Armenian Car Market Analysis

DS 116 Data Visualization

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2023-12-10

Introduction:

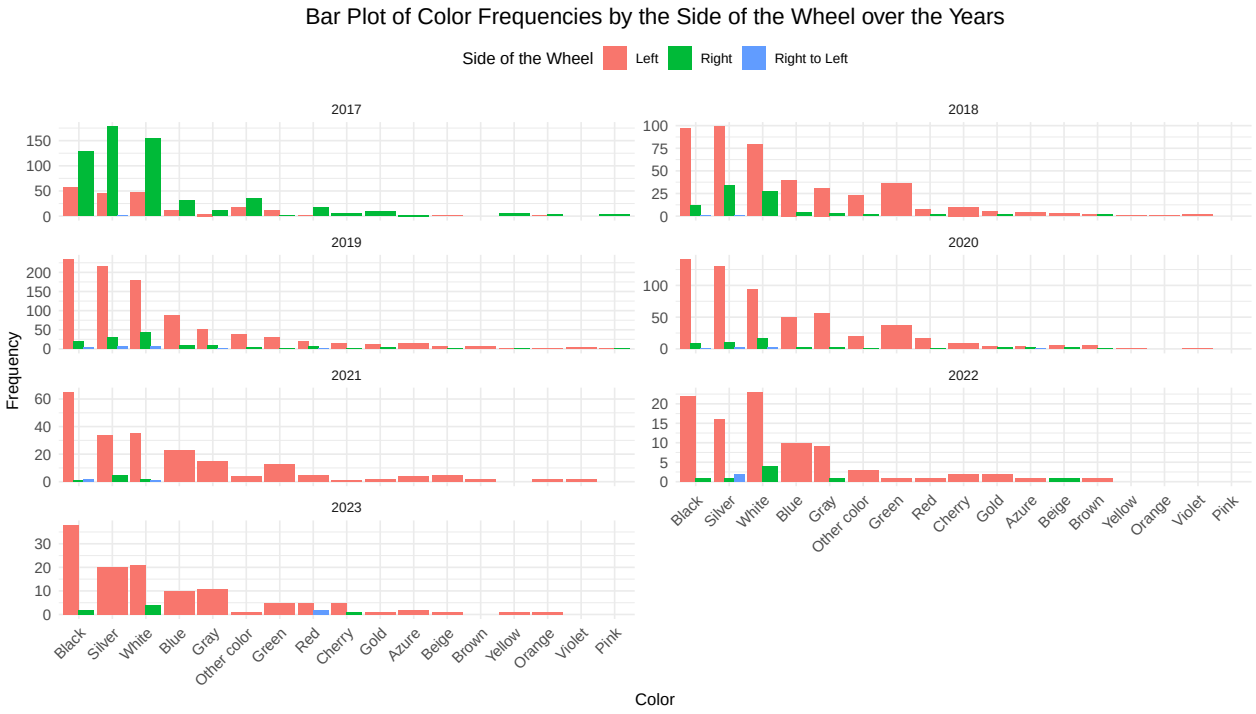
The project aims to analyze the Armenian car market, examine the buyers' and seller's preferences, and compare it with the US car market.

The major dataset used in the project was scrapped from "haycar.am", a web page for publishing cars for sale. Another two datasets were taken from kaggle.com and used to understand the differences between the native and foreign markets. One included data on the Armenian car market; the next contained US car data.

During the research, three hypotheses will be driven and presented.

Hypothesis 1: Mercedes-Benz is the most practical choice in the Armenian car market.

For this hypothesis, we will show the commonness of Mercedes-Benz in the Armenian market. After showing the popularity of the Mercedes-Benz, we will also analyze the features that make it competitive, including models, price, transmission type, wheel position, colors, mileage, newness, and the condition of the cars.

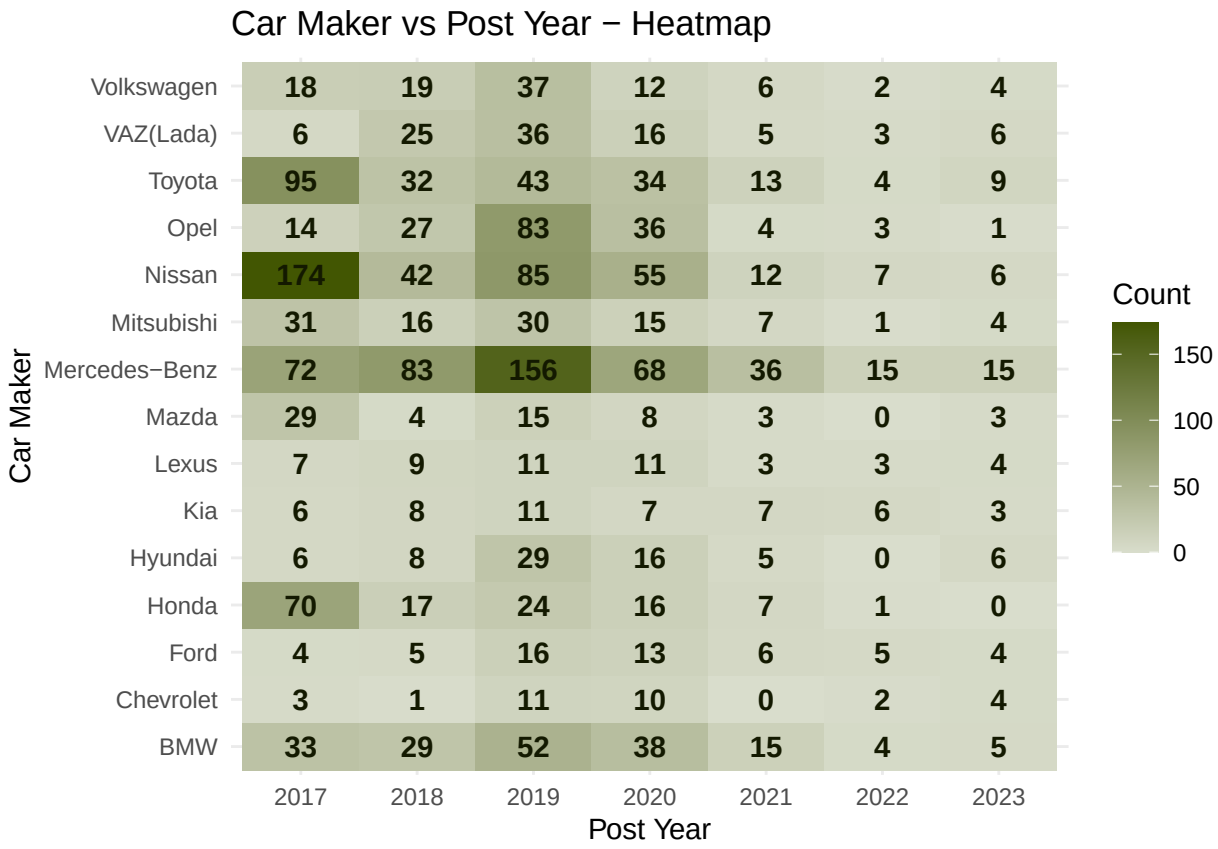


The bar plot shows the number of cars posted yearly from 2017 to 2023 on the 'haycar.am'. According to the bar plot, the number of right-hand drive cars was higher than that of left-hand cars only in 2017. After that, many left-hand cars were posted. It is worth mentioning that the cars whose wheel sides were changed from right to left are taking a very small amount. The plot also shows the distribution of the colors. We can see that Armenians are more inclined to sell cars in three colors: black, silver, and white.

Therefore, we can conclude the popularity of left-hand drive cars with colors black, white, or

silver is bigger in Armenia. Hence, buying either left-hand or right-hand cars from these top most popular colors will be practical decision.

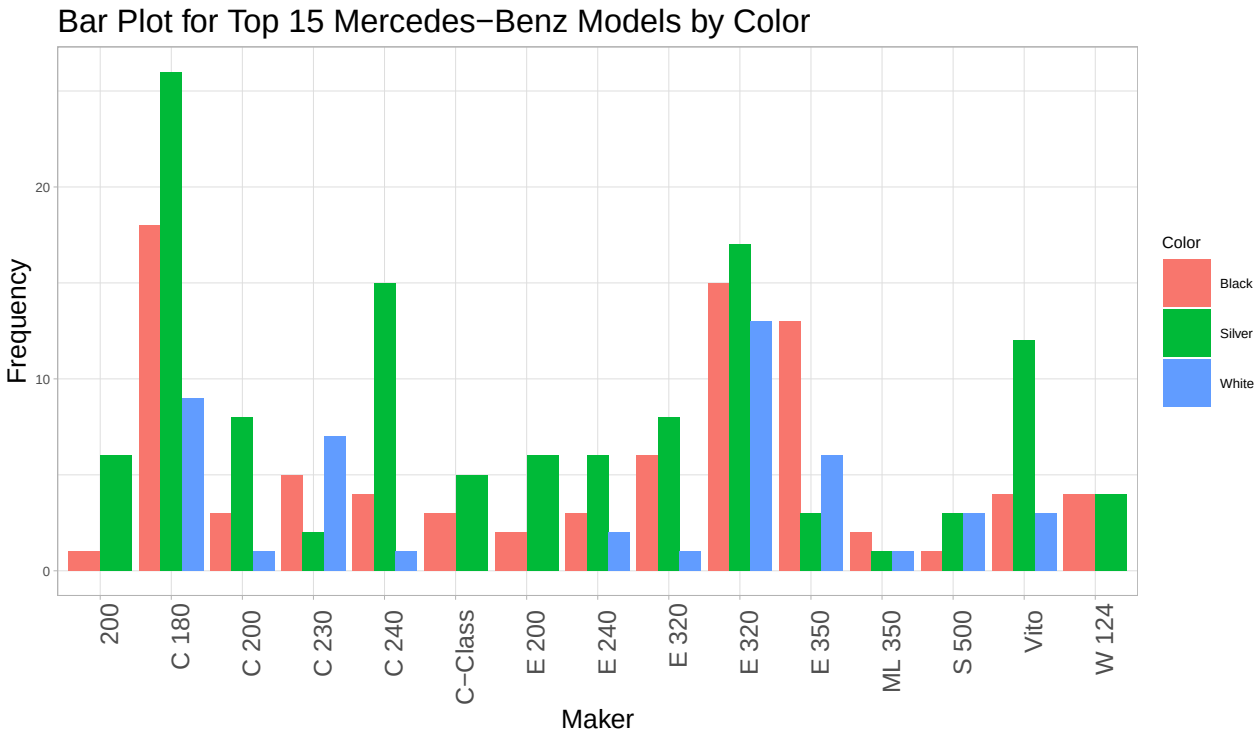
From this point, we filtered the dataset where colors are Black, White, and Silver, and the wheel side is either right or left.



