

Analysis of the Influence of Second-Hand Car Condition on the Value of Second-Hand Car

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Abstract: In recent years, China's used car market has experienced significant growth, emerging as a vital channel for vehicle owners to both sell and purchase cars. The rise of used car trading platforms has significantly improved transaction efficiency. Researchers have found that exploring ways to enhance the resale value of used cars is of great significance for used car sales. Therefore, the theme of this paper is an analysis of the impact of vehicle condition on resale value based on the Dongchedi platform. The study utilizes a combination of research methods, beginning with the collection of multidimensional data from the Dongchedi platform, spanning from 2007 to 2023, with a sample size of 150 vehicles. Using Python's OLS regression analysis, it examines the extent to which various factors affect resale value. The study finds that factors such as "whether it is a new model," "whether it is being resold for the first time," and "whether it has leather seats" have a significant impact on resale value. Conversely, factors such as "fuel consumption per 100 kilometers," "whether the car is black or white," and "whether an inspection report is available" do not demonstrate a statistically significant impact on resale value. This findings offer references for merchants and platforms in optimizing the pricing of used cars and the information display strategies of user interfaces.

Keywords: Used Car Market, Resale Value, OLS Regression Analysis

1. Introduction

In recent years, China's used car market has experienced substantial growth, establishing itself as a crucial channel for vehicle owners to both sell and purchase cars. "Used cars are an indispensable and important link in the automotive circulation industry. From the perspective of the used car transaction process, the upstream sellers mainly come from individuals or enterprises; the midstream consists of used car trading markets, which can be divided into online and offline, with the transaction model primarily involving a process from consumers to dealers and back to consumers. The downstream consumers are mainly divided into individuals and enterprises. According to recent data, from January to November 2024, the total transaction volume in the used car market reached 17.7139 million units, marking a 5.74% year-on-year increase and a rise of 961,600 units compared to the same period the previous year. The cumulative transaction value amounted to 1,165.243 billion yuan, while over 4 million applications for vehicle scrapping and replacement subsidies were recorded nationwide. This

reflects that a large number of consumers are actively participating in vehicle scrapping and replacement activities. Against this backdrop, the used car market has ushered in unprecedented development opportunities [1]. The above report indicates that the rise of used car trading platforms has significantly improved transaction efficiency and optimized the consumer experience.

As the market structure becomes increasingly diversified, the impact of various vehicle conditions on used car prices has become a focal point of industry attention. Moreover, with the rapid development of internet technology in recent years, the application of information technology and online platforms has facilitated the integration of the internet with traditional industries. Leveraging the unique advantages of the internet, the used car market has ushered in a new spring of development [2]. The "Internet Plus" initiative has reshaped the entire chain of used car assessment, transactions, finance, and services, opening a new chapter for market development. "Internet Plus" has promoted the transparency of information, convenience of transactions, and intelligent development in the used car market. Looking ahead, the future of the used car market will be shaped by the integration of online and offline services, the expansion of automotive finance, the application of intelligent technologies, and the growing prominence of new energy vehicles, all of which will drive further market growth. Therefore, this paper aims to study the emerging used car trading app "Dongchedi," using its statistical data as the research subject. As of 2024, Dongchedi's mobile DAU (Daily Active Users) is nearly 10 million, with 7.5 million automotive content creators covered by its operations, and 510 million users interested in cars [3]. It has become one of the most popular car purchasing platforms in China, particularly among younger demographics. Notably, there is a lack of prior research utilizing data from the Dongchedi app, making this study an important and valuable contribution to the field. Based on this, the article aims to analyze the impact of different vehicle condition factors on the resale value of used cars in the context of "Internet Plus," using emerging platforms as a medium, and to explore the key factors causing the differences. This study sets brand and energy type as control variables to reduce the interference of brand premiums and usage cost differences on prices. It selects whether the vehicle is a new model, whether it is being resold for the first time, fuel consumption per 100 kilometers, body color, whether there is an inspection report, and whether there are leather seats as independent variables to analyze their mechanisms affecting vehicle resale value. This research aims to assist consumers in more accurately assessing the market value of vehicles when making purchasing decisions, thus mitigating the negative effects of information asymmetry, which can lead to adverse selection and distorted transaction prices in the used car market. For instance, if consumers cannot accurately assess the vehicle's condition, it may lead to inferior vehicles entering the market, affecting price stability and exacerbating trust issues. Ultimately, this study seeks to optimize the pricing mechanism of the used car market, provide scientific pricing basis for used car trading platforms, assist the market in formulating more reasonable policies, and promote the stable development of the used car industry.

