

Are Used Cars Really Worth Less Than Newly Manufactured Vehicles?

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Table of Contents

| | |
|---------------------------------------|----|
| <u>Introduction</u> | 3 |
| <u>Executive Summary</u> | 4 |
| <u>The Analysis</u> | 6 |
| <u>What it Means</u> | 12 |
| <u>Conclusion</u> | 13 |
| <u>Resources</u> | 14 |

Introduction

The Big Why

“More People Than Ever Before Are Paying Over \$1000 Monthly for New Cars”, written by Nasdaq writer Josephine Nesbit is becoming a statistic we are all too familiar with. With rising costs and flatlining salaries, the purchasing power of the average American is becoming less and less, and with it, the availability of purchasing a new car.

Even when breaking it down we see that for a \$48,000 vehicle, the salary needed to support that can be as low as \$96,000. “...even if you purchase a \$48,000 vehicle and trade in your old car to knock the price down to \$40,000 at 7.5% for five years, that’s still an \$801 monthly payment.” Followed by: “...you’d need to make \$96,100 per year if you want that payment to be 10% of your income.” (Nesbit 2024). This calculation comes from the 20/4/10 rule, where you put down 20% of the car's price as a downpayment, take the car out on a 4 year (48 month) loan, and have the monthly payment of the vehicle be 10% of your overall income. But this is becoming increasingly more difficult. Why?

In this analysis we will attempt to garner more information regarding this fact, comparing the prices of new cars to those of used cars, same model, same brands, same manufacturer years, in order to visualize the relationship and trends between these vehicles we see on the lot of our local dealership. With an original hypothesis that used car prices are on average going to be priced lower than new car prices, we will perform an analysis to obtain evidence to support or reject it. The data used in this analysis was taken from cars.com, and covers over 100,000 of the millions of vehicles they put out online, and includes the car’s model, brand, price and manufacturer year.

Executive Summary

A basic overview

Key Insights:

Through a comprehensive analysis of data sourced from cars.com, this report investigates the cost dynamics between used and new vehicles across various brands and models. By examining trends over a 24-year period, significant observations regarding pricing patterns and market trends have been unveiled.

General Trends:

Analysis of average prices across different vehicle brands reveals notable disparities, with brands like Porsche commanding higher prices while Volkswagen and Chevrolet emerge as more cost-effective options.

Visual representations showcase the fluctuation in average prices of both new and used vehicles over time, with a noticeable increase in prices for vehicles manufactured in recent years.

Brand-specific Analysis:

Dove deeper into specific brands: Volkswagen, Lexus, and Chevrolet, the analysis uncovers consistent trends of price escalation, particularly for newer models.

Comparison of average prices between new and used vehicles for these brands highlights instances where new vehicles are priced higher than their used counterparts, indicating potential cost savings for consumers opting for used models.

Model-specific Analysis:

By isolating the top three models for each brand, the analysis highlighted pricing variations within the brands. It is observed that while new vehicles generally command higher prices, there was one exception where the used model was priced higher than its new variation, while the others persisted with the original hypothesis.

Statistical Significance:

Various two-sample t-tests were performed to provide further validation of the observed trends. The majority of the tests indicate statistically significant differences between the average prices of used and new vehicles, reaffirming the initial hypothesis.

Implications and Recommendations:

The findings underscore the financial advantage of purchasing used vehicles over new ones, particularly for budget-conscious consumers.

Recommendations include conducting thorough research and considering long-term expenses beyond the sticker price, such as maintenance and insurance, to make informed purchasing decisions.

Conclusion:

