

**A Research Study on Formula One:  
Determining the Effectiveness of Drivers Based on Their Experience**

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## INTRODUCTION

As of August 2020, there were eight Formula One drivers without a firm contract to race in the 2020-2021 season, out of only twenty driver seats in what is the highest circuit of car racing worldwide. Every year, teams have to decide to sign a driver that is already racing in, or that was recently racing in Formula One, or bring up a new driver either out of Formula Two (the racing league directly one level below Formula One) or from another racing league (Balfour, 2020). Teams had to make a decision: go for the experience or gamble for young potential.

Despite being a sport with hundreds of millions of followers globally, and with billions of dollars in revenue and media spend, only twenty drivers compete at the Formula One level annually, with many dreaming of becoming one of the selected few (Gough, 2020; Lange, 2020). In 70 years of history, there have been less than 800 Formula One drivers, with less than 120 drivers having raced over the last 20 years. Of these 800 drivers, only 33 have ever won a championship, and only 76 drivers (less than 10% of the total) have won 2 races or more in the 1,035 races since its inception (Davies, 2020). Being a good driver is not enough. These drivers want to be the best. Over the past few years, there has been a surge of younger drivers in Formula One. Many of these young drivers have had some very good results. For example, Lewis Hamilton, the current champion, started in Formula One at 22 years of age and is now the driver with most races won ever (Donaldson, 2020). Teams are constantly evaluating whether to sign a new driver with the promise to be the next big thing or to sign an older, more experienced and proven driver, even if that person may not win a championship. Along with that decision, comes an economic decision as well, which is how much to pay that driver.

The null hypothesis to be proven or disproven through this research is that a rookie driver is a more efficient decision for teams versus hiring an experienced veteran.

## Literature Review

There are only a handful of research studies about Formula One, with studies focused on why certain drivers or teams are successful but have not focused on how signing a driver might affect the results of the team. For example, there have been multiple studies about who the greatest driver of all time is (Smedley, et al., 2020), how a driver and car perform in certain conditions (Marino, Aversa, Mesquita, & Anand, 2015), and if the performance of a team is affected by the transactions a team makes with its competitors (Aversa, Furnari, & Haefliger, 2015). This study fills an important gap in the research field by estimating the expected effectiveness (total points at the end of a season along with the salary earned that year) of a rookie driver compared to older and more experienced drivers based on historical and statistical analysis from contracts of prior young and experienced drivers, and their results on the races they competed in, for which there were no studies or white papers found.

This research analyzed the historical results of Formula One teams when they changed drivers to determine whether a rookie driver or a more experienced driver had greater effectiveness. This study aimed to figure out whether teams would be better suited for the future if they signed a rookie driver or if they signed an older driver based on statistical analysis of historical results over the past 15 years, and estimate mathematically the effectiveness of a given driver based on their experience.

As the sport and popularity of Formula One has evolved and grown, the regulations for the points system have changed drastically. From the year chosen as the starting point (2005), the points system awarded the first eight finishers, with the point distribution going from ten points for the number one driver, to one point for number eight, (Diepraam, 2019). The point system

then changed in 2010, with the first ten finishers awarded points, and the distribution ranging from twenty-five points for the race champion, to one point for the tenth position driver, and no points for drivers in places 11 to 20 on each race (Diepraam, 2019).

## **METHODS**

### **Design**

This study explores the effectiveness of a rookie driver when compared to more experienced drivers. The goal of the research is to figure out what a team's expected results would be if they hired a rookie driver compared to a more experienced driver. This is important because the results that a driver achieves may be worth millions of dollars for a team. For the purpose of this study, a rookie driver is considered a driver that is in his first five years in Formula One. An experienced driver has been racing in Formula One for at least six years with a maximum of 13 years. A veteran driver has been racing in Formula One for at least 14 years.

A single method study was conducted through a quantitative analysis of data using statistical tools across points won per season and salary earned by the drivers each year. The method used to gather data and conduct the research was the causal-comparative method (Salkind, 2010), and that same method was used to identify a causative relationship between the grouping variable (selected driver) of the study and the dependent variable (expected effectiveness) of the study (Mahehwari, 2018).

The data gathered for this research included initially the last twenty years of results (from 2000 to 2019), however, it had to be adjusted to the years 2005 to 2019, since the data for salaries per driver is practically non-existent before 2005, as teams traditionally do not disclose the terms of a contract.

