Investment and Analysis of China's New Energy Industry Chain

Dingkun Guo

Luoyang NO.1 Senior High School, Luoyang, 471000, China

garyguo14@gmail.com

Abstract. The aim of this paper is to provide an intricate analysis of investment prospects within China's emerging clean energy sector using the Capital Asset Pricing Model (CAPM). Initially, the paper delves into the background, objective, and current state of China's clean energy industry. It then offers a comprehensive explanation of the CAPM model, elucidating its theoretical foundation and underlying assumptions. Key concepts such as the risk-free rate, beta coefficient, and market risk premium are clarified. In subsequent sections, the paper describes the data collection methods employed by the research institute and justifies the selection of sample companies.Moving on to the results section, the paper presents an evaluation of investment prospects by utilizing the beta coefficient as a pivotal determinant. The analysis takes into consideration pertinent factors like performance, growth potential, and financial stability, empowering investors to make well-informed decisions. Building upon the research findings, the paper concludes by providing comprehensive insights and recommendations for investment in China's clean energy sector. Furthermore, the paper substantiates its conclusions by citing relevant references, thereby establishing the credibility and validity of the findings.Ultimately, this study enhances our understanding and assessment of the investment potential within China's clean energy industry. By promoting sustainable development within this sector, this research contributes to China's broader objective of attaining long-term environmental and economic sustainability.

Keywords: New energy industry; Investment; Finance; risk.

1. Introduction

In the context of global sustainable development, the new energy industry has gained significant attention and support as a clean and renewable source of energy. Renewable energy refers to the sustainable and continuously replenished energy sources found in nature that are not derived from fossil fuels. These energy sources have the ability to regenerate and be utilized indefinitely, while remaining environmentally friendly and readily available. Renewable energy encompasses various forms such as hydropower, solar energy, wind energy, biomass energy, geothermal energy, and tidal energy. In recent times, the development of renewable energy has witnessed significant progress on a global scale. The market application and industry of certain renewable energy technologies, such as photovoltaic generation and wind power, have been experiencing annual growth rates exceeding 20%. Renewable energy has emerged as a crucial alternative for achieving energy diversification, addressing climate change concerns, and promoting sustainable development. Particularly in the last couple of years, the volatile fluctuations in global oil prices, coupled with the significance of the Kyoto Protocol, have propelled renewable energy into the limelight, attracting increased attention from numerous countries.[1]. In recent times, the scale of the new energy sector's assets and liabilities has experienced rapid growth. Thanks to the government's backing, the new energy industry has successfully accomplished an ambitious expansion strategy [2]. By the end of 2012, there were a surplus of 627 emerging energy industry companies, employing 46,800 individuals in this field, observing a growth of 3.31%. The total value of operational assets reaches 653.962 billion yuan, indicating an increase of 14.25%, while the overall debt stood at 435.001 billion yuan, experiencing a rise of 10.65% [3]. China, being one of the largest new energy markets in the world, has emerged as a crucial driver and participant in the global new energy industry. The Chinese authorities have introduced a range of policy initiatives to bolster the development of the new energy sector, acknowledging its significance in promoting economic transformation and advancement [4]. However, investors face the challenge of making scientifically and effective investment decisions in

the vast new energy industry chain. From an investor's perspective, determining investment strategies and goals in China's new energy industry chain is a crucial matter [5]. Investors must have a comprehensive understanding of the risk and return characteristics in order to make wise investment choices. Therefore, the objective of this research is to explore the investment scenario within China's emerging renewable energy sector, ultimately offering evidence-based investment insights employing the Capital Asset Pricing Model (CAPM). This study holds immense theoretical and practical significance. Firstly, a thorough analysis of investments in China's new energy industry chain can offer investors with scientific and reliable investment guidance, enabling them to mitigate risks and maximize returns. Secondly, the research findings can serve as a foundation for policy makers, assisting them in making informed decisions and fostering the sustainable development of China's new energy industry chain. Lastly, by extensively reviewing and referencing pertinent literature both domestically and internationally, this study can bridge the gap in relevant research areas and introduce fresh perspectives and ideas for academic and practical research in this domain. This study will adopt the following steps to achieve the research objectives: the first step is to collect and organize relevant data and information on China's new energy industry chain, and comprehensively sort out and analyze its development situation. The second step is to introduce the theoretical basis of the CAPM model, including an overview of the capital asset pricing model, basic assumptions, and methods for investment analysis using the CAPM model. The third step is to select suitable sample enterprises and calculate their beta coefficients to evaluate their risk characteristics in the new energy industry chain. Step 4: Based on beta coefficients and other relevant data, construct a reasonable investment portfolio to balance risk and return, and provide scientific investment advice and decision support.

