NFL Quarterback Development—The Role of Competing Quarterbacks, Rookie Playing Time, and Team Quality

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Abstract

Using data from 1994 to 2017, we consider characteristics that affect quarterback (QB) development in the National Football League. Our analysis leads to three key findings. Firstly, we show that a young QB's career is worsened when he plays alongside a Pro Bowl QB. Secondly, we find that QB's career outcomes are better when they are drafted by a bad team. Finally, we investigate the role of rookie playing time and find evidence that playing as a rookie reduces career outcomes. In all three cases, the effects are largest in the latter portion of a QB's career.

Keywords

football, sports economics, quarterback, national football league, labor economics

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Introduction

Among all positions in the National Football League (NFL), quarterbacks (QBs) have the greatest impact on team performance (Hughes et al., 2015). Given the importance of NFL QBs, it's no surprise that these athletes earn some of the highest salaries in professional sports. For example, NFL QB Patrick Mahomes signed a 10-year contract in 2021 that could be worth as much as

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\$503 million, the second largest contract in sports history at the time of signing.¹ As of 2024, the 18 highest compensated players—based on annual playing salary—in the NFL are quarterbacks.² Even with these incredible salaries, there is some evidence that QBs are underpaid relative to other players of other positions (Roach, 2018).

Quarterbacks are often at the forefront of the annual NFL draft. Of the 24 first-overall draft picks in the 21st century, 18 were quarterbacks. Such prospects are highly scrutinized by NFL fans and the media. Given the importance of QB play, massive salaries paid to top-tier QB talent, and the draft capital expended on these players, QB development is a key focus of NFL executives and other interested parties.

In this article, we use data from 1994 to 2017 to focus on three factors that could impact QB development. One of these factors is playing time as a rookie. Given the difficulty in transitioning from college football to the NFL, media pundits and former players often advocate the benefits of limited playing time for rookie QBs. In our article, we find some merits to this claim as NFL quarterbacks tend to be more productive after their fifth season if they received less playing time as a rookie.

Secondly, we examine the role of QB competition. In some cases, NFL QBs are drafted by a team that already possesses an elite QB; for example, the Green Bay Packers drafted QB Jordan Love in 2020. For the first three years of his career, Love was relegated to the bench while all-timegreat Aaron Rodgers maintained a firm grip on the starting role. Conversely, all other QBs selected in the first round of the 2020 draft were quickly promoted to the starting role, largely due to the dearth of talent at the position for each respective team. Not surprisingly, we show that competing QB talent adversely impacts playing time for young QBs. However, even when controlling for playing time, it appears a QB's experience worsened mid and late-career outcomes when they play alongside a Pro Bowl QB early in their career.

Finally, we consider the importance of team quality. It's feasible that teams with poor coaching or management do a poor job of developing NFL talent, especially at the QB position. Teams with a losing record often have weak offensive lines, which leads to QBs receiving more pressure, more sacks, and potentially more injuries. Interestingly, we find that being drafted by a bad team actually *helps* a QB's career trajectory. Specifically, when a team has a losing record in the year prior to drafting a new QB, the new QB outperforms his peers in the latter portion of his career. This result may suggest that such teams, which are likely building for the future, invest more in the development of young QB talent relative to teams that are in "win-now mode."

In the following sections, we review relevant literature on QB development, discuss the three factors introduced above, and provide an econometric analysis on QB performance.

The Determinants of QB Development

In the NFL, QBs typically enter the league via the annual draft, which is composed of seven rounds of selections with each of the 32 NFL teams (typically) allotted one pick per round. The NFL draft is highly scrutinized by fans, the media, and academics. Indeed, most prior research on the development of quarterbacks has focused on the drafting decisions made by NFL teams. The selection of NFL QBs appears to be primarily driven by two measurable factors—collegiate performance and outcomes at the annual NFL draft combine, where players can showcase their talents to NFL scouts and managers.³ Prior research indicates this is wise as many college performance variables (see Mulholland & Jensen, 2014; Weir & Wu, 2014) and NFL combine results (see Berri & Simmons, 2011; Pitts & Evans, 2018) have been shown to not only correlate with NFL draft-ordering but also subsequent NFL performance. However, the drafting process is complicated and inherently subjective. In addition to on-field performance and quantitative

factors, managers also consider qualitative and subjective characteristics of each player (Wolfson et al., 2011).

In most prior research related to NFL player development, researchers focus on how managers assess talent and how a newly drafted prospect affects team performance. In the current article, we take a different angle; we consider how a prospect is affected by his drafting team and associated playing environment. We focus specifically on three factors—competing quarterback quality, playing time as a rookie, and team quality.

Competing QB Quality

Media pundits frequently speculate on the role of competing QBs in the development of rookies. Generally, two schools of thought emerge—one camp suggests that playing behind an elite quarterback improves development of a rookie QB, while others argue that serving as the day-one starter allows quarterbacks the chance to immediately make an impact and hone their skills.