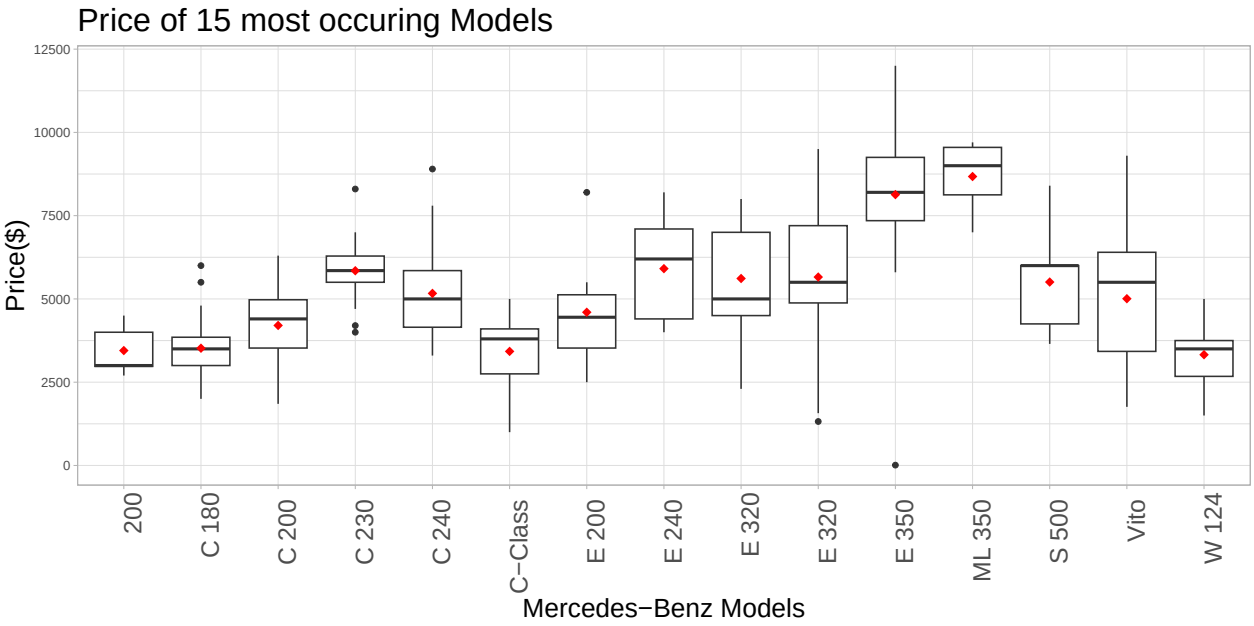
The data is filtered to the top 15 most common car makers to narrow down the research segment.

The heatmap is filled with the number of each car maker and the year it was published on the web. According to the plot, Mercedes-Benz leads every year except in 2017 posts, where Nissan is more popular. Interestingly, the number of posts for every car brand is decreasing over time due to the increasing popularity of other web pages or more available platforms for importing cars.

The rest of the analysis will be conducted to explore the convenience of the Mercedes-Benz models. Therefore, the filtered dataset will additionally be filtered with the top 15 most occurring Mercedes-Benz models.

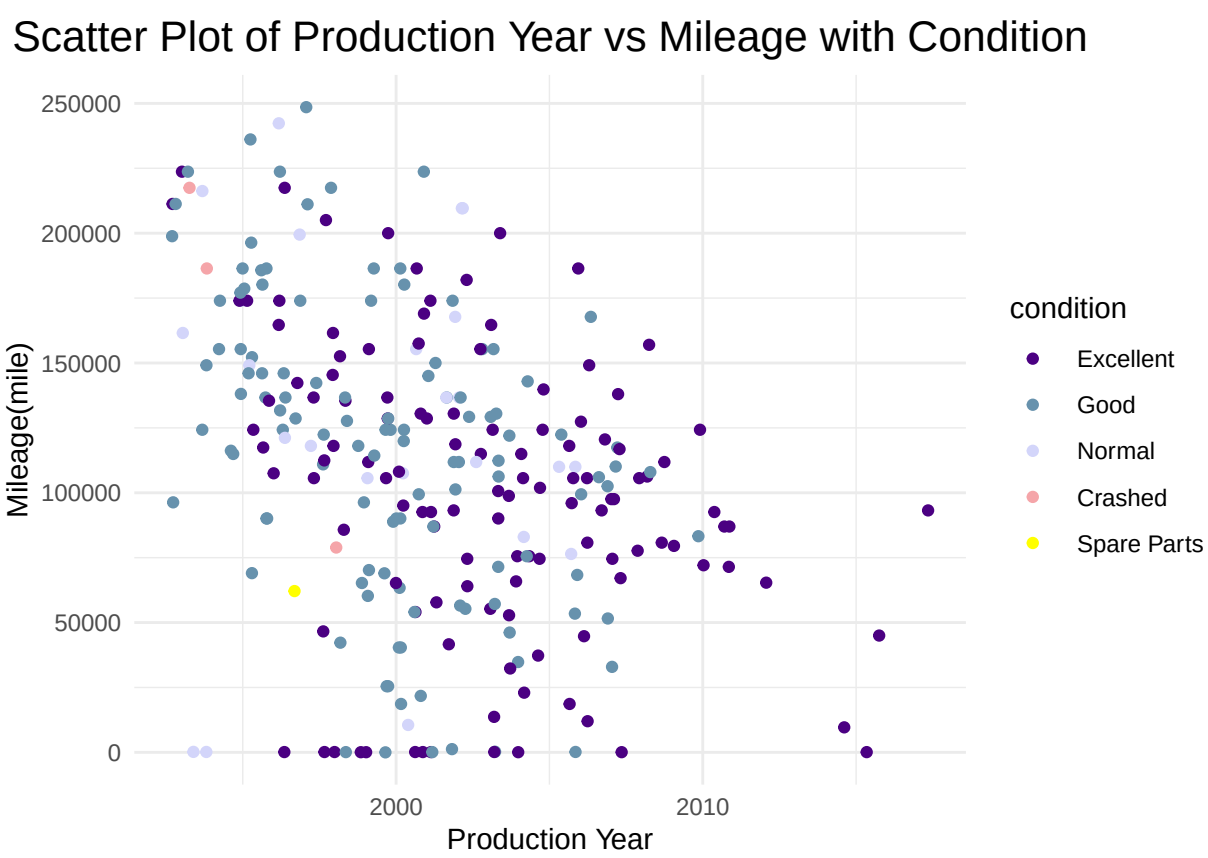


The bar plot shows the frequency of the top 15 car models filled with colors. Among these models, the most popular ones are C 180 and E 320. The plot shows that for each model we have at least 5 cars posted in the web page. Hence, overall we have many choices buying a car from Mercedes-Benz maker. The next insight we can take from the plot is that among these models, Silver is almost the most popular color, except for the models C 230, C 300, E 350 and ML 350.



The box plot shows the distribution of prices for each model. The price choices for the models are very diverse. The median price of the models starts from around 3500 dollars to 8500 dollars. Furthermore, the mean prices for each car model are marked with red diamonds. The difference between means and medians is not too big. Hence, there are no significantly expensive or cheap cars.

As a result, customers have a wide choice of Mercedes-Benz models related to price and frequency.



Other important factors besides the price should be considered for the top most common Mercedes-Benz models. They are the newness of the car, the mileage, and the condition(excellent, good, normal). These parameters are depicted in a single complex scatter plot. We see a negative correlation between the year that the model was built and the mileage. To be more specific, the newer the model is, the fewer miles are driven. Moreover, the bluish points indicate the better condition of the model's condition. In most cases, the newer the model is, the better the condition. However, we see some biases since the sellers are determining the condition. For example, we see two cars produced in 1995 in "excellent" condition, which is less probable. In addition, in our database, most of the top 15 Mercedes-Benz models are produced from 1995 to 2010. In addition, we have only three car, which is relatively newer, built in 2015.

In our dataset, the left-hand and right-hand top 15 most common models of Mercedes-Benz, colored black, white, and silver, have three transmission types: Semi-Automatic, Automatic, and Manual. However, we have only a single observation for the Semi-Automatic transmission type, which can't help us understand its price distribution. Hence, the row where the transmission type is Semi-Automatic was dropped from the dataset.

The ridge plot shows the price distribution for the Automatic and Manual transmission types. The prices for both of these transmissions come from normal distribution. The center for the automatic transmission type is shifted to the right of the manual. The median price for automatic cars is around 6000 dollars, and the median for manual cars is around 3000 dollars. Thus, automatic cars are more expensive.

Conclusion:

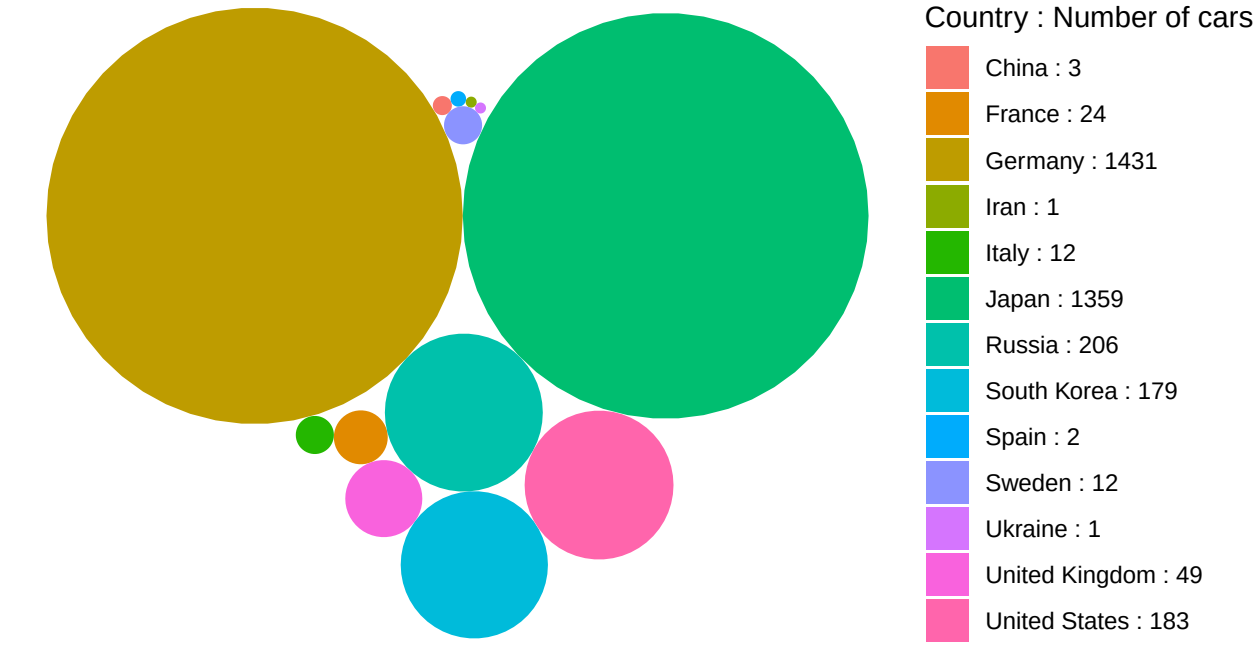
To sum up, Armenians are more inclined to sell left-sided black, white, and silver cars.

