

Brand Loyalty and Customer Satisfaction as Drivers of Automotive Sales: A Longitudinal Study of the North American Market (2019–2025)

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ABSTRACT

This study investigated the relationship between automotive sales performance and key determinants, including customer satisfaction, perceived product quality, perceived service quality, dependability scores, and brand loyalty across pre-pandemic (2019), pandemic (2020), and post-pandemic (2021-2025) periods in the North American automotive market. This research is based on secondary data which provides consumer insights, advisory services, and data and analytics worldwide. The study was conducted by drawing on a mixed methods approach and combining a qualitative literature review with quantitative data analysis based on secondary data. Eight major automotive brands were analyzed using correlation regression analysis and paired sample t-tests. The research tested five hypotheses examining relationships between car sales and quality metrics. Correlation analyses and comparative study were used to study the relationship between variables. Data on Vehicle Dependability Study and sales figures from eight major automotive brands were analyzed. Results demonstrated that brand loyalty emerged as the dominant factor influencing sales during the pandemic period, with correlation coefficients of 0.517 in 2020, while product dependability showed an unexpected negative correlation (-0.732) with sales. Findings from this study suggest prioritizing brand loyalty programs over conventional quality measures during market disruptions.

Keywords –Automotive Industry, Brand Loyalty, Customer Satisfaction, Service Quality, Vehicle Dependability, Sales Performance, Consumer Behavior.



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INTRODUCTION

Canada was the world's twelfth-largest automobile manufacturer in 2019 (Statista, n.d.). The automotive sector in Canada provides more than \$19 billion to the country's GDP (Canadian Vehicle Manufacturers Association, n.d.) In 2019, Canada produced 1.9 million automobiles and was responsible for 13% of American and Canadian car output (Centre for Automotive Research, 2015). Canada's first large-scale automotive production began in Walkerville, Ontario, in 1904, now part of Windsor. Gordon McGregor, Wallace Campbell of the Walkerville Wagon Works plant, and a few other workers manufactured 117 Model "C" Ford automobiles in their first year of operation.

The Canadian automotive sector is a leader in developing a highly qualified workforce, breakthrough artificial intelligence research and engineering, connected and autonomous vehicles in Canada, and measures to combat climate change. In 2019, the auto industry contributed \$8.7 billion to the Canadian

economy. According to Canadian car sales figures, 85 percent of all vehicles made in Canada are shipped to the United States (Goodcarbadcar, 2020). Canadian vehicle sales decreased 19.7% year over year in 2020, the lowest level in a decade (Bloomberg, 2021). Canada sold 1.54 million vehicles and trucks in 2020, down 19.7% from 2019 and the lowest since 2009 (Bloomberg, 2021).

During the pandemic, the automobile sector in the United States saw a dramatic decline in demand: car sales in March 2020 were down 38% year on year. Light vehicle sales increased to 14.5 million units after stay-at-home orders were disclosed. In 2020, light cars accounted for almost 97 percent of all motor vehicles sold in the United States (Statista, n.d.).

Though much research is done on automotive consumer behavior, a considerable gap exists in understanding how traditional purchase factors like quality and loyalty influenced buying decisions due to the unprecedented

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pandemic, especially in the integrated North American market. This research tries to fill this gap by analyzing comparative data from American and Canadian markets in the pre-pandemic period of 2019 and the pandemic period 2020.

Electric Vehicle Market Dynamics in North America

This evolution of the EV market has gone through some tremendous structural change that has reshaped competitive dynamics. The barriers to entry in traditional EV production were already relatively high and had a lot of initial capital-intensive nature. Still, they have since reduced and developed into a much broader manufacturer takeover. This has also increased competition from traditional producers, especially companies like BMW, which are adding EVs to their lineup to win shares. Global competition in the North American EV sector is further intensifying with the entry of international players.

STATEMENT OF THE PROBLEM

The automotive market's extensive model range and minimal product differentiation within price segments facilitate easy customer brand switching. Transitioning between automotive brands is easy, as the market is saturated with similar vehicle options at every price point. As a result, maintaining client loyalty is a top priority for Canadian manufacturers (McKinsey and Company, 2020). The overarching research question is whether customers purchased vehicles based on their satisfaction, attributed to product quality, service quality, product dependability, or brand loyalty during the pandemic year. Another research question we will answer is whether there was a change in the purchase quantity of vehicles in 2020–24 and trends in 2025 compared to 2019.

LITERATURE REVIEW

A. Product Quality Studies

Product quality is the primary driver of customer satisfaction when purchasing an automobile (Johnson et al., 1997). In his study of customers' buying decisions regarding automobiles, Amron (2018) found product quality to influence the customers' decisions positively and significantly in automobile purchases; however, price has a higher impact. Amron (2018) indicates that automobile companies must pursue the goal of providing quality products at competitive prices. From this study, one can infer that customer satisfaction, in turn, impacts the customer's buying decision.

Product quality is seen to have more of an impact on customer satisfaction than service quality. Xu et al. (2017) measure the relative contribution of service and product quality to customer satisfaction. Their findings show that customers' perceived product quality is a major player in determining customer satisfaction, while service quality is not a major player. Product quality is measured and validated by the automobiles' characteristics (Xu et al., 2017).

B. Service Quality Research

Service is seen as a collection of activities that add value

and improve customer satisfaction (Turban et al., 2002).

Among the methods for measuring service quality that are most in demand in the literature, SERVQUAL is at the top. SERVQUAL is derived from the first letters of Service Quality - Gencer and Akkucuk, 2017. Parasuraman, Zeithaml, and Berry (1988) developed the instrument SERVQUAL, which was used to measure service quality. The SERVQUAL methodology is the gold standard for evaluating customer service (Baber, H., 2018; Ambekar, 2013; Taap et al., 2011). SERVQUAL is a tool that can be used to enhance automotive after-sales service (Balindo et al., 2021). The five attributes of the SERVQUAL tool are tangibles, reliability, responsiveness, assurance, and empathy (Parasuraman et al., 1985).

