

# Analysis of the Used Car Market in the United States

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**Abstract.** Used cars are an essential part of the automobile market. With the change in people's car buying concept and increased consumer demand for cars, its market has become increasingly active. In this paper, we analyzed the United States used car market data to understand how factors like car brand, owner type, location, and mileage affect the price of used cars. We find that Asian brands account for a more significant proportion of the market. Comparing Honda and Toyota in Japanese cars, we assume that Toyota is relatively more cost-effective than Honda. We also identify several major sales hubs in the United States, such as New York and Massachusetts on the east coast, California on the West Coast, and Florida on the south. This paper thus provides used-car market potential consumers and existing sellers with price and location references.

**Keywords:** Used cars; Price analysis; US market.

## 1. Introduction

Over the last few years, the value of the used car market has grown significantly, accounting for an increasing share of the overall market value. The global used car market is projected to reach over 1.5 trillion US dollars in 2027 (Carlier, 2021). Specifically, the COVID-19 pandemic causes a considerable disturbance to the automotive industry. Consumers, especially commuters, are expected to prefer private transportation over mass transportation in the aftermath of the pandemic. However, persistent inventory shortage in the new car market and budget constraints of individual consumers are expected to deter new car purchases. In addition, myriad vital factors, such as the growth of online sales platforms, increased transparency of market information, and the introduction of certified used car programs, drive the market growth.

In this paper, we examine data collected by an automobile company from India based on various market surveys (Kumar, 2022). It had 8128 entries containing information on used cars, including selling prices, geographical location, year of purchase, mileage driven, type of owner, etc., from 1994 to 2020 in the United States. This paper will discuss the relationship between price and car brand, mileage driven, owner type, and location, followed by some explanations of the extreme values or unusual changes in the graphs. The main goal is to understand the factors influencing the selling price of cars in the market, provide some price references to help buyers make decisive purchase decisions, and help sellers make competitive pricing and product choices for the future market.

The main contribution of this paper is to study the relationship between multiple variables and used car prices, analyze and compare Honda and Toyota used car brands in specific, and provide more intuitive information reference through data visualization.

## 2. Used cars market analysis

Fig.1 ranks the number of cars sold by each vehicle brand from 2005 to 2020. The top five brands are Maruti, Hyundai, Mahindra, Tata, and Toyota. One Korean brand, two Japanese brands, and two Indian brands. Maruti was the most popular brand among the 2000 cars sold in this dataset. While this is a small percentage of the total U.S. used car market, together with Hyundai and Toyota, we can infer the popularity of Japanese and Korean cars in the United States. Statistics also show that in 2021, Asian brands continued to be the leading group among foreign manufacturers in the US (Carlier, 2022). The leading position of the Japanese and Korean brands further supports that Asian automobile manufacturers produce some of the best-selling vehicle models—for example, Toyota Corolla, Toyota Camry, and Honda Civic (Carlier, 2022). The main reasons for the popularity of Japanese and Korean vehicles are affordability, fuel efficiency, and reliability. Given the increased gasoline price

in the US, consumers may change their long-term decisions about which kind of vehicle to purchase. So, we might expect an increase in the demand for Asian brand used cars or a rise in the price of Asian brand used cars.

