

TECHNICAL REPORT FOR AMARIS AUTOS

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Introduction

Objective of the Project

This analysis aims to evaluate sales trends, identify customer purchasing behaviors, and forecast future sales patterns for Amaris Auto. Specifically, the focus is on determining which car brands sell the most and how engine size, number of doors, and mileage affect pricing. This report will help in making data-driven decisions to optimize inventory, enhance marketing strategies, and improve overall business performance.

Problem Being Addressed

The analysis seeks to answer key questions such as:

1. What are the sales trends over the past months/years?
2. Which vehicle models generate the highest revenue?
3. Who are the primary customer demographics?
4. What factors influence sales, such as seasonality or promotions?
5. How does fuel type affect pricing?
6. How do engine size, number of doors, and mileage impact pricing?

Key Datasets and Methodologies

The dataset used is car sales dataset, including brand, vehicle model, price and more. Microsoft Excel was used for data processing, analysis, and visualization, with pivot tables and charts employed to identify trends and compare performance metrics.

Story of Data

Data Source

The dataset is sourced from Kaggle, a public dataset repository.

Data Collection Process

The data may have been collected through point-of-sale systems, where each transaction is recorded automatically.

Data Structure

The dataset consists of rows and columns, where each row represents a unique car sale transaction.

Columns include:

- Brand (Car manufacturer)
- Model (Specific vehicle model)
- Production Year (Year the vehicle was manufactured)
- Engine Size (Capacity of the engine)
- Fuel Type (Petrol, diesel, electric, etc.)
- Transmission (Manual or automatic)
- Mileage (Distance the vehicle has traveled)
- Doors (Number of doors on the vehicle)
- Owner Count (Number of previous owners)
- Price (Selling price of the car)

Important Features and Their Significance

- **Brand & Model:** Helps determine top-selling brands and models.
- **Production Year & Mileage:** Indicates depreciation trends and pricing patterns.
- **Engine Size & Transmission Type:** Affects vehicle performance and pricing appeal.
- **Fuel Type:** Helps analyze customer preferences and fuel efficiency trends.
- **Doors & Owner Count:** Provides insight into vehicle desirability and market demand.
- **Price:** Key metric for analyzing trends and customer spending behavior.

Data Limitations or Biases

- Bias may exist if data is skewed towards a particular vehicle brand or model due to inventory constraints.
- External factors such as economic conditions and competitor pricing may not be fully accounted for in the dataset.

Data Splitting and Preprocessing

Data Cleaning

The dataset was already pre-cleaned, so minimal adjustments were needed. The only modification made was formatting the column headings for consistency.

Handling Missing Values

There were no missing values in the dataset, so no imputation or deletion was necessary.

Data Transformations

No transformations such as normalization, standardization, or feature engineering were performed.

Data Splitting

Independent Variables: Brand, Model, Fuel Type, Transmission, Year

Dependent Variables: Engine Size, Mileage, Doors, Owner Count, Price

Industry Context

This dataset belongs to the automotive industry, particularly within the car sales and dealership sector.

Stakeholders

Car manufacturers, dealerships, and car sellers. It could also be insurance companies and auto-loan providers.

Value to the Industry

Value to this industry could mean fair pricing for buyers and sellers, optimizing pricing strategies, retaining brand value, and high sales for manufacturers.

Pre-Analysis Board

Key Trends

1. **Age vs. Pricing:** Older cars may show a steady depreciation curve, but premium brands like BMW and Mercedes might retain value better.
2. **Brand vs. Pricing:** Luxury brands likely command higher resale values, while economy brands may depreciate faster.
3. **Transmission vs. Pricing:** Automatics may have higher upfront costs, but manuals could hold value better in performance models.
4. **Fuel Type vs. Pricing:** Diesel vehicles might retain value better than petrol models, given fuel efficiency and longevity.
5. **Mileage Impact:** Vehicles exceeding 100,000 miles could see a sharp decline in value.

Potential Correlations

1. **Brand & Mileage:** Higher-end brands might show lower depreciation rates at high mileage compared to economy brands.
2. **Fuel Type & Mileage:** Diesel cars might demonstrate better mileage retention compared to petrol models.
3. **Engine Size & Pricing:** Larger engines (V6/V8) could depreciate faster due to higher fuel costs.
4. **Owner Count & Pricing:** More previous owners might negatively impact resale value.