Other variables besides the salary per driver per year included the number of years the driver had been racing in Formula One, the ending position of the driver each season, and the calculated variable was the points the driver accumulated in each race.

The study also captured the data of what team the driver had worked with each year, to identify when new contracts occurred during their career, and thus compare how effective the hiring practices of the teams had been over time.

### **Procedure**

In order to determine the effectiveness of a driver, the study analyzed the number of points per year achieved for each driver. As mentioned previously, Formula One has changed the point system several times during its history. To account for the changes in regulation during the period of the study, this research adopted the point system used since 2010, which required to re-calculate the points awarded to drivers during the years 2005-2010, and from 2010 to 2019. One additional clarification is that in 2019, the Formula One organizers started awarding one extra point per race to the driver with the fastest lap in each race. This research does not incorporate these additional potential points, since the data for the fastest lap of each race is only available after 2010, when the new methodology was implemented.

The results from 2005-2019 were obtained from a freely available online database (Vopani, 2020). This database is public domain, so the data has been used liberally. This database included the results for every race and every driver since Formula One races started and catalogs them under a unique id. Each race from every year has its own id; for example, the Australian Grand Prix of the 2007 season is given the race id of 36. The database was then filtered to only include the data necessary to conduct the study, and its information was used to determine additional pieces of information required for the analysis. In the excel database created to

analyze the results, each column contained a different data category while each row contained the specific data that corresponded to that column. The main database included seven columns of data, with each column having a different category, some of these were raw data from the online database, while others were calculated fields. These categories were as follows:

- A. Name of the driver – used as an identifier to track the effectiveness of a driver over time
- B. Number of years racing in Formula One – used to determine whether the driver is a rookie, an experienced driver, or a veteran, with the categorization for a driver changing over time as they gained experience
- C. Number of years racing with their team – to determine if the driver was in a new contract and how effective their performance was concerning the salary earned
- D. Year – to track the results for each year and be able to define the point system conversion required for each race
- E. Total points scored in that year for each driver– used to measure effectiveness for the driver (most points at a “reasonable” salary is most effective)
- F. Salary – used to calculate the effectiveness of the driver (measured as dollars per point won, or points achieved per season per dollar paid)
- G. Cost of a point per dollar (how much did each singular point won during a season for a driver ‘cost’ to their employing teams)

Each cell in the database included the data corresponding to the driver. The database was aggregated from individual races to a yearly total, as the data itself was provided at the race level, which meant aggregating twenty races per year for each driver. While most of the data was

already included on the online database, some information, such as years racing by driver, the number of years with each team, and the cost of a point per dollar had to be calculated.

The average number of points per year for each of the three categories (rookie, experienced, and veteran) of driver experience was calculated in aggregate for each group. These values gave an idea as to, on average, whether a rookie driver outscored an experienced driver, a veteran driver, or none of the above. The annual salary was not included on the Vopani online database and was gathered as reported by news outlets (Renken, 2020). The average of the salaries for the three different groups of driver experience was calculated. With this information, the column labeled as cost per point was quantified by dividing the total number of points a driver accumulated during a singular season and dividing that number by the salary the driver earned during that season. By calculating this data at the driver level first, and then aggregating for each of the three tenure groups, the cost per point metric allowed for a direct comparison between the three distinct categories of drivers: rookie, experienced, and veteran.

The variance of the points between the three groups was determined in order to compare the averages of the three categories of driver experience and determine how “scattered” the results were over time. This helped to look for consistency in the number of points scored by rookie drivers, experienced drivers, or veteran drivers.

The study then compared the variances between each group using a one-way analysis of variance test (ANOVA), which allowed for a statistical examination of the points scored by each individual driver sorted by the number of years they had been racing in Formula One.

In order to explore if a correlation existed between the number of points scored by drivers and their years of experience driving (which seemed plausible given that the average points increased based on the average years racing), a regression analysis was performed. This

statistical analysis compared the number of points of each driver with the number of years they have been racing to determine if a direct correlation existed, testing for both linear and binomial correlations.

### **Materials**

An Apple MacBook Air was used to acquire research and find the database used in the study. Microsoft Excel was used to filter and sort the data used in terms of the years from 2005-2019. The historical database from Kaggle was used as the data source used in the study (Vopani, 2020). A calculator was manually used to double-check calculations done in Microsoft Excel, given complex databases and formulae were utilized.

### **RESULTS**

Over the last 15 years, there have been 84 drivers in Formula One. On average, over that period a driver has achieved 86 points per season, with the top 25% of drivers achieving 136 points, compared with only 10 points for the bottom 25% of drivers.

