(Not) Pedal to the Medal: A Paradox of Conservative Driving on the Road to the NASCAR Playoffs

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October 2024

1 Introduction

The National Association for Stock Car Auto Racing (NASCAR), is the United States' most popular motorsports league, and the second most popular motorsports league in the world behind Formula One. Today, NASCAR races attract between three and four million television viewers, in addition to well over 100,000 in person attendees for many of the races. NASCAR races take place across the country in venues ranging from half-mile dirt tracks, to monumental superspeedways, to non-oval road courses, and everything in between. The shortest NASCAR races are under 100 miles, while the longest in modern racing is the Coca-Cola 600, clocking in at a whopping 600 miles, typically requiring over 5 hours to complete. Suffice it to say, the NASCAR season is full of variety and puts drivers to the test against a multitude of challenges.

Before the 2004 season (a season generally runs from February through November), the NASCAR championship title was awarded based on a system of point accumulation through the entire season. In an effort to shore up falling viewership, NASCAR introduced a regular season and playoff structure in 2004, hoping to add excitement for viewers and eliminate the possibility of a small cohort of drivers running away with the lead early on in the season. The playoff structure was adapted until reaching its current form in the 2014 season. The rules are as follows.

The NASCAR season is broken up into 36 races, where each race is broken up into 3 stages (not necessarily of equal length). The first 26 constitute the regular season, and the remaining 10 constitute the playoffs. The playoffs consist of four rounds: the round of 16 (playoff races 1-3/season races 27-29), round of 12 (races 4-6), round of 8 races (7-9), and the Championship 4 (race 10/season race 36). At the end of each playoff round the four drivers with the fewest playoff points are eliminated. The driver with the most playoff points at the end of the 10th playoff race wins the Championship title. I will not say more about the nuances of the playoffs as the focus of this paper will be on the regular season, although I will return to the importance of playoff points shortly.

How do drivers qualify for the playoffs? NASCAR has a rule known as the "win-and-you're-in" rule: if a driver wins a regular season race, he or she automatically clinches a spot in the playoff. As indicated above, the playoffs are capped at 16 drivers yet there are 26 regular season races. If more than 16 drivers win races in the regular season, there is a system to determine which drivers will advance. However, importantly, there have never been more than 16 unique drivers to win races in the regular season since the NASCAR playoffs were introduced in 2004. In fact, most seasons see only 14 or 15 unique regular season winners. As such, henceforth, I will take the "win-and-you're-in" rule at face value; if a driver wins a regular season contest, they clinch a playoff berth.

The final rule that the reader must know is that playoff points can be accumulated throughout the regular season. Each race win nets a driver five playoff points, while a stage win within each race awards an additional playoff point. So, even if a driver qualifies for the playoffs with an early-season race win, there's still incentive to continue performing well. Additional playoff points are also awarded to the top 10 regular season drivers with 15 playoff points to the regular season champion. If a driver does not qualify for the playoffs, his playoff points are voided. To make this concrete, suppose a driver wins the regular season championship (15 playoff points), 3 regular season races (5 playoff points per race times 3 races, for 15 playoff points) and 6 stage wins (1 playoff point per stage win times 6 stage wins, for 6 playoff points) the driver enters the playoffs with an additional 36 playoff points that will aid him in his pursuit of advancement through the playoff rounds.

This paper will focus on the two-sided effect on driver behavior of NASCAR's "win-and-you're-in" rule. First, I will analyze the difference in driving behavior before and after a driver successfully clinches a playoff spot. Does he relax from the security in his achievement, become more aggressive in pursuit of the all-valuable playoff points, or just maintain his current behaviors? Then, I will turn to the difference in driving behavior for drivers that have not yet successfully clinched a playoff spot to understand how their driving behavior changes as the number of remaining playoff spots fall. Do they indeed become more aggressive as their chances of clinching a playoff spot dwindle?

The paper will proceed as follows. I will now conduct a (very) brief review of the relevant literature. Then I will discuss the data. Afterwards, I will discuss the estimation techniques and results on driving behavior for both groups discussed above; before vs. after clinching a playoff spot, and for those who have yet to clinch a spot as available playoff spots dwindle. Robustness checks will then be described. Finally, I will conclude with a brief discussion.

2 Literature

So far as I can tell, this is the first and only paper to analyze the behavior of NASCAR drivers in relation to their playoff contention. However, there are three categories of related literature that merit discussion. I will discuss them in turn, from least closely related to most closely related: literature that discusses the impacts of NASCAR on the broader economy, tournament theory literature that analyzes the NASCAR prize and incentive structure (the majority of NASCAR related economics literature), and finally a small group of more closely related papers on how clinching playoff spots changes sporting strategy.

NASCAR host cities are keen on reporting on the supposed economic value of NASCAR races. The state of North Carolina, typically home to two NASCAR races each season, claims that NASCAR's presence over these two weekends increases the state's economy by $42 million and supports 600 jobs (Cite). Chicago, a new NASCAR host city, finds that its now-annual street race brings in $109 million to the city each summer (Cite). While these numbers may well be true, and are often touted by local governments, the economics literature is less certain about their positive tone. The evidence appears to be quite mixed, generally suggesting that the true economic benefits may not outweigh the costs (Coates and Gearhart 2007), or at least may offer the most benefit to rural areas (Bernthal and Regan 2004).