Initial Insights

1. Luxury brands and diesel cars may hold value better over time.
2. High-mileage vehicles could experience significant depreciation beyond 100,000 miles.
3. Transmission type may influence pricing, with automatics costing more upfront but manuals retaining value in performance models.

In-Analysis

Unconfirmed Insights

1. **Depreciation Trends:** Older car models are consistently more affordable, but the degree of depreciation may depend on factors such as brand reputation and maintenance costs. Further analysis is needed to verify if some brands depreciate slower than others.
2. **Brand Pricing:** While BMW appears more affordable and Ford is priced higher, the minimal price difference raises questions about market perception and brand positioning. Additional analysis is required to confirm if this pricing gap is consistent across different model years.
3. **Transmission Preferences:** Automatic cars command the highest price, while semi-automatic options are the cheapest. This suggests consumer preference for ease of use, but further validation is needed to determine if this trend is global or region-specific.
4. **Fuel Type & Market Shifts:** The price difference between petrol and electric cars suggests that EVs remain premium-priced due to battery costs. However, it is unclear if this price gap is narrowing over time as EV technology advances.
5. **Mileage & Brand Correlation:** BMWs have lower mileage, possibly due to luxury positioning, while Ford cars show higher mileage, potentially due to commercial use. More data is needed to confirm if usage patterns align with brand reputation.
6. **Owner Count & Pricing:** Cars with 2-4 owners are cheaper, but those with one or five owners are more expensive. The pricing trend for five-owner vehicles is unclear and requires further investigation into whether rarity or other factors influence this pattern.

Recommendations

1. **Marketing & Sales Strategy:** Dealers should emphasize the affordability of older models while highlighting financing options for newer vehicles to attract a broader range of buyers.

2. **Brand Value Analysis:** A deeper look into resale value trends per brand can help dealerships and buyers make informed decisions. If Ford is marketed as a premium brand but its pricing is close to BMW, a strategy shift may be needed.
3. **Transmission-Based Pricing Strategy:** Dealerships could focus on promoting automatics to customers willing to pay more for convenience while offering semi-automatics as budget-friendly alternatives.
4. **EV Market Positioning:** To boost EV adoption, dealerships might offer incentives or financing plans to bridge the pricing gap between petrol and electric models.
5. **Mileage Considerations in Pricing:** Dealers should adjust pricing strategies based on average mileage per brand, emphasizing longevity for premium brands and affordability for high-mileage models.
6. **Owner Count Impact:** Further research on why five-owner cars are priced higher can help refine pricing models. If rarity is a factor, it could be leveraged in marketing efforts.

Analysis Techniques Used in Excel

1. **Pivot Tables & Charts:** Used to analyze pricing trends across car brands, fuel types, transmission types, and owner count, as well as to visualize data relationships.
2. **Filtering & Sorting:** Applied to organize data efficiently, identify high and low-price points, and spot key trends such as depreciation rates and mileage differences.
3. **SUM & COUNT Functions:** Used to calculate total sales, average prices, and the number of cars in each category, helping to quantify observed patterns.

Post-Analysis and Insights

Key Findings

1. **Diesel Cars:** Toyota is the most affordable diesel brand, while Ford is the most expensive. Newer models (2018–2023) and larger engines (4-5L) command higher prices. Diesel cars with 2-4 previous owners are cheaper, while those with 1 or 5 owners are more expensive. Semi-automatic diesel cars are among the most budget-friendly, especially for low-mileage options, with Audi and BMW offering the best deals.
2. **Electric Cars:** Honda is the most affordable electric brand, whereas Ford is the most expensive. Older models (pre-2017) and smaller engines (1-2L) offer better value. Semi-automatic electric cars are the cheapest, while automatic ones cost the most. Vehicles with 1, 3, or 4 previous owners are more affordable. Toyota provides the most budget-friendly low-mileage electric cars, while Honda has the highest mileage in this category.
3. **Hybrid Cars:** Kia is the most affordable hybrid brand, while Audi is the most expensive. Older models (pre-2018) and smaller engines (1-2L) offer better value. Manual hybrids are the cheapest, whereas automatic hybrids are the most expensive. Cars with 2-4 previous owners tend to be more budget-friendly. Volkswagen offers the most affordable low-mileage hybrid cars.
4. **Petrol Cars:** Mercedes is the most affordable petrol brand, while Volkswagen is the most expensive. Older models and smaller engines (1-2L) provide the best value. Semi-automatic petrol cars are the most budget-friendly, while automatic cars are the most expensive. Vehicles with multiple previous owners tend to be cheaper, but those with only one owner remain costly. Honda is the best option for low-mileage petrol cars, whereas Ford ranks the lowest in this category.