The means and variances for the three groups of driver experience were calculated. Both the variance and the mean compared the points between each group. Rounded to the nearest tenth, rookie drivers had a mean of 52.4 points, experienced drivers had a mean of 145.1, and the veteran drivers had a mean of 58.2.

Rookie drivers scored a variance of 5782.9, experienced drivers scored 13,532.1, and veteran drivers scored 6074.7.



**Table 1***Mean and Variance of Points Scored*

Group	Mean	Variance
1-5 years racing	52.4	5,782.9
7-13 years racing	145.1	13,532.1
14+ years racing	58.1	6,074.7

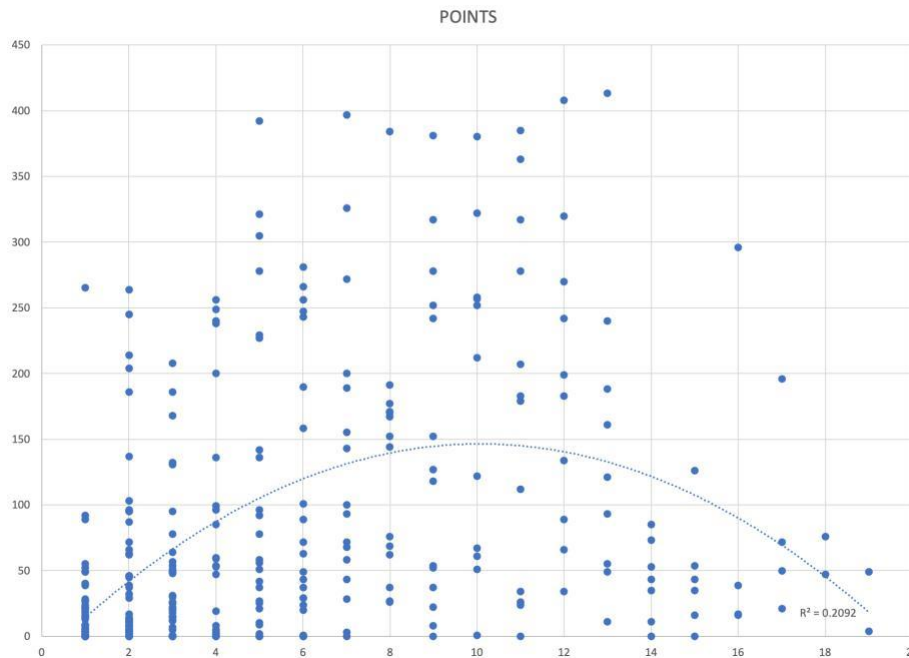
The analysis by groups proved insufficient to accept or reject the null hypothesis, which created the need to analyze results more exhaustively. Additional analyses were completed to understand the relevance of these groups, and the dispersion of the results: ANOVA, correlation, and segmented analysis within each group.

In order to compare the variances between the three groups, a one-way analysis of variance (ANOVA) was used to find the f-value, which measures the distance between a certain data point (points scored by one driver in a specific season) and the mean of the three groups. Rounded to the nearest hundredth, the f-value was calculated to be 34.79. Using this the p-value was computed. The p-value was then assessed to be 2.2E-14.

**Table 2***Analysis of Variance*

ANOVA: One-Way		
Source of Variation	F-value	P-value
Between Groups	34.78576	2.2E-14

A regression analysis was conducted to find the level of correlation between the number of points scored by a driver and the number of years that a driver has been racing. The scatterplot below (Figure 1) shows the results of that statistical analysis. In a regression analysis, a value known as the coefficient of determination ( $R^2$ ) is given. Rounded to the nearest hundredth, the coefficient of determination for this analysis was 0.21.

