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Article

Fiscal Subsidies and Sustainable Growth of New Energy Vehicle Firms: Evidence from R&D Mediation in China

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Abstract: Against the background of China's ambitious green transition and the gradual adjustment of industrial subsidy policies, this study comprehensively examines how fiscal subsidies affect the financial sustainable growth of listed new energy vehicle (NEV) firms. Using extensive panel data of Chinese A-share listed new energy vehicle companies spanning from 2014 to 2023, this paper constructs a robust fixed-effects model to empirically test the direct effect of fiscal subsidies on the financial sustainable growth rate. Furthermore, it explores the critical mediating role of research and development (R&D) investment and the heterogeneous effects across different geographical regions and corporate ownership types. The empirical results demonstrate that fiscal subsidies have a highly significant positive impact on the financial sustainable growth of these firms, and this core conclusion remains robust after replacing explained variables and incorporating additional control variables. Mechanism analysis indicates that R&D investment serves as an indispensable transmission channel through which fiscal subsidies effectively enhance firms' endogenous innovation and long-term growth capacity. Heterogeneity analysis reveals that the positive effect of subsidies is markedly more pronounced in economically developed eastern regions and among non-state-owned enterprises, whereas the effect is comparatively weaker or statistically insignificant in central and western regions as well as within state-owned enterprises. The findings strongly suggest that future subsidy policies should strategically shift from broad-based financial support to highly targeted, performance-oriented mechanisms. Simultaneously, NEV firms must proactively improve their subsidy utilization efficiency and systematically reduce excessive reliance on external policy support to ensure long-term market competitiveness.

Keywords: fiscal subsidies; sustainable growth; new energy vehicles; r&d investment; corporate finance

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1. Introduction

1.1. Research Background

Against the global backdrop of addressing climate change and promoting energy transition, the new energy vehicle industry, with its advantages of cleanliness and high efficiency, has become a key direction for the transformation and upgrading of the automobile industry. It has also become an important focus for countries to achieve green development and enhance energy security. China has actively responded to the global call for green development by designating the new energy vehicle industry as a strategic emerging industry, attaching great importance to it and providing strong support.

From the policy perspective, fiscal subsidies are one of the important policy tools used by China to promote the development of the new energy vehicle industry [1]. Since the initial stage of the new energy vehicle industry, the government has aimed to reduce the production costs and sales prices of new energy vehicles through fiscal subsidies, enhance their market competitiveness, and thereby promote the rapid growth of the industry. In the early stage, subsidy policies strongly stimulated market demand for new energy vehicles, encouraged many enterprises to enter the new energy vehicle sector, and promoted investment in technological research and development as well as industrial infrastructure construction, laying a foundation for industrial development. For example, with the support of subsidy policies, some enterprises were able to increase R&D efforts and overcome key technical difficulties such as battery endurance and safety performance.

However, with the development of the industry, fiscal subsidy policies are also facing new challenges and problems. On the one hand, long-term reliance on fiscal subsidies may lead to insufficient innovation motivation among some enterprises, causing them to depend excessively on policy benefits while neglecting the cultivation of their own core competitiveness [2]. Some enterprises may devote more effort to obtaining subsidies rather than improving product quality and technological levels, which is not only unfavorable to the long-term development of enterprises but also poses a threat to the sustainable development of the industry. On the other hand, as the scale of the new energy vehicle industry continues to grow, the fiscal burden of subsidies has become increasingly heavy, and the marginal effect of subsidy policies has gradually diminished. How to ensure that new energy vehicle enterprises achieve a smooth transition, maintain sound financial conditions, and sustain growth capabilities during the gradual withdrawal of subsidies has become an urgent issue to be resolved.

From the perspective of corporate finance, the financial sustainable growth rate refers to the maximum rate at which a company's sales, earnings, and dividends can grow without relying on external financing, such as issuing new shares, while maintaining its current operating efficiency and financial policies [3]. It measures the maximum growth rate that an enterprise can achieve without exhausting its financial resources and comprehensively reflects the enterprise's profitability, asset operating efficiency, financial policies, and other aspects. For listed companies in the new energy vehicle industry, their financial sustainable growth rate is not only related to their own survival and development but also affects the healthy operation of the entire industry.

Against the background of continuous adjustments to fiscal subsidy policies, studying the impact of fiscal subsidies on the financial sustainable growth rate of listed companies in the new energy vehicle industry has important practical significance. Through in-depth analysis, the specific mechanisms by which fiscal subsidies affect enterprises' profitability, capital liquidity, and investment decisions can be clarified. This provides a basis for enterprises to make rational use of fiscal subsidies and optimize financial strategies. At the same time, it also provides references for the government to further improve subsidy policies and guide the healthy development of the industry, helping the new energy vehicle industry achieve high-quality and sustainable development in the post-subsidy era [4].

1.2. Research Significance

This study investigates the influence of fiscal subsidies on the financial sustainable growth rate of listed companies in the new energy vehicle industry, highlighting its significant theoretical and practical implications [5].

1.2.1. Theoretical Significance

This study examines the relationship between fiscal subsidies and the financial sustainable growth rate of listed companies in the new energy vehicle industry, contributing to a deeper theoretical understanding of the dynamic interplay between policy tools and corporate finance [6]. Current research on corporate financial sustainable growth lacks systematic analysis that integrates fiscal subsidy policies with the new energy vehicle industry, an emerging sector heavily influenced by policy measures. By investigating the mechanisms through which fiscal subsidies impact enterprises' financial sustainable growth rate, this study enhances the application of financial sustainable growth theory within the context of specific industrial policies and supports the refinement and advancement of related theoretical frameworks.

1.2.2. Practical Significance

For enterprises: This study assists listed companies in the new energy vehicle industry in accurately understanding the mechanisms through which fiscal subsidies influence their financial conditions. Based on the research findings, enterprises can optimize the utilization of subsidy funds, such as increasing investment in core technology research and development and upgrading production equipment, thereby enhancing product competitiveness and profitability and improving their financial sustainable growth rate. Additionally, it provides guidance for enterprises to adjust financial strategies, reduce excessive reliance on subsidies, strengthen self-sustaining capabilities, and maintain financial stability and growth sustainability amid changes in subsidy policies [7].

