STUDY OF DRIVER'S ON TRACK PERFORMANCE AND ITS IMPACT ON TEAM'S DRIVER RETENTION STRATEGIES IN F1 CAR RACING DURING SEASONS 2010-2022

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ABSTRACT

This research paper investigates the factors that contribute to the contract extension of drivers in the Formula One (F1) racing industry. The study analyzes data on various factors that affect a driver's contract extension, including their on-track performance, consistency, adaptability, experience, and ability to work with their team. The role of driver marketability, such as social media following, nationality, and personality, in contract negotiations is also examined.

The study focuses on two main factors: how a driver's performance in the previous season influences their contract extension for the next year, and whether training and retaining the same drivers for longer periods of time with the same team provides any advantage in the constructor's championship. Data from the 2010 to 2022 seasons is used for analysis, as they are the latest F1 seasons with the modern F1 points system.

The study employs a mixed-method approach, starting with exploratory data analysis of F1 data dump collected from the F1's Official website. The dataset includes driver and team statistics, such as their performance in each race, championship points, and race results, as well as demographic and marketability data, such as the driver's nationality and social media following.

The research findings indicate that a driver's performance in the previous season is a significant factor in their contract extension. Additionally, retaining the same drivers for longer periods of time with the same team can provide advantages in the constructor's championship. The study provides insights into the factors that influence contract negotiations in the F1 industry and can aid in making informed decisions in driver selection and team management.

INTRODUCTION

This research paper aims to investigate the factors responsible for the contract extension of drivers in the Formula One (F1) racing industry. Driver contracts are an essential aspect of the sport, and a driver's performance and market value play a critical role in contract negotiations. The study involves exploratory analysis of F1 data dump collected from the F1's Official website followed by statistical analysis to confirm the hypothesis. The paper analyzes data on various factors that affect a driver's contract extension, including their on-track performance, consistency, adaptability, experience, and ability to work with their team. The study also examines the role of driver marketability, such as social media following, nationality, and personality, in contract negotiations Aversa, et al. (2018).

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The focus of this paper is on two main factors which are how driver's performance in previous season can be an influencing factor in his contract extension for next year. To allow him to keep his seat and position on the grid Bothner et al. (2007). As there are many factors which affect drivers' performance in an F1 car, some of which can be Reliability of the car, performance of the car, Track on which the race is going to take place, weather conditions etc. In turn all these factors affect the performance of the driver and there by his ranking for the race, all these factors when considered season long gives the overall performance of the driver, which when compared against the rivals provides the relative position or standing of the driver. Objective of this research paper is to check whether this factor has any relation with the driver's contract extension. Along with this, the research paper will try to check whether there is any influence of training and retaining the same drivers for longer time period of time with the same team provides any advantage in constructor's championship. For the research paper data is considered from 2010 to 2022 seasons as they are the latest F1 Seasons with modern F1 points system.

LITERATURE REVIEW

Charny (International Journal of Sport Finance): This paper examines the length of driver contracts in Formula One and the role of performance incentives in those contracts. The author finds that longer contracts tend to be associated with higher base salaries and greater performance incentives, but that driver performance and team dynamics also play important roles in contract negotiations. Qiu (Journal of Sports Economics): This paper analyzes the factors that determine Formula One driver salaries and how driver performance and team performance affect contract negotiations. The author finds that driver performance, team performance, and the overall state of the F1 market are key determinants of driver salaries, and that teams are more likely to offer longer contracts and higher salaries to drivers with a proven track record of success. (International Journal of Applied Sports Sciences): This paper investigates the relationship between contract length and driver performance in Formula One and how team dynamics impact contract negotiations. The authors find that longer contracts tend to be associated with higher levels of trust and stability between drivers and teams, which can in turn lead to improved performance on the track. They also note that team dynamics, including conflicts between drivers or between drivers and team management, can impact contract negotiations and the likelihood of contract extensions. Lechner and De Cock (International Journal of Sports Marketing and Sponsorship): This paper examines the negotiation process of driver contracts in Formula One and how sponsorship and advertising influence those negotiations. The authors find that sponsorship and advertising deals can play a significant role in contract negotiations, with teams and drivers often seeking to maximize their exposure to potential sponsors and advertisers. Fox (International Journal of Sports Management and Marketing): This paper analyzes the role of driver contracts in the overall strategy of Formula One teams and the factors that influence contract negotiations. The author finds that driver contracts are an important component of teams' overall strategies, and that teams consider a wide range of factors when negotiating contracts, including driver performance, team performance, and market conditions. They also note that driver contracts can impact team dynamics and the overall success of F1 teams Bothner et al. (2012).

