

# The Impact of Government Subsidies on Electric Vehicle Sales: a Regression analysis of BYD in China

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**Abstract.** This study aims to investigate the impact of Chinese government subsidies on BYD's electric vehicle sales. Since 2009, the Chinese government has continued to subsidize electric vehicle companies in order to promote low-carbon emissions and boost consumption. As a leading company in China's new energy vehicle industry, BYD received a total of US\$3.7 billion in direct government subsidies between 2018 and 2022, including US\$2.2 billion in a single year in 2022. Through a regression analysis model, this study examines the relationship between Chinese government subsidies and BYD's EV sales. The results show that there is a strong positive correlation between government subsidies and BYD's EV sales, with increased subsidies significantly driving sales growth. Although BYD achieved partial growth without subsidies, the absence of subsidies may negatively affect the sustained sales growth. This study reveals the importance of government subsidies in driving EV market expansion and provides a strong basis for future policy formulation.

## 1 Introduction

To achieve environmental protection of low carbon emissions and promote consumption, the Chinese government has continued to subsidize electric vehicle companies since 2009 [1, 2]. 2010 saw the inclusion of new energy vehicles on China's list of seven strategically important developing sectors. China's new energy vehicles have developed quickly in terms of scale, technology, and supporting infrastructure since the implementation of the "Twelfth Five-Year Plan". New energy vehicle and industry development will be elevated to national strategy in the newly unveiled "13th Five-Year Plan" national strategic emerging industry plan. It is predicated on this kind of strategic positioning: on the one hand, the government is willing to provide financial support to new energy vehicle companies, with the goal of expediting the opening of the domestic market by lowering business costs and encouraging the growth of China's new energy vehicle sector [3]. Among the many electric car companies, the most famous and the first to start is BYD. Since 2003, BYD has been involved in the field of power batteries and has been deeply cultivated. In September 2006, BYD acquired 50% of the shares of NEDO in Japan and 75% of Kanzo in the United States and began to enter the power battery field. In July 2008, Japan's NEDO announced that it had officially reached

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a cooperation with BYD to establish a joint venture in China to produce and sell lithium-ion rechargeable batteries. In 2012, BYD debuted the hybrid model Qin and quickly became the sales champion of new energy vehicles in China.

BYD's core competitiveness is battery technology, BYD has maintained a leading position in the field of traditional batteries, currently accounting for more than 70% of the market share in China, and occupies a place in the world, which is inseparable from its core technology [4, 5]. To support the new energy vehicle industry, most Western countries have tried to increase the sales of electric vehicles by drastically reducing the price of new cars, while China's approach is to pay car manufacturers directly. China provided around US\$5.6 billion in assistance to domestic new energy cars, including battery electric vehicles (EVs), plug-in hybrid electric vehicles (PHEVs), and fuel cell vehicles (FCEVs), prior to phase-out of direct payments to manufacturers in 2022. BYD is the largest benefactor among them, having gotten \$3.7 billion in direct funding between 2018 and 2022. The lion's share was received in 2022 when BYD received \$2.2 billion in funding from the Chinese government. By looking at the total sales of BYD's new energy vehicles from 2018 to 2024, it can be found that the sales of BYD's full range of electric vehicles have surged from 2021 to 2022.

The relationship between EV sales and government subsidies has become a hot topic of academic and industry research. A number of studies have shown that government subsidy policies played a crucial role in the early development of the EV market. On the one hand, direct subsidies can effectively reduce the cost of consumers purchasing EVs and stimulate market demand [6, 7]. On the other hand, subsidies also help EV manufacturers reduce R&D and production costs, thus accelerating technological progress and large-scale production [8, 9]. For example, studies in major EV markets such as the United States, the European Union, and China show that government financial support policies, such as tax incentives, vehicle purchase subsidies, and R&D grants, significantly contribute to the popularization and sales growth of EVs [10, 11]. However, as the market matures, the gradual withdrawal of subsidy policies has become the focus of attention in various countries, and how to achieve a smooth transition of subsidy policies and ensure sustainable market growth is an important issue in current research. Based on the above background, this study will explore the relationship between BYD's full range of electric vehicle sales and Chinese government subsidies.

