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The Impact of Economic Systems and Financial Systems on New Energy Vehicle Industry

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Abstract: In the contemporary world, energy security and environmental protection are issues of significant concern for governments and citizens alike. New energy vehicles (NEVs) offer solutions to both of these pressing challenges. Hence, their development and innovation status are particularly noteworthy. The purpose of this paper is to compare the impacts of different economic systems and financial systems in the United States and China on the innovation and improvement of the NEV industry. Furthermore, the conclusions will be extended to a broader range of industries to delve to the relevance between institutions and technological innovation. This paper mainly compares the influence of economic systems on business activities, the differences in government policies under different systems, and the impact of financial systems on corporate financing and listing. It finds that the most suitable environment for the development of technology innovation industries is an open market economy and a sound economic system.

Keywords: economic systems, financial systems, new energy vehicle industry, corporate innovation

1. Introduction

The economic system of a country, influenced by market mechanisms and government intervention, affects resource allocation, while the financial system impacts corporate financing and risk. Consequently, both play a significant role in corporate innovation activities. In the United States, a free-market system is implemented, while China has adopted a socialist market economy since 1992. The financial market in the United States plays a significant role, and the concentration of banks is relatively low. This type of financial system is referred to as a market-dominant financial system. In China's financial institutions, state-owned banks hold a dominant position, constituting a bank-dominant financial system. It is evident that there are vast differences between the two countries' economic systems and financial systems.

For a long time, the impact of different economic systems and financial systems on enterprise innovation has been extensively discussed. Existing research shows that trade liberalization helps expand market size, and a lower level of government intervention means that the market has a more significant impact in resource allocation, promoting enterprise competition and innovation by improving production efficiency and resource allocation efficiency through market mechanisms [1,2]. Moreover, when a country's technology is remote from the world frontier, government financial support can promote enterprises to increase investment, imitate or introduce technology.

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However, if the government continues to implement anti-competitive policies and existing enterprises choose to retain profits to avoid competition, this may lead to a non-convergence trap [3].

Financial development promotes economic convergence by increasing the efficiency of capital mobility and technology transfer. The development of financial markets helps to allocate resources more effectively in the economy, thereby increasing productivity and expanding production scale. The stock market provides a flexible financing channel for enterprises, enabling them to raise funds more easily to support R&D and innovation activities; the stock market also helps to diversify risks, providing investors with more choices for investing in innovative projects [4,5]. In well-funded, popular investment markets, investors are more willing to experiment, thus investing in more innovative and risky projects [6].

In summary, due to the unpredictability of technological innovation, resources can be allocated freely to the greatest extent in a free market and market-oriented financial system, and enterprises can obtain funds through risk investments in the stock market, enabling exploration and potential innovation. Government policy support can expand the scale of an industry and increase investment, but excessive intervention may backfire, preventing the industry from developing independently, achieving market competition, and reaching the technological frontier.

Amidst the growing environmental pressures and unstable political situations of the present day, the pursuit of eco-friendly and sustainable alternative transportation has become a top priority for governments and citizens worldwide. In this context, this discussion will examine the influence of varying economic systems and financial structures on the innovative growth of the NEV industry.

Currently, both the United States and China offer policy support for this industry by utilizing financial incentives like subsidies and tax benefits, which can reduce the cost of electric vehicles, enhance their competitiveness, and subsequently encourage the growth of the electric vehicle market. Secondly, government subsidies can stimulate enterprises to boost their capital expenditure and alleviate financing constraints when enterprises cannot recover funds during R&D [7-10]. In addition, government subsidies are seen as government recognition, which can enhance the reputation of enterprises in the market and attract more investment [11]. Existing research suggests that policy support has a threshold effect in the NEV industry, and governments need to further implement high-intensity policies [12]. However, empirical research indicate that China's subsidies promote the volume of technological innovation in the NEV sector, but they do not significantly impact the quality of these innovations [11].

The objective of this paper is to research the roles that economic systems and financial structures have played in the evolution of the NEV industry, and to draw lessons from these experiences in order to provide valuable insights for the advancement of technology innovation industries, including the new energy vehicle sector.

