

Formula 1 2022 Regulation Changes*

How did the 2022 F1 Regulations change the sport for better and for worse

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As Formula 1's new era of hybrid cars develops, a fresh range of rules and regulations have been put in place for the teams to follow attempting to create a closer, more competitive championship. This paper will investigate the impact of the 2022 Formula 1 regulations, designed to intensify the competitive landscape and elevate the racing experience through technical and fiscal adjustments. It examines lap times and overtaking dynamics, while the analysis zeroes in on the performance trajectories of the sport's leading contenders: Max Verstappen, Lewis Hamilton, and Charles Leclerc across varied circuit types from 2021 to 2022. It focuses on whether these regulatory modifications have indeed leveled the playing field, creating tighter competition and mitigating the performance differences between teams or have increased the gap even more. This research not only examines the immediate effects of the 2022 changes but also considers the balance between innovation and competition in Formula 1, thereby contributing to the ongoing dialogue on how to shape the future of this high-stakes sport.

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*Code and data are available at: https://github.com/fanger2791/F1_Regulations.

1 Introduction

Formula 1 (F1) is the pinnacle of motorsport, recognized worldwide for its high-speed and high-tech racing that pushes the limits of automotive engineering and driver skill to the limit. Established in 1950, it has evolved into a global phenomenon, comprising of a series of races, known as Grands Prix, held on different tracks and street circuits across various continents. The sport features single-seat, open-wheel cars powered by cutting-edge hybrid technology, emphasizing aerodynamic performance, energy recovery systems, and fuel efficiency. Teams, both factory-backed and independent, compete in a Constructors' Championship, while drivers compete for the Drivers' Championship, making F1 not just a test of technical innovation but also human endurance and strategy.

In 2022, Formula 1 underwent one of its most significant regulatory overhauls in the history of the sport, a change motivated by the desire to enhance competitive balance and improve racing quality. This transformation came at a critical juncture, as the world of Formula 1 sought to address growing concerns over the technological disparities among teams, and the often predictable nature of race outcomes. The regulations introduced for the 2022 season aimed to tackle these challenges by mandating a new car design philosophy, overhauling the aerodynamics to facilitate closer racing, and implementing cost caps to level the playing field among the competing teams.

The core of the 2022 regulations centered around a shift to ground-effect aerodynamics, a move designed to reduce the reliance on turbulent airflows generated by traditional wing-based designs and thereby minimize the performance degradation experienced by cars when following closely behind competitors. Additionally, the introduction of a budget cap aimed to reduce the escalating arms race in spending that had seen the wealthiest teams dominate the sport. These changes were complemented by adjustments to race weekend formats, marking a comprehensive approach to reforming the sport.

However, the transition was not without its challenges and controversies. Critics and experts argued that while the intention was to even the competition, the rapid and radical nature of these changes risked worsening existing disparities, at least in the short term, as teams adapted at different rates to the new regulations. Furthermore, concerns were raised about the potential for unintended consequences, such as increased racing incidents due to closer pack racing, and the possibility that the budget cap could stifle technological innovation.

Despite these debates, preliminary findings suggest that the 2022 regulations have had a profound impact on Formula 1. Races have generally become more competitive, with a wider array of teams and drivers finding themselves in contention for podium finishes. The budget cap has also initiated a more strategic allocation of resources among teams, potentially leveling the competitive field over the longer term. The paper's estimand is whether the 2022 Formula 1 regulations led to a significant increase in lap time in comparison to the previous time among the top drivers across different types of circuits but also increased the number of successful overtakes during races. We aim to quantify the impact of the 2022 Formula 1 regulatory

changes, providing a clear basis for evaluating their success in enhancing the sport's competitive balance and the quality of racing.

The remainder of the paper is organized as follows: Section 2 details the methodology and source data, including the use of the `f1dataR` package. Section 3 provides an analysis of the data with an emphasis on changes in the laptime and number of overtakes completed between 2021 and 2022 F1 cars. Section 4 discusses the specific challenges that came with the new regulations and on the balance between the intended objectives and the actual outcomes, offering recommendations for future regulatory adjustments.