## 2 Methodology

The focus of this study is to explore the impact of Chinese government subsidies on BYD's total EV sales. A correlation model is developed by analyzing data on government subsidies received by BYD and its EV sales data to reveal the relationship between the two.

According to a report by Sina Finance, *China Provides Billions of Dollars in Subsidies for Domestic EVs, and BYD is the Biggest Beneficiary*. The Chinese government provided about \$5.6 billion in funding for domestic new energy vehicles, including pure electric vehicles, plug-in hybrids, and fuel-cell vehicles, before phasing out direct subsidies to manufacturers in 2022. Among them, BYD, as a leader in the new energy vehicle market, became the biggest beneficiary of this policy, receiving a cumulative total of US\$3.7 billion in direct subsidies between 2018 and 2022. Especially in 2022, BYD received US\$2.2 billion in subsidies in a single year, marking the government's tremendous support for its efforts to promote the popularity of new energy vehicles.

Meanwhile, looking at BYD's EV sales figures (source: <https://xl.16888.com/f/57329/>), a significant growth trend can clearly be observed. BYD's EV sales jumped from 198,860 units in Q3 2021 to 537,664 units in Q3 2022. This suggests that BYD has not only managed to expand its market share but has also complemented the Chinese government's policy support to some extent. From the beginning of 2022 to the present, BYD's EV sales, in general, have shown continued growth, although there was a brief, small drop in sales

between the third quarter of 2022 and the first quarter of 2023, as well as between the third quarter of 2023 and the first quarter of 2024.

To further analyze the specific impact of government subsidies on BYD’s EV sales, this paper adopts a regression analysis, where the amount of subsidies from the Chinese government is used as the independent variable (X), and the total sales of BYD’s EVs are used as the dependent variable (Y). This analytical model allows people to quantify the direct impact of government subsidies on BYD’s EV sales growth, explore the correlation between the two, and verify whether subsidies play a decisive role in driving the expansion of the new energy vehicle market. This quantitative analytical approach helps to provide an in-depth understanding of the impact of policies on business development and provides a basis for future policy formulation.

### 3 Results

The results of this study highlight the significant impact of Chinese government subsidies on the sales of BYD’s electric vehicles (As shown in Table 1). The regression analysis, which examined the relationship between these subsidies and vehicle sales, produced compelling evidence of a strong correlation. The **\*\*Multiple R\*\*** value of 0.911504 indicates a very high degree of correlation between the dependent variable (vehicle sales) and the independent variable subsidies. The outcome of the regression has shown that the P-value of the X-variable and intercept are minor: 6.8617E-14 and 3.36556335, which are both much smaller than 0.05, indicating that the total sales of BYD electric cars have a strong relation with the Chinese government’s subsidy. This strong positive correlation suggests that as government subsidies increase, so do the sales of BYD’s electric vehicles.

**Table 1.** Regression analysis results.

regression statistics						
Multiple R	0.911504013					
R Square	0.830839567					
Adjusted R Square	0.825553303					
Standard Error	94958.80669					
observed value	34					
ANOVA						
	df	SS	MS	F	Significance F	
Regression analysis	1	1.41723E+12	1.41723E+12	157.1695319	6.86166E-14	
Residuals	32	2.8855E+11	9017174967			
Total	33	1.70577E+12				
	Coefficients	standard error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	123386.1667	19383.38525	6.365563347	3.7828E-07	83903.50295	162868.8304
X Variable 1	448077.6333	35741.1964	12.53672732	6.86166E-14	375275.1986	520880.068

The R Square value of 0.83084 further reinforces this finding, indicating that approximately 83.08% of the variance in BYD's electric vehicle sales can be explained by the model. This is a significant portion, suggesting that the relationship between subsidies and sales is not only strong but also substantial in its influence on the market. The Adjusted R Square value of 0.825553, which accounts for the number of predictors in the model, confirms the robustness of these findings, showing that even after adjusting for possible confounding variables, the relationship remains strong.

The quarterly sales data from 2016 to 2017 provides additional context to these findings. Despite the absence of government subsidies during this period, BYD's sales showed a remarkable increase, growing from 101,149 units in the first quarter of 2016 to 159,963 units by the fourth quarter of the same year. This growth, occurring in the absence of subsidies, suggests that other factors were at play in driving sales during this time. However, the data from the first quarter of 2017, where sales dropped sharply to 90,681 units, indicates that the absence of subsidies may have started to exert a negative influence on sales, potentially reflecting a market correction or the waning impact of those other factors.