2. Case Study of NEV Industry in US and China

2.1. The Evolution of NEV

Nowadays, NEVs are regarded as cutting-edge products and the direction for future development. However, as early as the 1920s and 1930s, inventors from various countries designed and manufactured early electric vehicles. Over the following half-century, electric vehicle technology advanced, offering practicality and capturing a certain market share. People chose electric vehicles for their quietness, zero emissions, and ease of operation. As transportation evolved and road construction flourished, the disadvantage of electric vehicles' limited range made it impossible for people to drive them to more distant locations. Coupled with the development of petroleum resources, advances in internal combustion engine technology, and the market impact of the

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affordable mass-produced Ford Model T between 1908 and 1927, electric vehicles were gradually replaced by gasoline vehicles. They eventually disappeared from public view in the 1930s, and research and development on electric vehicles came to a standstill.[1]

In 1943, smog plagued California, particularly the Los Angeles area, endangering people's lives and health. It wasn't until the 1950s that Professor Arie Jan Haagen-Smit of the California Institute of Technology pointed out that vehicle emissions were the primary culprit for air pollution, an opinion widely accepted by the scientific community. The issue of pollution from gasoline vehicle emissions was officially put on the agenda.[2] In the following decades, air pollution in industrialized countries worsened, and environmental issues received increasing attention, laying the groundwork for further evolution of NEVs.

In the 1970s, three oil crises erupted, causing global oil prices to fluctuate dramatically. Governments began to focus on energy security and diversified energy supply. Advocates argued that oil, as a finite and non-renewable resource, would gradually decrease in reserves due to human consumption, eventually leading to depletion. Although this argument was controversial, it raised concerns about energy issues, prompting renewed interest in new energy vehicles. During this period, many American car manufacturers began developing alternative fuel vehicles, including electric vehicles. Hindered by technological bottlenecks, these vehicles performed poorly and had flaws. At the close of the 20th century, the United States underwent a period of significant economic growth. With the improvement of the national economy, more people entered the middle class, and oil prices remained relatively low, so consumers did not need to worry about saving on refueling costs and even favored high fuel consumption vehicles. New energy vehicles in the United States faced a cold market. Nevertheless, scientists and engineers continued to work on improving electric vehicles and battery technology. At the turn of the twenty-first century, China achieved a series of research results on electric buses,[3] officially announcing its entry into the competition in the field of NEVs.

Technological breakthroughs and market prosperity for NEVs occurred in this century. In 2006, Silicon Valley start-up Tesla Motors (later Tesla, Inc.) announced that it would begin producing luxury electric sports cars capable of traveling more than 200 miles (approximately 321 kilometers) on a single charge, with technological breakthroughs stemming from the use of lithium-ion batteries. In the early twenty-first century, particularly after joining the World Trade Organization, China's economy achieved rapid growth, leading to technological advances and industrial structure upgrades. Although China's traditional automotive industry lagged behind developed countries, the improvement of the NEV industry coincided with China's economic rise [12], and through the support of Chinese government policies and resources, nurtured the internationally influential new energy vehicle brand “BYD” and a group of young innovative automotive enterprises known as “new car-making forces”.

In general, Chinese automakers' technical level, innovation capability, global market share, and brand influence fall short of Tesla’s. However, relying on China's vast market, these local brands have still achieved commercial success.

2.2. Comparisons in Terms of Economic System and Acts

Reviewing modern human history, since the economic reforms and opening up of China, Vietnam, and Laos, as well as the disintegration of the Soviet Union, only a very few countries in the world have continued to implement planned economies. History has proven that market economy is the

1 Source: The History of the Electric Car, https://www.energy.gov/
2 Source: The Road to Zero Emissions, https://ww2.arb.ca.gov/
3 Source: Academician Sun Fengchun and China's Electric Vehicles, https://www.bit.edu.cn/

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most suitable economic system for human society, at least at the current stage. The reasons why countries that originally practiced market economies persist in this system and those that originally practiced planned economies seek to change are closely related to their political systems.

Democratic systems encourage individual freedom, diversity, and competition, values that align with market economies. As a result, competition within the market is more robust, and the dissemination of information and knowledge is more open. In democratic systems, the rule of law is better protected, and clear laws and regulations safeguard private property and property rights, providing a stable environment for economic activities. Under a democratic system, government power is more decentralized and strictly constrained, with more checks and balances and regulatory mechanisms ensuring political stability and reducing the likelihood of excessive government control over economic activities [13]. Furthermore, democratic systems require policymakers to better consider the demands of the public, making government decisions more susceptible to public criticism and feedback, thus rendering policies more equitable and attentive to the rights and interests of all [14]. These factors collectively point to a market economic system, creating a favorable environment for economic development. It is evident that political systems have a decisive role in shaping economic systems.