2. Methods

2.1. Theoretical Basis of CAPM Model Data

Sharpe and Lintner were the pioneers of the Capital Asset Pricing Model (CAPM), which ultimately led to Sharpe's prestigious Nobel Prize achievement in 1990. This model builds upon the earlier advancements made by Markowitz in the field of portfolio choice, known as the mean-variance model [6]. The model is employed to ascertain the theoretically suitable expected return rate of an asset, consequently enabling firms to make projections about the anticipated cash flows and, in turn, estimate the potential price.

Where market Beta:

$$\beta iM = COV\ (Ri\ RM) \quad \sigma^2\ (RM) \tag{1}$$

In the Sharpe-Lintner CAPM equation, the expected return on asset i, E(Ri), is determined by its market beta, which represents how sensitive the asset is to changes in the market return. Beta is calculated by dividing the covariance of the asset return with the market return by the variance of the market return. The equation also takes into account the risk-free rate of return, Rf, and the market return, RM. According to this equation, the expected return on an asset is equal to the risk-free rate of return, RF, plus a premium for taking on risk. This premium includes the market risk premium, which is the anticipated market return, E(RM), subtracted by the risk-free interest rate, RF, and multiplied by the asset's market beta, i. In simpler terms, the projected return on any asset i can be calculated by adding the risk-free interest rate, RF, to a risk premium determined by the asset's market beta, iM, multiplied by the premium for each unit of beta risk, E(RM) - RF. Markowitz introduced an analytical approach that centers on maximizing expected utility and put forward a comprehensive solution for the portfolio selection problem. Sharpe (1964), on the other hand, presents a framework that captures the behavior of individual investors in the face of risk. By introducing a range of indifference curves, Sharpe illustrates the preference of investors, where greater utility is achieved as we move upwards. This framework additionally establishes balance conditions for the capital market and deduces the capital market line [5]. The beta coefficient mainly reflects the performance of a certain investment phenomenon on the market coefficient. The higher the absolute value of the beta

coefficient, the more significant the shift in return compared to the market coefficient. Conversely, the lower the absolute value of the beta coefficient, the less prominent the extent of its alteration relative to the market coefficient. Through the calculation of the beta coefficient, investors can assess the level of market risk associated with an individual security or a collection of securities, thereby enhancing their comprehension of investment market patterns and minimizing exposure to investment hazards [7].

3. Data

3.1. Data Collection

This article mainly obtains relevant data on China's new energy industry chain by referencing a wide range of sources such as reputable literature, academic papers, industry reports, and professional databases. In addition, to ensure a comprehensive analysis, Yahoo Finance will also be utilized to obtain stock prices, market indices, and other economic data related to the research topic.

3.2. Data Analysis

Upon acquiring the data, the first step is to thoroughly organize and verify its accuracy and authenticity. Following this, the article will proceed to calculate the beta coefficient of each enterprise data obtained based on the Capital Asset Pricing Model (CAPM). This calculation will enable analysis of the risk index associated with each enterprise. Finally, a comprehensive analysis will be conducted on the investment portfolio based on all acquired data.

3.3. Data Acquisition Approaches

The primary sources for this study consist of publicly-available financial data and industry reports. These include essential statistics such as stock price data, market index data, and financial data of related companies in the Chinese securities market. These data can easily be accessed through specialized financial databases such as Dongfang Wealth and Snowball, as well as through official regulatory agency websites.