The bulk of the literature related to NASCAR is concerned with the incentive structure. Two foundational papers identify that higher prizes cause drivers to be more aggressive, as measured by their average speed in a race (Becker and Huselid (1992) and Frick, Bernd & Humphreys, Brad, 2011). Additionally, the literature is concerned with NASCAR's nonlinear incentive structure; prize money is not rewarded as a linear function of, say number wins. This rank-order winner-take-all system was revealed to be inefficient with respect to performance (von Allmen 2001, Depken and Wilson 2004) and also causes excessively aggressive behavior. The need to maintain sponsorship adds an additional layer of complexity to the incentive structure, further exacerbating the inefficiencies of the highly non-linear incentive system (von Allmen 2001, Groothuis et. al 2011) by enticing drivers to maximize TV coverage time.

The most relevant section of the literature are those papers in sports economics that show how sporting behaviors change after clinching, or failing to clinch, a playoff spot. There is evidence from the National Basketball Association that teams will choose to rest their star players more after securing a playoff spot (Reilly et. al. 2023). Also in the NBA, as well as the NHL, draft incentives are such that if a team fails to qualify for the playoffs, they might strategically try to lose games to improve their draft selection number. There is robust evidence that teams do engage in this "losing to win" strategy (Taylor and Trogdon 2002, Fornwagner 2019).

This paper is the first in the literature to discuss how NASCAR's post-2014 playoff structure changes driver incentives as they either clinch a spot or face fewer and fewer remaining berths; in fact, almost all of the literature on NASCAR was published before any playoff system was introduced, so this analysis is overdue. With the availability of more detailed race data, this paper also moves beyond the literature's previously standard way of defining driver aggressiveness – average speed – and instead considers a more holistic set of strategic observables to describe driver behavior. I hope that this paper will reopen the conversation on NASCAR's driver incentive structure, and will spark further discussion about how clinching playoff spots affects all sorts of strategic decisions across many sports.

3 Data

NASCAR collects various types of data for each race. The most complete picture is offered by the loop data statistics which are electronically and automatically recorded by NASCAR, and made publicly available. Definitions and summary data of the relevant variables from the loop data statistics are offered in Tables **??** and **??**, respectively. I will use these statistics as proxies for driver aggression. The interpretations are quite straightforward. For example, a driver who improves his "best" position (or lowering his "worst" position) is being more aggressive by pushing towards the front of the pack (or staying out of the back). Similarly, a driver is displaying more aggressive driving if their quality passes, number of laps in the top 15, number of laps led, or number of laps with the fastest lap speed increase. These are all hard to achieve, and require more aggression. They also increase a driver's risk.

In order to compare across races, for each race, I rank all drivers on all of the statistics in Tables **??** and **??** from most aggressive (1) to least aggressive (40). There are typically 40 drivers in a race. Some statistics already appear in ordinal form, such as start, best, worse, finish and average positions. As an example, for statistics not already in ordinal form such as laps led, the driver who led the most laps is ranked 1 and the driver who led the least is ranked 40. This allows me to examine a driver's relative performance across races in comparison to the rest of the field of competitors. To make the importance of this conversion from continuous to ordinal concrete, consider a driver who leads 44 laps (or 23% of total laps) one weekend and 145 (36% of total laps) the next, as Chase Elliot did at Talladega and Dover in 2019. In both cases he was the most aggressive with regard to lap leading. These two observations will be discussed as equally aggressive on the lap leading metric; his lap leading ranking is 1 in both cases.

Necessarily, I also collect individual track data and race data available on official NASCAR platforms which describe the characteristics of a given track (style, pavement status, and loop distance) and the details of specific race runnings (date, lap requirements).

Since this paper is concerned with incentives during the regular season, I only consider the first 26 races of the 2019 through 2024 seasons. I have data for all 26 races per season for a total of 156 total races ranging from the 2019 season opener at Daytona on February 17th through the final regular season race in 2024 on September 8th at the Atlanta Motor Speedway. All of the races included in this analysis are listed in Table **??** with their date, track, track characteristics, and ex-ante mileage.

Table 1: Definitions of Metrics

Metric	**Definition**
Start	The position in which a driver qualifies to start a race. Fastest qualifier starts in position 1.
Worst	The worst position a driver finds himself in during the running of a race.
Best	The best position a driver finds himself in during the running of a race.
Avg	The average position of a driver during a race.
Finish	The finishing position of a driver at the end of a race.
Mid	The position of the driver at the midpoint of a race.
Top 15 Laps	The number of laps in which the driver's position was in the top 15 during a race.
Fastest Lap	The number of laps in which the driver drove the fastest lap (irrespective of position).
Laps Led	The number of laps in which the driver's position was 1 during a race.
Accident	A dummy variable for whether the driver was involved in an accident in the race.
Quality Passes	The number of times a driver passed another driver, where the latter driver was in the top 15, under green flag.
Green Flag Passes	The number of times a driver passed another driver under green flag conditions.
Green Flag Times Passed	The number of times a driver was passed by another driver under green flag conditions.
Green Flag Passing Diff	Green flag passes minus green flag times passed.

Table 2: Summary Statistics of Metrics

Metric	Min	Max	Median	Mean	SD
Start	1	40	19	19.44	10.96
Worst	1	40	32	31.03	6.22
Best	1	39	3	6.95	8.18
Avg	1	40	18	19.43	9.09
Finish	1	40	19	19.44	10.96
Mid	1	40	19	19.44	10.96
Top 15 Laps	0	500	58	100.38	112.53
Fastest Lap	0	133	1	5.51	10.71
Laps Led	0	446	0	6.69	23.95
Accident	0	1	0	0.1	0.3
Quality Passes	0	398	21	36.38	50.88
Green Flag Passes	1	568	76	93.96	82.81
Green Flag Times Passed	0	582	76	93.98	82.08
Green Flag Passing Diff	-85	76	0	-0.02	16.31

4 Resting or Revving: Post-Clinch Behavior

4.1 Theory

For the first 26 races of a NASCAR Cup Series season, the drivers share one goal: secure a spot in the playoffs. But, once a driver wins a race and securing a playoff berth is in the rearview mirror, the driver can then turn his focus to the ultimate goal: becoming the Cup Series champion. As discussed above, one helpful way to do this is to acquire playoff points by winning more in the regular season.

