

Tax Policy as a Driver of Innovation: A Case Study Analysis of BYD's R&D Growth in China's New Energy Vehicle Industry

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Abstract. Adapting to the tax system is an inevitable requirement for increasing innovation efficiency in the new era. Based on the relevant data given in the annual report of BYD from 2020 to 2023, the impact of taxation on BYD's innovation ability and its improvement ideas are obtained through year by year comparison. Results show that the investment and income of BYD R&D have increased significantly, the number and structure of R&D personnel have changed, the effect of technological innovation is significant, and the tax policy has a positive impact on innovation. In order to further promote the innovation and development of the new energy vehicle industry, it is suggested that the government continue to optimize and improve relevant tax policies, such as increasing the proportion of pre-tax deduction of R&D expenses, implementing preferential tax policies for high-tech enterprises, and optimizing the accelerated depreciation policy of fixed assets. At the same time, the government can also introduce a series of tax policies to encourage the consumption of new energy vehicles, such as purchase tax relief, vehicle and vessel tax incentives, etc., in order to reduce the cost of consumer car purchase and improve the market acceptance of new energy vehicles. The research conclusions have important reference significance for improving innovation-related tax policies and promoting high-quality development of BYD and other new energy vehicle industries.

Keywords: Innovation tax, Transformation of new energy enterprises, Policy coordination, New energy vehicle

1. Introduction

The principal objective of the collection of taxes is because they provide the government with the largest portion of revenue, and as a result, fund things like infrastructure, public services, and social welfare programs. Nonetheless, tax systems and enforcement heavily affect companies. Companies depend on the tax systems to function or hamper their growth or ability to operate. The tax system is the factor that can put companies in a fair fight and therefore welcome both profitability and success in the marketplace.

Taxes come in many ways, showing various rates, favors, and laws, so businesses, being more often than not complex, are facing these challenges across the shelf. It is easy for small businesses to

navigate taxes. Problems may arise from following specific regulations under the tax policies. On the other hand, there are corporations that have the resources and skills to capitalize tax benefits or exploit the loopholes.

The acceleration of the global "carbon neutrality" process has led to the development of new energy vehicles. It provides a good opportunity and also promotes China's electric vehicle industry development. According to the statistics of the Chinese Association of Automobile Manufacturers, the annual sales of new energy vehicles in China will exceed 6.8 million units in 2022, and the market share will increase to 25.6%, indicating that the new energy vehicle industry has a thriving prospect. This research seeks to analyze the particular tax policies and what effect its regulations have on innovation. This article will mainly focus on the impact of the tax system on firm innovation.

China's new energy vehicle industry has significantly benefited from a comprehensive suite of government subsidy policies over the past decade. These policies, including purchase subsidies, tax exemptions, and infrastructure support, have played a crucial role in fostering market growth and technological advancement [1, 2]. For instance, the government provided substantial purchase subsidies, which were instrumental in stimulating early adoption of NEVs [3]. However, as the market matured, these direct consumer subsidies were gradually phased out, officially ending by the end of 2022, signaling a shift towards market-driven development [4]. Despite the withdrawal of direct subsidies, other supportive measures, such as vehicle purchase tax exemptions, have been extended to continue encouraging NEV consumption and industry growth [5]. This strategic policy evolution has created a favorable environment for leading NEV manufacturers like BYD.

BYD, a prominent player in the new energy vehicle sector, has demonstrated remarkable performance growth amidst these policy shifts. The company's strategic alignment with national development goals, coupled with its continuous investment in research and development, has enabled it to capitalize on the supportive policy environment. For example, BYD's R&D investment surged to nearly 40 billion yuan in 2023, a 97% increase, accumulating to 140 billion yuan in total R&D investment. This significant investment has translated into a substantial increase in patent applications and a robust R&D workforce of over 102,800 personnel, underpinning its technological leadership and market expansion [Original document content]. This research seeks to analyze the particular tax policies and what effect its regulations have on innovation.

This article will mainly focus on the impact of the tax system on firm innovation. Due to the shared attributes of emerging industries, including high risk, uncertain innovation outcomes, publicity, and externality, the new energy automobile industry heavily relies on national fiscal and tax policies, demonstrating a high level of sensitivity to these policies. In recent years, although the state has introduced a variety of fiscal and tax support policies to support the development of new energy vehicle enterprises, but for the purpose of promoting the transformation of new energy vehicles to market-driven, coupled with the frequent phenomenon of "cheating", some government's subsidies for new energy vehicles are gradually reducing. In this context, finding out the impact of the tax policies on the technological innovation efficiency of new energy vehicle enterprises is conducive to improving the current preferential tax policy system, playing a "combination" of tax policies, and giving play to the long-term incentive role of preferential tax policies to achieve sustainable development of new energy vehicle enterprises.