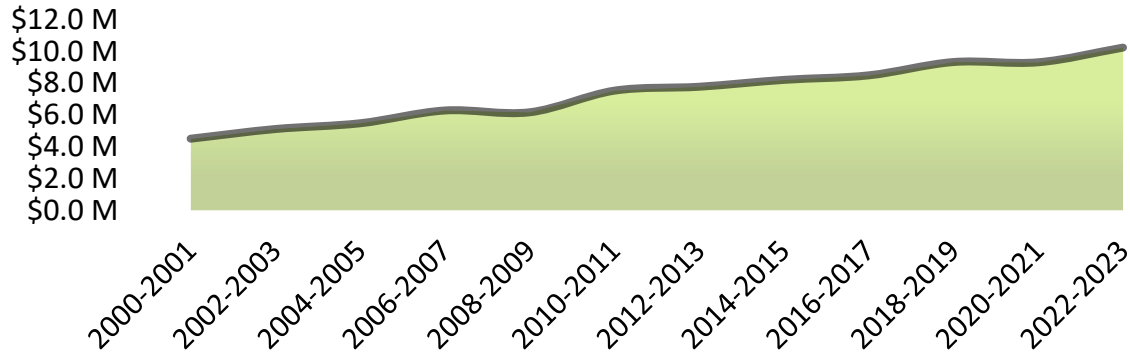
Comparison with Initial Findings

1. **Diesel Car Pricing:** The expectation that premium brands like BMW and Audi would be the most expensive does not hold, as Ford emerged as the priciest diesel brand.

2. **Electric Vehicle Pricing:** The assumption that newer electric models would retain value better was challenged by findings showing that older electric cars (pre-2017) remain more budget-friendly.
3. **Hybrid Car Ownership Trends:** It was expected that hybrids would be expensive across the board, but manual hybrids were found to be the most affordable, contradicting the assumption that automatics always hold more value.
4. **Petrol Car Mileage & Pricing:** While petrol cars were expected to be affordable, the strong link between ownership history and pricing suggests that single-owner cars command premium prices, which was not initially anticipated.

Data Visualizations & Charts

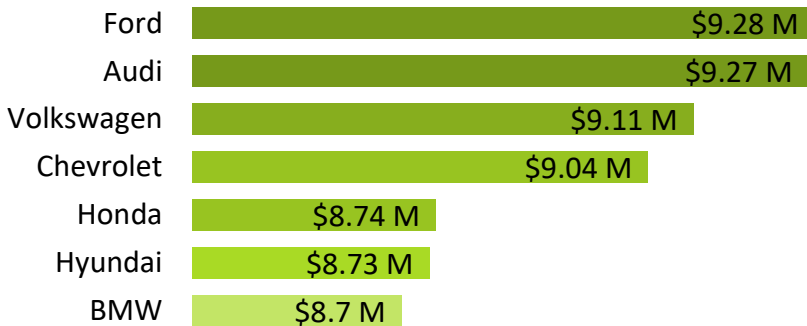
1. Sales Trend



Explanation

The sales trend report from 2000 to 2023 clearly shows that older car models tend to be more affordable compared to the latest models. This pricing pattern reflects the natural depreciation of vehicles over time, making newer models more expensive.

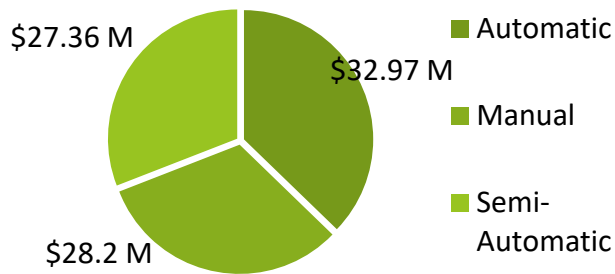
2. Car Brands Ranked by Price



Explanation

BMW brand of cars, has the lowest-selling price of \$8,695,364, while Ford, a premium brand seems to be on the high-side with selling price of \$9,277,494

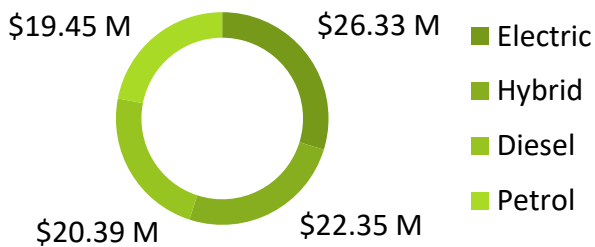
3. Transmission Options and Price Comparison



Explanation

semi-automatic transmission cars are the cheapest in this category with selling price of \$27,362,986, while automatic transmission cars are the most expensive, with selling price of \$32,965,185.