It stands to reason that a driver will become more risk-loving once he has secured his playoff spot. Why? The costs of risk taking have fallen, and the benefits have risen. Consider the following:

A driver is entering the fifteenth race of the regular season. He has not yet clinched a playoff spot. His first goal is to get into the playoffs. In order to do this, he must win a race. He only has twelve chances left to do so. If he displays too much aggression and consequently makes a costly mistake (assuming aggression is positively correlated with necessitated effort), he might end up at the back of the field or even knocked out of contention for that race, leaving him now with only 11 opportunities remaining. This is bad. Rationality suggests that a driver who is not yet in the playoffs is, yes, optimizing his behavior to win, but also racing somewhat conservatively so as to not face dire consequences that will undercut his chances of securing a playoff spot.

Compare this to a driver entering the fifteenth race of the regular season having just won the previous race and thus holding a berth in the playoffs. He no longer needs to win, in the same way that the driver in the previous paragraph had to. He would still like to win – setting aside sponsorship, career, and ego, he can acquire valuable playoff points from additional regular season wins – but can also, more than the previous paragraph's driver, afford to lose. This lower cost of losing enables him to take more risks and drive more aggressively; if he can win playoff points, that's great, but if in pursuit of them he messes up, it's not nearly as big of a deal. So, this driver ought to be more aggressive than before in pursuit of playoff points. Additionally, he may wish to practice for the playoffs where the level of competition will increase. Either way, this driver who had good reason to drive more conservatively while attempting to secure a spot in the playoffs during races 1-14, should now put the pedal to the metal.

Some might challenge this theory. Isn't it possible that after clinching a spot a driver would just like to relax and bide his time until the playoffs? Hopefully it is obvious by now that playoff points are far too valuable later on for this to be the case. Skeptics might push further and argue that a driver who has clinched a spot will behave less aggressively to avoid injury. After all, what's the point of acquiring playoff points if you'll be dead or facing a season ending injury by the time the playoffs roll around. These skeptics are unaware of the incredible safety of a NASCAR driver. The most common injury in NASCAR is carpal tunnel syndrome (cite). Let that sink in. The last time a NASCAR driver died from a race-related event was in 2001 when Dale Earnhardt was killed on the last lap of the Daytona 500.

Suffice it to say, the results below will show that drivers will, in fact, become more aggressive after clinching a playoff spot. Big time.

4.2 Estimation and Results

In order to estimate the effects of clinching a playoff spot on driving behavior, I regress rankings of various metrics of aggression, $Y_{i,n,t}$, on a dummy variable $CLINCH_{i,n,t}$, which takes the value zero if driver i starts race n in year t without having secured a playoff spot and one if driver i has clinched a playoff spot before starting race n. I additionally control for driver (Δ_i), track ($\tau_{n,t}$), race number ($\nu_{n,t}$), and planned/ex-ante race mileage ($\mu_{n,t}$). $\epsilon_{i,n,t}$ is the error term. This specification is as follows:

$$\begin{aligned} Y_{i,n,t} = &\alpha + \beta_1 CLINCH_{i,n,t} + \\ &\Delta_i + \tau_{n,t} + \nu_{n,t} + \mu_{n,t} + \epsilon_{i,n,t} \end{aligned} \tag{1}$$

The results of estimating this equation across 14 different metrics' rankings are shown below in Tables 3, 4 and 5. The first thing for the reader to observe are the significant negative coefficients β_1 for 10 of the 14 aggression metric rankings. These coefficients are to be interpreted as follows: after a driver clinches a playoff spot, his ranking on metric $Y_{i,n,t}$ will change by β_1. If it is negative, his ranking is improving, signaling greater aggression. If it is positive, he is driving more conservatively after clinching the spot.

Table 3: Regression Results 1A

	Dependent variable:					
	start	worst	best	finish	avg	mid
	(1)	(2)	(3)	(4)	(5)	(6)
Clinch	-2.933^{***}	-0.521^{**}	-0.797^{***}	-1.105^{***}	-1.115^{***}	-0.678^{*}
	t = −8.571	t = −2.415	t = −3.270	t = −2.783	t = −4.259	t = −1.833
Constant	19.770^{***}	34.524^{***}	3.798^{***}	18.204^{***}	19.053^{***}	19.299^{***}
	t = 11.675	t = 32.343	t = 3.148	t = 9.268	t = 14.997	t = 10.748
Driver FE	Yes	Yes	Yes	Yes	Yes	Yes
Track FE	Yes	Yes	Yes	Yes	Yes	Yes
Mileage FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,899	5,899	5,899	5,899	5,899	5,899
R^2	0.461	0.336	0.508	0.275	0.525	0.348
Adjusted R^2	0.446	0.317	0.494	0.255	0.512	0.331
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 4: Regression Results 1B

	Dependent variable:			
	Top 15 Laps Rank	Fastest Lap Rank	Laps Led Rank	Accident
	(7)	(8)	(9)	(10)
Clinch	-1.237^{***}	-1.778^{***}	-0.249^{*}	−0.005
	t = −3.929	t = −5.880	t = −1.802	t = −0.416
Constant	19.205^{***}	14.507^{***}	9.583^{***}	−0.024
	t = 12.330	t = 9.693	t = 14.010	t = −0.428
Driver FE	Yes	Yes	Yes	Yes
Track FE	Yes	Yes	Yes	Yes
Mileage FE	Yes	Yes	Yes	Yes
Observations	5,899	5,899	5,899	5,899
R^2	0.490	0.280	0.366	0.109
Adjusted R^2	0.476	0.261	0.349	0.085
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 5: Regression Results 1C