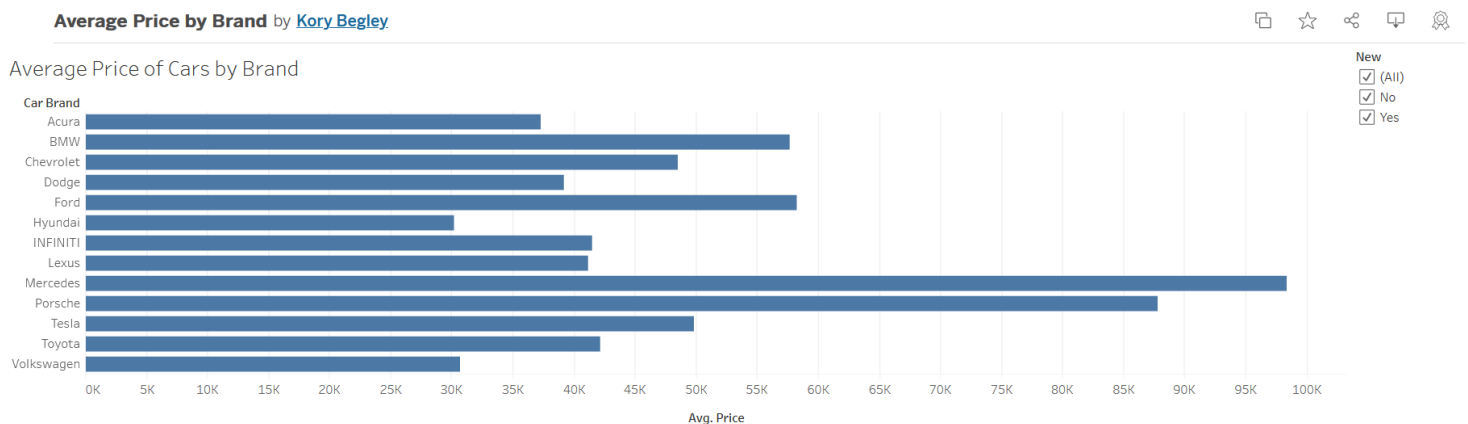
In conclusion, the analysis confirms that used vehicles generally offer a more cost-effective option compared to new ones, with pricing trends influenced by factors such as brand, model, and manufacturing year. These insights provide valuable guidance for consumers navigating the automotive market, emphasizing the importance of considering all aspects of car ownership to ensure financial security and informed decision-making.

The Analysis

What can we figure out using this data?

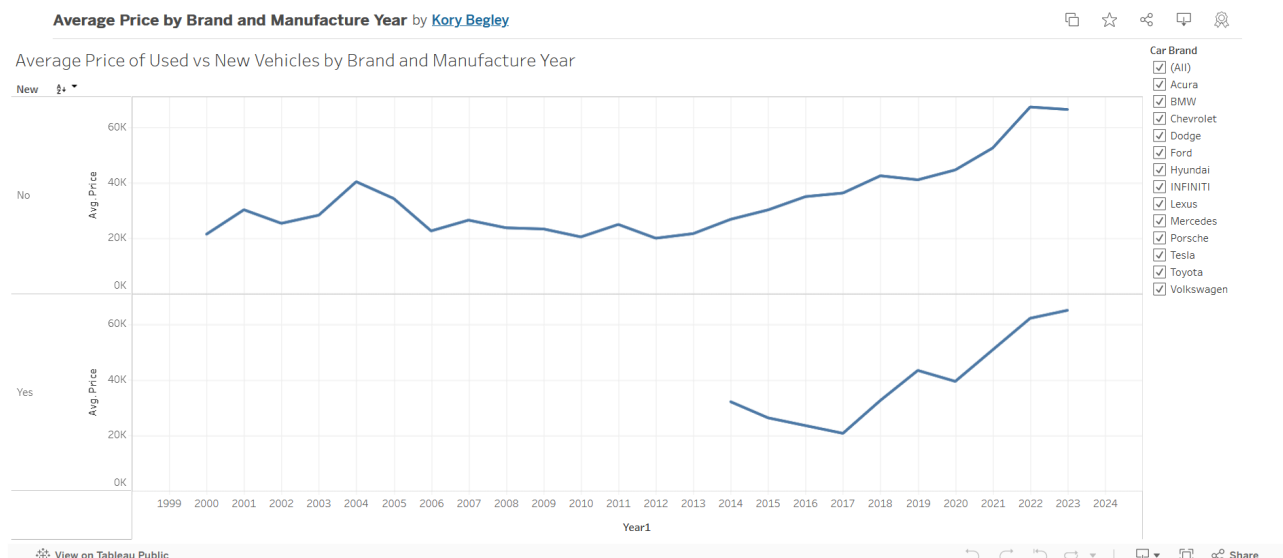
To understand the relationship in specific brands and models, we should first look at the overall set as a whole. The following visual depicts the average price of all vehicles by brand, and as we can see Porsche takes a big lead, while brands like Volkswagen and Hyundai are the two more cost effective brands. The link below brings you to the interactive dashboard where you can filter by used/new to see the difference in average price between the two.

