s future financial performance, and is a fundamental guarantee of enterprise value. At present, what is the level of green technology innovation in Chinese new energy companies? What is the impact of green technology innovation on earnings sustainability? In a regionally differentiated green financial development environment, does the impact of green technology innovation on earnings sustainability vary among new energy companies? In order to answer these questions, using the data of A-share listed new energy companies in China from 2008 to 2020 to empirically examine the impact of green technology innovation on earnings sustainability and further explore the possible external adjustment effect of regional green financial development, with a view to providing new theoretical support and path options for new energy companies to connect the innovation chain, capital chain and value chain in the process of green development in the new era.

The possible innovations of this paper are: 1) The impact of green technology innovation on the economic performance of companies has attracted attention and different views, but it has mainly focused on the impact on the current performance of companies, but not on the future performance of companies. This paper examines the economic consequences of green technology innovation from the dynamic perspective of corporate earnings sustainability, and focuses more on the role of green technology innovation in the sustainable development of companies. 2) Green technology innovation is a prerequisite and guarantee for the core competitiveness of new energy companies, but few studies have been conducted on the economic consequences of green technology innovation for

new energy companies. This paper takes new energy companies as the research object, further expanding the industrial field of research on the economic consequences of green technology innovation.

## **2. Literature Review and Hypothesis Development**

### **2.1. Green Technology Innovation and Earnings Sustainability**

Green technology innovation by new energy companies can generate good economic and social benefits and help promote the sustainable and healthy development of the companies. On the one hand, green technological innovation is conducive to enhancing the sustainable development performance of companies (Xi & Zhao, 2022), strengthening the support for the technological innovation of new energy companies, and promoting the sustainable financial development of companies (Huang et al., 2021). Green technology innovation brings good economic benefits to new energy companies by reducing resource consumption, increasing productivity, and reducing production costs. According to the cost-benefit principle, new energy companies develop and utilise renewable resources through green technology innovation, reduce the consumption of non-renewable resources, improve resource utilisation efficiency and reduce resource consumption costs, thereby reducing enterprise production costs, increasing enterprise revenue, achieving stable operation, improving enterprise financial performance and guaranteeing the stability and sustainability of future accounting surpluses. On the other hand, actively fulfilling social responsibility can help improve corporate earnings sustainability (Huo & Wang, 2021). Green technology innovation in new energy companies can reduce pollution at source by conducting clean production and reducing end-of-pipe emissions, in order to achieve the energy saving and emission reduction requirements put forward by the government and generate good social benefits. A series of synergistic effects such as improving corporate reputation and creating corporate value resources can be generated through actively fulfilling social responsibility, which is conducive to enhancing corporate earnings sustainability. In addition, with strong national support for the development of new energy industries and increasing social awareness of environmental protection, green technology innovation helps new energy companies to establish a good green image (Xie et al., 2019b), and new energy companies with a good green image can effectively enhance their brand value and corporate reputation, win more consumer trust, which in turn attracts and inspires consumers to make green purchases, enabling the companies to achieve higher financial performance (Zong et al., 2014) and prompting them to maintain the earnings sustainability. In summary, the following hypotheses are proposed.

Hypothesis 1: Green technology innovation in new energy companies has a positive impact on earnings sustainability.

### **2.2. Moderating Effect of Green Finance Development**

Green technology innovation by new energy companies requires a large amount

of capital investment, which is difficult to solve through internal financing. From the development path of new energy industries around the world, governments often promote the development of new energy industries by reducing the R&D and production costs of producers and the usage costs of consumers through specific financial funding subsidies (Yu & Yu, 2019). Although the government will give certain support and subsidies, the whole process of green technology innovation is highly invested, risky and long-period, and must be supported by the power of financial markets to obtain large amounts of funds. Green finance can promote the rational allocation of financial resources among industries and alleviate the financing constraints faced by new energy companies in carrying out green technology innovation (Zhu & Wang, 2022). Green financial development, as an external influence, creates a good business environment for enterprises' green technological innovation, especially in terms of financing constraints that can provide great convenience for enterprises (Zhang & Cao, 2022). In the background of vigorous development of green finance, enterprises' green technology innovation projects can generally obtain corresponding funds from the green finance system, which can help the smooth development of green technology innovation and stable development of business performance of new energy companies by improving financing efficiency and reducing financing costs. The intensity of environmental regulations has a positive impact on green technology innovation (Niu et al., 2022). The level of green financial development can, to a certain extent, represent the regional financial sector's support for the local clean industry (Zhang et al., 2022). In regions with a higher level of green financial development, new energy companies can receive more financial support for their green technology innovation, ensuring the continued stability of their capital chain and contributing to the sustainability of their surpluses. In summary, the following hypotheses are proposed.

