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Which Subsidy Mode Improves the Financial Performance of Renewable Energy Firms? A Panel Data Analysis of Wind and Solar Energy Companies between 2009 and 2014

Huiming Zhang [1,2,*], Yu Zheng [2], Dequn Zhou [3] and Peifeng Zhu [4]

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1 China Institute of Manufacturing Development & College of Economics and Management, Nanjing University of Information Science & Technology, Nanjing 210044, China
2 College of Economics and Management, Nanjing University of Information Science&Technology, Nanjing 210044, China; ilovebzh@163.com
3 Research Centre for Soft Energy Sciences, Nanjing University of Aeronautics and Astronautics, Nanjing 211100, China; dqzhou88@163.com
4 College of Economics and Management, Nanjing University of Chinese Medicine, Nanjing 210023, China; zpf001511@126.com
* Correspondence: 002068@ nuist.edu.cn or hm.zhang_16@163.com; Tel.: +86-139-1474-1963

Abstract: The effectiveness of subsidies in improving the performance of renewable energy firms has aroused significant research attention in recent years. As subsidy modes may affect corporate financial performance,we have chosen companies specializing in wind and solar energy in the Shanghai and Shenzhen stock markets as samples.The relationships between the subsidy modes and financial performance of these two types of companies are investigated with a panel data model. Results of the total sample indicate that both indirect and non-innovative subsidy have significant effects on the financial performance of renewable energy companies. The regressive coefficient of the former,however, is a negative value, which illustrates that taxation, bonus, and other market-based mechanisms impair corporate profitability. Moreover, the influence of innovative subsidy is weak, which means that the subsidy used for research and development, technical demonstration, and other innovations of renewable energy enterprises have failed to effectively enhance corporate financial performance. In terms of sub-industries, the direct subsidy for wind energy companies has achieved a significant effect. Incomparison, the indirect subsidy and innovative subsidy acquired by solar energy companies have notably reduced corporate profitability. Thissuggests an urgent reform of subsidy policy for this industry is needed. The government should consider differences in the effects subsidies have for wind and solar energy companies when improving subsidy policy. In addition, market-based subsidy mechanisms should be perfected, and the structure of innovative subsidies should be ameliorated.

Keywords: renewable energy; subsidy mode; financial performance; panel data model

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1. Introduction

The development of renewable energy in terms of energy production and consumption has become *de rigeur* among major countries; not only does it bring about a new point of economic growth but it can also alleviate climate change and energy safety to a certain extent. The US, UK, Japan, and other developed countries have established the role of subsidy policies in providing strong support. China similarly attaches great importance to renewable energy, especially for the wind and solar energy industries. Wind energy legislation includes the following: Renewable Energy Law (2005), Opinions of the State Council on Accelerating the Equipment Manufacturing Industry (2006), Implementation Measures for the Implementing Wind Power Industry (2006), Adjustment of Import Tax Preferential Policies for Large-scale Wind Energy Electricity Generator Equipment, Key Components and Raw Materials (2008), Interim Management Measures for Special-Project Funds of Wind Power Generation Equipment Industrialization (2008), Notice on the Improvement of Feed-tariff Policies of Wind Power (2009), On the Issue of Interim Measures for Additional Electricity Price Subsidy of Renewable Energy (2012), Notice on the Value-Added Tax of Wind Power (2015). As concerns the solar energy industry, subsidy policies include the following: Interim Management Measures for Financial Subsidies of PV Building (2009), Subsidies for Golden Sun Project (2010), Announcement on the Demonstration Project Directory of Golden Sun in 2012 and Notice on the Improvement of Photovoltaic Power Price Policies (2013), Notification on the Generating Capacity Subsidy for Distributive Photovoltaic Power (2013), Notice on the Value-Added Tax of Photovoltaic Power (2013), and other stipulations.

In relation to the above, the effect of subsidy has aroused the attention of governments and academic circles. Different subsidy modes used to stimulate the development of renewable energy may have varied influences on technical innovation and production cost, which, in turn, can affect corporate financial performance. Therefore, investigating subsidy modes may actually be more important than probing the entire subsidy. For example, the feed-in tariff can reduce the cost incurred by power-generation enterprises dealing with renewable energy. The expansion brought by employment subsidy may instead result in the rise of corporate operational costs, and the technical innovation spurred by the subsidy modes of R&D andtechnology upgrading projectsmay enhance corporate competitiveness, avoid anti-subsidy trade disputes of the WTO to a certain extent, and enhance corporate financial performance. Therefore, the comprehensive effect of subsidy modes on the financial performance of renewable energy companies is complicated. Using this complexity and data availability, we select wind and solar energy companies as samples that account for a large proportion of listed companies of renewable energy, and explore the relationship between these two variables by establishing a panel data model. The main contributions of this paper are (1) to present an investigation into the relationship between subsidy modes and financial performance for the wind and solar companies and (2) to make a comparative study with a view to reforming subsidy policies.