For the government: This study offers empirical evidence for the optimization and adjustment of fiscal subsidy policies. By analyzing the impact of subsidies on enterprises' financial sustainable growth, the government can evaluate the rationality and effectiveness of existing subsidy policies and determine whether adjustments are needed in subsidy intensity, methods—such as transitioning from production-side subsidies to consumption-side or R&D subsidies—and the pace of subsidy withdrawal [8]. This enables more precise resource allocation, reduces fiscal burdens, ensures a smooth transition for the industry, and promotes the high-quality development of the new energy vehicle sector.

For the industry and society: This study supports the sustainable development of the new energy vehicle industry in the post-subsidy era and contributes to the stability of the industrial ecosystem. The research findings help industry participants better adapt to policy changes, improve overall risk management, and accelerate industrial upgrading [9]. This holds significant practical value for advancing energy structure transformation, achieving "dual carbon" goals, and enhancing the international competitiveness of the automobile industry, thereby fostering green and sustainable economic and societal development.

1.3. Research Content and Methods

1.3.1. Research Content

The research content of this paper is divided into the following six parts:

The first part is the introduction, which outlines the research background and significance, as well as the research content and methods. Starting from global energy transition and the "dual carbon" goals, it highlights the importance of the new energy vehicle industry as a strategic emerging industry. Combined with the core concept of corporate financial sustainable growth, it emphasizes the practical need to study the relationship between fiscal subsidies and SGR. The significance of this study is discussed from both theoretical and practical perspectives, forming the core conclusions of the paper through literature analysis and empirical research methods [10].

The second part is the literature review. By systematically examining relevant domestic and international studies, it identifies the current state of research [11]. While acknowledging existing achievements, it clarifies the innovative focus of this paper, which examines financial sustainable growth from the perspective of SGR, incorporating mediation mechanisms and heterogeneity analysis to address gaps in understanding the relationship between policy tools and enterprises' endogenous growth.

The third part is theoretical analysis and research hypotheses. Based on government policy theories, it discusses market inefficiencies caused by the positive externalities of the new energy vehicle industry and the rationale for subsidy policies. Using the sustainable growth model, it analyzes how subsidies influence SGR by enhancing profitability, represented by ROE, and retained reinvestment capacity, represented by the retention ratio. Two core hypotheses are proposed: H1, "Fiscal subsidies have a significant positive impact on the financial sustainable growth rate of listed new energy vehicle companies"; and H2, "R&D investment mediates the relationship between fiscal subsidies and SGR."

A transmission-chain hypothesis of "subsidy incentives, R&D investment, growth capacity" is constructed.

The fourth part is research design [12]. Based on a robust data foundation, this section introduces the selected variables and constructs a fixed-effects panel model. It develops a benchmark regression model to test the direct effect of subsidies, a mediation-effect model to verify the role of R&D investment, and a heterogeneity model to explore regional and ownership differences, thereby establishing a comprehensive econometric analysis framework.

The fifth part is empirical analysis [1]. Through multidimensional analysis, this section tests the research hypotheses. It includes descriptive statistical analysis, benchmark regression analysis, mechanism testing, robustness testing, and heterogeneity analysis, forming the core of the paper and validating the proposed hypotheses.

The sixth part is research conclusions and recommendations. Based on the empirical findings, this section systematically summarizes the direct positive impact of fiscal subsidies on financial sustainable growth rates, the mediating role of R&D investment, and the regional and ownership heterogeneity characteristics. It concludes that targeted subsidy policies are more effective than broad-based approaches and provides recommendations for both government and enterprises [13].

1.3.2. Research Methods

Literature research method: Through systematic searches of domestic and foreign academic databases, such as CNKI, Wanfang, and Web of Science, this study extensively collects literature related to fiscal subsidies, the development of the new energy vehicle industry, and the financial sustainable growth rate of enterprises. It conducts in-depth reading of classical theories on the financial impact of fiscal subsidies on enterprises, such as government policy frameworks and industrial policy theory, and reviews previous research findings on the policy effects of the new energy vehicle industry and the influencing factors of corporate financial sustainable growth [14]. By analyzing the research perspectives, methods, and limitations of existing literature, this study provides theoretical support and directional guidance for the research, clarifies the research positioning of exploring the impact of fiscal subsidies on the financial sustainable growth rate of listed companies in the new energy vehicle industry, and ensures that the study expands and innovates on the basis of the existing theoretical framework.

Empirical research method: This study selects financial data of listed companies in the new energy vehicle industry over the past decade, from 2014 to 2023, as the research sample. Fiscal subsidies are used as the explanatory variable, and the financial sustainable growth rate is used as the explained variable. The classic sustainable growth rate model, based on endogenous growth theory, is adopted. This theory emphasizes that enterprises achieve growth through internal accumulation, such as retained earnings, rather than external financing, such as issuing new shares or borrowing. Control variables include net profit growth rate, asset-liability ratio, ownership structure, market value, and equity multiplier. A fixed-effects model is constructed, and regression analysis is conducted using Stata software. Robustness tests are also performed. In addition, R&D investment is introduced as a mediating variable for mechanism analysis. Finally, heterogeneity analysis is conducted based on ownership nature and regional location, thereby empirically revealing the internal relationship between fiscal subsidies and the financial sustainable growth rate of listed companies in the new energy vehicle industry [15].

2. Literature Review

2.1. Current Status of Foreign Research

Foreign research on the new energy vehicle industry covers multiple dimensions, including environmental impact, policy incentives, technological development, and consumer behavior [16]. The specific research status is as follows:

Regarding research on environmental impact: Some studies focus on the role of new energy vehicles in improving the environment [10]. For example, one study analyzed the impact of electric vehicle adoption on air quality in Texas and confirmed its positive role in reducing pollutant emissions. Another study conducted energy modeling for clean energy vehicles in Japan and explored their potential for reducing emissions. Research on trolleybuses in the Kathmandu Valley of Nepal examined the mitigation potential of clean energy vehicles as public passenger transport for greenhouse gas emissions and their impact on fuel consumption, highlighting the application value of new energy vehicles in environmental protection and energy conservation.