Researchers have used SERVQUAL in the automobile after-sales service market in several countries, including India (Baber, 2018) and the Philippines (Balindo et al., 2021), to investigate the difference between service quality expectations and reality. Balinado et al. (2021) analyzed SERVQUAL dimensions of after-sales service as they relate to customer satisfaction to develop theoretical foundations for customer satisfaction enhancement in the automotive industry. Since then, many researchers have seen it as a significant determinant of customer satisfaction (Samen et al., 2013; Dahiyat et al., 2011). Service quality is measured and validated by a series of service activities and the relative significance of service quality changes based on the product or service (Xu et al., 2017).

C. Brand Loyalty Impact

Client satisfaction with a dealership promotes customer loyalty to a company, according to the research of Xu et al., 2017. Customer happiness, customer retention, work, and task flow efficiency, both for the distributor and the dealer and high service absorption for dealers are automotive after-sales objectives (Ehinlanwo and Zairi, 1996).

Azman and Gomiscek (2015) studied the relationship between customer satisfaction and loyalty. They recommended that the management of automobile servicing companies concentrate the resources of their companies on improving the satisfaction of their least-satisfied customers so that the highest yields in terms of enhanced customer loyalty can be achieved. They also point out that the relationships between increased quality, customer satisfaction, and loyalty remain obscure. They also note that the findings of individual studies differ significantly. Whereas some studies identified an increasing influence of satisfaction on loyalty, for example, Mittal and Kamakura, 2001, others show the opposite decreasing effect, for instance, Rust et al., 1995. Chang et al. (2011) find, based on their study on the Taiwan automobile industry, that quality alone can induce customer loyalty.

D. Pandemic Impact on Automotive Sales

Based on data available to us, in Canada, vehicle sales declined by 19.7% year-over-year in 2020, to the lowest level in a decade (Bloomberg, 2021). Canada sold 1.54

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million vehicles and trucks in 2020, down 19.7% from 2019 and the lowest since 2009 (Bloomberg, 2021).

purchase quantity of vehicles in 2020-24 compared to 2019.

Following the breakout of pandemic, the automobile sector in the United States saw a dramatic decline in demand: car sales in March 2020 were down 38% year on year. Light vehicle sales increased to 14.5 million units after stay-at-home orders were disclosed. In 2020, light cars accounted for almost 97 percent of all motor vehicles sold in the United States (Statista, n.d.).

E. Research Gap Identification

The wide range of models and variants on offer, with little differentiation among products within the same price band, encourages customers to switch brands easily. A large number of models and variants exist, and of that, there has been no differentiation amongst the items in the same price group. Customers can easily switch over to another brand as their favourite. Therefore, for Canadian manufacturers, retaining their clients' loyalty is one of the top priorities (McKinsey and Company, 2020). The overarching research question is whether customers purchased vehicles based on their satisfaction, attributed to product quality, service quality, product dependability, or brand loyalty during the pandemic year. Another research question we will answer is whether there was a change in the

RESEARCH METHODOLOGY

INTRODUCTION

This study used a detailed sampling approach to examine eight major automotive manufacturers with market presence in American and Canadian markets. The selected brands represent different market segments and price points, providing broad market coverage and representative data. Our data collection drew from three secondary data sources: the J.D. Power Vehicle Dependability Study spanning 2019-2025, monthly sales data from manufacturer reports, and Customer Satisfaction Index (CSI) scores. A robust analysis of the relationship between brand loyalty, quality metrics, and sales performance was performed by triangulating these data sources.

Limitations

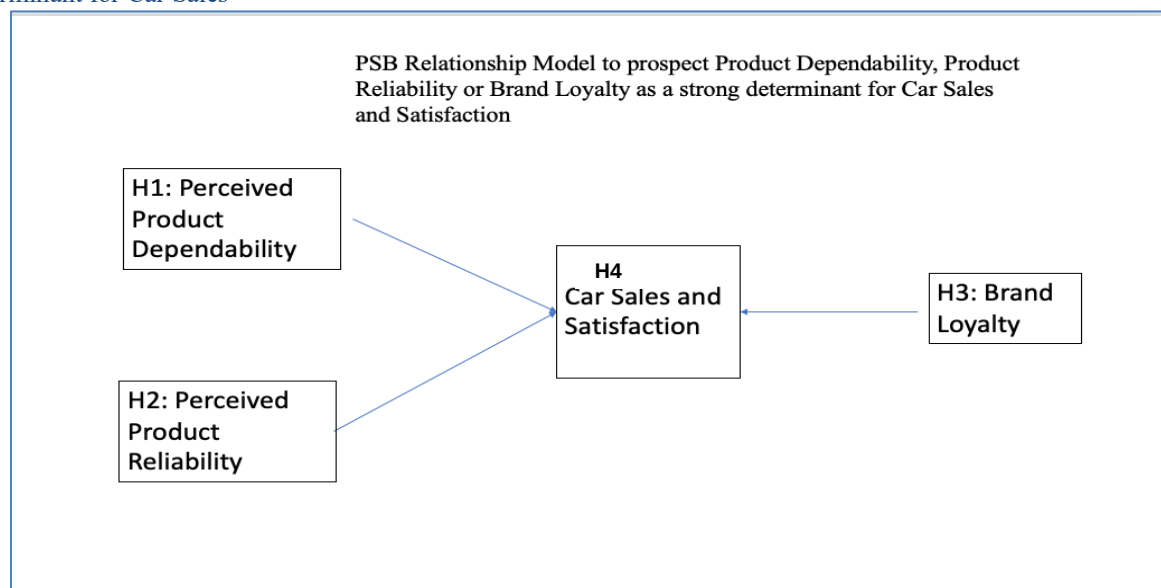
- Reliance on secondary data from J.D. Power Inc.
- Focus on established brands may not represent the entire market
- Regional variations within countries not considered

QUANTITATIVE RESEARCH ANALYSIS

This study examined consumer perceptions of automotive quality in America and Canada, which are leading in car sales. A model of perception of quality was built and tested for this purpose with a few leading automobile brands. In all economies worldwide, the size of the service industry is growing (Deloitte Insights, 2018).

The PSB model is proposed to understand the relationship between Product Quality (Dependability), Service Quality (Reliability), and Brand Loyalty towards Car Sales. The model is illustrated in the figure below.