2. Literature Review

Studies related to renewable energy subsidy can be grouped into two types: the selection and effects of subsidy modes and the influence of subsidies on corporate financial performance.

2.1. Selection and Effects of Subsidy Modes

Studies on the selection and effect of subsidy modes focus on three aspects.

(a) Selection of renewable energy subsidy modes in China with a review of international experience

Du *et al.* classified subsidies into four types: tax preference, fiscal subsidy, factor support, and preemption. Looking at the introduction of the US subsidy policies for the new energy industries and the analysis of existing flaws in Chinese policies, they proposed that China should encourage enterprises or individuals to build infrastructures for the new energy industry through either tax preference or tax reduction or exemption. In addition, China should both subsidize the individual purchases of new energy productsand incorporate a certain percentage of new energy products into governmental procurement. Finally, they maintained new energy companies could be subsidized through the addition of taxes on other traditional energy enterprises [1]. Focusing on Germany, Denmark, and some other European countries that are considered renewable energy powerhouses, Xie *et al.* analyzed their policy mechanisms and then proposed the direction Chinese reform could take regarding the types of subsidies, withaspectssuch as feed-in tariff, development foundation for renewable energy, and other financial support [2].

(b) Effect of trade disputes on the choice of subsidy mode

Disputes on international trade may affect the selection of subsidy modes, and such disputes have already aroused the attention of some scholars. For example, in their study,Xiong and Zhou pointed out that both ordinary competitive subsidy and R&D subsidy were more compliant with the WTO regulations than prohibited subsidiessuch as export subsidy or import substitution subsidy [3]; furthermore, these subsidies can avoid the trade disputes of "anti-subsidy" to a certain extent. Sun and Tang argued that a system plight exists in the subsidy of renewable energy under the WTO framework, and that China needs to reform subsidy policy to fix the problem [4]. Such reforms should include using green governmental procurement to support the industry of renewable energy, using R&D subsidy as much as possible, and changing direct subsidy into indirect subsidy. In contrast with China, as shown in the studies of Steve and Carolyn on Canadian Ontario, the feed-in tariff of Ontario was regarded as a challenge of prohibitive import substitution subsidy during the first round of debates over renewable energy at the WTO [5]. Therefore, the subsidy mode should also be improved.

(c) Effectiveness of the subsidy mode choices

Different subsidy modes indicate the varied influences of policy tools on the macro-economy, industrial or corporate production cost, technical innovation, and consumers. The results of the Grey prediction modelshow thatthe price subsidies of renewable energy in China can exert a noticeable positive influence on the macro-economy [6]. This viewpoint has also been supported by Ouyang and Lin, who pointed out that the diversion of subsidy from fossil energy to renewable energy may narrow the income gap [7].

Some scholars focused on the effect of subsidy modes on the downstream of the industry chain. For example, Lesserrevealed that the USwasbeing unreasonablypractical indirectlysubsidizing wind power generation because this subsidy mode aggravates market distortion [8]. Marco and Sánchez-Braza studied the influence of subsidy modes on solar energy [9,10]. The difference between the two lies in the fact thatthe former focused on capital subsidies whereas the latter emphasized property tax incentives.

With regards to the innovation subsidies, some findings indicate that modessuch as tax reduction or exemption [11], market and R&D support [12], and the transfer payment of investment and development [13] may exert influence on the technology of renewable energy and therefore have an indirect influence on corporate financial performance. However, as pointed out by Shen and Luo, some modes, such as the transfer payment of investment and development, may instead result in low-level technology [13]. Analysis on the effect of subsidy modes from the perspectives of production and operation cost and the supply of finished products is a key topic of current studies found in the literature.

Orvika provided evidence showing that subsidies that separate wind power incentives from markets signal dramatically increased costs [14]; an inflexible power system should focus instead on investment subsidies rather than on production subsidies or fixed prices. In encouraging the development of renewable energy, the most common policy support includes the feed-in tariff of renewable energy (FIT) and the renewable portfolio standard (RPS), as reported by Keyuraphan *et al.* [15]. In Thailand, integrating these two ways has been a feasible approach in encouraging the power production of renewable energy. While studying the effect of subsidy on power generation of renewable energy, Zhang *et al.* argued that determining a moderate subsidy limit is important in increasing the power generation capacity of wind energy [16].

Cost-effectiveness is an important method in determining the choice ofwhich subsidy mode to use. Relevant studies generally compare either electricity price subsidy to capital subsidy [17], electricity price subsidy to license market system or feed-in tariff to the three-policy mix of feed-in tariff, investment subsidy, and soft loan [18]. In all these studies, the attention is focused on the downstream of the renewable energy industry chain.

