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Research on Financial Performance Evaluation and Risk Governance of Photovoltaic Enterprises Under the Whole Industry Chain Model

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Abstract

As China puts forward the strategic development goals of "carbon peak" and "carbon neutrality", the demand for clean energy is increasing day by day. Solar energy-based power generation technology has developed rapidly in recent years and has become increasingly mature. The competition among photovoltaic companies has gradually intensified. At present, most leading enterprises in the photovoltaic industry are extending to the integration of the industrial chain, and the whole industrial chain strategy has become the mainstream strategic direction. Based on the above situation, from the perspective of the industrial chain, this paper selects the three leading enterprises in the photovoltaic industry, evaluates and analyzes their financial performance after the entire industrial chain model, and then explores the possible risks in the entire industrial chain model of photovoltaic enterprises, and puts forward the suggestions of governance risks.

Keywords: industrial chain model, performance evaluation, risk management

1. Introduction

The photovoltaic industry is an emerging new energy industry in China. With the continuous expansion of the new energy market and the continuous development of silicon wafer technology, the competition in the global energy basic industry is intensifying. In the past "13th Five-Year Plan" and "14th Five-Year Plan", the new energy industry is a key development area in my country. The report of the 20th National Congress of the Communist Party of China proposed: promote green development, develop green and low-carbon industries, improve the market-oriented allocation system of resources and environmental elements, and accelerate the research and development, promotion and application of advanced energy-saving and carbon-reducing technologies. Policy orientation supports the development of low-carbon energy photovoltaic industry. As the first "player" in clean energy, it is estimated that China's cumulative installed capacity of photovoltaics will reach about 700GW in 2025, becoming the main clean energy power. With the continuous optimization and upgrading of photovoltaic enterprises' technical requirements, many enterprises have invested a lot of money in research and development to reduce product

costs and improve photovoltaic conversion efficiency, in order to gain a certain leading edge in the global market; on the other hand, most of the leading enterprises in the current photovoltaic industry are extending towards the integration of the industrial chain, and the whole industrial chain strategy has become the mainstream strategic direction. The stable operation of the industrial chain supply chain is the key to a smooth economic cycle. In this context, this paper selects the three leading enterprises in the photovoltaic industry, LONGi, Zhonghuan, and Tongwei, to explore the impact of the implementation of the industrial chain integration strategy on corporate performance, and further analyze the risks inherent in the process of industrial chain integration. So as to provide a reference for the photovoltaic industry to prevent risks in the whole industrial chain process.

The research on industrial chain theory originated from Adam Smith's classical economist's theory on social division of labor. His famous "needle-making" case is a vivid description of the industrial chain function, but the traditional industrial chain is limited to the internal operation of the enterprise, which emphasizes the utilization of the enterprise's own resources, and only regards the industrial chain as a product chain. Li Tao (2013) believes that the whole industry chain model can bring all the main links of operation into the internal management of the enterprise, expand the business to the upstream and downstream of the industrial chain, and cover all business links. How does the implementation of the industrial chain model affect the performance of enterprises? The industrial organization theory of the Harvard School believes that the industrial chain integration strategy will increase the degree of monopoly of enterprises, thereby enhancing market competitiveness. Pisano (1991) research found that industrial chain integration can reduce information asymmetry, enable enterprises to understand changes in market supply and demand more quickly and accurately, conduct research and development and update technology in a timely manner, thereby improving enterprise performance. Andreou et al. (2016) found that the implementation of industrial vertical integration will reduce the production cost of enterprises and increase the profit margin of product sales. The research results of Zhang Xiang, et al. (2016), Chen Rui et al. (2017), Feng Changli et al. (2022) all prove that the enterprise industrial chain model integrates enterprise resources and improves the business performance of enterprises.

After combing the literature, it is found that the research on the industrial chain (integration) model has proved its positive impact on corporate performance, but the risk issues involved are less involved, so it is worth further exploring. At present, the global industrial and supply chains are being deeply reshaped, and cross-border investment is showing trends such as nearshoring, localization, and regionalization. As a result, the industrial and supply chains have become shorter and more flexible. The stable operation of the industrial chain supply chain is the key to a smooth economic cycle. In this context, this paper selects the three leading enterprises in the photovoltaic industry, LONGi, Zhonghuan, and Tongwei, to explore the impact of the implementation of the industrial chain integration strategy on corporate performance, and further analyze the risks inherent in the process of industrial chain integration. So as to provide a reference for the photovoltaic industry to prevent risks in the whole industrial chain process.

2. Analysis of the Drivers of the Industrial Chain Model of the Photovoltaic Industry

2.1 Policy Support

In recent years, the government has introduced many subsidy policies in the new energy and photovoltaic industries. In 2012, China included the photovoltaic industry as a strategic emerging industry, with the aim of vigorously promoting the development of renewable energy and realizing a green, low-carbon and environmental protection strategy. Later, some encouraging policies were introduced, such as "Guiding Opinions on Energy Work in 2021", "Guiding Opinions on the Implementation of the 13th Five-Year Plan for Renewable Energy Development", and the reports of the 19th and 20th National Congress of the Communist Party of China, all advocating ECO development. In order to promote the rapid development of the photovoltaic industry, the government has given relevant enterprises financial subsidies, financial loans, value-added tax rebates and other preferential policies. Under the favorable environment of the national policy, the photovoltaic industry began to expand to the

midstream and downstream of the photovoltaic industry. Through investment activities, such as new establishments and acquisitions, the extension to the downstream production stage was realized, the scale of the enterprise was expanded, and the development strategy of the entire industrial chain was implemented, which have improved corporate financial performance.

