

Vehicle Recall Analysis



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Abstract

The phenomenon of automobile recalls, which have increased in frequency in recent years, is examined in this project. The project's goal is to look at the factors that lead to car recalls, how they affect customers and vehicle manufacturers, and stock price of the manufacturer's company. This analysis is performed on Canada and united states of America's data over past 7 years. This analysis is all about how a stock price is affecting either in positive way like the stock price is increasing or in negative way like the stock price is falling after the recall news. This project shows the relationship between vehicle recalls and stock prices. For a recall there are many factors interlinked like cost, reputation of the company, equipment availability and severity of recall. The purpose of the study is to investigate how news of a vehicle recall affects the stock prices of the affected company. The event-based study of seven years review of news articles and stock price data connected to automobile recalls. Analysis is mainly performed on the top 5 companies with most of the recalls in the recent 7 years period in both countries. The study's findings indicate that the stock prices of the affected firm are significantly negatively impacted by vehicle recalls, with a typical decrease in stock price occurring in the two weeks after the recall announcement. In addition, the analysis also showed very little impact on very few companies even after the recall news articles were published.

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1. Introduction

A vehicle recall is a safety measure implemented by a vehicle manufacturer or regulatory agency to fix a defect or regulatory violation in a vehicle or its equipment. It is an initiative taken voluntarily by the manufacturer or mandated by a regulatory agency. The defect can be either safety or non safety issue.

Problem Statement:

To analyze the impact of vehicle recalls on the stock performance of an automotive company. Specifically, the aim is to investigate how vehicle recalls, which can result in significant costs for a company, affect investor confidence and subsequently the company's stock price. This analysis may involve examining the historical data of an automotive company's stock performance, as well as the timing and severity of any recalls. The goal is to provide insights that can help companies better understand how vehicle recalls can impact their financial performance and stock market valuation.

How a recall happens:

There are few steps involved in vehicle recall they are:

- **Identifying the defect:** Firstly, identifying the defect in a vehicle like safety or non-safety and how severity is the impact.
- **Notifying regulatory agencies:** Once the defect has been identified it needs to be registered with the regulatory agency and should get a unique recall id upon registration for that defect.
- **Notifying vehicle owners:** Every owner who is using the vehicle that has been recalled should be notified to bring their vehicle back to the dealer to get the part repaired or replaced.

- **Remedying the defect:** Once owners bring their vehicle to dealership manufacturer should make sure that the part is repaired or replaced and the defect is solved and the vehicle is safe to use.
- **Reporting to regulatory agencies:** After fixing the defect in the owner's car, the manufacturer should report back to the agency regarding the issue being solved for owners.
- **Closing the recall:** Once all the recalled vehicles get their recall issue solved the recall would be closed.

Overall, registering an automotive recall involves a complex process that requires coordination between the manufacturer, regulatory agencies, and vehicle owners. Timely and effective communication is critical to ensuring that affected vehicles are remedied as quickly as possible to minimize potential safety risks.

In this notifying owner about their recall would be crucial role

The notice time for car manufacturers after a recall may vary depending on the country or region where the recall is being conducted. In the United States & Canada, for example, the National Highway Traffic Safety Administration (NHTSA) and Transport Canada requires manufacturers to notify affected vehicle owners within 60 days of the recall announcement.

Recently Transport Canada imposed a huge fine on Hyundai Auto Canada Corp. As pleaded guilty to six different counts of criminal charges of violating the Motor Vehicle Safety Act. The six guilty pleas were all for failing to send out notices of safety defect within 60 days. The company will also pay a fine of \$360,000 for these charges.

Article link: <https://www.canada.ca/en/transport-canada/news/2023/04/transport-canada-announces-that-hyundai-auto-canada-corporation-has-pleaded-guilty-to-criminal-charges-for-violating-the-motor-vehicle-safety-act.html>

2. Description of Dataset

Name: Vehicle Recall Dataset

This dataset contains information on vehicle recalls that have been issued by various manufacturers from the year 2016 to 2022. The dataset includes details such as Recall Date, NHTSA ID, Manufacturer, Subject, component, Manufacturer campaign number, Recall Subject, Recall type, Potentially Affected, Recall Description, Consequence Summary, Corrective Action, Vehicle Model.

The variables in the dataset include:

Recall Date: The date of the recall.

NHTSA ID: the NHTSA number of the recall.

Manufacturer: The manufacturer of the vehicle.

Subject: The subject of the recall.

Component: The component of the vehicle which is recalled.

Mfr campaign number: The number of the manufacturer campaign.

Recall Subject: The subject of the vehicle recall.

Recall type: The type of the Recall of the vehicle.

Potentially Affected: the total number of vehicles affected by the recall.

Recall Description: The overall description of the recall.

Consequence Summary: The summary of consequences of the recall.

Corrective Action: The action took on the recall.

Vehicle Model: The model of the vehicle.

Name: Stocks dataset

This dataset contains information on stocks from year 2016 to 2022. The dataset includes details such as date of the stock, opening price of the stock, closing price of the stock, Maximum value of the stock, Minimum value of the stock, number of units traded in a day.

The variables in the dataset include:

Date: Date of the trading day

Open: Price from the first transaction of a trading day

High: Maximum price in a trading day

Low: Minimum price in a trading day

Close: Price from the last transaction of a trading day

Adj Close: Closing price adjusted to reflect the value after accounting for any corporate actions.

Volume: Number of units traded in a day

Observations: The datasets include thousands of observations of vehicle recalls issued by various manufacturers over a period of several years and the stocks values of the respective dates from 2016 to 2022.

Data types: The data types for the variables include strings, dates, and integers.

Missing values: The dataset may contain missing values for some of the variables, depending on the completeness of the original data source.

Unique values: The dataset may contain duplicate recall numbers for different manufacturers or models.

Statistical summary: Since the dataset is primarily categorical, summary statistics such as frequency counts and percentages can be used to describe the data.

Visualization: The dataset can be visualized using bar charts, pie charts, or other graphical representations to show the frequency of recalls by manufacturer, potentially affected vehicle and other variables.

The source of the dataset is NHTSA for USA vehicle recall data and Canada government site (TRANSPORT CANADA) and Stock data has been collected from Kaggle, Yahoo Finance and Wall Street Journal (WSJ).

The below links are the links of the sources of the datasets:

- <https://wwwapps.tc.gc.ca/Saf-Sec-Sur/7/VRDB-BDRV/search-recherche/menu.aspx?lang=eng>
- [NHTSA Recalls by Manufacturer | Tyler Data & Insights \(transportation.gov\)](#)
- <https://www.kaggle.com/datasets/varpit94/ford-stock-data>

3. Data Cleaning

To perform required analysis unnecessary columns like NHTSA ID, Recall Link, Manufacturer Campaign number from USA Recall Dataset and Recall Number, Recall Text, and French related columns such as CATEGORY_FTXT, SYSTEM_TYPE_FTXT, NOTIFICATION_TYPE_FTXT, COMMENT_FTXT from Canada Recall Dataset are removed and USA Dataset is filtered for recall data of years ranges from 2016 to 2022.



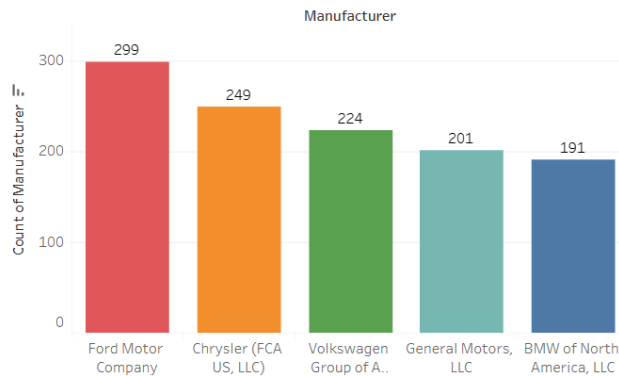
Vehicle_Recall.ipynb

4. Visualizations

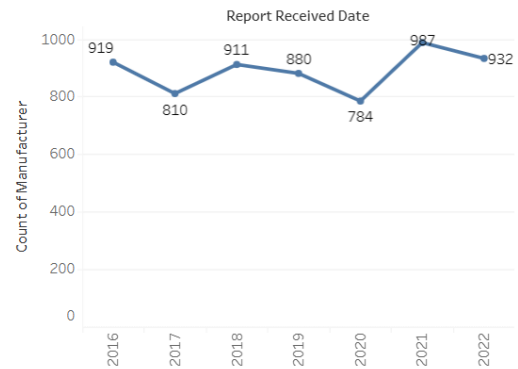
Tableau dashboards and story are used to depict vehicle recall analysis charts.