2. Literature Review

This article studies the impact of the condition of used cars on their resale value, specifically focusing on their pricing. As early as 1978, George Akerlof proposed the "Market for Lemons" theory, which explains the phenomenon of market failure caused by information asymmetry. Akerlof [5] argued that when one party in a transaction has more information than the other, it leads to market inefficiency, often resulting in inferior goods dominating the market. This is particularly evident in the used car market, where the uncertainty regarding the condition of used cars leads buyers to tend to pay an average price that is too low for each vehicle. This significantly decreases the resale value of used cars, causing high-quality vehicles to exit the market [5]. This phenomenon ultimately forms a vicious cycle, where prices further decline, leading to more good cars exiting the market, resulting in a failure of market mechanisms. In addition, Leland, Hayne E also pointed out that in markets with

information asymmetry, it is necessary to not only control information but also to have certain quality constraints, specifically regarding the condition of the cars [6]. This study builds on these theoretical frameworks by analyzing the factors that significantly influence used car pricing. By identifying key variables, the research aims to help buyers make more accurate price assessments, promote price fairness in the market, and facilitate the availability of high-quality products through a more transparent and efficient trading platform. Further supporting this approach, Wang et al. have demonstrated that machine learning methods can be used to optimize price predictions based on the multidimensional characteristics of used cars (such as age, mileage, brand, condition, etc.), thereby enhancing the accuracy and fairness of pricing [4]. Furthermore, the 2021 China Used Car Finance and Ecology Report mentioned that standardizing the used car market's pricing can learn from the standardized requirements for used car condition information in the United States and Japan [5]. These expert analyses provide a foundation for the feasibility and significance of our research, offering a comparative framework for the study. By employing regression analysis to study the impact of used car condition on the depreciation rate of used cars is a preliminary exploration of this approach.

Regarding the above issues, Zheng Yan, Liu Jie, and Zhang Jing pointed out that “signaling game theory” can also analyze the information asymmetry problem in the second-hand car market [6]. The application of signaling theory, they argue, is crucial for improving the functioning of the second-hand car market by reducing information asymmetry and fostering more efficient transactions [7]. Zhang Binghong believes that information asymmetry is the foundation of signaling theory [8]. For example, listed companies can transmit signals by increasing the transparency of accounting information, and based on this, he proposed relevant countermeasures to enhance information disclosure transparency under conditions of information asymmetry [9]. The above literature fully demonstrates the importance of signaling theory in the sales industry. In the context of second-hand car transactions, signaling theory can assist sellers in better communicating the true condition of vehicles under conditions of limited information. Through the inspection and screening of this information, they can choose products that meet their preferences. Additionally, it can reduce the risk of second-hand car sellers purchasing low-quality second-hand cars, allowing vehicles to achieve a more reasonable selling price that is closer to their true value, thereby improving the rationality and satisfaction of consumer decisions. However, it cannot guarantee the authenticity of the signals received by buyers regarding second-hand cars. Among these signals, there may be forged records or false statements provided to impersonate high-quality second-hand cars, making it difficult for buyers to fully verify the authenticity of these signals, and they still face certain transaction risks. In summary, it is necessary to continuously enhance market regulation and improve verification methods to better fulfill its role.

Additionally, for used car sellers, Michael Porter’s cost leadership strategy, introduced in his 1980 framework, plays a crucial role in enhancing competitiveness within the industry. Ma Shuanghua and Wang Maohong pointed out that the cost leadership management strategy originally refers to a company strengthening its internal cost control to reduce its overall costs below those of its main competitors, thereby becoming the cost leader in the industry [10]. Deng Guiqing compared the cost leadership strategy, differentiation strategy, and focus strategy, highlighting the advantages of the cost leadership strategy—maintaining profitability in price wars or enhancing competitiveness through low prices is a common competitive strategy for businesses [11]. Zheng Chunhong also recently pointed out that implementing a cost leadership strategy can fully leverage the economies of scale from mass production, allowing companies to gain greater bargaining power when purchasing raw materials to lower unit costs; at the same time, the efficient operation of production lines can reduce waste and further optimize the cost structure [12].

The above fully demonstrates the importance of a cost-first strategy for sales enterprises. Based on this theory, used car sellers can utilize standardized vehicle condition inspection processes to

accurately assess the true condition of the vehicles, and then use models to estimate their depreciation rates. This not only avoids purchasing high-priced vehicles with low depreciation rates but also saves costs during the procurement phase. Furthermore, used car sellers can implement a cost optimization strategy to establish a strict inventory management system, maintain close contact with suppliers, and stay updated on vehicle conditions to determine reasonable inventory levels. At the same time, a scientific and rational procurement process should be established to avoid inventory backlog [13]. In the event of inventory backlog, used car sellers should implement a quick pricing and sales strategy to minimize the risks of further depreciation and avoid long-term stagnation of unsold vehicles. This emphasizes the importance of understanding the factors that influence depreciation rates.