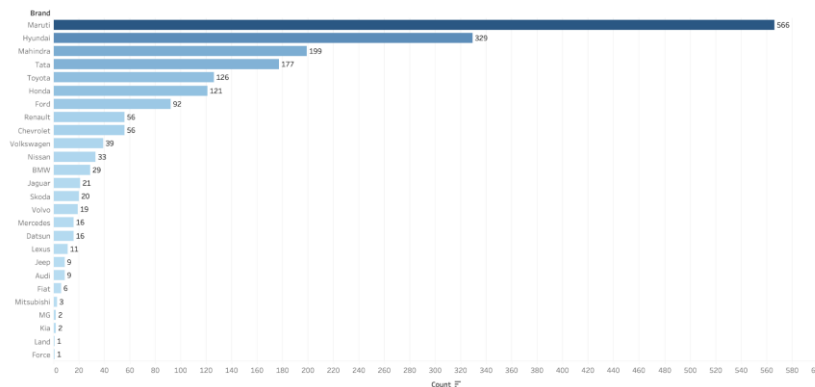


Fig. 1 Number of sales by vehicle brand

However, it is surprising that the Indian brand Mahindra had a significant proportion. One possible explanation is to consider the source of this dataset. This dataset was collected by an Indian company whose primary purpose is to enter the second-hand car market in India. Therefore, it would focus more on domestic car brands when collecting the survey to have more references for their local market. The location of Mahindra's distribution centers also contributes to its top position. According to its website (Mahindra USA, 2022), Mahindra has opened distribution centers in Texas, California, Arkansas, Tennessee, and Pennsylvania. Indeed, California and Texas are among the top states in the used car market, which will be detailed later.

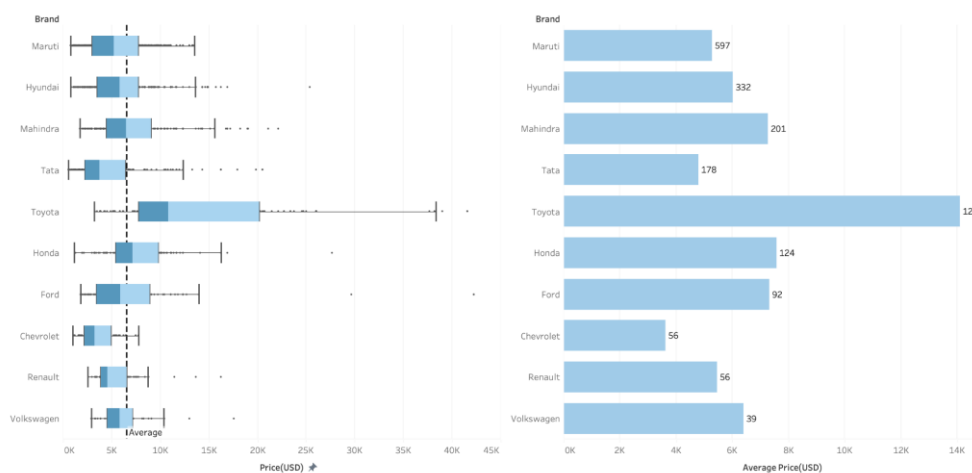


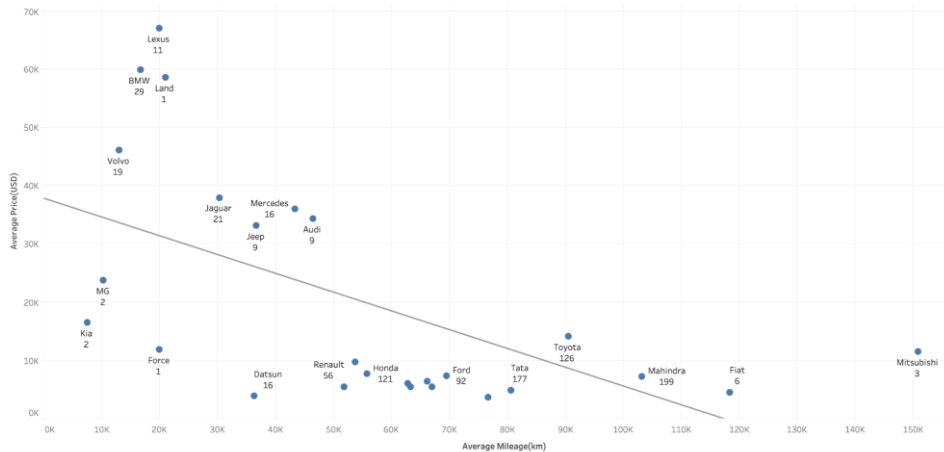
Fig. 2 Selling price by top 10 brands      Fig. 3 Average selling price and number of cars sold

Fig. 2 shows the price distribution of the used cars sold for the top 10 brands and an average price line of all cars sold between 2005 and 2020. Fig 3 provides information about each brand's average selling price and the number of cars sold during this period.

The overall price distribution of the top 10 brands is relatively similar. Except for Toyota and Honda, the other brands have over 50% of their cars with prices lower than the average price. Besides, most of the top four brands' selling prices are below average, indicating that these brands are relatively cost-effective. Japanese and Korean cars are recommended if consumers have a particular budget but do not know which car to choose.