2.2 Increase Market Share

In the photovoltaic upstream market in 2014, polysilicon wafer technology occupies most of the market share and still dominates the market. Because of its simple process and low cost, many mid-stream battery component companies choose polysilicon wafers, but the disadvantage of polysilicon wafers is that their photovoltaic conversion efficiency is relatively low. The essence of photovoltaic power generation is the reduction of cost per unit of electricity and the improvement of conversion efficiency. Although the cost of monocrystalline silicon wafers is higher and the process is complicated, its photovoltaic conversion efficiency is high, and its power generation effect in weak light environments is better than that of polycrystalline silicon wafers. From the perspective of long-term development, with the continuous research and development, technological progress and gradual expansion of production by upstream companies such as LONGi and TCL Zhonghuan, the cost of monocrystalline silicon wafers will continue to decline and even be equal to that of polycrystalline silicon wafers. In terms of performance, the application effect of monocrystalline silicon wafers in module cells is definitely better than that of polycrystalline silicon wafers, and if monocrystalline silicon wafers approach polycrystalline silicon wafers in terms of cost, then polycrystalline silicon wafers will have no competitive advantage, and their market share will gradually be surpassed by monocrystalline silicon wafers. The technical route of monocrystalline silicon has huge development potential. The company's business is expanding to the midstream and downstream enterprises. The production of downstream products requires the consumption of upstream products. As the demand for installed power stations in the market increases, the demand for component cells will also increase, and component products will require chips from upstream products, thereby broadening the sales channels for monocrystalline silicon wafers and increasing the market share of monocrystalline silicon.

2.3 Add New Profit Growth Points

As the problem of environmental pollution has gradually increased, under the vigorous publicity of the government, protecting the environment has become the consensus of mankind. In terms of energy use, clean energy is renewable and less polluting, while photovoltaics, as a relatively mature renewable energy technology, have greater market development potential. Since 2013, the government's support for the photovoltaic industry has continued to increase, and the three leading companies have all aggressively expanded forward-looking. Due to the low technical threshold and high returns of mid- and downstream businesses, and the application scenarios of photovoltaic power plants gradually increase, the demand for battery components and monocrystalline silicon will also increase accordingly. The scope of customers of enterprises will become wider, leading to diversification of income, thereby creating new profit growth points for enterprises.

2.4 Play Synergies

The advantage of the whole industry chain management strategy is that it can integrate the upstream and downstream resources of the enterprise and reduce transaction costs. For the photovoltaic industry, having a product price advantage and higher photovoltaic conversion efficiency means greater market potential. For LONGi, it has been focusing on the technology field in the early days, and its single business structure makes its advantages in the industrial chain not obvious. After the adjustment of the business structure, the connection of its own business chain will be more efficient, and the efficiency of resource allocation will be improved. The industrial chain integration strategy forms an internal market for integrated operation by opening up the upstream and downstream industrial chains, realizes the effective connection of the industrial chains, rationally allocates enterprise resources in all links of the industrial chain, and maximizes the improvement of enterprise cost efficiency.

3. Comparative Analysis of Corporate Financial Performance Under the Whole Industry Chain Model

This article selects three companies in the

photovoltaic industry that have implemented the industrial chain integration strategy, LONGi, Zhonghuan, and Tongwei, and then conducts a horizontal comparative analysis of their financial performance before and after the formation of the industrial chain.

3.1 Profile of Sample Companies

The three companies of LONGi, Tongwei and Zhonghuan are all companies integrating the photovoltaic industry chain. The three companies are not only the leading enterprises in the photovoltaic industry in China, but also rank among the best in the global photovoltaic enterprises and are quite competitive. The monocrystalline silicon of LONGi and Zhonghuan occupies most of the market. Tongwei is the leading company of the most upstream raw material silicon. Generally speaking, the three case companies have basic similarities in terms of industry status and development strategies, so they are comparable as analysis objects. Table 1 shows the basic situation of the three companies and the formation time of the entire industrial chain.

Table 1. Overview of the three leading companies in the photovoltaic industry

Company name (abbreviation)	**Main business**	**Time to enter the energy industry**	**Photovoltaic industry chain formation time**	**Industry ranking**
Longji Green Energy Technology Co., Ltd. (LONGi shares)	The business segment includes monocrystalline silicon wafers, battery components, green energy solutions, etc.	2000	2014	Photovoltaic enterprises ranked first in the country
TCL Zhonghuan Renewable Energy Technology Co., Ltd. (Zhonghuan shares)	Business includes monocrystalline silicon materials, battery components, power station construction business	2006	2015	One of the enterprises with the most complete varieties of silicon single crystals, ranked 6th in the country
Tongwei co., ltd. (Tongwei shares)	Businesses include polysilicon material production, solar cell components, solar power generation and feed industry, etc.	2006	2015	Photovoltaic enterprises ranked second in the country

Source: Compiled according to the official websites and Netease accounts of the three companies.

