RESEARCH ON THE IMPACT OF WASTE UTILIZATION IN HIGH-POLLUTING ENTERPRISES ON ECONOMIC ADDED VALUE EVA FROM THE PERSPECTIVE OF LOW-CARBON ECOLOGY

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ABSTRACT

At present, China's economy is developing rapidly, and the overall economic field is showing a trend of rapid growth. At the same time, the utilization of polluting wastes involves a trade-off between environmental pollution and the economy. This paper selects the method of economic value-added evaluation to analyze and predict the relationship between the two. The average single-share earnings of the group of companies that do not carry out recycling and utilization of polluting wastes are observed during 2019-2021. The results show that the net income per share and total income decreased by 32.43%, 10.28% and 32.73% respectively. During the period from 2019 to 2020, the number of EVA and the annual rate of change in income of companies that did not recycle polluting wastes decreased by 58.25% and 68.56%, respectively. On the contrary, the declines of enterprises that have been recycled are only 37.43% and 32.28%. Therefore, in recent years, enterprises that emit a large amount of pollutants should take the recycling and reuse of polluting waste as the main method.

KEYWORDS

Ecological environment; waste utilization; economic evaluation; energy enterprises; EVA evaluation.

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1. INTRODUCTION

Low carbon is an environmental responsibility for sustainable development [1, 2]. Low-carbon ecology requires people to establish a new outlook on life and consumption and also puts forward requirements for high-polluting enterprises to reuse corporate waste, thereby reducing carbon emissions and promoting the harmonious development of man and nature [3]. Low carbon will be an important way to coordinate economic and social development and protect the environment [4, 5].

Under the low-carbon economic model, people's life can gradually get away from the negative effects caused by the unreasonable use of energy, and enjoy a new life with the theme of economic energy and green energy [6]. Under the low-carbon ecology, reducing environmental pollution and ensuring low emissions is conducive to ecological environmental protection; in addition, it can also reduce the waste of resources, which is conducive to slowing down the speed of global warming and environmental degradation [7, 8]; improving corporate profits. In the production and development of an enterprise, there must be some waste of raw materials and products. For some waste materials in high-polluting enterprises, it usually takes nearly ten years to stabilize. The hazardous substances such as heavy metal ions and organic acids produced in the whole process cause pollution to the water, soil, and air in the surrounding living areas [9, 10]. At the same time, for the waste materials produced by high-polluting enterprises, there are also some resources that can be used such as metal materials. Therefore, the reuse of waste materials has a positive effect on alleviating environmental pressure and reducing carbon emissions [11, 12].

However, for enterprises, how to maximize corporate profits is the focus of enterprises. In the process of recycling waste materials, the enterprise can obtain its income and enhance the market competitiveness of the enterprise. Therefore, in the process of waste recycling in high-polluting enterprises, the company will consider the impact of waste material recycling on enterprise value assessment, and conduct a comprehensive assessment of its overall value. Through enterprise value assessment, it can further help investors make investments. Decision-making and business managers improve business decisions.

In the context of low-carbon ecology, a low-carbon economy is based on the theory of sustainable development. Through innovative ways such as industry and system, the development of energy towards an economic model with low consumption, low pollution and high utilization rate is realized. In the process of high-polluting enterprise waste recycling, how its impact on the economic added value of enterprises has attracted a lot of attention. Yang, Y. [13] argues that corporate waste poses new challenges to reducing environmental impact and enhancing resource sustainability for additive manufacturing. In the development of circular ecological economy, Aldieri, L. [14] analyzed the main characteristics of circular business models from the perspective of public interest, emphasizing how sharing economy business models can be well integrated and complementary with certain characteristics of circular economy, which is a powerful Pull factor [15, 16], other cycles of circular economy