US VEHICLE RECALL OVERVIEW

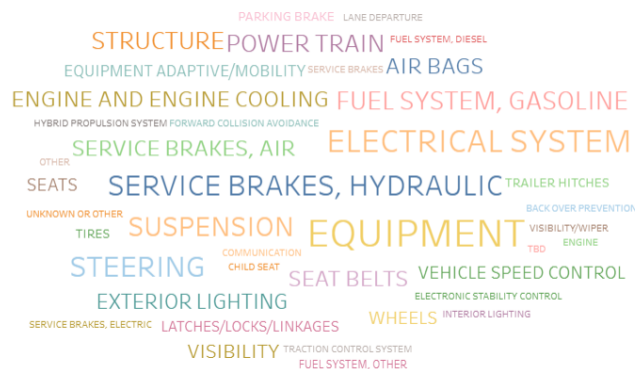
US Vehicle Recall based on Manufacturer



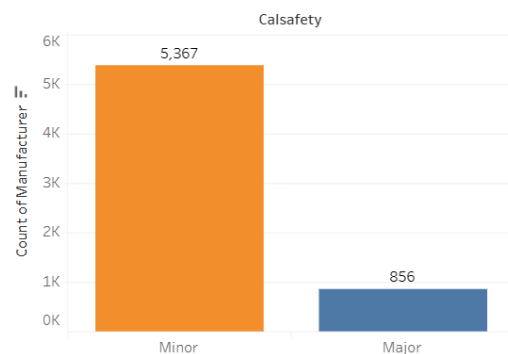
Count of Vehicle Recall Over the Years



Vehicle Recall based on Component



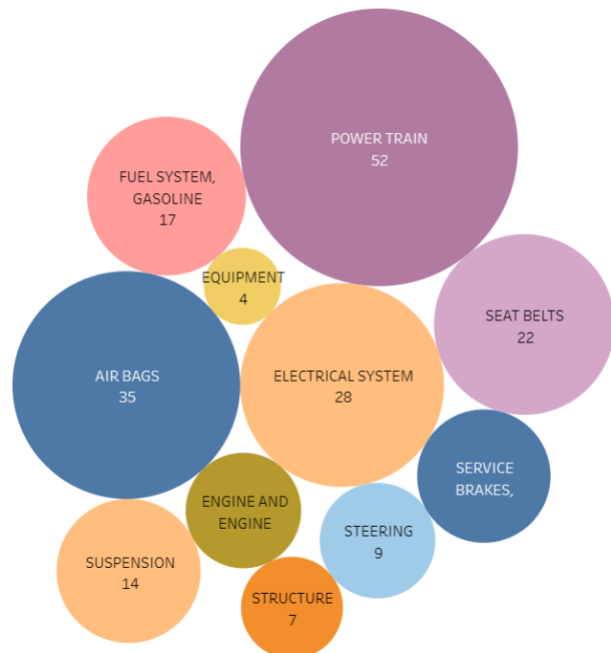
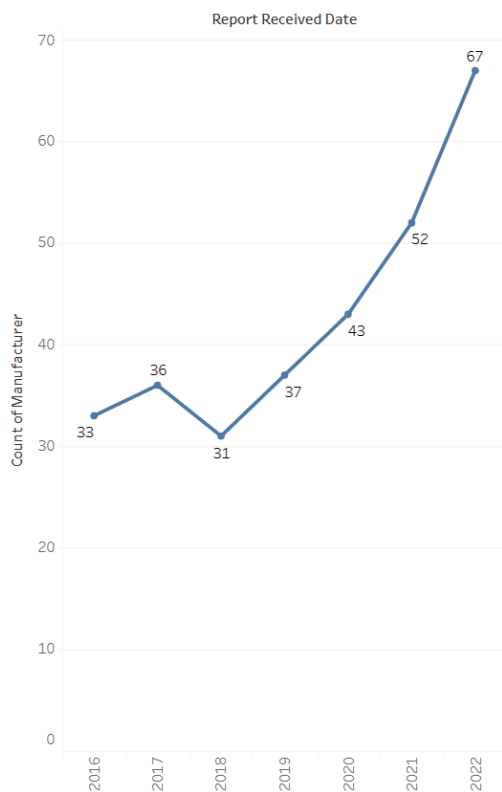
Classification of Recalls based on Potentially Affected



USA Vehicle Recall Overview: Based on the current web page context, it appears that there are four graphs on the page. The First graph shows the count of the vehicle recalls by manufacturer, Ford has 299 and Chrysler 249, Volkswagen has 224, General Motors – 201, BMW of North America, LLC. The Second graph shows the court of recall over the years 2016 to 2022 between 919 to 784. The Third graph shows vehicle recalls based on component classification. The fourth graph shows the classification. The fourth shows the classification of recalls based on potentially affected count of manufacture. Minors are 5,367 and Major has 856.

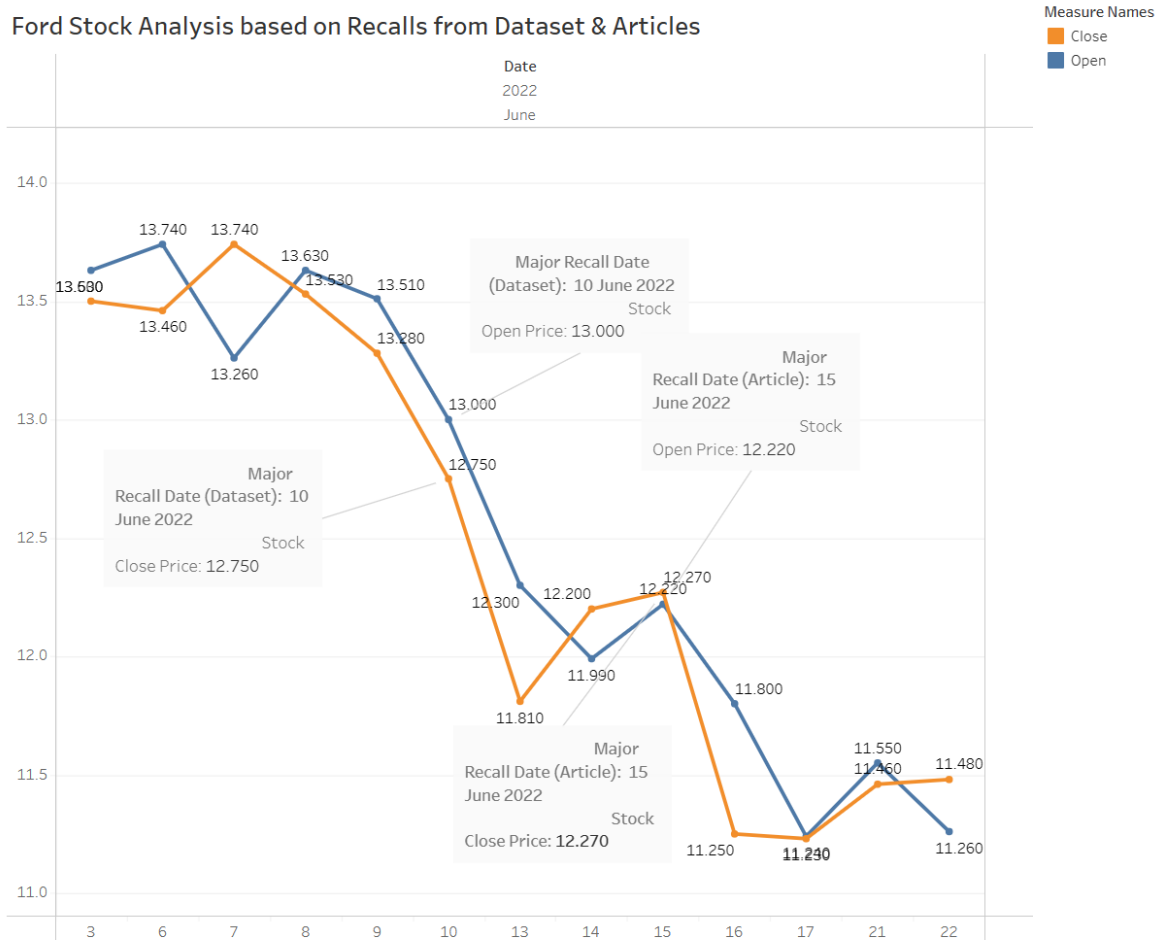
USA FORD MOTOR COMPANY RECALL ANALYSIS

Ford Motor Company Vehicle Recall Over the Years Ford Company recall analysis based on Component



USA Ford Motor Company Recall Analysis: Component over the years from 2016 to 2022. The Graph shows the count of manufacturer recalls by report received date. 33 to 67 over the years it is increasing. And in bubble chart we can see Power Train has 52 recalls and Air bags 35 recalls Furthermore fuel system and Electrical system has 28, Seat belts 22 and suspension are 14 recalls Structure and Steering has 9 recalls Service breaks.