2.2. Influence of Subsidy on Corporate Financial Performance

Theoretically, viewpoints on subsidy performance may seem contradicting, as in the case of promotion *vs.* rent-seeking viewpoints. According to the former, subsidies promote R&D and the investment in enterprises which enhance corporate performance in the current period. This view, however, has gained the support of only a few scholars, such as Kong and Li [19]. Instead, more scholars have pointed out that subsidy cannot necessarily be distributed effectively because of rent-seeking behavior. A subsidy may result in slow growth of profits or the reduction of return on asset. Beason, Bergstrom, Balsar and Ucdogruk, and Lu and Huang *et al.* all validated this argument through their empirical analyses of investment subsidy, fiscal subsidy, or food and beverage manufacturing companies [20–23]. Moreover, the influence of subsidy on corporate financial performance may also be uncertain and subject to some conditions, such as the period of influence [24], political relations, and others [25,26].

Although previous studies on the subsidy issue have been worthwhile and beneficial, several shortcomings are observed:(1) Studies on the relationship between subsidy and corporate financial performance mainlyexamine agriculture or ordinary manufacturing and pay little attention to the industry of renewable energy.Afew studies consider the influence of subsidy modes on corporate financial performance; (2) The classification of subsidy modes is not yet unified. At present, some scholars classify the subsidy modes into direct and indirect, whereas others classify the subsidy modes into tax preference, fiscal subsidy, factor support and preemption, and so on. The difference in classification results in an uncertain research conclusion. Using the abovementioned analysis and the subsidy types acquired by renewable energy firms in China, we classify subsidy modes according to the two standards (*i.e.*, whether they are fiscal direct subsidies or innovative subsidies), in order to explore the relationship of subsidies to corporate financial performance.

3. Model and Hypotheses

3.1. Research Hypotheses

A subsidy is generally considered to include direct fiscal input, tax reduction, financing preference, bonus, and other aspects. On the one hand, subsidy can be classified into two modes (direct subsidy and indirect subsidy) based on whether it is a fiscal direct subsidy. Alternatively, subsidiescan be used for the different purposes of R&D, technology upgrading projects, technological application, employment, and others. Therefore, thesubsidy modes can be classified into innovative subsidies and non-innovative subsidies, whereinnovative subsidies refer to technological supply and diffusion.

Before proposing the hypotheses, we need to analyze how subsidy modes influence corporate financial performance. Direct subsidy refers to the direct appropriation of fiscal funds. Under current circumstances, which show that the market-based mechanism has not yet been fully established, direct subsidies may have a more conspicuous influence than indirect subsidies on corporate financial performance. Innovative subsidiesare used to promote corporate innovative capacity. Only innovative capacity has been promoted to a certain degree, leading to an effectiveincrease in the profitability of enterprises. Thus, theoretically speaking, an innovative subsidy given to enterprises is more likely to enhance corporate profitability than a non-innovative one. Based on the above,we put forward the following hypotheses:

- H1: A direct subsidy has asignificant positive effecton corporate financial performance under the circumstance ofimperfect market-based mechanisms.
- H2: An innovative subsidy can promote corporate profitability more conspicuously than a non-innovative subsidy.

3.2. Sample Selection and Data Source

Enterprises listed in the Shanghai and Shenzhen stock exchanges, whose main business is renewable energy, include producers of wind energy, solar energy, bio-mass energy, and hydropower. Wind and solar energy companies figure predominantly and their subsidy issues have aroused the greatest attention. Therefore, these companies have been selected as samples. Considering that subsidiaryaccounts for subsidy in corporate annual reports began in 2009, we set the research period as 2009 to 2014. After the samples with negative net profit in this period are eliminated, the numbers of companies producing wind and solar energy are 26 and 21, respectively. The source for the data used in this study is the China Stock Market and Accounting ResearchDatabase. All estimations are obtained through the econometric software Stata.

3.3. Variable Selection and Model Setup

Two panel data models are established. The explanatory variables of the first model are direct subsidy and indirect subsidy. In accounting statements, a subsidy is recorded under the headings of "governmental subsidy" and "non-operating income". A direct subsidy includes special funds for industry development, direct funds of base construction and employee financial allocation. An indirect subsidy is taken to be the sum of tax reductions or exemptions, financing preferences, bonuses, and other market-based parameters, which equal total governmental subsidies minus direct subsidies. Innovative subsidies include research and development funds, techniques for the improvement of projects, special funds for science and technology infrastructure and other technical research and application subsidies. A non-innovative subsidy, therefore, equals total subsidies minus innovative subsidies. The subsidies for land evictions, heating, increasing employment and others are considered to be non-innovative ones.

The explained variable is corporate financial performance. Among numerous corporate profitability evaluation indices, netprofit is one of the most important indices; hence, it is used as the explained variable. Corporate age, capital intensity, and percentage of the largest shareholder serve as control variables.