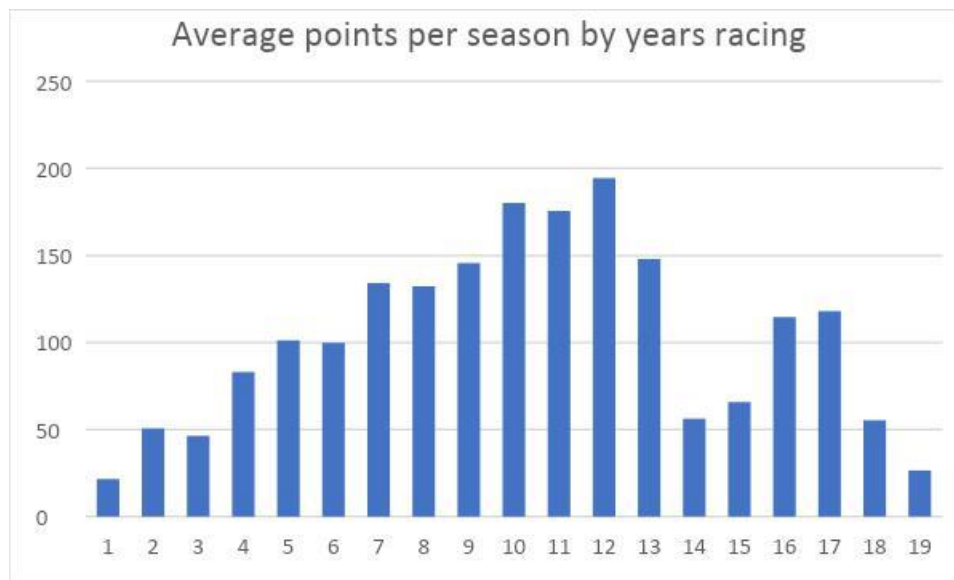


*Figure 1 – Points earned per season for each driver based on their years of experience from 2005 to 2019*

The final analysis conducted consisted of comparing the results for segments of drivers within each group (rookie, experienced, veterans), to identify whether pockets of opportunity existed within the groups that would support a modified null hypothesis. This analysis showed that in 30% of the cases, a rookie driver would be more efficient than an experienced driver. The results were twice as large in the case of veterans, where 62% of these drivers over the last 15 years performed the same or worse than an average rookie driver.

## DISCUSSION

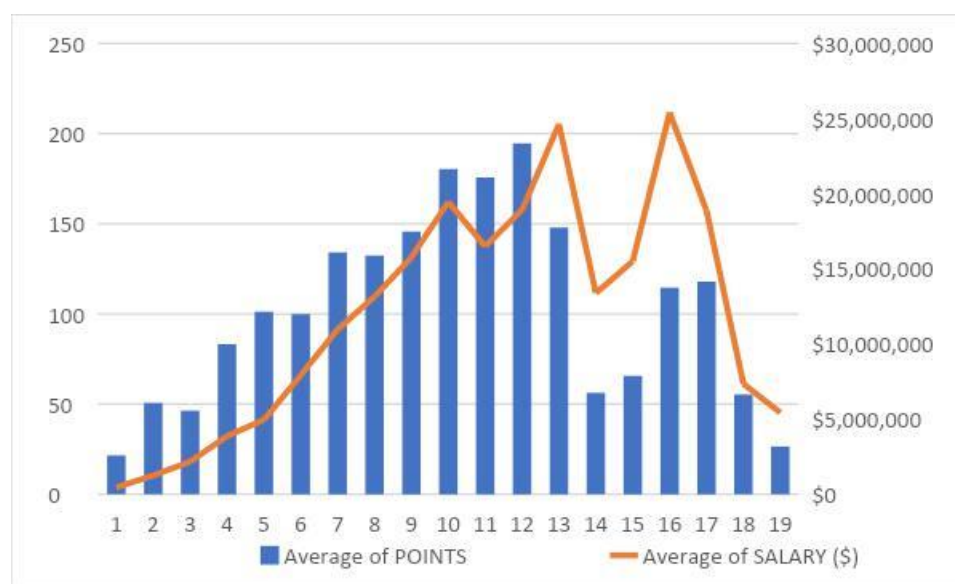
On average, Formula One drivers achieve more points based on the number of years they have been racing (Figure 2), with the average increasing each year for their first 10 years in their career, averaging 180 points by their 10<sup>th</sup> year. Past their 12<sup>th</sup> year, the average points for experienced drivers begin to decrease, with averages dropping significantly in years 14 and 15 to levels even below drivers in their 4<sup>th</sup> year. There are only a handful of drivers that remain racing past their 15<sup>th</sup> year, those that do achieve, on average, more points per season in their 16<sup>th</sup> and 17<sup>th</sup> years. The points of these drivers then decrease again past that point. Although drivers with these large sums of years racing in Formula One are not necessarily old, of course, their regression is to be expected as it has been proven that at a certain age, the reaction time of people will slow down (Tun & Lachman, 2008).