Hypothesis 2: Green financial development positively regulates the relationship between green technological innovation and earnings sustainability of new energy companies, and the higher the level of green financial development, the stronger the effect of green technology innovation on earnings sustainability for new energy companies.

### 3. Research Methodology

#### 3.1. Data Collection

Chinses A-share listed new energy companies from 2008 to 2020 are used as the research sample, and the main data sources are as follows: 1) Data on listed new energy companies are obtained from the concept sector classification in the RESSET database (RESSET database is a data platform that provides professional services for model testing, investment research, etc. It is designed by a number of renowned experts from Tsinghua University and Peking University who are engaged in financial database and financial modelling research), and 120 new energy companies operating in wind power, photovoltaic concept, solar energy,

HIT battery, geothermal energy, nuclear power, biomass energy and hydrogen energy are selected. 2) Earnings sustainability data from CSMAR's financial metrics analysis database. 3) Data related to green technology innovation were obtained from the environmental performance and governance disclosure tables of listed companies in the CSMAR environmental database and the China Research Data Service Platform CNDRS. 4) Data related to the level of green financial development were obtained from the CSMAR database and the China Statistical Yearbook, the China Energy Statistical Yearbook, the China Financial Statistical Yearbook and the China Insurance Statistical Yearbook. Excluding ST companies and samples with missing data, 570 valid samples were finally obtained. To avoid the influence of extreme values, all variables with a 1% upper and lower tail reduction.

### 3.2. Variable Selection

The selection of variables and related descriptions are now shown in **Table 1**.

**Table 1.** Indicator selection instructions and data sources.

Variable type	Variable name	Variable symbols	Variable definitions
Dependent variable	Accounting surplus for the next period	$Earn_{i,t+1}$	Return on assets for year t+1, being net profit for the following period/average total assets for the following period
Independent variables	Current accounting surplus	$Earn_{i,t}$	Return on assets for year t, being net profit for the period/average total assets for the period
	Green Technology Innovation	$GT$	Fitting the three major green technology innovation indicators using the entropy method
Adjustment variable	Green Financial Development	$GF$	Fitting the five major green finance indicators using the entropy method
Control variables	Company Size	$Size$	Natural logarithm of total assets
	Company Growth	$Growth$	Increase in operating income for the year/Operating income for the previous year
	Capital Intensity	$Capint$	Total Assets/Operating Income
	Concentration of shareholding	$Top$	Percentage of shareholding of the largest shareholder
	Years	$Year$	Annual dummy variables
	Industries	$Industry$	Industry dummy variables
	Provinces	$Province$	Province dummy variables

### 3.2.1. Earnings Sustainability

Freeman et al. (1982) first used a linear first-order autoregressive model to estimate earnings sustainability, using current period earnings to forecast next period earnings, with the regression coefficients obtained by statistical methods representing earnings sustainability. After being popularised by Sloan (1996), Xie (2001) and Richardson et al. (2005), it has now become a mainstream method. Drawing on the above studies, the regression coefficient of the current period's earnings on the next period's earnings in a linear first-order autoregressive model is used to measure earnings sustainability. In which the selection of corporate earnings (Earn) is referred to Gong and Xie (2018), and the Return on Assets (ROA) is chosen to measure earnings (Earn).

### 3.2.2. Green Technology Innovation

The existing literature mostly uses the number of green patent applications (authorizations) or green process (product) innovations to measure the green technology innovation of companies. In order to cover a more comprehensive scope of enterprise green technology innovation, a comprehensive green technology innovation index (GT) was constructed from three dimensions: end-of-pipe green technology innovation, clean production green technology innovation and the number of green patents granted, referring to the method of Xi and Zhao (2022). Among them, the data of green technology innovation for end-of-pipe pollution reduction and green technology innovation for cleaner production were obtained from the environmental performance and governance disclosure table of listed companies in the CSMAR environmental database, and the value of 1 was taken if there was a description of the treatment of exhaust gas emission reduction, wastewater emission reduction, dust and smoke treatment, solid waste utilization and disposal, noise and light pollution radiation, etc., respectively, otherwise it was 0, and the scores are summed as a proxy for green technology innovation in end-of-pipe pollution reduction. If a description of the implementation of cleaner production exists in the enterprise, the value is 1, otherwise it is 0, and it is taken as a proxy for green technology innovation in cleaner production. The number of green patents granted was obtained from the green patent data of listed enterprises in the China Research Data Service Platform CNDRS. The entropy value method was used to fit the above three indicators into the green technology innovation index.