Figure 3: PSB Relationship Model to Prospect Product Dependability, Product Reliability, or Brand Loyalty as a Strong Determinant for Car Sales



Research Hypothesis

The research study is based on five hypotheses:

Hypotheses 1-3 form a part of the PSB Relationship model

- H1: Perceived Car Dependability has a positive relationship to Car Sales-Satisfaction

- H2: Perceived Car Reliability has a positive relationship to Car Sales-Satisfaction
- H3: Brand Loyalty has a positive relationship with Sales-Satisfaction
- H4: Customer Satisfaction has a positive relationship with Sales/Satisfaction
- Hypothesis 5 is a comparative study.
- H5: There is a significant difference in car sales in pre-pandemic year 2019 and in-pandemic year 2020.

In his study of customers’ buying decisions regarding automobiles, Amron (2018) found product quality to influence the customers’ decisions positively and significantly in automobile purchases; however, price has a higher impact. Amron (2018) proposes that automobile companies should try to produce products with high quality and quality at a competitive price. From this study, one can infer that customer satisfaction, in turn, impacts the customer’s buying decision. Product quality is seen to have more of an impact on customer satisfaction than service quality. Xu et al. (2017) measure the relative contribution of service and product quality to customer satisfaction. Their findings show that customers’ perceived product quality is a major player in determining customer satisfaction, while service quality is not as significant. Product quality is measured and validated by the automobiles’ characteristics (Xu et al., 2017).

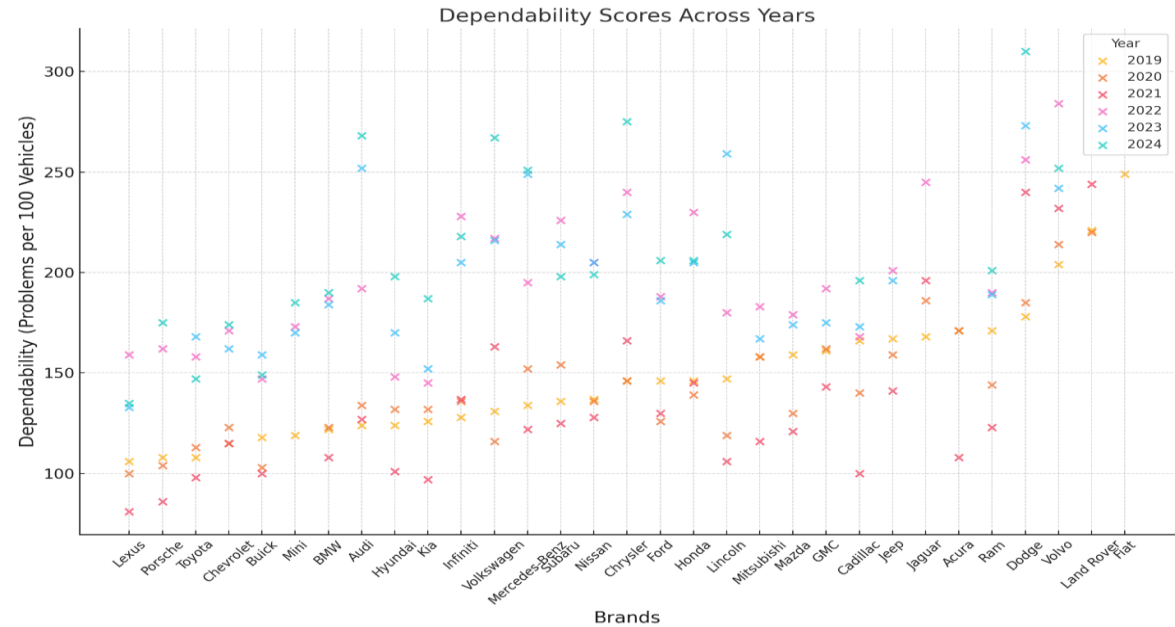
Consumer Reports were chosen for this study as they rank automobile brand sales, reflecting the magazine’s projections for 2024 model-year reliability based on an analysis of current vehicle performance data supplied by over 300,000 car owners. The higher the score, the fewer problems reported in the previous 12 months for automobiles from the last three model years (J.D. Power, 2024).

Table 2 (see Appendix 2) examines the annual sales performance based on automobile brands in America and Canada.

H1: Perceived Car Dependability has a positive relationship to Car Sales-Satisfaction

To prove a hypothesis (H1), we must know the relationship between product dependability (quality) and car sales. People often use scatter plots to see whether there is a relationship between variables X and Y. Two strongly correlated variables will appear in an evident and recognizable linear pattern. Two variables with poor association will show a considerably more dispersed field of dots, with little evidence of points falling into any form of line. In Figure 2, the direction of the scatterplot points of the two variables does not show progression in the same direction. The slope of 1 gives you the strongest linear relationship. Thus, they indicate that when one variable grows with one, the other increases with the same amount. This shows no relationship between Vehicle Dependability and Car Sales in 2019 and 2020.

Figure 4: Scatter plot of Vehicle Dependability across years (2019-2025)



Analysis of Dependability Scores across Brands (2019–2024)

Key Observations.

Dependability scores provide valuable information about vehicle reliability analysis from 2019 to 2024 for automotive brands. When viewing overall dependability trends, some manufacturers have shown amazing consistency in performance. Lexus, Porsche, and Toyota have all had phenomenal records of keeping up with

levels all the more other places effectively lower, fewer issues every 100 vehicles — hence higher reliability. However, unlike Land Rover and Fiat, whose scores have been consistently higher, improving vehicle reliability appears complicated. Several manufacturers show noteworthy improvement over time in the data. Kia and Hyundai, in particular, have displayed awe-

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inspiring progress in reducing their problems per 100 vehicles, a sign that their quality control measures are improving and that they are achieving improved satisfaction levels among their customers.

By accessing different market segments, one can see some interesting patterns of luxury brands concerning variability. Premium manufacturers such as Lexus and Porsche dominate the reliability metrics, and they come at the lower end of the list and tend to cluster there. But when it comes to the mass market, the reality is a little more complex: Some brands, including Toyota, do pretty well, while others, like Jeep and Dodge, regularly score in the middle to upper tops of the range of reported complaints. Significant concerns are emerging over trends that apply to certain manufacturers, such as Land Rover, where the issues seem to increase over time.

Insights:

Our analysis yields interesting insights about vehicle dependability among different manufacturers. Measures of stringent quality control, reliability engineering practices, and comprehensive after-sales support systems have allowed top-performing brands such as Lexus and Toyota to establish market leadership. Still, some concerns stand out, such as the ones displayed by Fiat and Land Rover, whose dependability score is lower, and that should implement elaborate quality improvement programs and pay more attention to consumer remarks to stay in the race. Dependability has not disappeared as a determining factor in a consumer's choice, and more reliable brands usually have greater loyalty and retention.