*Figure 2 – Average points earned per season based on driver's years of experience*

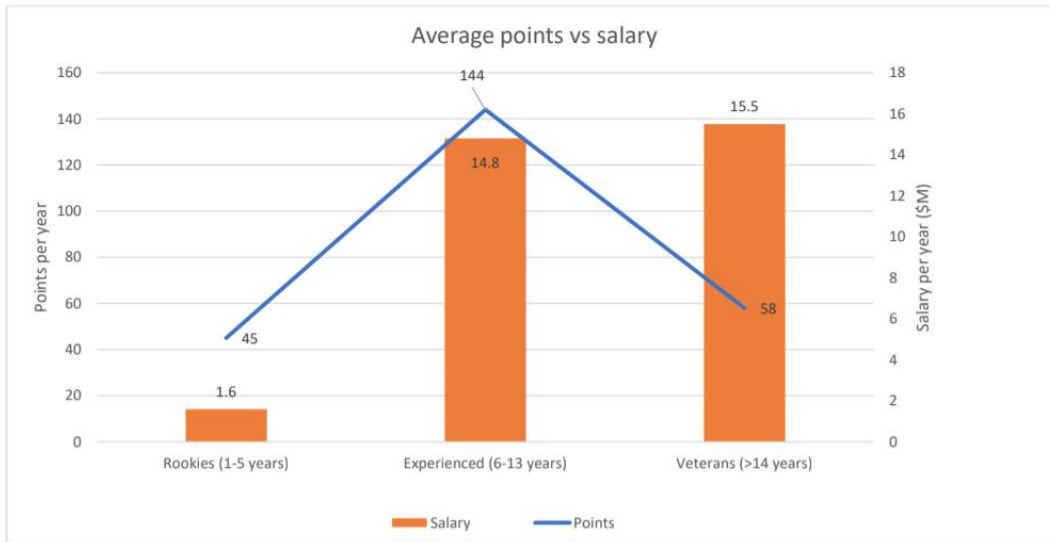
Average salary per year also increases with driver experience, as shown in Figure 3. The salary past a driver's 12<sup>th</sup> year, however, does not decline at the same rate that the average points

decline, with drivers in their 15<sup>th</sup> and 16<sup>th</sup> years averaging a salary as large as drivers in their 13<sup>th</sup> year which is the year that, on average, follows the year with the greatest number of points achieved. The increase in salary in the 15<sup>th</sup> and 16<sup>th</sup> years can be attributed to the fact that the majority of these drivers have experienced success throughout their lengthy careers and are likely previous Formula One world champions (Balfour, 2014). For example, Fernando Alonso, a two-time Formula One world champion in his 19<sup>th</sup> year racing in Formula One, recently signed a one-year contract worth 20 million dollars, the third-highest salary for the 2021 season.



*Figure 3 – Average points earned per season and average salary by driver's years of experience*

After understanding the extent to which points and salary increase with driver's experience over time, the results were grouped by category of experience, as rookies, experienced, and veterans drivers. In Figure 4, the orange bars represent the average salary for each group of drivers in millions of dollars and the blue line represents the average points scored by that group of drivers over the fifteen years.

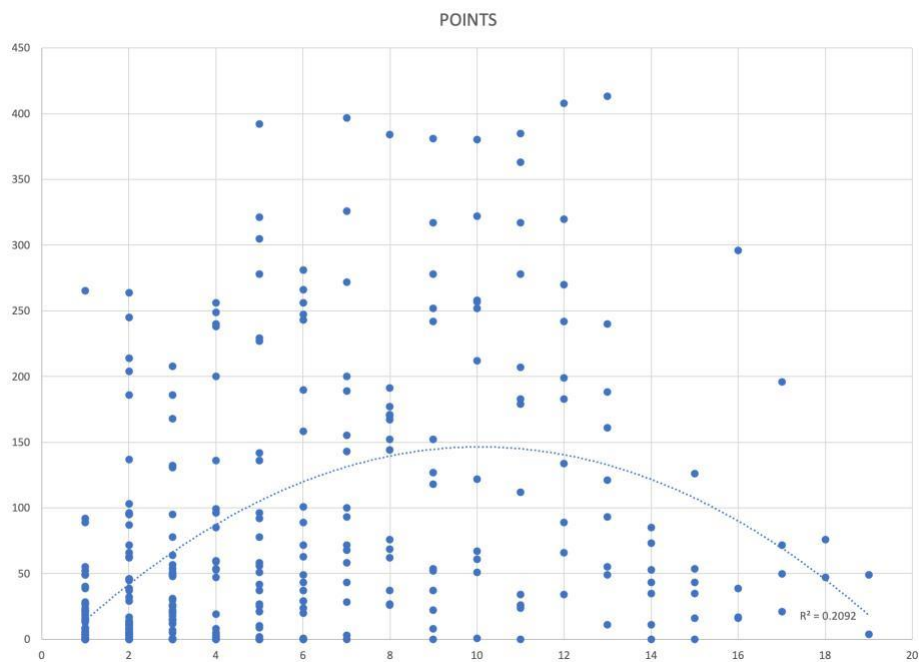


*Figure 4 – Average salary and points earned per season by groups of drivers based on their years of experience*