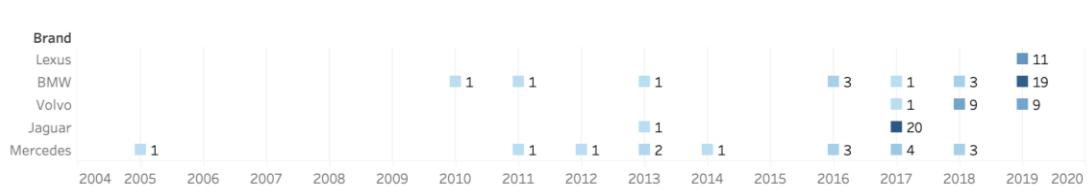
Fig. 2 and Fig. 3 also suggest that Toyota has the highest selling price among the top 10 brands. Remarkably, the average selling price of Toyota is much higher than Honda. This is important information for buyers who prefer Japanese brands. Although the sales quantity of the two cars in this chart is only about 125, we can still reasonably infer that Toyota's average selling price will be higher than Honda's in the U.S. used-car market as a whole. Nevertheless, Toyota's high price can be justified

for many reasons. For example, maintenance costs. According to a car sales website, the average maintenance cost for Honda owners is \$7,500, which is much lower than any other brand except Toyota at \$6,000 (IAM 2022). Moreover, Toyota puts more emphasis on reliability while Honda focuses more on creating high-performance vehicles (U.S.News, 2021).



**Fig. 4** Correlation between average mileage and average selling price by brands

Fig. 4 describes the correlation between average mileage in km and average selling price in US dollars for each brand, together with a regression line analysis. Each point is labeled by the number of cars sold by each brand during the 15-year-period. We can see there is a strong negative relationship between these two variables. The OLS estimate for the slope on average mileage driven is -0.32, which is statistically significant under the 5% significance level. This inverse relationship is quite understandable since the more mileage a car had, the older it was, and the lower its value on average.



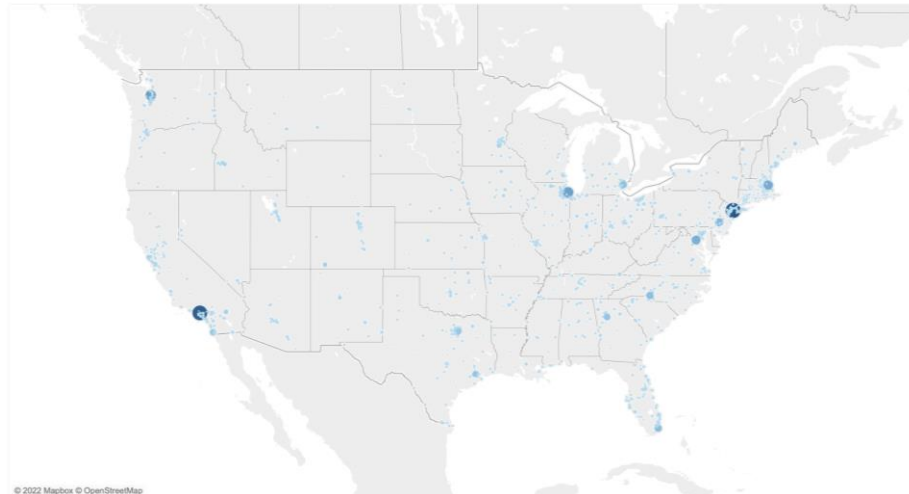
**Fig. 5** Sales breakdown for Lexus, BMW, Volvo, Jaguar, and Mercedes

Some brands, like Lexus, BMW, Volvo, Jaguar, and Mercedes, have relatively high average selling prices. There are several possible explanations to consider. First, as we can see from Fig. 4, cars from these five brands had relatively low mileage. According to the Carfax website, the common rule of mileage for a used car is approximately 12,000 miles added per year. Therefore, on average, cars with relatively less mileage indicate shorter ownership and thus are priced higher. Second, these five brands had a relatively small number of vehicles sold compared to other brands, for which the actual average price in the US used car market may be overestimated in this dataset. Third, Fig. 5 provides the sales breakdown for these five brands, in which we find that most car sales of these five brands were between 2017 and 2019. So these cars should be relatively new, considering they have less mileage than other brands. Last, we should consider price inflation, as a later graph will illustrate.