In the Democracy Index report by The Economist, the United States was rated as a “flawed democracy” with a composite score of 7.85, ranking 30th, while China was rated as an authoritarian regime with a composite score of 1.94, ranking 156th.[4] According to the Index of Economic Freedom published by The Wall Street Journal and The Heritage Foundation, the former scored 70.6, ranking 25th, while the latter scored 48.3, ranking 154th.[5] Additionally, as mentioned earlier, the United States practices a free-market system, while China practices a socialist market economy. Comparing the two sets of reports, the political and economic systems of the United States and China are quite distinct. However, extended policy assistance for the development of NEV industry. Table 1 below briefly lists the important policies and timelines of both governments in promoting the new energy vehicle industry.

Considering the United States' early industrialization and involvement in international trade, as well as its emphasis on environmental preservation and energy challenges, the U.S. government has accelerated the development of the NEV sector. As seen in Section 2.1, the US government leads industry competition and development through policy formulation and provides relevant safeguards and support. The policy support provided by the government, a favorable competitive atmosphere and market environment, and the technical cooperation offered by top universities and research institutions together create an external environment conducive to corporate technological innovation and research and development [15].

In China's economic system, the government holds far more resources than enterprises, thus playing a more significant role. With relatively backward technology, China's initial exposure to the new energy sector was government-led, seeking intergovernmental cooperation and technology transfer. Subsequently, the government frequently introduced a large number of policies, investing substantial funds and resources to encourage new energy vehicle enterprises to conduct technology research and development and corresponding infrastructure construction, promoting industry development. Additionally, it is worth noting that foreign automakers could only enter the Chinese market through joint ventures with local automakers before 2018, but Tesla established a wholly owned subsidiary in China that year. The relaxation of China's foreign automaker access policy allowed Tesla to have a "catfish effect" in the Chinese market. It can be inferred that the Chinese government aims to promote innovation and development of the NEV industry through a combination of market competition and policy support.

4 Source: Democracy Index 2022, https://www.eiu.com/

5 Source: 2023 Index of economic freedom, https://www.heritage.org/

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Table 1: Important policies of the US and China on NEV and environmental protection[6].

	US		China	
NEV	1975 Energy Policy and Conservation Act	Encourage alternative fuels and alternative fuel vehicles, financial support	1992 Sino-US Government Cooperation	Cooperate with the US government, transform technology
	1992 Energy Policy Act	Encourage alternative fuels and alternative fuel transportation, R&D support, financial support	2010 State Council's Decision on Accelerating Strategic Emerging Industries Development	Integrate NEV industry into national strategic development
	2009 American Recovery and Reinvestment Act	$115mn investment in charging infrastructure	2020 NEV Industry Development Plan (2021-2035)	Formulate overall goals and specific tasks
Environmental protection	1955 The Air Pollution Control Act	Fund research for air pollution	2000 PRC Air Pollution Prevention and Control Law	Establish air pollution prevention and control standards
	1990 Amendments to the Clean Air Act of 1970	NAAQS attainment provisions expansion and modification	2021 Action Plan for Carbon Peaking by 2030	Promote non-fossil energy, reduce carbon emissions

2.3. Comparison Between the US and China in Terms of Financial System

Tesla's journey from its inception to success also demonstrates the impact of the financial system on innovative industries. The company was founded in 2003, underwent a Series A financing round in 2004, raising approximately $75 million, with about $67 million coming from investor Elon Musk, who then became the company's chairman. Tesla subsequently held three more financing rounds, raising large sums from various investors and venture capital firms. In 2010, Tesla went public on the NASDAQ, issuing 13.3 million shares of common stock and raising approximately $226 million. It has since carried out multiple secondary public offerings and bond issuances. In addition, Tesla has actively participated in the cryptocurrency market.

6 Source: The History of the Electric Car, https://www.energy.gov/; Evolution of the Clean Air Act, https://www.epa.gov/; State Council's Decision on Accelerating Strategic Emerging Industries Development, http://www.gov.cn/; NEV Industry Development Plan , http://www.mofcom.gov.cn/;PRC Air Pollution Prevention and Control Law, https://www.mee.gov.cn/;Action plan for carbon peaking by 2030, http://www.gov.cn/

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With the help of massive funding, Tesla has been able to implement innovative plans and continuously inject funds into project research and development. The following Figure 1 shows Tesla's research and development investments over the past 5 years.