To investigate this, reviewing the complete literature will involve examining various related prior studies, including other resources, which can include annual reports from specific companies, policymaking reports, articles, and research.

Scholars haven't reached a unified conclusion yet on the impact of tax incentives on enterprise innovation input, output and efficiency. Most scholars believe that tax incentives have a positive incentive effect on enterprises to increase innovation input and output and improve innovation efficiency, for example, "The empirical results of this paper show that there is a significant positive correlation between the intensity of income tax incentives and the efficiency of technological innovation"[6] while other scholars hold the opposite view. Even a small number of scholars believe that there is a nonlinear relationship between them and there is an optimal incentive interval.

In response to this uncertainty, BYD, the sample this paper is going to use, has been increasing the amount of R&D input, the percentage the R&D input takes of the total output and staff number. Although most results have been positive, with the income from innovation going from negative to positive and so on, there is still need to further investigate how to adjust to increase efficiency.

This study examines the impact of tax policies on innovation capabilities within China's new energy vehicle industry, using BYD as a representative case study. Through comprehensive analysis of BYD's annual reports from 2020 to 2023, this research employs literature review and archival research methodologies to investigate how tax incentives influence R&D investment, innovation efficiency, and technological development. The study analyzes key metrics including R&D expenditure trends, personnel structure changes, patent applications, and innovation outcomes to assess policy effectiveness. By examining specific policies such as pre-tax deduction for R&D expenses and preferential tax rates for high-tech enterprises, this research aims to provide evidence-based recommendations for optimizing tax policy frameworks to enhance innovation-driven development and promote sustainable industry growth.

2. Literature review

Research on the impact of tax incentives on enterprise innovation has yielded varied conclusions. While many scholars suggest a positive correlation between tax incentives and increased innovation input, output, and efficiency [6], others present opposing views or propose a nonlinear relationship with an optimal incentive interval. This section reviews existing literature on tax policies and innovation, focusing on macroeconomic conditions, direct tax policies, sectoral analyses, international comparisons, and the role of government support.

Macroeconomic stability significantly influences the effectiveness of tax policies aimed at fostering innovation. Studies indicate that innovation funding, particularly through tax incentives, is highly dependent on the broader economic environment [7]. For instance, during periods of economic downturn or deflation, tax cuts or incentives may prove more effective in sustaining investment in research and development (R&D) [8]. Therefore, the design of tax policies to promote innovation must consider prevailing macroeconomic conditions to ensure their efficacy.

Well-structured tax policies have a profound and positive impact on enterprise innovation. Targeted fiscal policies, such as R&D tax credits, reduced corporate tax rates for innovative firms, and specific incentives for small and medium-sized enterprises (SMEs), have been shown to stimulate technological innovation [9, 10, 11]. These policies enhance R&D investment and output, thereby improving overall innovation efficiency. Recent research specifically highlights that "tax incentives have the ability to drive up the innovation efficiency of new-energy vehicle enterprises" [12], and that "the optimization in the tax system exerts a significantly positive influence on enterprise innovation efficiency" [12]. This underscores the critical role of fiscal strategies in promoting innovation.

Sector-specific tax policies are essential to address the diverse needs of different economic sectors. For high-tech firms, specific tax incentives are crucial drivers of innovation [13].

Conversely, SMEs require broader fiscal support to overcome financial barriers and innovate, as fiscal incentives play a distinct yet equally vital role in their development [14, 15]. However, some studies suggest a potential “crowding-out effect” where tax incentives might, to some extent, inhibit the innovation capability of private small and micro enterprises [16]. This highlights the need for carefully tailored policies that consider the unique characteristics of each sector.

International comparisons offer valuable insights into effective tax policies for stimulating innovation. Analyzing how different countries utilize tax incentives can inform the evolution of domestic tax policies [6]. Preferential tax policies have been shown to boost new energy enterprises’ innovation by increasing R&D investment and output quality [17]. It is also recognized that “tax policy can be designed to encourage innovation through various mechanisms, such as cost reductions for innovative inputs and reduced taxes on profits from intellectual property” [18]. This global perspective emphasizes the potential for adopting successful strategies from other nations to enhance national innovation capacity..