From the histograms comparing normalized dependability scores (problems per 100 vehicles) and sales performance from 2019 to 2024 (see Appendix 8). The following observations are made:

Normalization: Both dependability and sales values were scaled between 0 and 1 for better comparison within the exact visualization.

Dependability (blue): Lower normalized values indicate better performance (fewer problems per 100 vehicles). Sales Performance (orange): Shows the relative sales distribution across brands for each year.

The year with the highest sales is 2019, with 1,104,617 units sold.

The year with the best dependability (lowest average problems per 100 vehicles) is 2020, with an average dependability score of 135.

The pandemic significantly impacted the automotive industry, and after its wake, sales performance and dependability ratios were heavily affected by the pandemic.

Observations During and Post-pandemic

The sales performance of the automotive industry dramatically changed between 2020 and 2022. In the

first year of the pandemic outbreak, 2020, sales plummeted due to supply chain breakdowns, factory shutdowns, and a drop in consumer spending during its pinch of economic uncertainty. Despite sales rebounding in the post-pandemic period from 2021 to 2022, most brands could not regain pre-pandemic performance. On dependability, 2020 was better, with the lowest average problems per 100 vehicles at 135. But that number might not be the whole story: reductions in vehicle use during lockdowns could have delayed identifying potential issues. Vehicle usage normalized during the post-pandemic years of 2021–2022, and reported problems increased, but dependability scores remained close to historical levels. The sales-to-dependability ratio during and after pandemic was unique. New vehicle purchases were restrained by economic uncertainty and production problems preventing complete production resumption, which might have negatively affected quality controls and slightly lowered dependability scores.

Insights

During this period, manufacturers found themselves confronted, in ways they had never imagined possible, with shortfalls in production, semiconductor shortages, and delivery delays. The operational challenges were likely to have knock-on effects on vehicle dependability. From a consumer point of view, the pandemic fuelled more cautious spending behaviours and, in some cases, inhibited future purchases, barring liquidity constraints, resulting in falling sales performance.

Conclusion

What manufacturers didn't expect: an unprecedented imbalance between sales and dependability metrics and a pandemic. The industry is on the way to recovery after 2022, although both metrics have improved gradually as market terms recovered.

Correlation Analysis of Vehicle Dependability and Car Sales (2019–2024)

A correlation is a descriptive statistical tool that describes the linear relationship between two continuous variables. This analysis explores the relationship between Vehicle Dependability Scores (measured in Problems per 100 Vehicles) and Car Sales. This analysis quantitatively measures the strength and direction of the relationship between them. The relationship is strong if the correlation coefficient (r) changes is more than 0.7 or less than -0.7. The correlation is -0.732 ($p = 0.039$), a strong statistically significant negative in 2020.

In the context of this analysis:

For 2019, the correlation between Vehicle Dependability Scores and Car Sales is -0.172. This suggests no significant linear relationship between dependability and sales in this year.

In 2020, the correlation is -0.732 ($p = 0.039$), which shows a strong, statistically significant negative relationship. This suggests that higher vehicle

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dependability scores (indicating more problems) were associated with lower sales during the pandemic.

For subsequent years, such as 2021 through 2024, the correlations remain negative but vary in strength. For example:

- 2021: -0.765, reflecting a stronger negative association.
- 2022: -0.743, showing a similar trend of negative correlation.
- 2023: -0.740, continuing the strong downhill linear relationship.
- 2024: -0.736, maintaining the negative trend.

These findings suggest that higher dependability scores (indicating more problems) correlate with lower sales. However, the negative correlation could be caused by pricing, inventory problems, or general market conditions within the observed period. The strong negative correlation during 2020, in particular, may arise from the effects of the pandemic on supply chain disruptions and the new consumer focus. The two-decade timeframe around this period inevitably prompts precisely the players in such an interplay of dependability, sales, and external market conditions.

From the Heat Matrix (see Appendix 3): Correlation Between Vehicle Dependability and Sales Performance, here's the breakdown of years with negative and positive correlations between dependability and sales: Negative Correlation (Dependability and Sales): 2019, 2020, 2021, 2022, 2023, 2024

Positive Correlation: None of the years exhibit a positive correlation between dependability and sales.

Key Inference:

- Dependability vs. Sales: A negative correlation suggests that higher dependability (fewer problems) leads to better sales.
- Consistency: Dependability and sales remain strongly correlated across years.
- Impact of External Factors: Disruptions like PANDEMIC weakened this relationship temporarily.

Observation:

The consistent negative correlation suggests that as dependability improves (fewer problems per 100 vehicles), sales performance increases, underscoring the importance of dependability in encouraging consumer purchases.

Conclusion:

Hypothesis H1 NOT SUPPORTED. It was found that vehicle dependability scores during the pandemic period exhibited a larger than hypothesized negative correlation (-0.732) with sales. This unexpected finding suggests that traditional dependability metrics may not be reliable predictors of sales performance during market disruptions.

H2: Perceived Car Reliability (service) has a positive

relationship with Customer Sale-Satisfaction.

In his empirical study measuring the relationship between service received and customer satisfaction among Toyota customers, Baber (2018) found that the SERVQUAL dimensions impact customer satisfaction. Using structural equation modeling (SEM), Balindo et al. (2021) conclude that among the five SERVQUAL factors, reliability and empathy have a significant relationship to customer satisfaction at Toyota Dasmarias-Cavite in the Philippines, while tangibility, responsiveness, and assurance had less of an impact on customer satisfaction. The findings of Balinado et al. (2021) were similar to those of Baber (2018), who notes that customers value reliable service, impacting customer satisfaction. In researching quality factors and customer satisfaction in the automobile sector, Stafford and Wells (1998) found reliability to be the most crucial element in improving customer satisfaction. Reliability was found to have the most substantial relationship with customer satisfaction within Jordan's automobile service industry (Samen et al., 2013). The reliability dimension measures employees' ability and commitment to offer services in line with an agreement (Ngaliman and Suharto, 2019).