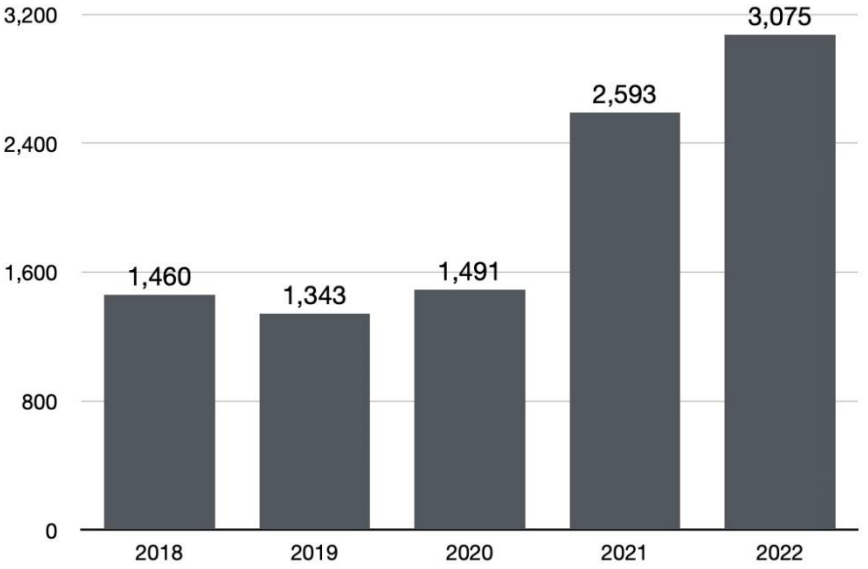

Figure 1: Tesla's R&D investments from 2018 to 2022 ($mn, source: https://www.statista.com/).

Furthermore, the R&D cost per vehicle sold by Tesla in 2021 was $2,984, three times the industry average ($1,000 per vehicle), far exceeding other automakers' R&D investments[7], enabling Tesla to maintain its leading position in electric vehicle technology. In the third quarter of 2022, Tesla's R&D expenditure per vehicle dropped to a historical low of $2,131. Analysts pointed out that Tesla's production of vehicles reached a new high, spreading R&D costs across more vehicles, and lowering the R&D cost per vehicle through economies of scale, which is a positive signal for the company's long-term profitability[8].

Tesla's massive R&D investments have ultimately translated into a series of innovative achievements, such as the 4680 Battery, Plaid Motor, and autonomous driving assistance systems. With the backing of capital, Tesla has conducted disruptive thinking and research and development, positioning itself as a high-end brand and leading the global NEV industry forward [15].

Among China's innovative NEV brands, BYD went public on the Hong Kong main board in 2002. In 2008, the famous American investor Warren Buffett's Berkshire Hathaway Energy Company subscribed to 225 million shares of BYD. In 2011, BYD was multiply listed on the Shenzhen Stock Exchange. The following Figure 2 shows BYD's research and development investments over the past 5 years. As of the end of 2022, the number of R&D personnel in the company has reached 69,697, with a total of over 39,000 patent applications worldwide and more than 27,000 authorized patents[9].

7 Source: Tesla's Spending On R&D Is Higher Than Legacy Auto's – Per Car Sold, https://cleantechnica.com/; Tesla records the highest R&D spend per car sold at $2984, https://stockapps.com/

8 Source: Tesla's Q3 2022 R&D Spend per Car of $2131 Is the Lowest of Any Quarter, https://stockapps.com/

9 Source: Detailed Analysis of BYD Annual Report, https://www.dongchedi.com/

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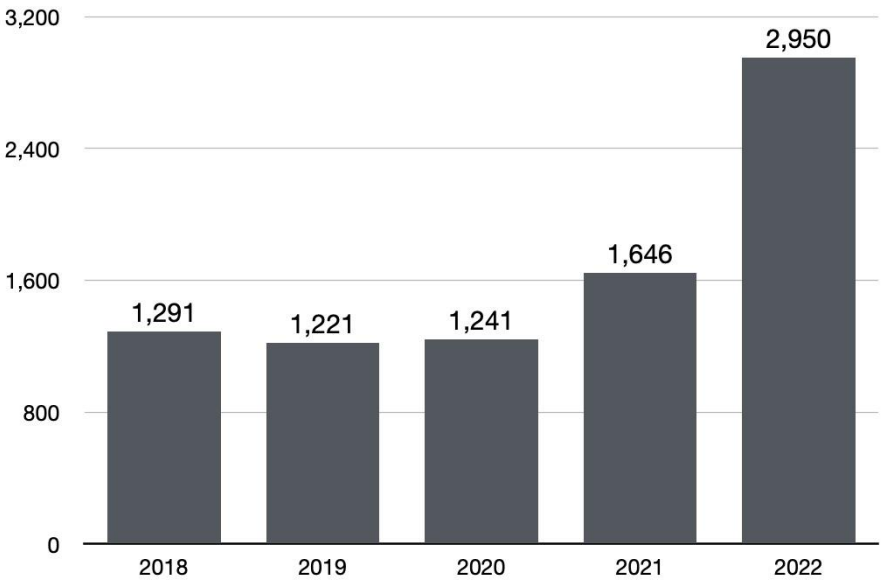