(1) Corporate age. Theoretically, the net profit of an enterprise increases with the number of years it has existed. An enterprise with a longer period of existence may be more capable of making profit because it has accumulated market knowledge and experience. Therefore, corporate age is a variableaffecting corporate netprofit. The years of corporateexistence are taken asa measurement for this variable.
(2) Capital intensity. Increased capital intensity represents the higher proportion of materialized labor consumption in the production costs and the lower proportion of direct labor consumption. This function shows greater capital investment per unit labor than usualand enhances corporate profitability. Capital intensity is valued as the ratio of fixed assets to total employees.
(3) Percentage of the largest shareholder. The percentage of the largest shareholder reflects the distribution of control rights to a certain extent and determines the agency management between ownership and managerial authority. The relationship between the percentage of the largest shareholder and corporate financial performance is uncertain. A viewpoint shows that a positive relationship exists between the two variables because the governing power of the largest shareholder grows with his or her shareholding, thereby reducing the opportunist tendency of managers and promoting corporate value and profitability. An opposite viewpoint holds that the largest shareholder has the largest number of shares, which may enable him or her to infringe upon the interest of small and medium shareholders and the overall corporate interest. Based on the abovementioned analysis, the panel model is established and expressed as

$$\mathrm{L}n\,(\mathrm{Pro}fit_{it}) = \beta_0 + \beta_1 Ln\,(Dsub_{\mathrm{it}}) + \beta_2 Ln\,(NDsub_{\mathrm{it}}) + \lambda_1 Ln\,(Age_{\mathrm{it}}) + \lambda_2 Ln\,(\mathrm{T}op_{\mathrm{it}}) + \lambda_3 Ln\,(Cpl_{it}) + \varepsilon_{it} \quad (1)$$

where $Profit_{it}$, $Dsub_{it}$, $NDsub_{it}$, Age_{it}, Top_{it}, and Cpl_{it} denote corporate netprofit, direct subsidy, indirect subsidy, corporate age, capital intensity and percentage of the largest shareholder, respectively.

The second model is the panel model of innovative subsidy and non-innovative subsidy, which is expressed as

$$Ln\,(Profit_{it}) = \beta_0 + \beta_1 Ln\,(Isub_{it}) + \beta_2 Ln\,(NIsub_{it}) + \lambda_1 Ln\,(Age_{it}) + \lambda_2 Ln\,(Top_{it}) + \lambda_3 Ln\,(Cpl_{it}) + \varepsilon_{it} \quad (2)$$

where $Isub_{it}$ and $NIsub_{it}$ denote innovative subsidy and non-innovative subsidy, respectively. The symbols and definitions are shown in Table 1.

Table 1. Variable symbol and definition.

Variable Classification	Variable Symbol	Variable Measurement
Dependent variable	Profit	The net profits
Explanatory variables	Dsub	The direct fiscal appropriation
	NDsub	The sum of market-oriented subsidies
	Isub	The sum of technology supply and diffusion subsidies
	NIsub	The value of total subsidies minus the innovative ones
Control variables	Age	The number of years enterprise has existed
	Top	The proportion of the largest shareholder in total shares
	Cpl	The ratio of fixed assets to total employees

4. EmpiricalResults

4.1. Descriptive Statistical Analysis

Descriptive statistical analysis is presented in Tables 2 and 3. As shown in Figure 1, the netprofit of wind energy companies from 2009 to 2014 was higher than that of solar energy companiesas a whole. The average of the netprofit of windenergy companies declined for two consecutive years from 2009 to 2011 and began to rebound in 2012. The rebound is probably caused by the enacting of incentivepolicies such as the Twelfth Five-year Plan for Wind Power Technology and Twelfth Five-year Plan for Renewable Energy.The average of the netprofit of solar energy companies assumed a fluctuating trend from 2009 to 2012 and then gained 299.287 million yuan in 2009. Thereafter, the net profit increased to 584.069 million yuan in 2010, followed bya rebound in 2013 after a transient declining trend. Between 2009 and 2012, the solar industry experienced overcapacity and reorganized itself. Some firms subsequently shut down and quit the market, which led to an increase in earnings of other firmsin 2013.

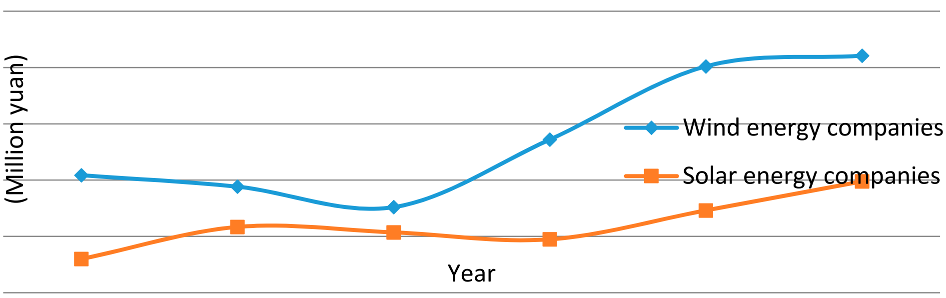

Figure 1. Net profits of renewable energy companies between 2009 and 2014.

Table 2. The descriptive statistics (wind companies).