Consider the highly scrutinized draft selection of the 2020 Green Bay Packers. At the time of this draft, elite incumbent QB Aaron Rodgers was in the prime of his career and had three years remaining on his contract. Surprisingly, the franchise exhausted their lone first-round draft pick to select quarterback, Jordan Love. Although Rodgers was "not thrilled with the pick" (Chiari, 2020), media reports regarding the relationship between Rodgers and the young prospect, Love, are generally favorable. Packers coach, Matt LaFleur, called Rodgers "an incredible mentor" (Zucker, 2020). Love echoed this sentiment stating that he and Rodgers had a "Master and the Padawan" relationship (Hodklewicz, 2021), referencing a master-apprenticeship relationship from Star Wars.

While Love may have learned from Rodgers, it's easy to imagine that Love's precarious position could adversely affect his career. In the 2020 draft, five QBs were selected in the first two rounds—Joe Burrow (1st overall), Tua Tagovailoa (5th), Justin Herbert (6th), Jordan Love (26th), and Jalen Hurts (53rd). Love stands alone in this group as all four of his fellow draftees are now starters. As his counterparts developed their skills in NFL games and built relationships with other starters, Love watched games from the sidelines.

Love's scenario is not unique—many other highly touted QB prospects have been drafted by teams with strong incumbent QBs. Aaron Rodgers was in a similar position when the Packers drafted him, while Hall of Famer, Brett Favre, was in the prime of his career. Contrary to the Rodgers-Love tandem, Favre deemphasized his role in Rodgers's development stating, "I don't have to give him any insights into what I do or don't do" (Bensinger, 2016). Regardless of his intentions, it's feasible that Favre played a role in molding Rodgers into an all-time great.

Playing as a Rookie

Should an NFL team play or sit a rookie QB that has the potential to be a phenom? This is a frequently debated question among the media and fans. Occasionally, rookie QBs are immediately awarded the starting job; in the 14 seasons since 2010, 21 rookie QBs started their first game in the NFL.⁴ Despite the immense raw talent, these rookies collectively posted completion percentages and QB ratings far below the league averages and were also more likely to commit turnovers. While there are exceptions (such as C.J. Stroud in 2023), most rookie QBs are *firmly* in the bottom half of starting QBs.

Even when a rookie is capable of performing at a high level, it may be best to delay thrusting him into a starting role. In 2021, Chicago Bears Head coach Matt Nagy elected to sit 11th overall pick Justin Fields. Nagy argued, "If we play Justin early to satisfy our needs and not do what's best for Justin and the Chicago Bears, we're going to ruin Justin and hurt the Bears" (Lambert, 2021).

Given Nagy's track record, it's hard to fault his judgement. As Offensive Coordinator of the 2017 Kansas City Chiefs, Nagy orchestrated the team's offense with veteran QB Alex Smith, while 10th overall pick Patrick Mahomes watched from the sidelines. Mahomes would win the NFL MVP just one season later.

Not all agree with Nagy's approach. As a rookie, Peyton Manning threw an NFL rookie record 28 interceptions in 1998. But he ultimately developed into one of the greatest QBs in NFL history. Manning believes that starting as a rookie is "the best way to learn" (Manfred, 2014). Peyton's brother, Eli, who started 234 games in the NFL, nine as a rookie, agrees: "There's a lot to learn and honestly, I believe the best way to do it is through experience and to get out there... make the mistakes, see it all and try to just find a way to get completions and move the ball" (Stapleton, 2017). Ultimately, there is no decisive answer to whether a rookie QB should start or sit.

Team Quality

For several reasons, elite QB prospects often sign with below-average teams. Teams with using records generally don't have an elite QB on the roster at the time of the NFL draft and thusly, there is a need at the position. Also, teams with losing records are more likely to focus on the future; drafting a QB is generally not seen to align with a "win-now" mentality. Furthermore, given that the teams with the worst records are awarded the earliest draft picks and QB prospects are often considered the most valuable, good teams rarely have a chance to select top QB talent. The 2021 NFL draft is a good example of this phenomenon. Of the 259 total picks in the draft, 10 were quarterbacks. Of those 10, five were selected among the first 15 overall picks. None of the teams drafting these first five QBs made the playoffs in the prior season. Clearly there is a *connection* among a team's winning percentage, a team's decision to draft a QB, and subsequent playing time allotted to a rookie QB. We hope our analysis will help to disentangle these effects to determine if team quality affects QB development.

There are many anecdotal cases of a bad team adversely affecting a QB's career. Notably, 2002 first overall pick, David Carr, had the dubious honor of starting as a rookie for the woeful Houston Texans expansion team. The Texans' offensive line, which featured two rookies, failed to protect Carr, who finished the season with an NFL record 76 sacks. In his five years with Houston, Carr led the league in sacks three times as the Texans floundered to a combined win–loss record of 24–56. Carr started four more games with the Carolina Panthers the following season, before serving as a seldom-used backup for the remainder of his career. A similar case can be made for the 1999 first overall pick, Tim Couch. For the expansion Cleveland Browns, Couch led the NFL in sacks as a rookie and was out of the NFL just five years later.