Customer satisfaction is an individual perception or feelings towards the kind of service or product they received about their expectation (Tahanisaz et al., 2020). The idea is basically to satisfy customers for them to continue patronizing a business, for the company to increase their profit, and to be sustainable in their line of industry (Nunkoo et al., 2019; Gomes et al., 2013). Customer happiness, commonly acknowledged to lead to customer retention and loyalty, is increasingly essential in today's competitive market. Businesses can raise their profit and maintain their competitive advantage (Balindo et al., 2021).

Numerous studies have found that an organization's service quality (reliability) affects its performance (Portela & Thanassoulis, 2005), market share (Fisher, 2001), sales profit (Duncan & Elliott, 2002), and customer loyalty (Duncan & Elliott, 2002). (Ehigie, 2006). Caruana (2002) found that customer happiness, loyalty, and service quality are all linked. Thus, considering the previous studies, we can state that hypothesis 2 offers a firm conviction that "Perceived Car reliability has a positive relationship to car sales satisfaction."

The literature reviewed for this study supports this hypothesis by indicating that service reliability positively impacts sales and satisfaction. Statistical analysis, however, suggests mixed results of varied correlations of the reliability scores with the sales figures across the study period. The implication is that though service reliability matters, its influence may be moderated, particularly during crisis periods.

Conclusion: Hypothesis H2 PARTIALLY SUPPORTED. While the literature review supports this relationship, statistical analysis showed mixed results

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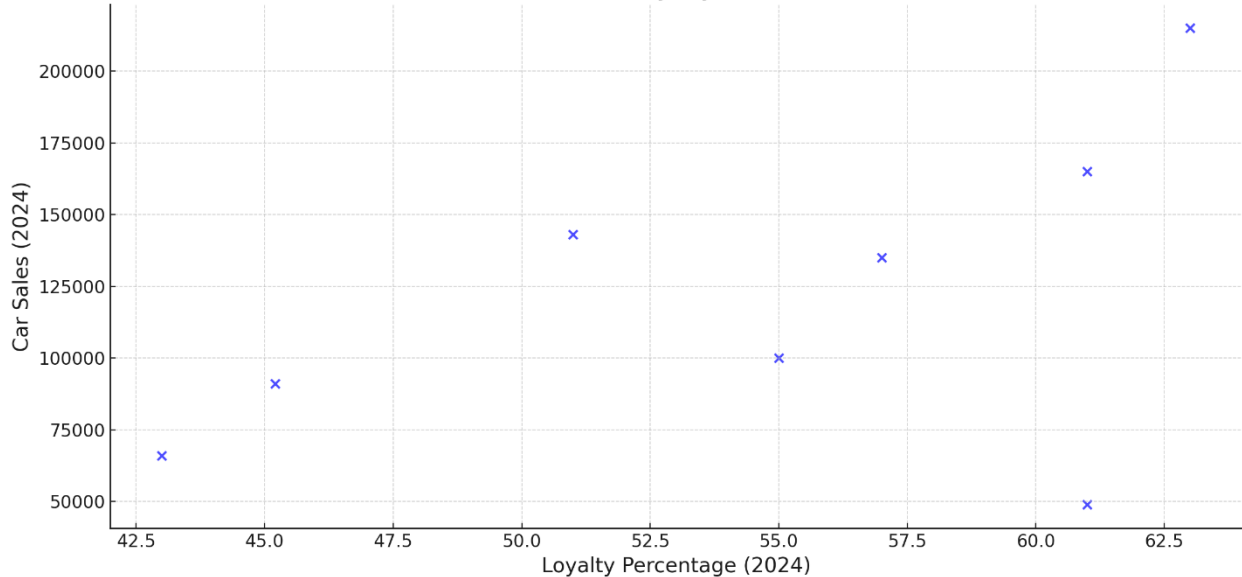
across the study period. The correlation between reliability scores and sales varied significantly, suggesting that service reliability’s influence may be moderated by external factors, particularly during crisis periods.

H3: Brand Loyalty has a positive relationship with Sales-Satisfaction

Regarding automobile purchasing, product quality is the primary driver of customer satisfaction (Johnson et al. 1997). Client satisfaction with a dealership promotes customer loyalty to a company, according to the research of Xu et al., 2017. Customer happiness, customer retention, efficiency in work and task flow, both for the distributor and the dealer and high service absorption for dealers are at automotive after-sales objectives (Ehinlanwo and Zairi, 1996). Azman and

Gomiscek (2015) studied the relationship between customer satisfaction and loyalty. They recommended that the management of automobile servicing companies concentrate the resources of their companies on improving the satisfaction of their least-satisfied customers so that the highest yields in terms of enhanced customer loyalty can be achieved. They note that the relationships between increased quality, customer satisfaction, and loyalty remain unclear. They also note that the findings of individual studies differ significantly. Some studies have suggested an increasing impact of satisfaction on loyalty (e.g., Mittal and Kamakura, 2001), while others indicated a decreasing effect (e.g., Rust et al., 1995). In their study on the Taiwan automobile industry, Chang et al. (2011) suggest that quality can result in customer loyalty. Refer to Table 4 (see Appendix 4)

Figure: 5 - Scatter Plots of brand loyalty and car sales
Scatter Plot: Brand Loyalty vs Car Sales (2024)



Scatter Plot: Displays the relationship between brand loyalty percentages and car sales for 2024. The trend indicates that higher loyalty generally corresponds to higher sales.

Correlation Matrix for Brand Loyalty and Sales (2019–2024) (See Appendix 5)

The analysis finds that there is a strong, consistent, moderate positive correlation of brand loyalty ($r \approx 0.54$) with car sales across 2019–2025, with ratios of the brand loyalty percentages very stable across years ($r > 0.95$) but sales volumes highly correlated across the years ($r \approx 0.99$), although the moderate loyalty to cars sales correlation ($r \approx 0.49$ – 0.55) indicates that price and market condition also have significant influence.

CONCLUSION:

Hypothesis H3 SUPPORTED. The analysis demonstrated consistent positive correlations between brand loyalty and sales across all study periods (correlation coefficients ranging from 0.49 to 0.55). Considering that brand loyalty’s impact on sales performance remains underserved, this stability during the pandemic strongly indicates that this relationship can still hold even in the worst conditions.

