

The Evolution of Formula One

Exploratory Data Analysis



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Python Project

Agenda

- Topical Background
- Data Overview
- Questions of Interest
- Analysis
- Summary
- Future work



What is Formula One?

- Founded in 1950
- Highest level of open-wheel racing in the world
- \$2.6 billion in annual revenue
- 20 drivers on 10 teams (2 per) compete for the championship
- In 2023, there will be 24 races in 19 different countries
- Widely considered to be the highest achievement in motorsport



Formula One race map: 1950 - 1959



Formula One race map: 2010 - present



Data Summary

Kaggle Dataset: Formula 1 World Championship (1950-2023)

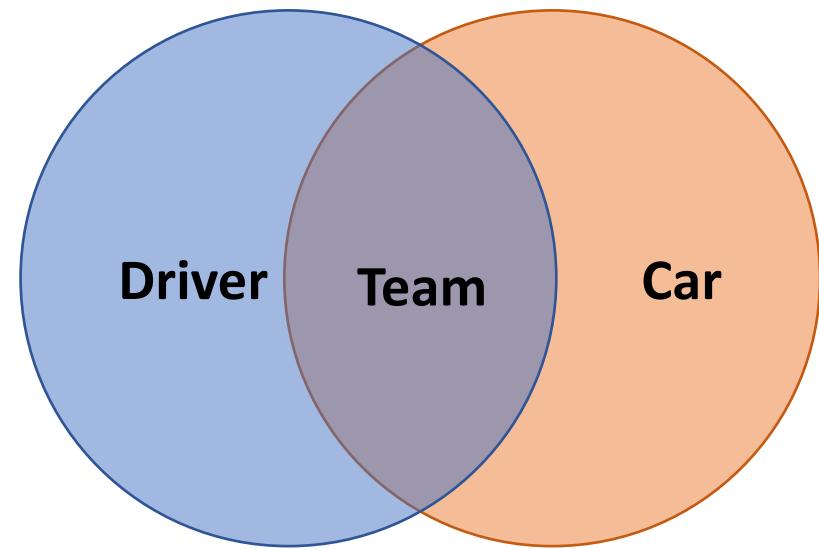
Description	Time Period	Source
Complete Race History	1950 - 2022	kaggle
Driver/Team Results and Standings	1950 - 2022	kaggle
Lap Times and Car Speed	2004 - 2022	kaggle
Team Budgets	2013 - 2022	various (see appendix)

Questions of Interest

How does driver age impact success?

How much faster have Formula One cars gotten since 2004?

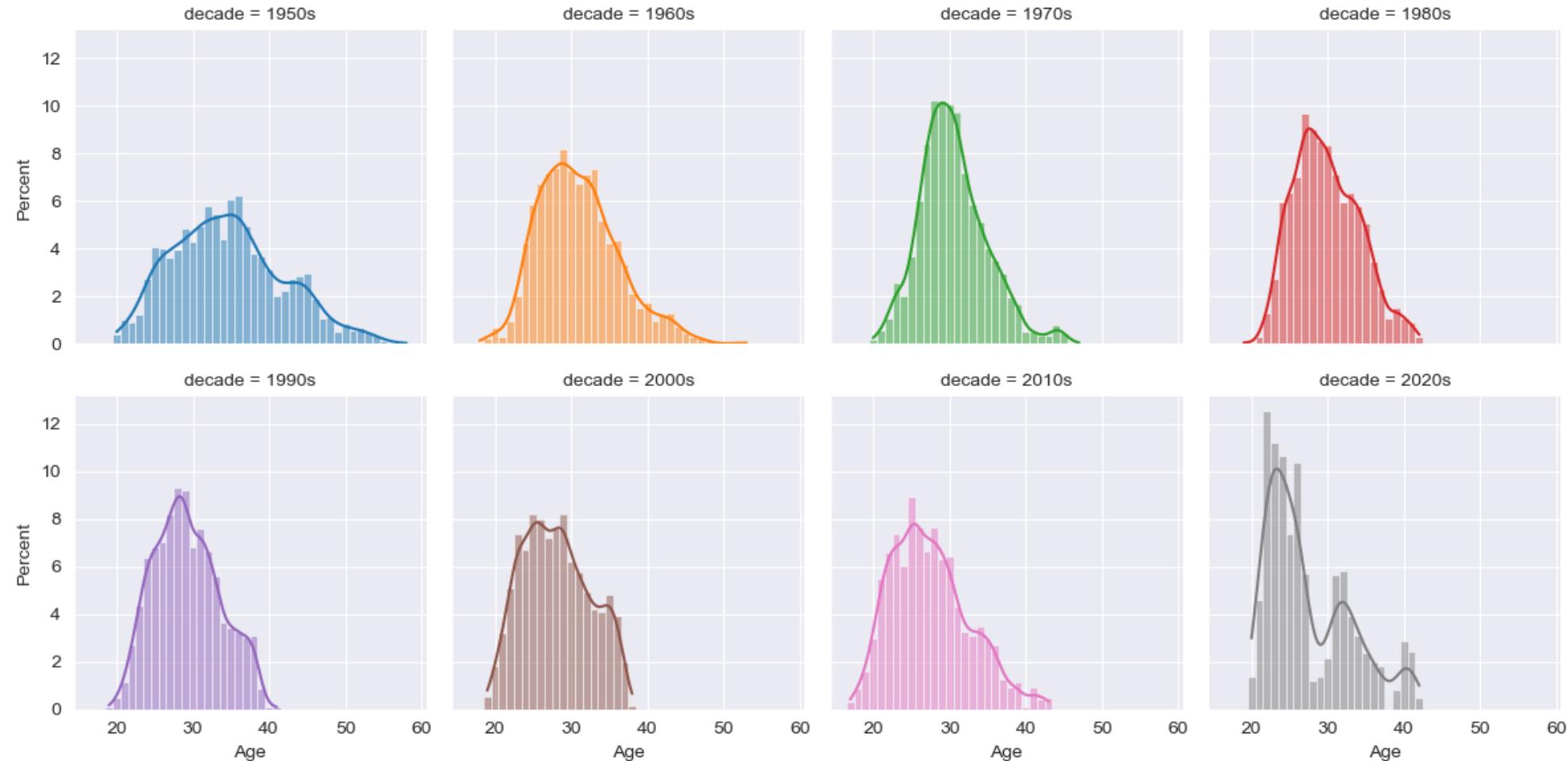
Why has one newly-founded team dominated the sport in the last 10 years?



How does driver age impact success?

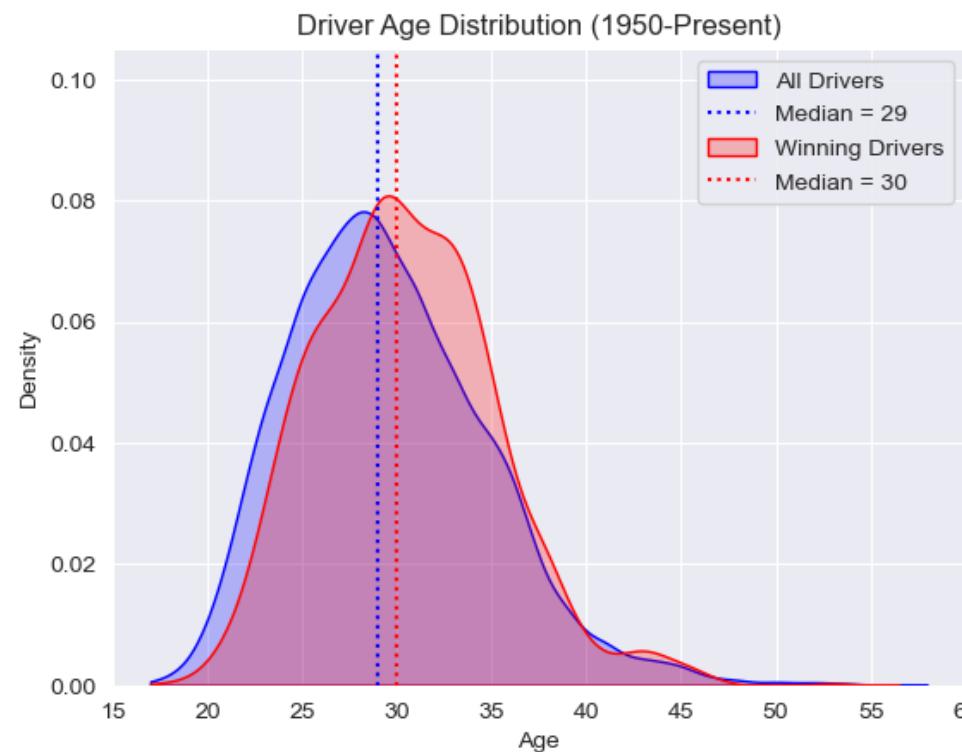
Analyzing Driver Performance
throughout F1 history