Carr and Couch's situation—leading an expansion team—is unique. Nonetheless, there is a case to be made for the detrimental effects of being drafted by a bad team. The period between 2015 and 2018 offers dramatic evidence. Of the 12 QBs selected in the first round of these NFL drafts, four were drafted by teams that had a winning record in the prior season. In all four cases (Patrick Mahomes, Josh Allen, Deshaun Watson, and Lamar Jackson), these young QBs quickly developed into world class players. Comparatively, the other eight QBs have only three combined Pro Bowl appearances (two for Jared Goff and one for Carson Wentz), and the four quarterbacks joining the worst teams have exhibited performances far below expectations.⁵ While counter-examples abound (e.g., Joe Burrow for the Cincinnati Bengals), there are clear differences in career trajectories for QBs based on the recent on-field success of the drafting team. For example, QBs drafted to teams with a winning record are far more likely to sign a contract extension with their first NFL squad (Hiefetz, 2021).

Data and Methods

Data for this article were collected from Pro-Football-Reference.com, a website that provides free data on NFL and collegiate football players. Our data collection begins with QBs drafted in 1994, the first year in which a salary cap was mandated for the league. Our data collection ends in 2017, which allows us to consider player performance for at least five full seasons for all players in our sample. During this timeframe, 282 quarterbacks were drafted. We drop five quarterbacks that were drafted by expansion teams, leaving us with 277 quarterbacks.⁶

In Table 1, we provide summary statistics for variables used in our forthcoming models. Ten different dependent variables are used. *RookieGS* is the number of games started in a QB's rookie season, *GS2345* is the aggregate number of games started in a QB's second, third, fourth, and fifth seasons, and *GSAfterSeason5* is the number of games started after season five. Likewise, we include similar controls for passing yards and approximate value.⁷ While passing yards is self-explanatory, approximate value (AV) is a variable that readers may not recognize. Although the formula for calculating AV is complex, the concept is simple—AV is designed to be a catch-all measure of performance for any NFL player.⁸ We chose to use AV for two key reasons. One, AV inherently accounts for all aspects of a QB's playing performance, including rushing yards and fumbles, which are ignored by passing-specific variables. Secondly, AV equals zero for players

Variable	Mean	Std. Deviation	Minimum	Maximum
Dependent variables				
GSRookie ^a	2.911	5.078	0	16
GS2345ª	14.238	14.238	0	64
GSAfterSeason5	15.408	15.408	0	254
YdsRookie ^a	601.667	1047.904	-4	4374
Yds2345 ^ª	3228.156	4665.065	0	18,707
YdsAfterSeason5	3850.206	10,333.19	0	70,595
AVRookie ^ª	1.6348	3.446	-5	19
AV2345ª	10.546	16.866	-2	74
AVAfterSeason5	12.340	34.859	0	16
Newly drafted QB				
DraftPick	121.801	80.323	I	253
DraftPick2	21,264.450	19,650.590	I	64,009
Age	22.848	0.959	21	29
Age2	522.926	45.206	441	841
Incumbent QB				
IncuProBowlsPrior	3228.156	4665.065	0	18,707
IncuProBowlSame	0.188	2.373	0	14
IncuProBowlsAfter	1.167	2.431	0	14
IncuAge	29.486	3.953	22	39
IncuAge2	884.982	240.936	484	1521
Drafting team				
WinsPrior	7.464	3.335	0	16
WinsSame	7.759	3.219	0	15
WinsSame2	70.523	50.880	0	225

Table I. Summary Statistics.

^aThese variables are used as both dependent and independent variables.

that never compete in the NFL, while no value would be provided for QB rating in such cases. AV has been used in similar research in sports economics.⁹

Table 1 arranges the independent variables into three categories. We include nine variables that are unique to a given QB. *DraftPick* indicates the overall selection number for a quarterback in a draft. For example, Matt Ryan was selected as the third overall pick in 2001. His *DraftPick* value is three. *DraftPick2* is the square of this value (nine for Ryan). We include controls for a QB's age and a squared-term (*Age* and *Age2*). We also incorporate six of the aforementioned variables as controls in various iterations of our analyses. These variables are indicated by an asterisk in Table 1.

Next, we incorporate five controls for the "incumbent" QB. While many performance measures could be used, we elected to focus on Pro Bowl selections. Each year, three quarterbacks are selected for the Pro Bowl in each conference following an NFL regular season. While there is subjectivity in Pro Bowl selections, Pro Bowl QBs are, without exception, high-achieving players that are seldom replaced by a younger QB. We believe that our inclusion of Pro Bowl QBs—the elite—narrows our focus to players that are *very* unlikely to cede their starting role to a young QB. *IncuProBowlsPrior* is the total number of Pro Bowls that an incumbent QB had been selected for at the time that a new QB was drafted. *IncuProBowlSame* is a dummy variable indicating if the incumbent earned a Pro Bowl slot in the new QB's first year. And, *IncuProBowlsAfter* is the total Pro Bowl nods an incumbent receives after the new QB's first season.

Our last category of control variables focuses on the team for which a new QB is drafted. *WinsPrior* is the number of wins a team earns in the season prior to drafting a new QB. We also include two controls for team performance in a QB's rookie season—*WinsSame* and the squared term, *WinsSame2*.