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require a clear push factor. Braun, A.T. [17] believes that the transformation of a circular ecological economy requires a new value creation structure, thereby changing the business model. In the development of enterprises, they need to comprehensively consider after-tax net operating profit, weighted average cost of capital and total assets [18, 19], so that they can guide the development of enterprises. Gotts, I. [20] research shows that at the local level, the waste trade has become a monopoly. Their research proves that very good income can be generated in the transaction of waste and waste. Nawaz, M. [21] takes a holistic approach and examines the formal and informal aspects of the recycling value chain, assessing possible integration in waste management approaches through the use of recycling as a tool for achieving sustainability [22, 23]. To curb the trend of the massive increase in waste and reduce the adverse impact on the environment, Namkung, H. [24] proposed to promote several waste recycling policies, including waste-to-energy, which can effectively relieve pressure and respond to the production of polluting plastic waste. Alternative chemicals and fuel oils can play a key role in a country's sustainable development, generating huge benefits. Lassou, P. [25] proposed that accounting is an important component when evaluating economic growth. Gao, Y. [26] used the Global Productivity Index to estimate provincial TFP levels considering carbon emissions when conducting economic accounting [27, 28], comparing different assumed returns to scale and considering the ranking inversion problem. Nassani, A. A. [29] argues that in assessing sustainable development, accounting plays an important role in achieving national economic development through energy efficiency, economic insurance prices and sound financial development. Evidence provided by Bakre, O. M. [30] shows that accounting is an important foundation for economic development, and the selection of appropriate accounting is crucial to the valuation of assets. Fuentes-Saguar [31] analyzed the economic linkages between the bioeconomy sector and other economic sectors, and it is important to determine their aggregate and disaggregated effects on economic growth. Their study showed that in complex databases, based on accounting matrix analysis. Content evaluation of wealth creation plays a key role.

Abhayawansa, S. [32] reviewed existing research on national policy-making on value creation, sustainability and SDGs, identified gaps in national accountability and methodologies in national governance processes, and for the accounting component, organizations. The concept of value creation makes a lot of sense. Based on our analysis of the work of previous research scholars, we can find that there is still great commercial value in corporate waste. It is profitable for businesses to recycle and reuse waste materials. Therefore, based on promoting a low-carbon ecology, it is feasible for high-polluting enterprises to recycle and reuse waste materials. In assessing the benefits of waste materials, accounting can accurately analyze them, which can help to provide managers with useful information for decision-making and promote their confidence in the recycling of waste materials.

An important guarantee for the improvement of low-carbon ecological capacity is the multiple utilization and recycling of system resources, products and wastes. In

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carrying out the low-carbon ecological sustainable development model, the low-carbon ecological city should consider the goal of maximizing human social welfare, and must also ensure the income of enterprises in the recycling and reuse of waste materials. Therefore, in the recycling and reuse of waste materials from high-polluting enterprises, we comprehensively consider the nature, scale, development stage and organizational form of the enterprise to select relevant accounting items for adjustment, which truly reflects the ability of the enterprise to create value. According to the quality of the waste to be treated and the challenges of the substances to be treated, corresponding accounting adjustments are made to the R&D expenses, financial expenses, accounting preparations, and credit adjustment of the enterprise, to increase the economic benefits of the enterprise in the utilization of waste.

2. EVA CALCULATION AND MODEL STRUCTURE INTRODUCTION

According to research, the stakeholders involved in the utilization of waste resources in high-polluting enterprises include environmental protection units, business units, waste treatment stations, and the transportation industry. If there is effective cooperation among these participants to convert high-polluting corporate waste into secondary products, it will be beneficial to the improvement of China's high-polluting corporate waste resource utilization and the implementation of the dual-carbon strategy. To assess the impact of waste utilization in high-polluting enterprises on economic added value, we use algorithms to predict it, promote policies related to waste recycling in high-pollution enterprises, and formulate effective measures such as reasonable subsidies and penalties.

The essence of EVA is the input cost of corporate shareholders for waste utilization of high-polluting enterprises. When EVA is positive, the project can truly create value for corporate shareholders when the income from high-polluting corporate waste is greater than the input cost of corporate shareholders. EVA comprehensively considers the impact of the input cost of corporate shareholders on the utilization of waste in high-pollution enterprises, and can better reflect the value created by the utilization of waste in high-pollution enterprises for corporate shareholders.

2.1. CALCULATION OF EVA

The economic value added EVA is defined as the difference between the net operating profit after tax and the total cost of capital. The specific calculation process is as follows:

$$EVA = NOPAT - WACC \times TC \tag{1}$$

Among them, NOPAT is the adjusted net operating profit after tax of the enterprise; WACC is the weighted average cost of capital of the enterprise; TC is the adjusted total assets of the enterprise. When the adjusted net profit after tax of the enterprise is

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greater than the cost of capital, that is, when EVA > 0, the enterprise creates corporate shareholder value; and when the cost of capital is greater than the adjusted net profit after tax of the enterprise, that is, when EVA < 0, even if the enterprise accounting. If the profit is greater than zero, in fact, the enterprise is still depleting enterprise capital and does not create value for the shareholders of the enterprise.