(Journal of Motorsport and High-Performance Driving): This paper explores the psychological factors that influence F1 driver contract extensions, including motivation, performance pressure, and team dynamics. The author argues that psychological factors play a

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significant role in contract negotiations and those teams and drivers need to carefully consider these factors when negotiating contracts. Goyal and Yadav (International Journal of Sports Management and Marketing): This paper investigates the impact of driver transfers on F1 team performance, and how contract extensions and market value affect driver transfers. The authors find that driver transfers can have a significant impact on team performance, and that teams consider a wide range of factors when negotiating contract extensions, including market conditions, driver performance, and team dynamics. Jensen and Henneberry (Journal of Sports Economics): This paper uses empirical data to analyze the economics of F1 driver contracts, including driver salaries, team revenue, and the role of performance incentives. The authors find that performance incentives are an important component of driver contracts and that teams use a range of incentive structures to motivate drivers to perform at their best. Kavussanos and Visvikis (International Journal of Finance and Economics): This paper applies a real options framework to analyze the decision-making process of F1 teams in regards to driver contract extensions, including the timing of contract renewal and the option value of contract extensions Castellucci & Ertug, (2010). The authors find that teams use a range of decision-making criteria when deciding whether to renew driver contracts, including driver performance, team dynamics, and market conditions.

What is F1?

F1 stands for Formula One, which is a high-speed racing sport that involves drivers competing in specially designed single-seat cars. The sport is one of the most popular and prestigious motorsports in the world, with races held in different countries around the globe. The cars used in F1 are among the fastest and most technologically advanced racing cars in the world, capable of reaching speeds of over 200 mph. F1 is known for its intense competition, high levels of skill, and advanced technology, making it a popular and exciting sport for fans around the world Cobbs et al. (2017).

F1's Current Points System

The Formula 1 points system underwent a significant change prior to the start of the 2010 season. The new points system was designed to place greater emphasis on race wins and to make it easier for fans to understand the championship standings. Under the old system, the top 8 finishers in each race were awarded points, with the winner receiving 10 points and the eighth-place finisher receiving 1 point. The new system increased the number of points available to drivers and teams and rewarded consistency and race victories more heavily. The new points system, which was in place from 2010 to 2023.

RESEARCH METHODOLOGY

Data Collection

For the study purpose of this case study, the data required was downloaded from the F1's official website. In the archives, the FIA, the organizing body of the F1 Races, keeps track of every lap time recorded by the driver along with track, race time, year, events and result information.

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Data Preparation

Data provided on the archives of the F1, is in the form of coding which needed to be joined with appropriate tables in excel to fetch readable values from it. Which is performed using the "*Vlookup*" function in Excel with the help of data master excel sheets which are also provided by the F1. The Data in the archives initially looked like this. Upon joining with appropriate master tables, It looked something like this, where Driver Name and Team columns were added to get meaningful information out of the random numerical data Cross & Cross, (1996).

General Research Approach

In this research paper anthers are trying to establish the relation between the performance of the driver vs his next year's contract extension Judde et al. (2013).
Hence, H0 – There is no Relation between the Previous season's driver performance and his contract extension for next season. To study the above hypothesis, Average ranking of the driver will be compared against his teams average rank for an entire season and then it will be checked if the driver is replaced or retained for the next season.