Variables	Year	2009	2010	2011	2012	2013	2014
Profit (million yuan)	Mean	1043.764	941.696	759.642	1359.855	2010.718	2105.544
	Min	6.025	30.532	5.818	7.144	7.279	15.911
	Max	5393.144	3739.722	4498.217	6852.454	12,900.02	13,562.37
Dsub (million yuan)	Mean	42.408	59.390	88.061	65.223	60.787	87.084
	Min	0	0	0.337	0	0	0
	Max	457.45	529.607	929.816	472.900	545.191	763.328
NDsub (million yuan)	Mean	30.249	27.050	26.936	31.734	19.763	106.936
	Min	0	0	0	0	0	0
	Max	191.543	192.718	208.888	311.754	138.789	1015.659
Isub (million yuan)	Mean	8.982	16.013	29.386	16.615	13.439	16.804
	Min	0	0	0	0	0	0
	Max	86.25	98.951	477.987	68.687	61.804	86.400
NIsub (million yuan)	Mean	63.674	70.427	85.611	80.333	67.144	142.065
	Min	0	0	0.025	0.030	0	0.100
	Max	459.627	545.472	660.384	552.669	556.818	834.92
Age (years)	Mean	12.231	13.231	14.231	15.231	16.231	17.231
	Min	1	2	3	4	5	6
	Max	21	22	23	24	25	26
Top (%)	Mean	41.519	40.210	38.978	40.796	38.802	38.261
	Min	18.270	8.910	8.980	8.980	8.98	8.98
	Max	70.540	70.540	66.39	73.670	67.39	67.39
Cpl (million yuan/per capita)	Mean	6.698	6.375	2.770	3.409	2.966	2.913
	Min	0.068	0.078	0.088	0.099	0.116	0.127
	Max	98.708	109.410	18.978	27.250	14.504	16.561

Table 3. The descriptive statistics(solar companies).

Variables	Year	2009	2010	2011	2012	2013	2014
Profit (million yuan)	Mean	299.286	584.069	535.731	473.818	731.002	988.946
	Min	2.710	31.720	0.230	5.320	0.670	0
	Max	1579.310	3868.160	3282	3252.260	4280.990	8119.020
Dsub (million yuan)	Mean	27.828	31.918	52.080	44.918	48.152	84.458
	Min	0	1.350	2.170	2.520	2.320	0.860
	Max	219.850	155.340	380.770	189.700	226.410	418.230
NDsub (million yuan)	Mean	5.446	6.312	5.020	6.462	10.650	9.159
	Min	0	0	0	0	0	0
	Max	50.000	52.780	19.400	24.220	54.880	66.039
Isub (million yuan)	Mean	1.140	1.905	1.458	5.142	4.724	10.212
	Min	0	0	0	0	0	0
	Max	8.940	14.787	5.980	56.000	52.030	70.890
NIsub (million yuan)	Mean	32.134	34.918	55.642	47.244	54.078	83.406
	Min	1.160	1.350	1.220	0.640	3.710	1.34
	Max	219.850	155.340	381.660	199.700	220.260	440.320
Age (years)	Mean	14.524	15.524	16.524	17.524	18.524	19.524
	Min	2	3	4	5	6	7
	Max	39	40	41	42	43	44
Top (%)	Mean	57.004	54.270	52.859	51.933	52.948	37.919
	Min	32.71	21.97	14.82	15.670	14.790	3.620
	Max	76	76	74	77	74	57.350
Cpl (million yuan/per capita)	Mean	1.463	1.827	1.696	1.624	1.622	2.510
	Min	0.150	0.010	0.080	0.050	0.060	0.080
	Max	10.340	14.230	13.280	9.830	9.020	19.400

Figures 2 and 3 present the characteristics of subsidy modes for the two types of companies. Both the direct and non-innovative subsidies of windand solar energy companies from 2009 to 2014 were obviously higher than their indirect and innovative subsidies. Innovative subsidieshad the lowest showing of the four subsidy modes at 16.804 million yuan in 2014. This figure is significantly lower than the 142.065 million yuan for non-innovative subsidized companies, the 87.084 million yuanof direct subsidies, and the 71.779 million yuan for indirect subsidized companies in the same year.

Forsub-industries, wind energy companies are higher than solar energy enterprises. The direct subsidy and non-innovative subsidy of solar energy companies have similar trends, and these two types of subsidies are significantly higher thanthe direct and innovative subsidies. All four types of subsidies for wind energy companies went through a fluctuant trend from 2009 to 2013 and rebounded in 2014. The accruement of innovative subsidy was relatively small, from 13.438 million yuan to 16.804 million yuan, whereas the three other types of subsidies increased dramatically. Similarly, the four types of subsidies for solar energy companies fluctuated from 2009 to 2013, and indirect subsidy declined slightly in 2013 from 10.65 million yuan to 9.16 million yuan, whereas direct, innovative, and non-innovative subsidies increased considerably.

Obviously, Figures 1–3 provide evidence showing that the financial performance of renewable energy companies improved markedly in the lasttwo years. Of the various types of subsidies, indirect subsidies and innovative subsidies account for a relatively small share of the total subsidy. From 2009 to 2013, the various subsidiesfor these two types of companies fluctuated, but in 2014, all three types of subsidies increased considerably.