3.2 Financial Performance Evaluation

In order to evaluate the financial performance of photovoltaic enterprises after implementing the integration strategy of the whole industrial chain, the financial data of three companies, LONGi, Zhonghuan and Tongwei, after the formation of the industrial chain, were analyzed for their operating performance in 2015-2021.

3.2.1 Profitability Analysis

Profitability, growth rate and risk level are the driving factors for maximizing the company's value. Among them, profitability is the basis for the company's growth and risk prevention. Therefore, profitability is very important in corporate performance evaluation. In order to evaluate the profitability of the three companies LONGi, Tongwei and Zhonghuan after implementing the whole industry chain model, and considering the availability of data, this paper selects the two indicators of gross profit margin and return on net assets to analyze their profitability respectively.

(1) Gross profit margin. The gross profit margin reflects the market competitiveness at the product level of an enterprise, and can reflect

the product competitive advantages among industry competitors. As a leading enterprise in the photovoltaic industry, the changes in the sales gross profit margin of the three companies from 2015 to 2021 are shown in Figure 1.

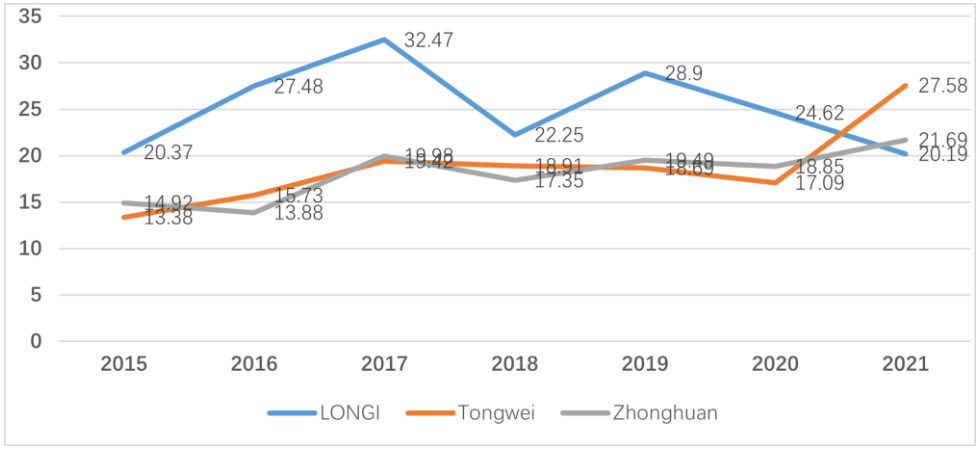

Figure 1. Changes in gross profit margin on sales of the three companies from 2015 to 2021 (%)

Data source: Organized according to Oriental Fortune.com

It can be seen from Figure 1 that after the three companies implemented the whole industry chain model, the gross profit margin of the three companies showed an overall upward trend. Among them, the gross profit margin of Longji shares increased significantly higher than that of Tongwei shares and Zhonghuan shares after 2015, but the magnitude of change is also relatively large. After a sharp decline in 2018, it rebounded in 2091 and continued to decline. In 2021, the gross profit margin of Longji shares will decline greatly, and it will be surpassed by Tongwei shares. The main reason is that the cost of polysilicon materials will rise in 2021. Tongwei is a leading company in polysilicon materials, which not only has a cost advantage in the middle and lower reaches, but also expands the profitability of polysilicon materials. Zhonghuan shares are showing a slow upward trend as a whole, and the gross profit margin in 2021 will also increase greatly. This is because Zhonghuan has achieved innovation in the technology of producing monocrystalline silicon wafers. The new technology has significantly improved the utilization rate of raw materials and reduced polysilicon materials, and reduces the production cost.

(2) Return on equity (ROE). ROE is the core indicator that reflects the company's profitability and management level, and it can better reflect the management ability of the company's management and the prediction and judgment of the industry's development. The changes in the ROE of the three companies from 2015 to 2021 are shown in Figure 2.

Figure 2. Changes in the ROE of the three companies from 2015 to 2021 (unit: %)

Data source: Organized according to Oriental Fortune.com

It can be seen from Figure 2 that the ROE of the three companies has gradually increased since 2015. Among them, the ROE of LONGi shares has risen rapidly after 2015, reaching a peak of 30.14% in 2017. In 2018, affected by the "531" New Policy, it fell seriously. It will continue to rise and will show a downward trend in 2021. Overall, its ROE is always higher than that of the other two companies. The ROE of Tongwei has remained stable at around 15%, and there will be a relatively large increase of 24.24% in 2021, surpassing LONGi. Although the ROE of Zhonghuan has always been lower than that of the other two companies, it has grown steadily. In 2021, there will be a sharp jump, rising from 7.55% to 17.97%, with a growth rate of 138%, reflecting the immediate economic benefits brought by technological innovation.

3.2.2 Analysis of Solvency

The analysis of solvency is also an evaluation of the company's credit risk, and the strength of repayment ability is the key factor affecting the healthy survival and development of the company. In order to measure the short-term and long-term solvency of LONGi, Tongwei and Zhonghuan after implementing the whole industry chain model, this paper selects two indicators of current ratio and asset-liability ratio to analyze respectively.

