

From Trends to Drivers: Key Factors Propelling Electric Vehicle Sales

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Abstract: With the rapid advancement of human economic levels and modern civilization, the automobile manufacturing industry is increasingly confronted with challenges related to energy scarcity and environmental pollution. Low carbon emissions and energy savings have become the main focus of automotive development. Under the influence of government incentives, the sales of household electric vehicles (EVs) have increased significantly, although they still represent a small share of the overall car market. To examine the factors influencing consumer purchases of household EVs, this report integrates both qualitative and quantitative analyses, controlling for single variables. Using linear regression, an empirical analysis was conducted on 18 BYD models with varying ranges and prices. The results indicate a strong positive correlation between driving range, selling price, and EV sales. Looking ahead, the development of new energy vehicles should prioritize longer ranges, high-quality features, and cost-effective performance.

Keywords: Electric vehicle; Endurance mileage; Selling price; EV sales; Empirical analysis

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1. Introduction

With the rise of sustainable development and the growing popularity of low-carbon concepts, new energy vehicles have become a significant trend in the automotive industry. The most notable of these are pure electric vehicles (EVs) powered by onboard batteries. Compared to traditional gasoline-powered cars, EVs boast high energy efficiency, fewer exhaust emissions, and zero pollution. Despite the global surge in production and sales of electric vehicles since 2013, their overall market share remains relatively low^[1].

As an emerging and still-developing industry, electric vehicles present consumers with various considerations when making purchasing decisions. One of the key factors influencing these decisions is the vehicle's range, a critical metric in evaluating performance. Additionally, selling price and quality, which are influenced by household income levels, are also primary concerns for many consumers^[2]. This study uses market share as an indicator of EV sales and employs linear regression analysis and control variate methods to empirically examine the relationship between range, selling price, and electric vehicle sales.

2. Literature collection and integration

2.1. Literature review

Through keyword searches, three studies examining the relationship between range, selling price, and sales of household EVs were identified. Cheron and Zins^[3] highlighted that consumers prioritize the range of electric vehicles and the size of the battery capacity. Giansoldati *et al.*^[4] investigated the purchase intentions of Italian consumers, concluding that the limited range for daily driving partially reduced their willingness to purchase. From the perspective of challenges facing electric vehicles, Ajanovic^[2] argued that improved sales prospects for EVs can only be achieved by enhancing battery technology to lower prices.

In determining a reasonable metric for measuring sales, three studies utilizing market share as an index for EV sales were found. Mau *et al.*^[5] mentioned that EV attributes influence market share, which partially reflects sales. By examining subsidies for new energy vehicles in the European Union, Gómez Vilchez and Thiel^[6] found that higher subsidies led to increased market shares for electric vehicles, indicating positive industry sales. Yan *et al.*^[1] suggested that overcoming the issue of low market share is crucial for further expanding industry sales. Therefore, using market share as an index for measuring EV sales is a scientifically sound approach^[7].

2.2. Qualitative analysis of endurance mileage, selling price, and EV sales

Endurance mileage is a key factor influencing family car sales. With rapid advancements in electric system technology, the endurance mileage of new energy vehicles has significantly improved. For most families, a greater endurance mileage better meets daily life needs. If electric vehicles lag behind gasoline-powered cars in endurance mileage, consumers may struggle to shift their perceptions and embrace new energy vehicles^[8,9]. Thus, endurance mileage is a crucial determinant of household EV sales.

The selling price is closely related to the endurance mileage. The cost of purchasing an EV is a significant factor in consumer hesitation^[4]. A survey of 1,248 electric vehicle owners across six countries revealed that purchase price is a top priority for consumers, and price reductions would significantly increase purchase intentions^[6]. Consumers typically seek to spend less money while obtaining a high-performance, reputable vehicle. As such, to boost sales, the practicality and affordability of family EVs should be enhanced by improving performance and lowering selling prices.

2.3. Determining indicators for measuring sales

To accurately reflect the market performance of electric vehicles, an appropriate measurement index should be selected. Market share, which represents the proportion of a product's sales within its market segment, is a useful metric for evaluating product quality^[10]. Listing the numerical market share allows for the quantification of household EV sales and provides insights into the industry's growth potential^[11].

3. Data source and collection

The data for this analysis primarily comes from Public Car Network, Pacific Auto Network, CPCA, JATO, and the financial statements of various brands. To examine the recent development of the electric vehicle (EV) industry, data on global EV sales and growth rates from 2014 to 2021 were collected. Due to the large number of brands in the EV market, macro data analysis can be challenging^[12]. This report uses the control variable method to improve the accuracy of the survey results. Data on the mileage, selling price, sales volume, and market share of 18 BYD models in China from January to September 2022 were selected to analyze the factors influencing EV sales^[13].

4. Methodology

To determine the factors affecting EV sales and analyze their relationships, this report uses the global EV sales growth rate from 2014 to 2021 to reflect current market trends. Then, to estimate the factors influencing consumer purchases, data on 18 different BYD models were collected. Based on linear regression, the relationship between range, selling price, and sales is empirically analyzed ^[5].