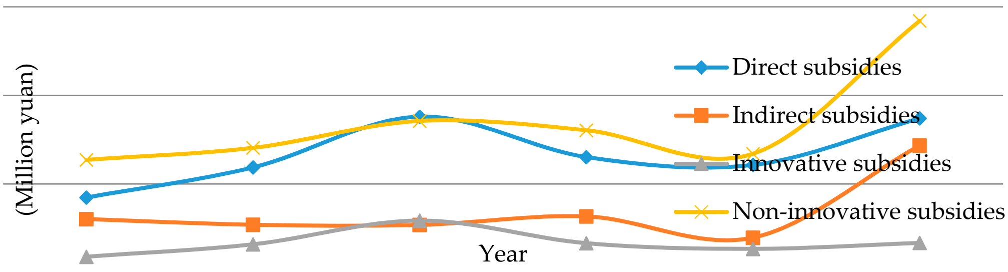

Figure 2. Subsidy modes for wind energy companies between 2009 and 2014.

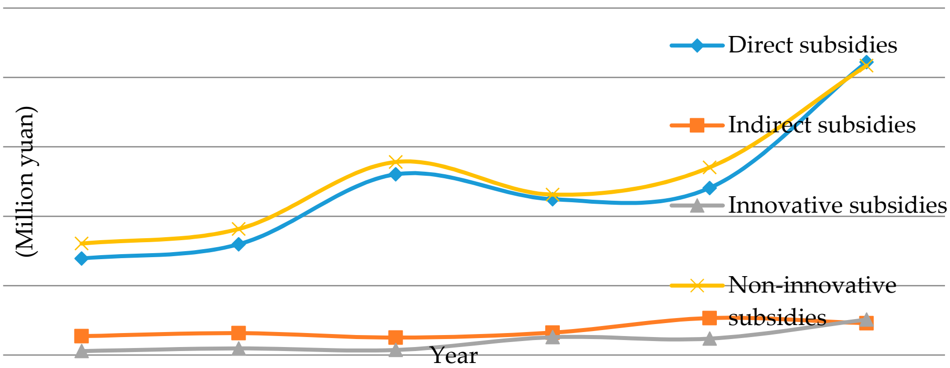

Figure 3. Subsidy modes for solar energy companies between 2009 and 2014.

4.2. The RegressionAnalysis of Total Samples

A correlation test must be conducted before empirical analysis is undertaken. If correlation coefficients are both less than 0.5, various explanatory variables and control variables are weakly correlated. The absolute values of correlation coefficients have a maximum value of 0.3230 and a minimum value of 0.0140; so, as both are less than 0.5, weak correlation is evident.

First, the estimation result for the entire sample is presented (see Table 4). The Hausman test value of 0.0000 shows thatthe fixed effect model is selected for both Formulas (1) and (2). Looking at the explanatory variables, the influence of direct subsidy on corporate financial performance is insignificant, but indirect subsidy mode and corporate net profit are negatively correlated at the 10% significance level. When the indirect subsidy increases by 1%, corporate net profit decreases to 0.0227%. Obviously, the direct subsidy fails to significantly improve the profitability of renewable energy companies. A higher indirect subsidy characterized by taxes and incentives may actually impair corporate financial subsidies, indicating that Chinese market-based subsidy mechanisms need to be urgently improved. With regards to research hypothesis H2, the innovative subsidies of both the current period and the two lag periods do not significantly influence the financial performance of renewable energy companies, whereas the non-innovative subsidies of the two lag periods obviously enhance corporate financial performance. This finding impliesthat there is a time-lag in the functioning of non-innovative subsidies. When non-innovative subsidy increases by 1%, corporate net profit also increases by 0.0737%. Of the control variables, corporate history, largest shareholder, and capital intensity insignificantly influence corporate financial performance.

Table 4. Estimation results of total samples.

Direct and Indirect Subsidy Modes			Innovativeand Non-Innovative Subsidy Modes		
Explanatory	**Fixed Effects**	**Random Effects**	**Explanatory**	**Fixed Effects**	**Random Effects**
Cons	17.3028 *** (9.76)	17.1614 *** (13.48)	Cons	17.6254 *** (7.75)	17.2036 *** (11.25)
Age	0.0784 (1.45)	0.0055 (0.27)	Age	0.1088 (1.10)	−0.0006 (−0.02)
Top	0.0586 (0.16)	−0.1266 (−0.47)	Top	−0.1658 (−0.39)	−0.1724 (−0.56)
Cpl	0.0701 (1.42)	0.1307 ** (2.72)	Cpl	0.0360 (0.64)	0.0979 * (1.89)
Dsub	0.0298 (1.14)	0.0583 ** (2.28)	$Isub_{-2}$	−0.0263 (−1.42)	−0.0093 (−0.57)
NDsub	−0.0227 * (−1.69)	−0.0101(−0.75)	$NIsub_{-2}$	0. 0737 * (2.13)	0.0973 ** (2.92)
Hausman value	0.0000		Hausman value	0.0000	

Note: the figures in brackets are *T* test results; *, ** and *** represent 10%, 5% and 1% significance level. $Isub_{-2}$ and $NIsub_{-2}$ are innovative and non-innovative subsidy lagging for two periods, respectively.