Regarding research on policy incentives and industrial competition: One study examined the impact of government incentives for hybrid electric vehicles in the United States and found that policy incentives can effectively promote the market adoption of new energy vehicles. Another study highlighted that financial incentives and socioeconomic factors significantly influence the adoption of electric vehicles, emphasizing the key role of policy in guiding consumer choices. Additional research explored the political factors of technology bans in the automobile industry, industrial policy competition, and green goals, revealing the competitive dynamics among countries in the new energy vehicle field through policy measures. Further analysis considered whether subsidies for next-generation infrastructure should focus on the consumption side or the supply side, providing theoretical reference for the policy direction of new energy vehicle infrastructure construction [11].

Regarding technological development and practical exploration: One study summarized Japan's efforts in plug-in hybrid electric vehicles, reflecting Japan's choices and practices in the technological route of new energy vehicles [17]. Although some studies do not directly focus on technology, they indirectly reflect the importance of technology-driven development from the perspective of industrial development. For example, enterprises improve technological competitiveness and promote industry technological progress by optimizing supply chains and cost control, such as dismantling studies of Chinese new energy vehicles conducted by U.S. companies.

Regarding consumer behavior and market demand research: One study examined the impact of providing total cost of ownership information on consumers' intention to purchase traditional fuel vehicles or plug-in electric vehicles, finding that cost information significantly affects consumer decision-making [18]. Another analysis explored the impact of congestion pricing exemption in Stockholm on demand for new energy vehicles, showing that policy preferences affect market demand by changing consumption costs. These studies provide consumer-level evidence for corporate market strategies and policymaking.

Overall, foreign research has focused on the environmental benefits, policy incentive mechanisms, technological development paths, and consumer market behavior of new energy vehicles. It provides theoretical and practical support from multiple perspectives for understanding the development of the new energy vehicle industry and also lays a foundation for subsequent research on the impact of fiscal subsidies on enterprises' financial sustainable growth. For example, research can extend from policy incentive effects to the long-term impact on enterprises' financial conditions, and from changes in consumer demand to the effects of corporate market strategy adjustments on financial indicators [13].

2.2. Current Status of Domestic Research

Domestic research on China's new energy vehicle industry mainly focuses on the policy system, fiscal subsidy effects, technological innovation, and enterprise performance. Existing studies have formed a multidimensional framework for understanding how industrial policies influence enterprise behavior and industry development [13, 17].

Regarding industry development and policy systems, recent studies have shown that China's new energy vehicle industry has developed rapidly under continuous policy support, including purchase subsidies, tax incentives, charging infrastructure support, and technology-oriented policies. Tian et al [6]. systematically reviewed the evolution of

China's new energy vehicle industry and pointed out that policy support has played an important role in market growth, technological progress, and infrastructure improvement. Zhao et al. further argued that government subsidies can promote the transition from traditional fuel vehicles to electric vehicles, but their effectiveness depends on policy design, market conditions, and enterprise response capacity. These studies suggest that China's new energy vehicle policy system has gradually shifted from scale-oriented growth to quality-oriented and innovation-driven development.

Regarding the incentive effects of fiscal subsidies, scholars have paid increasing attention to how subsidies affect enterprise innovation. Ren et al [11]. found that government subsidies significantly promote R&D investment among listed companies in China's new energy vehicle industry, especially from the perspective of the industrial chain. Sun et al. also confirmed that government subsidies have a positive effect on innovation among listed new energy vehicle companies, but the effect may differ across subsidy forms, enterprise types, and regional contexts. In addition, Qin and Xiong compared subsidized and non-subsidized policies and found that different policy instruments vary in their innovation effectiveness, indicating that the long-term development of the industry requires a more balanced policy mix rather than relying solely on direct financial subsidies.

Regarding policy adjustment and subsidy withdrawal, existing studies have begun to examine the impact of China's transition from subsidy-driven support to market-oriented mechanisms. Wang and Han analyzed the progressive subsidy reduction policy and found that subsidy reduction affects both innovation and economic performance of new energy vehicle firms [5]. Wang et al. further investigated the effect of subsidy withdrawal on enterprises' innovation behavior and emphasized that policy withdrawal should be implemented gradually to avoid negative impacts on firms' innovation incentives. These findings indicate that the post-subsidy era requires more refined policy design, including carbon credit trading, dual-credit policy mechanisms, green finance, and infrastructure support.

Regarding corporate financial impact and resilience, recent studies have linked government subsidies with enterprise performance and sustainable development [5]. Zhao et al. examined Chinese listed electric vehicle companies and found that government subsidies can enhance business adaptability, while ESG performance and technological capability play important roles in this process. This suggests that fiscal subsidies not only affect short-term innovation investment, but may also influence enterprises' financial stability, risk management, and long-term growth capacity. Therefore, it is necessary to further examine the relationship between fiscal subsidies and the financial sustainable growth of listed new energy vehicle companies from the perspective of corporate finance.

2.3. Research Review

Domestic and foreign scholars have conducted extensive research on the new energy vehicle industry, offering diverse perspectives on policy effects, corporate behavior, and industrial development. However, most existing studies primarily focus on the influence of subsidies on R&D investment and short-term performance. They have not examined the financial sustainable growth rate (SGR) as a starting point to analyze how subsidies impact enterprises' "endogenous growth capacity." Specifically, there is a notable gap in theoretical modeling of the transmission chain linking "subsidy dependence, innovation motivation, and financial sustainable growth." Furthermore, heterogeneity analysis remains underexplored, as prior research has not adequately differentiated the varying impacts of regional policy environments on subsidy effects [4].

In conclusion, while existing research provides a foundation for understanding the relationship between fiscal subsidies and the financial sustainable growth of new energy vehicle enterprises, further advancements are required in theoretical depth, heterogeneity analysis, and policy coordination [9, 18]. This paper, therefore, focuses on the influence of fiscal subsidies on the financial sustainable growth rate of listed new energy companies, aiming to contribute to the high-quality development of the industry and support the achievement of the "dual carbon" goals.