3.4. Introduction to Sample Enterprises

3.4.1 BYD

BYD has firmly established itself as a pioneering enterprise that predominantly specializes in cutting-edge new energy vehicles. Renowned for its impeccable product quality and unrivaled technical prowess, the company has not only cemented its dominance in the domestic market but has positioned itself as a trailblazer and industry leader. BYDBYD's relentless commitment to innovation and environmentally-friendly transportation solutions has propelled it to the forefront of the new energy vehicle revolution in China, earning it widespread recognition and acclaim both within the industry and among consumers. With a deep-rooted understanding of the changing dynamics of the automotive sector and a steadfast dedication to sustainable mobility, BYDBYD continues to push boundaries, setting unprecedented benchmarks for excellence and serving as an exemplar for the broader industry to emulate [8]. The figure1 shows the beta coefficient of BYD.

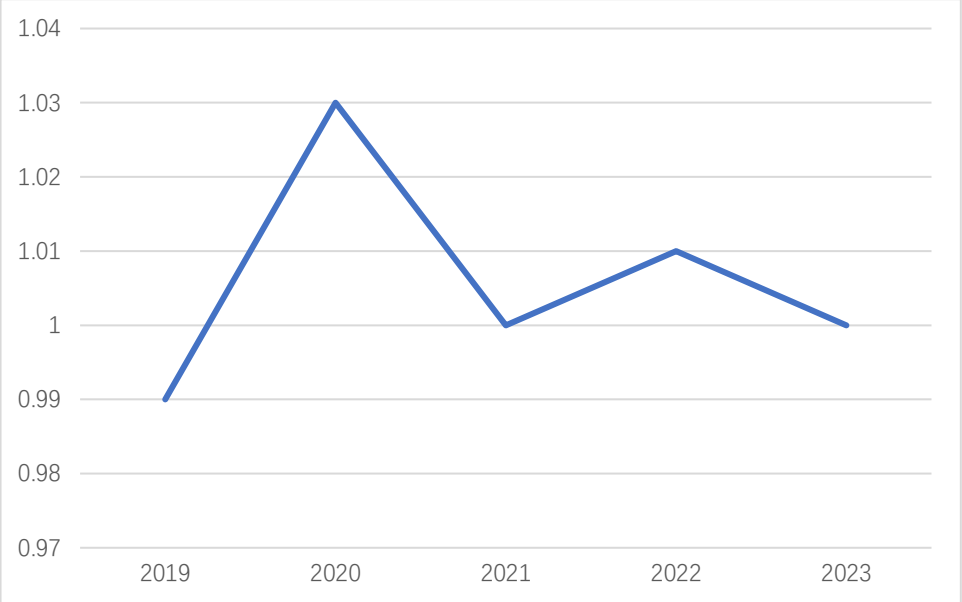

Fig. 1 Beta ratio of BYD

3.4.2 Huadian Energy

Huadian Energy, known as one of the five state-owned sole proprietorship power generation enterprise groups in China, has successfully established its position as a prominent leader in the power generation sector. With the aim of embracing the opportunities offered by the reform of China's national power system, this company has emerged as a crucial player in the energy industry. Having made remarkable progress, Huadian Energy currently holds an impressive ranking of 368th among the prestigious Fortune 500 companies. This achievement not only reflects its strong financial performance but also demonstrates its influence and significance in the global market. At the core of its operations, Huadian Energy focuses on power generation, a critical sector that fuels the country's economic growth and development. With a commitment to supplying reliable and sustainable energy, the company employs advanced technologies and innovative practices to optimize its power generation capacity. Through continuous research and development efforts, Huadian Energy has successfully diversified its power generation portfolio, enabling it to tap into various sources of energy. Ranging from traditional fossil fuels to renewable resources such as wind, solar, and hydropower, the company strives to strike a balance between meeting the increasing energy demands and promoting environmental sustainability. Expanding its reach beyond domestic borders, Huadian Energy has established a strong presence in international markets. Leveraging its extensive experience and expertise, the company has undertaken power generation projects in countries across Asia, Africa, and the Americas. By sharing its knowledge and collaborating with local partners, Huadian Energy contributes to the development and growth of energy infrastructure globally. Furthermore, as a responsible corporate citizen, Huadian Energy prioritizes social and environmental responsibility. It actively engages in community development programs, emphasizing education, healthcare, and poverty alleviation initiatives. By investing in sustainable practices and reducing its carbon footprint, the company demonstrates its commitment to supporting the global transition to clean and renewable energy sources.In conclusion, Huadian Energy's remarkable success as a key player in the power generation sector is evident through its high-ranking position among the Fortune 500 companies. With an unwavering focus on technological advancements, diversification of energy sources, and global expansion, the company continues to solidify its standing as a leader in the energy industry while actively contributing to a sustainable future [9]. The figure2 shows the beta coefficient of Huadian Energy.