Moreover, Mercedes-Benz models are prominent in the market and have a wide range of prices and relatively less driven cars. As a result, Mercedes-Benz is considered a very practical, affordable, and comfortable choice in the Armenian market by considering many factors.

Hypothesis 2: Armenians exhibit a higher inclination towards vehicles manufactured in Germany compared to cars produced in other countries.

For this hypothesis we will prepare a dataset which will contain information about car makers, specifically the names of car makers present in our main dataset, country of origin of the makers and its foundation year. There are 56 unique car maker companies in our dataset and in the preceding research all of them will be considered.

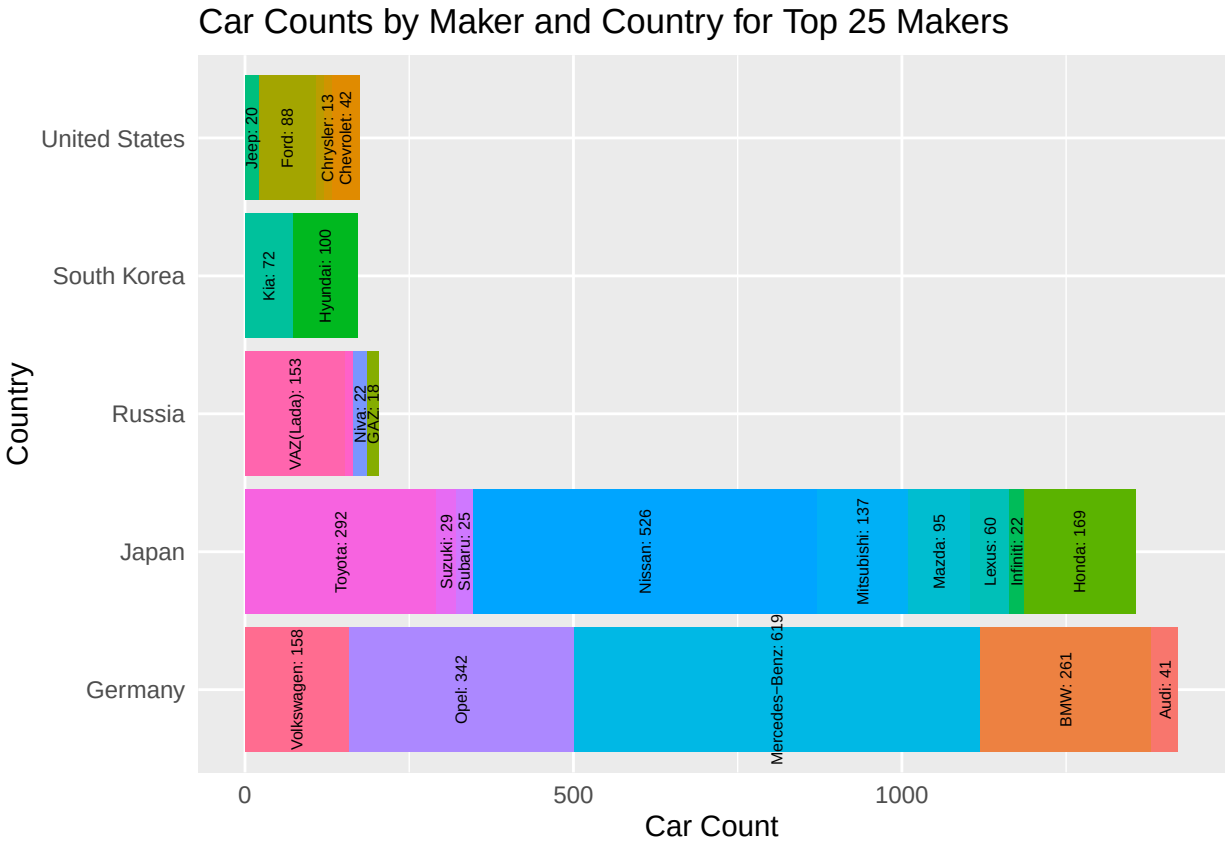
To begin with, let's see the proportion of the car maker countries in the Armenian car selling market.



We used Circular packing graph to visualize the proportion of car production countries for selling cars in the Armenian market. The number of cars in each category of country is also displayed to show the difference with precise number. The graph shows that there are two leading countries in the Armenian car selling market: Germany(1487 cars) and Japan(1296 cars). However, cars from Germany production are more than Japan's. Russia, South Korea

and United States occupy almost equal proportion of the Armenian market and come after German and Japan. The rest of the countries have significantly lower proportion in the market.

For better understanding and visualizing the data, let's filter the dataset for the top 5 countries and then filter again for the top 25 car makers(considering the frequency).

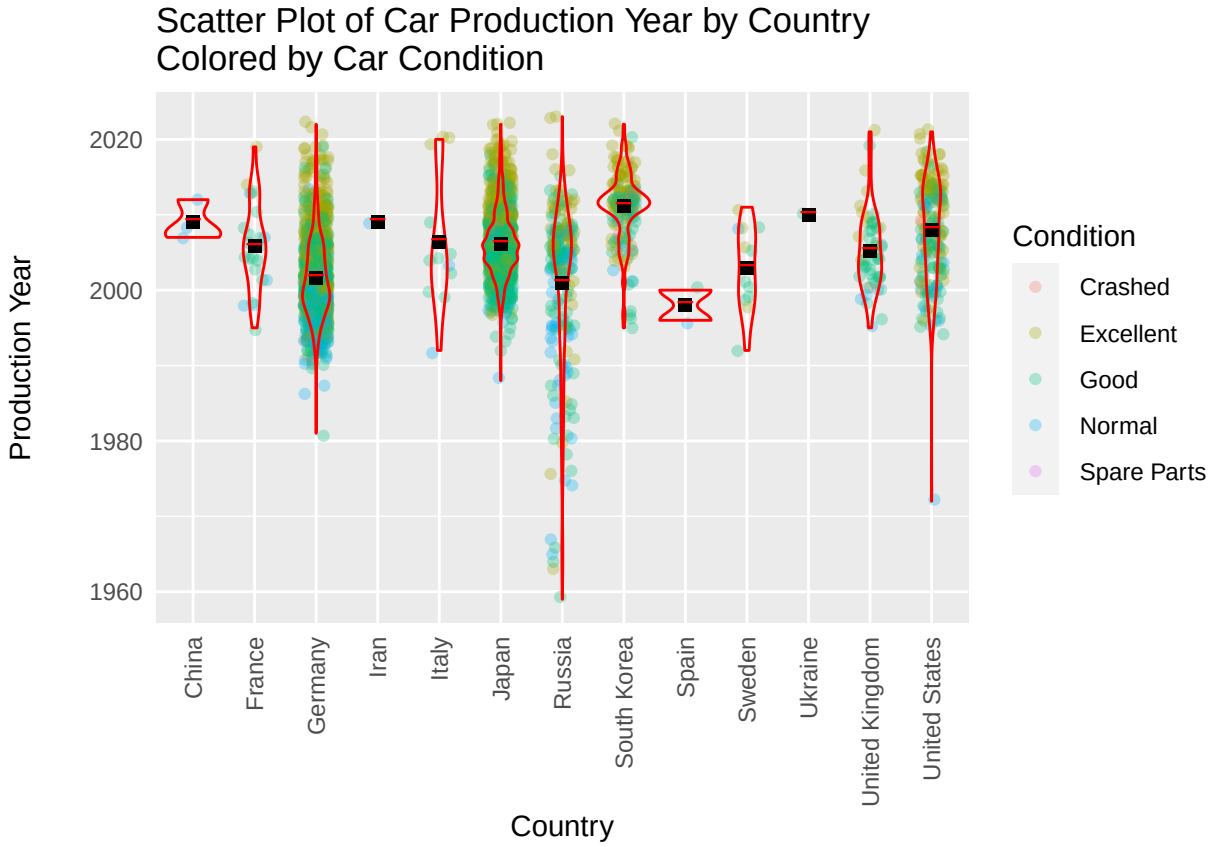


Let's examine the bar plot, which represents car counts by maker and country for the top 25 makers. Among the top 25 car makers it is notable that the Germany again is the leading country. The considerable proportion of the car maker from Germany presents Mercedes-Benz which is almost the half of the German production cars in Armenian market. Second leading Car maker for Armenian market is Japan as we can see from the above plot. And the leading Japanese car maker is Nissan with 535 cars. Nissan is also the second most common car maker for the Armenian market among all car makers. Opel is second most

used German car maker for Armenian market.

As we concluded from the previous plot, Russia, South Korea and United States also are almost the same level of the competition for the market among the top 25 car makers. Russia is a little ahead from South Korea and United States.

The plot bellow visualizes the relationship between car production year and country, with points colored based on the condition of the cars. Violin plots are overlaid to show the distribution of production years.