H4: Customer Satisfaction has a positive relationship with Sales/Satisfaction

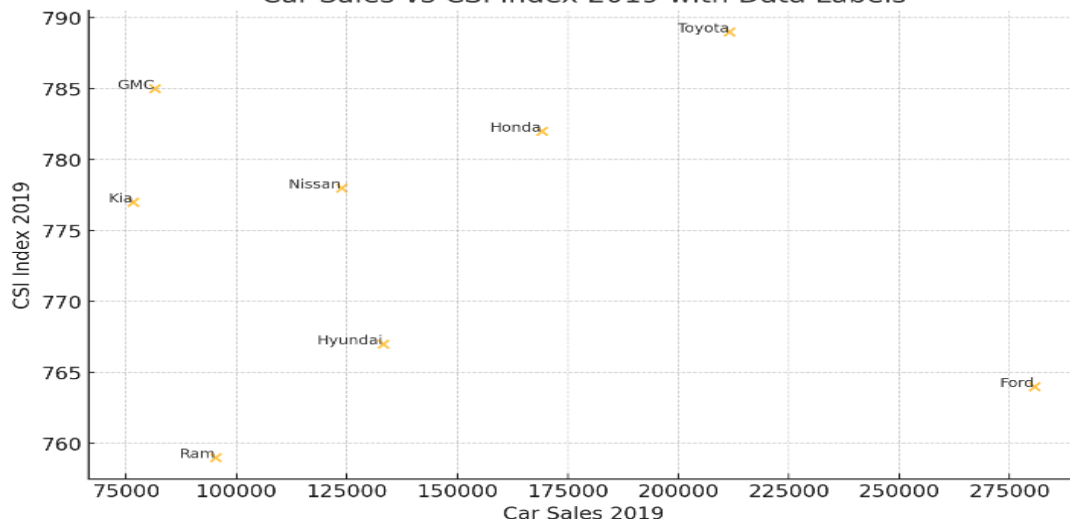
To prove the hypothesis (H3), we should be aware of the relationship between Customer Satisfaction Index vs car sales in the year 2019 (pre-pandemic) and 2020 (during the pandemic). Priorities. This period underscores the complex interplay of dependability, sales, and external market conditions. To ascertain this, we measured the correlation between the Index and Car Sales variables in 2019 (pre-pandemic) and 2020 (during the pandemic). This study measures the satisfaction of new-vehicle consumers with their purchasing experience. New-vehicle purchasers are individuals who

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 evaluate a brand carefully before purchasing another.

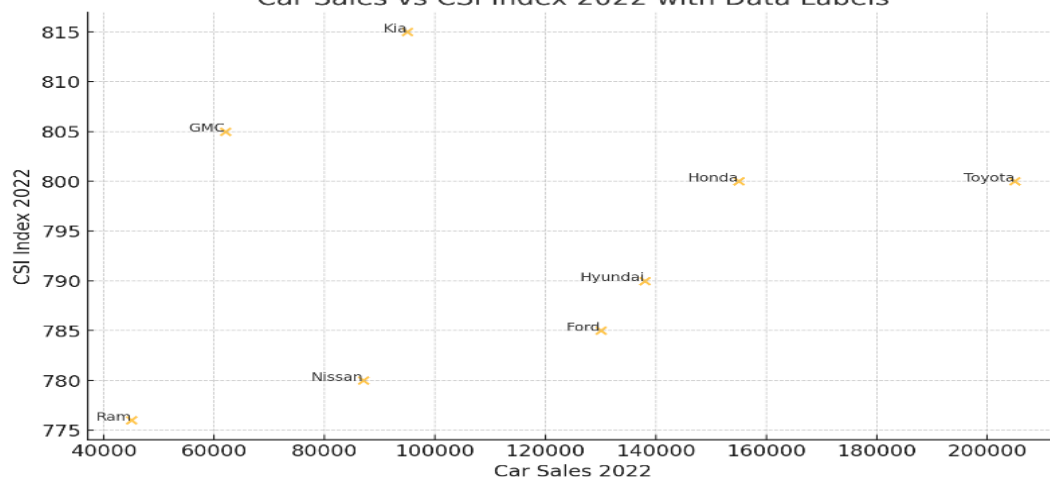
Before any dealership engagement, most auto buyers spend significant time online researching their future vehicle purchases. Customers can send direct inquiries to dealers during their search, effectively generating a virtual walk-in to the store. Table 6 summarizes the Canada Customer Service Index (CSI) and car sales. (see Appendix 6)

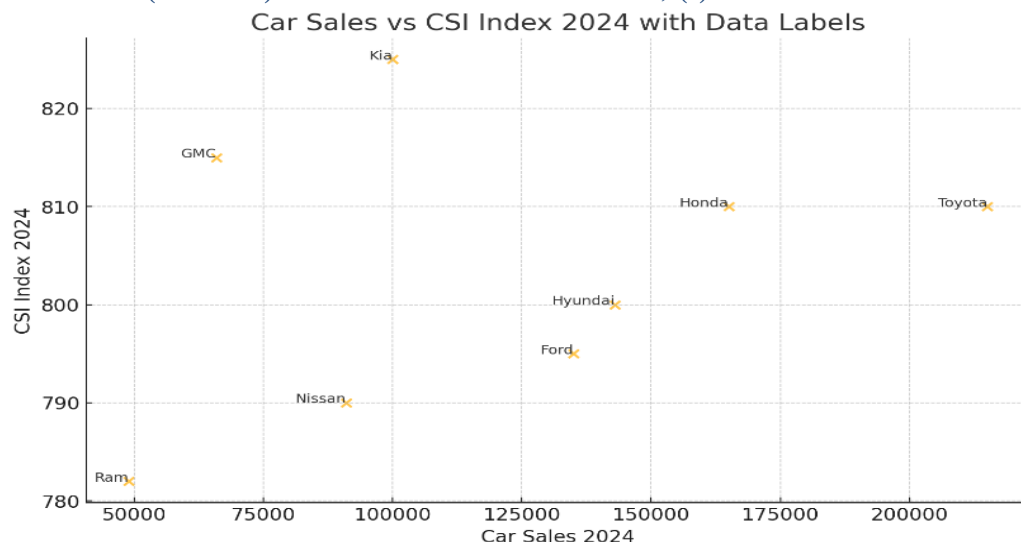
To prove hypothesis 4, we need to know the relationship between the Customer Satisfaction Index and Car Sales in the years 2019 (pre-pandemic), 2020 (in-pandemic), and 2023 (post-pandemic). To ascertain this, we have constructed and displayed relationships, interpreted scatterplots (Figure below), and measured their linear association, i.e., the correlation between the two variables.