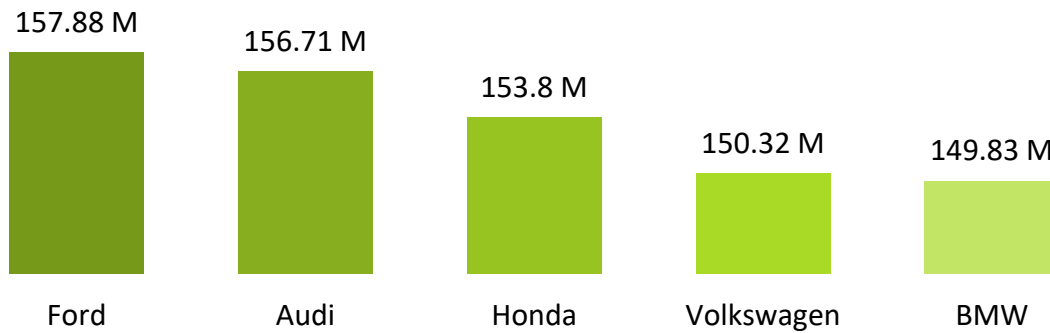
4. Fuel Type with Pricing



Explanation

Petrol-type of cars come cheaper with selling price of \$19,450,054, while Electric cars are on the high side with selling price of \$26,334,578.

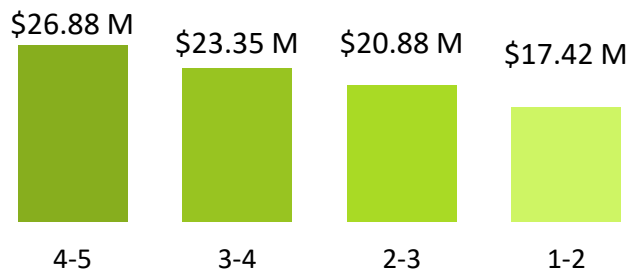
5. Brands By Mileage



Explanation

BMW tops the chart with lowest mileage with 149,830,329, while Ford brand have the highest mileage with 157,881,505

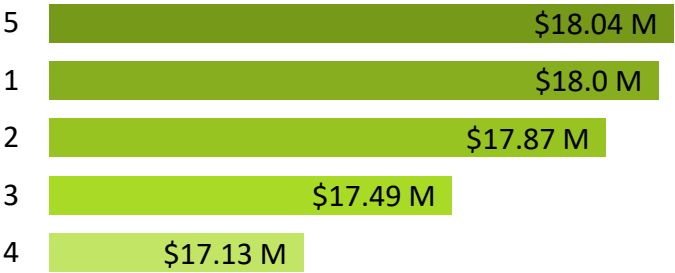
6. Engine Size with Pricing



Explanation

smaller engines are cheaper than the bigger ones by a wide margin.

7. Owner Count with Pricing



Explanation

Cars with 2,3,4 previous owners are cheaper, while the ones with 1 and 5 owners have expensive selling price.

Dashboard



Recommendations and Observations

Actionable Insights

1. **Promote Affordable Diesel and Petrol Options:** Since Toyota (diesel) and Mercedes (petrol) are the most budget-friendly brands, dealerships should highlight these options in marketing campaigns targeting cost-conscious buyers.
2. **Optimize Inventory for Hybrid and Electric Vehicles:** Stock more Kia and Hyundai hybrids for affordability and emphasize Toyota's lower-mileage electric models to appeal to buyers looking for EVs with reduced wear.
3. **Encourage Purchases of Older Models:** Since older models (pre-2018 for diesel, hybrid, and petrol, and pre-2017 for electric) offer better value, dealerships can create targeted promotions, trade-in programs, and financing deals for these cars.
4. **Educate Buyers on Transmission Choices:** Given that semi-automatic and manual transmissions offer better affordability across fuel types, dealerships should provide educational content on cost-benefit comparisons to influence customer decisions.