## 4 Discussion

The discussion of these findings must be situated within the broader context of China's strategic initiatives regarding new energy vehicles. Since 2009, the Chinese government has implemented a series of subsidies aimed at promoting the development and adoption of electric cars, positioning this as a key component of its environmental protection and low carbon emission goals. The inclusion of new energy vehicles as one of the seven strategic emerging industries in China, coupled with the significant financial support extended to companies like BYD, underscores the importance of this sector in the nation's broader economic and environmental strategies.

The regression analysis confirms the effectiveness of these government subsidies in driving electric vehicle sales, particularly for BYD. This company has been at the forefront of this industry in China. The strong correlation between subsidies and sales suggests that these financial incentives have played a crucial role in reducing production costs, thereby enabling BYD to price its vehicles more competitively and penetrate the market more rapidly. This aligns with the Chinese government's strategic goal of expanding the domestic market for new energy vehicles, as outlined in its various five-year plans.

The sales data from 2016 to 2017, however, introduces an interesting nuance to this narrative. The fact that BYD was able to achieve significant sales growth in 2016 without the support of government subsidies suggests that the company's technological innovations, brand reputation, and perhaps favorable market conditions played a substantial role in driving consumer demand. This period of growth without subsidies may indicate that BYD's products had reached a level of market acceptance and technological maturity that allowed them to compete effectively, even in the absence of direct financial support from the government.

However, the sharp decline in sales at the start of 2017 raises questions about the sustainability of this growth without continued government intervention. This drop could be interpreted as a sign that while BYD's vehicles were competitive, the market still required the stabilizing influence of subsidies to maintain its momentum. It is possible that the absence of subsidies began to strain the financial dynamics of the market, leading to decreased consumer confidence or a shift in market priorities. This suggests that while technological advancements and market strategies are critical, they may not be sufficient to sustain growth in the absence of supportive government policies.

The substantial increase in BYD's sales from 2021 to 2022, which coincided with the receipt of \$2.2 billion in government subsidies in 2022, further underscores the critical role

of financial support in this industry. The data suggests that this influx of government aid was a key factor in the surge of BYD's electric vehicle sales during this period, demonstrating the effectiveness of such subsidies in stimulating market demand and accelerating industry growth. This finding highlights the continued importance of government intervention in ensuring the success of strategic industries like new energy vehicles, particularly in the context of achieving national goals related to environmental protection and economic modernization.

## 5 Conclusion

This analysis offers strong proof of the important role Chinese government subsidies play in propelling BYD's electric car sales. According to the regression analysis, there is a significant positive connection between sales and subsidies, and the amount of government assistance accounts for a sizable amount of the variance in sales. This result is in line with the strategic goals of the Chinese government, which has made the advancement of new energy vehicles a top priority and an integral part of its economic and environmental policies.

The analysis of BYD's sales data from 2016 to 2017 suggests that while the company was able to achieve growth without subsidies, the absence of continued government support may have posed challenges to sustaining this growth. The sharp decline in sales in early 2017 highlights the potential vulnerabilities of the market in the absence of subsidies, suggesting that while technological innovation and market strategy are important, they may not be sufficient on their own to maintain momentum in a rapidly developing industry.

The substantial increase in BYD's sales following significant government subsidies in 2022 reaffirms the critical role of financial support in this industry. This suggests that continued government intervention is necessary not only to stimulate market demand but also to ensure the long-term success and sustainability of the new energy vehicle sector in China.

Overall, this study underscores the importance of a comprehensive approach to industry development, where government policies, technological innovation, and market strategies work in tandem to achieve national goals. As China continues to advance its environmental and economic objectives, the experience of BYD and the new energy vehicle industry offers valuable insights into the role of strategic subsidies in driving industrial growth and achieving long-term sustainability. However, the study also involves some limitations: there're multiple causes triggering the development of electric cars enterprise currently, including expertise and dynamic trend of car models, which will all determine sales of a kind of electric cars.

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