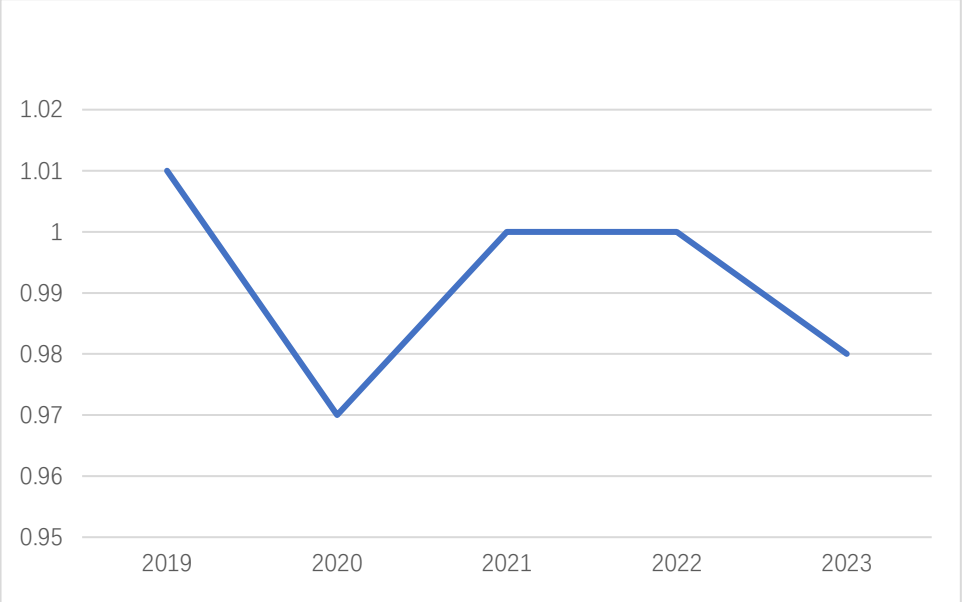

Fig. 2 Beta ratio of Huadian Energy

3.4.3 CATL

Founded in 2011 and headquartered in Fujian, China, CATL is widely recognized for its advanced power and energy storage battery technology. The company's comprehensive industry capabilities encompass various aspects such as research and development, manufacturing, materials, battery cells, battery systems, as well as battery recycling and secondary utilization in the field of energy storage [10]. In Figure 3, the beta coefficient of CATL is depicted.