Link to Tableau visual: [Here](#)



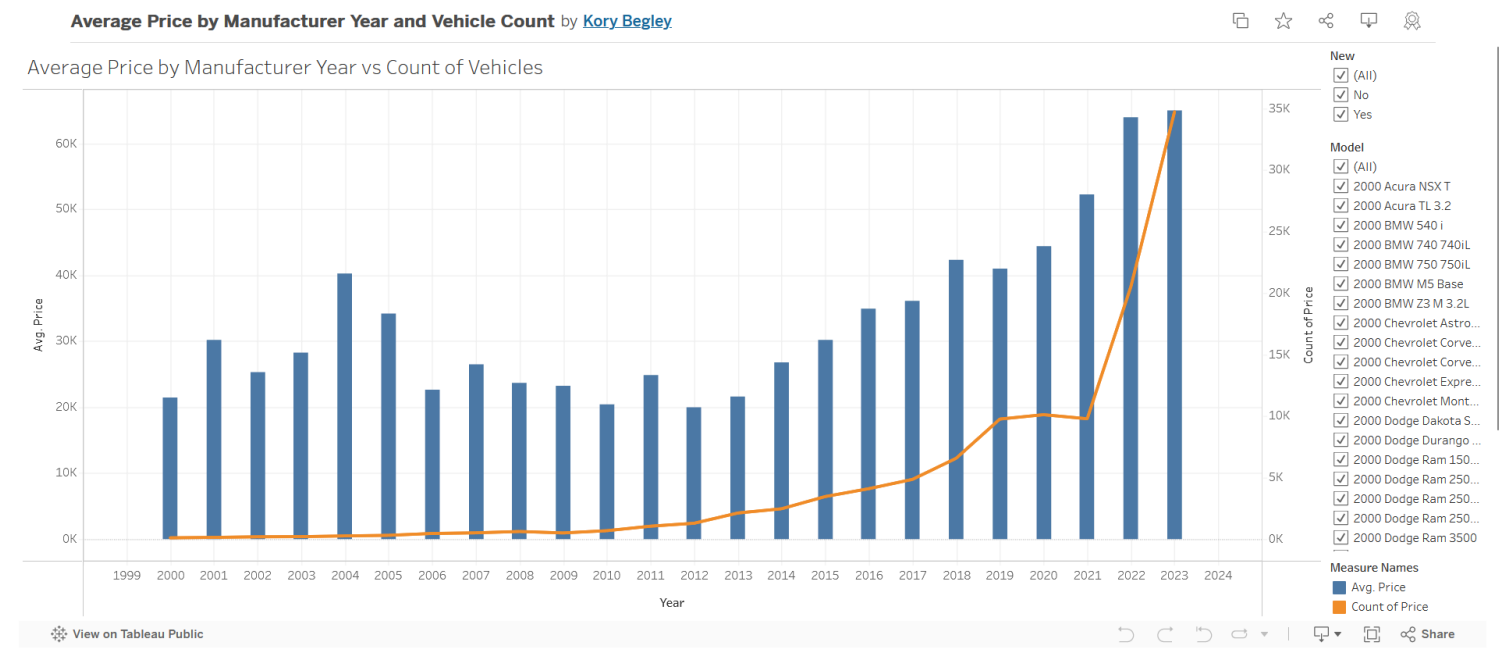
Alongside that, we can get a deeper look into the average price of used vs new vehicles with the following visual. As the visual depicts, the data used did not consist of any new vehicles before 2014, we still however have a decades worth of manufacturer year data to look at these trends. We notice a big dip in average price for new vehicles in 2017, before quickly rising back up to match the used vehicles where for the following 5-6 years they remain around the same key point. If you would like to get a deeper look into how specific brands compare, you can use the following link to the Tableau visual.