The fact that the average points for experienced drivers is over three times as large as the average points for rookies, would reject the null hypothesis for this research. The result is not as clear, however, for veteran drivers. In addition, it can be seen that there is a significant difference in the average salaries for rookie drivers versus those with more experience. For example, the annual salary of veteran drivers is ~10 times that of rookie drivers per year (\$15.5M vs \$1.6M), and these drivers' average points is merely 25% higher than those of rookie drivers (58 vs 45 average points per year), raising the question whether those veterans are worth the salary they are perceiving when compared to a rookie driver.

By analyzing results beyond simply averages, and looking at individual driver performance, an even more scattered picture is present, with a significant variation on points achieved for drivers with the same level of experience. Figure 5 shows that there is a large variation in points for drivers at different years of experience. For example, rookies in their second year of experience achieve anything from zero to over 250 points per season.

Experienced drivers show an even larger spread, as evidenced by the almost twice as large variance observed before for this group. As an example, drivers in their 9<sup>th</sup> year achieved from zero points to over 350 over the past 15 years. The variation for veterans decreases somewhat and as suggested by the variance calculation, it is somewhat similar to that of the rookies. In the case of drivers with 15 years of experience, their range goes from zero to almost 200 points. All three groups of driver experience (rookie, experienced, and veterans) have drivers that score more points and also drivers that don't score any point at all during an entire season.



*Figure 5 – Points earned per season by individual drivers based on their years of experience driving*

As seen in the top right corner of the chart, the coefficient of determination is given, with a rounded value of  $R^2 = 0.21$ . In this scenario, the coefficient of determination analyzes the predictability of estimating the number of points that a driver with a certain number of years racing will have. With a value of 0.21, the coefficient of determination allows the conclusion that

there is a little to no chance of predicting how many points a driver will have based only on their years of experience, which supports the null hypothesis for this research.

The analysis of variance (ANOVA) shown previously in Table 2 provided two crucial values, relevant to study the three groups in comparison with each other: the f-value and the p-value. The f-value was found by performing an f-test on the three groups. Ideally, a smaller f-value (close to a ratio of 1.0) would prove the null hypothesis true. Thus, the f-value of 34.79 proves that the variance between the three groups is much larger than the expected value. When dealing with the p-value, the same principle applies. However, even though the p-value in this study is 2.2E-14, this is only calculating the probability of accurately being able to estimate how many points a driver will have in their next season. This means that it is very hard for teams to predict how well a driver will do based only on the group of experience it belongs to, also supporting the null hypothesis.

Figure 6 shows that there are opportunities for teams to make more efficient decisions in terms of their drivers. The green box illustrates a positive opportunity, as these drivers are being paid a rookie salary and are scoring well above the average for a rookie driver. The data shows that over the last 15 years, there is a significantly large amount of experienced and veteran drivers that have achieved results that are the same or worse (illustrated by the red boxes on the chart) than the results of rookie drivers. These experienced and veteran drivers are being paid significantly more than rookie drivers, but are also scoring either well below the average for their group for experienced drivers, or not better than rookies in the case of veterans, partially supporting the null hypothesis that a rookie driver can be more effective than an experienced driver, but only in some cases.



*Figure 6 – Identification of areas of opportunity for teams at different driver tenures*

To calculate the extent of this opportunity, and measure the potential salary savings from making a more efficient decision, results were analyzed further within each group of drivers, to test a modified null hypothesis, expressed as “rookie drivers are a more efficient decision for Formula One teams versus a meaningful portion of experienced drivers and versus a large portion of veteran drivers”. In Figure 7, there are several measures of evaluation comparing experienced and veteran drivers to rookies. There are two columns with data for both the experienced and veteran drivers; the one on the left represents salary and the one on the right shows points earned. There are four color-coded differentiators within each group: significantly better than rookies, a bit better than rookies, approximately the same as rookies, and less than



rookies. Since the average points scored for rookie drivers is 48, when comparing experienced drivers, significantly better translates to 100 points or more scored (more than twice better performance), a bit better than rookies translates to 61-99 points scored, approximately the same translates to 50-60 points scored, and less than rookies translates to below 50 points scored. The same distinction is used when comparing veteran drivers.