(1) Current ratio. The current ratio reflects the ability of an enterprise to repay short-term debts, and is an important indicator to measure the current financial ability of an enterprise, especially the ability to realize current assets. The changes in the current ratios of the three companies from 2015 to 2021 are shown in Figure 3.

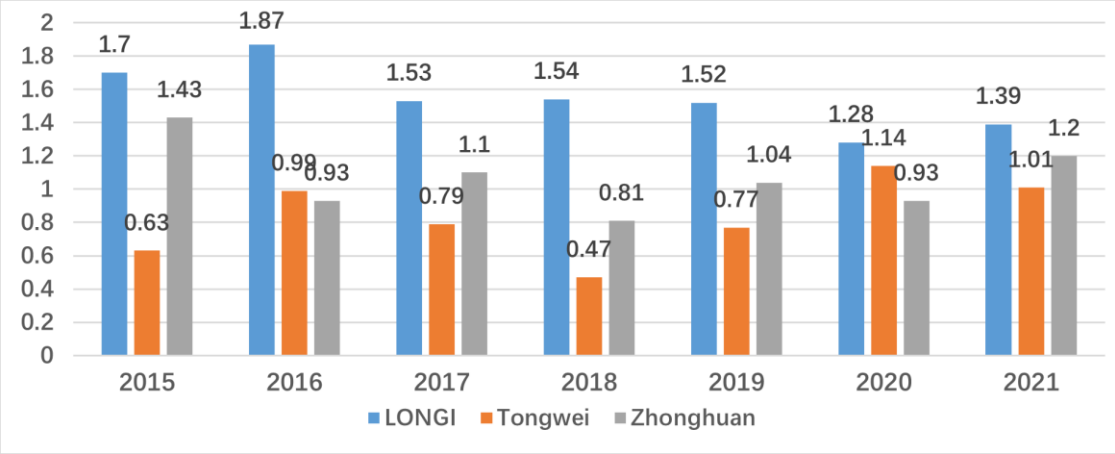

Figure 3. Changes in the current ratio of the three companies from 2015 to 2021

Data source: Organized according to Oriental Fortune.com

According to Figure 3, since 2015, the current ratio of LONGi shares has fluctuated around 1.5, with strong liquidity and low short-term credit risk. The current ratio of Tongwei's shares has continued to slump, fluctuating since 2015, and basically below 1, indicating that the company's liquidity is weak and the risk of short-term debt repayment is high. After 2015, Zhonghuan shares also fluctuated around the mean value of 1. It can be found that the current ratios of the three leading enterprises in the photovoltaic industry are generally low, reflecting the weak liquidity of the industry, excessive short-term liabilities, and relatively large credit risks.

(2) Asset-liability ratio. The asset-liability ratio reflects the strength of the company's long-term solvency, and is also an important indicator for comprehensively evaluating the rationality of the capital structure. The asset-liability ratios of the three companies from 2015 to 2021 are shown in Table 2.

Table 2. Changes in the asset-liability ratio of the three companies from 2015 to 2021 (Unit: %)

Era	2015	2016	2017	2018	2019	2020	2021
LONGi shares	44.62	47.35	56.68	57.58	52.29	59.38	51.31
Tongwei shares	62.12	44.85	46.37	60.43	61.37	50.91	52.8

Zhonghuan Shares	51.09	53.66	58.08	63.17	58.17	52.18	46.42

Data source: Organized according to Oriental Fortune.com

According to Table 2, it can be seen that the asset-liability ratios of the three companies have always remained in the range of 50-60%, and the debt levels are relatively high. The asset-liability ratio of LONGi shares is basically maintained at around 50%; Zhonghuan shares first increased year by year, and then declined after reaching a peak in 2018. The asset-liability ratio of Tongwei shares has changed greatly, exceeding 60% in 2015, 2018, and 2019. Considering its profitability, its financial leverage level is relatively high and its financial risk is relatively high.

In general, after the implementation of the whole industry chain model, the three companies have shown the characteristics of reduced liquidity and increased financial leverage. The reason is that due to the national policy of supporting energy development, powerful companies in the photovoltaic industry have begun to expand downstream business vigorously, so there is more capital demand. Combined with the analysis of profitability, LONGi shares have the highest capital flow efficiency and low risk, reflecting the stability of its financial structure.

3.2.3 Operational Capability Analysis

Operational capability analysis is the analysis of the operating efficiency and benefits of enterprise assets, aiming to point out the direction for improving the economic benefits of enterprises. This paper selects the indicators of inventory turnover rate and accounts receivable turnover rate to evaluate and analyze the asset utilization efficiency of three photovoltaic enterprises.

(1) Inventory turnover rate. Inventory turnover rate is an index to measure the efficiency of inventory operation in the production and operation of an enterprise. It not only reflects the level of inventory management of the enterprise, but also affects the liquidity and short-term solvency of the enterprise. The faster the inventory turnover rate, the faster the inventory realization speed. The stronger the liquidity, the stronger the short-term solvency. Table 3 shows the changes in the inventory turnover ratio of the three companies from 2015 to 2021.