Figure 2: BYD's R&D investments from 2018 to 2022 (MN$, source https://www.statista.com/).

BYD's most eye-catching innovation is the "Blade Battery," which boasts high safety and stability. Its unique integrated structure design incorporates the battery pack as the vehicle's bottom, enhancing the body's strength while reducing weight, thus increasing the driving range. However, the integrated design also brings some inconveniences, such as difficulties in vehicle sealing performance and battery maintenance.

The reason BYD focuses on the innovative structural design of the "Blade Battery" is that it is a lithium iron phosphate battery. In contrast, Tesla's 4680 battery is a ternary lithium battery with better energy density, activity, and overall performance. The latter has higher technical difficulty and production cost[10]. The superiority of the two companies' battery technologies remains to be tested over time.

BYD's technological breakthroughs have also translated into market performance. In 2022, BYD's vehicles accounted for 31.7% of China's NEV sales and 18.31% of the global market share[11].

Apart from BYD, other Chinese new energy vehicle brands have chosen to list on the Hong Kong Stock Exchange or the NASDAQ in the United States. From the choices of Chinese companies, it can be seen that China's domestic stock exchanges lack international visibility, failing to attract international investors or institutions, and making it difficult for listed companies to achieve higher valuations and brand image.

2.4. Discussion and Suggestion

The new energy vehicle industries in both the United States and China have similarly developed in the context of market competition, benefiting from government policy support and raising funds in financial markets. However, the political and economic systems in the United States are more liberal and open than those in China. The U.S. government's policies tend to focus on guidance and assistance, while the Chinese government's policies lean more toward directly promoting industrial

10 Source: Comparison between Blade Battery and Tesla's 4680 Technology, https://libattery.ofweek.com/

11 Source: Ranking of Market Share for New Energy Passenger Vehicle Brands, http://data.cpcaauto.com/; BYD #1 In World In Plugin Vehicle Sales In 2022, https://cleantechnica.com/

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development. The U.S. financial system is more mature, with its securities markets and venture capital more readily available to help enterprises obtain investments.

When extending from the NEV industry to the entire technology innovation industry, it is impossible for a country, no matter how wealthy, to subsidize all industries. Moreover, government leaders and policymakers cannot predict the direction and future trends of technological development. If funds and resources are poured into a single field or project, and if it fails, the national wealth will be wasted, and potentially valuable innovative fields may be missed. Therefore, a free political system, open market economy, and sound financial system are essential conditions for promoting the development of technological innovation. The government may consider providing policy support for innovative industries in their infancy when the market scale is still small, helping them expand, attract investment, and raise awareness.

3. Conclusion

The purpose of this paper is to compare the current economic systems and financial systems in U.S. and China, and to analyze the impact of different systems in both countries on the innovative development of the NEV industry. The analytical conclusions drawn from this industry will be generalized to identify the system that is better suited for technological innovation.

This paper first reviews the existing academic research on economic systems, financial systems, and the NEV industry, along with briefly reviewing the evolution history of NEVs. It then compares the impact of different economic systems on business operations, together with the differences in government policies under the corresponding systems in terms of formulation and implementation. In addition, it compares the influence of different financial systems on corporate listing and financing, as well as issues related to R&D investment and results transformation. The paper concludes that the development of technology innovation industries requires a free political system, an open market economy, and a sound financial system, with timely and appropriate government support yielding beneficial effects.

There are several limitations in this paper. Firstly, it does not examine whether the numerous new energy vehicle companies in the U.S. and Chinese markets receive equal policy support. Secondly, the nature of competition and cooperation between automakers is not discussed. Lastly, the role of Chinese state-owned automobile companies in the domestic market and the impact of government policies on enterprises are not addressed. These series of existing issues can be further investigated in future research by collecting more comprehensive data and employing appropriate theoretical models.

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