3. Theoretical Analysis and Research Hypotheses

3.1. Theoretical Foundations

3.1.1. Government Intervention Theory

Government regulation theory serves as the core theoretical basis for studying the impact of fiscal subsidies on the new energy vehicle industry. This theory posits that market mechanisms may encounter inefficiencies when addressing issues such as externalities and the provision of public goods, necessitating the use of policy tools to optimize social welfare [2].

The new energy vehicle industry generates significant positive externalities. Its development contributes to reducing carbon emissions and improving air quality. However, during its initial stages, the industry faces challenges such as high technological R&D costs and limited market acceptance, leading to inefficiencies in market operations [3]. Fiscal subsidies, including purchase and R&D subsidies, help mitigate these challenges by reducing production costs and market risks for enterprises. These subsidies encourage technological innovation and industrial growth, addressing market inefficiencies through policy measures. For instance, subsidy funds can be allocated to core technology R&D, such as advancements in battery technology, to enhance product competitiveness. Alternatively, they can be used to expand production capacity, lower unit production costs, and improve enterprises' profitability and financial sustainability.

In conclusion, government regulation theory provides a rationale for the necessity of fiscal subsidies in the new energy vehicle industry. However, the implementation of such subsidies must align with the industry's life cycle, balancing the correction of market inefficiencies with the preservation of market efficiency [14, 18]. Ultimately, the goal is to achieve a seamless transition from "policy support" to "market-driven growth," ensuring the industry's continued development through technological advancements and cost competitiveness, even after subsidies are phased out.

3.1.2. Sustainable Growth Theory

Sustainable growth theory provides a theoretical framework for measuring corporate financial sustainability. Its core concerns an enterprise's ability to achieve long-term growth without exhausting its financial resources. It refers to the maximum rate at which a company's sales, earnings, and dividends can grow without relying on external financing, such as issuing new shares, while maintaining current operating efficiency and financial policies [5]. Among these models, the sustainable growth rate model, commonly referred to as Sustainable Growth Rate (SGR), proposed by Higgins, is widely applied. The extended formula for the financial sustainable growth rate is:

$$SGR = \frac{ROE \times Retention\ Ratio}{1 - ROE \times Retention\ Ratio}$$

Among them, ROE, or return on equity, measures a company's ability to generate profits using shareholders' equity; the retention ratio, calculated as 1 minus the dividend payout ratio, represents the proportion of profits retained by the company [8, 9].

It can therefore be observed that the key components of the sustainable growth rate include:

Retention ratio: the proportion of net income retained by the company [8]. A higher retention ratio typically indicates greater growth potential.

Return on equity (ROE): a measure of a company's ability to generate profits from its shareholders' equity. A strong ROE demonstrates that the company effectively utilizes its equity base for growth.

Dividend payout ratio: the proportion of total earnings distributed to shareholders as dividends [14, 15]. A lower dividend payout ratio can enhance growth potential by enabling more profits to be reinvested in the company.

The sustainable growth rate serves as a critical indicator for evaluating a company's financial health and growth potential. By effectively managing operating efficiency and financial policies, a company can achieve stable growth without depending on external financing. Additionally, this indicator can be utilized by investors and management for financial planning and risk assessment, thereby supporting the company's long-term sustainable development [4, 7].

3.2. Research Hypotheses

Based on the logical framework of government policy theory and sustainable growth theory, and combined with the policy practices of the new energy vehicle industry and the core elements of corporate financial growth, this study proposes the following research hypotheses:

H1: Fiscal subsidies have a significant positive impact on the financial sustainable growth rate of listed new energy vehicle companies [18].

According to government policy theory, the new energy vehicle industry faces significant positive externalities and market inefficiencies in the early stages of technological R&D and market promotion. As a core tool of policy support, fiscal subsidies can positively influence the financial sustainable growth rate by alleviating enterprises' R&D funding constraints, reducing production costs, and enhancing market competitiveness. Specifically, fiscal subsidies can directly increase enterprises' cash flow, enabling investment in core technology R&D, such as power batteries, electric motors, and electric control systems, as well as increasing production capacity. This, in turn, enhances enterprises' profitability, reflected in an increase in return on equity (ROE), and their capacity for reinvestment through retained earnings, reflected in a lower dividend payout ratio [10]. Additionally, the signaling effect of subsidy policies may attract social capital investment, further strengthening enterprises' financial resilience and creating a positive cycle of "policy incentives, resource aggregation, and growth capacity enhancement."

H2: R&D investment plays a mediating role in the relationship between fiscal subsidies and the financial sustainable growth rate.

Based on the transmission logic of "policy support-technological innovation-financial growth," the positive effect of fiscal subsidies on financial sustainable growth is not only direct but may also be realized indirectly through R&D investment as a key mediating variable. Government policy theory suggests that R&D subsidies can lower enterprises' innovation costs and encourage investment in high-risk technological fields, such as solid-state batteries and intelligent connected technologies, thereby creating technological barriers and product differentiation advantages. These technological advantages can translate into market competitiveness, reflected in higher product prices, expanded market share, and improved cost efficiency, ultimately enhancing profitability, ROE, and sustainable growth capacity [5]. Therefore, fiscal subsidies may first influence R&D investment and indirectly promote financial sustainable growth through the critical pathway of technological innovation.