Using these variables, we create 12 models. While these models differ in scope and control variables, the general empirical form, which is estimated using ordinary least squares, is structured as follows:

Performance_{ijt} =
$$\alpha + X'_{i}\beta + Q'_{i}\gamma + L'_{i}\pi + Team_{j} + Draft_{t} + \varepsilon_{i}$$
.

in these models, *Performance* for QB *i* drafted by team *j* in year *t* is assessed by the 10 dependent variables provided in Table 1. X'_i is a vector of control variables specific to QB *i*. Q'_i is a vector of control variables related to the competency of the team that drafted QB *i*. L'_i is a third vector of controls, related to the competency of the incumbent QB paired with QB *i*. *Team_j* is a vector of team-specific constant terms that are included to account for time-invariant features of each NFL franchise that might impact QB performance. *Draft_i* is a vector of constant terms indicating the year in which a quarterback was drafted. These draft-year fixed effects are included to account for the fact that QB talent (in a given draft) and competition (within the NFL) vary through time. Furthermore, since our sample concludes in 2017, many QBs have not yet completed their careers; thus, year fixed effects are necessary to correctly address variations in potential seasons played across draft classes. While we use multiple models to consider QB performance outcomes through time, each individual model employs cross-sectional data.

Results

Playing Time as a Rookie

We begin our analysis by estimating the factors associated with playing time as a rookie, proxied by regular season games started.¹⁰ Our data indicate significant variability in rookie playing time.

Of the 277 quarterbacks in our sample, 180 did not start a game as a rookie, while 42 started at least 10 regular season games.

We estimate two models; results for these models are posted in Table 2. The first of these models only includes control variables that are known at the time of an NFL draft. Thus, this regression projects the number of games a QB can expect to start as a rookie before his rookie season begins. The second model includes these same independent variables in addition to controls that would be unknown to a QB prior to his first season, such as the number of wins that a team has during the QB's rookie campaign. Not surprisingly, we find a negative sign for *DraftPick* in both regressions, indicating that quarterbacks selected earlier in the NFL draft are more likely to start as a rookie. However, we also show a positive (but small) coefficient for the squared DraftPick variable (*DraftPick2*). Collectively, these two results indicate that a player's draft position is a relevant factor in rookie playing time, but the marginal importance of draft position diminishes in the latter rounds of the draft.¹¹

While conventional wisdom indicates that older, more seasoned, rookies may more quickly earn playing time, we do not find any connection between age and playing time. Conventional wisdom also suggests that rookie QBs are less likely to earn playing time when there is more competition for the starting role. To investigate this possibility, we include controls for performance of the best QB on the roster (aside from the newly drafted rookie); we loosely refer to this QB as the "incumbent."¹² In the first model, we include only a control for the number of Pro Bowl selections the incumbent earned prior to the new QB being drafted (*IncuProBowlsPrior*). This variable is insignificant in the first regression. For a newly drafted QB concerned with earning playing time as a rookie, this result suggests that the QB can disregard the historical provess of the incumbent QB. In the second model, we include two additional controls for the incumbent QB Pro

	GSRo	ookie	GSRookie		
Variable	Coeff	p-Value	Coeff	p-Value	
DraftPick	-0.087 ^a	<0.001	-0.085 ^a	<0.001	
DraftPick2	0.000ª	<0.001	0.000ª	<0.001	
Age	-6.310	0.190	-3.980	0.393	
Age2	0.144	0.156	0.094	0.333	
IncuProBowlsPrior	0.045	0.742	0.024	0.866	
IncuProBowlSame			-0.846	0.239	
IncuProBowlsAfter			-0.179 ^c	0.094	
IncuAge	0.692	0.420	0.712	0.404	
IncuAge2	-0.015	0.299	-0.015	0.283	
WinsPrior	-0.219^{a}	0.007	-0.150 ^c	0.072	
WinsSame			-0.979ª	0.001	
WinsSame2			0.058ª	0.004	
Intercept	71.950	0.203	51.740	0.346	
n	277		277		
R ²	0.601		0.621		
Includes team fixed effects	Yes		Yes		
Includes year fixed effects	Yes		Yes		

Table 2. Games Started as a Rookie.

^aSignificant at the 0.01 level of significance.

^bSignificant at the 0.05 level of significance.

^cSignificant at the 0.1 level of significance.

Bowls. While we find no significant impact for the incumbent reaching the Pro Bowl in the new QB's rookie season (*IncuProBowlSame*), we find a marginally negative coefficient for *IncuProBowlsAfter*. This implies that newly drafted QBs earn less playing time as a rookie when competing against a QB that will eventually achieve Pro Bowl selections.

As one might expect, we find significant evidence of team quality impacting rookie QB playing time. In the first specification, we find a negative coefficient for WinsPrior. This variable indicates that a QB can expect to play 0.22 fewer games as a rookie for each additional game the drafting team won prior to signing the new QB. In the second specification, we find a negative and strongly significant sign for *WinsSame* and a positive and highly significant effect for the squared-term of this variable (*WinsSame2*). Collectively, these results indicate two avenues through which rookie QBs appear to receive playing time. One avenue for playing time is to play for a very bad team. Given that a minority of teams reach the NFL playoffs, it's common for losing teams to build for the future and provide more playing time to rookies.¹³ The second avenue is to play for a very good team, one that locks-up a playoff spot with a few games remaining, which allows the team to play rookies when the benefits of winning additional games are reduced. Using the coefficients for WinsSame and WinsSame2, we find that rookie QBs are least likely to start a game when their team wins eight or nine of their 16 games; such teams are usually needing additional wins to reach the playoffs even in their last few games. Rookie QBs are progressively more likely to earn a start when their team wins more than nine games or fewer than eight. Relative to being on a team with eight wins, a rookie QB is likely to start one additional game when his team wins four or 13 games. As forthcoming models indicate, rookie playing time is a relevant factor in the career trajectory of an NFL QB. As such, these results show that a rookie QB's team quality has the potential to exert major changes on an NFL QB's career.

