

EVALUATION OF FISCAL POLICY EFFECT OF CHINA'S PHOTOVOLTAIC INDUSTRY

Gang AN¹ and Hang WANG^{2*}

¹*School of Economics and Management, Wuhan University, Wuhan, 430072 China*

²*The Centre of Finance Research, Wuhan University, Wuhan, 430072 China*

**E-mail: 34604169@qq.com*

ABSTRACT

To explore the role of fiscal policies in promoting the development of photovoltaic industry, the effects of financial subsidies on the development of China's photovoltaic industry were analyzed by using the micro data of listed companies. The empirical analysis results in this study indicate that the fiscal policies represented by financial subsidies play a remarkable positive impetus function and financial subsidies are positively correlated with the operating performance of Photovoltaic enterprises. With larger the asset size and higher the Research and Development (R&D) investments, the operating performance of Photovoltaic enterprises is the better. Based on the above results, this study puts forward some policy suggestions on optimizing fiscal policy tools and further promoting the development of photovoltaic industry.

Keywords: photovoltaic industry, fiscal policy, evaluation

1. INTRODUCTION

With the global energy shortage and environmental pollution becoming increasingly serious, the importance of clean energy is becoming increasingly prominent. China has a large population and huge energy demand. How to solve the contradiction between increasing energy demand and environmental carrying capacity is extremely urgent. Traditional energy sources are usually non-renewable, often accompanied by severe environmental pollution.

The new energy industry in the context of low-carbon economic development has been given the responsibility of seizing the strategic high ground of the future, and it has also promoted economic transformation and upgrading and promoted economic and social sustainable development.

1.1. Major Features

China has abundant solar energy resources in natural conditions. In the long run, if China can widely use solar photovoltaic power generation technology, the pressure on energy supply and demand encountered by domestic economic development will be greatly eased.

However, development of China's photovoltaic industry has not been smooth sailing. It was initially regarded as a sunrise industry and has been tilted by national policies. Later, it has been vigorously developed as a pillar industry throughout the country, with the consequent lack of overall planning and blind investment. There is a serious overcapacity. At the same time, with the global economic downturn, trade protectionism, and European and American double-reverse investigations, the global PV market demand growth slows, product export resistance increases, photovoltaic power plant financing becomes more difficult, and power station construction is suspended. The industry entered an adjustment period.

As an emerging strategic industry, the photovoltaic industry has a strong positive externality: on the one hand, the development of photovoltaic industry and technological innovation can drive the development of other related industries; on the other hand,

the use of renewable energy such as solar energy as a substitute for traditional energy is beneficial to Energy saving, pollution prevention and control. From the perspective of domestic and international practice, many countries have vigorously supported the development of the photovoltaic industry by implementing tilting policies such as on-grid tariffs, financial subsidies and credit concessions for photovoltaic power generation, and promoted the development of the photovoltaic industry. The photovoltaic industry is one of the emerging strategic industries. It is an industry supported by the government using macro-control measures. How to optimize fiscal policy tools to achieve government intervention in the economy and solve market failure has become an urgent problem to be solved. To this end, it is necessary to analyze and evaluate the effectiveness of China's current fiscal policy to promote the development of the photovoltaic industry, and provide reference for optimizing the design of fiscal policy.

Many scholars at home and abroad have carried out in-depth research on the development and the existing dilemma of photovoltaic industry, and analyzed the problems and challenges encountered in the development of photovoltaic industry in China and foreign countries. Lawrence pointed out that the key to the development of photovoltaic industry lies in technology research and development. The improvement in the cost of applying products and the reduction of the cost of applied products, the country should pay more attention to the development of the international market [1]. Dusoncher and Telaretti targeted the photovoltaic industry in various countries in Eastern Europe, and the results show that in some cases, the macro industrial policy does not generate positive incentives. Due to different national conditions, the same policies have achieved different effects in different countries. When formulating policies to support the development of the photovoltaic industry, we must pay attention to local conditions [2]. China's PV industry development faces difficulties in grid connection, subsidy misplacement, and the incentive mechanism, which has affected China's PV industry policy development [3]. Feiyang and Fansheng analyzed the stock performance of listed companies in mainland China before and after the introduction of policies to test the effectiveness of supportive policies. The research shows that different policy effects have different effects [4].