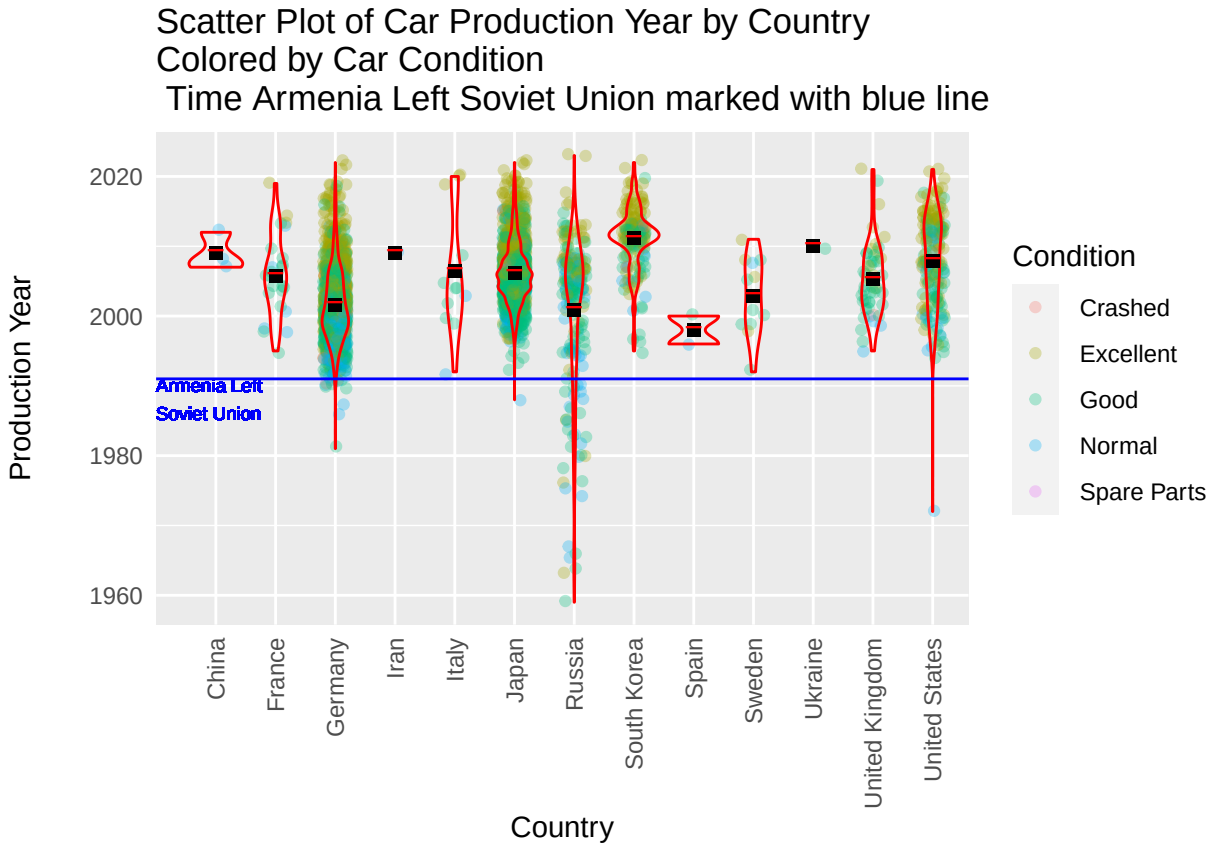
The presented ggplot visualization offers a comprehensive exploration of the relationship between car production years and various countries, highlighting distinct patterns across different conditions. The use of scatter plot aesthetics, complemented by color-coded conditions and violin plots, provides a deep understanding of the dataset.

The colors assigned to different car conditions serve as a visual aid in underlying trends within each category. Notably, the prevalence of cars in "Normal," "Good," or "Excellent"

condition is evident. The inclusion of violin plots enhances this understanding by offering a visual representation of the distribution of production years within each country.

A striking observation is the disparity in mean production years between Germany and Japan, with the Germany exhibiting a lower mean production year. This discrepancy prompts further investigation into the tendency of Armenian car buyers towards German and Japanese production cars.

Further analysis reveals intriguing insights into Japanese car production. The prominence of production years falling between 2005 and 2010 is notable, substantiated by the considerable width of the corresponding violin plot. This concentration may indicate a specific period of heightened production or a market preference for cars from that timeframe.



The examination of Russian car production unveils a broader range of production years, suggesting diverse factors influencing the longevity of vehicles in circulation. Notably, the wider range may be attributed to historical factors, particularly the Soviet era. This might

be because of the fact that Armenia was a Soviet country and the cars produced during that time are still in the use. The car production time matches with the time period of Soviet Armenian time. Other than Russian production cars have production year from 1990 to 2020. Let's show the time when Armenia left Soviet Union on the graph to see how this event affected to car market in Armenia.

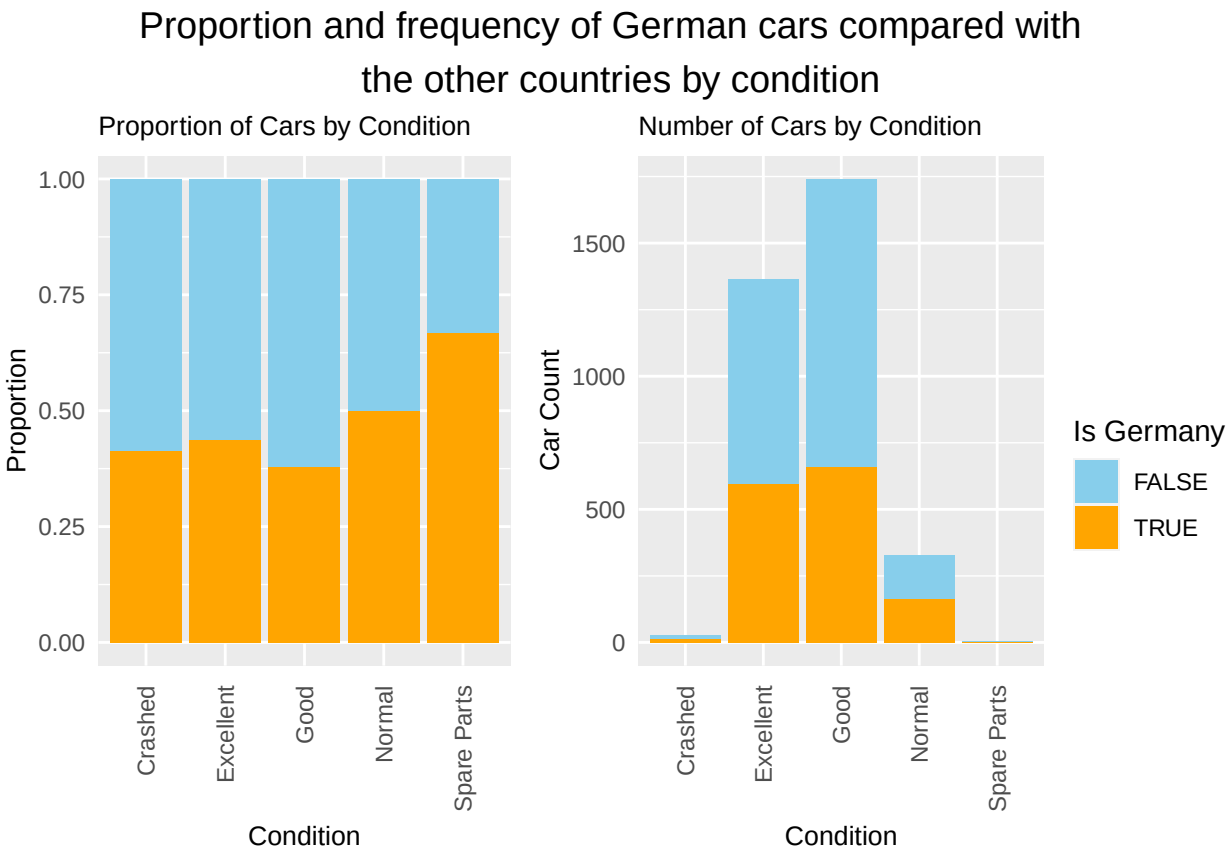
Now we can see that the the number of cars present in Armenia now having production year greater than 1991, which is the year Armenia left Soviet Union, dramatically increases. Although Russia was a dominant in the Armenian market before 1991, the picture changes when Armenia starts to open up for cars from other countries. Armenia starts to import cars with other countries production like Germany, Japan, United States, Italy and etc. We can see that German production cars entered Armenia right during that time and the second dominant in Armenian market(Japan) enters some years later. Here we consider the entering time by the presence of cars with the lowest production year.

In an effort to get better inside into the relationship between car condition and German production, let's consider a dual-plot visualization employed to show proportion and frequency histograms.

A meticulous examination of the condition categories reveals intriguing insights into the prevalence of German-manufactured cars in the Armenian market. Notably, a predominant portion of the cars is observed to be in 'Good' condition, with German-produced cars constituting approximately 40% of this category. Similarly, the 'Excellent' condition category boasts a significant share of German cars, surpassing the 40% mark.

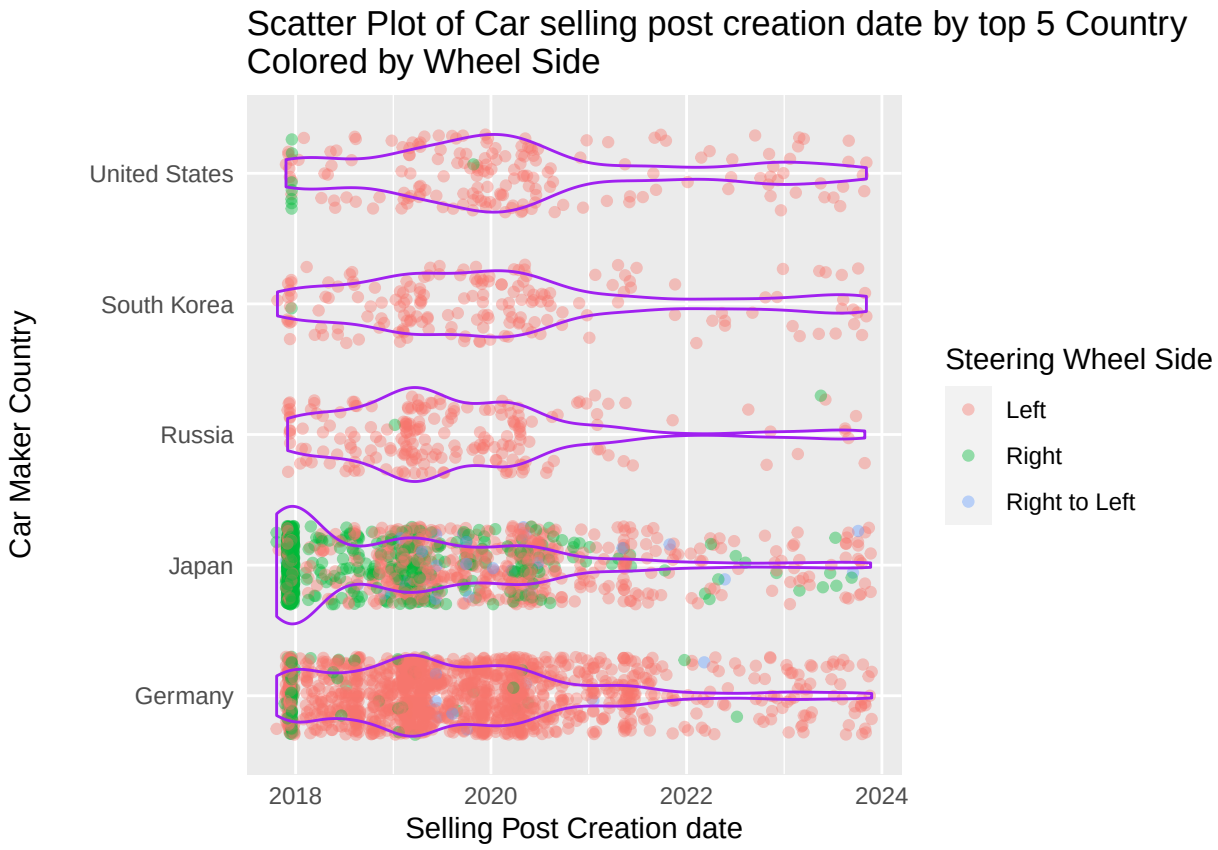
A noteworthy observation emerges in the 'Normal' condition category, where an intriguing trend unfolds – half of the cars in this category are attributed to German car manufacturers. The 'Crashed' cars category, while showcasing a considerable proportion from Germany, is characterized by a relatively small total count. Conversely, the 'Spare Parts' category, albeit