Link to Tableau visual: [Here](#)



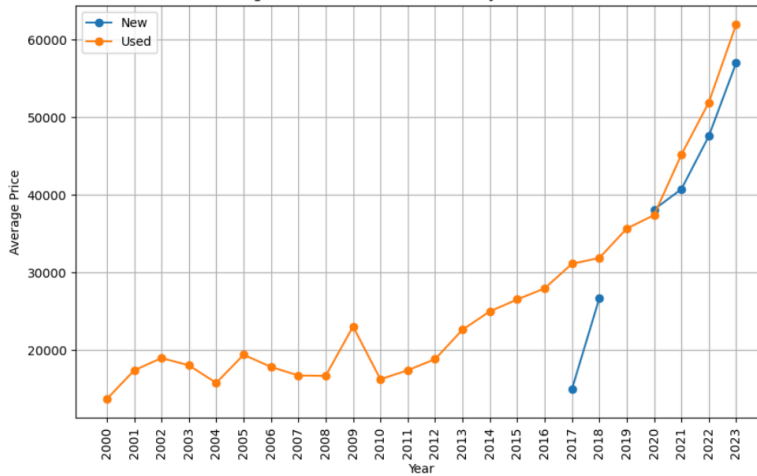
Our final general look at the data consists of comparing the average price of new and used vehicles when looking at the manufacturer year, as well as the amount of vehicles that were accounted for in the dataset. While this doesn't cover the entirety of vehicles that were in circulation at the time, cars.com being one of the top largest automotive classified sites, harboring millions of vehicle prices and listings. This visual gives us a glimpse at the potential trends between vehicle count and average price. While no specific conclusion can be drawn, as average price dips and rises while the amount of vehicles follows a consistent growth over the 24 year period, we can notice that in the last 5 years, prices have only gone up, where as in the preceding 15 years, there were highs and lows that differed from year to year. If you'd like to use the interactive version of this visual, you may use the link below to compare the used prices only and new prices, as well as filtering by specific car brands to see how those have changed in the last 25 years.

Link to Tableau visual: [Here](#)

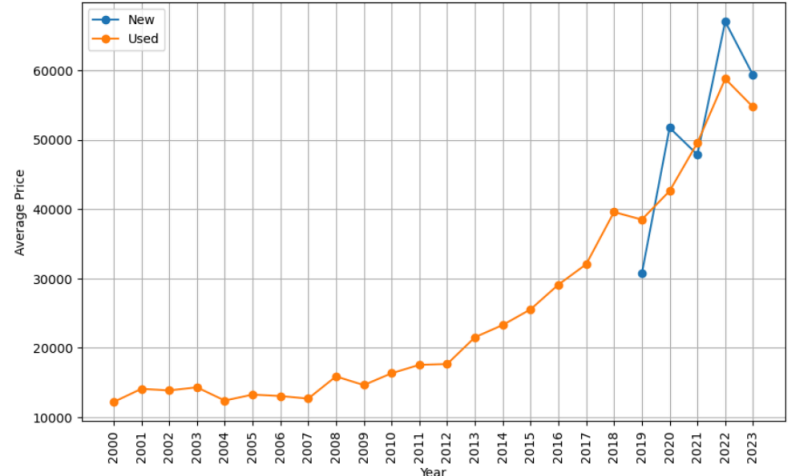


Now that we understand the basic relationship between the average price of used and new vehicles by multiple variables, we can take a closer look into the actual brands and models these numbers represent. In order to do this, this analysis found the top 3 brands by looking at the number of times they appeared in the dataset. After some data manipulation we were able to get the amounts of the top 3 brands, and these were: Volkswagen at 9966.0 appearances, Lexus at 9962.0 appearances, and Chevrolet with 9913.0 appearances. The following visuals depict the 3 brands average prices for used and new vehicles by manufacturer year.

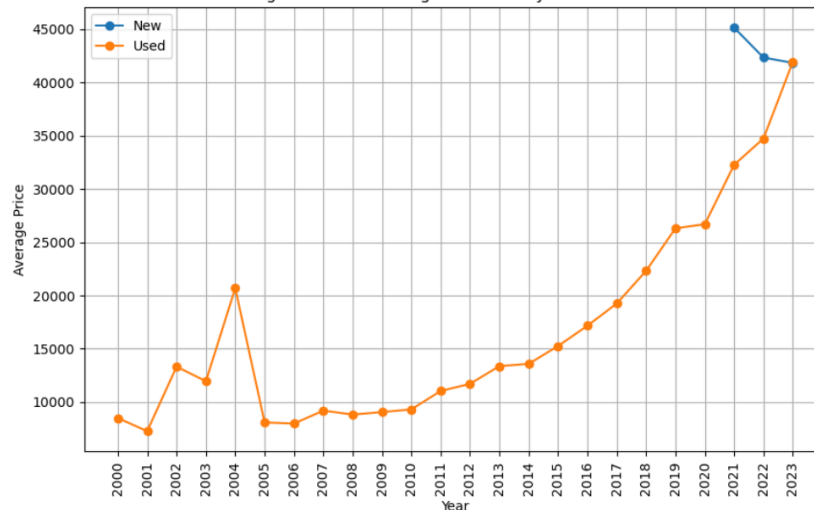
Average Price of Chevrolet Vehicles by Manufacture Year