4.1. Analysis of sales trend in the EV market

Table 1 presents the sales volume and growth rate of global EVs from 2014 to 2021. The last column shows the year-over-year changes, which are generally positive, with significant growth ^[14].

Table 1. Global EV sales and year-on-year growth rate, 2014–2021

Year	Sales (ten thousand)	Growth rate (%)
2014	35.00	-
2015	54.90	56.86%
2016	32.89	-40.10%
2017	122.30	271.89%
2018	201.82	65.02%
2019	210.00	4.05%
2020	324.00	54.29%
2021	675.00	108.33%

Figure 1 illustrates the global sales of electric vehicles and changes in growth rates from 2014 to 2021. As shown, global EV sales rose from 350,000 units in 2014 to 67.5 million in 2021, with the annual growth rate consistently positive. Since 2018, global EVs have made significant advancements by focusing on vehicle performance, improving range, and building cost-effective models. These developments have led to increased consumer trust in EVs ^[15].

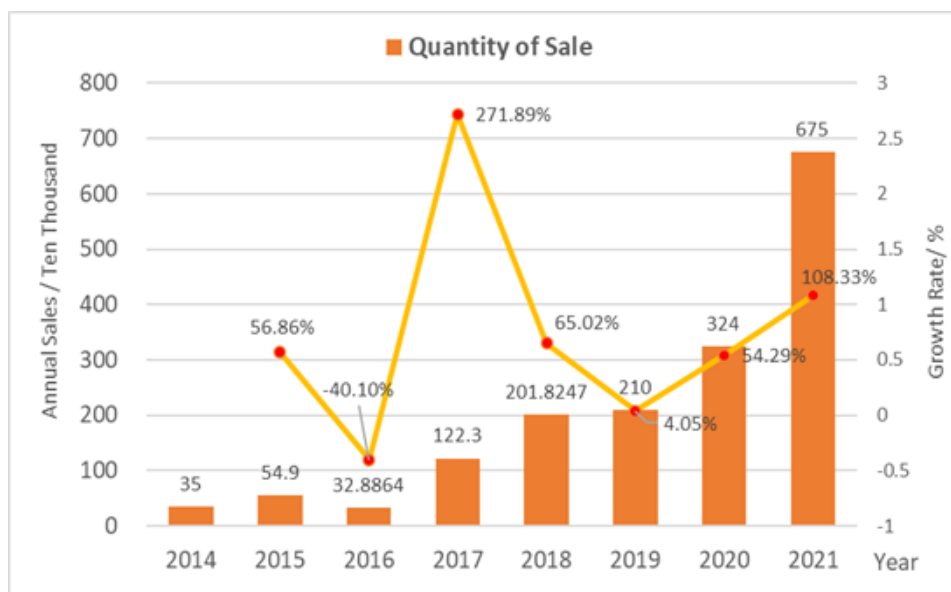


Figure 1. Graph of global EV sales and growth rate

4.2. Linear regression analysis of endurance mileage, selling price, and EV sales

To further analyze the impact of endurance mileage and selling price on EV sales, this report conducts an empirical analysis of these two variables using linear regression. According to Kong *et al.* [12], increasing endurance mileage results in higher costs, which can impact sales. To test this relationship, data on endurance mileage and market share for 18 different BYD models from January to September 2022 were used to create a scatter plot, followed by trendline fitting [10]. The scatter plot is shown in **Figure 2**.

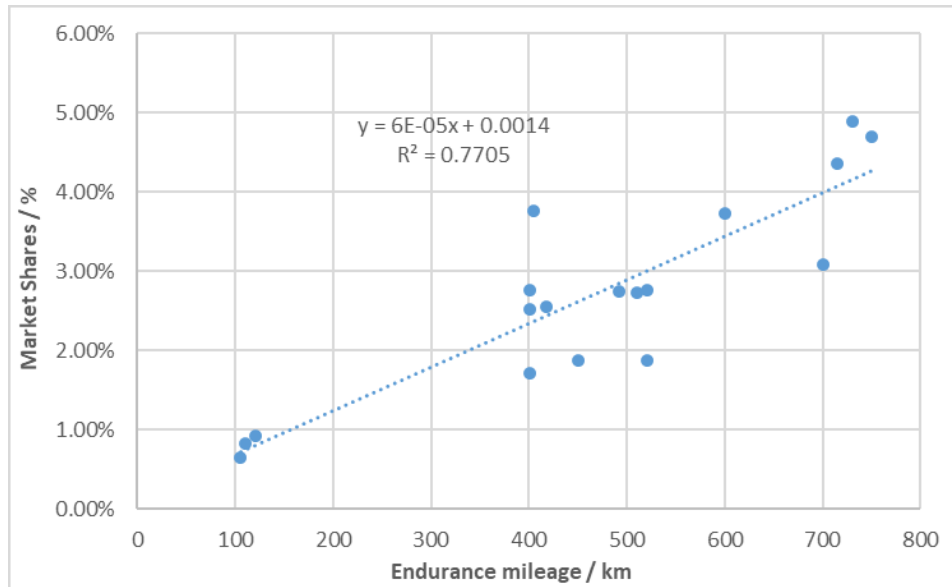


Figure 2. Scatter plot of endurance mileage and market share from January to September 2022

The linear regression equation is $y = 6 \times 10^{-5}x + 0.0014$, and the R^2 value is 0.7705, indicating a high degree of fit. The correlation coefficient r is calculated to be 0.8778.