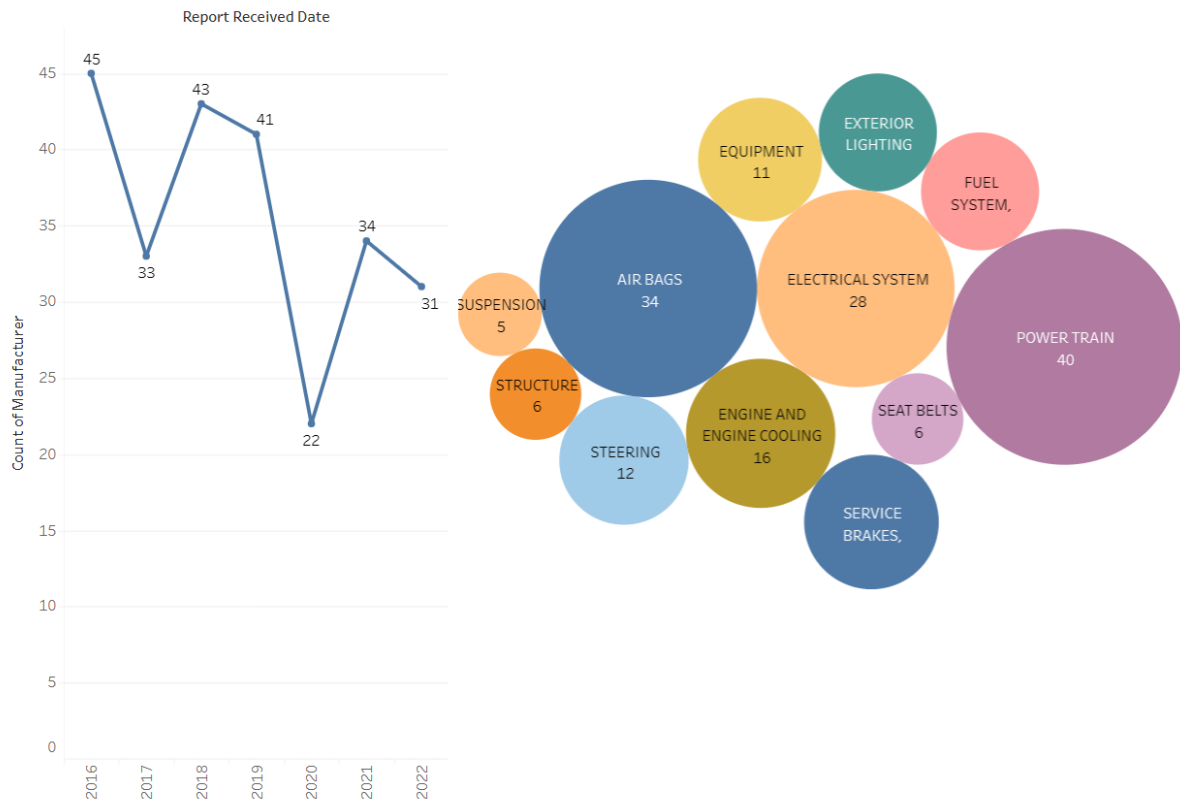
Ford Stock Analysis based on Recalls from Dataset & Articles



Ford Stock Analysis based on Recalls from dataset & Articles: Ford Stock performance that take into account data on vehicle recalls and information from articles. June 2022 we can see how stock was performed major recall data is 10 June 2022 open price 13.00 and recall date June 2022 close price was 12.750 stock is impacted when news was come out.

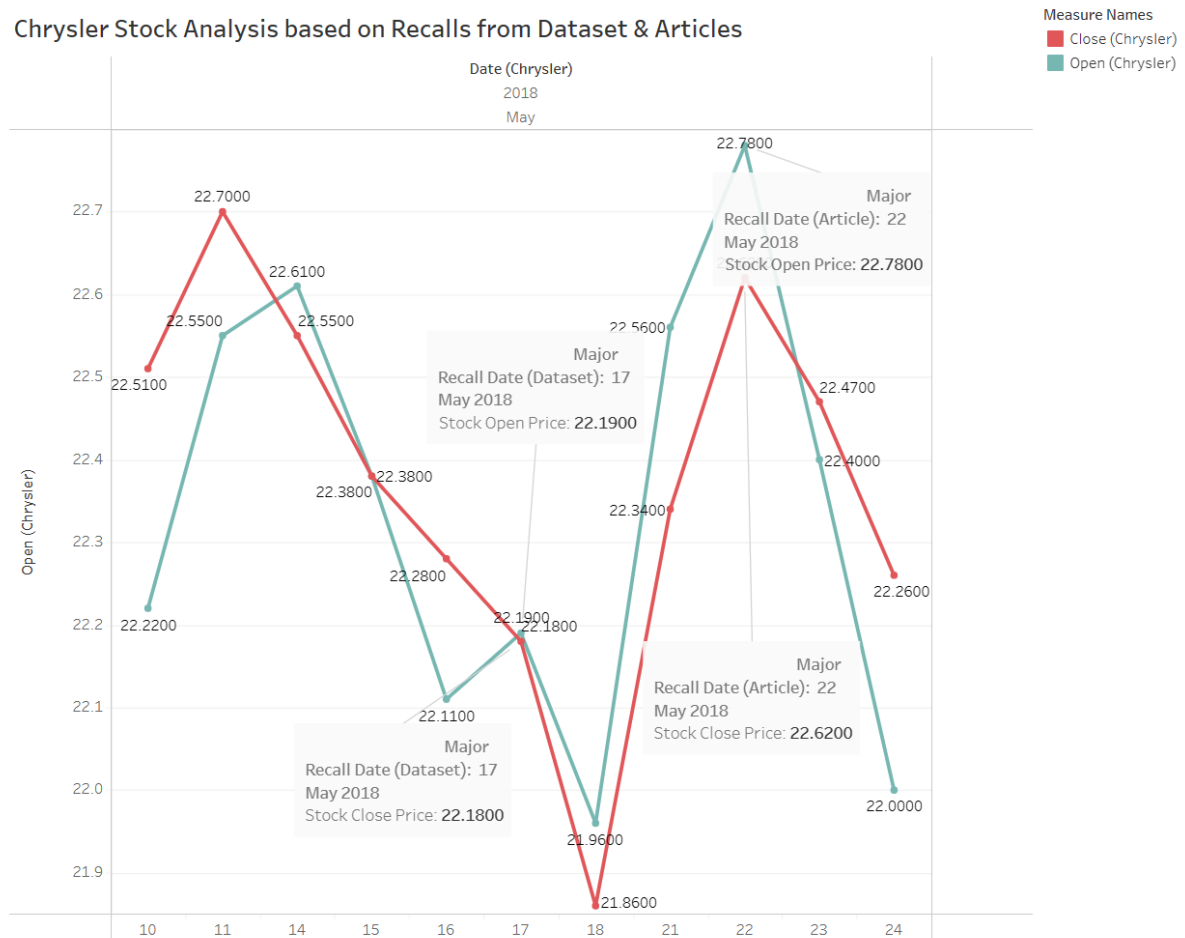
USA CHRYSLER COMPANY RECALL ANALYSIS

Chrysler Company Vehicle Recall Over the Years Chrysler Company recall analysis based on Component



USA Chrysler Company Recall Analysis: The analysis is based on the component and shows a count of manufactures from 45 to 31 over 2016 to 2022 and in bubble chart we can see Power Train has 40 recalls and Air bags 34 recalls Furthermore fuel system and Electrical system has 28, Seat belts 6 and suspension are 5 recalls Structure and recalls on Steering and Service breaks.