Average Price of Lexus Vehicles by Manufacture Year



Average Price of Volkswagen Vehicles by Manufacture Year



As we can note from the above visuals, used cars have a lot more data to go off of, while new vehicles are only more recent. This can be due to the fact that manufacturers aren't making these older models new anymore, as well as cars.com, (the source of this data) not selling new vehicles that were made in previous years. With that aside, we can observe the trends between not only the new and used average prices for each brand, but the consistent trends in used car prices between brands. Around vehicles manufactured in 2013 we notice the start to an increase in average price in the coming years. While previous years were dependent and changed by brand. For example, Volkswagen having a big spike in vehicles manufactured in 2004, and Chevrolet having a similar spike on a smaller scale for vehicles manufactured in 2009. When looking at new vehicles for these brands though, we notice that they're around the same price point, and in some instances being lower. Like Lexus vehicles that were manufactured in 2019, new vehicles were priced around 8-9k lower than the used vehicles in circulation. It's important to remember that this data pertains to cars.com data and that data only, and may not reflect what

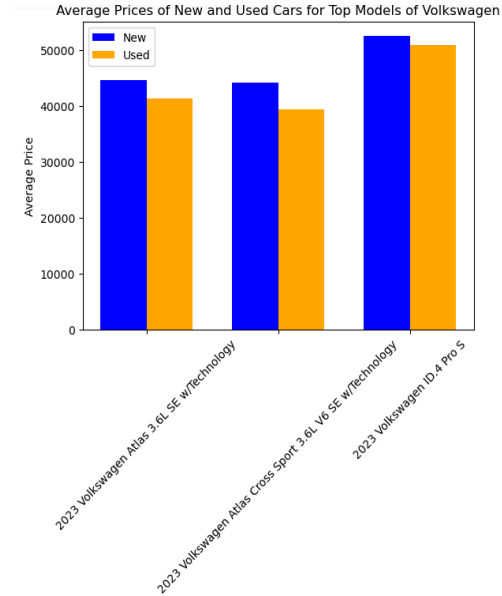
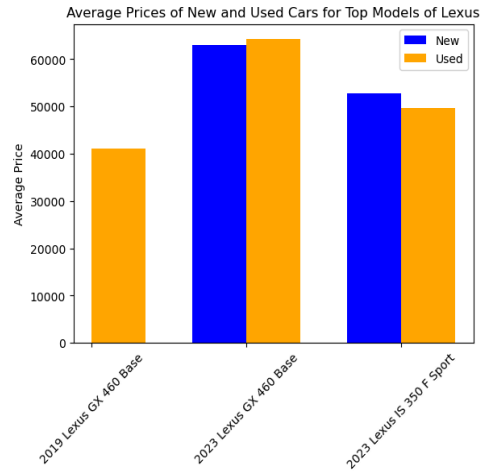
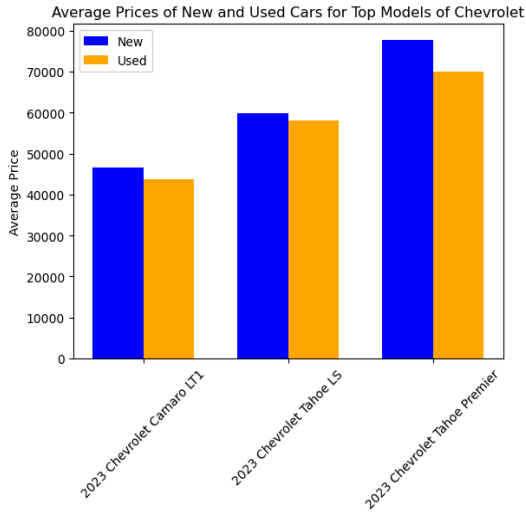
is seen locally at dealerships you may be browsing at. This gives an example as to how the prices have changed with manufacturer year between the popular brands and provides a glimpse of the trends between all of the used vehicles in these brands.