### 3.2.3. Green Financial Development

The method of constructing a comprehensive index of green finance development is used to measure the level of regional green finance development. Referring to Zhang et al. (2022) to construct a comprehensive index of green finance development (GF) from five dimensions: green credit, green securities, green insurance, green investment, and carbon finance. Among them, green credit is expressed as the proportion of interest expenditure of six energy-consuming industrial industries to total industrial interest expenditure, green securities is expressed as the proportion of market value of A shares of environmental protec-

tion industries to total market value of A shares, green insurance is expressed as the proportion of agricultural insurance income to total agricultural output, green investment is expressed as the ratio of regional investment in environmental pollution control to regional GDP, carbon finance is expressed as the ratio of regional carbon dioxide emissions to regional GDP. The entropy method was used to fit the above five indicators into a green finance development index.

### 3.2.4. Control Variables

Company size (*Size*), company growth (*Growth*), capital intensity (*Capint*), and concentration of shareholding (*Top*) were selected as control variables, and the effects of year, industry and province were also controlled.

### 3.3. Model Design

To measure earnings sustainability using a linear first-order autoregressive model, Model (1) was developed.

$$Earn_{i,t+1} = \alpha_0 + \alpha_1 Earn_{i,t} + \sum \alpha_k Control_{i,t} + \sum Year + \sum Industry + \sum Province + \varepsilon_{i,t} \quad (1)$$

To test the impact of green technology innovation on earnings sustainability in new energy companies, Model (2) was developed.

$$Earn_{i,t+1} = \alpha_0 + \alpha_1 Earn_{i,t} + \alpha_2 GT_{i,t} + \alpha_3 Earn_{i,t} \times GT_{i,t} + \sum \alpha_k Control_{i,t} + \sum Year + \sum Industry + \sum Province + \varepsilon_{i,t} \quad (2)$$

To test the impact of green financial development on the relationship between green technology innovation and earnings sustainability of new energy companies, Model (3) was developed.

$$Earn_{i,t+1} = \alpha_0 + \alpha_1 Earn_{i,t} + \alpha_2 GT_{i,t} + \alpha_3 GF_{i,t} + \alpha_4 Earn_{i,t} \times GT_{i,t} + \alpha_5 GT_{i,t} \times GF_{i,t} + \alpha_6 Earn_{i,t} \times GT_{i,t} \times GF_{i,t} + \sum \alpha_k Control_{i,t} + \sum Year + \sum Industry + \sum Province + \varepsilon_{i,t} \quad (3)$$

### 3.4. Regression Method Selection and Model Test

Using panel data, the Hausman test results show that a regression using a fixed effects model is more appropriate, so the fixed-effect panel regression method is finally selected. In order to ensure the robustness of the results, the linear correlation analysis of the main variables is first carried out and there is no variable group exceeding 0.6. Further multicollinearity tests are performed on each model. The relevant test parameters indicate that there were no serious multicollinearity problems among the variables in all models.

## 4. Empirical Analysis and Model Checking

### 4.1. Descriptive Statistics

**Table 2** presents the results of descriptive statistics for the main variables. The minimum value of current earnings  $Earn_{i,t}$  is  $-0.169$  and the maximum value is

**Table 2.** Descriptive statistics of variables.

Variables	Sample size	Mean value	Standard deviation	Minimum value	Maximum value
$Earn_{i,t+1}$	570	0.026	0.043	-0.169	0.142
$Earn_{i,t}$	570	0.027	0.046	-0.169	0.163
$GT$	570	0.150	0.197	0	0.645
$GF$	570	0.235	0.157	0.064	0.793
$Size$	570	23.020	1.674	20.340	26.810
$Growth$	570	0.124	0.268	-0.481	1.097
$Capint$	570	2.674	1.670	0.383	10.660
$Top$	570	38.920	15.550	8.915	77.320

0.163, indicating that the level of earnings of new energy listed companies in China varies widely. The mean value of green technology innovation is 0.150, which indicates that although the listed companies of new energy have certain green technology innovation ability, the overall level is not high. The standard deviation of green financial development level is 0.157, with the minimum value of 0.064 and the maximum value of 0.793, which can be found that there is a large difference in the level of green financial development among regions in China.