Table 3. Changes in inventory turnover ratio of the three companies from 2015 to 2021

Era	2015	2016	2017	2018	2019	2020	2021
LONGi shares	3.58	6.09	6.17	5.13	4.4	4.62	5.06
Tongwei shares	14.84	14.53	13.36	13.32	15.26	14.13	10.86
Zhonghuan Shares	2.7	3.8	5.01	6.77	8.33	8.36	12.21

Data source: Organized according to Oriental Fortune.com

It can be seen from Table 3 that Tongwei's inventory turnover rate maintains the highest level among the three companies, and the turnover speed is the fastest, indicating that the company's inventory asset management efficiency is good, the level of inventory capital occupation is low, and the asset realization ability is the strongest. The inventory turnover rate of LONGi has risen and fallen, and the overall change rate is not large and relatively stable. The inventory turnover rate of Zhonghuan Co., Ltd. has maintained a steady upward trend, and the maximum value in 2021 will increase by 3.5 times compared with 2015, indicating that the sales level and management efficiency of Zhonghuan Co., Ltd. continue to be stable and improving. Photovoltaic enterprises are mostly asset-heavy enterprises, and the scale of fixed assets is increasing year by year. The small change in inventory turnover rate indicates that all links of the industrial chain fit well. This also shows that the rapid expansion of business in midstream and downstream enterprises will lead to the increase of financial leverage and the reduction of asset operation efficiency, which will increase the financial risk of the enterprise to a certain extent.

(2) Accounts receivable turnover rate. The accounts receivable turnover ratio reflects the

number of times that accounts receivable are turned into cash in the current year. The high turnover rate of accounts receivable indicates that the company collects accounts quickly, has less bad debt losses, and has strong asset liquidity, which will greatly reduce short-term credit risks. Figure 4 shows the changes in the accounts receivable turnover ratio of the three companies from 2015 to 2021.

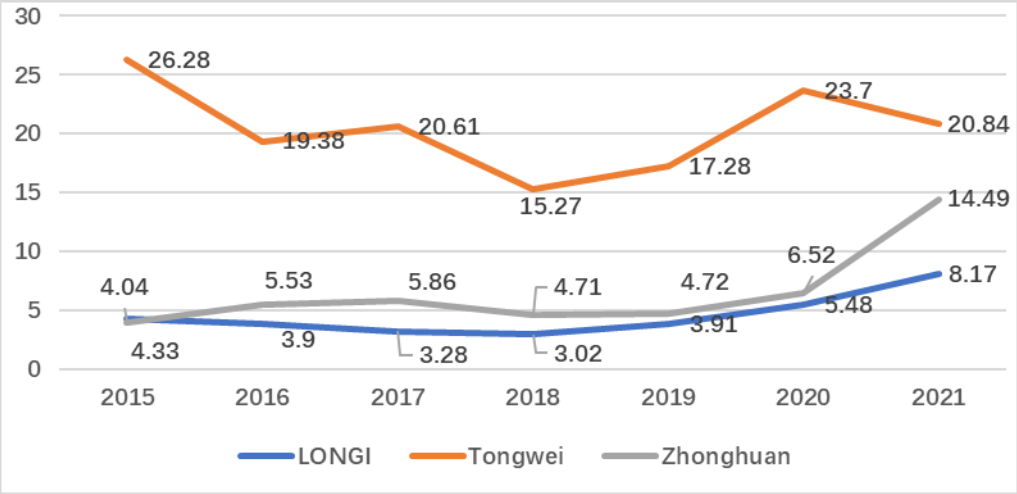

Figure 4. Changes in accounts receivable turnover ratio of the three companies from 2015 to 2021

Data source: Organized according to Oriental Fortune.com

It can be seen from Figure 4 that after the implementation of the entire industrial chain, Tongwei's accounts receivable turnover rate has always been in an obviously high turnover advantage compared with LONGi and Zhonghuan, but it continued to decline during 2015-2018, and basically in an upward trend after 2019. The accounts receivable turnover ratio of LONGi and Zhonghuan has basically remained at a relatively low and stable level, and will increase significantly in 2021.

From the overall perspective of operating capabilities, Tongwei's operating capabilities are stronger. The main reason may be that its main business is different from that of LONGi and Zhonghuan. Both LONGi and Zhonghuan are companies that are dominated by monocrystalline silicon wafers and then expand to downstream businesses. Tongwei's original main business was polysilicon materials. After implementing the whole industry chain strategy, its operating capacity declined due to the increase in customers and products. Generally speaking, the layout of the whole industry chain strategy will lead to changes in the company's products and business structure, followed by the diversification of the customer system and income. From the perspective of indicator performance, the asset operation efficiency of LONGi is slightly worse than that of the other two companies, mainly because its industry expands faster and produces more products to occupy a larger market share, which also accelerates the expansion of its asset scale.

3.2.4 Growth Capacity Analysis

The company's growth capability is an important indicator to evaluate the company's long-term performance and high-quality development, and it is also the basis and key to promote the improvement of the capital market and protect the rights and interests of investors. There are many indicators to evaluate the company's growth capability. This paper selects the growth rate of operating income, net profit growth rate and asset growth rate to analyze the growth capabilities of the three companies.