Another point of interest is the comparison between Toyota and Honda. In Fig. 2, the average selling price of Toyota is higher than that of Honda. When we look at the relationship between average selling price and average mileage in Fig. 4, the average mileage of Toyota is also higher than that of Honda. If consumers think of buying a used car and selling it later, Toyota holds its value better than Honda. Therefore, it is recommended that they choose Toyota if cost-efficiency is their priority concern.

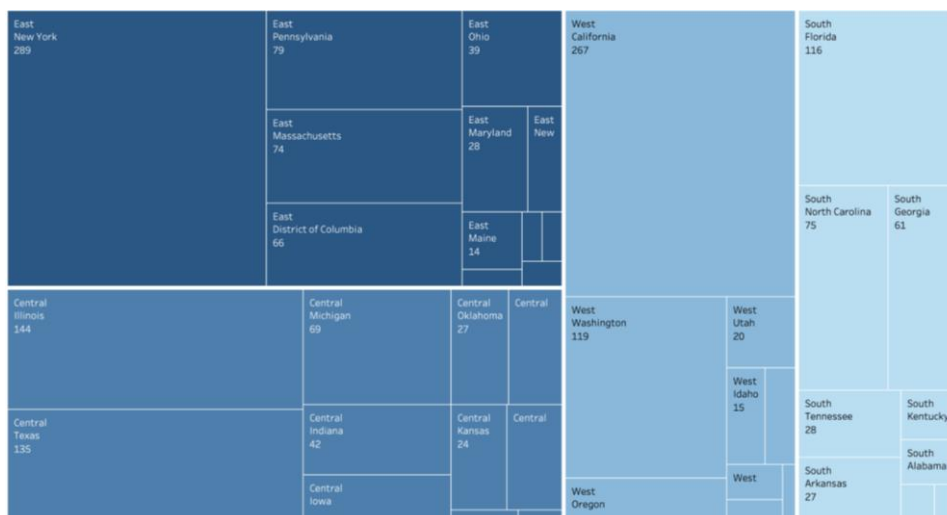
Fig. 6 shows the distribution of used cars between 2005 and 2020. Overall, the distribution of vehicle sales is denser in the Northeast and more scattered in the West. We can infer that there is

relatively more supply and demand in the Northeast. A study comparing east coast and West coast data found that Boston and New York prefer lower mileage cars, indicating that people in the Northeast like changing and cars are sold at newer condition (Liu, 2017). Liu also mentioned that higher liquidity is an important feature of the used car market in the East Coast. The map reveals several major selling cities for the used car, including New York City, Boston, Washington DC, Philadelphia, etc. Therefore, consumers are advised to consider these cities if conditions and budget permit, as more cars are available and thus more options for them.



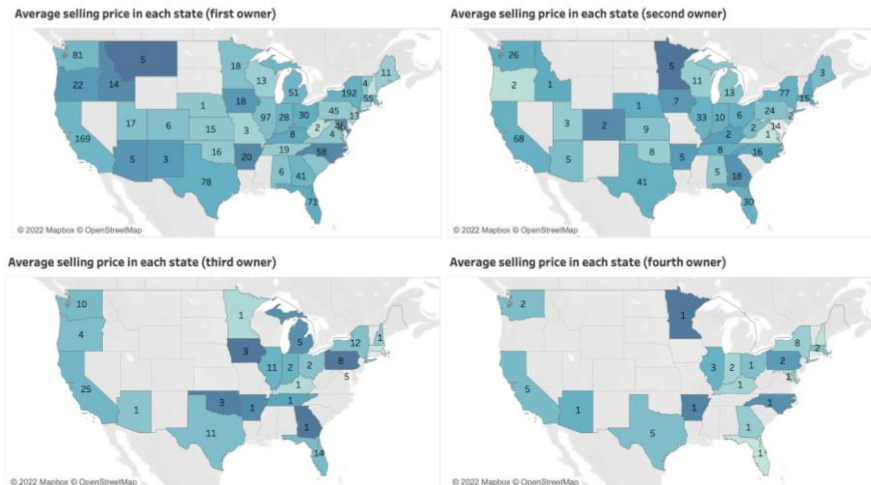
**Fig. 6** Major selling locations in the US