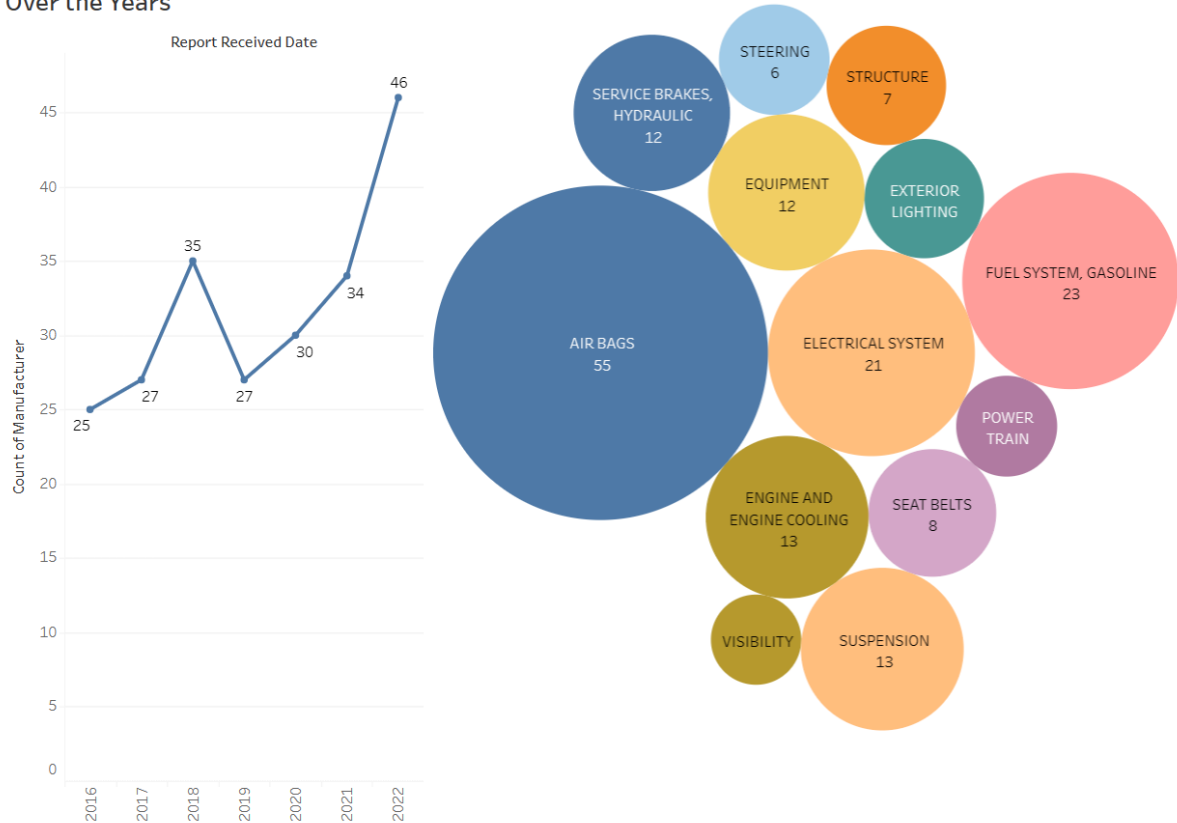
Chrysler Stock Analysis based on Recalls from Dataset & Articles



Chrysler Stock Analysis based on recall from dataset & Articles. Stock performance that takes into account data on vehicle recalls and information from articles. May 2018 we can see 17 May 2018 stock open price 22.1900 and recall data close price was 17 May 2018 we can see in the graph slowly the over the time the stock is study increase.

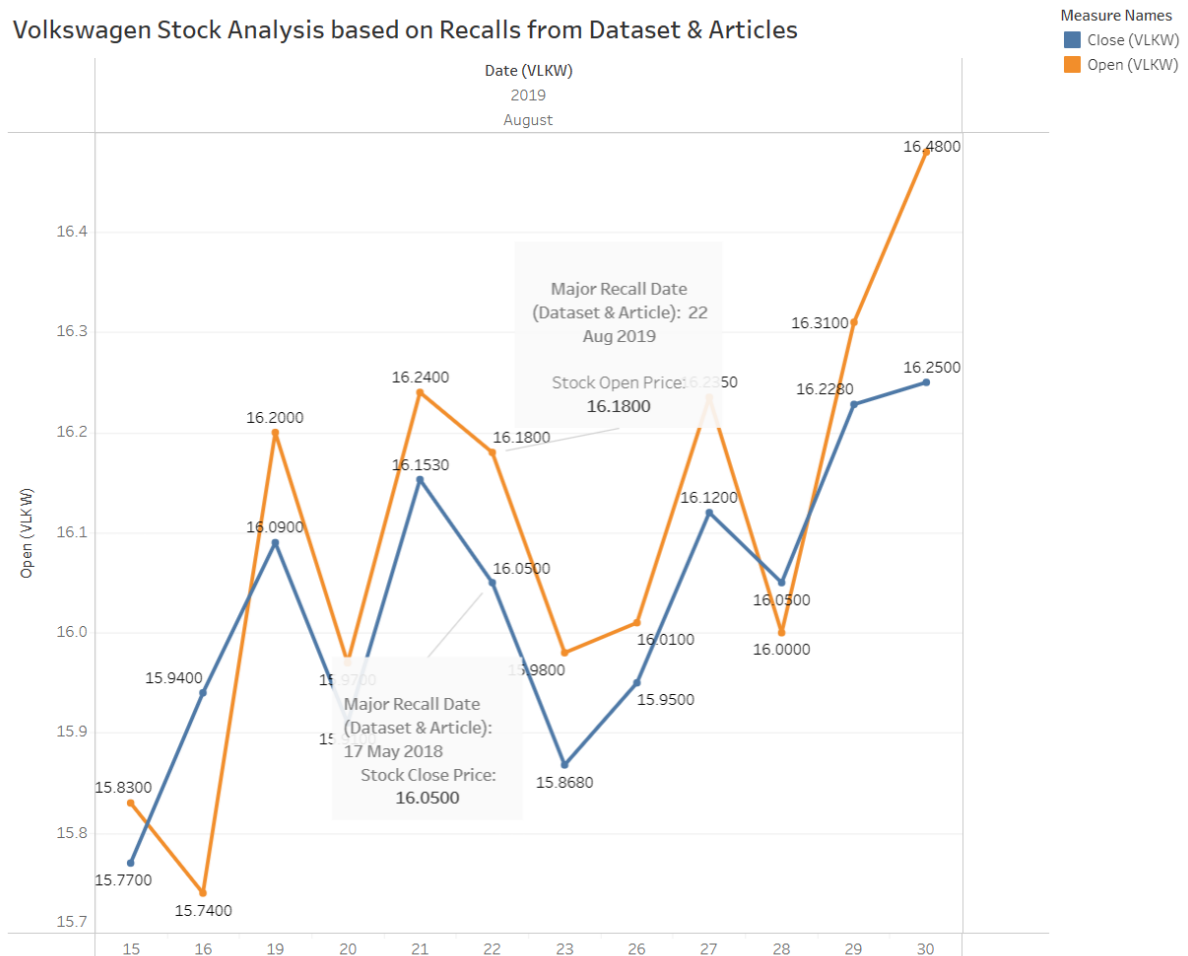
USA VOLKSWAGEN COMPANY RECALL ANALYSIS

Volkswagen Company Vehicle Recall Volkswagen Company recall analysis based on Component Over the Years



USA Volkswagen company Recall Analysis. The analysis is based on the component and shows a count of manufactures from 25 to 46 over 2016 to 2022 it depicts recalls on Volkswagen is increasing and in bubble chart we can see Power train recall and Air bags 55 recalls highest in Volkswagen recalls Furthermore fuel system has 23 recalls and Electrical system has 21, Seat belts are 8 recalls and suspension are 13 recalls Structure and recalls on Steering and Service breaks followed overall same.

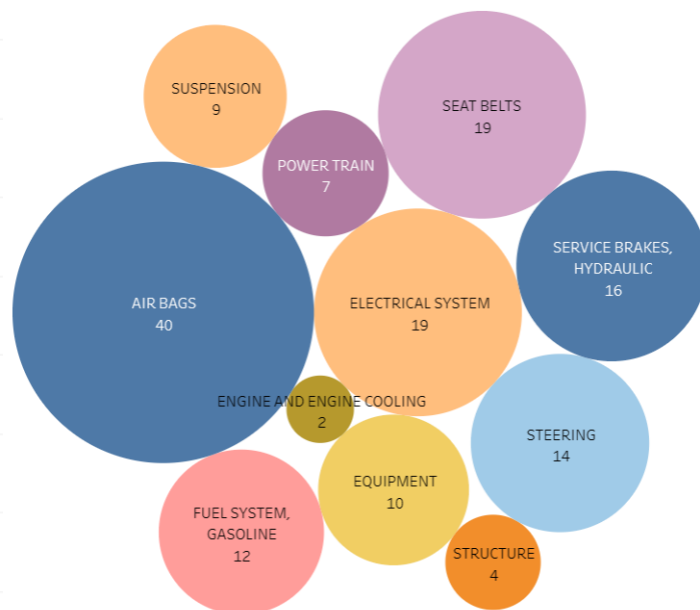
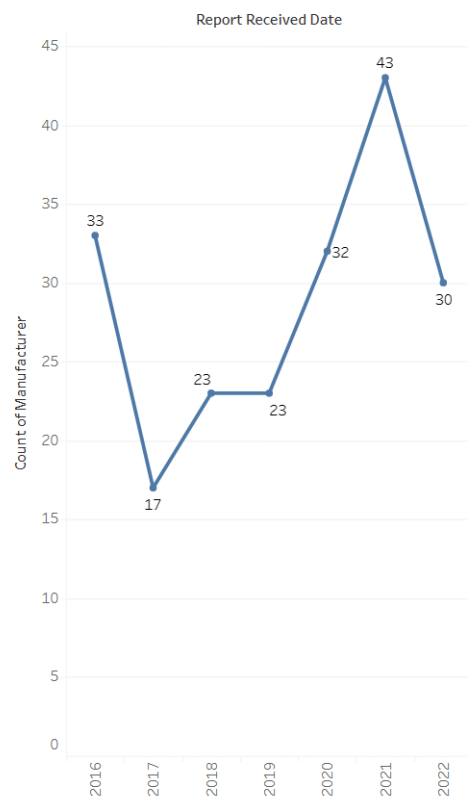
Volkswagen Stock Analysis based on Recalls from Dataset & Articles



Volkswagen Stock Analysis: Stock performance that considers data on vehicle recalls and information from articles. August 2019 we can see 22 Aug 2019 stock open price 16.1800 and recall data close price was 22 Aug 2019 we can see in the graph slowly the over the time the stock is study increase.