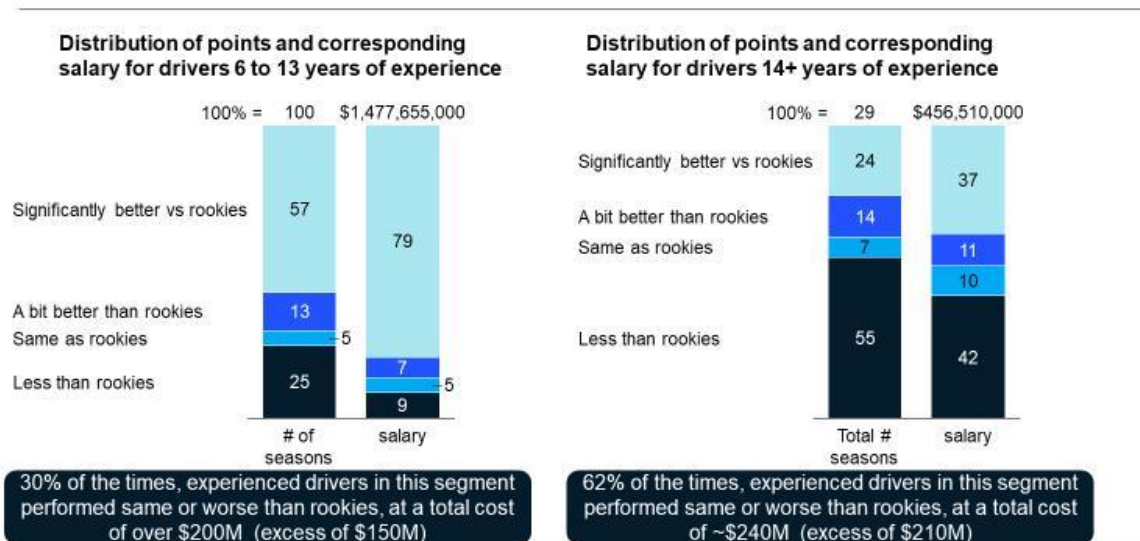
Starting with the salary column for experienced drivers, it can be seen that 79% of the total salary paid to that group of drivers over the 15 years of analysis was given to the experienced drivers that performed significantly better than rookie drivers, which supports the notion that these drivers are earning their keep. 7% of the total salary was given to experienced drivers that performed slightly better than rookie drivers, and 14% was given to experienced drivers that performed the same or worse than rookie drivers. The same logic is applied to the veteran drivers when comparing the distribution of their salaries.

The implication is that teams have overpaid some of these drivers significantly, leading to more efficient decision-making opportunities. By calculating the salaries paid to these experienced and veteran drivers during those years, and comparing them to the salaries paid to rookie drivers that are achieving the same or better results, the study shows that teams have overpaid experienced and veteran drivers by around 360 million dollars, as a rookie would have achieved similar results, which will be detailed as follows. Over the last 15 years, for experienced drivers with 6 to 13 years, 25% of their seasons were worse than an average rookie driver, and an additional 5% of seasons their results were the same, for a total of 30% of the times that experienced drivers performed the same or worse than an average rookie. For veteran drivers, the differences are even more glaring, with their results being worse than that of an average rookie driver 55% of the time, and an additional 7% of the time where their results are

approximately the same, for a total of 62% of the time that a veteran driver performed the same or worse than an average rookie.

By adding up the salaries that these experienced and veteran drivers earned during those seasons, and comparing the total of those salaries versus the amount that average rookies would have earned during those same seasons, it is estimated that teams spent an incremental 360 million dollars during those seasons by hiring an underperforming experienced or veteran driver instead of a rookie.

### Comparison of salary and points for drivers of different level of experience



*Figure 7 – Comparison of points and salary earned for subgroups of experienced and veteran drivers versus rookie drivers*

In summary, when comparing the cost per point for drivers, we can see that there is an opportunity to replace 25% of experienced drivers in years 6-13, and over 60% of drivers with 14+ years of experience with rookies, as they would be expected to perform at similar point levels at much lower cost, providing teams the opportunity to create more competition for the

coveted Formula One driver position, and saving in aggregate 360 million dollars, an equivalent of 24 million dollars per year.