## 4.2. Analysis of Empirical Results

Panel A in **Table 3** shows the results of the regression of green technology innovation on earnings sustainability. In Model (1), the coefficient of current earnings is significantly positive at the 1% level ( $\alpha > 0$ ;  $p < 0.01$ ), indicating that the earnings of listed new energy companies has a persistent characteristic. In Model (2), the coefficient of the cross product of current earnings and green technology innovation ( $Earn_{i,t} \times GT$ ) is 0.829 and is significant at the 1% level ( $\alpha = 0.829$ ;  $p < 0.01$ ), indicating that green technology innovation is significantly and positively related to earnings sustainability, and green technology innovation is conducive to improving the earnings sustainability of new energy companies. Hypothesis 1 is tested. In Model (3), the coefficient of the cross product term ( $Earn_{i,t} \times GT \times GF$ ) of current earnings, green technological innovation and the level of green financial development is 5.295 and significant at the 1% level ( $\alpha = 5.295$ ;  $p < 0.01$ ), indicating that green financial development has a significant external adjustment effect, green financial development will significantly enhance the positive effect of green technological innovation on the earnings sustainability of new energy companies, and the higher the level of green financial development, the stronger the effect of green technology innovation on the earnings sustainability of new energy companies. Hypothesis 2 is tested.

## 4.3. Further Research

In order to further analyze the impact of green technology innovation on the



**Table 3.** Empirical results of green technology innovation and earnings sustainability.

	Panel A: Regression Results			Panel B: Further Research	
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
	$Earn_{i,t+1}$	$Earn_{i,t+1}$	$Earn_{i,t+1}$	$Earn_{i,t+1}$	$Earn_{i,t+1}$
$Earn_{i,t}$	0.446*** (7.101)	0.344*** (4.481)	0.329*** (4.459)		
$GT$		-0.012 (-0.850)	0.004 (0.218)		0.005 (0.372)
$Earn_{i,t} \times GT$		0.829*** (2.830)	-0.268 (-0.546)		
$GF$			0.024 (1.053)		
$GT \times GF$			-0.082* (-1.841)		
$Earn_{i,t} \times GT \times GF$			5.295*** (2.709)		
$AE_{i,t}$				0.342*** (4.750)	0.273*** (3.252)
$CE_{i,t}$				0.421*** (5.885)	0.350*** (4.058)
$AE_{i,t} \times GT$					0.639* (1.745)
$CE_{i,t} \times GT$					0.490 (1.500)
$_cons$	0.073* (1.877)	0.094** (2.405)	0.079** (2.007)	0.097** (2.469)	0.114*** (2.864)
$Controls$	Yes	Yes	Yes	Yes	Yes
$Year$	Yes	Yes	Yes	Yes	Yes
$Industry$	Yes	Yes	Yes	Yes	Yes
$Province$	Yes	Yes	Yes	Yes	Yes
$N$	570	570	570	570	570
$Adj\_R^2$	0.366	0.388	0.386	0.336	0.349

\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

sustainability of accrual surplus and cash flow surplus of new energy companies, dividing the companies surplus into two parts: accrual items and cash flow items. Models (4) and (5) were developed for testing, where  $AE$  represents accrual surplus, measured by “(net profit—net cash flow from operating activities)/average total assets”, and  $CE$  represents cash flow surplus, measured by “net cash flow

from operating activities/average total assets”, with the same control variables as above.

$$Earn_{i,t+1} = \beta_0 + \beta_1 AE_{i,t} + \beta_2 CE_{i,t} + \sum \beta_k Control_{i,t} + \sum Year + \sum Industry + \sum Province + \varepsilon_{i,t} \quad (4)$$

$$Earn_{i,t+1} = \beta_0 + \beta_1 AE_{i,t} + \beta_2 CE_{i,t} + \beta_3 GT_{i,t} + \beta_3 AE_{i,t} \times GT_{i,t} + \beta_4 CE_{i,t} \times GT_{i,t} + \sum \beta_k Control_{i,t} + \sum Year + \sum Industry + \sum Province + \varepsilon_{i,t} \quad (5)$$