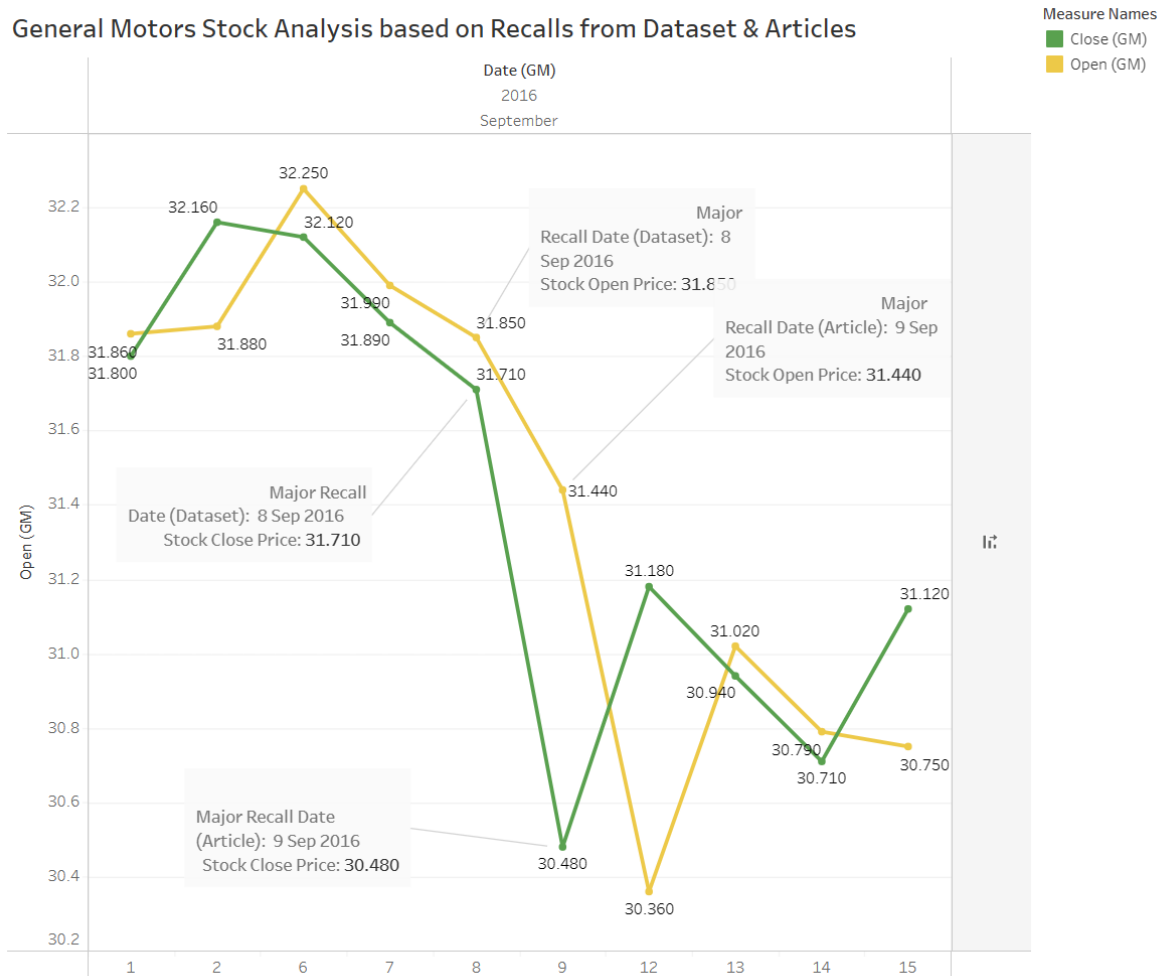
USA GENERAL MOTORS COMPANY RECALL ANALYSIS

General Motors Company Vehicle Recall
Over the Years



USA General Motors Company Recall Analysis: The Analysis of the General Motors company from 2016 to 2022 components are 33 to 30 over increase and down. Air bags are the biggest recall followed by the Electrical system and service breaks. Fuel system and Gasoline are 12. The remaining components are the same level and Stock analysis for GM was 2016 September we can see stock price 31.860 and major recall was 8 Sep 2016 31.710 we can see how it was impacted.

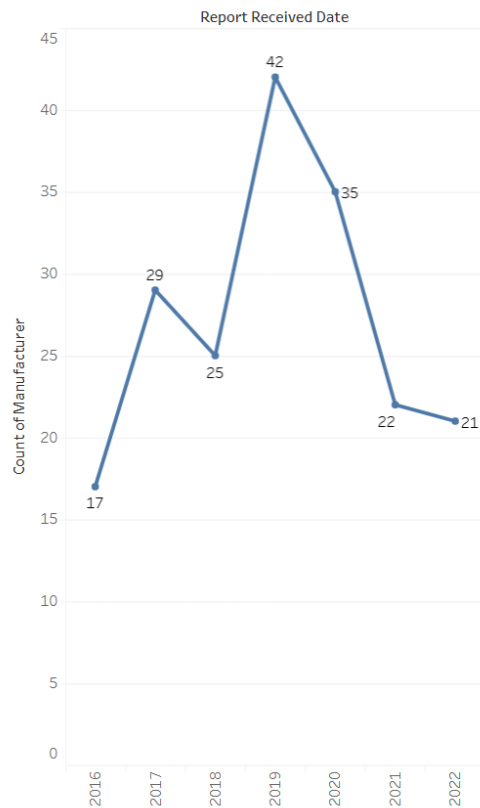
General Motors Stock Analysis based on Recalls from Dataset & Articles



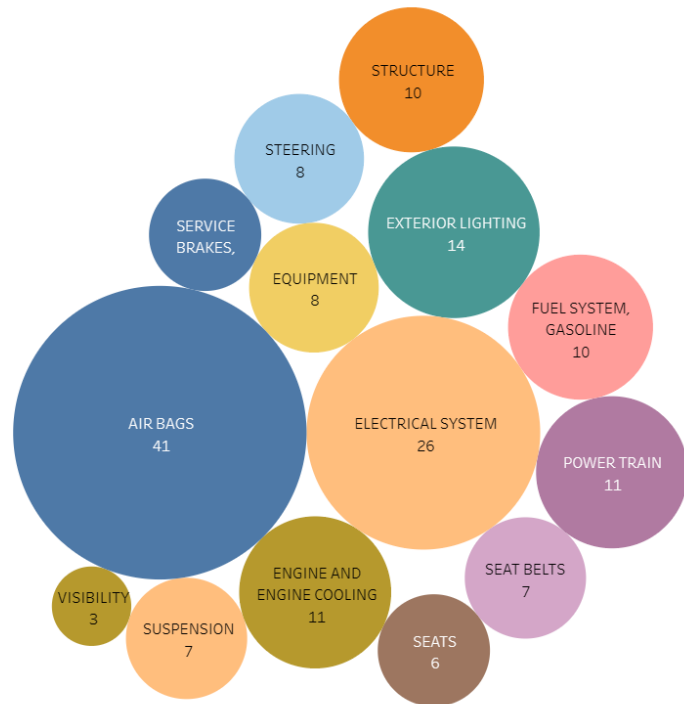
USA General Motors Company Stock Analysis: Stock performance that considers data on vehicle recalls and information from articles. Once the recall news came out on September 8th, we can see that there is a steady decline in the stock value later it increased a bit but didn't reach the normal state.