Actual Process

The performance of a driver in a racing competition is often evaluated based on various factors, such as their finishing position in each race, their overall ranking, and their consistency throughout the season. However, the performance of a driver cannot be evaluated in isolation, as it is also dependent on the performance of their team. Hence, it is crucial to consider the team's performance as well when evaluating a driver's performance Schreyer & Torgler, (2018).

To calculate the team's average finishing position, the same method as for the driver can be used. This involves calculating the average of the finishing positions of all the drivers in the team in each race throughout the season. For instance, if a team has two drivers, and their finishing positions in each race are 1st and 10th in the first race, 5th and 6th in the second race, and 2nd and 4th in the third race, then their average finishing position would be (1+10+5+6+2+4)/6 = 4.67. This calculation gives an overall average finishing position for the team for the previous year, which can serve as a benchmark for evaluating the team's performance Wurman et al. (2022).

The next step is to compare the driver's average position with the team's average position. This can be done by subtracting the driver's average position from the team's average position. For instance, if a driver's average finishing position is 3rd, and the team's average finishing position is 5th, then the difference would be 2 (5-3). A positive difference indicates that the driver performed better than the team's average, while a negative difference indicates that the driver performed worse than the team's average. By comparing the driver's and team's average positions, we can identify the drivers who performed exceptionally well or poorly compared to their team. For example, if a driver consistently finishes ahead of their teammate, but the team's overall performance is poor, then it suggests that the driver is outperforming their car and team. This could be an indication of the driver's exceptional skill or ability to adapt to different racing conditions. Similarly, if a driver consistently finishes behind their teammate, but the team's overall performance is good, then it suggests that the driver is underperforming and needs to improve their skills or adapt to the car's characteristics better. Overall, considering the team's

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performance is crucial when evaluating a driver's performance, as it provides a more comprehensive and accurate picture of their capabilities. By comparing the driver's and team's average positions, we can identify the drivers who are performing exceptionally well or poorly compared to their team and make necessary adjustments to improve their performance. Furthermore, analyzing the team's performance can also provide insights into the car's performance, enabling the team to make necessary adjustments to improve the car's speed, handling, and reliability, thus benefiting all the drivers in the team Zeithaml et al. (2001).

Teams Average Ranking is calculated in tableau using for each year from 2010 to 2022 using year filter Figure 1.

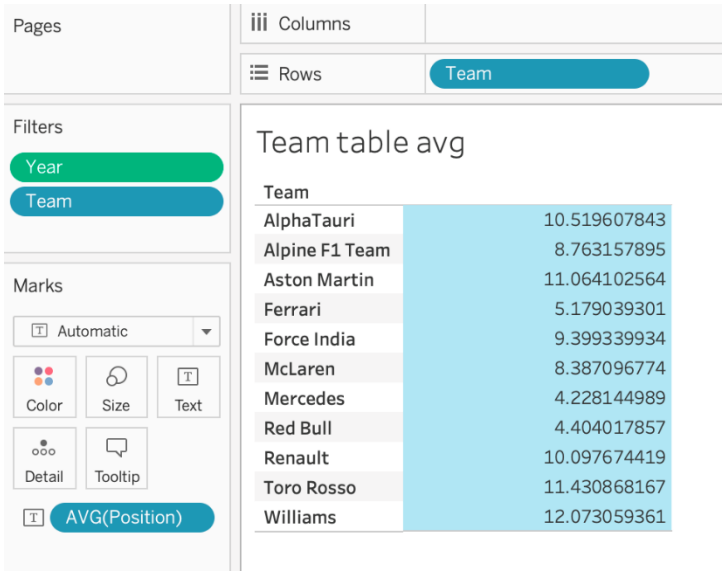

FIGURE 1
TEAMS AVERAGE RANKING

Driver’s average position is calculated using the same method in tableau (Ref image).