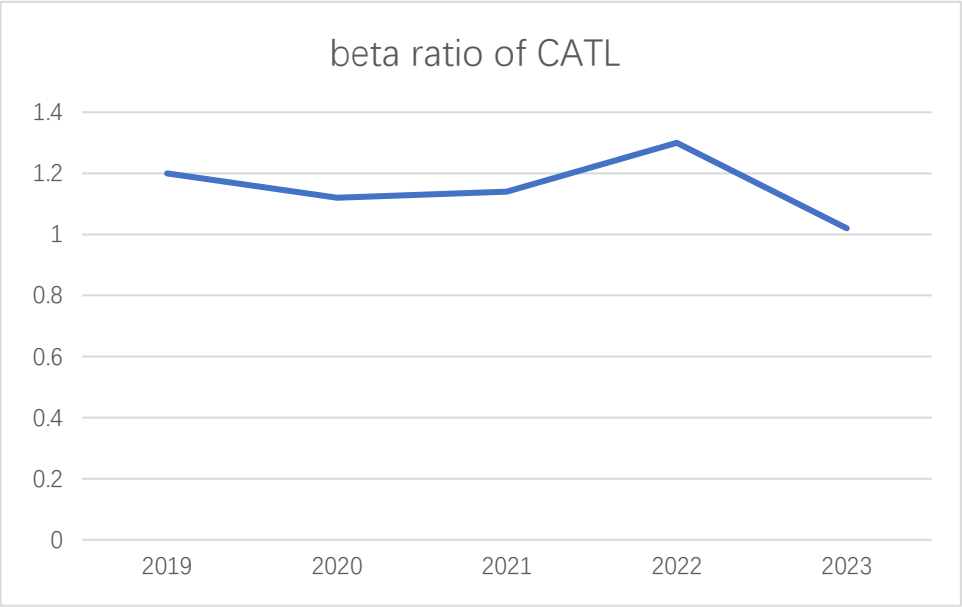

Fig. 3 Beta ratio of CATL

3.5. Time Span

The data collection time span of this study is the past five years, starting from 2019 and ending in 2023. This extended time frame was chosen to provide a comprehensive understanding of the performance and changes in the sample enterprises across different market environments, ensuring the stability and reliability of the obtained data. By observing the enterprises over a longer period, a more accurate analysis can be conducted, capturing any fluctuations or trends that may have occurred.

4. Results

By conducting a comprehensive and in-depth analysis of the financial data of the sample enterprises, several significant and noteworthy conclusions can be drawn. Firstly, BYD, a leading player in the automotive industry, has consistently displayed strong and stable financial development over the past five years. Its operating revenue and net profit have exhibited a continuous and positive growth trajectory, illustrating the company's exceptional performance and profitability. Moreover, the total assets and net assets of BYD have steadily increased, indicating the company's robust asset size and financial strength.In contrast, China Huadian, a prominent player in the energy sector, has experienced fluctuating financial conditions throughout the same time period. Despite some annual variations in its operating income and net profit, an overall growth trend can still be observed. This resilience and adaptability showcased by China Huadian reflects the company's ability to navigate through challenges and maintain its position in the market.

On the other hand, CATL, a leading energy storage solutions provider, has achieved remarkable financial growth over the past five years, particularly in its operating revenue and net profit. These indicators have shown a rapid and significant upward trend, showcasing the successful expansion of CATL's business in the energy storage sector. Moreover, CATL's total assets and net assets have also experienced substantial growth, further highlighting the company's strong financial position and stability.Overall, the findings of this comprehensive study provide valuable insights into the varying and dynamic financial situations of the sample enterprises. While BYD has consistently maintained a stable and profitable performance, China Huadian has exhibited resilience in the face of fluctuations, and CATL has enjoyed remarkable growth in the energy storage field. These insights contribute to a comprehensive understanding of the market dynamics and performance trends of the sample enterprises within the given time frame. They can serve as a valuable reference for potential investors, industry experts, and stakeholders in evaluating the financial health and potential of these key players.

5. Conclusion

The primary goal of this study is to conduct an extensive examination of the investment in China's emerging energy industry chain and employ the CAPM model for correlated research purposes. Through the collection and organization of pertinent data on China's new energy industry chain, a combination with the CAPM model is proposed, resulting in the selection of BYD, Huadian Energy, and CATL as representative enterprises for the calculation of their beta coefficients. Moreover, an evaluation of their risk characteristics in the new energy industry chain will be conducted, with the ultimate aim of providing valuable decision-making support and investment suggestions in China's new energy industry chain. Based on industry reports and relevant data analysis, the following conclusion can be drawn: the overall development trend of China's new energy industry chain is showing a good trend. Under the support of government policies and driven by market demand, enterprises in all aspects of the new energy industry chain have achieved a certain degree of development. Especially in the fields of solar energy and electricity, their technological level and market share are constantly improving. The market scale of the new energy industry chain is continuously enlarging. Along with the growing international requests for sustainable energy and the enhancement of environmental consciousness, the new energy market in China is displaying a swift upward trend. Technological innovation plays a crucial role in the new energy industry chain. Enterprises in the new energy field need to continuously strengthen their research and development capabilities, promote technological innovation, and meet the market's demand for efficient, reliable, and environmentally friendly energy equipment and solutions. However, there are still certain deficiencies in this study. For instance, the duration of the study is comparatively limited, leading to an incomplete portrayal of the long-range performance and evolving patterns of the sampled companies and the entire Chinese new energy industry continuum. Meanwhile, this study did not consider the impact of macroeconomic environment, policy factors, and market competition.

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