USA BMW COMPANY RECALL ANALYSIS

BMW Company Vehicle Recall Over the Years

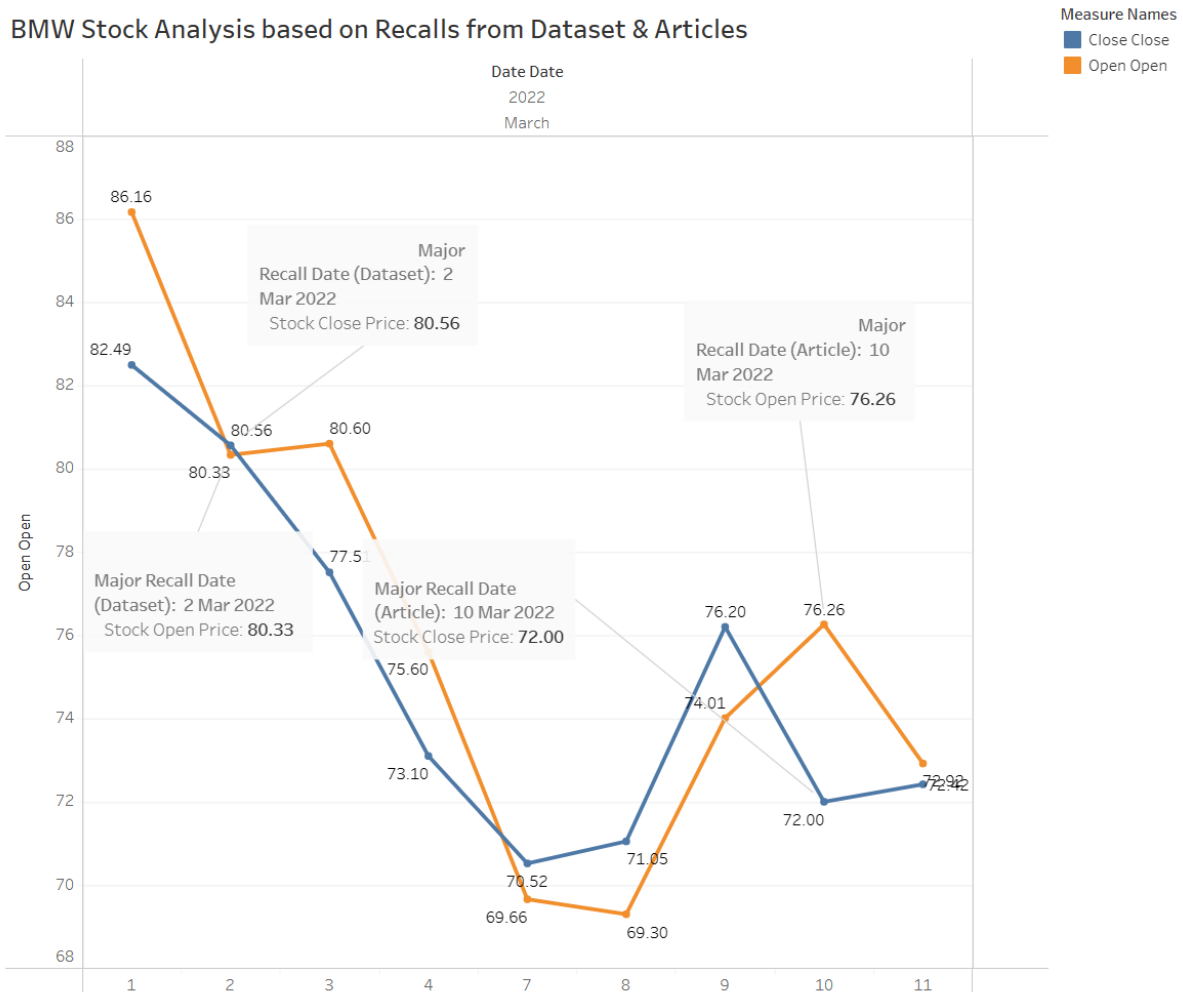


BMW Company recall analysis based on Component



USA BMW Company Recall Analysis: The Analysis over the years from 2016 to 2022 from 17 components to 21 components and it has reached 42 peaks in the year 2019 that was the highest component recalls. Air bags are 41 recalls that is highest components recall and remaining components follow the same and BMW Stock analysis in 2 march 2022 the stock open price was 80.56 and close price was 80.33 and slowly coming back to same position where it was in previous seems like recall impact on stocks is only from few days because here we have taken one week before and one after and recalls news was out.

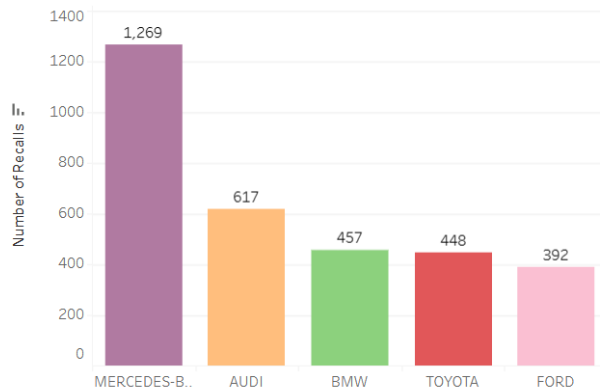
BMW Stock Analysis based on Recalls from Dataset & Articles



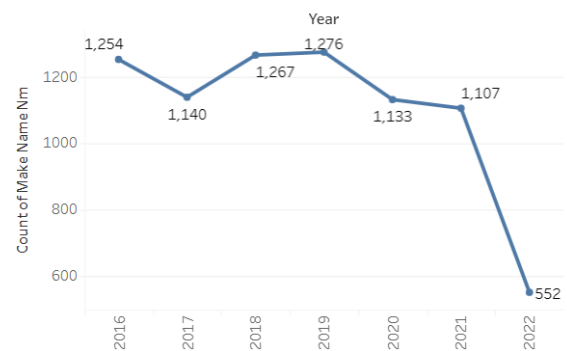
USA BMW Motors Company Stock Analysis: Stock performance that considers data on vehicle recalls and information from articles. Once the recall was registered on march 2nd 2022, we can see that there is a huge downfall of stock value until 8th march then it started increasing a bit but on 10th march when articles were out, we can again see the downfall starting.

CANADA VEHICLE RECALL OVERVIEW

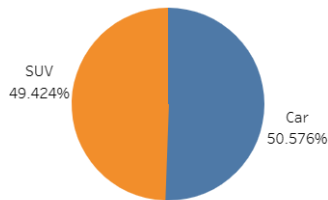
Number of Recalls based on Manufacturer



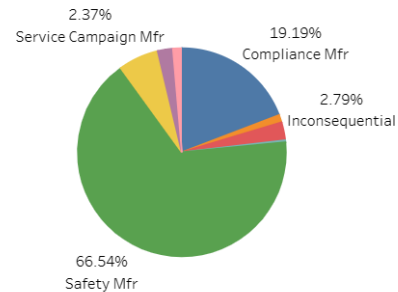
Count of Vehicle Recall Over the Years



Recall based on Category of Vehicle



Vehicle Recall based on Notification Type



CANADA VEHICLE RECALL OVERVIEW:

Canada vehicle overview there are Five companies MERCEDES BENZE and AUDI, BMW, TOYOTA, FORD. In Canada Mercedes has highest recall in Canada 1,269 and Audi has 617 and BMW has 457 furthermore Toyota has 448 recalls and Ford has 392 recalls.

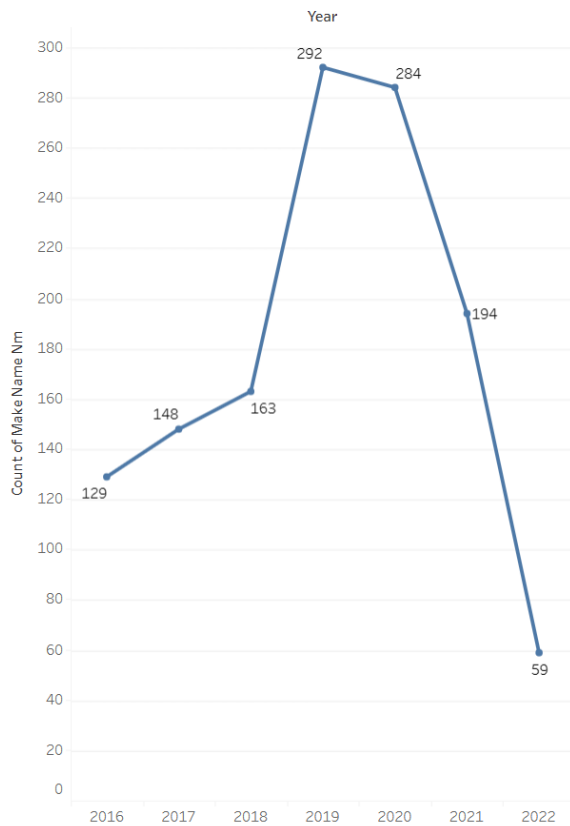
In Canada Sedan are highest recalls 50.576 percentage and SUV has 49.424 percent recalls

Count of vehicle recall over the years 2016 to 2022 from 1254 to reduce to 552 over the years vehicle recall in Canada is decreasing.

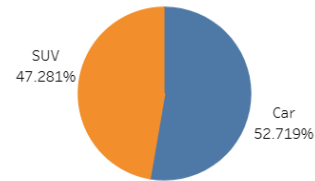
Vehicle recall based on notification type 66.54 percent are safety MFR and service Campaign has 2.37 percent and 19.19 percent compliance and 2.79 percent inconsequential.