Note: Alaska and Hawaii are omitted from the map because there is no data entry in the dataset



**Fig. 7** Sales rank in each region

Fig. 7 summarizes the number of cars sold in each state and categorizes them into four sales regions defined by the survey. The survey defines the region as East, Central, South, and West. According to this division, the eastern and central markets have more considerable sales amounts. The result coincides with the market character of the East Coast that consumers like changing cars. Although this differs from the Census region and division of the United States, it provides consumers with helpful information about the state sales. Specifically, New York, Illinois, California, Texas, and Florida are sales volume rank states, indicating larger size and higher market liquidity in these states. Hence, consumers are advised to consider these states when purchasing a used car across the state. Moreover, as mentioned previously, Mahindra has distribution centers in Texas, California, Arkansas, Tennessee, and Pennsylvania. These five states account for 26.5% of total cars sold, which helps to explain Mahindra's position in the ranking.



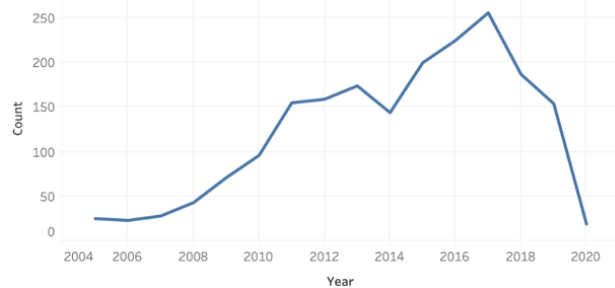
**Fig. 8** Average selling price in each state by owner type

Note: This dataset contains five types of car owners, but the test-drive type is ignored for this paper

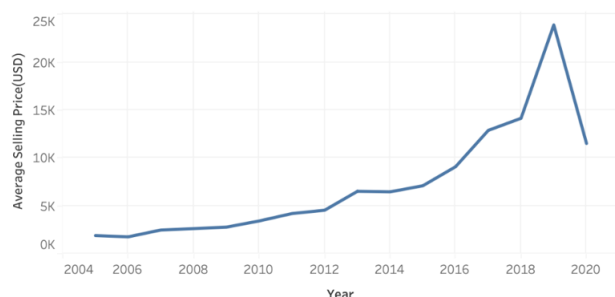
Fig. 8 illustrates the average selling price in US dollars for the used car sold between 2005 and 2020 in each state by different types of owners. The darker shade on the map indicates a higher average selling price. The numbers on the map show the number of cars sold in each state by each type of owner.

We see a difference in the number of cars sold by first-hand owners and second owners, but their difference in the regional distribution is not very obvious. There was no record of sales in only a few states. Given the size of this dataset and the number of total cars sold, we cannot conclude that these states did not have any used car transactions. However, as the type of car owner changes, sales decrease or even disappear in the central region, leaving only the East and West coasts.