But how about specific models? It is true there is a wide variety between the price of a brand's more affordable cars and their luxury models, so how about looking at the top 3 models for each of these brands. In order to get the top 3 models, a similar process was used that isolated the top 3 brands. This left us with:

| | |
|---|-----|
| 2023 Volkswagen Atlas 3.6L SE w/Technology | 306 |
| 2023 Volkswagen Atlas Cross Sport 3.6L V6 SE w/Technology | 297 |
| 2023 Volkswagen ID.4 Pro S | 265 |
| 2023 Lexus GX 460 Base | 200 |
| 2023 Lexus IS 350 F Sport | 173 |
| 2019 Lexus GX 460 Base | 123 |
| 2023 Chevrolet Tahoe LS | 239 |
| 2023 Chevrolet Tahoe Premier | 223 |
| 2023 Chevrolet Camaro LT1 | 213 |

As was prevalent in the original visuals, 2023 models had the highest count, and as such, are more likely to be the most common manufacture year for these top models. The number next to each model indicates the amount of times they showed up in the data. It's interesting to note that for Lexus, the top model was the 2023 Lexus GX 460 Base, and the third most common is the 2019 version of that vehicle, so this data wasn't restricted to just 2023, and can include multiple versions of the same model.

The following visuals depict the average price of used and new vehicles for the top 3 models of each brand.



As can be seen in the above visuals, new cars are priced higher on average except for a couple key models. First we should note that 2019 Lexus vehicle had no new vehicles, so the only value for that is the used version, which is the second lowest average, so if it followed the same trend as the other 8 models, the new version would be a few thousand dollars above it at around \$42,300/\$43,000. And the other case we want to look at is also a Lexus, and it's the 2023 GX 460 Base, where the used price is actually higher than the new price by around a thousand dollars. While a seemingly insignificant amount of money, it's important to point out as it's the only model where this is the case. Although the scale of the y-axis is different for each one, when looking closely at the actual values being represented, used models tend to stay around the \$40,000 mark, while new models float anywhere from the mid \$40,000s all the way to \$50,000 and \$60,000. When comparing this to the case we identified in the introduction of this report with a \$48,000 vehicle needing a \$96,000 salary, the average used cars fit right around this use case, and new vehicles stray higher and more expensive compared to this use case. While the previous visuals accounted for specific manufacturer years and how they compare over time, these visuals depict the average price for all of the manufacturer years for both used and new, so we have to keep in mind that 8/9 of these vehicles are from 2023, and are more likely to be on the more expensive side, albeit them being the most common from the original dataset.

When moving forward, we should also keep in mind that these values pertain only to cars.com and are not representative of any local dealerships and other online automotive brands. We can however, use this data to interpret and set a baseline for the numbers and observations we make locally when purchasing or looking to purchase a new vehicle.

Lastly, various two sample t-tests were performed to ensure statistical significance for what was observed. A two sample t-test is a statistical method that measures whether or not the means of two groups are equal. This was used in this analysis as we can use the two averages we've been primarily observing (used vehicle prices and new vehicle prices) and measure them to see if they're equal to each other or are statistically different. Since t-tests work best when the data is normally distributed, and as we've observed is not the case from our dataset, this isn't conclusive evidence, it serves as another tool that can help us understand the difference in used car prices and new car prices. Now that we've identified the context and use case for performing these tests, the results were:

Overall used vs new car prices:

t-statistic: 109.85328461410134

Critical t-value: 1.9599858542715154

Volkswagen used vs new car prices:

t-statistic: 89.96707894642257

Critical t-value: 1.9602239933702907

Lexus used vs new car prices:

t-statistic: 26.683959683983364

Critical t-value: 1.9647875279653393

Chevrolet used vs new car prices:

t-statistic: 1.0050480904480676

Critical t-value: 1.9635648233526373

The larger T-stats are a result of the data not being normally distributed, but their size still does provide relevant information to this analysis with the use of the critical t-value. 3 of the 4 of these two sample t-tests end up rejecting the null hypothesis at 95% confidence. This is due to the t-stat being higher than the critical t-value, however, the one instance where we fail to reject the null hypothesis is with chevrolet. Where the t-stat is actually lower than the critical t-value, meaning that on average used chevy cars are priced higher than new chevy cars at a 95% confidence. When looking at the other 3 t-tests, the higher t-stat is indicative that at a 95% confidence, used car prices are on average lower than new car prices, which aligns with our original hypothesis.