Early Career Playing Time

We continue our analysis of QB playing time in Table 3, focusing now on the aggregate playing time that a QB can expect to receive in their second, third, fourth, and fifth seasons. The choice to consider the first five seasons of a QB's career is not arbitrary; present-day NFL rookie contracts typically persist for four years, with a possible team-option to retain a first-round draftee for a fifth season. Thus, the models included in Table 3 consider key seasons for a QB that is hoping to establish his footing in the NFL and earn an additional contract. Players that start more games will generally have longer careers, earn higher salaries, achieve more wins, start more games in the playoffs, earn more media exposure, and ultimately have the potential to achieve accolades such as Pro Bowls and Hall of Fame selections.

The first model of Table 3, which mirrors the first model of Table 2, addresses expected playing time for a QB in his second through fifth seasons. As expected, the results of this model once again indicate that early draft picks can expect more playing time. We also find marginal significance for *WinsPrior*, indicating that a player being drafted to a bad team can expect more playing time in seasons two through five. While the first model of Table 3 includes variables that are known to the QB *prior* to starting his rookie season, the second model includes four additional controls that would be known following a QB's rookie season. As one would expect, *RookieGS* is strongly correlated with *GS2345*. This simply indicates that QBs earning playing time as a rookie can expect to continue earning playing time in their next four seasons. While age did not appear to influence rookie playing time, we find that a QB's age is a meaningful determinant of playing time in his second through fifth seasons.¹⁴ By simultaneously considering the coefficients for *Age* and *Age2*, we can surmise that QB's can anticipate maximum playing time in their second through fifth seasons when they were drafted at age 22 or 23. Quarterbacks drafted at age 20 can expect to play about 3.5 fewer games during this stretch and 25-year-old draftees start about four fewer games

	GS23	45	G\$2345		
Variable	Coeff	p-Value	Coeff	p-Value	
DraftPick	-0.431 ^a	<0.001	-0.295ª	<0.001	
DraftPick2	0.001 ^a	<0.001	0.001ª	<0.001	
Age	23.136	0.151	27.682 ^b	0.056	
Age2	-0.503	0.135	-0.617 ^c	0.039	
IncuProBowlsPrior	0.475	0.452	0.516	0.416	
IncuProBowlSame			-5.224 ^c	0.038	
IncuProBowlsAfter					
IncuAge	4.120	0.296	2.317	0.539	
IncuAge2	-0.072	0.278	-0.037	0.561	
WinsPrior	-0.671 ^b	0.083	-0.336	0.368	
WinsSame			0.574	0.667	
WinsSame2			-0.006	0.951	
RookieGS			1.500 ^a	<0.001	
Intercept	-279.750	0.139	-320.049 ^b	0.062	
n	277		277		
R ²	0.569		0.634		
Includes team fixed effects	Yes		Yes		
Includes year fixed effects	Yes		Yes		

Table 3. Games Started, Early Career.

^aSignificant at the 0.01 level of significance.

^bSignificant at the 0.1 level of significance.

^cSignificant at the 0.05 level of significance.

(both relative to 22 or 23-year-old draftees). Given that this model controls for both rookie playing time and a QB's draft position, it's interesting that older players, who are often labeled as "NFL-ready," are less likely to earn playing time.

Finally, our results indicate the potential adverse effects of playing alongside an elite QB. When a rookie QB plays behind a Pro Bowl QB, he can expect to start 5.2 fewer games in his second through fifth seasons. While this is not a surprising result, we believe that such a finding is useful in that it provides tangible and measurable evidence of the adverse effects of QB competition on a prospect's career trajectory.

Late Career Playing Time

Next, we consider a QB's career after season five. Rookie QBs are given contracts that last 4 years, with the fifth year serving as a team option for first-round picks. Therefore, the seasons after year five represent the (potential) second leg of a QB's career. A QB that has earned enough tout can negotiate for a second contract. For elite QBs, this second contract could be *extremely* lucrative. It's important to note that our dataset includes all quarterbacks drafted from 1994 to 2017. As such, all players in our study have completed at least five seasons. However, many players are still competing and thusly the total number of games started, both in their careers and after season five, have not been fully realized. By including fixed effects for draft-year, we control for the number of possible seasons (and regular season games) in which each player could have competed, which inherently allows for the significance of each variable to be truly realized in our regression results. As with prior models, we include two specifications—the first considers factors known to a QB

when he is drafted and the second incorporates additional controls to account for other factors that occurred in the five years preceding a QB's sixth season.