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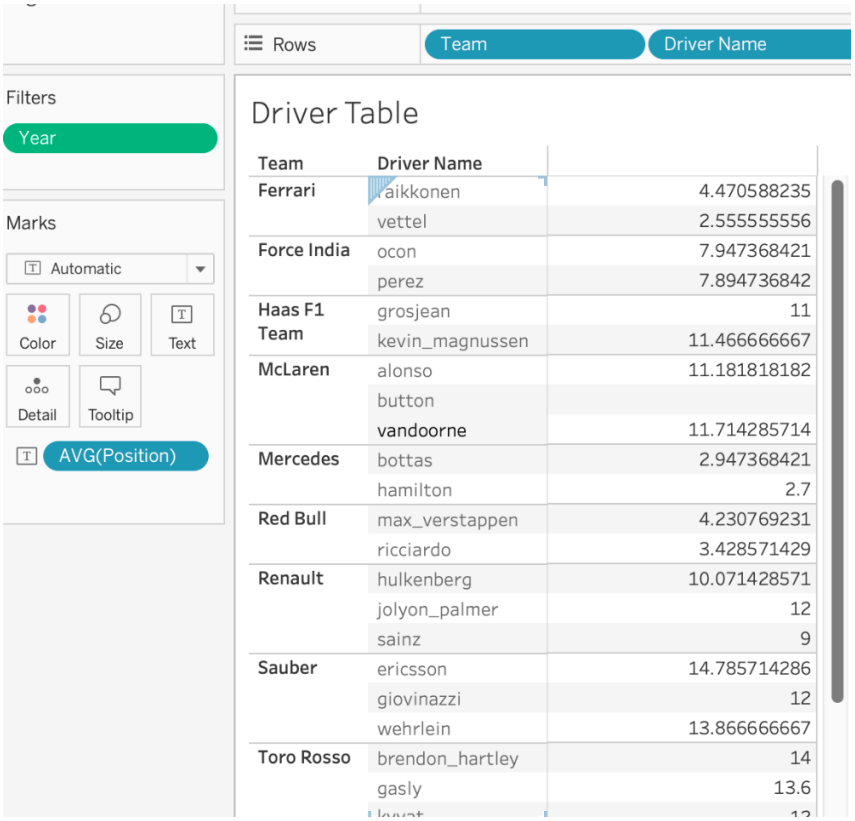

Team	Driver Name	
Ferrari	raikkonen	4.470588235
	vettel	2.555555556
Force India	ocon	7.947368421
	perez	7.894736842
Haas F1 Team	grosjean	11
	kevin_magnussen	11.466666667
McLaren	alonso	11.181818182
	button	
	vandoorne	11.714285714
Mercedes	bottas	2.947368421
	hamilton	2.7
Red Bull	max_verstappen	4.230769231
	ricciardo	3.428571429
Renault	hulkenberg	10.071428571
	jolyon_palmer	12
	sainz	9
Sauber	ericsson	14.785714286
	giovinazzi	12
	wehrlein	13.866666667
Toro Rosso	brendon_hartley	14
	gasly	13.6

FIGURE 2
DRIVER'S AVERAGE POSITION

Here Drivers who were replaced throughout the research paper scope timeline, for them the variance of driver's average points vs teams average points were classified in 3 groups named 'Strict', 'Medium' and 'Lenient'. The drivers having delta between driver's average and team's average in the range of '0.00 to 0.50' were classified into 'Strict' teams category, '0.50 to 1.00' were classified into 'Medium' category and lastly delta greater than 1 classified into 'Lenient' Category Figure 2.

Team's Tendency to Retain and Train Drivers

For this analysis, teams average rank over the years is considered in the research study scope period (i.e. 2010 to 2022) were considered to rank the teams followed by classifying them in the 3 groups 'Top Order', 'Middle Order' and 'Tailender Teams'. In the study only those teams are considered who were participating in the F1 for the entire study scope time period. Teams like Lotus F1 who was participating till 2014 but left in 2015 and hence it has not been considered in this study. On the other hand teams like 'Toro Rosso' which later turned to 'Alpha Tauri' are considered.