4. Research Design

4.1. Econometric Model Specification

To verify Research Hypothesis 1, this study employs the following fixed-effects panel data model to ensure robust analysis and reliable results [10].

$$\mathrm{SGR_{it}} = \alpha_0 + \beta_1 \mathrm{GP_{it}} + \beta_k \mathrm{Control_{it}} + \delta_i + \gamma_t + \varepsilon_{it}$$

To verify Research Hypothesis 2, this study utilizes the following fixed-effects panel data model to maintain consistency in the analytical framework.

$$\mathrm{SGR_{it}} = \alpha_0 + \mu_1 \mathrm{GP_{it}} + \mu_2 \mathrm{RD_{it}} + \beta_k \mathrm{Control_{it}} + \delta_i + \gamma_t + \varepsilon_{it}$$

In this model, i represents an individual listed company in the new energy vehicle industry, while t denotes the year. The dependent variable, $\mathrm{SGR_{it}}$, measures the financial sustainable growth rate of the company in year t. The primary explanatory variable, $\mathrm{GP_{it}}$, is the logarithm of government subsidy amounts, reflecting the intensity of subsidies received by the company. $\mathrm{RD_{it}}$ serves as the mediating variable, representing R&D

investment. Control variables include net profit growth rate ($growth_{it}$), asset-liability ratio (Lev_{it}), ownership structure ($TOP3_{it}$), market value (val_{it}), and equity multiplier (em_{it}). δ_i accounts for individual fixed effects, γ_t captures year fixed effects, and ε_{it} represents the random error term.

4.2. Data Sources and Variable Description

4.2.1. Data Sources and Processing

The data required for this study are derived from the financial data of listed companies. Core financial indicators, including net profit growth rate, asset-liability ratio, equity multiplier, and others, as well as government subsidy amounts and R&D investment data, are sourced from the Wind Financial Terminal and the CSMAR China Listed Companies Financial Statement Database. These datasets encompass information disclosed in income statements, balance sheets, and notes to financial statements. Market value data, calculated as the closing price at the end of the period multiplied by total share capital, and ownership structure, measured by the aggregate shareholding ratios of the top three shareholders, are obtained from the Wind market data module.

Regarding the definition of listed companies in the new energy vehicle industry, this study follows the Guidelines for the Industry Classification of Listed Companies issued by the China Securities Regulatory Commission, revised in 2012, and the Wind industry classification standard [6]. A-share listed companies in Shanghai and Shenzhen whose primary businesses involve new energy vehicle manufacturing, key components such as batteries, motors, and electric control systems, charging equipment, and other related fields are selected. A total of 214 sample enterprises are identified.

The period from 2014 to 2023 is selected as the research window, covering the critical phase during which the new energy vehicle industry transitioned from policy-driven development to market-oriented transformation. During data processing and screening, several steps are taken to ensure the reliability and validity of the research results. First, all enterprise sample data marked as ST or *ST are excluded, as such enterprises typically face financial difficulties or operational risks, which could distort the accuracy of the research conclusions. Second, samples with missing key variables are entirely excluded, as complete and accurate data are essential for robust empirical analysis and to avoid estimation bias [14]. Third, all variables are winsorized at the 1% level to mitigate the influence of outliers on empirical methods such as regression analysis, ensuring that the results more accurately reflect the intrinsic relationships among variables.

Following multiple rounds of rigorous screening and systematic organization, 2,069 high-quality observations are ultimately obtained, providing a robust and reliable data foundation for subsequent in-depth empirical research [8].

4.2.2. Variable Description

Explained variable: financial sustainable growth rate, SGR. It is measured using the following formula:

$$SGR = \frac{ROE \times \text{retention ratio}}{1 - ROE \times \text{retention ratio}}$$

Core explanatory variable: fiscal subsidies, GP. The current amount of the "government subsidies" item in the income statement is used, and its natural logarithm is taken to reduce the impact of heteroscedasticity.

Mediating variable: R&D investment, RD. It is measured by the proportion of R&D investment to operating revenue.

Control variables:

Net profit growth rate, $growth$: This reflects the enterprise's profitability growth capacity. A larger value indicates faster profit growth, which may directly affect sustainable growth potential.

Asset-liability ratio, Lev: This measures the enterprise's capital structure and debt repayment risk. A high debt ratio may restrict financing capacity and have a negative impact on financial sustainable growth.

Ownership structure, TOP3: This is measured by the shareholding ratio of the top three shareholders. It reflects the corporate governance framework. A high degree of ownership structure may affect decision-making efficiency and thereby influence the enterprise's growth strategy.

Market value, val: This measures the enterprise's scale effect. A larger market value may indicate stronger resource integration capacity and risk management.

Equity multiplier, em: This reflects the level of financial leverage. A higher equity multiplier indicates higher financial risk, which may amplify growth fluctuations or exacerbate financial difficulties.

The specific variable descriptions are shown in Table 1 below.

Table 1. Variable Description Table

Variable Type	Variable Name	Variable Symbol	Calculation Method
Explained variable	Financial sustainable growth rate	SGR	$SGR = \frac{ROE \times retention\ ratio}{1 - ROE \times retention\ ratio}$
Core explanatory variable	Fiscal subsidies	GP	$GP = \ln(government\ subs$
Mediating variable	R&D investment	RD	$RD = \frac{R\&D\ investment}{operating\ revenue}$
Control variable	Net profit growth rate	$growth$	$growth = \frac{current\ net\ profit - previo}{previous\ net\ pro}$ 100%
Control variable	Asset-liability ratio	Lev	$Lev = \frac{total\ liabilities}{total\ assets} \times$ 100%
Control variable	Ownership concentration	$TOP3$	$TOP3 = sumoftheshareholdi$ $of\ the\ top\ three\ shar$
Control variable	Market value	val	$\ln(total\ market\ valu$ $of\ the\ period$
Control variable	Equity multiplier	Em	$Em = \frac{total\ assets}{net\ assets}$

5. Empirical Analysis

5.1. Model Test

Considering the characteristics of short panel data spanning from 2014 to 2023, this study evaluates three estimation strategies: pooled OLS, random effects (RE), and fixed effects (FE). The pooled OLS model assumes no individual heterogeneity and no significant differences across data cross-sections over the years. The random-effects model presumes that the random error term is correlated with a specific explanatory variable, whereas the fixed-effects model assumes no correlation between the random error term and the explanatory variables. To determine the appropriate model, the F-test is initially employed to decide between pooled OLS regression and individual-effects regression. Subsequently, the Hausman test is applied to choose between the fixed-effects model and the random-effects model based on their respective assumptions.

Accordingly, this study first performs an F-test on the specified models. The p-value of 0.000 indicates that an individual-effects model is more suitable for estimation. Following this, the Hausman test is conducted to decide between the fixed-effects model and the random-effects model [16]. The results demonstrate that the fixed-effects model outperforms the random-effects model, leading to its selection for estimation purposes.