2.2. INTRODUCTION OF EVA MODEL

To easily evaluate the impact of waste utilization in high-polluting enterprises on economic added value, the internal and external environments of enterprises tend to be stable in the short term, so EVA is divided into two different stage models. The details are as follows:

1.2.1 Single-stage model

1. Zero growth model

The utilization of waste resources in high-polluting enterprises has entered a mature period, and the EVA value remains stable and unchanged. The growth value of EVA in each cycle is 0, as shown in Figure 1:

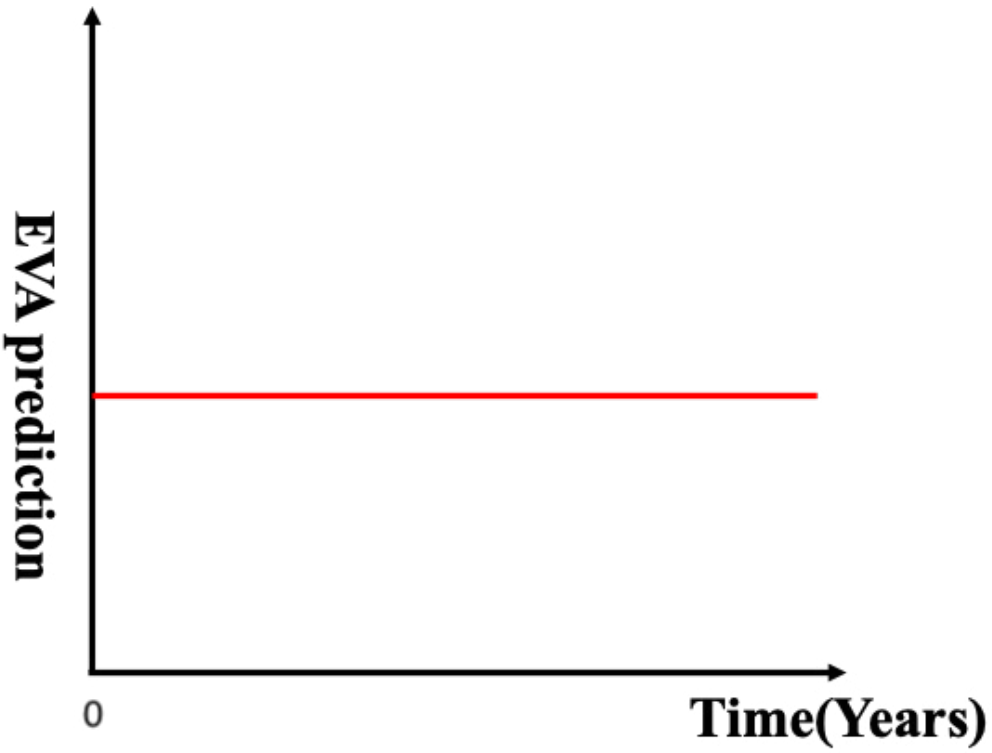

Figure 1. EVA zero growth model

$$EVA_1 = EVA_2 = EVA_3 \ldots EVA_n \quad (2)$$

$$enterprise\ value = I + \sum_{i=1}^{n} \frac{EVA_i}{(1+r)^i} + EVA \sum_{i=1}^{n} \frac{1}{(1+r)^i} \quad (3)$$

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Among them, I am the investment cost; r is the discount rate. Enterprise value is the sum of the invested capital and the present value of the expected EVA.

2. Fixed growth model

The enterprise's EVA grows at a fixed growth rate g, as shown in picture 2.