Description of the Data

The secondary data for this research paper was collected from Kaggle and pertains to the F1 championships from 1950-2022. The dataset includes a variety of information related to lap times, race locations, grand prix names, driver standings, and other relevant statistics.

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The raw format of the data requires additional processing and joining with master tables to obtain readable information. For example, to make sense of the driver standings data, it is necessary to join it with a driver list that provides additional information about each driver, such as their name, nationality, team affiliation, and other relevant details. Similarly, the race location data needs to be joined with a list of grand prix names to provide more context about each race.

The lap time data in the dataset provides detailed information about the performance of each driver during each race. Lap times are measured in milliseconds and include information about the time it took to complete each lap, as well as the average speed and distance covered during each lap. This information can be used to analyze the performance of individual drivers, as well as to compare the performance of different teams and car models over time.

The dataset also includes information about the locations of each race, including the country, city, and circuit name. This information can be used to analyze trends in the popularity of certain locations over time, as well as to identify any patterns or anomalies in race scheduling.

In addition to lap times and race locations, the dataset includes a variety of other statistics related to the F1 championships. For example, it includes information about the number of laps completed by each driver, as well as their final position in each race. It also includes data on the number of points earned by each driver throughout the season, as well as their overall ranking in the driver standings. Overall, the secondary data collected from Kaggle for this research paper provides a rich source of information about the F1 championships from 1950-2022. While the raw format of the data requires additional processing and joining with master tables to obtain readable information, the insights that can be gained from this dataset are valuable for understanding trends and patterns in F1 racing over time.

Inference

Based on the results of the chi-square test, with a p-value of 0.02, it can be inferred that there is a statistically significant relationship between the performance of F1 drivers' performance and their contract extension for the next season. This means that the likelihood of observing such a relationship by chance is very low, and the observed relationship is more likely due to a real association between the two variables. Therefore, we can conclude that the F1 driver's performance is likely to be a significant factor in determining whether or not they will receive a contract extension for the next season. However, it is important to note that statistical significance does not necessarily imply practical significance, and other factors may also influence the decision to extend a driver's contract.

While the chi-square test may have shown a significant relationship between the performance of F1 drivers and their contract extension for the next season, it is important to note that driver performance is only one of several factors that teams consider when deciding to extend or terminate a driver's contract. Other important factors that can influence contract decisions include the driver's behavior and attitude, their ability to work well with the team and their potential for future success, as well as the team's financial constraints and overall goals. For example, a team may choose to retain a driver who has had a poor season if they believe that the driver has the potential to improve and bring future success to the team. Similarly, a team may choose to terminate a driver's contract despite strong performance if they believe that the driver's behavior or attitude is negatively impacting the team's performance. Therefore, while driver performance is certainly an important factor, it is not the only factor that teams consider when making contract decisions in F1 racing. It has been observed that around 66% of the F1 drivers who performed poorly in the previous season have been replaced in the next season. This

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suggests that driver performance is indeed an important factor in determining contract extensions in F1 racing, and poor performance can result in a driver being replaced by the team. The F1 teams have been very strict with driver performance and have been known to make changes in their driver lineup if they do not perform up to the team's expectations. According to research, it has been observed that 62% of the F1 drivers who were replaced during the study scope period were only 0.5 positions short of their team's average rank. This indicates that F1 teams have set high performance standards for their drivers, and even a slight deviation from these standards can result in a driver being replaced. It also suggests that teams are willing to make changes to their driver lineup even if the driver's performance is not significantly worse than the team's average performance. This approach is in line with the high-performance culture of F1 racing, where teams strive to achieve excellence and are willing to make tough decisions to achieve their goals. According to research, the turnover rate of drivers in Formula 1 teams can provide insights into their performance over time. In the last 10 years, the top order teams - Red Bull, Mercedes, and Ferrari - have replaced drivers in the range of 5 to 8, which is the lowest turnover rate. In contrast, the middle order teams have replaced 9 to 10 drivers, while the lower order teams have replaced 10 to 15 drivers in the same period.

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