	Dependent variable:			
	Quality Passes Rank	GF Passes Rank	GF Times Passed Rank	GF Pass Diff Rank
	(11)	(12)	(13)	(14)
Clinch	-0.746^{**}	0.345	0.212	0.317
	t = −2.308	t = 0.846	t = 0.520	t = 0.710
Constant	18.000^{***}	17.705^{***}	19.278^{***}	16.841^{***}
	t = 11.258	t = 8.775	t = 9.565	t = 7.613
Driver FE	Yes	Yes	Yes	Yes
Track FE	Yes	Yes	Yes	Yes
Mileage FE	Yes	Yes	Yes	Yes
Observations	5,899	5,899	5,899	5,899
R^2	0.437	0.237	0.238	0.079
Adjusted R^2	0.421	0.216	0.218	0.054
Note:				*p<0.1; **p<0.05; ***p<0.01

Thus, these negative coefficients provide substantial support for the theory outlined above that clinching a spot leads to less conservative driving, or conversely, more aggressive behavior. The remaining 3 do not contradict the theory, they are simply statistically insignificant.

The reader should make a number of important observations about the magnitudes of the coefficients. Firstly, the most apparent behavior change after clinching a playoff spot is on the starting position. Starting positions in NASCAR are determined by qualifying laps that take place before the start of the race. The driver with the fastest qualifying lap starts at the front, the second fastest in second, and so forth. However, there is a risk with putting the pedal to the metal during qualifying; if you crash or break any rules, you are immediately relegated to start at the back of the field, which is very costly. Once a driver clinches a playoff spot, my estimation suggests that, all else equal, he qualifies three full positions better than he would've before clinching a spot, suggesting substantially more aggressive driving on the qualifying lap. This is substantiated by a similar behavioral change – faster laps – being exhibited during the race. A driver is expected to improve 2 positions in the ranking of the number of laps during which that driver ran the fastest lap.

Drivers also improve their running position during the race after clinching a playoff spot. All else equal, after clinching, drivers spend more laps running in the top 15 – improving their ranking by 1.25 – improve their best position during the race by almost 1, improve their finishing and average position by slightly more than 1, and their position at the race midpoint by .7. They also lead laps slightly more, although the statistical confidence is slightly lower here.

It is important to note, also, the behaviors in which drivers do not change after clinching a playoff spot. They do not pass more in the aggregate – although they do make more risky passes as described above – nor do they allow themselves to be passed any more or less than they would've before clinching a spot. These findings are, in fact, quite sensible. The total passing and times passed metrics mostly contain information about what happens in the back of the field due to the fact that a lot more passing happens in the back than in the front. This passing in the back is, definitionally, less risky than, say, passing in the top 15 (the cutoff NASCAR uses for "quality passes"). So, it is reasonable to suspect that these metrics would not change, as they are quite noisy proxies for aggressiveness, in a way that the quality passes metric, which does show a meaningful post-clinch change, is not.

I will now turn to the other group of drivers: those (yet) without a spot in the playoffs.

5 Playoff or Bust: Aggression on the Edge of Elimination

5.1 Theory

As I've alluded to earlier, one unique feature of the NASCAR playoff structure is that by just the second race in the regular season, the number of available playoff spots has already, definitionally, decreased. This provides an interesting setting to measure how aggressive behavior responds to changing stakes. The language of cost benefit analysis employed earlier will serve again here.

Consider two different drivers at two unique points in the season. The first driver is entering the second race without having clinched a playoff spot (meaning he was not the winner of the Daytona 500, the season opener). The latter is entering the 26th race – the final one of the regular season – without having clinched a playoff spot. For the first driver, he knows that there are 15 remaining spots and 25 remaining races in which to secure one. The latter driver, to state the obvious, is in a much more uncomfortable position. He has only one final chance to secure a playoff spot (footnote here about cor(spots left, race number) = .927) . In other words, the benefits of aggression for the first driver are relatively lower than those for the second driver, while the cost of not being aggressive is substantially higher for the second driver than the first. This is all to say that we would expect the second driver to drive much more aggressively than the first, in pursuit of the final spot.

More generally, I expect that as the number of available playoff spots diminishes as the season progresses, drivers who have not yet clinched a spot will become more and more aggressive. In particular, I expect that while going from, say 16 to 15 spots remaining should, all else equal, make a driver who has not yet clinched a spot more aggressive, the change from, say, three to two remaining spots should engender an even more substantial increase in aggressive driving. All spots are not created equal.

I will now describe two estimates of this effect. The first, more naive, simply tests whether decreasing playoff spots causes additional aggression in drivers that have not yet clinched a playoff spot (it does). The latter, quite a bit more nuanced and informative, breaks down changes in aggressive driving behavior amongst those who have yet to clinch a spot by number of spots left, allowing for heterogeneity across different numbers of remaining playoff positions. Allowing for this heterogeneity, unsurprisingly, turns out to be important.