A similar linear regression analysis was performed for selling price and market share, with selling price as the explanatory variable and market share as the response variable [1]. The results are shown in **Figure 3**.

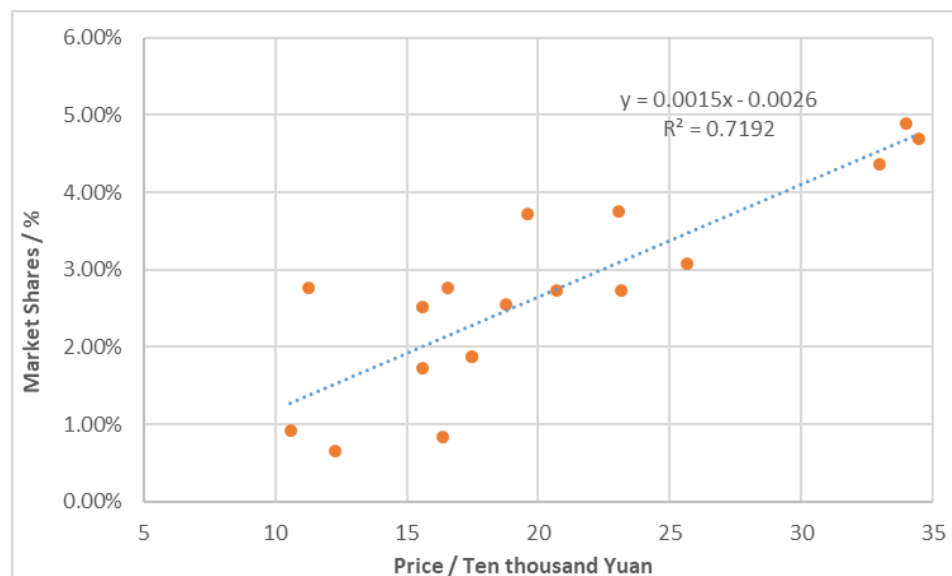


Figure 3. Scatter plot of selling price and market share from January to September 2022

The linear regression equation derived from fitting the scatter plot is $y = 1.5 \times 10^{-3}x - 0.0026$, and the R^2 value is 0.7192, with no outliers. The correlation coefficient r is 0.8481, indicating a strong positive correlation between selling price and market share.

Based on these correlation tests, endurance mileage and selling price are strongly correlated with market share, suggesting that these two factors significantly influence EV sales.

4.3. Analysis and data limitations

This survey only analyzes the impact of range and selling price on EV sales. Other factors, such as government policy, after-sales service, and infrastructure development, were not considered, which may introduce some bias. However, these factors likely have a limited impact on overall EV sales and would not significantly alter the results. Additionally, since only one brand was analyzed, the results may be somewhat specific to BYD. Nonetheless, given the similarities in consumer purchasing psychology across different brands, the findings of this report are likely to hold up in practice. Therefore, this report has a high degree of credibility.

5. Conclusion

This report presents several conclusions regarding the factors that affect EV sales. By reviewing relevant literature, market share has been identified as the key index for measuring sales. First, the development of the EV industry has been advancing steadily since the field of new energy vehicles found its footing. Between 2014 and 2021, global EV sales experienced dramatic growth, with annual growth rates remaining positive at relatively high levels. Notably, in 2017 and 2021, growth rates reached 271.89% and 108.33%, respectively. This suggests that the EV industry has achieved significant breakthroughs in various areas.

Second, due to the practicality of household electric vehicles, endurance mileage and selling price emerge as the most important factors influencing consumer purchasing decisions. Regression analysis reveals that endurance mileage and selling price have a strong positive linear correlation with market share. This demonstrates that as endurance mileage and selling prices increase, the market share for these types of EVs grows accordingly. Thus, these two factors significantly impact electric vehicle sales^[8].

In conclusion, the findings of this report suggest that EV sales are growing as vehicle performance, endurance mileage, and pricing improve. The key for electric vehicles to surpass traditional fuel vehicles lies in achieving a leap in cost-effective performance. Looking ahead, the future of the EV industry appears promising. Companies should continue to innovate in battery technology to substantially improve performance while reducing costs, ultimately striving to build a high-quality EV industry characterized by endurance mileage, high performance, smart technology, and interconnectivity.

Disclosure statement

The author declares no conflict of interest.

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