Driver age distribution throughout history



Driver win distribution

All-time → Last 10 years



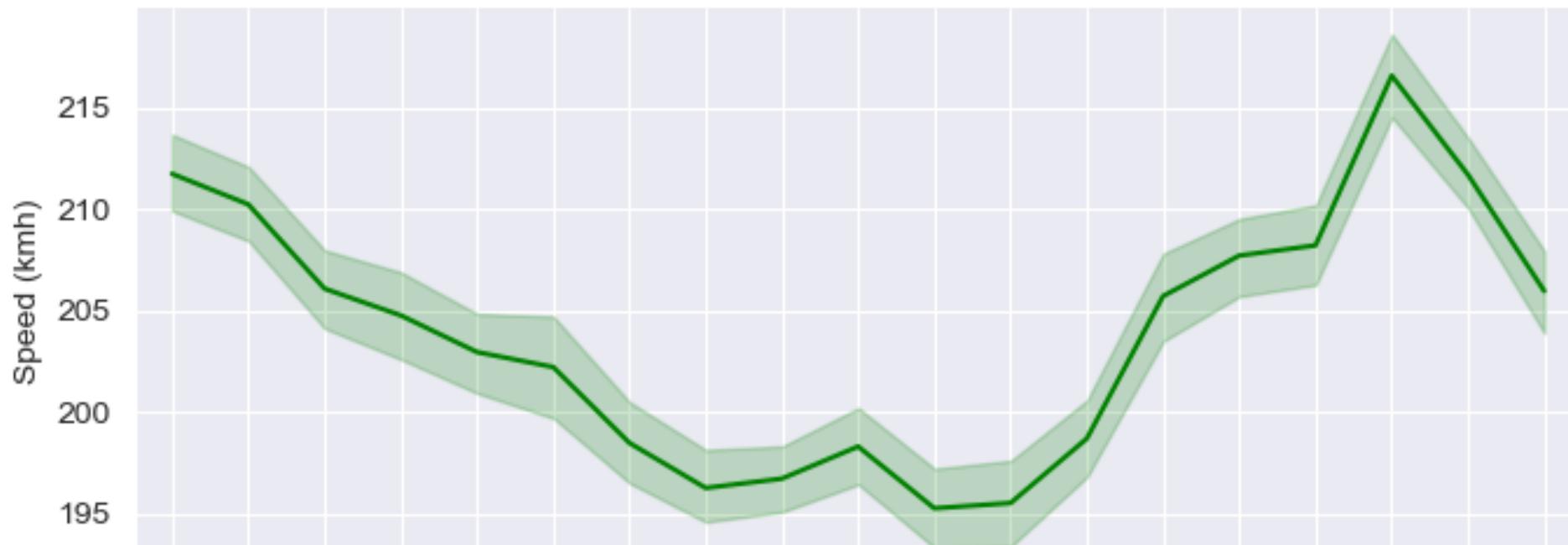
How much faster have Formula 1 cars gotten since 2004?

Analyzing Car Speeds from
2004 - 2022

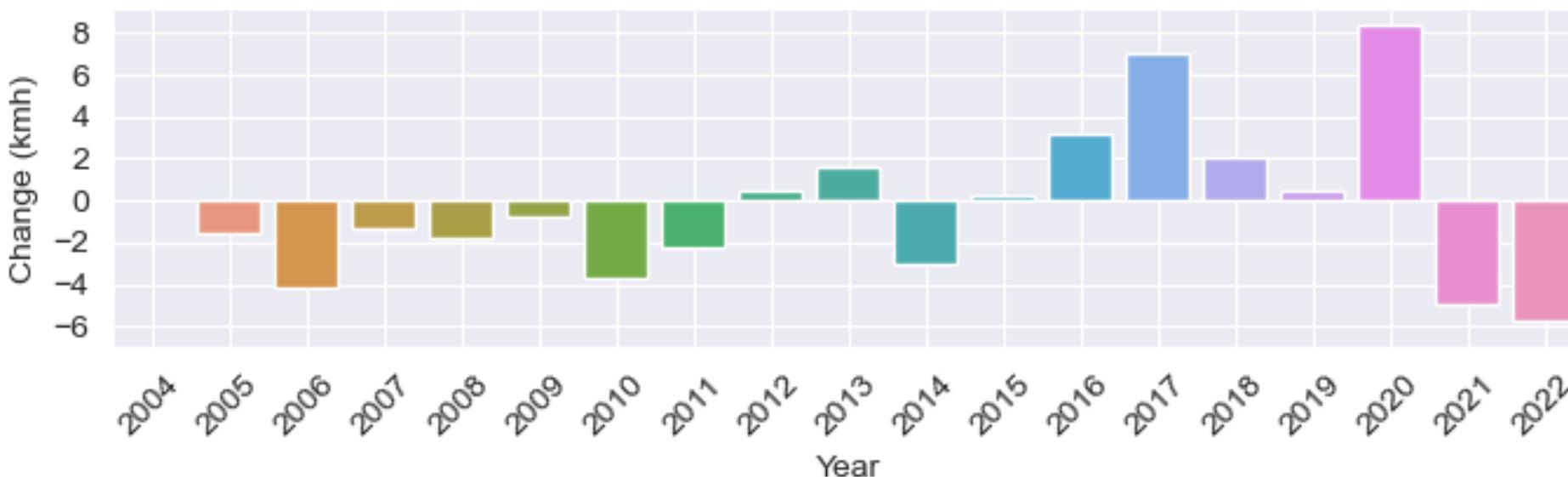
Short answer: They haven't...



Average Speed (kmh) 2004-2022



Year to Year Change



What were the largest changes year to year?



2020: COVID results in skewed data

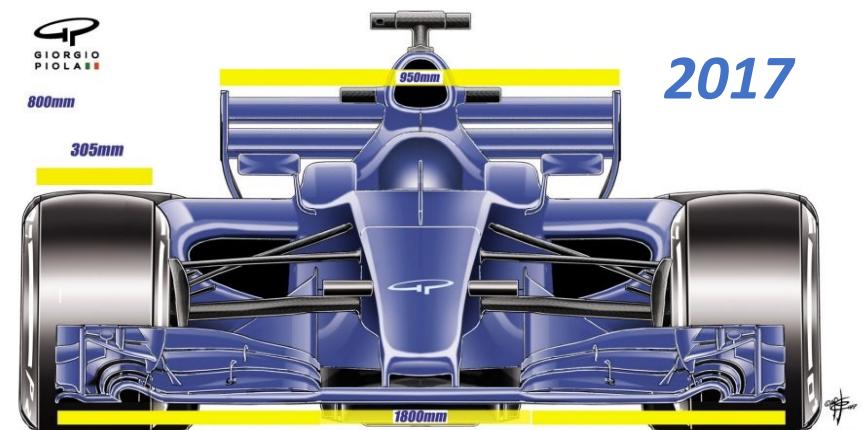
- Schedule Changes
 - 22 races originally scheduled
 - 13 races canceled
 - 5 races added that are not part of the normal race schedule
- The resulting data pulled from 2020 is not comparable to the prior year



2017: New specifications for car/tire width

- Car width and tire width increased
 - More body surface area creates more aerodynamic downforce
 - More tire surface area increases friction
- Cars can go much faster around turns
- **Average speed increased by 7.03 kmh**

	2016	2017
Car Width	1800 mm	2000 mm
Tire Width	245 mm	305 mm
Avg Speed	198.68 kmh	205.71 kmh