What it Means

So now that we've seen all these numbers and statistics, what do they mean?

With all of the information we've gathered, we can observe a few things. When it comes to the general dataset, brands that are often associated with more affordable vehicles do on average cost less than the other competing brands, and are more likely to be the most common brands, as observed with our top 3 brands. The top 3 brands being Volkswagen, Lexus, and Chevrolet, we can see to the first visual and note that they are on the lower - middle end of the overall price range. Additionally, we see that the average price of new and used vehicles manufactured more recently is higher than those of its predecessors, with vehicles manufactured in the 2014-2023 range increasing each and each year. When it comes to the top 3 brands, we can notice a consistent 100% increase in price over the ~20 year period, with inclines and declines varying, the most recent vehicles being typically double the lowest average price noted. If one was looking for a new vehicle to purchase, they'd want to look at and compare prices of more recent vehicles in the 2019-2023 range, compared to the prices of vehicles in the 2011-2014 range, and make decisions based on their personal budget and needs. In many cases, an older model would be more financially safe than a newer vehicle, as noted by the drastic increase in price over time.

As well, when looking at the top 3 models, we get specific value differences between the average prices and notice that in 7 out of 9 models, the newer vehicles were priced higher than the used vehicles, even if they are 2023 models. With a couple such cases holding a different observation or no relationship observed at all, such as the case of the 2019 Lexus that had no record of new vehicles manufactured, which could be due to its age as all of the other vehicles were 2023 models and has sufficient data pertaining to both used and new vehicles. This data and interpretation can be used to compare prices of similar models locally and determine if the prices have risen or fallen when paired against the observed averages. It can also serve as a baseline that if a similar model is priced higher than the observed average, it may not be the best candidate for a new vehicle purchase. All aspects of this analysis consolidate to inform us as consumers what is best for us and our budget, and how the market looks locally when compared to the data displayed from cars.com.

Conclusion

What now?

Given all that was analyzed and observed we affirmed the original hypothesis that used vehicles are typically priced lower than new vehicles. As well, vehicles manufactured more recently will be on average higher priced than vehicles manufactured beforehand. This could be due to upgraded technology, increased safety mechanisms, or a need to match increasing market prices. Given the average prices by manufacturer year of the top 3 brands we observed, the most affordable option for vehicles would be from 2004-2014, with vehicles manufactured after 2014 being on average increasingly more expensive.

In order to obtain a well rounded conclusion from this analysis, comparing these stats to those you can find locally will allow you to see the tangible differences in vehicles near you and those shown by cars.com.

For those continuing in their car ownership journey, it's important to look past the sticker price of vehicles and also take into account long term expenses like repair, gas, and insurance. As noted by the marketwatch article: "Budget Struggles: How Car Ownership Impacts Your Wallet and Well-Being", fuel, unexpected repairs, insurance, and maintenance tend to be the highest and most important strains on car owners' budgets. It's important to work these into your budget as they will set you up for success and potentially save you thousands of dollars over time with a more sound decision for a vehicle. The article concludes, "Understanding all aspects of car ownership, like warranties and maintenance costs, is key in these decisions..." (Lewis 2023), further develops this idea that the expenses past the sticker prices we observed in this analysis are also integral in ensuring financial security after obtaining a vehicle. With the importance of owning a car as a means of transportation increasing, the necessity to be well informed at the variables and process to obtaining that means of transportation will also increase, with no sign of slowing down.

Resources

20, January, et al. "More People than Ever Before Are Paying over \$1000 Monthly for New Cars." Nasdaq, 20 Jan. 2024,
[https://www.nasdaq.com/articles/more-people-than-ever-before-are-paying-over-\\$1000-monthly-for-new-cars](https://www.nasdaq.com/articles/more-people-than-ever-before-are-paying-over-$1000-monthly-for-new-cars)

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www.marketwatch.com/guides/car-warranty/car-ownership-budget-struggles/.