Table 1: F1 Driver Standings 2022

Driver	Position	Points	Wins	Constructors
Max Verstappen	1	454	15	Red Bull
Leclerc	2	308	3	Ferrari
Perez	3	305	2	Red Bull
Russell	4	275	1	Mercedes
Sainz	5	246	1	Ferrari
Hamilton	6	240	0	Mercedes
Norris	7	122	0	Mclaren
Ocon	8	92	0	Alpine
Alonso	9	81	0	Alpine
Bottas	10	49	0	Alfa

Table 2: F1 Driver Standings 2021

Driver	Position	Points	Wins	Constructors
Max Verstappen	1	395.5	10	Red Bull
Hamilton	2	387.5	8	Mercedes
Bottas	3	226.0	1	Mercedes
Perez	4	190.0	1	Red Bull
Sainz	5	164.5	0	Ferrari
Norris	6	160.0	0	Mclaren
Leclerc	7	159.0	0	Ferrari
Ricciardo	8	115.0	1	Mclaren
Gasly	9	110.0	0	Alphatauri
Alonso	10	81.0	0	Alpine

2 Data

3 Results

4 Discussion

5 References

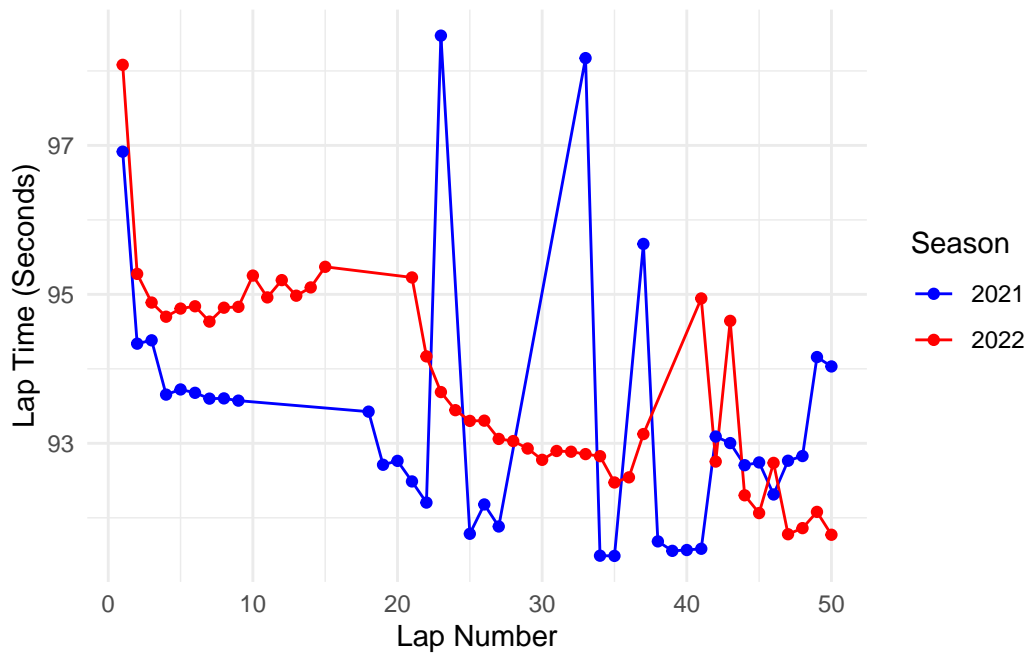


Figure 1: Max Verstappen Lap Times in Jeddah - 2021 vs. 2022

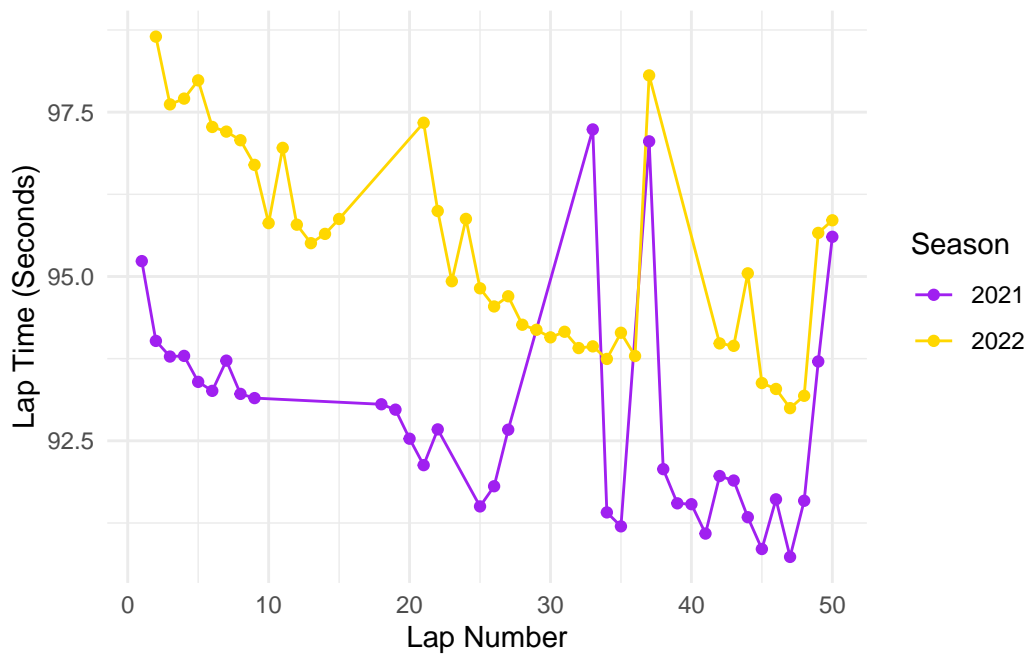


Figure 2: Lewis Hamilton Lap Times in Jeddah - 2021 vs. 2022

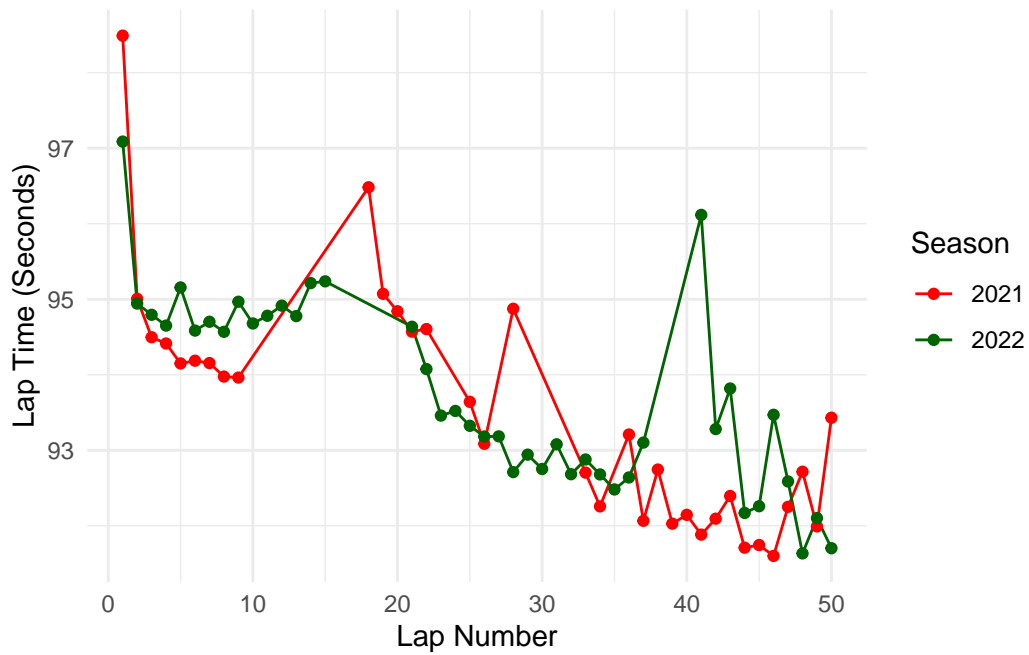
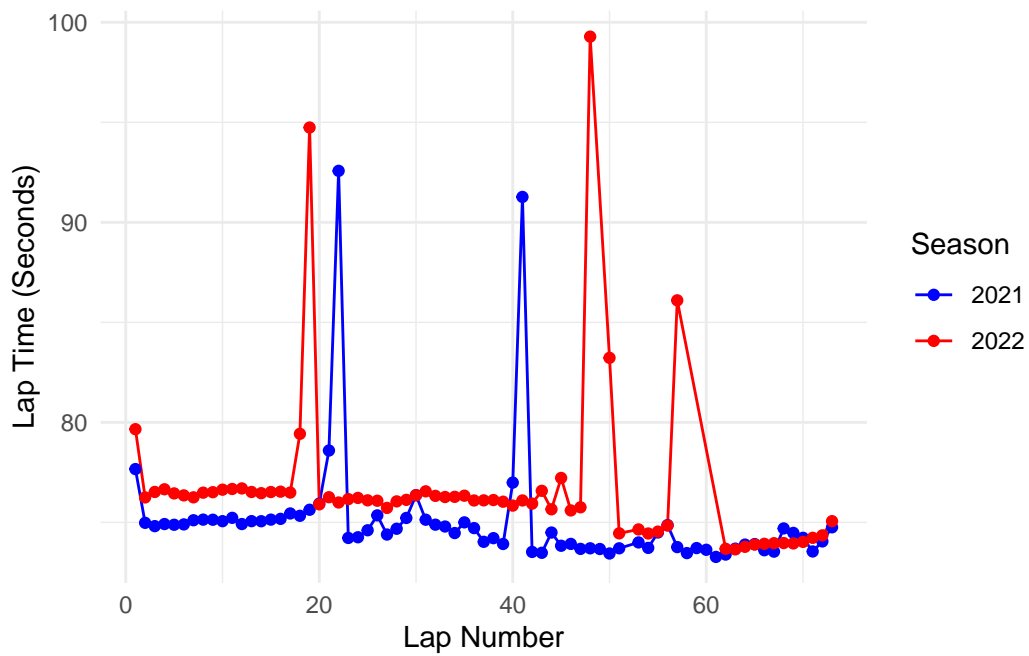