Panel B in **Table 3** shows the regression results after further segmentation of surplus items. In Model (4), the coefficients of both accrual surplus and cash flow surplus are significantly positive at the 1% level ( $\beta > 0$ ;  $p < 0.01$ ), indicating that the surplus of listed new energy companies and its components have persistent characteristics. In Model (5), the coefficients of the cross product term ( $AE_{i,t} \times GT$ ) and the cross product term ( $CE_{i,t} \times GT$ ) are both positive ( $\beta > 0$ ), indicating that green technology innovation is conducive to the sustainability of accrual surplus and cash flow surplus. The coefficient of the cross multiplier between accrual surplus and green technology innovation ( $AE_{i,t} \times GT$ ) is 0.639, which is significant at the 10% level ( $\beta = 0.639$ ;  $p < 0.1$ ), while the coefficient of the cross multiplier between cash flow surplus and green technology innovation ( $CE_{i,t} \times GT$ ) is 0.490 ( $\beta = 0.490$ ;  $p > 0.1$ ), indicating that green technology innovation has a significant effect on the sustainability of accrual surplus, but not on the sustainability of cash flow surplus. This may be due to the fact that green technology innovation in new energy listed companies requires a large amount of financial support, which leads to the limited amount of funds that management can call on, reducing the possibility of management using accrued surplus management for personal gain, thus significantly enhancing the sustainability of corporate accrued surplus. At the same time, green technology innovation by enterprises requires a large amount of cash flow to be invested in green technology innovation projects, which may lead to insufficient cash flow available to enterprises, resulting in a less significant effect of green technology innovation on the sustainability of cash flow surplus.

#### 4.4. Robustness Tests

##### 4.4.1. Two-Stage Least Squares (2SLS)

In the regression analysis of the relationship between corporate green technology innovation and earnings sustainability, although some variables were controlled, key variables may still be missed and there is a two-way causal relationship between green technology innovation and earnings sustainability to some extent. In order to overcome the endogeneity problem and to ensure the reliability of the results, instrumental variables were selected for the 2SLS regression analysis. The selection of instrumental variables generally follows two conditions: 1) One is the correlation condition, the selected instrumental variables should be highly correlated with the explanatory variables and a good substitute

for the explanatory variables. 2) The second is the exogeneity condition, the selected instrumental variables should be uncorrelated with the random disturbance terms and there is no channel or mechanism for the explanatory variables to act backwards on the instrumental variables. Based on the above conditions, if the problem of endogeneity between variables exists only at the firm level, the regional-industry average of the explanatory variable in the firm's location can be selected as the instrumental variable (Fisman & Svensson, 2007). Therefore, the mean of green technology innovation in the province and industry ( $GT\_Province$ ,  $GT\_Industry$ ) in which the firm is located is selected as the instrumental variable.

The results of the two-stage least squares regression (2SLS) are shown in **Table 4**. Column (1) in **Table 4** shows the results of the first stage regression,  $GT\_Province$ ,  $GT\_Industry$  and  $GT$  are all significantly correlated at the 1% level ( $p < 0.01$ ), satisfying the correlation condition of the instrumental variables, and the results of the Wald exogeneity test are all significant at the 1% level ( $p < 0.01$ ), satisfying the exogeneity condition of the instrumental variables. This indicates that the selected instrumental variables are reasonable. Bringing the results of the first stage fit into the second stage regression, Column (2) in **Table 4** shows the results of the second stage regression. The coefficient of the interaction term ( $Earn_{i,t} \times GT$ ) is 0.864, which is significantly positive at the 5% level, indicating that green technology innovation and earnings sustainability of new

**Table 4.** Two-stage least squares (2SLS).

	(1)	(2)
	$GT$	$Earn_{i,t+1}$
$GT\_Province$	0.719*** (6.130)	
$GT\_Industry$	0.644*** (5.084)	
$Earn_{i,t}$		0.414*** (7.966)
$Earn_{i,t} \times GT$		0.864** (2.222)
$\_cons$	-0.578*** (-5.343)	0.037 (1.509)
$Controls$	Yes	Yes
$N$	570	570
Wald chi2	147.75***	331.25***
Adj_R <sup>2</sup>	0.197	0.360

\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

energy companies are significantly positively correlated, green technology innovation is conducive to improving the earnings sustainability of new energy companies. The conclusion is relatively robust.

#### 4.4.2. Proxy Variables for Earnings Sustainability

Considering that there are various proxy variables for earnings, among which return on main business assets is an important indicator of company profitability, therefore, return on main business assets (Croa) is chosen to replace return on assets (ROA) as a proxy variable for earnings, and return on main business assets is measured by “profit from main business/total assets”, and the Models (1)-(3) are regressed again. The regression results are shown in Panel A of **Table 5**. The above conclusions are relatively robust.