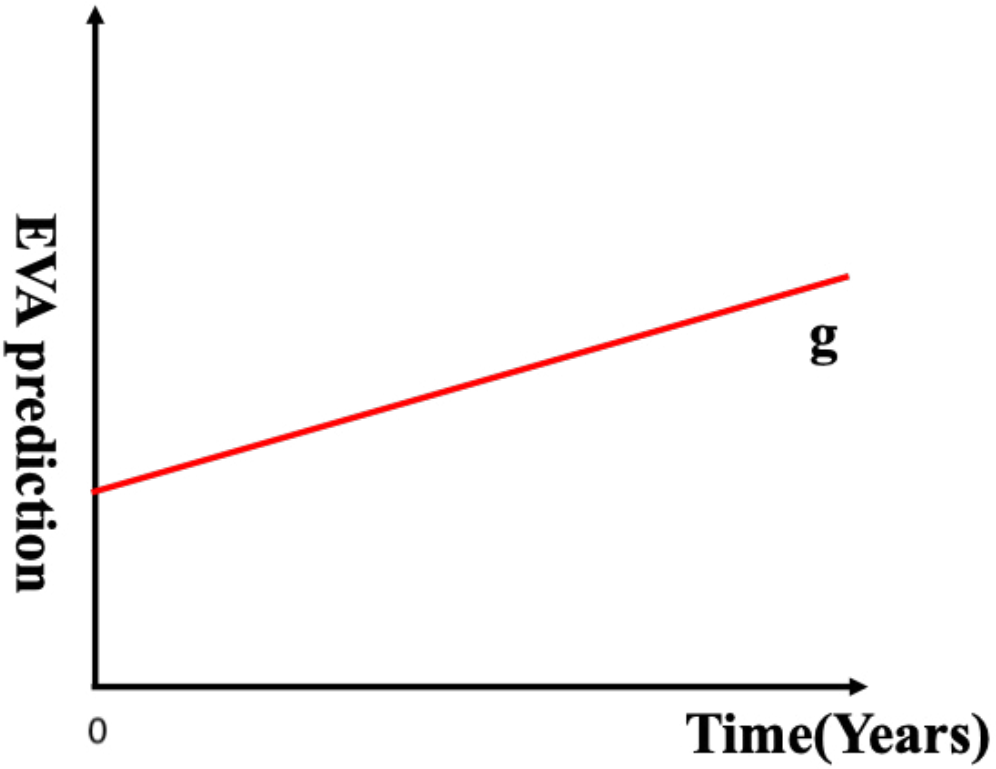

Figure 2 EVA fixed growth model

$$EVA_i = (1+g)^{n-1} EVA_1 \quad (4)$$

$$enterprise\ value = I + \sum_{i=1}^{n} \frac{EVA_i}{(1+r)^i} \quad (5)$$

Among them, g is a fixed growth rate.

2.2.1. TWO-STAGE GROWTH MODEL

The two-stage growth model includes the stage of rapid increase of enterprise value in the early stage and the stage of gradual stability in the later stage. According to the long-term competition equilibrium theory of the market, the company's enterprise value cannot maintain the trend of rapid growth in the early stage because its peers will enter the market one after another. Until the average value of EVA gets closer and closer to 0. The enterprise value is the sum of the capital sum and the present value of EVA during the period of continuous n-year extraordinary growth and the present value of EVA during the later period of continuous annual extraordinary growth. The specific calculation process is as follows:

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$$\text{enterprise value} = I + \sum_{i=1}^{n} \frac{EVA_i}{(1+r)^i} + \frac{EVA_i(1+g)^n}{r(1+r)^n} \quad (6)$$

This paper introduces the theoretical system of EVA enterprise value evaluation, clarifies the essence of economic value-added EVA, the calculation of the EVA model, the adjustment principle of relevant accounting items and the premise of its application. Enterprises are different from other resources. First of all, the recycling of waste in high-polluting enterprises must be a profitable behavior established within the scope of certain laws and regulations, and it is an organic combination of various elements that constitute the utilization of high-polluting waste. At the same time, according to the changes in the environment in the reuse of resources, the measures for waste disposal should be adjusted appropriately, to continue to make profits and bring benefits to the shareholders of the company. The evaluation of enterprise value through EVA is not only to consider the total value of enterprise assets, but also to analyze and evaluate all its assets and profitability from the perspective of the enterprise as a whole, and to evaluate the value of the enterprise as a whole.

Therefore, the accurate evaluation of enterprise value can provide investors with efficient investment decisions, and can also help enterprise managers to clarify the current value of enterprise nation and the impact of various investment, financing, operation and distribution decisions on enterprise nation value, and then formulate corresponding enterprises. Strategic planning to enhance corporate value creation capabilities.