In Table 2, we showed that the number of wins that a team achieves prior to drafting a new QB is inversely correlated with the number of games that a rookie quarterback can expect to start. Table 3 showed marginal evidence that such effects persist as a QB progresses through his second to fifth seasons. In Table 4, this variable is *highly* significant and, again, exhibits a negative coefficient. The first model of Table 4 shows that a newly drafted QB can expect to start 2.8 fewer games after his fifth season for each additional game that his new team wins in the season prior to his draft. Even after additional controls are incorporated, in the second model of Table 4, this general finding persists. Simply put, rookie QBs interested in playing time should hope to be drafted by a bad team.¹⁵

In the second model of Table 4, we include controls for prior games-started. We divide prior playing time into two variables—*GSRookie* and *GS2345*—so that we can isolate possible effects of rookie playing time. Of course, *GS2345* is highly significant, indicating that QBs earning playing time in seasons two through five will continue earning playing time. However, we find a negative coefficient for *GSRookie*; for two otherwise similar QBs, the one with *less* playing time as a rookie can expect to start more games after his fifth season. This perhaps supports the oft-held claim that QBs can develop bad habits or succumb to injury (e.g., Robert Griffin III) if they are tossed into a starting position before they are ready. Forthcoming models will expound upon this finding.

	GSAfterS	eason5	GSAfterSeason5		
Variable	Coeff	p-Value	Coeff	p-Value 0.700	
DraftPick	-0.443 ^a	<0.001	0.052		
DraftPick2	0.001 ^a	0.006	-0.000	0.775	
Age	17.646	0.565	-22.965	0.432	
Age2	-0.413	0.516	0.485	0.423	
IncuProBowlsPrior	0.246	0.903	-0.09 l	0.958	
IncuProBowlSame			-9.162 ^b	0.092	
IncuProBowlsAfter			-2.454 ^b	0.075	
IncuAge	4.584	0.739	-1.205	0.912	
IncuAge2	-0.068	0.776	0.024	0.899	
WinsPrior	-2.784 ^a	0.002	−1.779 ^c	0.014	
WinsSame			-0.567	0.833	
WinsSame2			0.076	0.687	
GSRookie			-1.421 ^b	0.066	
GS2345			1.408 ^ª	<0.001	
Intercept	-197.432	0.621	-320.049 ^b	0.062	
n	277		277		
R ²	0.362		0.634		
Includes team fixed effects	Yes		Yes		
Includes year fixed effects	Yes		Yes		

Table 4. Games Started, Late Career.

^aSignificant at the 0.01 level of significance.

^bSignificant at the 0.1 level of significance.

^cSignificant at the 0.05 level of significance.

The second model of Table 4 also indicates that a player's career can be derailed by intense QB competition in his first five seasons. A young QB that plays alongside a Pro Bowl QB in his rookie season can expect to start 9.2 fewer games after season five. For each additional Pro Bowl selection, the incumbent receives in subsequent seasons (whether this occurs on the same team or not), the drafted QB can expect to start 2.5 fewer games after season five. Given that our model controls for the drafted QB's career starts in seasons two through five, this is a robust result.

Passing Yards and AV

A QB's legacy is often shaped by his career longevity and his ability to amass key performance statistics. Tables 5 and 6 build upon the findings from earlier models, which showed that a QB's career, especially after season five, is influenced by team quality, QB competition, and rookie playing time. Specifically, a QB is likely to play fewer games after his fifth season when he competed for playing time with a Pro Bowl QB early in his career and was drafted by a bad team. Furthermore, all else equal, a QB plays fewer games after his fifth career season when he received playing time as a rookie. Given that such factors affect the number of games a QB starts later in his career, it's no surprise that these factors also affect career passing touchdowns and career passing yards.

In Table 5, we create three models, focusing on passing yardage earned for a rookie QB, a QB in his second through fifth seasons, and a QB in seasons thereafter. Since players starting more

	YdsRookie		Yds2345		YdsAfterSeason5	
Variable	Coeff	p-Value	Coeff	p-Value	Coeff	p-Value
DraftPick	-18.408ª	<0.001	-58.062ª	<0.001	2.248	0.948
DraftPick2	0.050 ^ª	<0.001	0.156 ^ª	0.002	-0.002	0.984
Age	-1488.282	0.101	4799.670	0.205	- I 358.309	0.859
Age2	33.446 ^b	0.078	-110.075	0.158	29.115	0.855
IncuProBowlsPrior	-2.546	0.928	106.964	0.467	-43.363	0.930
IncuProBowlSame			—1110.674 ^b	0.069	-2591.905 ^b	0.071
IncuProBowlsAfter					-812.528 ^c	0.046
IncuAge	140.304	0.402	645.285	0.457	- 1009.600	0.749
IncuAge2	-2.869	0.304	-10.304	0.486	18.089	0.745
WinsPrior	-50.426ª	0.003	-54.334	0.561	-483.988 ^a	0.010
WinsSame			136.288	0.671	-358.727	0.630
WinsSame2			-1.460	0.945	33.640	0.524
YdsRookie			1.968 ^a	<0.001		
GSRookie					-336.494	0.110
Yds2345					1.450 ^a	<0.001
Intercept	17,154.850	0.101	-57,374.110	0.196	33,630.800	0.731
n	277		277		277	
R ²	0.622		0.619		0.573	
Includes team fixed effects	Yes		Yes		Yes	
Includes year fixed effects	Yes		Yes		Yes	

Table 5. Passing Yards.