(1) Growth rate of operating income. This indicator reflects the relative growth of operating income, and is an important indicator to measure the company's operating conditions and market share, and to predict the business expansion trend of the company. Figure 5 shows the trend of the growth rate of operating income of the three companies from 2015 to 2021.

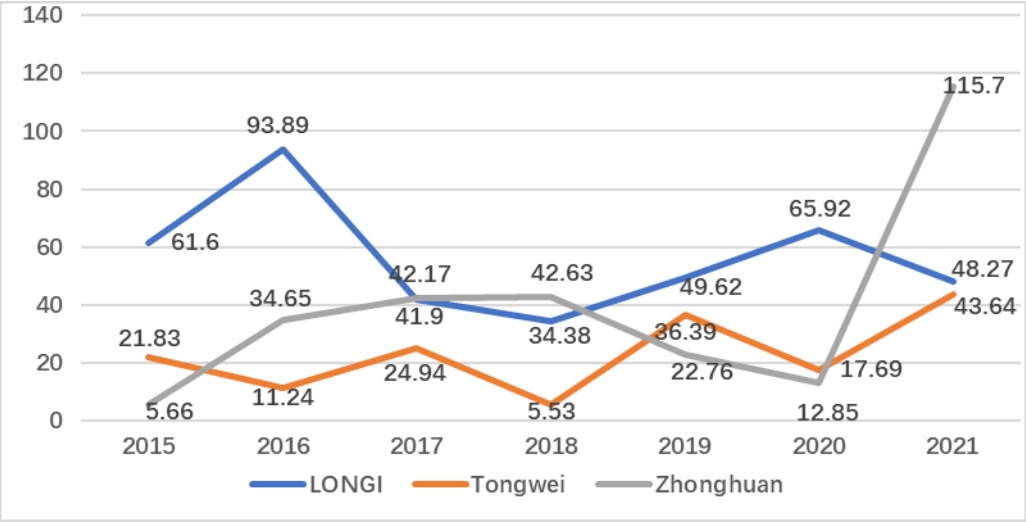

Figure 5. Changes in the growth rate of operating income of the three companies from 2015 to 2021

Data source: Organized according to Oriental Fortune.com

Figure 5 shows that since 2015, the operating income growth rate of the three companies has continued to be positive, and LONGi shares have maintained an average of about 50%, which has always been higher than that of Zhonghuan and Tongwei, but the fluctuations are relatively large, and there will be a downward trend in 2021. The growth rate of Zhonghuan's operating income first rose and then fell, and also fluctuated greatly. In 2021, there will be a sharp upward trend. The reason is that the market competitiveness of technological innovation products has increased and the income level has grown rapidly. Tongwei's revenue growth rate fluctuates like waves, showing an overall upward trend.

(2) Net profit growth rate. This indicator reflects the company's capital accumulation. The higher the ratio, the more capital the company has accumulated, and the stronger its ability to deal with risks and sustain development. The change of net profit growth rate of the three companies from 2015 to 2021 is shown in Table 4.

Table 4. 2015-2021 net profit growth rate and average value of the three companies (unit: %)

Era	2015	2016	2017	2018	2019	2020	2021	average value
LONGi shares	77.25	197.36	130.38	-28.24	106.4	61.99	6.24	79
Zhonghuan Shares	52.96	98.94	45.41	8.16	42.93	20.51	270.03	77
Tongwei shares	123.77	39.07	96	0.51	30.51	36.95	127.5	65

Data source: Organized according to Oriental Fortune.com

It can be seen from Table 4 that the profit growth rate of the three photovoltaic companies after the implementation of the whole industry chain is relatively good, with an average of more than 65%, indicating that the implementation of the whole industry chain has greatly enhanced the profitability of the enterprise, but it also reflects that the profit growth rate fluctuates relatively slowly. Especially in 2018, affected by the policy, the profits of the three companies all dropped sharply, LONGi shares experienced negative growth, and the growth rate of the other two companies fell sharply. Specifically, except for 2018, LONGi shares will suffer a serious decline in net profit margin due to the sharp increase in upstream raw material prices and period expenses in 2021, and the net profit will maintain high growth in the rest of the time. Zhonghuan shares will have a high growth rate of 270% in 2021, due to the accelerated expansion of its product scale, and through technological progress, the consumption rate of silicon materials has been reduced, and production costs have been reduced, resulting in

a substantial increase in profits. Tongwei also has a net profit growth rate of 127.50%, because the price of polysilicon, its main business product, has risen sharply.

(3) Asset growth rate. Assets represent the size of the company, and asset growth rate reflects the company's expansion speed. The larger the growth rate, the faster the company's growth. The changes in total assets and growth rates of the three companies from 2015 to 2021 are shown in Table 5 and Figure 6.