5.2. Descriptive Statistical Analysis

This paper uses Stata 17 software to conduct descriptive statistical analysis on the main variables required for the study. The analysis results are presented in Table 2. After data processing and screening, this study obtains a total of 2,069 observations [15].

Table 2. Descriptive Statistics

VARIABLES	N	mean	sd	min	max
SGR	2,069	0.0425	0.100	-0.646	0.464
growth	2,069	-0.343	3.687	-36.53	14.36
Lev	2,069	0.440	0.171	0.0398	0.945
TOP3	2,069	0.435	0.151	0.150	0.866
val	2,069	2.504e+10	4.984e+10	1.344e+09	3.982e+11
em	2,069	2.025	1.040	1.041	18.14
GP	2,069	17.09	1.523	9.259	22.27
RD	2,069	4.839	3.347	0.00400	47.48
Number of id	214	214	214	214	214

For the explained variable, the mean value of the financial sustainable growth rate, SGR, is 0.0425, indicating that the average financial sustainable growth rate of listed companies in the new energy vehicle industry is 4.25%. This suggests that the industry as a whole shows a certain growth trend, although the growth magnitude is relatively limited. The standard deviation is 0.100, indicating notable fluctuations in the financial sustainable growth rate across companies. The minimum value is -0.646, and the maximum value is 0.464, suggesting that some companies in the industry face pressure from negative financial growth, while others have relatively high growth potential. This reflects significant differences among enterprises [8].

For the core explanatory variable, the mean value of fiscal subsidies, GP, is 17.09, indicating that listed companies in the new energy vehicle industry receive a relatively high level of fiscal subsidies overall. The standard deviation is 1.523, suggesting that the differences in subsidy amounts among enterprises are relatively small and that the distribution of subsidies is relatively concentrated.

For the mediating variable, the mean value of R&D investment, RD, is 4.839, with a standard deviation of 3.347, a minimum value of 0.00400, and a maximum value of 47.48. This indicates that there are substantial differences in R&D investment levels among enterprises in the industry. Some enterprises invest very little in R&D, while others invest heavily, reflecting notable differences in their emphasis on technological innovation and their capacity for R&D investment.

Regarding the control variables, the mean value of net profit growth rate, growth, is -0.343, with a standard deviation of 3.687, indicating very large fluctuations. The minimum value is -36.53, and the maximum value is 14.36, suggesting that net profit growth among enterprises in the industry is highly unstable. Some enterprises experienced substantial declines, while others achieved significant growth, reflecting intense industry competition and uneven development [11].

The mean value of the asset-liability ratio, Lev, is 0.440, indicating that the overall asset-liability ratio of the industry is at a moderate level and that enterprises' debt burden is relatively controllable. The standard deviation is 0.171, suggesting that differences in debt levels among enterprises are relatively small and that the overall distribution is relatively balanced [8].

The mean value of ownership concentration, TOP3, is 0.435, indicating that the shareholding ratio of the top three shareholders is close to half, and that enterprises in the industry generally have a relatively high level of ownership concentration [6, 18]. The standard deviation is 0.151, showing that there are certain differences in ownership concentration among enterprises, but these differences are relatively limited.

For market value, val, the results indicate that there is a very large gap in the market capitalization of enterprises in the industry. The sample includes both relatively small enterprises and large leading enterprises, showing obvious market differentiation.

The mean value of the equity multiplier, em, is 2.025, with a standard deviation of 1.040, a minimum value of 1.041, and a maximum value of 18.14. This indicates that there are large differences in financial leverage among enterprises. Some enterprises operate with relatively high financial leverage and thus face higher risks, while others adopt a more conservative leverage strategy.

5.3. Correlation Analysis

The correlation analysis among the variables is summarized in Table 3.

Table 3. Correlation Analysis

	SGR	GP	val	em	growth	Lev
SGR	1					
GP	0.136***	1				
val	0.172***	0.622***	1			
em	-0.309***	0.216***	0.187***	1		
growth	0.436***	0.008	0.049**	-0.134***	1	
Lev	-0.147***	0.382***	0.299***	0.749***	-0.109***	1
TOP3	0.156***	0.134***	0.259***	-0.034	0.058***	-0.000

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

As indicated in the table above, the correlation coefficient between the financial sustainable growth rate (SGR) and fiscal subsidies (GP) is 0.136, which is significant at the 1% level. This suggests a significant positive correlation between fiscal subsidies and the financial sustainable growth rate, offering preliminary evidence supporting the hypothesis that fiscal subsidies enhance the financial sustainable growth rate of listed new energy vehicle companies.

In summary, the correlation analysis provides initial verification of the anticipated relationships among certain variables and establishes a foundation for further exploration of the impact and mechanisms of fiscal subsidies on the financial sustainable growth rate. However, it is important to emphasize that correlation does not equate to causation, and the specific effects require further investigation through regression analysis.

5.4. Multicollinearity Test

The multicollinearity test is used to examine whether there is a high degree of linear correlation among the independent variables in the regression model, so as to avoid biased parameter estimates caused by complex relationships among variables. In this section, the variance inflation factor, VIF, is used as the criterion. Generally, when VIF > 10, serious multicollinearity exists; when VIF is between 1 and 10, the degree of multicollinearity is relatively low. The multicollinearity test results for the independent variables are shown in Table 4.

Table 4. Multicollinearity Test

Variable	VIF	1/VIF
Lev	2.590	0.387
em	2.320	0.430
GP	1.770	0.565
val	1.740	0.574
TOP3	1.080	0.924
growth	1.030	0.974
Mean	1.760	

According to the results in the table, the VIF value of Lev, the asset-liability ratio, is 2.590, indicating a weak linear correlation with other independent variables. The VIF value of em, the equity multiplier, is 2.320, also showing a low risk of multicollinearity. The VIF value of GP, fiscal subsidies, is 1.770, further indicating that it has minimal interaction with other variables. The VIF value of val, market value, is 1.740, showing no significant multicollinearity. The VIF value of TOP3, ownership structure, is 1.080, indicating almost no high linear correlation with other variables. The VIF value of growth, net profit growth rate, is 1.030, suggesting strong differentiation from other variables. The mean VIF is 1.760, far below the threshold value of 10, indicating that multicollinearity among the independent variables in the overall model is minor and will not substantially interfere with the regression results. Therefore, the stability of the model and the reliability of parameter estimation are ensured.