^aSignificant at the 0.01 level of significance.

^bSignificant at the 0.1 level of significance.

^cSignificant at the 0.05 level of significance.

	AVRookie		AV2345		AVAfterSeason5	
Variable	Coeff	p-Value	Coeff	p-Value	Coeff	p-Value
DraftPick	-0.055ª	<0.001	-0.238ª	<0.001	0.028	0.807
DraftPick2	0.000 ^a	<0.001	0.001ª	0.001	-0.000	0.837
Age	-0.550	0.883	9.281	0.485	-9.102	0.723
Age2	0.016	0.835	-0.23 I	0.398	0.201	0.707
IncuProBowlsPrior	-0.056	0.578	0.128	0.823	0.388	0.815
IncuProBowlSame			_4.352 ^b	0.055	-7.703	0.123
IncuProBowlsAfter					-3.019 ^c	0.039
IncuAge	0.068	0.910	1.508	0.642	-1.674	0.872
IncuAge2	-0.002	0.836	-0.023	0.677	0.028	0.878
WinsPrior	-0.142 ^c	0.018	-0.170	0.637	-1.545 [°]	0.011
WinsSame			0.016	0.989	-1.1 04	0.653
WinsSame2			0.017	0.828	0.070	0.689
AVRookie			1.690ª	0.001		
GSRookie					—1.152 ^b	0.084
AV2345					1.410 ^a	<0.001
Intercept	9.165	0.825	-97.197	0.539	142.783	0.671
n	277		277		277	
R ²	0.505		0.587		0.592	
Includes team fixed effects	Yes		Yes		Yes	
Includes year fixed effects	Yes		Yes		Yes	

Table 6. Approximate Value.

^aSignificant at the 0.01 level of significance.

^bSignificant at the 0.1 level of significance.

^cSignificant at the 0.05 level of significance.

games will have the opportunity to amass more passing yards, it's not surprising that the models in Table 5 produce similar results to earlier models estimating games started. Nevertheless, the models in Table 5 allow us to see the on-field effects of altered playing time that result from relevant control variables and also serve as a robustness check.

Our findings in Table 5 corroborate with results in preceding models. We again show potential damaging effects of playing alongside a Pro Bowl QB. When a rookie QB plays alongside a Pro Bowl QB, his career projections are reduced; he can expect about 1111 fewer passing yards in seasons two through five and 2592 fewer passing yards after season five. Results from Table 5 also confirm earlier findings of the detrimental rookie and late-career effects of being drafted by a winning team. For each additional win that a team earns in the season prior to drafting a new QB, the new QB can expect to throw for 50 fewer yards as a rookie and 484 fewer yards after his fifth season. Interestingly, we show that a QB's draft position (*DraftPick* and *DraftPick2*) is no longer relevant after his fifth season. While draft positioning impacts playing time and passing yardage in a QB's first five seasons, his draft positioning no longer has a clear impact on a QBs career following his fifth season.

Table 6 repeats the process provided in Table 5 but replaces passing yards with approximate value (AV). As discussed earlier, AV is a catch-all measure of player performance that incorporates factors like rushing yardage, turnovers, and completion percentage. While AV is not a perfect measure of quality, even a casual fan notes that it appears to highly correlate with QB quality.¹⁶ Despite the change in dependent variable, the results from these models closely mirror Table 5.

Drafted QBs are adversely impacted by playing alongside a Pro Bowl QB (or QB that will *eventually* reach the Pro Bowl). We also find that being drafted by a team that was successful in the year prior to the draft leads to reduced AV for a quarterback in both the new QB's rookie season and, especially, after his fifth season. Finally, we find a borderline-significant negative sign for *GSRookie* in the model predicting late-career AV, perhaps suggesting that earning playing time as a rookie ultimately harms a QB's development.

Discussion

Using our results, we can consider the future performance of recent draftees. In 2021, five quarterbacks were drafted in the first round. As predicted by the results in Table 2, playing time was highly dependent upon team performance (and, of course, draft position). Top two overall picks, Trevor Lawrence and Zach Wilson, both joined woefully bad teams and were immediately thrust into a starting role. As suggested in Tables 4 and 6, we might consider these early starts to be detrimental to their long-term career prospects. However, our models predict that they will eventually benefit from being drafted by a losing team and (if nothing dramatic changes in the next few years) *not* competing alongside a Pro Bowl teammate at the quarterback position.