5.2 Estimation and Results

5.2.1 No Heterogeneity

First I create a new variable, $SPOTS\_LEFT$, which is defined at the beginning of race n in season t as 16 minus the number of unique winners in season t in races 1 through $n-1$ (all previous races, i.e. non-inclusive). To test whether decreasing playoff spots left causes additional aggression in drivers that have not yet clinched a playoff spot, I estimate the following equation:

$$\begin{aligned} Y_{i,n,t} =& \alpha + \gamma_1[(1 - CLINCH_{i,n,t}) * SPOTS\_LEFT_{n,t}] + \\ & \Delta_i + \tau_{n,t} + \nu_{n,t} + \mu_{n,t} + \epsilon_{i,n,t} \end{aligned} \tag{2}$$

This equation is quite similar to equation 1, just with a new independent variable of interest. By multiplying the number of playoff spots left by $(1 - clinch)$, I can isolate the effect of the decreasing playoff spots specifically on the driving behavior of drivers who have, as of the end of race $n-1$, failed to clinch a playoff spot (such that $CLINCH = 0$). Importantly, the γ_1 coefficient should be interpreted as the marginal effect of an additional available playoff spot on outcome measure Y. Note that a positive and significant γ_1 estimate corresponds with greater aggression as the number of playoff spots decrease.

The results of estimating Equation (2) are shown below in Tables 6, 7, and 8. The reader should notice many similarities to the results described in Part IV. All coefficients carry the expected positive sign, and are significant, with the exception of the same variables from Part IV that are poor proxies for aggression. Table 9 shows, in increasing order, how many remaining playoff spots must be lost for a driver who has yet to clinch a playoff spot to improve his ranking in that metric by one full spot. This table should be read as follows: after the loss of 3 available slots, the driver will improve his qualifying position by 1, after the loss of 4 available spots the driver will improve his fastest lap ranking by 1, and after the loss of 7 available spots the driver will improve his top 15 laps ranking by 1. Of course, as previewed above, the downfall with this measurement is that it assumes that, say, going from 16 to 9 (a difference of 7) remaining playoff spots will cause the same 1 rank improvement in top 15 laps ranking as, say, going from 9 to 2 (also a difference of 7) remaining playoff spots. This should be cause for concern.

Table 6: Regression Results 2A

	Dependent variable:					
	start	worst	best	finish	avg	mid
	(1)	(2)	(3)	(4)	(5)	(6)
Clinch	0.304^{***}	0.067^{***}	0.144^{***}	0.167^{***}	0.151^{***}	0.118^{***}
	t = 7.542	t = 2.631	t = 5.027	t = 3.577	t = 4.824	t = 2.671
Constant	15.979^{***}	33.668^{***}	1.897	16.031^{***}	16.916^{***}	17.666^{***}
	t = 8.937	t = 29.914	t = 1.492	t = 7.743	t = 12.183	t = 9.001
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,899	5,899	5,899	5,899	5,899	5,899
R^2	0.460	0.336	0.509	0.276	0.525	0.349
Adjusted R^2	0.445	0.318	0.496	0.256	0.512	0.331
Note:						$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 7: Regression Results 2B

	Dependent variable:			
	Top 15 Laps Rank	Fastest Lap Rank	Laps Led Rank	Accident
	(7)	(8)	(9)	(10)
Clinch	0.136^{***}	0.261^{***}	−0.001	−0.0003
	t = 3.671	t = 7.331	t = −0.051	t = −0.272
Constant	17.493^{***}	11.127^{***}	9.638^{***}	−0.023
	t = 10.649	t = 7.062	t = 13.357	t = −0.412
Control Variables	Yes	Yes	Yes	Yes
Observations	5,899	5,899	5,899	5,899
R^2	0.490	0.283	0.366	0.109
Adjusted R^2	0.476	0.263	0.348	0.085
Note:				$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 8: Regression Results 2C

	Dependent variable:			
	Quality Passes Rank	GF Passes Rank	GF Times Passed Rank	GF Pass Diff Rank
	(11)	(12)	(13)	(14)
Clinch	0.066*	0.006	0.018	−0.029
	t = 1.725	t = 0.119	t = 0.370	t = −0.553
Constant	17.211***	17.565***	18.991***	17.198***
	t = 10.206	t = 8.255	t = 8.936	t = 7.372
Control Variables	Yes	Yes	Yes	Yes
Observations	5,899	5,899	5,899	5,899
R^2	0.436	0.237	0.238	0.079
Adjusted R^2	0.421	0.216	0.218	0.054
Note:				*p<0.1; **p<0.05; ***p<0.01

Metric	**Improve 1 Rank per X Fewer Playoff Spots**
start	3.29
worst	14.93
best	6.94
finish	5.99
avg	6.62
mid	8.47
top 15 laps	7.35
fastest lap	3.83
quality passes	15.15

Table 9: 1 Rank Improvement per X Fewer Playoff Spots

5.2.2 Allowing for Heterogeneity

To mitigate this problem, I now turn to a more flexible version of Equation 2, allowing for heterogeneity of the effects depending on the number of remaining spots. In this specification, I am able to identify how driving behavior changes differently when there are differing amounts of remaining spots.

To do so, I group the $SPOTS\_LEFT$ term into discrete bins. The base case set of bins are 0-4, 5-9, 10-14, and 14-16. Again, the supposition is that the effects should be differently pronounced depending on how many spots are left. I construct dummy variables for each bin and interact those variables with $(1 - CLINCH)$ to ensure that I am looking at those drivers i in race number n in year t who have yet to clinch a spot.

A coefficient β_i on

$$(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [a, b])$$

therefore will measure the behavioral change of a driver who has yet to clinch a playoff spot if the number of playoff spots remaining falls within a and b. inclusive, *as compared to* the excluded bin. In all specifications, the excluded bin corresponds to the *most* amount of remaining spots.