representing a minor share overall, exhibits Germany as the dominant contributor



One can assume, that most of the sellers tend to categories their cars towards better condition. However the picture can change if the detailed examination of each car will be done. Or another way of checking the truthfulness of the cars' condition presented by the seller, can be gathering the feedback from the buyers or people interested to buy.

Let's compare the countries by the steering wheel type and examine the selling posts distribution for the whole period.

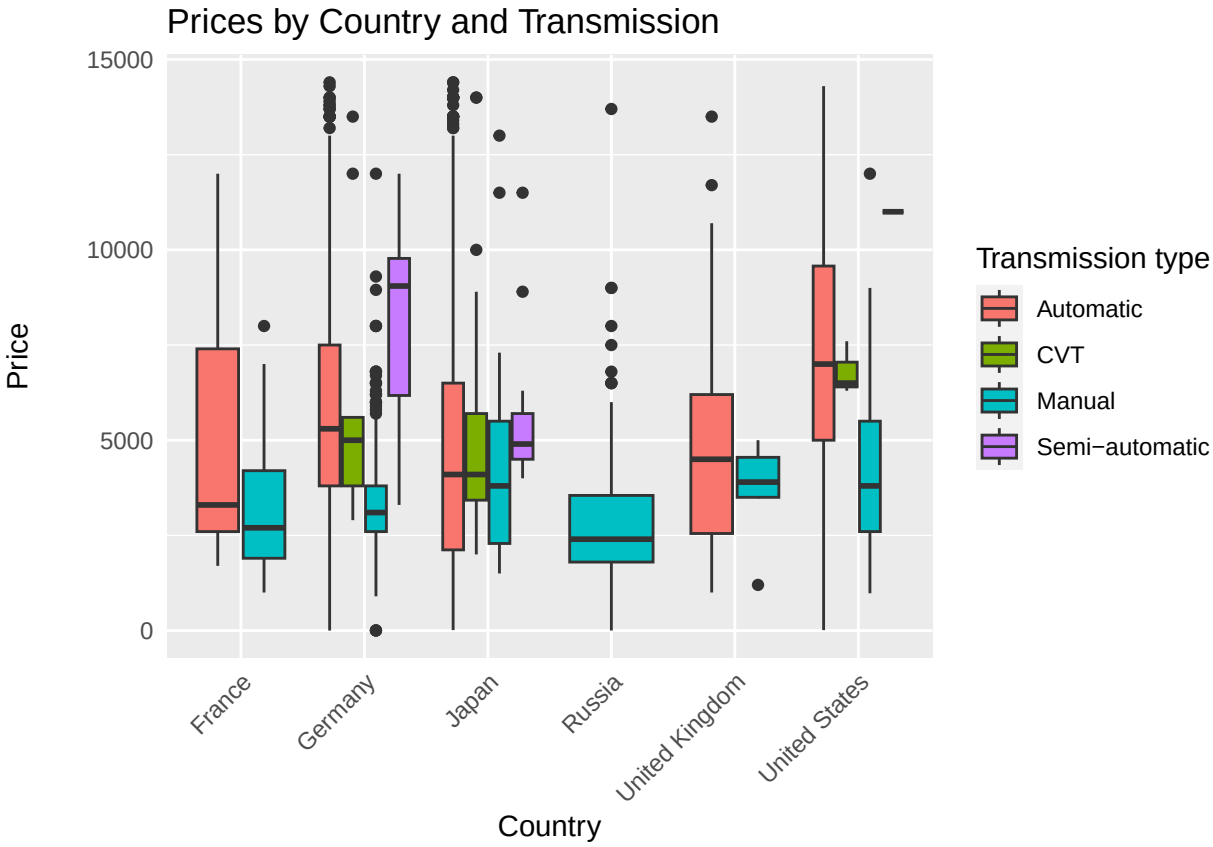


This graph shows that after 2021 the number of posts for sale decreases since the number of points is less from 2021 to 2024. However, during the whole period German production cars are still leading.

Another interesting fact that the majority of cars produced by Japanese car makers has Right side steering wheel and Germany production cars have Left side steering wheels. In Japan the traffic is right sided and in Germany the traffic is left sided. Since in Armenia the traffic is left sided the need for cars with left side steering wheel is more. So, German production cars are more in sale than Japanese. However, Armenians might like the quality of Japanese production cars, because they are still in the second place by usage frequency. So, if the number of cars produced by Japanese car makers with left sided steering wheel was

more, maybe the Japan would be in the first place in Armenian car selling market.

For the next step let's filter data for leading countries and filter out the outliers for price for better visibility on the graph.



To begin with, German and Japanese production cars offer more verity of transmission types and this might be the reason that those two countries are leading in the market. Moreover, the median price for Japanese cars are lower than German cars. This phenomenons can promote Japanese cars in Armenia to compromise the fact that majority of Japanese production cars are with Right steering wheel, as we discussed earlier. Hence, Japan occupies the most part of Armenian car market by almost catching up with Germany.

As we said, German production cars offer more variety of transmission types. Overall, the price of Semi-automatic cars with German production have highest median price and the middle 50% of the Semi-automatic cars have higher prices.

Generally the most common transmission type is Manual and Automatic. Interestingly, Russian production cars are only with Manual transmission. US cars with Automatic transmission have the highest mean price for the cars with Automatic transmission. It also does not have outliers.

Conclusion:

During our research for this hypothesis some interesting things were observed, which can lead into deeper understanding the car market in Armenia and do better choices when considering to buy a car in Armenia. One of the findings was that Armenian car market became diverse just after the 1991 which was the year when Armenia left Soviet Union. Another fascinating phenomenon was the high frequency of Japanese cars present in Armenian market, despite the fact that majority of the cars produced in Japan are with Right steering wheel. So, maybe Armenians are more comfortable to own Japanese production cars because of the quality, price and diversity in choice and maybe more cars produced by Japan with Left steering wheel would make the Japan the first dominant in the Armenian market. Currently the first dominant by the car production country in Armenian car market can be considered Germany. People, who want to import cars from other countries, can consider this information to be able to choose the better selling cars for Armenian market. An example of such car can be with the Japanese production with left steering wheel, colored black or silver.

Hyphothesis 3: The market of Armenian cars are significantly different from USA market.