4.3. Regressive Analysis of Sub-Industries

The estimation results of sub-industries are compared. With regards to the direct subsidy and indirect subsidy effects of wind energy companies, the Hausman test value is 0.5797. The original hypothesis should not be rejected, and the random effect should be selected. In contrast to the regressionresults of the entire sample, among the explainable variables, the influence of direct subsidy on corporate financial performance is significant at the 10% significance level;this coincides with H1. When direct subsidy increases by 1%, corporate net profit also increases by 0.0460%. Indirect subsidy has a weak influence. Of the various control variables, capital intensity has a greater effect on corporate financial performance, with a 1% significance level. Looking at innovative and non-innovative subsidy modes, the Hausman test value is 0.0000, and the fixed effect model is adopted. As indicated by Table 5, both types of subsidies do not significantly influence corporate financial performance. Promoting corporate innovative capacity, the subsidies for R&D, technological demonstration, old project renovation, and other recipients fails to achieve the expected effect. Hence, the technological innovative capacity of wind energy companies needs to be promoted.

The empirical result of solar energy companies is different from that of wind energyfirms. The finding can be inferred from the Hausman test value in Table 6, where both Formulas (1) and (2) select the fixed effect model. Direct subsidies acquired by solar energy companies fail to enhance their financial performance,unlike the results achieved by wind energy companies.Furthermore, a weak negative correlation exists between these two variables, rejecting H1. Indirect subsidies remarkably impair corporate profitability, and the regressive coefficient −0.0474% passes the 5% significance level test. Corporate history, largest shareholder, and other control variables all have a weak influence on corporate netprofit. The innovative subsidies granted to solar energy companies actually reduced corporate netprofit, thus rejecting H2. When innovative subsidies increase by 1%, corporate net profit declines by −0.0484%, but the negative effect of innovative subsidy lags for two periods. Empirical tests of the current period and the one-lag period demonstrate that innovative subsidies do not have a significant influence on corporate performance. According to the sub-industry findings, solar energy companies need subsidy policy reform more urgently than wind energy companies because the regressive coefficients of indirect and innovative subsidies of solar energy companies reject the hypotheses.

Table 5. Estimation results of sub-industry(wind energy companies).

Direct and Indirect Subsidy Modes			**Innovativeand Non-Innovative Subsidy Modes**		
Explanatory	**Fixed Effects**	**Random Effects**	**Explanatory**	**Fixed Effects**	**Random Effects**
Cons	10.9574 *** (4.29)	9.7463 *** (6.16)	Cons	10.9475 *** (4.27)	9.7827 *** (6.21)
Age	0.2435 (0.59)	0.2184 (0.69)	Age	0.3303 (0.82)	0.3157 (1.03)
Top	1.0016 * (1.67)	0.5581 (1.51)	Top	1.0129 * (1.69)	0.5112 (1.39)
Cpl	0.2774 ** (2.53)	0.4573 *** (5.12)	Cpl	0.2992 ** (2.71)	0.4811 *** (5.34)
Dsub	0.0293 (1.22)	0.0460 * (1.96)	Isub	−0.01950 (−1.15)	−0.0069 (−0.40)
NDsub	0.0111 (0.59)	0.0177 (0.94)	NIsub	0.0205 (0.76)	0.0386 (1.47)
Hausman value	0.5797		Hausman value	0.0000	

Note: the figures in brackets are *T* test results; *, ** and *** represent 10%, 5% and 1% significance level.

Table 6. Estimation results of sub-industry (solar energy companies).

Direct and Indirect Subsidy Modes			**Innovativeand Non-Innovative Subsidy Modes**		
Explanatory	**Fixed Effects**	**Random Effects**	**Explanatory**	**Fixed Effects**	**Random Effects**
Cons	19.76339 *** (7.01)	20.07996 *** (8.70)	Cons	17.0767 *** (4.77)	17.1926 *** (6.19)
Age	0.0705 (1.07)	0.0288 (0.91)	Age	0.1502 (1.39)	0.0564 (1.58)
Top	−0.2355 (−0.49)	−0.4942 (−1.24)	Top	−0.2702 (−0.55)	−0.5373 (−1.36)
Capital	0.0171697 (0.29)	0.0283 (0.48)	Capital	0.0132 (0.22)	0.0003 (0.01)
Dsub	−0.0400 (−0.63)	0.0250 (0.41)	$Isub_{-2}$	−0.0484 ** (−2.16)	−0.0524 ** (−2.55)
NDsub	−0.0474 ** (−2.47)	−0.0361 * (−1.95)	N $Isub_{-2}$	0.0362 (0.33)	0.1996 * (1.92)
Hausman value	0.0011		Hausman value	0.0036	

Note: the figures in brackets are *T* test results; *, ** and *** represent 10%, 5% and 1% significance level. $Isub_{-2}$ and $NIsub_{-2}$ are innovative and non-innovative subsidy lagging for two periods, respectively.