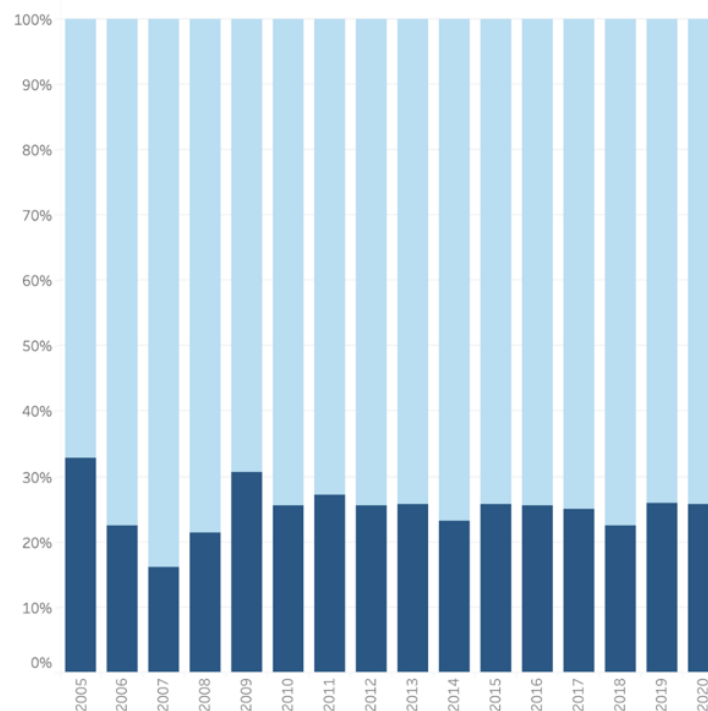
While these four maps show a decrease in the number of cars sold and the change of location based on the type of owners, it provides some unusual information. We notice that the states with the highest car prices for all types of car owners are not the states we usually think of as California, New York, or the District of Columbia. Instead, they are Montana, Minnesota, Iowa, and Oklahoma. A reasonable explanation is because of the sample size. All the states mentioned above have very few cars sold, so the actual average price is likely to be overestimated. Therefore, more data should be collected for further analysis.



**Fig. 9** Number of cars sold from 2005 to 2020



**Fig. 10** Average selling price from 2005 to 2020



**Fig. 11** Turnover ratio (number of cars sold / total number) for dealer and individual seller

Fig. 9 provides the number of cars sold between 2005 and 2020. Two turning points worthy of attention are the rise of automobile sales in 2014 and the sharp decline from 2019 to 2020. Used car sales jumped in 2014, reaching their highest level since 2005. Although the dataset is small considering the actual market size, this change is consistent with the trend of the U.S. economy that analysts predicted in 2014 (Lebeaucarnews, 2014). Growth forces like “increasing consumer confidence, falling gas prices, and cheaper leases” helped increase demand (Aaron, 2015). The sharp decline between 2019 and 2020 is primarily due to the COVID-19 pandemic. Based on the number we have for this dataset, the number of cars sold experienced a decrease of 87.5%.

The number of cars sold decreased from 2019 to 2020, but the turnover ratio (number of cars sold / total number) for dealers and individual sellers in 2020 were roughly the same as in 2019, as Fig. 11 shows. This helps better understand the impact of COVID-19 on the used car market. The total sales dropped, but consumers' purchase intention has not changed much. One possible explanation is that people would purchase a used car to avoid using mass transportation in the aftermath of the pandemic.

Fig. 10 indicates a drop in the average price of used cars in 2020 after 15 years of growth. This suggests the increasing sales price trend. Inflation has accelerated and is at a 41-year high in the US, causing a decline in new cars, according to the Cox Automotive/Moody’s Analytics Vehicle Affordability Index (Hailes, 2022). COVID-19 is an exogenous disruption, so it is reasonable to expect a gradual rise in the price of used cars as the economy recovers from the pandemic.

### 3. Conclusions and implications

In this paper, we analyzed the used car market data in the United States and examined the relationship between the average selling price and multiple variables. The analysis of brand market share reveals that Japanese and Korean brands are the most successful brands among the non-domestic manufacturers. So, consumers are suggested to consider Japanese or Korean brands when purchasing a used car, given their affordability, reliability, and fuel efficiency. The comparison between Honda and Toyota indicates that Toyota is relatively more cost-effective. The median mileage in the dataset is 60,000 km. We find that most cars with a mileage of 60,000km are sold for \$10,000 or less, which can help consumers calculate their budget based on the mileage requirements.

The most popular sales cities and states mentioned in this report provide a market reference for consumers, where there are more vehicle choices and more price choices. At the same time, sellers of used cars can also plan the future market direction according to these places.

As the economy recovers from COVID-19, used-car prices are expected to rise, and potential buyers are suggested to prepare for the coming price increase. However, due to the relatively small sample size, this paper may not give the full picture of the used-car market in the US. Also, we have not thoroughly analyzed the impact of COVID-19 on the used car market because of the timing of the data. At the same time, some researchers believe that although inflation is driving up used car prices at this stage, it will not lead to inflation in the future. Instead, used cars should be the source of deflation in the coming months (Hailes, 2022). So we advise consumers to make careful considerations based on their own needs and budget.

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