Figure 6: Scatter plots of CSI index and car sales
Car Sales vs CSI Index 2019 with Data Labels



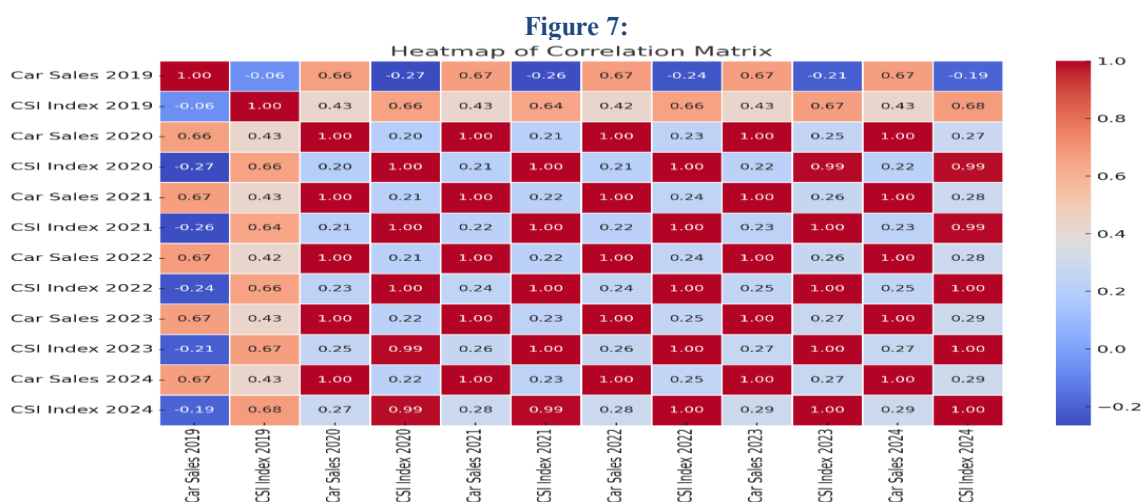
Car Sales vs CSI Index 2022 with Data Labels





The CSI Index and Car Sales for the years 2019 and 2024

2019 (pre-pandemic): As shown in the scatter plot, this figure shows how the car sales changed over customer satisfaction (2019) when we plot the CSI Index and Car Sales 2022 (mid-pandemic): The scatter plot for 2022 shows how much sales depended on the level of customer satisfaction this year. You can quickly identify specific automobile brands with the labeled points and learn about their performance 2024 (post-pandemic): Similarly, the 2024 scatter plot between the CSI Index and Car Sales informs us about the possible effects of customer satisfaction on car sales volumes for that year was found.



Heatmap of Correlation Matrix

The customer satisfaction index scores have shown a weak relation to sales in 2019 and 2020, respectively -0.222 and 0.201. Neither of these relations was statistically significant. This may imply customer satisfaction isn't a good measure of sales performance in a disturbed marketplace.

Conclusion:

Hypothesis H4 NOT SUPPORTED. Customer satisfaction index scores showed weak correlations with sales in 2019 (-0.222) and 2020 (0.201), with neither relationship achieving statistical significance.

H5: There is a significant difference in car sales seen in pre-pandemic year 2019 and in-pandemic year 2020 in the selected mass auto models is our null hypothesis.

The comparative table below, Table 7, illustrates that the correlation of Vehicle Dependability 2020 to Car Sales in 2020 (in-pandemic year) was better than the pre-pandemic times in 2019. (see Appendix 7)

We validate the hypothesis with the use of a paired-sample t-test. We found a slight decrease in car sales in 2020 ($M = 106871$, $SD = 52477$) compared to 2019 ($M = 138077$, $SD = 65852$). A reduction of 31206 was observed ($SD = 59591$), but it's not statistically significant, $t(7) = 1.48$, $p = 0.182$.

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The result of the paired-samples t-test indicated a fall in average car sales from 138,077 units in 2019 to 106,871 units in 2020 - a fall of 31,206 units. However, this fall was not statistically significant, $p = 0.182$, suggesting that while sales fell during the pandemic, the variation across brands was too large to conclude that there is a consistent market-wide effect.

Conclusion: Hypothesis H5 NOT SUPPORTED. While average sales decreased from 138,077 units (2019) to 106,871 units (2020), the paired-sample t-test revealed this difference was not statistically significant ($p = 0.182$). The high variation across brands suggests that pandemic impacts were not uniform across the market.

Implications for the Industry

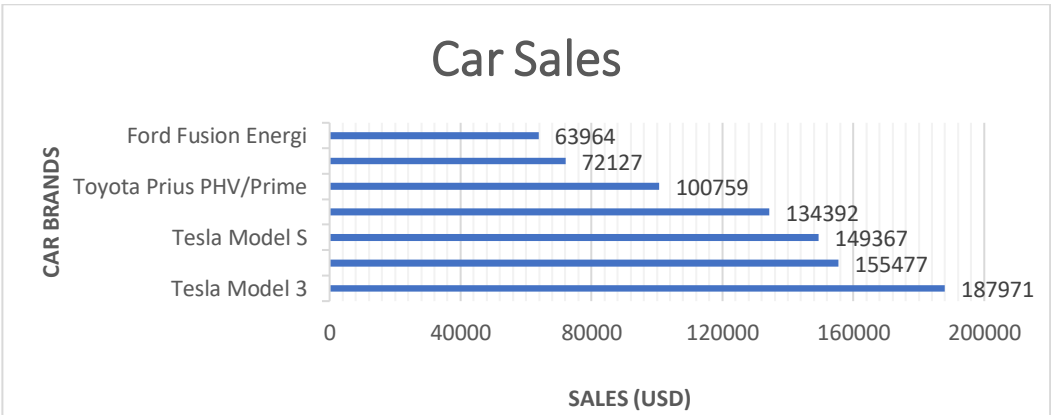
The findings have profound implications for strategy in the automotive sector and future research. Our analysis suggests manufacturers must re-evaluate their approach to quality metrics and brand loyalty during crises. The surprising relationship between the dependability scores and sales performance points to the need to reconsider traditional quality measures when market disruptions are pertinent.