**Table 5.** Proxy variables for earnings sustainability and green technology innovation.

	Panel A: Replacing Earning			Panel B: Replacing Green Technology Innovation		
	Model (1)	Model (2)	Model (3)	Model (1)	Model (2)	Model (3)
	$Earn_{i,t+1}$	$Earn_{i,t+1}$	$Earn_{i,t+1}$	$Earn_{i,t+1}$	$Earn_{i,t+1}$	$Earn_{i,t+1}$
$Earn_{i,t}$	0.477*** (7.327)	0.372*** (4.751)	0.360*** (4.616)	0.446*** (7.101)	0.417*** (6.148)	0.364*** (4.344)
$GT$		-0.012 (-0.798)	0.011 (0.510)		-0.001 (-1.075)	0.018 (1.281)
$Earn_{i,t} \times GT$		0.871*** (3.150)	0.031 (0.066)		0.036** (2.019)	0.027 (0.080)
$GF$			0.040 (1.528)			0.044 (1.524)
$GT \times GF$			-0.107* (-1.839)			-0.094** (-2.522)
$Earn_{i,t} \times GT \times GF$			4.249* (1.831)			2.404* (1.880)
$_cons$	0.062 (1.460)	0.084* (1.937)	0.055 (1.279)	0.073* (1.877)	0.076* (1.959)	0.049 (1.079)
$Controls$	Yes	Yes	Yes	Yes	Yes	Yes
$Year$	Yes	Yes	Yes	Yes	Yes	Yes
$Industry$	Yes	Yes	Yes	Yes	Yes	Yes
$Province$	Yes	Yes	Yes	Yes	Yes	Yes
$N$	570	570	570	570	570	570
$Adj\_R^2$	0.393	0.417	0.412	0.366	0.370	0.360

\* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

#### 4.4.3. Proxy Variables for Green Technology Innovation

Considering there are various proxy variables for green technology innovation, among which the number of green patents granted, is an important indicator of the green technology innovation capability. So, using the natural logarithm of the number of green patents granted as a proxy variable for green technology innovation, and other control variables remain unchanged, and the Models (1)-(3) are regressed again. The regression results are shown in Panel B of **Table 5**. The above conclusions are relatively robust.

## 5. Conclusion and Recommendations

### 5.1. Research Conclusion

Taking Chinese A-share new energy listed companies from 2008 to 2020 as a sample, study the impact of green technology innovation on earnings sustainability, and the role of the development of green finance in its impact mechanism. The research conclusions are as follows:

- 1) The green technology innovation of new energy companies and earnings sustainability are significantly positively related, strengthening green technology innovation is an important way to improve the earnings sustainability of new energy companies.
- 2) The green finance development has a significant external adjustment effect, the higher the level of green finance development, the stronger the role of new energy companies' green technology innovation on earnings sustainability.
- 3) Compared with the sustainability of the cash flow surplus, the green technology innovation of new energy companies plays a more significant role in improving the sustainability of the accrued surplus.

### 5.2. Recommendations

Based on the findings of the study, relevant recommendations are put forward:

- 1) New energy companies should be fully aware that green technology innovation is not only a social responsibility that they must undertake, but also an important guarantee for the sustainability of their profits. So, companies should actively build a green innovation culture, enhance the initiative of green technology innovation, integrate and use internal and external resources to increase innovation investment, promote the transformation and application of innovation results, and seek long-term way of sustainable profitability through green development.
- 2) Green technology innovation requires a large amount of capital investment. While actively carrying out green technology innovation, new energy companies should also pay attention to the stability of their cash flow, maintain a balance between the cash flow of green technology innovation investment and the cash flow of daily operation activities, and avoid the risk of the capital chain.
- 3) Governments at all levels should enhance policy guidance for green technology innovation in new energy companies, promote policy synergy, streng-

then factor protection, create a favourable environment for green technology innovation, and actively promote green consumer upgrading to open up a broader market and create greater value space for the transformation and application of green technology innovation results in new energy companies.

4) Bringing into play the combined efforts of the “proactive government” and the “effective market”, actively building a regional green financial system, supporting financial institutions to innovate green financial products and services, and encouraging more social capital to participate in green technology innovation of new energy companies, so as to alleviate the financing constraints of new energy companies, reduce financing costs and improve the efficiency of green technology innovation.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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