3. Method

3.1. Model Introduction

This study employs the Ordinary Least Squares (OLS) regression model to investigate the primary factors influencing the dependent variable, "retention rate." The OLS method, a widely utilized regression technique, aims to minimize the sum of squared errors between observed and predicted values. By doing so, it provides the best linear estimate of the relationship between independent and dependent variables. It helps assess the independent linear impact and significance of each independent variable on the dependent variable and is widely applied in fields such as economics, statistics, and engineering. In this experiment, the main focus is on the impact of different characteristics of vehicles in the used car market on their retention rate. The OLS model was used to perform regression analysis on these parameters to explore their linear relationship with the retention rate of used cars.

For the analysis, 122 samples were first selected from the dataset for regression analysis, with the dependent variable being the "retention rate" and the independent variables including six factors such as "fuel consumption per 100 kilometers," "whether it is a new model," and "whether it is the first resale." We used the statsmodels library in Python to conduct the regression analysis. After constructing the OLS model, we calculated the regression coefficients, standard errors, t-values, and corresponding p-values to assess the significance of each independent variable.

In the experiment, we performed OLS regression analysis on vehicle data using the statsmodels library in Python. Subsequently, we established the OLS regression model and fitted the data using `sm.OLS(y, X).fit()`, and finally, we used the `model.summary()` method to output the results of the regression analysis.

3.2. Result Analysis

The model's R-squared is 0.752, indicating that approximately 75.2% of the variation in the dependent variable "retention rate" can be explained by these independent variables. This suggests that the model performs well in explaining the "retention rate."

Table 1: The following is an analysis of the results for each independent variable.

Variables	Coefficient (coef)	t-value	p-value	Significance	Explanation
const	0.1782	—	0.004	Significant	Even when all independent variables are set to zero, the baseline value of the retention rate is still significantly greater than zero.

Table 1: (continued).

Fuel consumption per 100 km	-0.0068	-0.983	0.328	Not significant	Fuel consumption per 100 kilometers does not have a significant impact on the resale value, so fuel consumption is not the main factor affecting the resale value of used cars.
Is it a new car	0.3144	15.067	0.000	Significant	New models have a very significant positive impact on resale value, with new cars retaining their value better than older cars, which aligns with market common sense.
Is it a first resale	0.0447	2.384	0.019	Significant	Vehicles that are sold for the first time usually maintain better condition, which results in a higher resale value, in line with market common sense.
Is it black or white	0.0253	1.205	0.231	Not significant	The color of the vehicle (black, white, or other colors) does not have a significant impact on its resale value, although black and white may be favored by consumer preferences.
Is there a testing report	0.0152	0.798	0.427	Not significant	Is there a detection report that shows the impact on the retention rate is not significant, even though it may influence consumer purchasing decisions?
Is there leather seats	0.0611	2.939	0.004	Significant	Genuine leather seats have a significant positive impact on resale value. As a high-value feature, they can effectively enhance market retention value.

4. Discussion

Based on the data obtained from the experiment, we can conclude that the p-value for the fuel consumption of used cars per 100 kilometers is 0.328, which is considered a non-significant variable. This means that in the current study, fuel consumption per 100 kilometers is not a key factor affecting the resale value of used cars. As Tang Yi pointed out, fuel consumption is a factor that consumers consider when deciding whether to purchase a used car, and vehicles with lower fuel consumption tend to retain their value better [14]. Since there are usually professionals responsible for assessing fuel consumption in used car transactions, and consumers can accurately understand the relevant data, cars with higher fuel consumption often see a faster decline in price. This is the main reason affecting the resale value of used cars. Therefore, we initially predicted that the fuel consumption per 100 kilometers of used cars might significantly impact their resale value [15]. However, the research results are not as expected. This may be due to the unique supply and demand conditions for vehicles in the market, leading buyers to focus more on scarcity rather than fuel consumption. Ultimately, in the used car market, people prioritize the condition of the car; a cost-effective used car can make consumers less concerned about fuel costs. The p-value for whether a used car is a new model is 0, indicating it is a significant variable, and there is sufficient evidence to suggest a significant relationship between whether a used car is a new model and its resale value. Therefore, analyzing whether a used car is a new model can help both buyers and sellers make reasonable transactions. In

contrast, the p-value for whether a used car is a new model was 0, indicating a significant relationship between the status of a car being a new model and its resale value. This result supports the importance of model year as a significant determinant of pricing in the used car market, providing both buyers and sellers with valuable insights for making reasonable transaction decisions.