The strong performance of some brands during the pandemic suggests that customer retention strategies may be more important than the conventional quality metrics under conditions of market disruption. Also, the observation of US and Canadian markets reveals the application of market-specific strategies possibly derived from regional differences in consumer behavior and economic market conditions.

The introduction of electric vehicles not only reshaped the North American automotive industry but did so dramatically — especially between 2019, before the advent of the pandemic, and the pandemic era itself. Tesla maintained its market leadership (74% market share) while traditional manufacturers experienced varying degrees of sales decline

This illustrates a changing direction for the industry and the preferences of its consumers.

Fig: 1

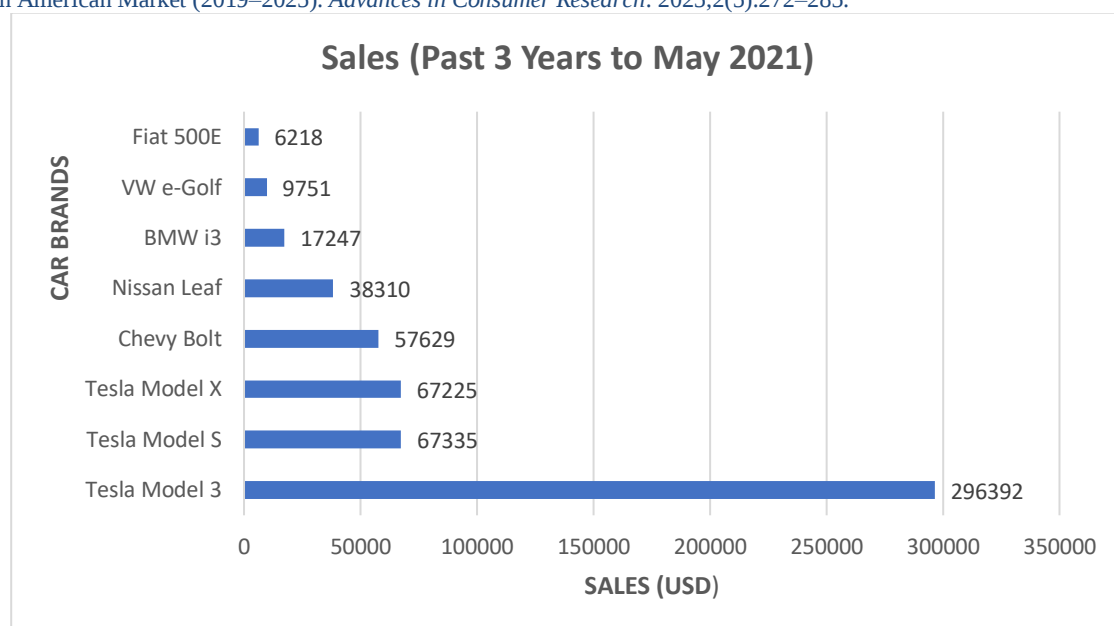


Data sourced from InsideEVs (2024)

During the pre-pandemic period, Tesla was dominant in the market, with its penetration into North America’s total EV market sales, constituting three models (Model 3, Model S, and Model X) at 47.5%. That dominance also underscored Tesla’s success at positioning the strength of its first mover advantage and reflected its cohesive market positioning strategy.

During the pandemic, the EV market exhibited remarkable resilience and growth — primarily by May 2021 — in broader economic challenges. Analysis from BuyAutoInsurance.com revealed unprecedented market performance, with the top 10 EV models achieving combined sales of 568,000 units. However, Tesla had a 74% market share, which no one challenged. In the EV segment, the Model 3, priced strategically at \$35,000, continued to hold a commanding market share, commanding about 300,000 units sold, indicating the perfect access and brand prestige.

Fig. 2



Data sourced from InsideEVs (2024)

Future Research Direction

Future research should be directed at several critical areas that extend these findings. A longitudinal study of post-pandemic recovery patterns is urgently needed to assess the durability of changes observed in consumer behavior. A more detailed examination of regional variations within American and Canadian markets might uncover some important local factors affecting sales performance. Future research might be needed to see how digital marketing strategies affect brand loyalty in crisis periods. This would also enable the manufacturer to prepare for future market disruption adequately.

SAP-LAP and EV Linkage

In addition to conventional analysis, incorporating system-based methods such as SAP-LAP (Situation-Actor-Process/Learning-Action-Performance) modelling offers an intense understanding of automotive sales dynamics post-2019. An SAP-LAP analysis conducted on the North American automotive sales systems (2019-2039) revealed that PANDEMIC disruptions deeply influenced brand loyalty, service quality, and market regaining processes. Through feedback loops, customer satisfaction was found to cynically impact new sales performance. Key actors – including car manufacturers, policy makers, service providers, and customers – performed interactive roles in recovery approaches. Modelling such systemic behaviours not only discovers the significance of R&D investments and trust rebuilding but also highlights flexibility pathways for automotive brands. Future research should consider vigorous system modelling tools like “Insight Maker” to better forecast market behaviours under ambiguous and crisis conditions.

Electric Vehicle (EV) Market Growth + Trade tariffs Update

Furthermore, the evolving Electric Vehicle (EV) sector

shows new variables vital for understanding market resilience. As of 2025, EV sales in North America have surged, accounting for nearly 12% of all new car sales (inside EVs, 2025). Tesla remains a leader, but competition from traditional and new competitors like Rivian, BYD, and Lucid Motors is intensifying. Meanwhile, the US has recently imposed new tariffs of up to 100% on Chinese-made EVs, batteries, and related components (White House Press Briefing, 2024), reshaping global supply chains and encouraging localized manufacturing in North America. Future automotive sales research must bear the impact of EV-specific market dynamics, including technical innovation, sustainability trends, and trade policies affecting consumer choice and brand loyalty.

CONCLUSION

The results from this study show that brand loyalty significantly affects car sales across pre-pandemic (2019) and pandemic (2020) periods. The analysis reveals that brand loyalty is the primary driver of automotive sales rather than product dependability or customer satisfaction indices. Our correlation analysis shows that Brand Loyalty has a strong relationship or a positive association with car sales. Secondly, we show a significant difference in car sales numbers from pre-pandemic to in-pandemic times.

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