3. ANALYSIS AND DISCUSSION OF EVA MODEL RESULTS

3.1. EVA TRENDS

At present, China's economy is developing rapidly, and the overall economic field is showing a trend of rapid growth. However, while the national economy has achieved greater improvement, the pollution of the ecological environment has gradually emerged. Therefore, in conjunction with economic development, the protection of the ecological environment has been put on the agenda. With the destruction of the ecological environment and natural disasters all over the world, countries have gradually realized the seriousness of the situation and have introduced relevant governance and protection measures. To balance the contradictory relationship between economic development and environmental protection, China has put forward the development concept of "prioritizing ecological protection and developing circular economy". Among them, the viewpoints of green ecological development and sustainable development are considered to be the main directions and goals for the simultaneous development of China's economy and environment in the future.

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In the effective implementation measures, we gradually distribute the research focus to all aspects and details of the economy and the environment. However, the utilization of waste in high-polluting enterprises involves the relationship and trade-off between the two, so it is feasible and meaningful to analyze it based on the ecological environment and economy. Therefore, this section aims at the management and assumption of rational utilization of wastes produced by a large number of highly polluting enterprises. And focus on the research on the economic impact of rational utilization of waste.

In addition, to link the utilization of waste produced by high-polluting enterprises and the changes in economic values, we selected the method of Economic Value Added Evaluation (EVA). The data results obtained by the EVA evaluation method can provide a comprehensive and sufficient basis for the complex relationship between shareholders and enterprises, such as constraints, cooperation, and games. Since shareholders' investment in polluting companies requires comprehensive investment factors such as comprehensive costs, short-term returns, and long-term development. In the case of simplified analysis, considering that the EVA evaluation value is positive, the investment income produced by the target enterprise invested by shareholders will be greater than the cost. And when the cost of equity and debt are taken into account, the income for shareholders can be obtained from the profits other than investment costs.

First, we select some enterprises as experimental companies to conduct a comprehensive analysis of EVA based on input and expenditure. Starting from the changes and fluctuations of corporate financial indicators, we compare and analyze the historical financial indicators of randomly selected enterprises with pollution characteristics and the financial indicators of the industry to which they belong. The reasons for the difference and the influencing factors are analyzed, and these factors are summarized and analyzed to obtain the EVA evaluation value level of the enterprise in the industry and the directional development trend and direction of the difference. When the amount of data is large enough, a regression model can be obtained to achieve predictions based on past data. Analyze and evaluate the profitability, debt repayment, operation and development capabilities of enterprises with pollution characteristics, so that the management and investors can have a deeper understanding of the financial status and operating results of the enterprise, which is more conducive to accurate and reasonable judgment of the evaluation results more objective and true reflection of corporate value. In Table 1, we summarize the financial indicators of basic operating items for some enterprises with pollution characteristics. It was observed that the group of enterprises that did not carry out the recycling and utilization of polluting waste had a good financial trend in the period from 2017 to 2019. The average income per share, net income per share, and total income growth rate of each enterprise in this group were as follows: 76.19%, 15.05% and 9.35%. There are slight fluctuations in net income, which is within the normal income range. During the period from 2019 to 2021, it was observed that the average income per share, net income per share, and total income of each company

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in this group decreased by 32.43%, 10.28% and 32.73% respectively. This is partly due to energy conservation and emission reduction. A series of policies and indicators such as pollution emissions limit the effect. However, the lack of polluting waste recycling processes and design is also one of the reasons for the declining economic benefits of various enterprises.

Table 1. Financial indicators of basic operation projects of high-polluting enterprises

Evaluation indicators	2017	2018	2019	2020	2021
Income per share (yuan/ share)	0.21	0.35	0.37	0.32	0.25
Net income per share (yuan/share)	3.72	4.21	4.28	4.02	3.84
Total income (ten thousand yuan)	27015.83	24382.09	29542.17	21530.04	19872.88
Net income (ten thousand yuan)	2964.3	-257.6	-643.1	-1282.2	-1352.4