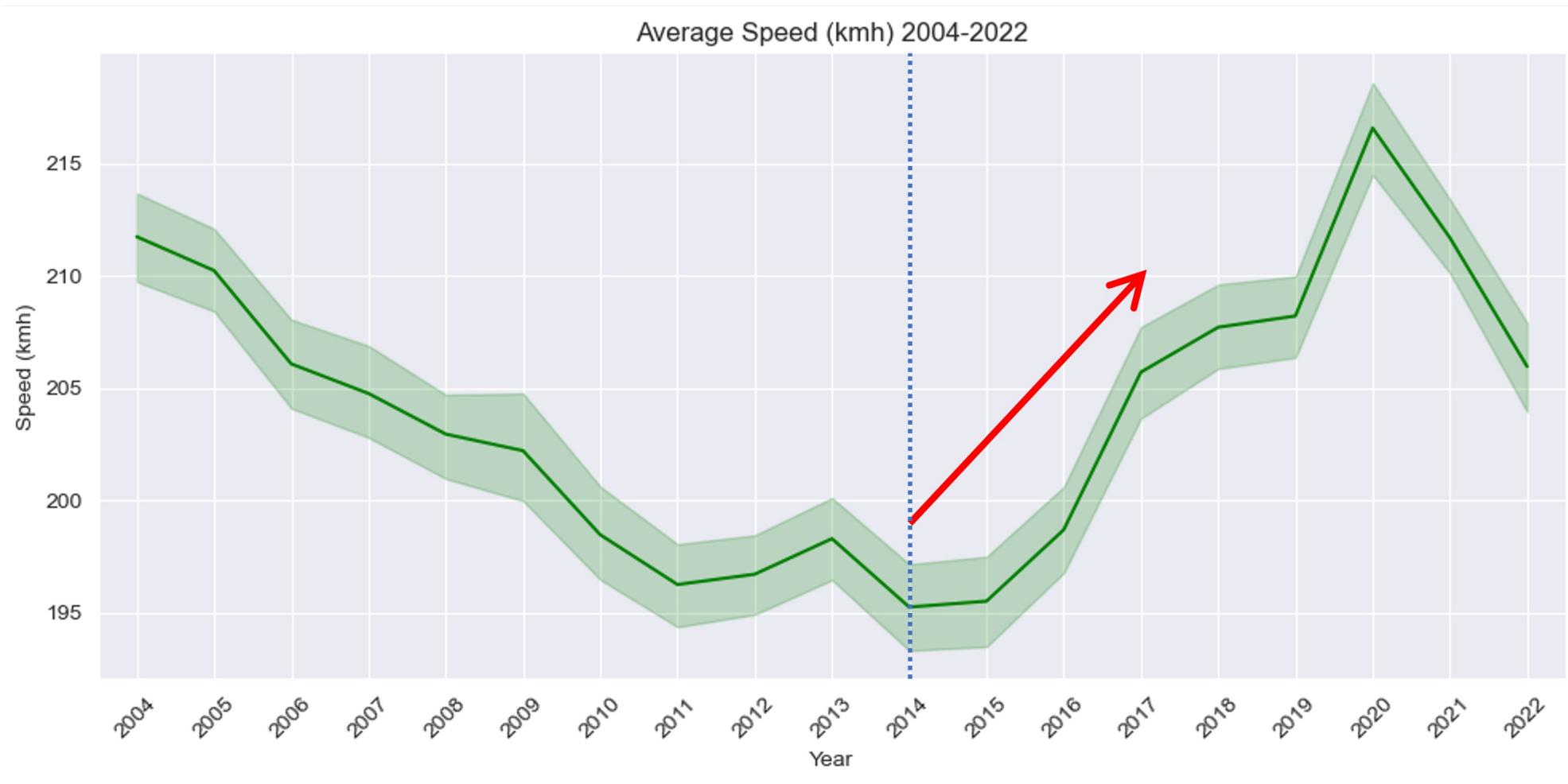


2022: Aerodynamic specification overhaul

- Teams are forced to completely redesign their aerodynamic packages to fit new regulations.
- These changes were made to improve the quality of racing and result in more ‘action’ during the race.
- Car speed decreased by 5.74 kmh



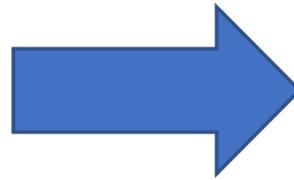
Why did cars start getting faster after 2014?