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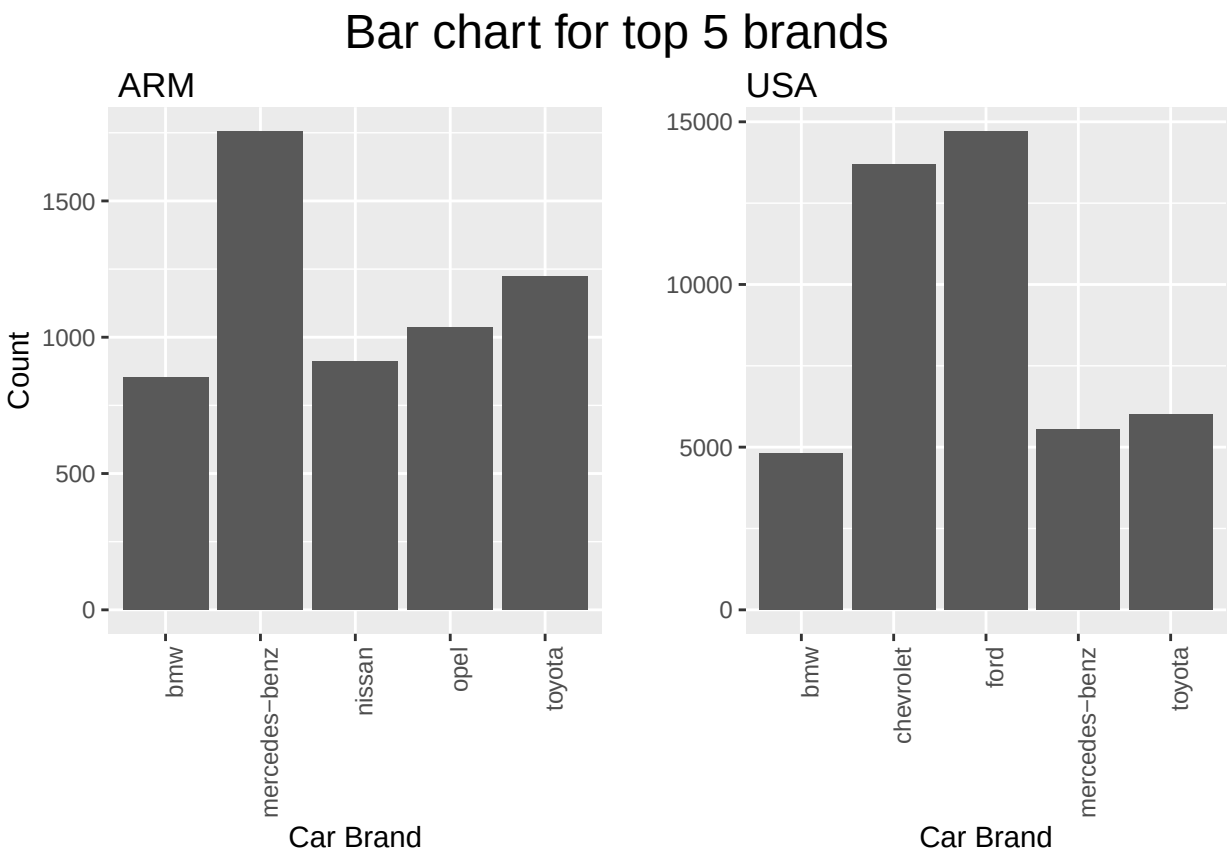
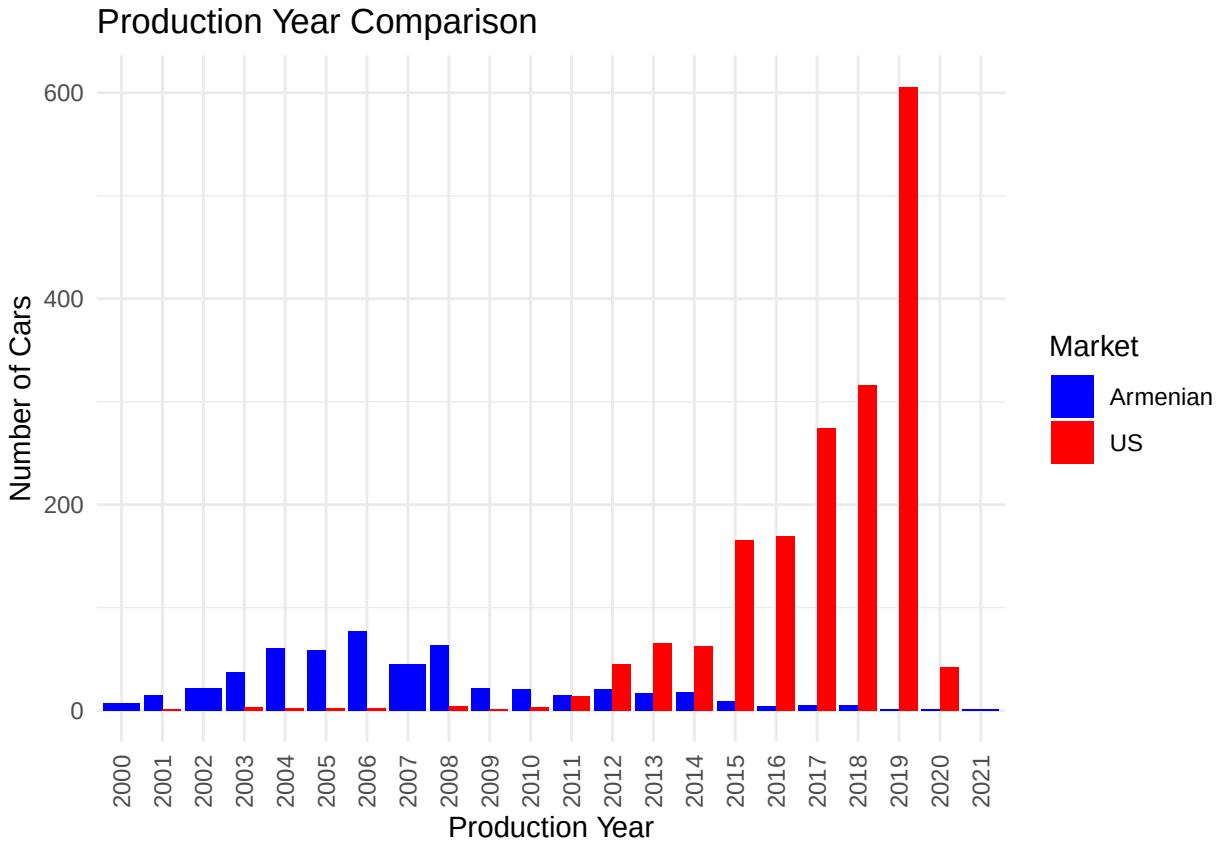
Hyphothesis 3: The market of Armenian cars are significantly different from USA market.

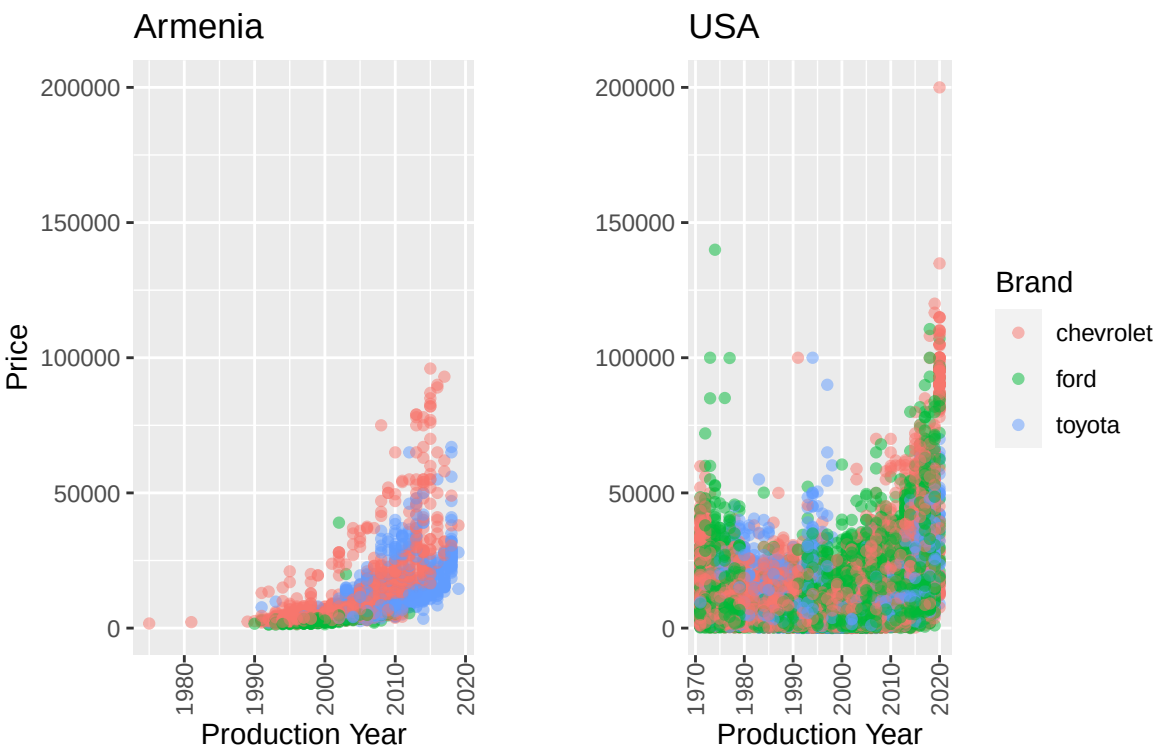


This bar plot offers a comparative analysis of the prevalence of leading car brands in different countries. Notably, in the Armenian market, Mercedes-Benz emerges as the dominant choice. Meanwhile, in the United States, Ford and Chevrolet exhibit a near equal popularity, reflecting the strong affinity for American automotive brands among the local populace. The preference for Ford and Chevrolet in the U.S. is indicative of a cultural inclination towards domestic car manufacturers. This observation underscores the influence of national identity and brand loyalty in shaping automotive choices within diverse markets.

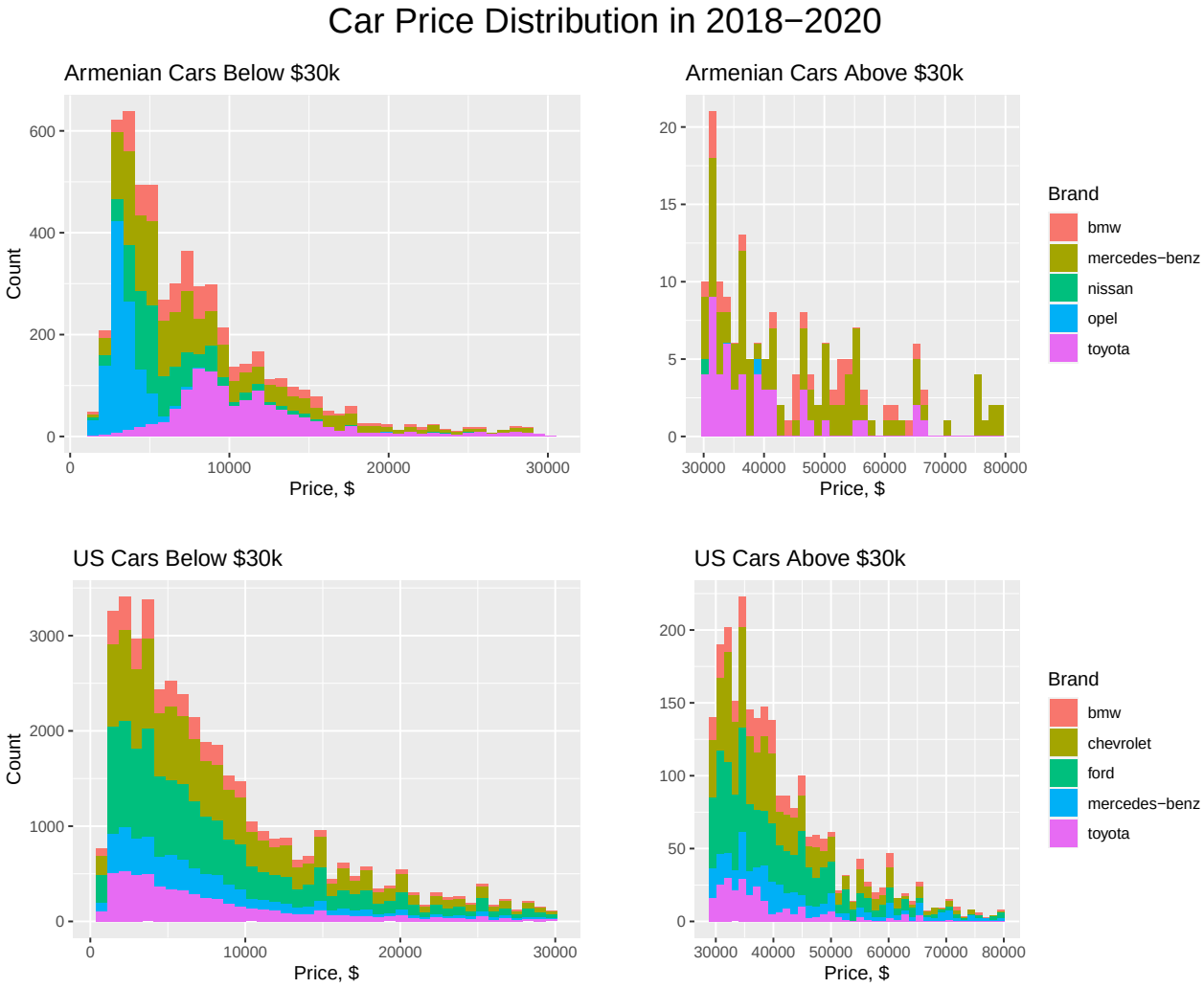


This bar plot illustrates the distribution of production years for cars in both the Armenian and U.S. markets. Notably, the Armenian market boasts a significant presence of older cars, particularly from the 2000-2010 period, where the number of cars surpasses that of the U.S. market. Subsequently, in the year 2011, the number of cars becomes equivalent in both markets. However, beyond 2011, U.S. cars gradually outpace Armenian cars in terms of quantity.