Both fiscal expenditure and government support play crucial roles in fostering innovation. Government spending on R&D and infrastructure directly impacts technological innovation [19]. Preferential tax policies, by reducing costs and easing financing, boost the innovation efficiency of new energy enterprises [20]. This indicates that a balanced policy approach, where government grants and subsidies work in tandem with tax incentives, is necessary to create a robust environment for innovation. Furthermore, “fiscal stimuli are increasingly used to promote R&D and innovation activities” [21]

3. Current situation

3.1. Current industry situation

The new energy car industry development in China has seen growth in recent years, key points regarding this situation include market growth, government support, Infrastructure development, and environmental goals.

In recent years, perspective of the number of new energy vehicles, the number of new energy vehicles in China from 2015 to 2021 has also maintained sustained growth. According to statistics, in 2015, the number of new energy vehicles in China reached 583,200, exceeding originally planned by the government. In 2016, the number of vehicles reached 1.09 million, an increase of 87% year-on-year. In 2020, 4.92 million vehicles will be sold, with the year-on-year growth rate slowing down due to factors such as the epidemic, slowing down to 29.18% compared to last year. 7.84 million units in 2021, an increase of 59.25%.

Government support includes preferential tax policies, infrastructure construction, R&D support by subsidies, and publicity activities. Preferential tax policies include tax exemption off new energy vehicles, including exemption and halving, in order to reduce the cost of car purchase and encourage consumers to buy and use new energy vehicles. The government has established a series of development plans for the new energy automobile industry, outlining clear goals, key focus areas, and supportive measures, thereby offering policy direction for its growth.

3.2. Current company situation

BYD, a top energy car company in China, has taken advantage of this environment. From 1995-2008, it experienced it’s basic development phase, then from 2009, it started it’s scale expansion stage, in which it accelerated the pace of car production and sales, and launched a number of new

models. BYD adheres to the development concept of "basing on technology, use technology to succeed" and constantly increases investment in research and development. In 2023, BYD's research and development investment is nearly 40 billion yuan, an increase of 97%, and the cumulative research and development investment has reached 140 billion yuan. Up to now, BYD has applied for more than 48,000 patents worldwide, authorized more than 30,000 patents, and has more than 102,800 research and development personnel. These patents and talent reserves have provided strong support for BYD's technological innovation.

3.3. Current policy situation

In the course of BYD's development, the tax policy has had a profound and concrete impact on its innovation process. There are some specific tax policies which have played an important role in BYD's innovation process. Pre-tax deduction policy for R&D expenses, a continuous implementation over the years. The policy allows enterprises to deduct research and development expenses in accordance with a certain percentage (such as 75% or 100%) when making income tax declarations, thereby reducing the actual tax burden of enterprises. Preferential tax treatment for high-tech enterprises has been applied since BYD and its subsidiaries were recognized as high-tech enterprises. It allows a lower corporate income tax rate (usually 15%), while the corporate income tax rate of general enterprises is 25%. There are many other policies that are also advantageous to BYD's innovation and development, but are too general or have started a long time ago, therefore not included in this part.

3.4. Data analysis

Table 1. BYD R&D spending from 2020 to 2023

	2020	2021	2022	2023
R&D investment amount (Yuan)	8,555,951,000	10,626,587,000	20,223,242,000	39,917,743,000
R&D investment as a percentage of revenue	5.46%	4.92%	4.77%	6.63%
Amount of capitalization of R&D investment (Yuan)	2,635,613,000	1,091,090,000	1,568,789,000	342,798,000
Capitalized R&D investment as a percentage of R&D investment	12.75%	24.80%	7.76%	0.86%

This table shows the company's R&D spending from 2020 to 2023. In these four years, the company's research and development investment showed a trend of year-on-year growth, from 8.556 billion yuan in 2020 to 39.918 billion yuan in 2023, showing the company's continued attention to and investment in research and development activities.

In terms of the proportion of R&D investment to operating revenue, the company has a relatively high proportion in 2020 and 2023, at 5.46% and 6.63% respectively, while the proportion in 2021 and 2022 is relatively low, at 4.92% and 4.77% respectively, mostly presenting an upwards trend.

Table 2. R&D personnel structure change from 2020 to 2023

	2020	2021	2022	2023
Research staff number	30703	40382	69697	102844
Proportion of R&D personnel	13.69%	14.01%	12.23%	14.62%
undergraduate	13454	20017	36018	46823
master	2231	3953	7827	23706
doctor	187	295	590	1587
Under 30 (years old)	14674	19770	37302	61337
30-40 (years old)	13981	18049	28606	36182

Over the past four years, the company has significantly increased its R&D personnel, emphasizing its investment in innovation. The company's strategy to recruit highly educated talent has led to a surge in undergraduate, master's, and doctoral R&D personnel. Notably, the company has attracted a large number of young talents under 30 while maintaining a steady increase in experienced 30-40 year olds. This rapid development and expansion in R&D has laid a solid foundation for the company's technological innovation and long-term growth.