Figure 3: Charles Leclerc Lap Times in Jeddah - 2021 vs. 2022



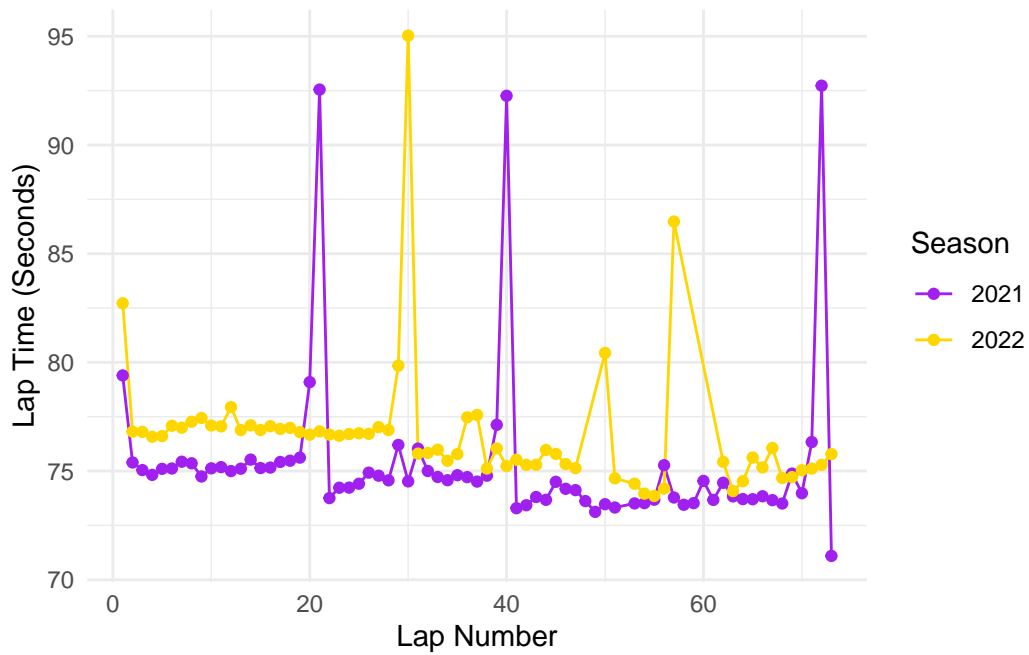


Figure 5: Lewis Hamilton Lap Times in the Netherlands - 2021 vs. 2022

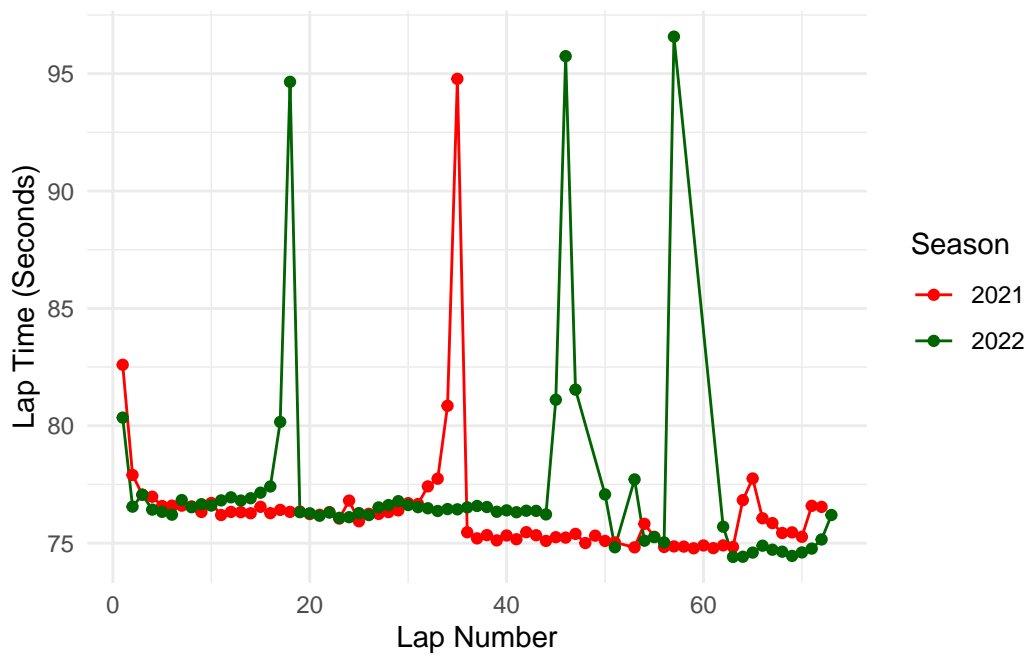


Figure 6: Charles Leclerc Lap Times in the Netherlands - 2021 vs. 2022