CANADA MERCEDES BENZ RECALL ANALYSIS

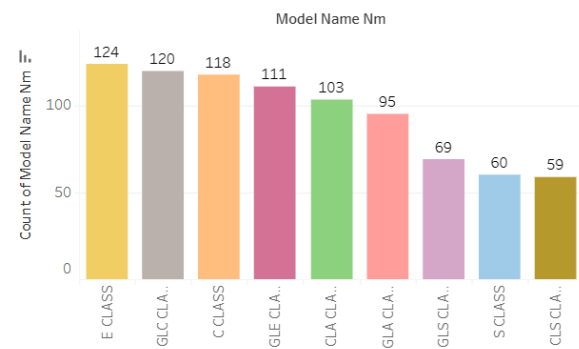
MERCEDES-BENZ: Count of Recalls Over the Years



MERCEDES BENZ: Recall based on Category of Vehicle

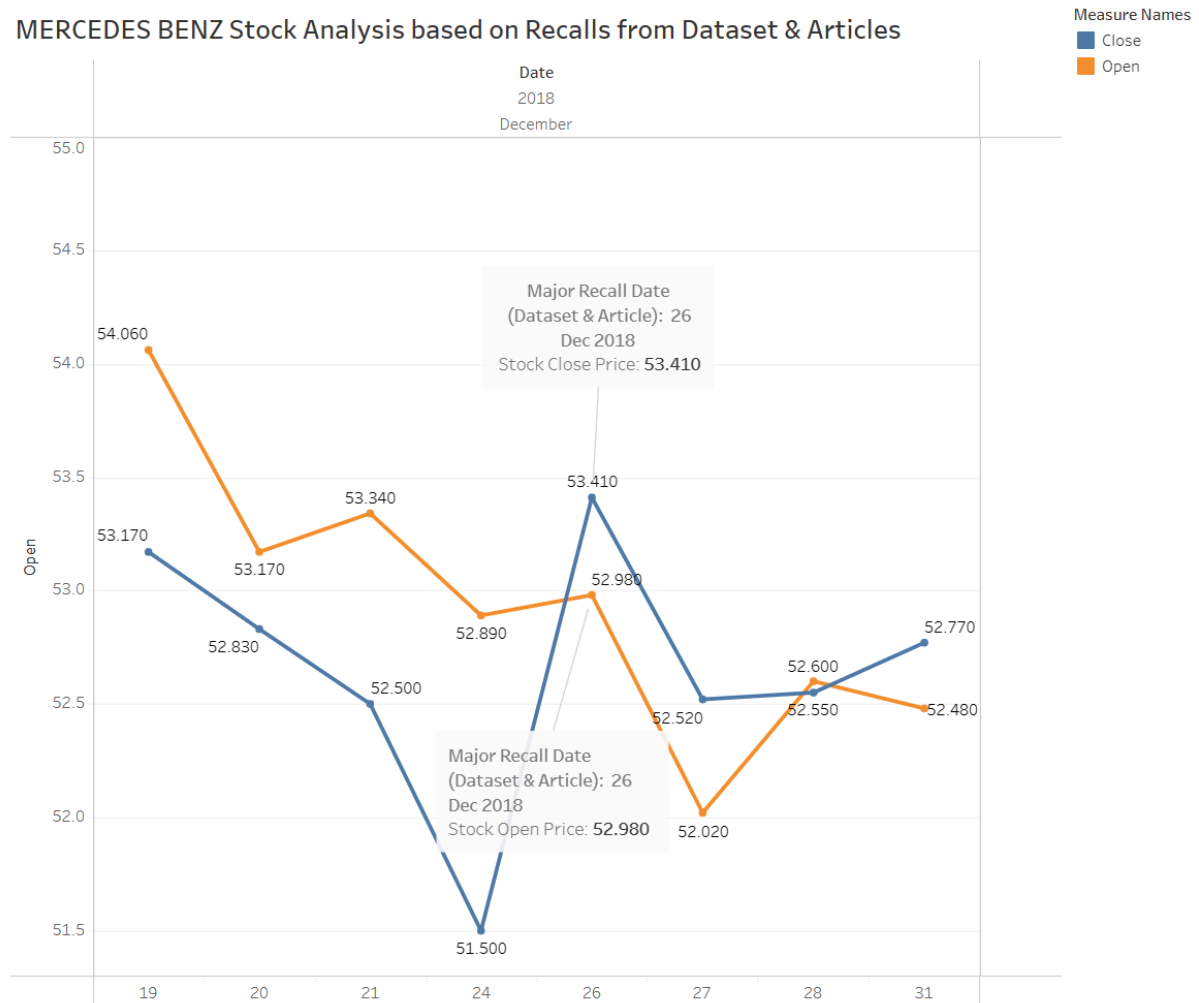


Mercedes Benz: Number of recalls in different models



CANADA MERCEDES BENZ: has highest recall over the years from 2016 to 2022 count of recall are 129 to 59 and in 2019 the count of recall is 292 it was highest recalls. SUV are the 47.281 percent and car are the 52.719 percent. Number of recalls in different models: E-Class has the highest recall 124 followed by the G-class 120 and Class were 118 and remaining model range of recall 95 to 59 overall.

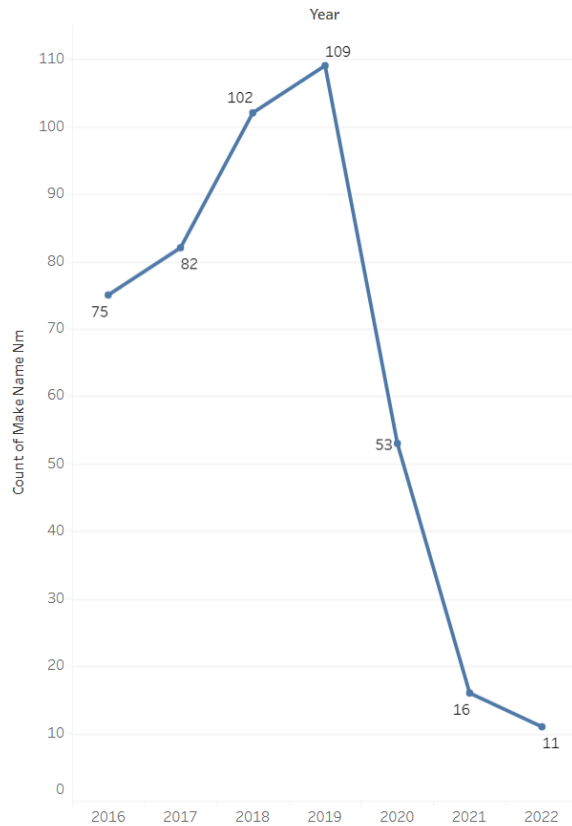
MERCEDES BENZ Stock Analysis based on Recalls from Dataset & Articles



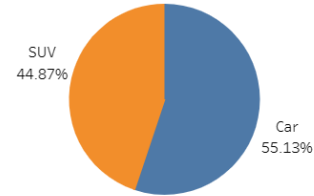
STOCK ANALYSIS FOR MERCEDE BENZ: December 2018 news was out about recall stock performance was 26 December 2018 open price was 53.410 and close price was 52.980. Over the year it became normal like where it was.