This equation can be written as follows:

$$\begin{aligned} Y_{i,n,t} = \beta_0 + \beta_1 &\left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [0, 4])\right] + \\ &\beta_2 \left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [5, 9])\right] + \\ &\beta_3 \left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [10, 14])\right] + \\ &\Delta_i + \tau_{n,t} + \nu_{n,t} + \mu_{n,t} + \epsilon_{i,n,t} \end{aligned} \tag{3}$$

Seeing as the bucketing choices are relatively arbitrary, for robustness purposes I consider two alternative groupings, represented here:

$$\begin{aligned} Y_{i,n,t} = \beta_0 + \beta_1 &\left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [0, 3])\right] + \\ &\beta_2 \left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [4, 7])\right] + \\ &\beta_3 \left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [8, 11])\right] + \\ &\Delta_i + \tau_{n,t} + \nu_{n,t} + \mu_{n,t} + \epsilon_{i,n,t} \end{aligned} \tag{4}$$

$$\begin{aligned} Y_{i,n,t} = \beta_0 + \beta_1 &\left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [0, 2])\right] + \\ &\beta_2 \left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [3, 5])\right] + \\ &\beta_3 \left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [6, 8])\right] + \\ &\beta_3 \left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [9, 11])\right] + \\ &\beta_3 \left[(1 - CLINCH_{i,n,t}) \cdot I(SPOTS\_LEFT_{n,t} \in [12, 14])\right] + \\ &\Delta_i + \tau_{n,t} + \nu_{n,t} + \mu_{n,t} + \epsilon_{i,n,t} \end{aligned} \tag{5}$$

Estimating the full set represented by Equations (3) through (5) with 14 outcomes of interest results in $14 * (3 + 3 + 5) = 154$ coefficient estimates of β_i. These estimates, and their corresponding t-statistics are presented in Table X. Cells colored green have coefficients that are significant.

Presenting the results in this manner immediately reveals the expected trend. As the cutoff value decreases, the effect of fewer (as opposed to many) playoff spots becomes more pronounced.

6 Appendix

Table 10: Race Summary Data

Year	Race Number	Date	Track Name	Loop Distance (miles)	Total Mileage	Driver Name
2019	1	2019/02/17	Daytona International Speedway	2.500	518	Denny Hamlin
2019	2	2019/02/24	Atlanta Motor Speedway	1.540	500	Brad Keselowski
2019	3	2019/03/03	Las Vegas Motor Speedway	1.500	400	Joey Logano
2019	4	2019/03/10	ISM Raceway	1.000	312	Kyle Busch
2019	5	2019/03/17	Auto Club Speedway	2.000	400	Kyle Busch
2019	6	2019/03/24	Martinsville Speedway	0.526	263	Brad Keselowski
2019	7	2019/03/31	Texas Motor Speedway	1.500	501	Denny Hamlin
2019	8	2019/04/07	Bristol Motor Speedway	0.533	266	Kyle Busch
2019	9	2019/04/14	Richmond Raceway	0.750	300	Martin Truex Jr.
2019	10	2019/04/28	Talladega Superspeedway	2.660	500	Chase Elliott
2019	11	2019/05/06	Dover International Speedway	1.000	400	Martin Truex Jr.
2019	12	2019/05/12	Kansas Speedway	1.500	406	Brad Keselowski
2019	13	2019/05/27	Charlotte Motor Speedway	1.500	600	Martin Truex Jr.
2019	14	2019/06/02	Pocono Raceway	2.500	400	Kyle Busch
2019	15	2019/06/11	Michigan International Speedway	2.000	406	Joey Logano
2019	16	2019/06/23	Sonoma Raceway	2.520	227	Martin Truex Jr.
2019	17	2019/06/30	Chicagoland Speedway	1.500	400	Alex Bowman
2019	18	2019/07/07	Daytona International Speedway	2.500	318	Justin Haley
2019	19	2019/07/14	Kentucky Speedway	1.500	404	Kurt Busch
2019	20	2019/07/21	New Hampshire Motor Speedway	1.058	318	Kevin Harvick
2019	21	2019/07/28	Pocono Raceway	2.500	408	Denny Hamlin
2019	22	2019/08/04	Watkins Glen International	2.450	221	Chase Elliott
2019	23	2019/08/11	Michigan International Speedway	2.000	400	Kevin Harvick
2019	24	2019/08/18	Bristol Motor Speedway	0.533	266	Denny Hamlin
2019	25	2019/09/02	Darlington Raceway	1.366	501	Erik Jones
2019	26	2019/09/08	Indianapolis Motor Speedway	2.500	400	Kevin Harvick