In conclusion, this research study has proven that while on average, experienced drivers are more effective performers (more points despite higher salaries) than rookie drivers, there is a significant opportunity where rookies outperform 30% of experienced drivers, and 62% of veteran drivers, creating room for more competition in the Formula One circuit.

### **Limitations**

As with all research studies, there are limitations, enumerated below:

One possible limitation may be the relatively small sample size when comparing the past 15 years to the entire 71 year-long history of Formula One. The reduced sample size was due to the salary of drivers not available before 2005, as this was closely guarded confidential information. This obstacle occurred mainly because there was less media around the sport of Formula One, so no one kept track of the salaries. This potential limitation, however, is relatively minor, as the salaries of Formula One drivers have skyrocketed only during the last 15 years. This increase in salary makes these latest years of Formula One the most valuable, as the cost per point for each driver shows a better reflection of their performance. In addition, a side analysis was conducted to analyze rookie versus experienced performance in prior years, with similar results as observed in this analysis (higher performance for more experienced drivers in the average, with significant variation in performance across tenure groups). One interesting fact is that prior to 2005, drivers had longer tenures driving, highlighting the fact that Formula One teams have been acting in the lines of this study, by hiring more rookie drivers and limiting the tenure for veterans.

Some drivers have gap years in between their Formula One racing careers, either due to a short retirement or being replaced by another driver. This study accounted for this by not counting the years they were missing from Formula One as part of their Formula One careers (years racing). Hence, a driver that competed in Formula One for three seasons, left for two years to race elsewhere, and then came back, would count in the analysis for his fourth season, which is believed to be a fair representation, as competition outside of Formula One is generally accepted as of less caliber.

Historically, some team owners have hired their relatives as their driver. This may have influenced the driver to feel safe about not having to perform on the race track since they have a relative (or even themselves in some cases) as their employer. For this study, this particular effect is relevant only for rookie drivers, as most of these familial drivers only compete for one or two seasons, bringing down the rookie driver average performance (this handful of drivers scored none or very few points) which would highlight a higher potential performance for deserving rookies and increased their true efficiency as compared to experienced or veteran ones.

Another limitation of this study is that there was no measure from any emotional or personal aspect on a driver's performance. For example, in 2009, Lewis Hamilton, the most accomplished driver in Formula One history, broke up with his four-year girlfriend. This year was the statistically worst year of Hamilton's career.

Many studies have focused on the quality of the car as one of the most important criteria for a team's performance in Formula One. This study excludes the car quality / relative performance from its analysis. When analyzing driver careers for the duration of the study, it is seen that drivers change teams a significant amount of times during their careers. For example, the current champion (and seven-time champion during his career), Hamilton, has driven for four

different teams, winning championships with three of them. A similar situation is observed with the majority of drivers in the current championship season (as stated at the beginning of this white paper, eight of the current drivers changed teams for the 2021 season), making this point about the car quality less relevant for this study, and strengthens the hypothesis that focusing a significant level of attention on the driver is one of the most important decisions a team can make, in parallel with improving the car quality.

Finally, the rationale for teams to choose a certain driver may have to do with factors outside of earning points, for example hiring a charismatic driver to bring popularity to their brand, or as an image icon. This is a limitation from this analysis, which given recent hiring decisions, may impact more for veteran drivers, who are former champions at the sunset of their careers, and may represent for their teams a way to gather followers not based on winning but on their driver image.

## **CONCLUSION**

This research set out to prove or disprove the null hypothesis that a rookie driver is a more efficient decision for teams versus hiring an experienced veteran. Initial analyses showed that points earned by drivers do increase with experience, with the highest average in years of experience in between years 10 to 12 of experience. While in most cases, an experienced driver (6-13 years racing) will statistically be the most effective driver out of the three groups, there are many instances where those drivers underperform.

A more thorough analysis demonstrated that a partially modified null hypothesis can be accepted, as some rookie drivers are a more efficient decision versus 30% of the experienced drivers, and versus 62% of the veteran drivers. Over the last 15 years, these decisions represented

an excess in cost for teams adding up to 360 million dollars, or 24 million dollars per year, over what teams would have spent on rookie drivers during that period. By comparing results at the driver level, and proactively identifying promising rookies, Formula One teams can make more efficient decisions when selecting their next driver.

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