Many scholars have studied the effectiveness of fiscal and taxation policies in promoting the development of emerging industries. However, due to differences in research methods, variable settings, and data types, the research conclusions are different. Candelise et al. pointed out the shortcomings of the current fiscal and taxation policies in the UK, and proposed some practicable policy instruments, such as "incoming tariffs" and "target cost reduction", and further analyzed these policies. The impact of tools on the development of the UK PV market [5]. For different types of ownership companies, finance stickers and tax incentives encourage innovation has differences [6]. Guangqiang et al. studied the different effects of financial subsidies and tax incentives based on the perspective of industrial development. The results show that tax incentives are more effective in inspiring corporate technological innovation than financial subsidies [7].

Based on the existing research literature, this study uses the data of listed companies in China's photovoltaic industry to construct a quantitative regression model to analyze the impact of financial subsidies on the operating performance of listed companies in the photovoltaic industry, and then study the incentive effect of fiscal policy to explore whether fiscal policy starts.

2. THE CURRENT STATUS OF CHINA'S PHOTOVOLTAIC INDUSTRY FISCAL POLICY

At various stages of the development of China's photovoltaic industry, the government has used fiscal policy means to achieve the objectives of industrial policy, and has shown different characteristics as the development of the industry changes. Before 2005, the relevant policies of China's photovoltaic industry were mainly reflected in the "Power Transmission to the Countryside" project implemented by the former National Planning Commission. The goal was to use the abundant solar energy, wind energy, water energy and other renewable energy sources in the remote areas of the western region to solve the production of the local population with electricity problems in life. The promulgation of the "Renewable Energy Law of the People's Republic of China" provided a legal framework for the promotion and utilization of renewable energy such as solar energy. Since then, the state has successively issued a series of supporting policies, especially after

2009, the relevant ministries and commissions have intensively introduced Targeted policy documents to promote the development of the photovoltaic industry, aimed at promoting the use of voltaic power generation technology and the health and sustainable development of the industry.

In order to promote the development of the new energy industry, China has formulated a variety of policies to support the development of the photovoltaic industry after entering the new century. The “Renewable Energy Law of the People’s Republic of China” was officially implemented in January 2006. This law is in resource survey and development planning, industrial guidance and technical support, promotion and application, price management and cost sharing, economic incentives and supervision measures, and legal responsibility. Provisions have been made in other areas, opening the beginning of China’s support for the development of new energy. Subsequently, in the aspects of on-grid tariffs, fund disbursement, power station construction, tax incentives, etc., the state has successively issued relevant policies, which provided a good guiding role for the domestic PV industry. However, with changes in the global PV product market, the upstream and downstream development imbalance of the domestic PV industry chain has become increasingly significant. The relevant departments of China have adjusted their fiscal and taxation policies in order to develop the healthy and orderly development of the domestic PV industry.

After the promulgation and implementation of the “Renewable Energy Law of the People’s Republic of China”, the Ministry of Finance and other relevant departments successively issued the “Solar Roof Plan” and “Golden Sun Demonstration Project” to carry out the initial installation of grid-connected power generation in photovoltaic building applications and photovoltaic power generation demonstration projects. Subsidy, in 2011, the National Development and Reform Commission issued the “Notice on Improving the On-grid Price Policy for Solar Photovoltaic Power Generation”, formulated a national unified solar photovoltaic power generation benchmark on-grid price, and approved a unified verification standard for the on-grid price of solar photovoltaic power generation projects. “Distribution Measures for Distributed Photovoltaic Power Generation Projects” issued by the Ministry of Finance has made relevant provision on subsidy project confirmation, subsidy stan-

dards, subsidized electricity and fund disbursement. Since then, the Ministry of Finance has issued documents on the financial subsidies for the Golden Sun demonstration project in the pre-allocated areas and the government fund for the self-generated electricity for distributed generation.