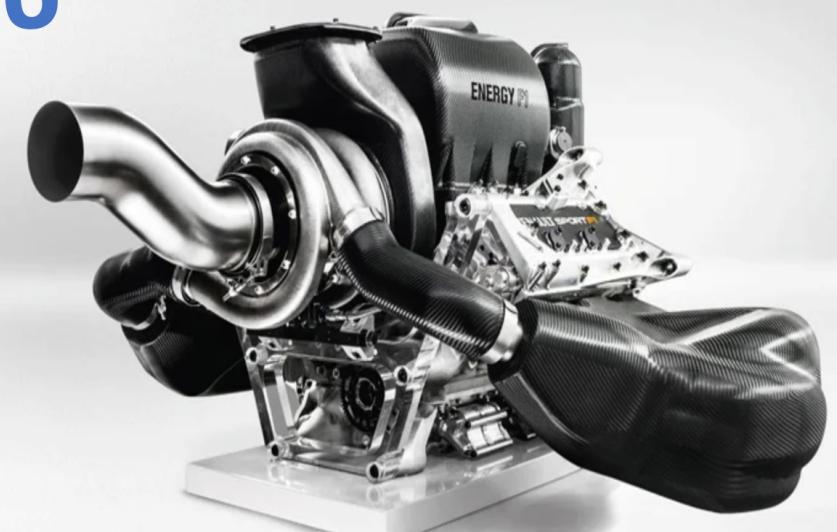
2014: V6-Hybrid engine replaces V8

All teams are forced to design a completely new engine

V8



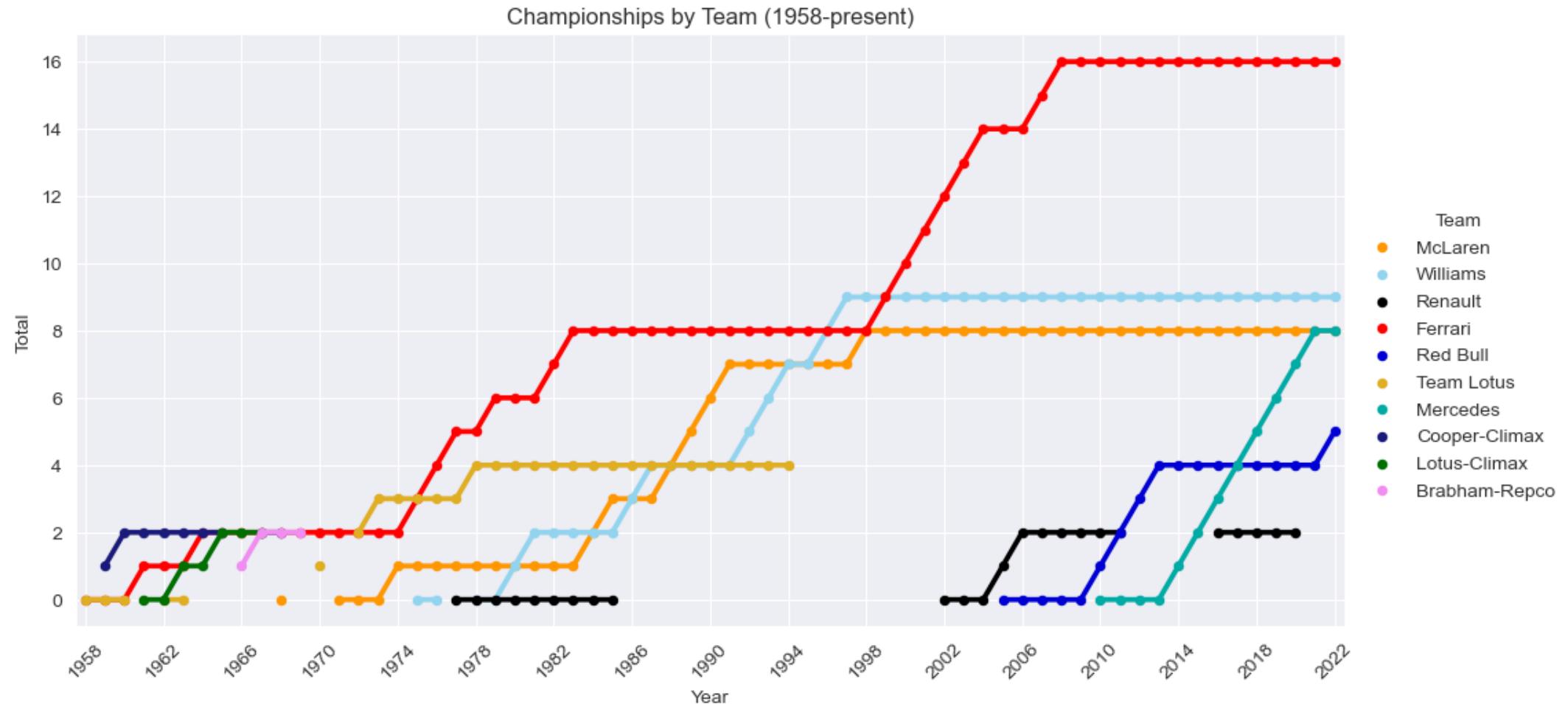
V6



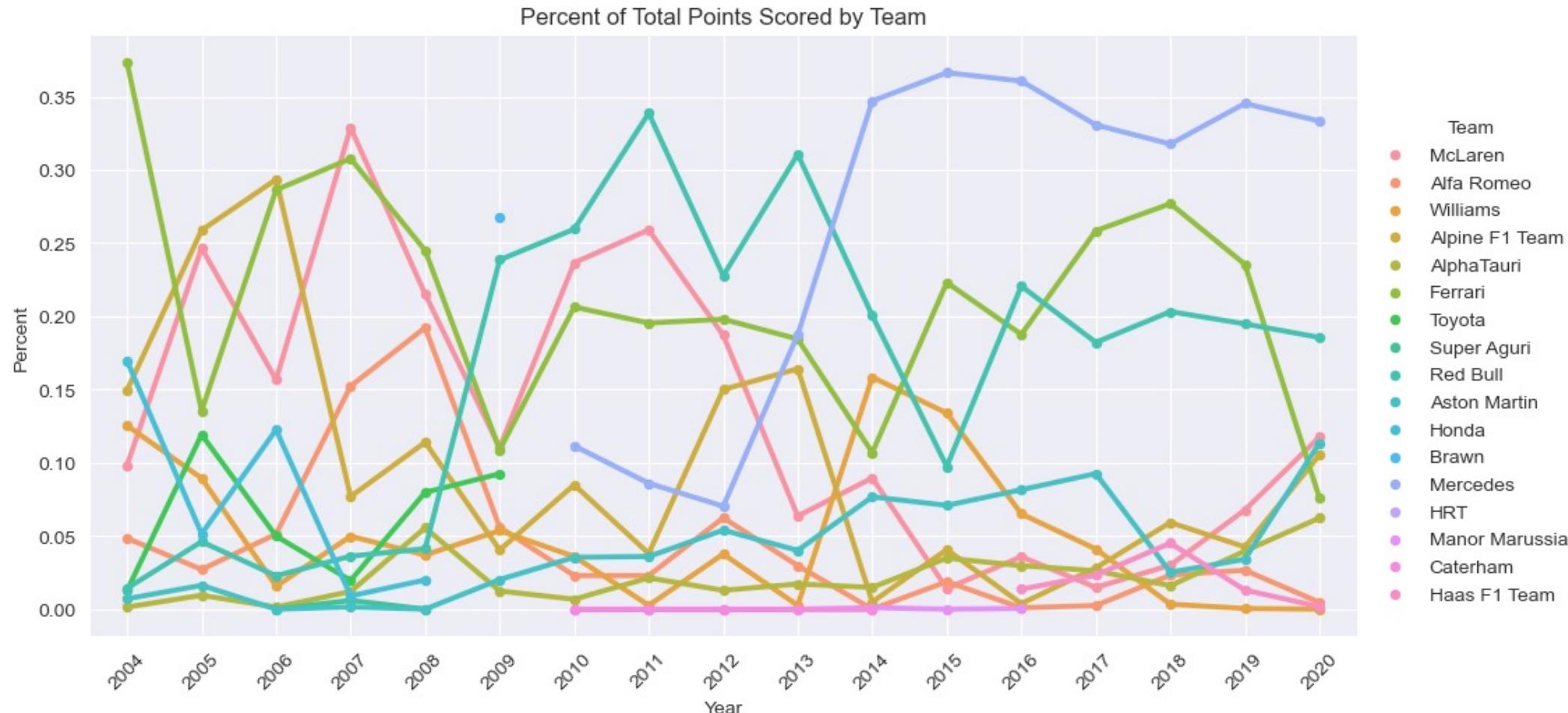
Why has a new team dominated the sport in the last 10 years?