Furthermore, the p-value for whether a used car is being resold for the first time was 0.019, also indicating a statistically significant relationship. This suggests that first-time resale status plays a key role in determining the resale value of a vehicle, offering valuable information for industry participants to optimize inventory management and pricing strategies. The impact of whether a vehicle is "black or white" on the resale value of used cars is not significant, which differs from the initial expectations of the research. This is supported by the "Consumer Automotive Color Preference Survey" released by Axalta, which shows the color and paint preferences of car owners in the four major automotive producing countries (China, Germany, Mexico, and the United States). Over 1,000 Chinese respondents aged between 25 and 60 believe that color is one of the key factors considered when purchasing a car, influencing 99% of their buying decisions. At the same time, 26% of respondents consider black to be their favorite color, while 11% prefer white, making these two colors the most represented in the survey data [16]. In the early stages of the research, it was predicted that the preference for black and white colors among most car owners might significantly affect the resale value of used cars. However, the results of the regression analysis contradicted this prediction, which may be due to the following reasons. First, there is a change in the market supply and demand relationship. Although black and white are found to be the most popular vehicle colors, car manufacturers typically adjust the production ratio of colors based on market demand. The supply of popular colors is often abundant, which helps avoid price fluctuations caused by scarcity. Therefore, there may be more black and white vehicles on used car platforms, and under the balance of supply and demand, the data does not clearly reflect their impact on the resale value of used cars. Secondly, since our analysis is based on the Dongchedi platform, its users may lean more towards a younger demographic, making rare colors (such as yellow and orange) potentially more appealing to this group (like young consumers), as noted in iSeeCars.com's research on the U.S. automotive market although this factor was not directly explored in this analysis. Another regression result that contradicts the previous predictions is that the presence or absence of an inspection report does not significantly affect the resale value of used cars. As mentioned earlier, the standardized control of used car quality relies on professional inspections, but the analysis shows that buyers and sellers may not prioritize this condition when selling used cars. This situation may be related to the underdeveloped used car appraisal and evaluation system, which could weaken the role of inspection reports in pricing, as well as the varying levels of buyers' recognition of the authority of multiple inspections. Wei Haijiao discussed this issue in the literature review "Research on Factors Influencing Used Car Price Assessment in China [17]." Finally, consistent with the research hypothesis, whether a car has genuine leather seats significantly affects its resale value, which may relate to the manufacturing cost of the car itself and buyers' demands for comfort and interior quality.

5. Research Layout and Prospects

Although this study has made important findings from data analysis, there are still certain limitations. Firstly, the study simply divided the body colors into "black and white" and "other", failing to refine the possible market preference differences for different colors. Second, while fuel type and fuel consumption per 100 kilometers did not show a significant direct effect on the resale value of used cars, these factors are inherently linked to the overall cost of vehicle ownership. Differences in fuel efficiency and fuel type can influence a buyer's total cost of ownership, which, although not directly correlated with resale value in this analysis, could have an indirect impact on buyer decision-making and pricing. Future research could further explore these relationships, investigating how fuel type and

consumption influence buyer behavior in more depth. To address these limitations, future studies could Future research can start with more detailed data classification to further explore the role of other possible factors such as vehicle color, fuel model, and fuel consumption per 100 kilometers, providing more comprehensive guidance for the second-hand car market in the future.

6. Conclusion

This study provides important practical guidance for sellers and second-hand car trading platforms by conducting regression analysis on the main factors affecting the resale value of second-hand cars. From the perspective of signal theory, research has shown that confidence in a vehicle's new model attributes, clarity of first resale records, and high-end interior configuration can serve as significant positive signals, enhancing buyers' trust and preference for vehicle quality. Sellers can enhance the attractiveness of used cars by strengthening these signal features, displaying detailed vehicle usage records, highlighting the value of interior upgrades, and emphasizing technological updates, thereby increasing resale value and reducing the negative impact of information asymmetry

From the perspective of cost priority strategy, the study suggests that second-hand car sellers should prioritize investments in areas that directly improve resale value, such as modest interior upgrades, repairing essential components, or optimizing the vehicle's appearance. On the other hand, they should focus on controlling costs for features that have a lesser impact on resale value. This approach allows sellers to allocate resources efficiently, which can substantially increase profit margins and, in turn, maximize overall resale value. By adopting this cost priority strategy, sellers can make informed decisions on where to direct their investments, ensuring higher returns without overextending their budgets. For second-hand car trading platforms, the research results also provide specific directions for optimizing information display. The platform can optimize the information display logic around the key factors that consumers are concerned about, reduce redundant information, highlight the high resale value of vehicles, and help consumers make decisions quickly. This can not only shorten the transaction cycle, but also promote user stickiness and long-term revenue growth of the platform by increasing the satisfaction of both buyers and sellers.

In summary, this study combines signal theory, pricing optimization, and cost priority strategy, providing not only a specific practical path for second-hand car sellers to improve vehicle resale value, but also a strategic reference for trading platforms to improve user experience and transaction efficiency, thereby jointly promoting the healthy development of the second-hand car market and a win-win situation for all parties.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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