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Year	Race Number	Date	Track Name	Loop Distance (miles)	Total Mileage	Driver Name
2020	1	2020/02/16	Daytona International Speedway	2.500	522	Denny Hamlin
2020	2	2020/02/23	Las Vegas Motor Speedway	1.500	400	Joey Logano
2020	3	2020/03/01	Auto Club Speedway	2.000	400	Alex Bowman
2020	4	2020/03/08	Phoenix Raceway	1.000	316	Joey Logano
2020	5	2020/05/17	Darlington Raceway	1.366	400	Kevin Harvick
2020	6	2020/05/21	Darlington Raceway	1.366	284	Denny Hamlin
2020	7	2020/05/25	Charlotte Motor Speedway	1.500	608	Brad Keselowski
2020	8	2020/05/29	Charlotte Motor Speedway	1.500	312	Chase Elliott
2020	9	2020/05/31	Bristol Motor Speedway	0.533	266	Brad Keselowski
2020	10	2020/06/07	Atlanta Motor Speedway	1.540	500	Kevin Harvick
2020	11	2020/06/11	Martinsville Speedway	0.526	263	Martin Truex Jr.
2020	12	2020/06/14	Homestead-Miami Speedway	1.500	400	Denny Hamlin
2020	13	2020/06/22	Talladega Superspeedway	2.660	508	Ryan Blaney
2020	14	2020/06/27	Pocono Raceway	2.500	325	Kevin Harvick
2020	15	2020/06/28	Pocono Raceway	2.500	350	Denny Hamlin
2020	16	2020/07/05	Indianapolis Motor Speedway	2.500	402	Kevin Harvick
2020	17	2020/07/12	Kentucky Speedway	1.500	400	Cole Custer
2020	18	2020/07/19	Texas Motor Speedway	1.500	501	Austin Dillon
2020	19	2020/07/24	Kansas Speedway	1.500	400	Denny Hamlin
2020	20	2020/08/02	New Hampshire Motor Speedway	1.058	318	Brad Keselowski
2020	21	2020/08/08	Michigan International Speedway	2.000	322	Kevin Harvick
2020	22	2020/08/09	Michigan International Speedway	2.000	312	Kevin Harvick
2020	23	2020/08/16	Daytona International Speedway Road Course	3.610	235	Chase Elliott
2020	24	2020/08/22	Dover International Speedway	1.000	311	Denny Hamlin
2020	25	2020/08/23	Dover International Speedway	1.000	311	Kevin Harvick
2020	26	2020/08/30	Daytona International Speedway	2.500	410	William Byron
2021	1	2021/02/14	Daytona International Speedway	2.500	500	Michael McDowell
2021	2	2021/02/21	DAYTONA Road Course	3.610	253	Christopher Bell

Continued on next page

Year	Race Number	Date	Track Name	Loop Distance (miles)	Total Mileage	Driver Name
2021	3	2021/02/28	Homestead-Miami Speedway	1.500	400	William Byron
2021	4	2021/03/07	Las Vegas Motor Speedway	1.500	400	Kyle Larson
2021	5	2021/03/14	Phoenix Raceway	1.000	312	Martin Truex Jr.
2021	6	2021/03/21	Atlanta Motor Speedway	1.540	500	Ryan Blaney
2021	7	2021/03/29	Bristol Motor Speedway Dirt	0.533	135	Joey Logano
2021	8	2021/04/11	Martinsville Speedway	0.526	263	Martin Truex Jr.
2021	9	2021/04/18	Richmond Raceway	0.750	300	Alex Bowman
2021	10	2021/04/25	Talladega Superspeedway	2.660	508	Brad Keselowski
2021	11	2021/05/02	Kansas Speedway	1.500	400	Kyle Busch
2021	12	2021/05/09	Darlington Raceway	1.366	400	Martin Truex Jr.
2021	13	2021/05/16	Dover International Speedway	1.000	400	Alex Bowman
2021	14	2021/05/23	Circuit of The Americas	3.426	185	Chase Elliott
2021	15	2021/05/31	Charlotte Motor Speedway	1.500	600	Kyle Larson
2021	16	2021/06/06	Sonoma Raceway	2.520	232	Kyle Larson
2021	17	2021/06/20	Nashville Superspeedway	1.330	399	Kyle Larson
2021	18	2021/06/26	Pocono Raceway	2.500	325	Alex Bowman
2021	19	2021/06/27	Pocono Raceway	2.500	350	Kyle Busch
2021	20	2021/07/04	Road America	4.048	251	Chase Elliott
2021	21	2021/07/11	Atlanta Motor Speedway	1.540	400	Kurt Busch
2021	22	2021/07/18	New Hampshire Motor Speedway	1.058	310	Aric Almirola
2021	23	2021/08/08	Watkins Glen International	2.450	221	Kyle Larson
2021	24	2021/08/15	Indianapolis Motor Speedway Road Course	2.439	232	AJ Allmendinger
2021	25	2021/08/22	Michigan International Speedway	2.000	400	Ryan Blaney
2021	26	2021/08/29	Daytona International Speedway	2.500	412	Ryan Blaney
2022	1	2022/02/20	Daytona International Speedway	2.500	502	Austin Cindric
2022	2	2022/02/27	Auto Club Speedway	2.000	400	Kyle Larson
2022	3	2022/03/06	Las Vegas Motor Speedway	1.500	411	Alex Bowman
2022	4	2022/03/13	Phoenix Raceway	1.000	312	Chase Briscoe

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Year	Race Number	Date	Track Name	Loop Distance (miles)	Total Mileage	Driver Name
2022	5	2022/03/20	Atlanta Motor Speedway	1.540	500	William Byron
2022	6	2022/03/27	Circuit of The Americas	3.426	236	Ross Chastain
2022	7	2022/04/03	Richmond Raceway	0.750	300	Denny Hamlin
2022	8	2022/04/10	Martinsville Speedway	0.526	212	William Byron
2022	9	2022/04/18	Bristol Motor Speedway Dirt	0.533	133	Kyle Busch
2022	10	2022/04/24	Talladega Superspeedway	2.660	500	Ross Chastain
2022	11	2022/05/01	Dover Motor Speedway	1.000	400	Chase Elliott
2022	12	2022/05/08	Darlington Raceway	1.366	400	Joey Logano
2022	13	2022/05/15	Kansas Speedway	1.500	400	Kurt Busch
2022	14	2022/05/30	Charlotte Motor Speedway	1.500	620	Denny Hamlin
2022	15	2022/06/05	World Wide Technology Raceway	1.250	306	Joey Logano
2022	16	2022/06/12	Sonoma Raceway	2.520	277	Daniel Suarez
2022	17	2022/06/26	Nashville Superspeedway	1.330	399	Chase Elliott
2022	18	2022/07/03	Road America	4.048	251	Tyler Reddick
2022	19	2022/07/10	Atlanta Motor Speedway	1.540	400	Chase Elliott
2022	20	2022/07/17	New Hampshire Motor Speedway	1.058	318	Christopher Bell
2022	21	2022/07/24	Pocono Raceway	2.500	400	Denny Hamlin
2022	22	2022/07/31	Indianapolis Motor Speedway Road Course	2.439	210	Tyler Reddick
2022	23	2022/08/07	Michigan International Speedway	2.000	400	Kevin Harvick
2022	24	2022/08/14	Richmond Raceway	0.750	300	Kevin Harvick
2022	25	2022/08/21	Watkins Glen International	2.450	221	Kyle Larson
2022	26	2022/08/28	Daytona International Speedway	2.500	400	Austin Dillon
2023	1	2023/02/19	Daytona International Speedway	2.500	530	Ricky Stenhouse Jr.
2023	2	2023/02/26	Auto Club Speedway	2.000	400	Kyle Busch
2023	3	2023/03/05	Las Vegas Motor Speedway	1.500	406	William Byron
2023	4	2023/03/12	Phoenix Raceway	1.000	317	William Byron
2023	5	2023/03/19	Atlanta Motor Speedway	1.540	400	Joey Logano
2023	6	2023/03/26	Circuit of The Americas	3.426	257	Tyler Reddick