Analyzing team performance
and budget from 2013 - 2022

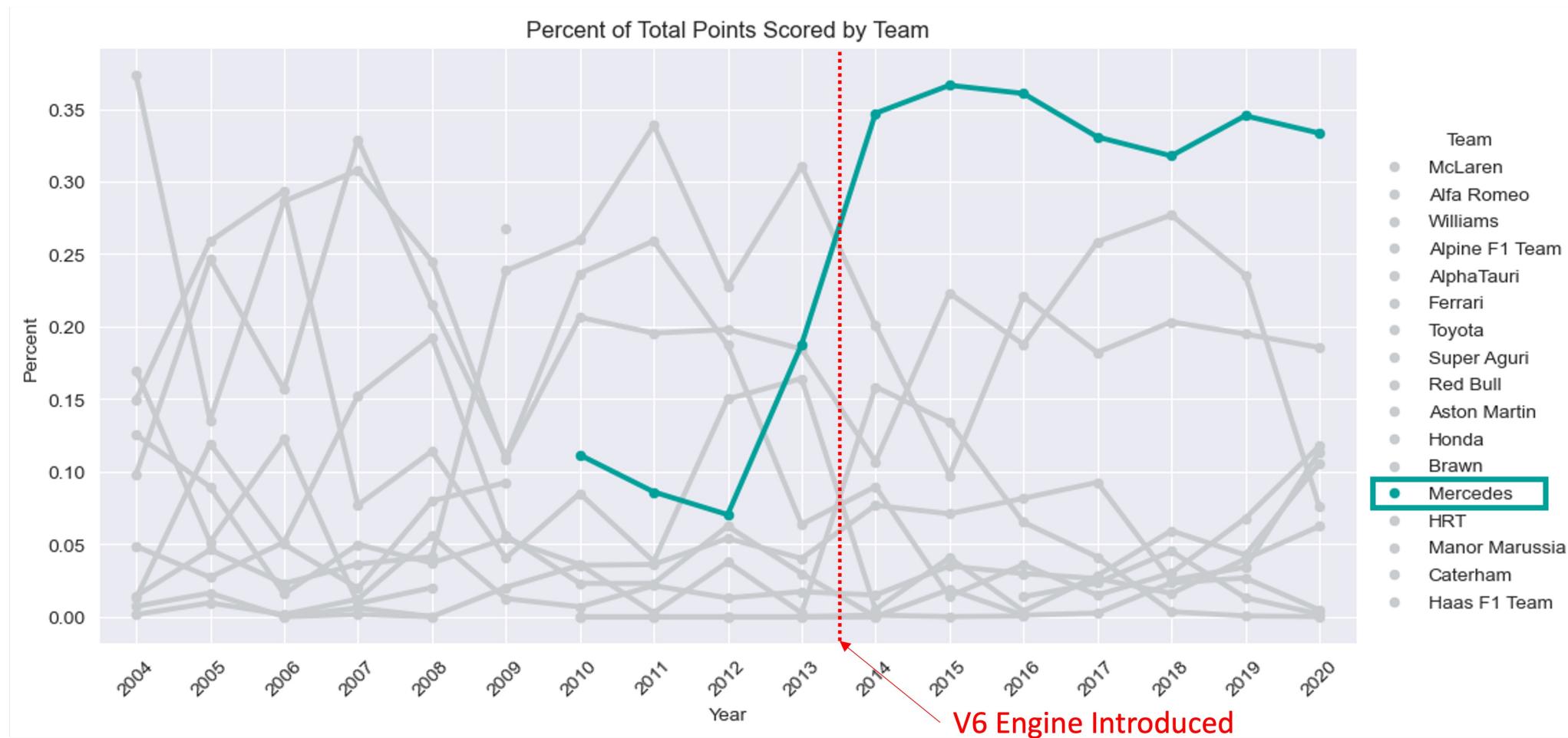
Team Championships throughout history



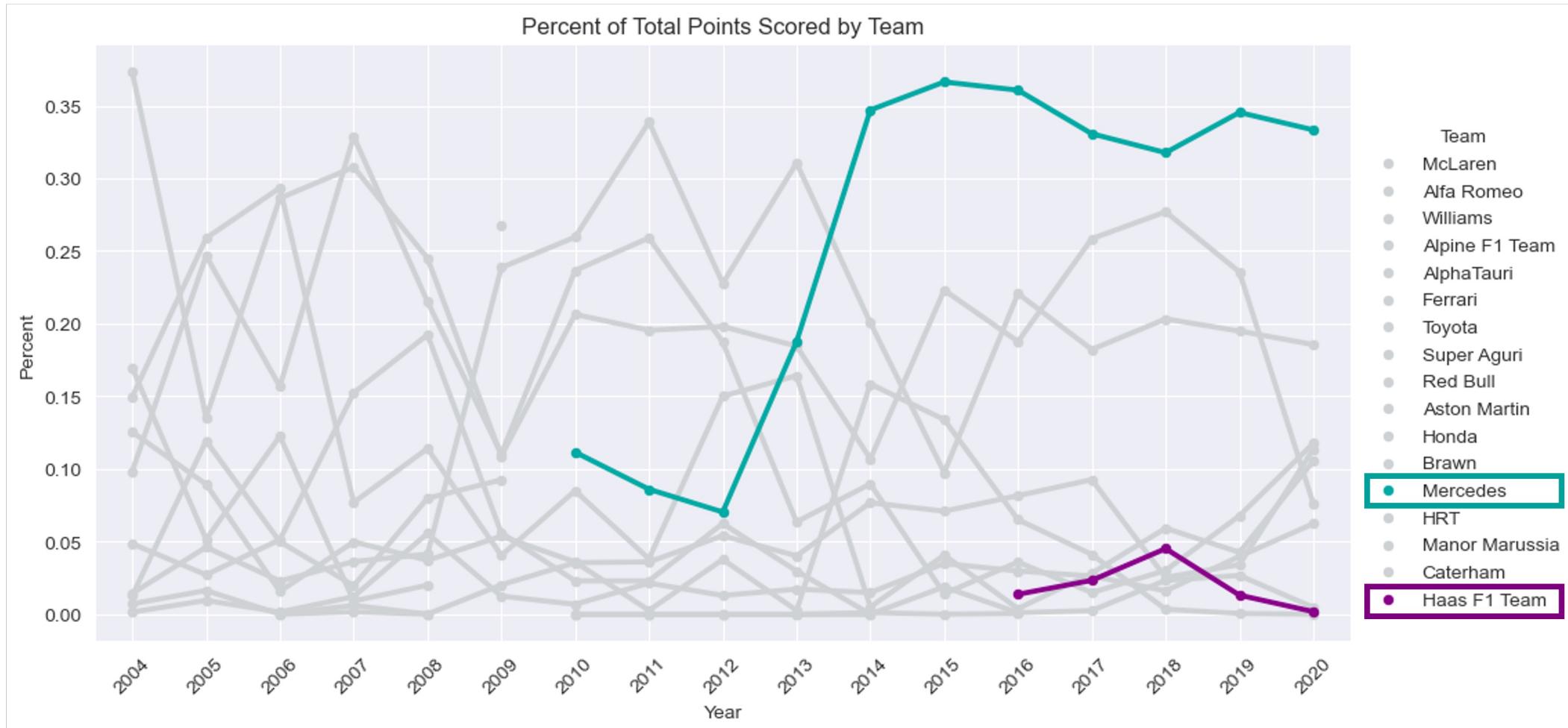
Individual team performance 2004-2020



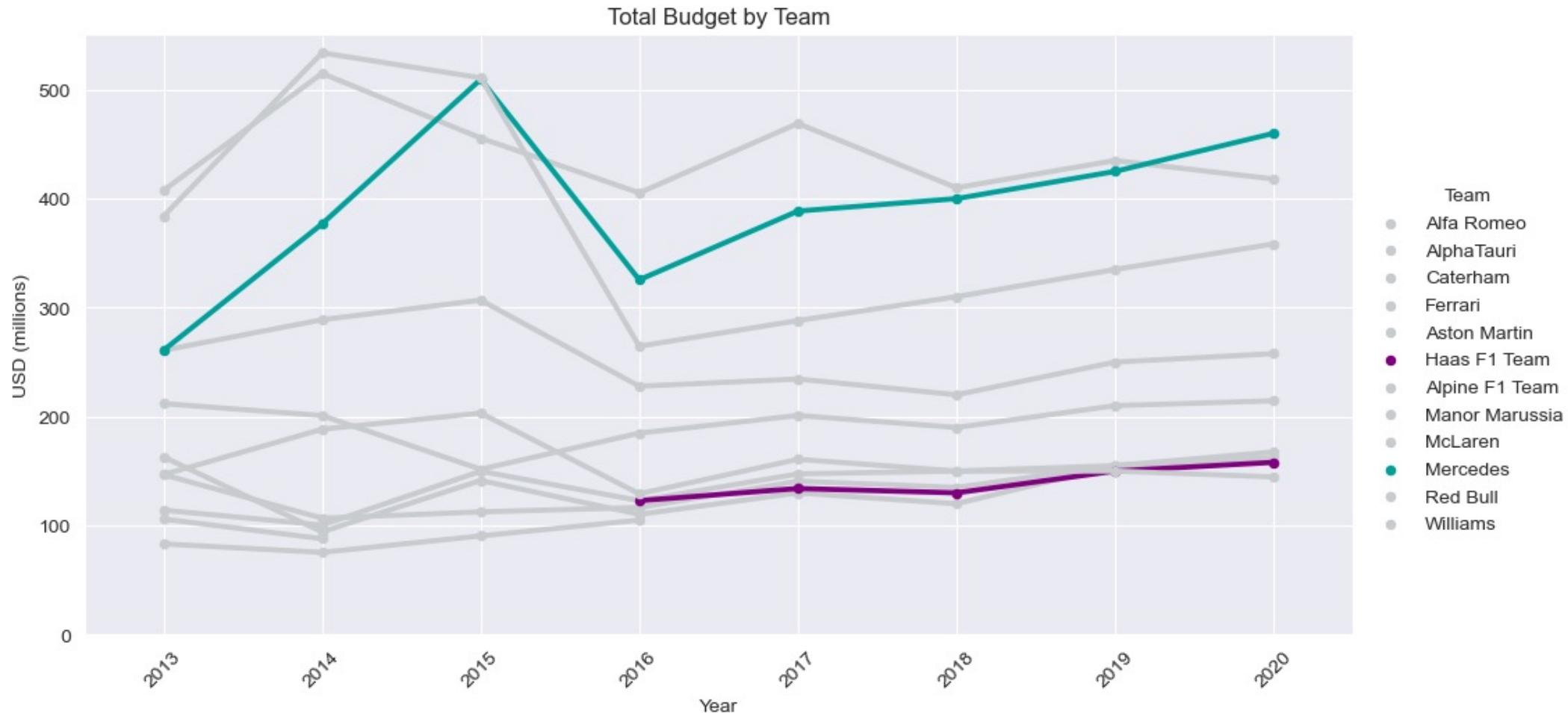
Mercedes dominates the V6 era