Subsequently, we conducted supervised learning on the process of comprehensive evaluation of EVA based on some selected enterprises as training data. The trained model is used to further correct the EVA number of existing enterprises that do not recycle polluted waste, and it is also used to predict the EVA number of enterprises that recycle polluted waste. In this section, we will compare the comprehensive evaluation results of EVA brought about by these two different development methods, and use the difference between the two results to evaluate the necessity and prospect of establishing a polluting waste recycling system. Among them, the comparison results of EVA numbers from 2017 to 2021 between companies that did and did not recycle polluted waste are shown in Figure 3. It was observed that from 2017 to 2019, all companies in the industry had a certain degree of sag trend. , but from the numerical analysis, the change rate of the EVA evaluation value is maintained between 5% and 7%. Therefore, it can be regarded as normal industry or market fluctuations. During the period from 2019 to 2020, it was observed that the EVA number of enterprises that did not recycle polluted wastes decreased by 58.25%, and the value of the EVA change rate during 2021 even reached -2.65%. On the contrary, the EVA number of enterprises that have carried out a certain degree and frequency of polluting waste recycling will only decrease by 37.43% from 2019 to 2020. During 2021, the change rate of EVA will reach 4.27%, an increase of 6.92% year-on-year for companies that do not recycle polluting waste. Therefore, through the development trend of the rate of change of the EVA evaluation value over time, companies involved in the large-scale discharge of polluting waste in recent years should update their technology promptly, and take the recycling and reuse of polluted waste as another main way of enterprise development, which can make Chemical and energy companies with traditional pollution emissions will get more stable economic benefits in 2022 when the economy is depressed.

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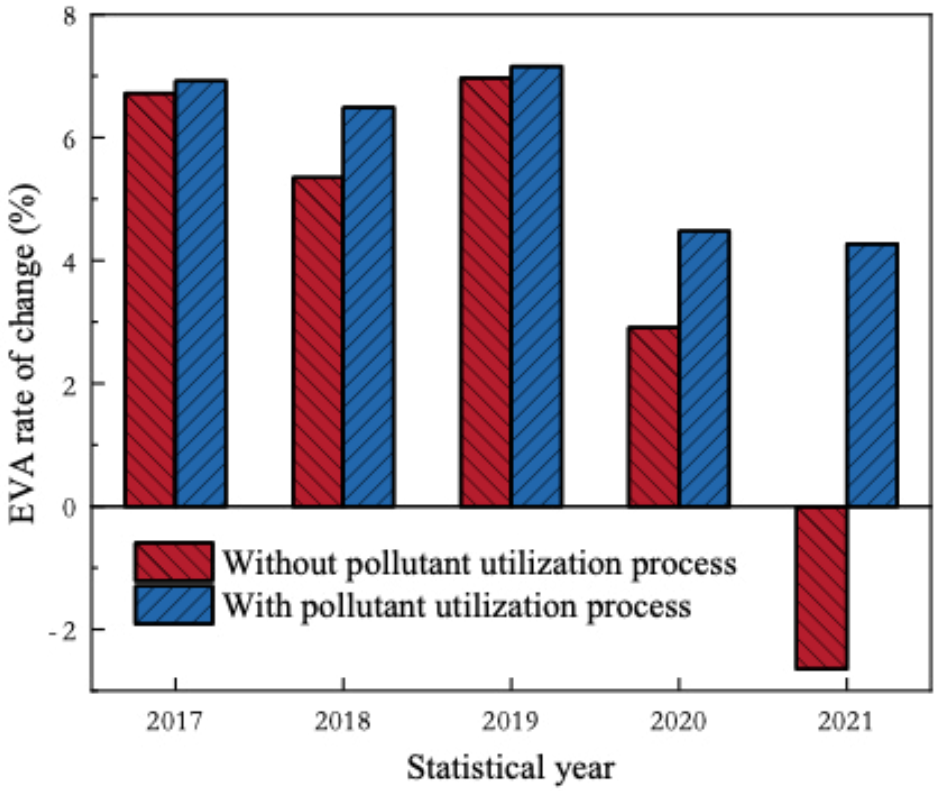

Figure 3. Changes in EVA change rate over time for companies with and without polluting waste recycling

3.2. TRENDS IN ANNUAL CORPORATE EARNINGS

Finally, we will compare the annual net income results of these two different development methods, which can evaluate the economics and profitability of establishing a polluting waste recycling system. The comparison results of the average annual income change rate from 2017 to 2021 for companies that did and did not recycle polluted waste are shown in Figure 4. It is observed that the change rate of the EVA assessment value during the period from 2017 to 2019 is similar to that in Figure 3. Consider normal industry or market volatility. During the period from 2019 to 2020, the annual income change rate of companies that did not recycle polluting wastes showed a huge drop, reaching 68.56%. However, the annual rate of change in earnings of enterprises that have already carried out polluting waste recycling decreased by only 32.28%. Therefore, the results show that the technology of recycling and reusing polluting wastes can enable enterprises involved in the large-scale discharge of polluting wastes in recent years to gain the upper hand in green ecology and sustainable development and obtain more stability in economic fluctuations means to reduce the volatility of its returns.