In terms of taxation policies of the photovoltaic industry, the state has also introduced relevant tax incentives to support the development of the photovoltaic industry, mainly involving value-added tax, corporate income tax, and resource tax. In 2013, the Ministry of Finance issued “Notice on the Value-added Tax Policy for Photovoltaic Power Generation”, which stipulates that the implementation of VAT on the sale of self-produced photovoltaic products will be refunded. The income tax preferential policy is mainly the “three exemptions and three reductions” policy, that is, the conditions for new solar power projects approved by the government investment department, exempt from the first to third year from the year when the project obtains the first production and operation income. Income tax, half of the fourth to sixth year of corporate income tax. China began to levy a resource tax with various taxable natural resources as the object of taxation, and reformed the oil and natural gas resource tax. Starting from Xinjiang, the pilot will change from the quantitative levy to the ad valorem, and the reform will be extended to Provinces.

It must be acknowledged that in recent years, the state has successively issued a series of policies and measures to promote the development of the photovoltaic industry, giving strong support to the development of the photovoltaic industry in terms of industrial positioning and layout, photovoltaic grid-connected power generation pricing, tax reduction and other aspects, and more emphasis on domestic. The development of the market and the digesting of production capacity have injected “incentives” into the market for revitalizing photovoltaic products. However, the ultimate goal of this series of fiscal policy measures should be that the photovoltaic industry itself continues to develop healthily, free from dependence on fiscal and taxation policies, and adapt to market competition.

3. METHODOLOGY

From the existing literature, when analyzing the incentive effect of fiscal policy on the development of the industry, many scholars at home and abroad

Table 1. The Definition of Related Variables

Variable type	Variable name	Variable symbol	Variable meaning
Interpreted variable	Enterprise annual total income	ZSR	Annual operating income + non-operating income
Explanatory variable	Financial subsidy	CZBT	Government subsidy income received by enterprises
Control variable	Total assets	ZZC	(total assets at the beginning of the period + total assets at the end of the period)/2
Control variable	Total operating cost	ZCB	Annual total operating cost
Control variable	R&D spending	YFZC	Annual R&D expenditure

mainly rely on the theory of public finance and the theory of industrial development. Among them, according to the theory of public finance, fiscal policy mainly plays a role in correcting market failures and realizing the role of effective allocation of resources, and from the perspective of industrial development theory, the role of fiscal policy is mainly to give preferential treatment to specific industries during the germination and growth of industrial development. In order to study the incentive effect of fiscal policy on the development of photovoltaic industry, this paper intends to select the micro-data of listed companies in the photovoltaic industry to conduct empirical research on the incentive effect of financial subsidies. As the photovoltaic industry includes different links in the upper, middle and lower reaches, in order to facilitate analysis and comparison, the analysis objects selected in this paper are all downstream power generation enterprises in the photovoltaic industry. Based on the data of the listed companies of the downstream photovoltaic power generation enterprises in 2012–2015, the panel data model is constructed. To study the impact of financial subsidies on corporate development, the sample data comes from Guotaian database, Sina Finance News, Juchao Information Network and the annual reports of listed companies.

Based on the above analysis, the panel data model constructed in this paper has the following variables:

Interpreted variable: enterprise Annual Total Income (ZSR), this paper mainly studies the incentive effect of fiscal policy on PV enterprises, and the core indicator to measure business performance is the income level of enterprises, which reflects the competitiveness and sustainability of enterprises and markets. Operating capacity is an important in-

dicator that comprehensively reflects the business performance of the company. The total annual income of the enterprise in this paper is the sum of operating income and non-operating income.

Explanatory variables: financial subsidies (CZBT), financial subsidies are the core independent variables in the empirical study of this paper, reflecting the increased income of enterprises due to financial subsidies. According to the detailed data disclosed in the financial statements of the sample enterprises, the financial subsidies obtained by the enterprises are mainly reflected in the government subsidy subjects under the income statement of the income statement, and the financial subsidy details obtained by some enterprises are listed in the notes to the financial statements. Government grants listed in the company's financial statements and notes.