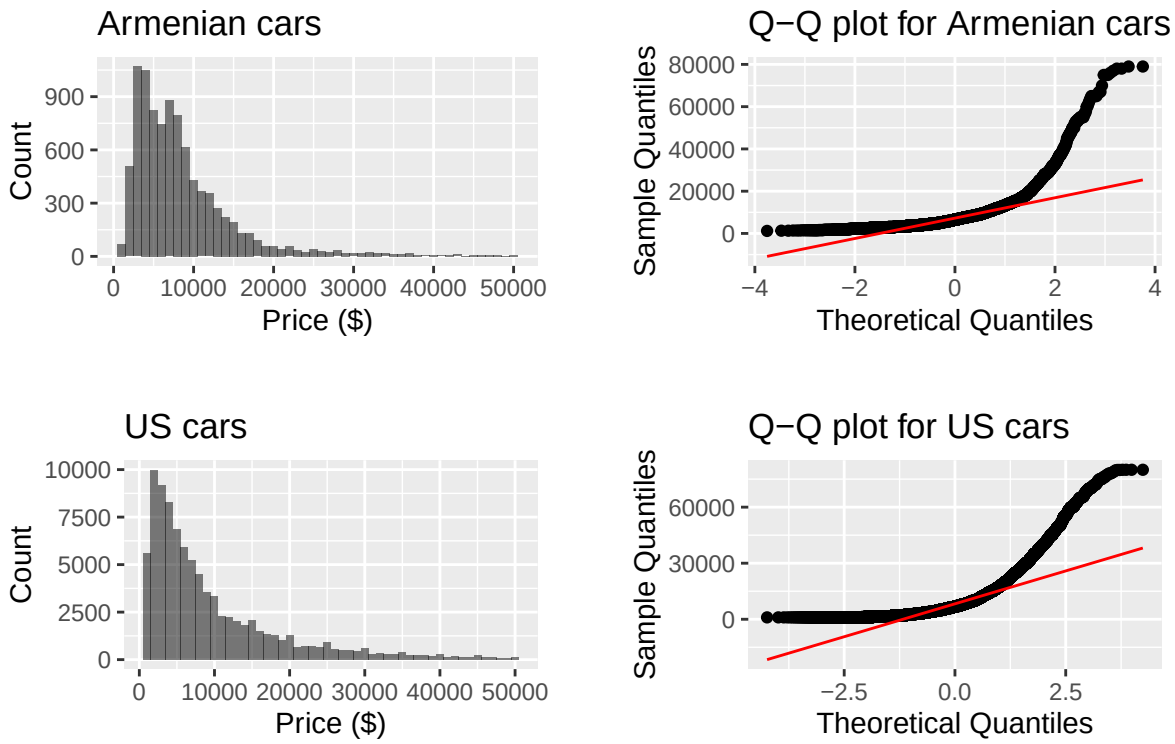
This trend indicates a distinctive advantage for the Armenian market in hosting a larger proportion of older vehicles, potentially reflecting factors such as import patterns, consumer preferences, or economic considerations during that specific time frame.



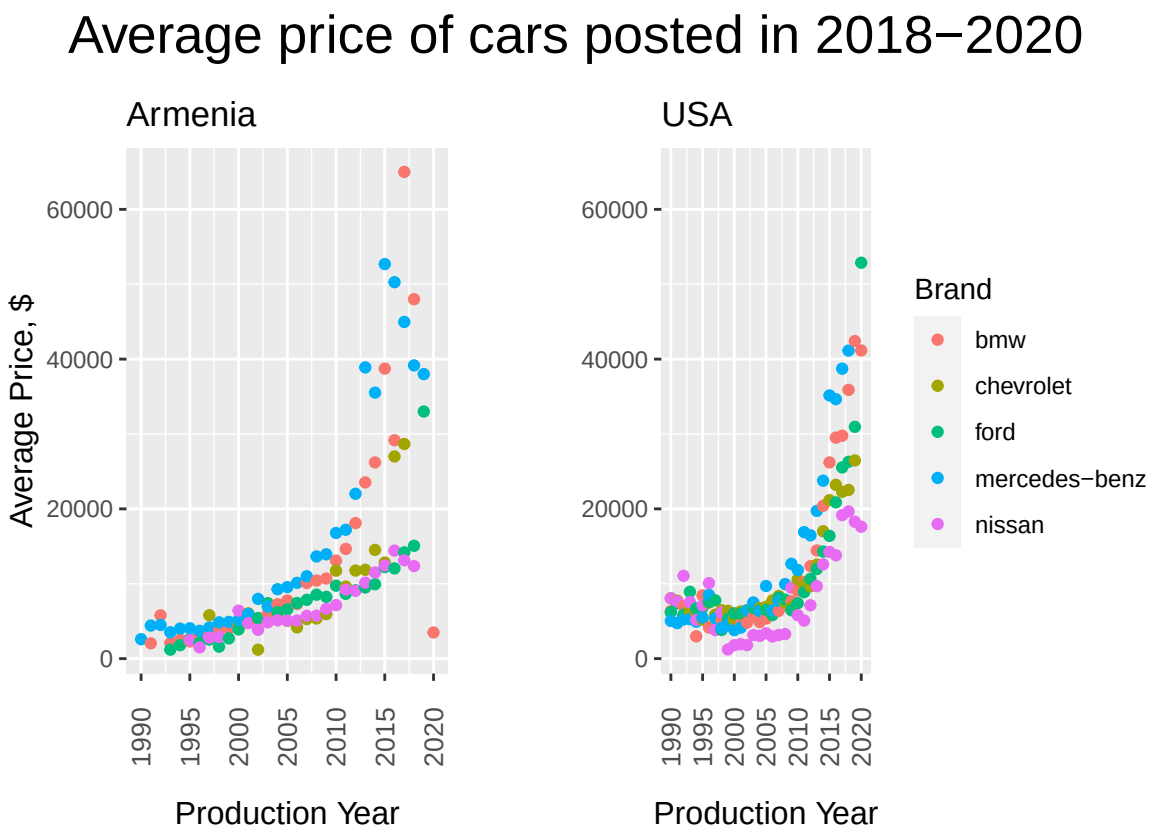
This is a scatterplot of 3 common car brands in both countries. We see that in Armenian and US there are several outliers. While in Armenian market Chevrolet is the leading car brand, Ford is the leading brand for US. Based on our dataset, we see that the average production year in Armenia is approximately 2011, we can't see a clear pattern in USA. The average car price in Armenia is approximately 25000 dollars, meanwhile we also can't see a clear pattern here.



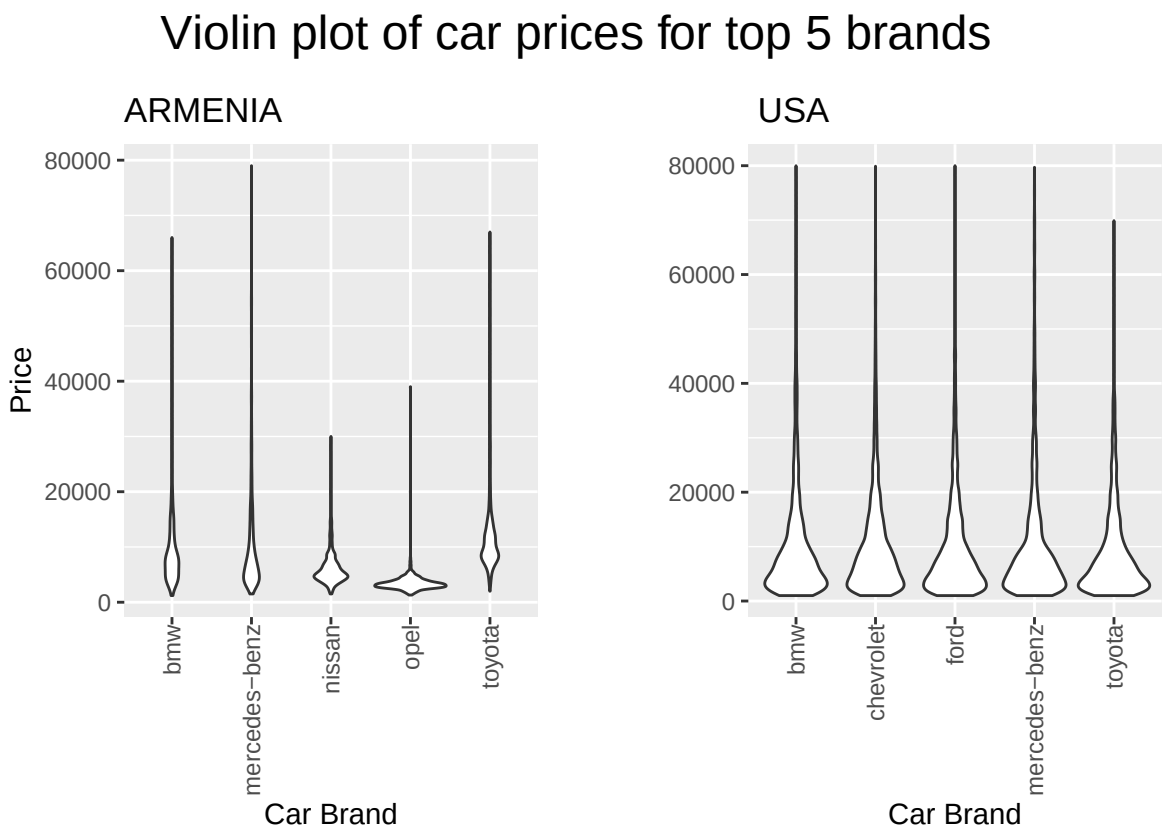
In order to have initial general understanding about Armenian and US car markets are plotted 4 histograms: 2 histogram for cars, which price is below $30k, and 2 histograms for above $30k. The 5 most common car brands in US and Armenia differ from each other, but there are 2 mutual car brands: mercedes-benz and toyota. In Armenian market the most expensive car brand is Mercedes-benz, and the less expensive brand is Opel, as its price range is between 0 and $50k. In case of US, Ford and Chevrolet are the most common brand among both ceap and expensive price ranges.