Table 5. Total assets of the three companies from 2015 to 2021 (unit: 100 million yuan)

Era	2015	2016	2017	2018	2019	2020	2021	average growth rate
LONGi shares	102.1	191.7	328.8	396.6	593	876.3	977.3	51%
Tongwei shares	155.5	214	255.5	384.8	468.2	642.5	882.5	32%
Zhonghuan Shares	210.8	229.9	310.1	427	491.2	587.2	779.8	22%

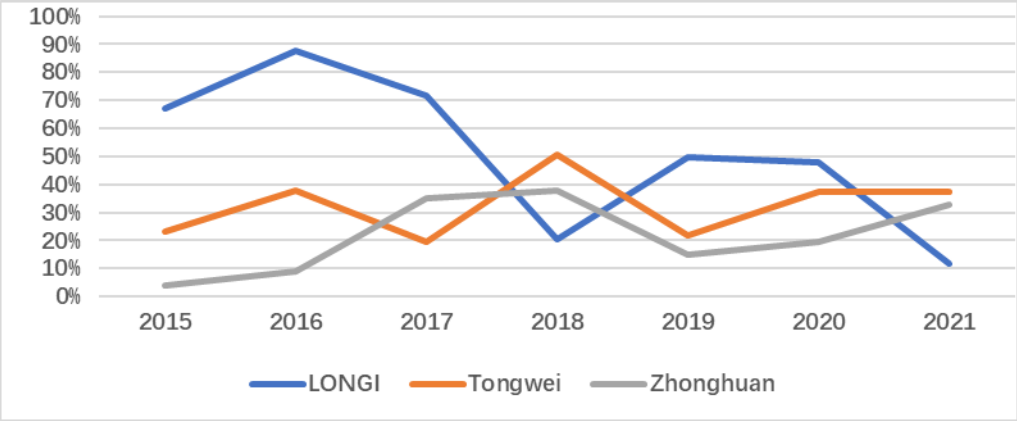

Figure 6. Changes in the asset growth rate of the three companies from 2015 to 2021

Data source: Organized according to Oriental Fortune.com

It can be seen from Table 5 that the asset scale of the three enterprises in the photovoltaic industry has expanded rapidly. LONGi, Tongwei and Zhonghuan have increased from 10.2 billion, 15.5 billion, and 21.08 billion in 2015 to 97.7 billion, 88.2 billion, and 77.98 billion in 2021, among which LONGi's shares have increased by more than 8 times, with the fastest growth rate, and it has become the number one in the industry. From Figure 6, it can be seen that the asset growth rate of the three companies is changing. The growth rate of Longji shares is uneven, while the asset growth rate of Tongwei and Zhonghuan shows an overall slow increase with little fluctuation.

Through the evaluation and analysis of the financial performance of the three leading enterprises in the photovoltaic industry after implementing the whole industry chain model, whether it is profitability, asset utilization efficiency or company growth ability, they all show a continuous upward trend, indicating the positive impact of the implementation effect of the whole industry chain. However, from the perspective of solvency, the three companies have a large demand for funds when rapidly expanding the midstream and downstream enterprises of the industrial chain, which increases the leverage effect and correspondingly increases the credit risk. From the perspective of growth capacity, most of the time, the growth rate of net profit of the three companies is greater than the growth rate of operating income and asset scale, which shows that the implementation of the whole industry chain strategy has a good effect. While integrating and synergizing all links to reduce costs, it has brought greater profit margins to the enterprise, and the rapid expansion of scale has enhanced the company's overall anti-risk ability. All in all, LONGi's overall performance in the formation of the industrial chain is the

most obvious, ranking first in the industry in terms of scale and operating income, highlighting the company's management's excellent management capabilities and efficiency.

4. Corporate Risks and Governance Countermeasures Under the Whole Industry Chain Model

Profitability, growth capability and risk level are the drivers of company value. Benefiting from the global "dual carbon" trend and the concept of green development, the photovoltaic new energy industry has ushered in a period of rapid development. The financial performance of leading companies such as Longji in the photovoltaic industry has increased significantly, and their profitability and growth capabilities have continued to increase. However, in the process of pursuing the maximization of the company's value, there must be various risks.

4.1 Credit Risk and Its Governance

As China puts forward the strategic development goals of "carbon peak" and "carbon neutrality", the demand for clean energy is increasing day by day. As an energy industry with strong development potential, the photovoltaic industry has received strong support from national policies. Taking advantage of the favorable policies, leading enterprises in the photovoltaic industry seize the opportunity to rapidly expand upstream and downstream enterprises. During the expansion of the industrial chain and the rapid growth of enterprises on the chain, there will inevitably be a large demand for funds. The company will increase the scale of debt financing, which will lead to increased financial risks for the company. As can be seen from the previous analysis of financial capabilities, the integration of the industrial chain will inevitably prompt enterprises to accelerate financing and use these funds to expand production scale and produce more different products, which will further lead to a decline in the inventory turnover rate of enterprises. However, the increase in customers and the diversification of income will bring about a decrease in the turnover rate of accounts receivable. These may increase the company's credit risk.

The main way to manage credit risk is to adjust the company's capital structure. In the development of the entire industrial chain, the company should pay attention to the ability of the future cash flow it creates and the level of leverage risk. While expanding the industrial chain, it should pay attention to the synergistic advantages of the industrial chain and multi-channel diversified financing. Enterprises should continue to carry out technological innovation and improve asset utilization efficiency to maintain a relatively stable financial structure and profitability. The focus of the performance evaluation of companies on the chain is to predict the future cash flow of the entire company, while paying attention to the demand and supply chain operation level of companies on the industrial chain.