Optimizations or Business Decisions

1. **Adjust Pricing Strategies:** Since smaller engines (1-2L) provide the best value, dealerships should consider pricing strategies that make them even more attractive to buyers seeking affordability without compromising performance.
2. **Enhance Used Car Marketing:** Vehicles with 2-4 previous owners balance cost and reliability, making them ideal for buyers who want affordability without sacrificing trust. Dealerships can highlight these options in their used car promotions.
3. **Focus on Brand Positioning:** Since Volkswagen is the most expensive petrol brand and Audi leads in hybrid pricing, dealerships should reinforce their premium positioning and justify the higher prices with branding and feature highlights.

4. **Target Low-Mileage Buyers with Specific Brands:** Honda offers the best low-mileage petrol and electric options, making it the go-to brand for mileage-conscious buyers. Marketing efforts can emphasize this benefit to attract customers focused on long-term value.

Unexpected Outcomes

1. **Mercedes Being the Most Affordable Petrol Brand:** Despite being a luxury brand, Mercedes offers the cheapest petrol cars, which may be due to market perception or pricing strategies. Further analysis is needed to determine whether this is due to depreciation or model-specific factors.
2. **Electric Cars Having Higher Mileage:** Typically, hybrids or petrol cars were expected to have the highest mileage, but electric cars showed increased mileage. This could be due to EV owners driving more to maximize charging benefits and lower operational costs.
3. **Volkswagen's High Pricing for Petrol Models:** While Volkswagen is generally seen as a mid-range brand, its petrol cars are the most expensive. This suggests brand perception, model features, or market demand may be influencing pricing more than expected.

Conclusion

Key Learnings

1. Car pricing is significantly influenced by factors such as fuel type, engine size, model year, and transmission type. Older models (pre-2018 for diesel, hybrid, and petrol; pre-2017 for electric) and smaller engines (1-2L) consistently provide better affordability.
2. Diesel and petrol cars tend to be more budget-friendly than electric and hybrid cars. Toyota and Mercedes offer the most affordable diesel and petrol options, respectively, while hybrid and electric vehicles generally come at a premium.
3. Ownership history plays a role in pricing, with vehicles that have 2-4 previous owners offering the best balance between cost and reliability. Cars with only one previous owner are often the most expensive, possibly due to perceived better maintenance.
4. Transmission type impacts pricing, with automatic cars being the most expensive and semi-automatic/manual cars offering more budget-friendly alternatives.
5. Electric cars tend to have higher mileage, likely due to their lower operating costs and growing adoption, while hybrid vehicles exhibit the lowest mileage usage.

Limitations

1. **Data Scope:** The analysis was based on available sales data but did not factor in external variables like geographic location, seasonal pricing changes, or market demand fluctuations.
2. **Data Quality:** Some pricing variations may be influenced by external factors such as promotions, dealership strategies, or model-specific depreciation rates, which were not accounted for.
3. **Limited Consideration of Vehicle Features:** Factors such as safety ratings, technology upgrades, and interior features were not included in the analysis, though they could impact pricing and demand.

Future Research

1. **Market Demand and Seasonal Trends:** Further analysis could explore how car pricing fluctuates across different seasons or economic conditions.
2. **Resale Value Over Time:** A study on how depreciation affects different brands and models over extended periods could provide deeper insights into long-term vehicle value.
3. **Geographical Price Variations:** Examining how location affects car pricing could help in understanding regional market preferences and variations.
4. **Impact of Car Features on Pricing:** Adding data on safety features, in-car technology, and brand reputation could refine the pricing analysis.
5. **Consumer Preferences:** A survey or behavioral analysis of buyer choices could reveal trends influencing why certain brands or transmission types are preferred.

References

Saurabh Badole (2024). Car Price Dataset. [online] Kaggle.com. Available at: <https://www.kaggle.com/datasets/saurabhbadole/car-price-dataset> [Accessed 18 Mar. 2025].

Anderson, S.T. and Saltee, J.M. (2016) 'Designing policies to make cars greener: A review of the literature', *Annual Review of Resource Economics*, 8(1), pp. 157–180. Available at: <https://doi.org/10.1146/annurev-resource-100815-095357>.