QQplots are used for understanding the types of distribution. Both histograms are decreasing exponentially. Armenian cars' histogram decreases more drastically than in case of US cars'. In the above QQ plot, we see that points are departed from three straight line indicating deviations from normality. In the tails of QQ plot, deviations indicate the presence of outliers. The QQ plot has S-shaped patterns, indicating skewness in the data. The points bend upwards and it suggests that the distribution has tails that are heavier than those of a normal distribution. histogram:In both plots, the peaks occur once, it suggests a unimodal distribution, meaning there is one prominent mode in the data. This indicate a central tendency in the distribution.

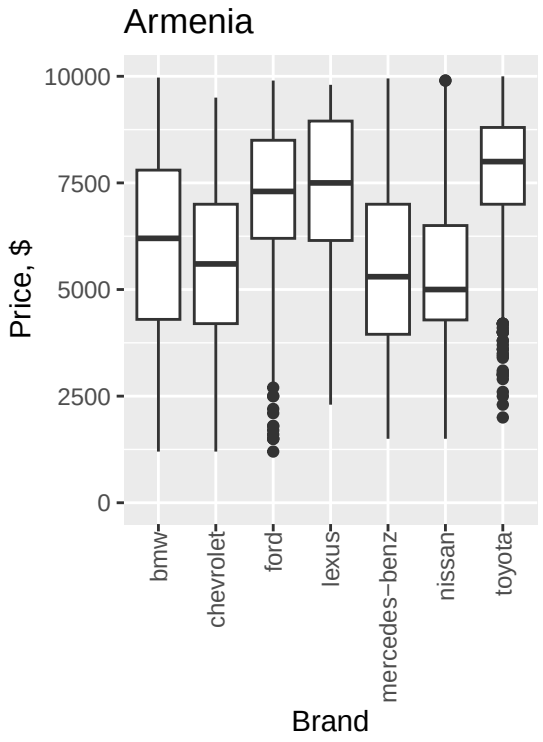


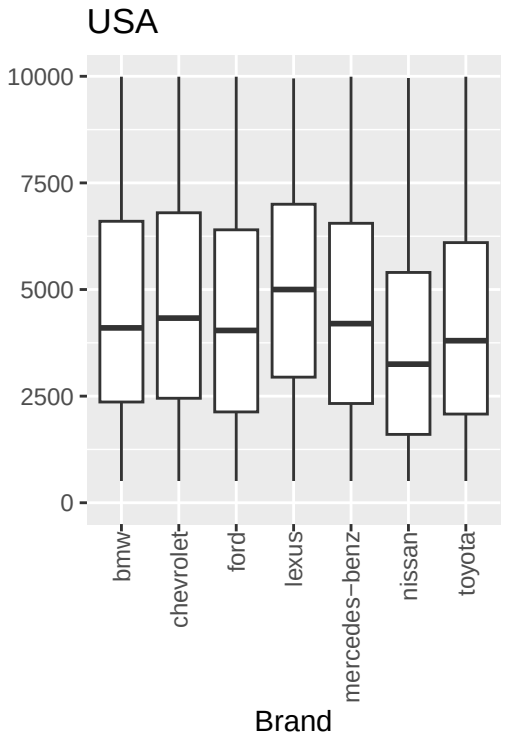
The plots show the cars' price increase based on the production year. In case of Armenian market, cars' prices produced after 2010 start to increase dramatically. In US car market, cars' prices, which produced between 1990 and 2010 have more or less the same price, as there are not any noticeable ups and downs. It is interesting both in US and Armenia Nissan cars' prices regardless year of production are below $20K, even brand new Nissan prices doesn't exceed $20k.

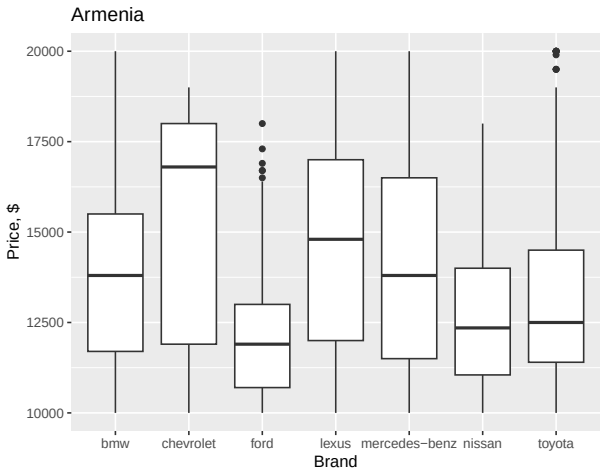


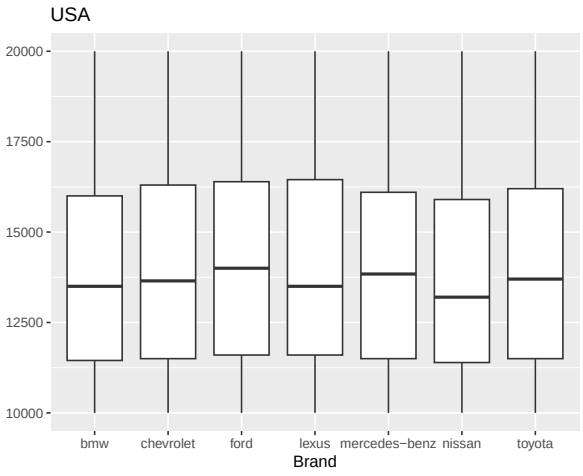
This is a violin plot depicting the price distribution of the top 5 car brands. In the Armenian market, Opel exhibits a broad range of prices, indicating significant variability within the Opel car lineup. Conversely, Mercedes-Benz displays a long tail in its distribution, suggesting a higher degree of dissimilarity in prices among Mercedes-Benz models. Contrastingly, in the U.S. market, there is uniformity in both the width and length of the violin plots for the top 5 car brands. This uniformity suggests a more consistent pricing structure across these brands in the U.S., with less variability compared to the Armenian market.

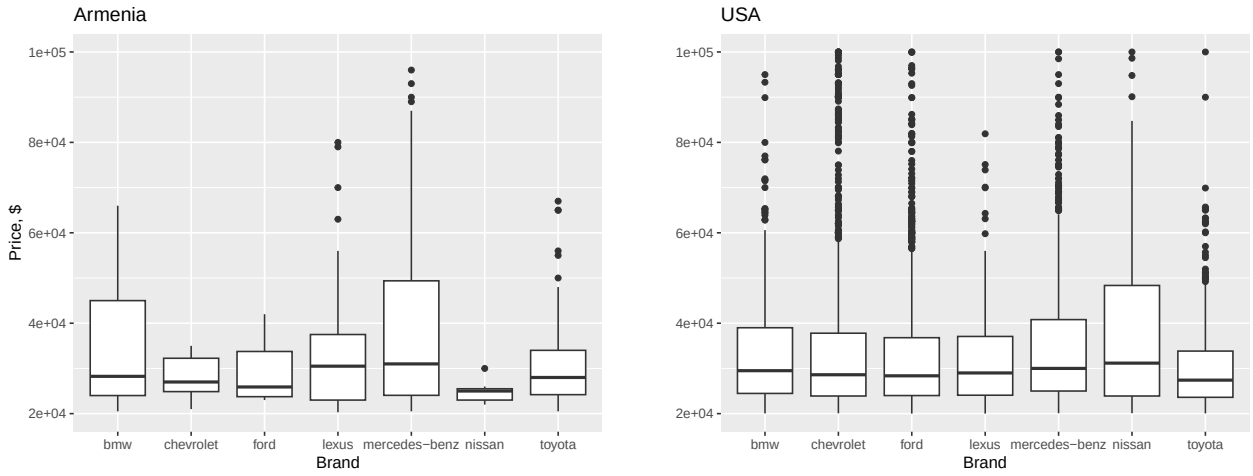
Price distribution of cars posted in 2018−2020











Top 7 US car brands' boxplots does not differ from each other too much. In case of Armenia, top 7 brands' boxplots have more obvious differences, and there are lot of outliers as well(ford and nissan). The boxplots show the price distributions for the top 7 car brands, based on three price categories: below $10,000 (less expensive), $10,000 to $20,000 (expensive), and $20,000 to $100,000 (very expensive). For the top 7 car brands in the USA, there are not many differences in the less expensive and expensive categories, as indicated by the similar lengths of the boxes, and the median and mean prices are more or less close to each. However, in Armenia, the boxplots for the top 7 brands show more obvious differences, clearly indicating significant variability in the price range from brand to brand across all categories.

Conclusion

The observed patterns in the comparative analysis between the Armenian and U.S. car markets lend support to the hypothesis that U.S. car prices are generally higher than those in Armenia. The histograms and violin plots reveal a broader price range and greater pricing consistency within the Armenian market, where the majority of cars fall within the $0 to $20,000 range. In contrast, the U.S. market extends to a $30,000 range, suggesting a higher overall pricing tier for cars in the United States.

The violin plot analysis further underscores the higher degree of dissimilarity in prices

among Armenian car brands, particularly for Opel, as opposed to the more consistent pricing structure across the top U.S. car brands. This variance in pricing dynamics aligns with the hypothesis that the U.S. market generally experiences higher and more uniform car prices compared to the Armenian market.

Moreover, the examination of production years reveals that the U.S. market tends to have a more significant proportion of newer vehicles, potentially contributing to the overall higher pricing trend. While both markets exhibit unique characteristics and trends, the collective evidence supports the hypothesis that, on average, U.S. car prices are comparatively higher than those in Armenia. This distinction likely arises from a combination of economic factors, consumer preferences, and market dynamics that influence the pricing structures in each country's automotive industry.

Interactive Dashboard

With the following link you can view the Interactive dashboard which will help you to make better choices when considering to buy a new car in Armenia.