4.2 Industrial Chain Management Risk and Its Governance

Enterprises in the industry chain are a kind of strategic partnership, and their strategic choices are influenced by their respective utilization drivers. During the operation of the industrial chain, due to the influence of information asymmetry, information distortion, market uncertainty and related economic, political, and legal factors, enterprises on the chain will have various risks such as information communication and collaboration. From the perspective of the entire chain, the maximization of the interests of each member does not necessarily lead to the maximization of the benefits of the entire industrial chain. This kind of involution will inevitably affect the overall operation level and competitiveness of the industrial chain. In addition, with the continuous expansion of the company's scale and net assets in the industrial chain, it is necessary to develop new products and new markets, supplemented by a new management model, to ensure that the company's profitability and growth capabilities are in sync. For the core enterprises on the chain, this has greatly challenged the business leaders' prediction of industry development, judgment of new profit growth points, and coordination of team management capabilities. Therefore, in the development of the entire industrial chain, factors that affect the efficiency of industrial chain management must be fully considered.

Based on the above analysis, this article suggests: (1) Adhere to the principle of "win-win interests" for enterprises in the industrial chain. The core of the whole industry chain is to collaboratively create a friendly supply chain interface, and based on the business logic of "win-win interests", the supply chain layout is

carried out in advance to obtain more supply chain resources and stable guarantees. On the other hand, the company's differentiated market layout, flexible collaboration with customers, and long-term and stable cooperation with international and domestic customers have brought more innovation drivers and anti-risk capabilities to the company, and improved the company's operating capabilities and competitive advantages. The company insists on technological innovation and digital transformation, enhances endogenous competitiveness, and goes through industry cycles. Under the large fluctuations in the supply chain of the new energy photovoltaic industry, the company's profitability and sustainable development competitiveness are guaranteed. (2) Talent training. The company must absorb and cultivate excellent scientific and technological innovation talents, engineer technical talents, information management talents and create excellent "artisan-type" talents on the front line. At the same time, companies need to strengthen their corporate culture and strengthen team stability and cohesion. Core central companies should pay attention to improving the environmental, social and governance levels related to the supply chain, and improve the supply chain traceability management system. The cooperative enterprises on the chain formulate a code of conduct for cooperative relations to ensure that the industrial chain cooperative enterprises maintain high standards of compliance and moral requirements in terms of employee rights, health and safety, and environmental responsibility, and reduce internal friction.

4.3 Market Risk and Its Governance

The general environment of the "double carbon" goal will inevitably release the overall production capacity of the photovoltaic industry chain in the future, showing an upward trend, and profit changes will gradually be transmitted from the upstream to the middle and downstream. This trend of change will further increase market competition in the photovoltaic industry. The high-growth and high-anticipation photovoltaic industry has attracted a large influx of capital, the production capacity of each link in the industrial chain has rapidly expanded, products tend to be homogeneous, market competition has become increasingly fierce, and the industrial structure is facing reshaping. The unbalanced supply and demand of polysilicon materials, monocrystalline silicon wafers, batteries, and components due to phased investment and production cycle have caused periodic supply shortages or excesses of some products, bringing more uncertainties to the market environment and operations. Modules in photovoltaic products will be the key to future industrial integration and competition in the Red Sea. How to avoid enterprises lingering in the Red Sea competition and create new profit growth points has become a key point of the company's strategy in the photovoltaic industry chain.

To deal with market risks, suggestions: (1) Enterprises in the industrial chain should strengthen collaborative governance and information sharing mechanisms, and have a clear judgment and understanding of the industry's development direction and their own development path. Enterprises should have high traceability capabilities to meet customer needs for customized and differentiated products, while actively expanding and deepening industrial layout. To ensure information communication and supply chain security, all links of the industrial chain make up for their own shortcomings through upstream and downstream extension, and develop in a deeply integrated form. (2) Enterprises should always adhere to the differentiated business philosophy, and accelerate the integration of digital intelligence manufacturing and technological innovation, product innovation, manufacturing methods, and business model innovation. At the same time, enterprises should enhance their independent research and development capabilities and core competitiveness of products, go through the industry development cycle, and continuously improve their market competitiveness. (3) Enterprises should create a "blue ocean strategy", shift their attention from the supply side of the market to the demand side, and shift from paying attention to and surpassing what competitors do to providing a leap in value for buyers. At the same time, enterprises should rebuild market and industry boundaries, tap potential demand, and avoid "involution".

Fund Projects

The 2021 Quality Engineering Project of Guangzhou Huashang College "Internship Base for Off-campus College Students Based on

Ideological and Political Integration of Lessons" (Project No.: HS2021KZLGC07); Guangdong University of Finance and Economics Huashang College's 2020 quality engineering project "Intermediate Financial Accounting" first-class course construction project (Project No.: HS2020ZLGC09); Financial Management, a key discipline construction project of Guangzhou Huashang University in 2020 (Project No.: 2020HSXK02); Guangdong Province's 2021 First-Class Undergraduate Professional Construction Project "Financial Management" (Jiao Gao Ting Han [2021] No. 7); The 2021 Innovation and Entrepreneurship Project of Guangzhou Huashang College "The Study of Industrial College Innovation and Entrepreneurship Education based on hierarchy of needs " (Project No.: HS2021CXCY03).

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