Control variables: total assets (ZZC), total operating costs (ZCB), research and development expenditures (YFZC) and other variables that affect the total income of enterprises. The control variables mainly include factors other than the core explanatory variables that affect the explanatory variables. The total assets refer to the stock of assets owned by the enterprise [8]. It is the material basis for ensuring normal business activities and the necessary condition for the sustainable operation of the enterprise; the total cost reflects the enterprise. The sum of production materials and labor costs consumed by production and operation activities, the level of enterprise control costs directly affects the business performance of the enterprise; R&D expenditure refers to the funds invested by the enterprise in research and development in the same year, representing the long-term development strategy and investment tendency of the enterprise, re-

Table 2. Panel Data Regression Results (Fixed Effect Model)

	1	2	3
Fiscal subsidy	0.034***	0.027***	0.023***
	(12.55)	(9.54)	(6.69)
Total assets	0.421***	0.326***	0.306*
	(14.30)	(4.68)	(1.79)
Operating cost		0.683***	0.617***
		(9.31)	(8.43)
R&D spending			0.295*
			(1.73)
R ²	0.5096	0.5383	0.5475

Note: The values in brackets are *t* values, and ***, ** and * are significant at 1 %, 5 % and 10 % levels respectively.

flecting the development capability and Growth potential. The definition of related variables is illustrated in Table 1.

On this basis, the paper constructs the panel data regression model as follows:

$$ZSR_{it} = \alpha_{it} + CZB_{it} + ZZC_{it} + ZCB_{it} + YFZC_{it} + \varepsilon_{it} \tag{1}$$

4. RESULTS ANALYSIS

Since this paper conducts the empirical analysis based on panel data from 2012 to 2015, which is typical of short panel data, the impact of single cross-section data on time series is negligible, so the mixed regression hypothesis is rejected. The Hausman test results significantly reject the assumption that the fixed-effect regression coefficient and the random-effect regression coefficient are unbiased and consistent, so the random effect is rejected, and the fixed-effect estimation model is used, and the robust standard deviation is used for correction. In order to ensure the reliability of the regression results, this paper uses stepwise regression method to introduce control variables.

Table 2 shows that the financial subsidy has a significant positive incentive effect on the PV business performance. The financial subsidy is positively correlated with the PV business performance, and passed the test at the 1 % significance level.

In other words, the government’s financial subsidies to PV companies have made the company’s operating performance better, indicating that the government’s financial subsidies have played a positive role in promoting the development of photovoltaic enterprises. Financial subsidies mainly play a role in influencing the investment and product sales of PV companies: financial subsidies will change the relative prices of factor income between the PV industry and other industries, causing changes in supply and demand, guiding PV companies to expand investment and expand sales. Subsidies promote the consumption of PV products through income effects and substitution effects. The income effect of financial subsidies refers to the government’s adoption of financial subsidies, which changes the actual purchasing power of relevant consumers and encourages relevant consumers to purchase photovoltaic products. The substitution effect of financial subsidies refers to the pricing of products after PV companies receive financial subsidies. It is reflected that the financial subsidy changes the relative price of photovoltaic products and their competing products, thereby attracting consumers to purchase photovoltaic products and improving the operating performance of photovoltaic enterprises.

The empirical research results show that the total assets, operating costs and R&D expenditures of PV companies in the sample range are positively correlated with the income. The higher the total assets, operating costs and R&D expenditures of en-

terprises, the higher the total income level of the enterprises, and the regression results is passed the significance test at the 10 % level. This shows that the larger the scale of assets and the higher the R&D investment, the better the operating performance of PV companies. This shows that the PV industry has certain economies of scale. This result reminds us that we should pay attention to the advantages of economies of scale when adjusting and optimizing relevant policies.

5. CONCLUSIONS

The empirical analysis of this paper shows that the fiscal policy represented by financial subsidies plays a significant positive role in promoting the development of the photovoltaic industry. The financial subsidies are significantly positively correlated with the operating performance of photovoltaic enterprises; the larger the scale of assets, the more R&D investment. Higher PV companies have better business performance. The results of this study provide enlightenment for the adjustment and optimization of fiscal policy. As a emerging strategic industry, the photovoltaic industry is still immature, the investment return period is long, it is difficult to profit in the short term, and the final result of technological innovation investment is uncertain. The financial subsidy contributes to the risk of the enterprise and partially reduces the operational risk, thus positively stimulating the development of the photovoltaic enterprise.

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Gang AN, Ph.D. in Public Finance from School of E&M, Wuhan University



Hang WANG, Ph.D. in Public Finance from the Centre of Finance Research, Wuhan University