Mercedes compared to another new team



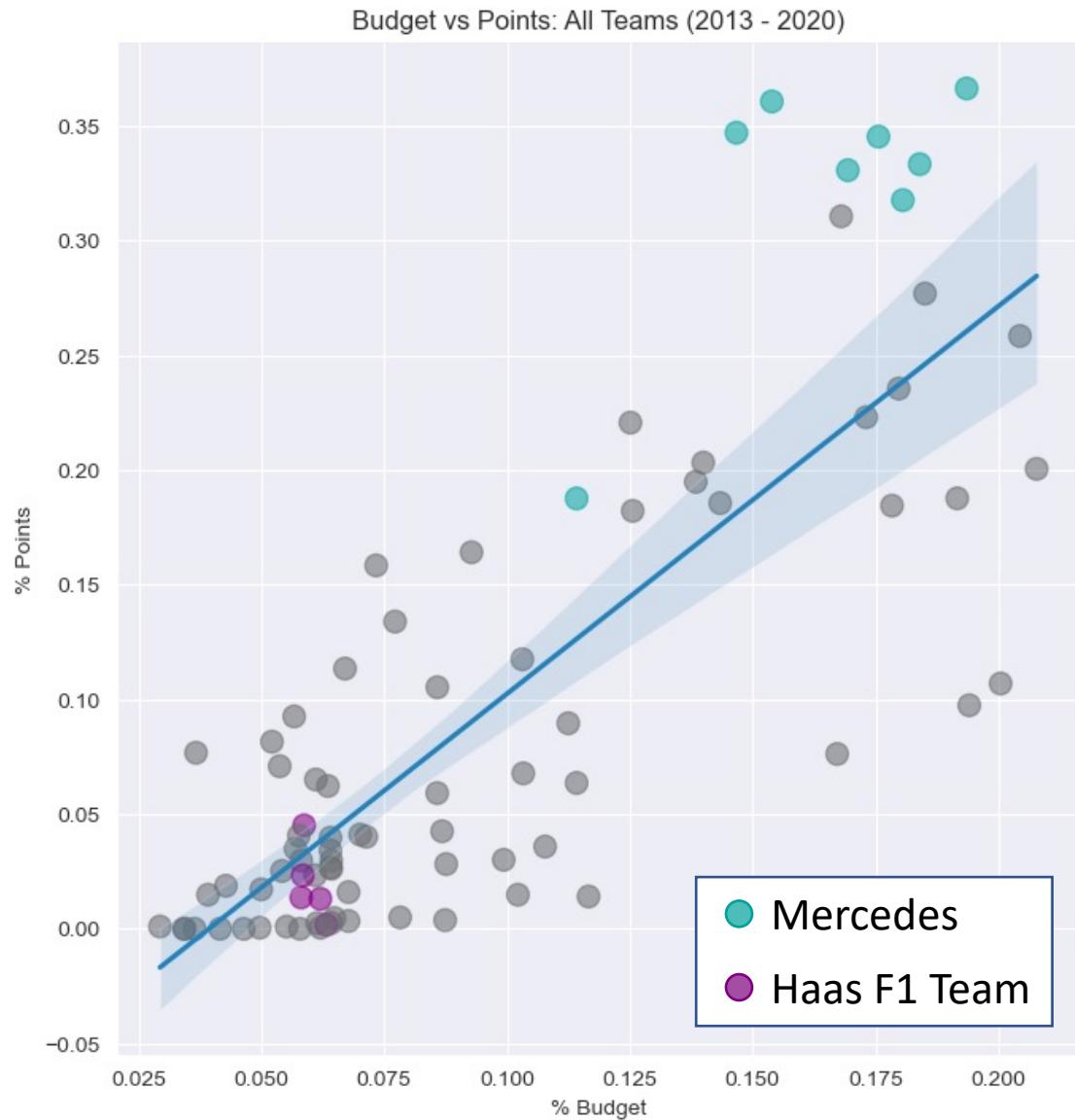
Budget comparison (2013-2020)



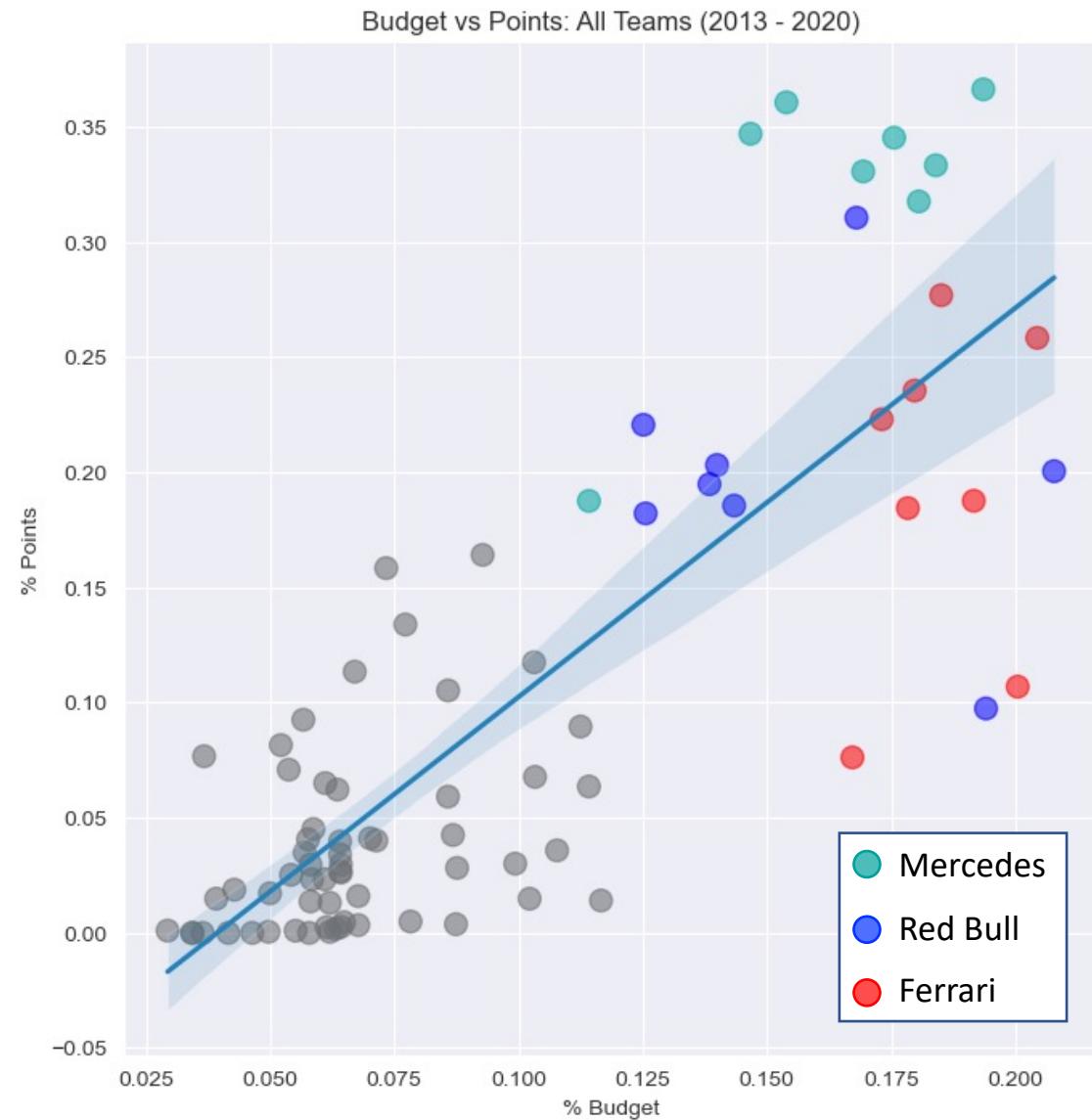
Correlation between budget and points scored



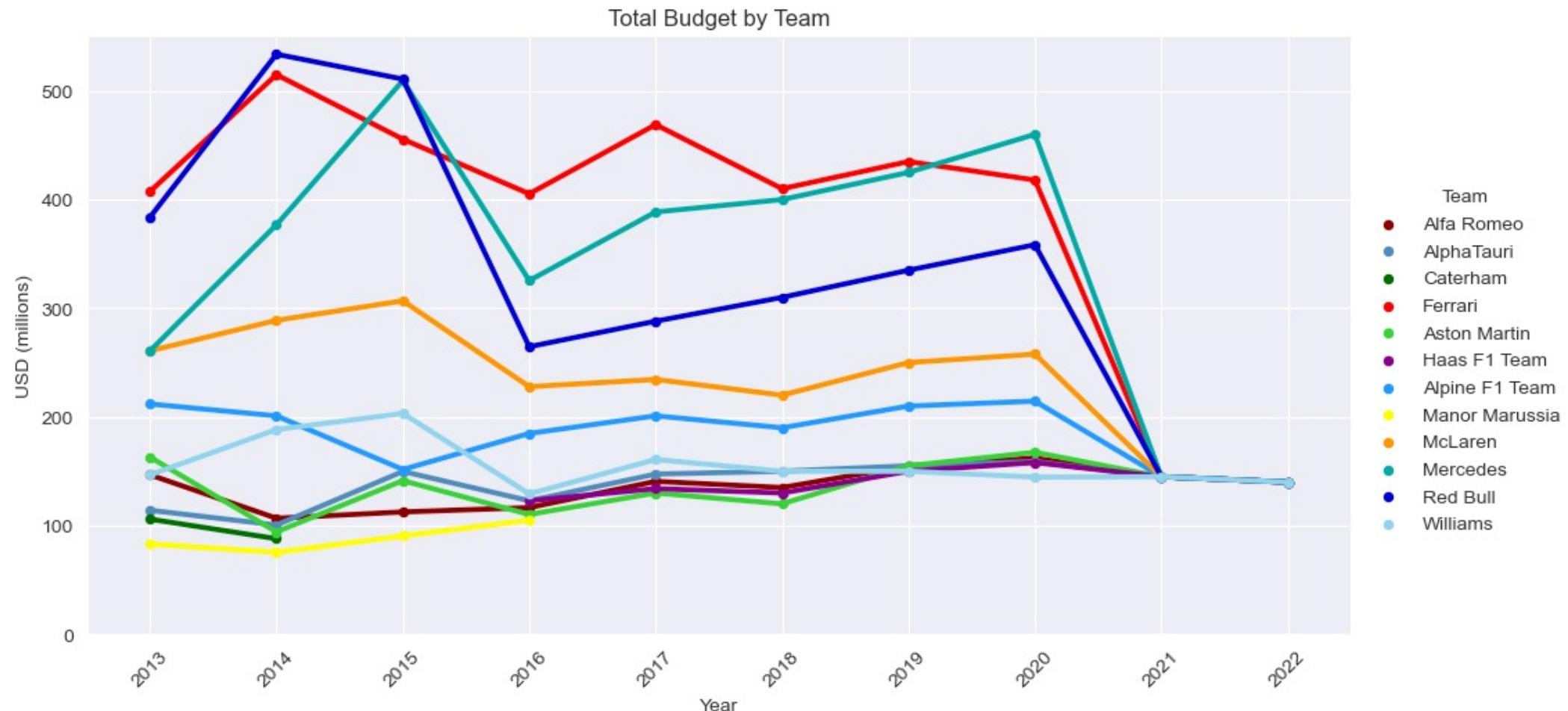
Correlation between budget and points scored