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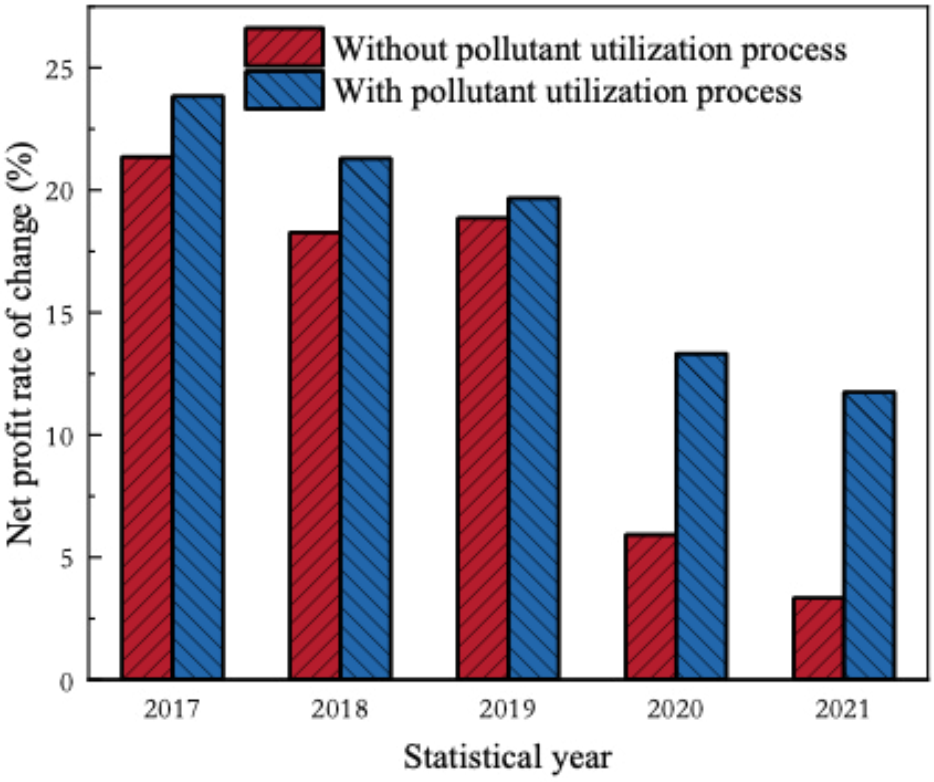

Figure 4. Changes in the annual income change rate of enterprises with and without polluting waste recycling over time

4. CONCLUSION

At present, China's economy is developing rapidly, and the overall economic field is showing a trend of rapid growth. But at the same time, the pollution of the ecological environment began to appear gradually. The utilization of polluting wastes involves a trade-off between the two, so we choose the Economic Value Added Evaluation (EVA) method to analyze and predict the relationship between the two. The first conclusion is as follows:

1. It was observed that during the period from 2019 to 2021, in the group of enterprises that did not carry out the recycling and utilization of polluted waste, it was observed that the average income per share, net income per share, and total income of each enterprise in this group decreased by 32.43%, respectively 10.28% and 32.73%, which to a certain extent are limited by a series of policies and indicators such as energy conservation, emission reduction, and pollution discharge. However, the lack of polluting waste recycling processes and design is also one of the reasons for the continuous decline of the economic benefits of various enterprises;

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2. During the period from 2019 to 2020, it was observed that the EVA number of enterprises that did not recycle polluted wastes decreased by 58.25%, and the value of the EVA change rate during 2021 even reached -2.65%. On the contrary, the EVA number of enterprises that have carried out a certain degree and frequency of polluting waste recycling will only decrease by 37.43% from 2019 to 2020. During 2021, the change rate of EVA will reach 4.27%, which is a year-on-year increase of 6.92% for companies that do not recycle polluting waste;

3. From 2019 to 2020, the annual income change rate of enterprises that did not recycle polluting wastes showed a huge drop, reaching 68.56%. However, the annual rate of change in earnings of enterprises that have already carried out polluting waste recycling decreased by only 32.28%. Therefore, the results show that the technology of recycling and reusing polluting wastes can enable enterprises involved in the large-scale discharge of polluting wastes in recent years to gain the upper hand in green ecology and sustainable development and obtain more stability in economic fluctuations means to reduce the volatility of its returns.

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