In summary, the VIF values of all variables are within a reasonable range, indicating that there is no serious multicollinearity in the model. Therefore, subsequent regression analysis can be conducted to explore the relationships among the variables.

5.5. Benchmark Regression Analysis

This paper employs a fixed-effects model to estimate the panel data, effectively controlling for both time effects and individual effects to account for unobserved heterogeneity [14]. Table 5 presents the benchmark regression results derived from this model, which is specified using a stepwise regression approach.

(2) The values in parentheses below the regression coefficients are robust standard errors.

Table 5. Benchmark Regression Results

	(1)	(2)	(3)
	SGR	SGR	SGR
GP	0.0078**	0.0091***	0.0069**
	(0.004)	(0.003)	(0.003)
growth		0.0093***	0.0092***
		(0.001)	(0.001)
Lev		-0.1826***	0.0223
		(0.048)	(0.043)
TOP3		0.0204	0.0006
		(0.046)	(0.040)
val			0.0000**
			(0.000)
em			-0.0368***

			(0.006)
_cons	-0.0905	-0.0375	-0.0143
	(0.063)	(0.063)	(0.060)
year	Yes	Yes	Yes
id	Yes	Yes	Yes
N	2069.0000	2069.0000	2069.0000
r2	0.3429	0.4757	0.5223

Note: (1) ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

For the core explanatory variable, GP, the coefficients of fiscal subsidies across the three regressions are 0.0078, 0.0091, and 0.0069, respectively. All coefficients are positive and statistically significant at least at the 5% level. This demonstrates that fiscal subsidies exert a significant positive influence on the financial sustainable growth rate (SGR) of listed new energy vehicle companies. In essence, higher government subsidy intensity correlates with an increased financial sustainable growth rate for these enterprises, providing preliminary support for the research hypothesis.

Furthermore, the coefficients of determination for columns (1) to (3) are 0.3429, 0.4757, and 0.5223, respectively, indicating a progressive increase [4]. This suggests that as additional control variables are incorporated, the model's explanatory power for the dependent variable, SGR, improves, thereby enhancing the overall model fit.

In conclusion, the benchmark regression results confirm that fiscal subsidies have a significant positive impact on the financial sustainable growth rate of listed companies in the new energy vehicle sector. These findings lay the groundwork for further investigation into the underlying mechanisms through which fiscal subsidies influence financial sustainable growth rates.

5.6. Robustness Test

The previous section empirically analyzed the impact of fiscal subsidies on the financial sustainable growth rate of listed companies in the new energy vehicle industry using a fixed-effects model. To further test the robustness of the results, this study conducts robustness tests by replacing the explained variable and adding control variables. The results of the robustness tests are presented in Tables 6 and 7.

(2) The values in parentheses below the regression coefficients are robust standard errors.

Table 6. Robustness Test: Replacing the Explained Variable

	(1)	**(2)**
	ROA	ROE
GP	0.0059**	0.0108***
	(0.003)	(0.004)
val	0.0000	0.0000*
	(0.000)	(0.000)
em	-0.0060**	-0.0612***
	(0.003)	(0.008)
growth	0.0056***	0.0126***
	(0.001)	(0.002)
Lev	-0.1046***	-0.0088
	(0.028)	(0.071)
TOP3	0.0151	0.0513
	(0.028)	(0.052)
_cons	-0.0114	-0.0287

	(0.044)	(0.068)
year	Yes	Yes
id	Yes	Yes
N	2069.0000	2069.0000
r2	0.5463	0.5320

Note: (1) ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

After replacing the explained variable with ROA and ROE, respectively, the coefficient of the core explanatory variable, GP, in column (1), where the explained variable is ROA, is 0.0059 and significantly positive at the 5% level. This demonstrates that fiscal subsidies have a significant positive effect on return on assets (ROA); in other words, greater subsidy intensity corresponds to higher ROA. In column (2), where the explained variable is ROE, the coefficient is 0.0108 and significantly positive at the 1% level, indicating that fiscal subsidies also exert a significant positive effect on return on equity (ROE).

This finding aligns with the conclusion of the benchmark regression, which suggests that fiscal subsidies promote the financial sustainable growth rate, thereby preliminarily confirming the robustness of the results [8].

After replacing the explained variables with ROA and ROE, the coefficient of the core explanatory variable, GP, remains significantly positive, and the signs and significance of the main control variables are generally consistent with the benchmark regression results. This consistency indicates that the empirical results of the previous fixed-effects model are robust. In other words, the conclusion that fiscal subsidies positively influence the financial condition of listed companies in the new energy vehicle industry is reliable and not easily affected by changes in the explained variable [4].

In addition, to further verify the robustness of the benchmark regression results, this study incorporates additional control variables, including listing age, age, and the net profit margin of fixed assets (NR), into the regression analysis. The results are shown in Table 7.

Table 7. Robustness Test: Adding Control Variables

	(1)	**(2)**
	SGR	SGR
GP	0.0066**	0.0056*
	(0.003)	(0.003)
val	0.0000**	0.0000**
	(0.000)	(0.000)
em	-0.0368***	-0.0368***
	(0.006)	(0.006)
growth	0.0091***	0.0085***
	(0.001)	(0.001)
Lev	0.0170	0.0244
	(0.044)	(0.043)
TOP3	0.0213	0.0517
	(0.042)	(0.041)
age	0.0209	0.0247
	(0.017)	(0.016)
NR		0.0070**
		(0.003)

_cons	-0.0674	-0.0784
	(0.075)	(0.072)
year	Yes	Yes
id	Yes	Yes
N	2069.0000	2069.0000
r2	0.5229	0.5494

Note: (1) ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.
(2) The values in parentheses below the regression coefficients are robust standard errors.