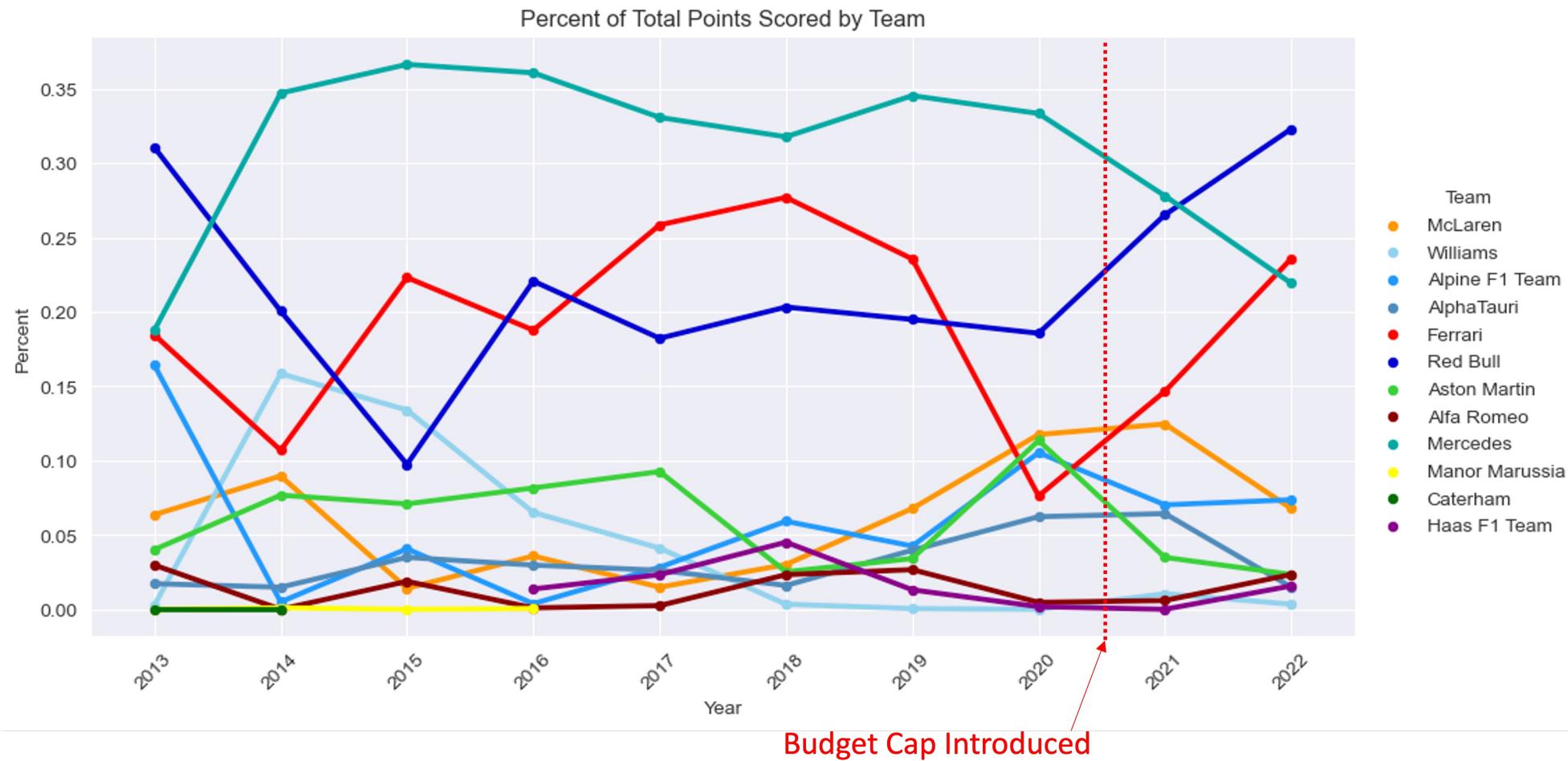
Correlation between budget and points scored



Formula One implements budget cap in 2021



Individual team performance with budget cap



Summary

- While overall driver age is decreasing in recent years, more experienced drivers are still winning
- Advancement in technology is constantly changing car performance
- Formula One hopes to achieve more parity in the sport with a new budget cap.



Future Work

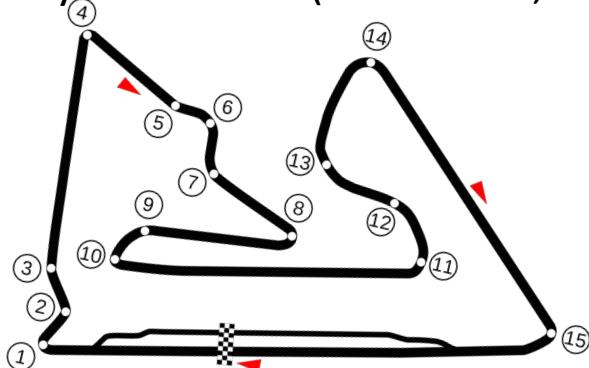
- Find alternate data source that includes lap time data for entire Formula One history
- Analyze driver salaries and their correlation with individual performance
- Dig deeper into the data inconsistencies that were uncovered