The reasons for the weak or negative impact of indirect and innovative subsidies on the financial performance of both types of companies include information asymmetry, less detailed subsidy standards and unreasonable innovative subsidy structure. The information asymmetry in the subsidizing process implies that senior managers probably seek unjustified rents, thus resulting in the abuse of subsidies. With regard to the allocation of indirect subsidies, there is a lack of detailed standards relating to grants, such as technological level, corporate scale and financial performance evaluation. Innovative subsidy can be subdivided into two subsidy modes, namely technological supply and diffusion. The unreasonable innovative subsidy structure illustrates that China attaches more importance to technological supply subsidies than technological diffusion ones. Furthermore, for technological diffusion subsidies, feed-in tariffs fail to stimulate renewable energy companies because of grid connection, power priority purchase and cross-regional transmission.Thus, unreasonable innovative subsidy structures can improve neither innovation capability nor application of renewable energy companies notably.

In addition to information asymmetry and subsidy methods, excessive subsidies in periods of weak domestic market demand enhance overcapacity risks, thus reducing profitability of renewable energy companies.

4.4. Robust Test

To validate the reliability of the empirical analysis result, we employ different measurements of corporate financial performance and capital intensity for a re-test. Based on the replacement of net profit with the proportion of net profit to main business income, results illustrate that the regressive coefficient of direct subsidy for the wind energy companies is 0.0295, passing the 10% significance level test.Similar tothe former studies, indirect subsidy showsaweak impact, and the p-value is 0.449. As for solar companies, both the indirect and innovative subsidies reduce the profitability notably, and the regressive coefficients are -0.0463 and -0.0363, respectively.

Based on the substitutionof the ratio of inventory to total assets for capital intensity, the results are the same as those obtained previously. Therefore, the result of variable inspection is robust.

5. Conclusions

This study employs the panel model to examine the correlation between subsidy modes andfinancial performanceforrenewable energy companies. Indirect subsidy and non-innovative subsidy obviously have a significant influence on the financial performance of the entire sample. However, because the coefficient of the former subsidy is a negative value, tax, bonus, and other market-based mechanisms impair corporate profitability, failing to achieve the government-desired goals. The result of the re-test shows that direct and innovative subsidies are inconsistent with H1 and H2. In terms of sub-industries, the subsidy effect of wind energy companies is slightly better than that of solar energy companies. The direct subsidy for wind energy companies achieves a considerable effect, thus supporting H1. By comparison, indirect, innovative, and non-innovative subsidies all have non-significant effects. Both indirect and innovative subsidies acquired by solar energy companies remarkably reduce corporate profitability, indicating that the subsidy policy of this industry sector needs to be discussed again. The policy implications are statedbelow.

(1) Perfecting market-based subsidy mechanisms such as tax, bonus, *etc*. Tax, bonus, and other subsidy mechanisms granted to renewable energy companies must be detailed according to set standards, such as scale, technological level, and financial performance of renewable energy companies; this strengthens the auditing process prior to the granting of subsidies and increases supervision of the use of subsidies. The enforcement of market-based subsidy mechanisms is more likely to be effective when guaranteed by institutions.Moreover, a reward and punishment system should be established by which the indirect subsidy amount and the type of next year's subsidy will be determined by the previous year'sperformance. For energy companies that perform better, more funds can be granted; for companies with lower performance after subsidies, subsidies should be reduced or even eliminated.

(2) Increasing the subsidies for technological diffusion.As indicated by previous analysis, technological supply and diffusionsubsidiesare two types of innovative subsidy. The former mainly refers to subsidizing technological R&D, whereas the latter emphasizes technological promotion and demonstration. As revealed by the analysis of annual corporate reports, the R&D subsidies of renewable energy companies account for a considerate percentage, whereas the subsidies used for technological diffusion are insufficient.This weakens the transformation of technological achievements to a certain extent. Therefore, the government should increase the percentage of innovative subsidies such as technique improvement projects, government rewards for demonstration projects and project soft loans allotted for technological diffusion while reinforcing the audit and supervision of subsidies.

(3) Subsidy policies should be reformed to vary from wind energy companies to solar ones. Compared with the policies for wind energy companies, the subsidy policies for solar energy companiesrequiremore urgent improvements.Direct, indirect and innovative subsidies for these types of companies all need reformation. In contrast to direct subsidies, the latter two forms of subsidy should be of particular concern because of their notable negative impact on corporate financial performance.

While perfecting the mechanism of indirect and innovative subsidies for wind energy companies, we can continue to increase the amount of direct subsidies in a way that does not conflict with current WTO trade disputes.

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