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Year	Race Number	Date	Track Name	Loop Distance (miles)	Total Mileage	Driver Name
2023	7	2023/04/02	Richmond Raceway	0.750	300	Kyle Larson
2023	8	2023/04/10	Bristol Motor Speedway Dirt	0.533	133	Christopher Bell
2023	9	2023/04/16	Martinsville Speedway	0.526	210	Kyle Larson
2023	10	2023/04/23	Talladega Superspeedway	2.660	521	Kyle Busch
2023	11	2023/05/01	Dover Motor Speedway	1.000	400	Martin Truex Jr.
2023	12	2023/05/07	Kansas Speedway	1.500	400	Denny Hamlin
2023	13	2023/05/14	Darlington Raceway	1.366	403	William Byron
2023	14	2023/05/29	Charlotte Motor Speedway	1.500	600	Ryan Blaney
2023	15	2023/06/04	World Wide Technology Raceway	1.250	304	Kyle Busch
2023	16	2023/06/11	Sonoma Raceway	2.520	277	Martin Truex Jr.
2023	17	2023/06/26	Nashville Superspeedway	1.330	399	Ross Chastain
2023	18	2023/07/03	Chicago Street Race	2.200	172	Shane Van Gisbergen
2023	19	2023/07/10	Atlanta Motor Speedway	1.540	285	William Byron
2023	20	2023/07/17	New Hampshire Motor Speedway	1.058	318	Martin Truex Jr.
2023	21	2023/07/23	Pocono Raceway	2.500	400	Denny Hamlin
2023	22	2023/07/30	Richmond Raceway	0.750	300	Chris Buescher
2023	23	2023/08/06	Michigan International Speedway	2.000	400	Chris Buescher
2023	24	2023/08/13	Indianapolis Motor Speedway Road Course	2.439	200	Michael McDowell
2023	25	2023/08/20	Watkins Glen International	2.450	221	William Byron
2023	26	2023/08/27	Daytona International Speedway	2.500	408	Chris Buescher
2024	1	2024/02/20	Daytona International Speedway	2.500	500	William Byron
2024	2	2024/02/25	Atlanta Motor Speedway	1.540	400	Daniel Suarez
2024	3	2024/03/03	Las Vegas Motor Speedway	1.500	400	Kyle Larson
2024	4	2024/03/10	Phoenix Raceway	1.000	312	Christopher Bell
2024	5	2024/03/17	Bristol Motor Speedway	0.533	266	Denny Hamlin
2024	6	2024/03/24	Circuit of The Americas	3.426	233	William Byron
2024	7	2024/04/01	Richmond Raceway	0.750	305	Denny Hamlin
2024	8	2024/04/07	Martinsville Speedway	0.526	218	William Byron

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Year	Race Number	Date	Track Name	Loop Distance (miles)	Total Mileage	Driver Name
2024	9	2024/04/14	Texas Motor Speedway	1.500	414	Chase Elliott
2024	10	2024/04/21	Talladega Superspeedway	2.660	500	Tyler Reddick
2024	11	2024/04/28	Dover Motor Speedway	1.000	400	Denny Hamlin
2024	12	2024/05/05	Kansas Speedway	1.500	402	Kyle Larson
2024	13	2024/05/12	Darlington Raceway	1.366	400	Brad Keselowski
2024	14	2024/05/27	Charlotte Motor Speedway	1.500	374	Christopher Bell
2024	15	2024/06/02	World Wide Technology Raceway	1.250	300	Austin Cindric
2024	16	2024/06/09	Sonoma Raceway	2.520	277	Kyle Larson
2024	17	2024/06/17	Iowa Speedway	0.875	306	Ryan Blaney
2024	18	2024/06/23	New Hampshire Motor Speedway	1.058	323	Christopher Bell
2024	19	2024/06/30	Nashville Superspeedway	1.330	440	Joey Logano
2024	20	2024/07/07	Chicago Street Race	2.200	128	Alex Bowman
2024	21	2024/07/14	Pocono Raceway	2.500	400	Ryan Blaney
2024	22	2024/07/21	Indianapolis Motor Speedway	2.500	418	Kyle Larson
2024	23	2024/08/12	Richmond Raceway	0.750	306	Austin Dillon
2024	24	2024/08/18	Michigan International Speedway	2.000	412	Tyler Reddick
2024	25	2024/08/25	Daytona International Speedway	2.500	410	Harrison Burton
2024	26	2024/09/02	Darlington Raceway	1.366	501	Chase Briscoe