Table 3. Comparison of investment income between 2021 and 2023

	Sum	Proportion of total investment profit
2021	-57,134,000	-1.26%
2023	1,635,141,000	4.39%

The provided information summarizes a comparison of investment income between 2021 and 2023. In 2021, the investment income was negative at -57,134,000 yuan, contributing -1.26% to the total profit. Conversely, in 2023, the investment income was positive and significantly higher at 1,635,141,000 yuan, accounting for 4.39% of the total profit. This indicates a substantial improvement in investment performance over the two-year period.

BYD, a pioneer in the global new energy vehicle industry, has made significant strides in technological innovation, market expansion, and social responsibility. Its cutting-edge products, renowned for their performance, eco-friendliness, and user experience, have acquired international acclaim. With a relentless focus on R&D, BYD continues to push the boundaries of what's possible in the sector. Globally, BYD's footprint spans numerous countries, offering sustainable transportation solutions to diverse markets. Its collaborations with local partners foster economic growth and environmental progress. Moreover, BYD prioritizes social welfare, investing in employee development, and supporting vulnerable communities, demonstrating commitment to the progress. As a responsible corporate citizen, BYD's dedication to innovation, sustainability, and social good sets an example for the industry.

3.5. Organizational innovation and management ability

BYD's organizational innovation and management excellence are exemplified through multiple facets. In terms of organizational innovation, the company has pioneered numerous technological breakthroughs, including the blade battery, DM-i super hybrid, and e Platform 3.0, enhancing product competitiveness and propelling industry progress. With over 102,800 R&D personnel,

BYD's significant investment in research and development ensures its technological leadership. A diversified product line spanning new energy vehicles, electronics, and batteries mitigates risks and strengthens its market position. BYD's innovative service model blends online and offline services, fostering a customer-centric approach. Organizationally, it adopts split management and a business group system, fostering agility and efficiency, enabling each unit to respond swiftly to market dynamics.

In management, BYD adheres to a people-oriented philosophy, fostering a familial work environment through employee care initiatives and affordable housing. Talent development is prioritized, with comprehensive training programs spanning various job fields. Its management style is characterized by simplicity and efficiency, believing in straightforward communication and execution. The application of closed-loop thinking through the PDCA cycle ensures tasks are meticulously executed and processes continuously optimized.

Moreover, BYD possesses a clear strategic vision, rooted in its philosophy of basing on innovation and succeeding by technological advantages. Its various business groups operate independently yet synergistically, achieving strategic alignment to bolster overall competitiveness. This integrated approach enables BYD to adapt rapidly to market shifts, enhancing operational efficiency and ensuring sustainable growth. In summary, BYD's commitment to organizational innovation, coupled with its people-centric management strategies and strategic alignment, positions it as a leading player in its industries, fostering continuous progress and success.

4. Conclusion

This study has thoroughly examined the intricate relationship between tax policies and enterprise innovation, with a specific focus on the new energy vehicle industry in China, using BYD as a representative case. Our analysis reveals that tax policies, particularly those related to R&D deductions and preferential tax rates for high-tech enterprises, have significantly contributed to the growth in R&D investment, personnel expansion, and overall technological innovation within BYD. The substantial increase in BYD's R&D expenditure and patent applications underscores the positive impact of a supportive tax environment on corporate innovation capabilities. Furthermore, the study highlights how government support, through various fiscal and tax incentives, has fostered a robust ecosystem for the new energy vehicle sector, enabling companies like BYD to achieve remarkable market penetration and technological advancements.

Reflecting on these findings, it becomes evident that while tax incentives are powerful tools for stimulating innovation, their effectiveness is deeply intertwined with broader economic conditions and the strategic responses of enterprises. The gradual phasing out of direct purchase subsidies for new energy vehicles in China, for instance, signals a shift towards a more market-driven approach, which necessitates continuous adaptation from both policymakers and industry players. Future research could delve deeper into the long-term sustainability of innovation driven by tax policies in a post-subsidy era, exploring how companies maintain their competitive edge and innovation momentum without direct government financial aid. Additionally, a comparative analysis across different industries or regions could provide further insights into the generalizability of these findings and inform more nuanced policy recommendations for fostering innovation in diverse economic contexts.

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