CANADA TOYOTA RECALL ANALYSIS

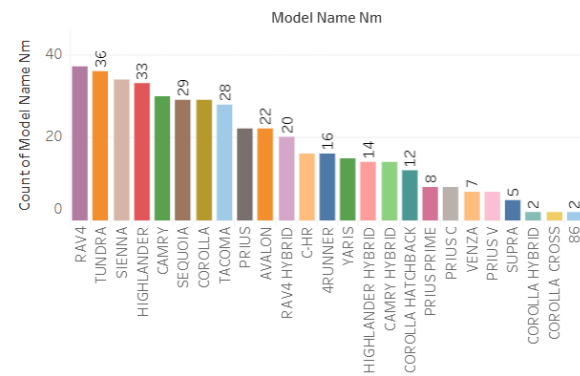
TOYOTA: Count of Recalls Over the Years



TOYOTA: Recall based on Category of Vehicle

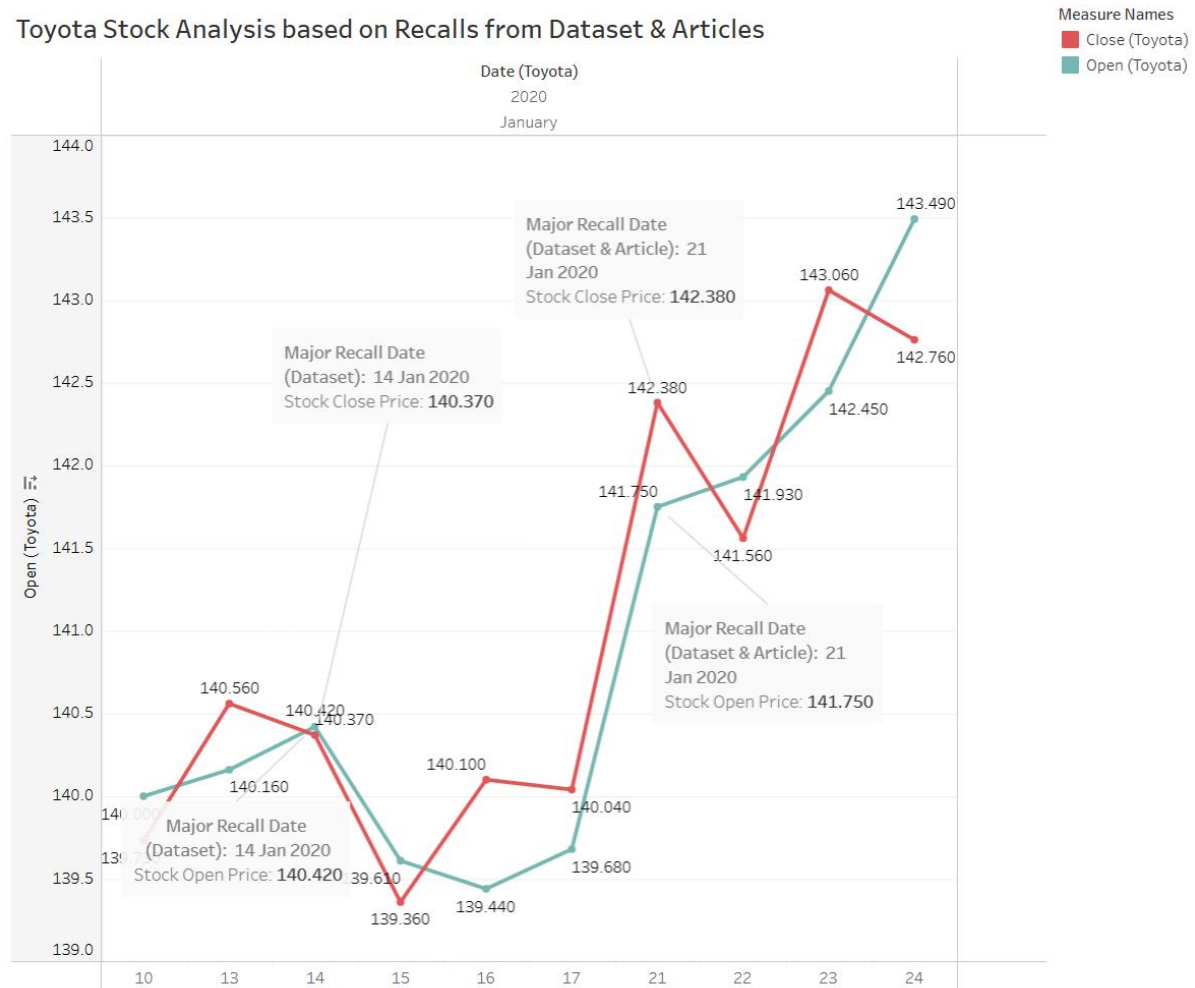


TOYOTA: Number of recalls in different models



CANADA TOYOTA RECALL ANALYSIS: has highest recall over the years from 2016 to 2022 count of recall are 75 to 11 and in 2019 the count of recall is 109 it was highest recalls. SUV are the 44.87 percent and car are the 55.13 percent. Rav4 model has highest recall over various models.

Toyota Stock Analysis based on Recalls from Dataset & Articles



CANADA TOYOTA STOCK ANALYSIS : On 14th Jan 2020 when recall was recorded the stock value dipped very little for two days and then tends to increase until articles were published on 21st January 2020 after then decreased a very little for one day and surprisingly it started increasing normally going on further.

5. Challenges In a Recall

There are several challenges associated with vehicle recalls that manufacturers and regulators need to address. Some of the key challenges are:

Identifying the affected vehicles: One of the biggest challenges in a vehicle recall is identifying the affected vehicles. This requires tracking the production and sale of millions of vehicles, often across multiple years and models. The

manufacturer must have accurate and up-to-date records of all vehicles to be able to quickly identify those that need to be recalled.

Communicating with vehicle owners: Once the affected vehicles have been identified, the manufacturer must communicate with the vehicle owners to inform them of the recall and advise them of the necessary actions. This can be a difficult process as many vehicle owners may not be aware of the recall or may not take it seriously.

Managing the logistics of the recall: A vehicle recall involves a significant amount of logistics, including ordering replacement parts, coordinating repairs, and managing the flow of vehicles in and out of dealerships. This can be a major challenge for manufacturers, especially when the number of affected vehicles is high.

Cost: The cost of a recall can be significant for a company, which can affect its financial performance. In addition to the direct costs of repairing or replacing vehicles, a recall can also result in lost sales, legal expenses, and damage to the company's reputation.

Meeting regulatory requirements: Manufacturers must comply with all relevant regulations and laws when conducting a vehicle recall. Failure to comply can result in fines and damage to the manufacturer's reputation.

Ensuring the effectiveness of the recall: It is critical that the recall is effective in addressing the identified issue. Manufacturers must ensure that the replacement parts and repairs are of high quality and that the issue is fully resolved for all affected vehicles.

Maintaining customer satisfaction: A vehicle recall can be inconvenient and stressful for customers. Manufacturers must work to maintain customer satisfaction by providing clear communication, minimizing disruptions, and ensuring that the recall is carried out as quickly and efficiently as possible.

Overall, vehicle recalls present significant challenges for manufacturers and regulators, but it is essential to ensure the safety of vehicle owners and prevent accidents or other hazards on the road.

ARTICLE LINK:

<https://www.sme.org/technologies/articles/2020/september/how-to-meet-the-challenge-of-auto-recalls/>

6. Conclusion

The number of vehicle recalls has been increasing in recent years. Over 13 million vehicles were recalled globally in 2020 alone due to safety concerns. The NHTSA issued over 1,000 safety recalls involving over 35 million vehicles and other equipment in 2021. The most common reasons for 75% of vehicle recalls are safety-related issues such as faulty airbags and Power Train as these can lead to severe injuries and loss of life as well.

Many vehicle recalls are initiated by the manufacturers themselves, but sometimes they are prompted by NHTSA investigations or public complaints. The cost of a vehicle recall can be significant for manufacturers, ranging from tens of millions to billions of dollars depending on the scope of the recall.

Vehicle recalls can have a significant impact on consumer perceptions of a brand. A poorly managed recall can damage a manufacturer's reputation and lead to a loss of sales. The effectiveness of a recall can vary depending on how quickly and comprehensively it is carried out. Factors that can impact the success of a recall include the availability of replacement parts, the quality of repairs, and the level of consumer awareness. The recall process can be challenging for manufacturers, with potential difficulties including identifying affected vehicles, communicating with consumers, managing logistics, and complying with regulations. Advances in technology, such as connected vehicles and autonomous

driving systems, are introducing new challenges for vehicle recalls as these systems become more complex and interconnected.

The impact on a company's stock price depends on various factors, including the severity and scope of the recall, the company's response, and public perception. On average, recalls can result in a 3.3% decline in a company's stock price immediately after a recall is reported or published in articles. Companies that are perceived to have a strong track record for quality and safety may be less affected by recalls than those with a history of problems. For example, General Motors' stock price declined by over 20% during a high-profile recall in 2016, while Toyota's stock price remained relatively stable and also tend to increase when compared to earlier during a recall in 2020.

The impact of a recall on a company's stock price may also depend on broader market trends and investor sentiment. For example, if there is a general downturn in the market or negative news affecting the automotive industry as a whole, a recall may have a smaller relative impact.

Overall, vehicle recalls are a complex and costly issue for manufacturers and regulators, and there is a need for continued efforts to improve recall processes and prevent safety issues from occurring in the first place. Because this vehicle recalls can have a range of financial impacts for companies

GitHub Link for the project:

<https://github.com/MKUNASANI531/Vehicle-recall>

Tableau cloud link:

<https://public.tableau.com/app/profile/rajasekhar3560/viz/VEHICLERECALLANALYSIS/VehicleRecallAnalysis?publish=yes>

7. References

- <https://www.newstreaming.com/top-5-supply-chain-challenges-in-the-automotive-industry/>
- <https://www.guideautoweb.com/en/articles/66413/ford-recalls-nearly-3-million-vehicles-to-fix-shift-cable-issue/>
- <https://www.usatoday.com/story/money/cars/2021/03/18/gda-car-recalls-20210318/43470599/>
- <https://www.usatoday.com/story/money/cars/2020/06/18/gda-car-recalls-20200618/111982106/>
- https://www.thecarconnection.com/news/1130078_gm-expands-recall-of-2018-escalade-tahoe-yukon-suvs-and-silverado-and-sierra-pickups
- <https://datahub.transportation.gov/Automobiles/NHTSA-Recalls-by-Manufacturer/mu99-t4jn>