As shown in the table above, after incorporating more control variables, the coefficient of government subsidies, GP, remains significantly positive. This finding indicates that fiscal subsidies continue to have a positive effect on the financial sustainable growth rate, with the significance level consistent with the benchmark regression results [16]. Therefore, the conclusion that fiscal subsidies promote financial sustainable growth is further validated as robust.

In summary, whether the explained variable is replaced or additional control variables are incorporated, the sign and significance of the core explanatory variable remain stable. The regression results of the original control variables are also consistent with those of the benchmark regression and do not undermine the core conclusion [6]. This demonstrates that the benchmark regression results are robust, the conclusion that fiscal subsidies promote the financial sustainable growth of listed new energy vehicle companies is reliable, and the explanatory power of the model is further enhanced after accounting for additional influencing factors.

6. Research Conclusions and Recommendations

6.1. Research Conclusions

6.1.1. Fiscal Subsidies Have a Significant Positive Impact on the Financial Sustainable Growth Rate

Based on the fixed-effects model analysis of panel data from listed new energy vehicle companies from 2014 to 2023, fiscal subsidies have a significant positive effect on enterprises' financial sustainable growth rate (SGR). In the benchmark regression, each 1% increase in government subsidies is associated with an average increase of approximately 0.7% to 0.9% in SGR. This conclusion remains robust after replacing the explained variable with ROA and ROE and incorporating additional control variables. These results indicate that fiscal subsidies can enhance enterprises' endogenous growth capacity by easing financial constraints, increasing R&D investment, and strengthening market competitiveness. Therefore, the core hypothesis that fiscal subsidies promote financial sustainable growth is supported.

6.1.2. R&D Investment Is a Key Mediating Path through Which Fiscal Subsidies Affect Financial Sustainable Growth

The mechanism analysis indicates that for every 1% increase in fiscal subsidies, enterprises' R&D investment intensity (RD) rises by approximately 0.19%, and this increase in R&D investment further and significantly promotes the financial sustainable growth rate (SGR). This suggests that subsidy funds operate through the transmission chain of "policy incentives-technological innovation-financial growth." Specifically, government subsidies first encourage enterprises to increase R&D investment in key areas such as battery technology and intelligent connected vehicles. These technological advantages are then translated into stronger product competitiveness and profitability, thereby ultimately achieving financial sustainable growth.

6.1.3. The Effects of Fiscal Subsidies Show Significant Heterogeneity

Regional differences: In the eastern region, fiscal subsidies have a significant positive effect on SGR, supported by a complete industrial chain, the agglomeration of innovation resources, and high policy implementation efficiency. In the central region, the subsidy effect is significantly negative, possibly due to a weak industrial foundation and low efficiency in innovation transformation. In the western region, the subsidy effect is not significant, indicating that policy dividends have not been fully realized because of the relatively small economic scale and insufficient supporting infrastructure.

Ownership differences: Non-state-owned enterprises respond more actively to subsidies. For every 1% increase in subsidies, SGR increases by 0.83%, indicating that these enterprises have more flexible mechanisms and higher market sensitivity. By contrast, the subsidy effect is not significant among state-owned enterprises, possibly because budget flexibility and limited innovation incentives reduce subsidy efficiency.

6.2. Recommendations

6.2.1. Government Level: Optimize the Subsidy Structure and Strengthen Targeted Policy Implementation

First, the subsidy model should shift from universal subsidies to dynamic subsidies linked to performance. Subsidy standards should be formulated with emphasis on R&D investment and the efficiency of technological upgrading, such as patent output and improvements in battery energy density, so as to avoid resource misallocation caused by broad and undifferentiated subsidies. For example, enterprises whose R&D investment accounts for more than 10% of revenue may be assigned a higher subsidy coefficient, thereby directing funds toward areas with stronger innovation performance. At the same time, production-side and purchase-side subsidies should be gradually reduced, while support for charging infrastructure, solid-state batteries, and other forward-looking technologies should be increased to strengthen the industry's long-term competitiveness.

Second, differentiated regional policies should be implemented to narrow development gaps. In the eastern region, the advantages of industrial clusters should be used to explore a coordinated mechanism combining subsidies and the carbon trading market. Market-based instruments, such as carbon credit trading, can gradually replace part of fiscal subsidies and encourage enterprises to shift from policy dependence to innovation-driven development. In the central and western regions, special subsidy funds should be established to support the construction of industrial-chain supporting facilities, such as battery raw material bases and charging networks, so as to reduce enterprises' operating costs. Cross-regional technology sharing and talent mobility should also be strengthened to improve the effectiveness of subsidy utilization.

Third, ownership-oriented policies should be optimized according to enterprise type. For non-state-owned enterprises, the current subsidy intensity should be maintained, and a combined policy of subsidies and green credit should be explored to broaden financing channels and support their flexibility in technological R&D and market development. For state-owned enterprises, a subsidy efficiency assessment mechanism should be introduced. Subsidies should be linked to indicators such as R&D investment intensity and market share improvement, so as to address soft budget limitations and stimulate innovation incentives.

6.2.2. Enterprise Level: Improve the Efficiency of Subsidy Utilization and Strengthen Endogenous Growth Capacity

First, enterprises should optimize the allocation of subsidy funds and improve the efficiency of R&D commercialization. A dedicated management system for subsidy funds should be established to ensure that subsidies are primarily directed toward breakthroughs in core technologies and to avoid idle funds or non-productive expenditures. Enterprises should also strengthen industry-university-research cooperation and shorten the cycle of technological application, for example by establishing incentive mechanisms for the commercialization of R&D achievements. In this way, R&D investment can be effectively translated into product premium capacity and greater market share.

Second, enterprises should adjust their financial strategies and reduce the risk of subsidy dependence. Enterprises should reasonably control financial leverage and reduce debt risk through diversified financing channels, such as equity financing and supply-chain finance, thereby enhancing financial resilience. They should also optimize dividend distribution policies and increase the retained earnings ratio. It is recommended that the retention ratio should not be lower than 60%. Profits generated from subsidies should be used for capacity improvement and technological iteration so as to strengthen endogenous growth momentum.

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