Weather conditions not included in dataset

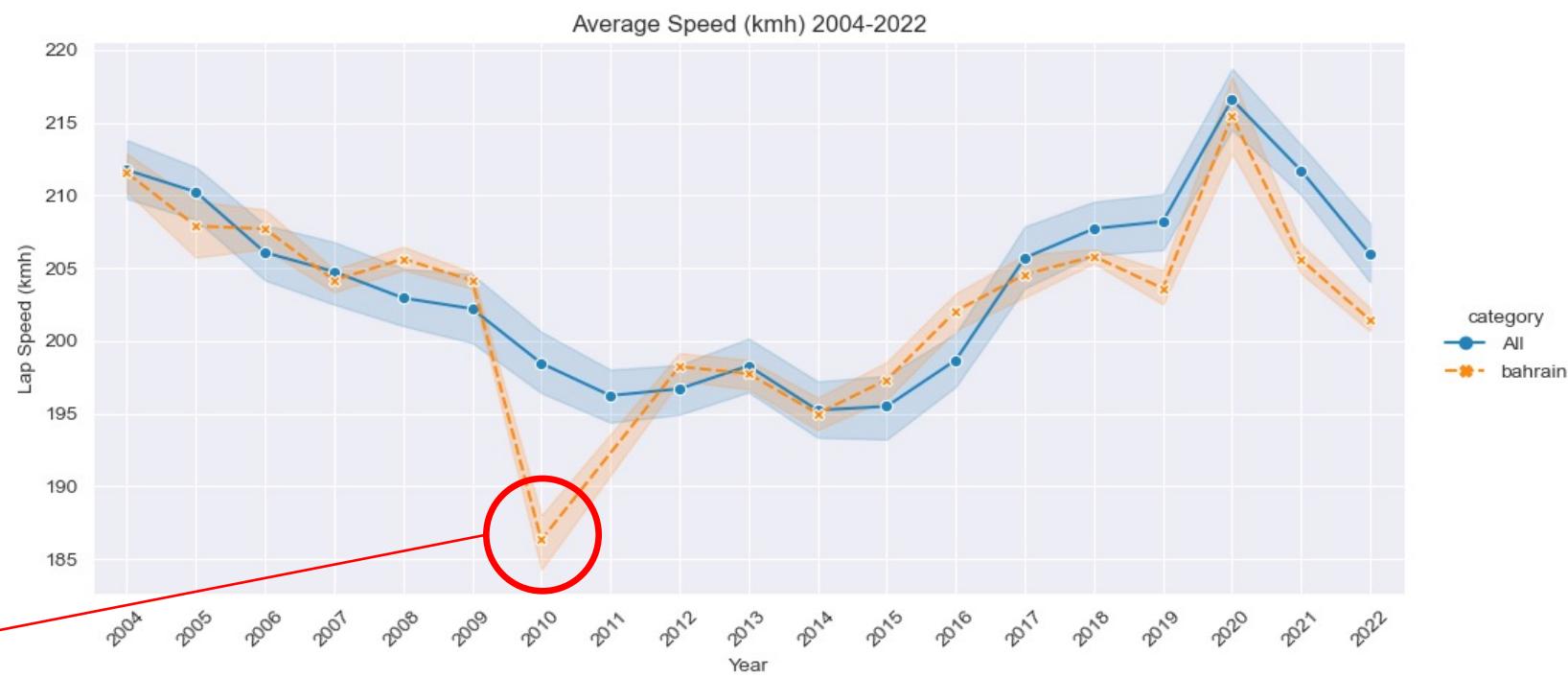
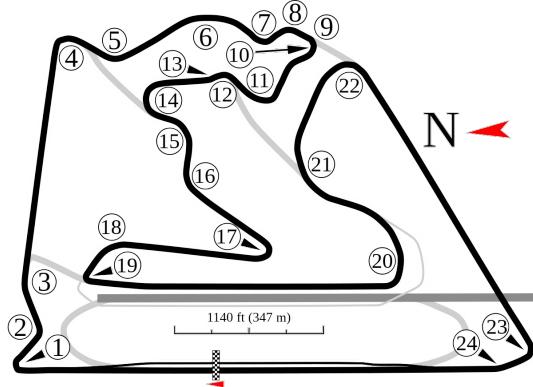


Track layout not included in dataset

Typical Layout: 5.4 km (2004-2009, 2011-2022)



2010 Layout: 6.3 km



Questions?

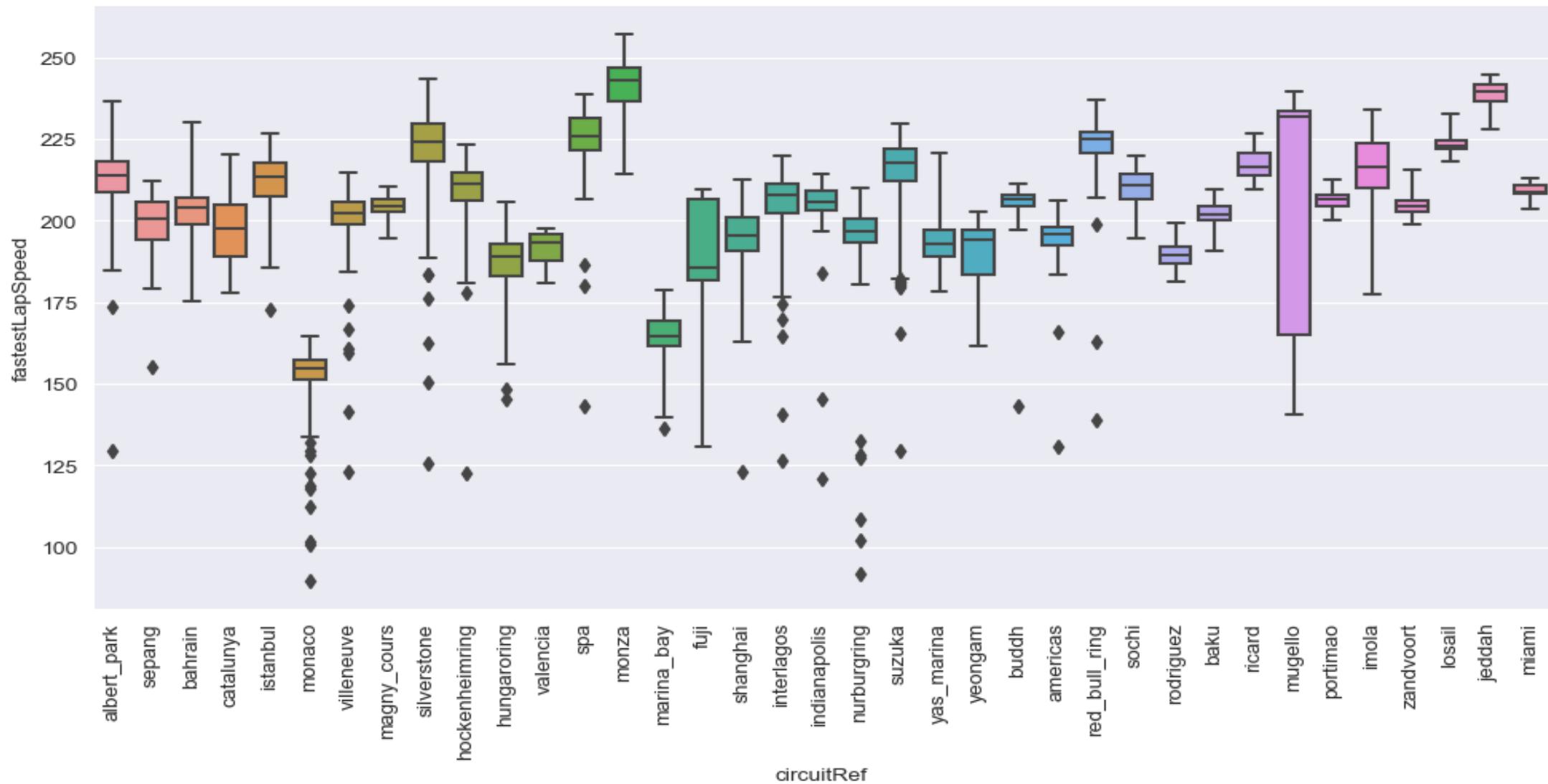
Appendix

Additional Information

References

Data	Source
Formula 1	https://www.kaggle.com/datasets/rohanrao/formula-1-world-championship-1950-2020
Budget Data 2013	https://bleacherreport.com/articles/1875408-red-bull-and-lotus-got-the-most-value-for-their-money-in-the-2013-f1-season
Budget Data 2014	https://bleacherreport.com/articles/2281654-mercedes-and-williams-were-the-most-efficient-teams-in-the-2014-formula-1-season
Budget Data 2015	https://bleacherreport.com/articles/2597997-f1-team-budgets-which-teams-got-the-best-value-for-their-money-in-2015#:~:text=In%202015%2C%20F1%20teams%20collectively,the%20course%20of%20the%20season
Budget Data 2016	https://www.autosport.com/f1/news/how-much-did-formula-1-teams-spend-in-2016-5109312/5109312/
Budget Data 2017	https://www.autosport.com/f1/news/revealed-what-f1-teams-really-spent-in-2017-5110279/5110279/
Budget Data 2018	https://www.racefans.net/2018/12/19/how-much-f1-teams-spent-race-2018-part-one/
Budget Data 2018	https://www.racefans.net/2018/12/26/the-cost-of-f1-revealed-how-much-teams-spent-in-2018-part-two/
Budget Data 2019	https://www.racefans.net/2019/12/27/the-cost-of-f1-2019-team-budgets-analysed-part-one/
Budget Data 2020	https://www.racefans.net/2020/01/02/the-cost-of-f1-2019-part-two-what-the-top-teams-spent/

Circuit Data Before Removing Outliers



Lap Times Over the years