Third overall pick, Trey Lance, began his rookie season in a very different scenario. While the 49ers finished the 2020 season with six wins and ten losses, their strong performance in 2021 (10-7 and a Super Bowl appearance) likely reduced the playing time that Trey Lance earned as the 49ers stuck with middling QB Jimmy Garoppolo, firmly spending the season in "win-now mode." Our model indicates that Trey was in an ideal scenario for development as a rookie. He was drafted by a team with a losing-record in the season prior to the draft and appears to not be competing alongside a Pro-Bowl caliber QB. These characteristics should also benefit 2020 draftees Joe Burrow, Tua Tagovailoa, and Justin Herbert, who entered a similar scenario. Despite poor performance prior to drafting Trey Lance, the 49ers enjoyed moderate regular season success during Lance's rookie season (finishing with a 10-7 record). Our models (correctly) anticipated that Lance would receive little playing time as a rookie; however, this isn't necessarily detrimental to his development and our results indicate that, if anything, a reduction in rookie playing time may actually improve his career longevity.¹⁷ While our models suggest that Lance was in an ideal scenario for career growth, media members generally criticized the development of Trey Lance (see Buhler, 2022; Farrar, 2022; Florio, 2022; Kelly, 2022).¹⁸ Prior to 2023, Lance was traded to the Dallas Cowboys for a 4th round pick, lending credence to these concerns. In the case of Lance, it appears that his career trajectory runs contrary to the projections made by our models.

Collectively, our results indicate that QB prospects appear to be meaningfully affected by matters that are generally outside of their control. Perhaps most notably, a QB's career appears to be deeply affected by team quality. In our analysis, we show that a QB can expect to play fewer games as a rookie when he is drafted by a team that had a winning record in the prior season. While this is not a surprising result, we show evidence that this effect appears to persist and is strongest in the latter years of a QB's NFL career. For each additional win that a team has prior to drafting a QB, said QB can expect to start 2.8 fewer games and throw for 484 fewer passing yards after his fifth season. We also show that QB career trajectories are detrimentally impacted by playing alongside an elite QB as a rookie. For example, we show that a QB starts five fewer games in seasons two through five and nine fewer games after season five when he played alongside a Pro Bowl QB as a rookie. Finally, we provide modest support for the common claim that rookie playing time harms a QB's development. Given the importance of the quarterback position, these results should not be taken lightly. Our models provide novel results that should be useful for NFL executives and other interested parties.

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Notes

- 1. For a full breakdown of Mahomes's contract, see Spotrac (2022).
- 2. Source: https://www.spotrac.com/nfl/contracts/.
- 3. The NFL combine, which is held the month prior to the NFL draft, serves as a talent showcase for NFL prospects. While prospects are not required to participate, most do. Although much of the media attention is focused on prospects' performances in demonstrations of speed and strength, the combine also includes player interviews, intelligence assessment using the Wonderlic test, injury evaluations, and more.
- Sam Bradford, Cam Newton, Andrew Luck, Russell Wilson, Robert Griffin III, Ryan Tannehill, Jameis Winston, Marcus Mariota, Carson Wentz, Sam Darnold, Kyler Murray, Joe Burrow, Trevor Lawrence, Zach Wilson, and Mac Jones.
- Mitch Trubisky (joining 3-13 Bears), Jameis Winston (2-14, Buccaneers), Marcus Mariota (2-14 Titans), and Baker Mayfield (0-16, Browns).
- 6. We also omitted players that were collegiate QBs but were drafted under the expectation that the player would play a different position in the NFL.
- 7. Note that our data includes QBs from 1994 to 2017. Many of these QBs are still playing and have thusly not realized their full career value for GSA fterSeason5. To account for this concern, we used draft-year fixed effects in each regression.
- See the following link for more information regarding the calculations used in AV: https://www.sportsreference.com/blog/approximate-value-methodology?.
- 9. For example, see Salaga et al. (2020) and Weir and Wu (2014).
- 10. It's not uncommon for rookie QBs to receive playing time on special defense, in garbage time, or in running situations (e.g., "Wildcat" offenses). Thus, using games *played* would lead to inclusion of games where QBs were not truly serving a meaningful quarterback role. We elected to use games *started* to focus solely on scenarios where a QB is playing a traditional starting quarterback role.
- 11. As a robustness check, we also estimated models that employed categorical variables for draft position (e.g., drafted 1-10 overall and 11-20). Our key results did not change.
- 12. Note that this QB is not always a true incumbent—he may have been newly acquired in the offseason. Likewise, this quarterback is not necessarily the returning starter. In our dataset, the "incumbent" is

defined as the quarterback that received the most playing time aside from the rookie QB or in the few cases where a rookie QB played every offensive snap for a team, the QB listed second on the depth chart.

- 13. This may also lead to fewer wins, improving a team's position in the upcoming NFL draft. This may be done in an effort to "tank" for a higher draft pick in the upcoming draft.
- 14. In alternate specifications, we included categorical variables for QB age (e.g., 19, 20, and 21). This adjustment to our model did not lead to any meaningful changes to our model output.
- 15. In alternate specifications, we included a squared-term of this variable. It was insignificant in all models. Thus, it appears that there is a monotonic relationship between team wins (prior to the draft) and subsequent QB playing time.
- The top five all-time QB leaders in career AV are Tom Brady, Drew Brees, Peyton Manning, Brett Favre, and Fran Tarkenton. For a list of AV leaders, see: https://www.pro-football-reference.com/leaders/av_ career.htm.
- 17. Obviously, if Trey Lance had quickly developed into an elite talent, he would have won the starting role as a rookie. So, playing as a rookie could serve as a non-causal indication of future performance. But, holding Lance's talent constant, our models indicate that his dearth of playing time in his rookie season will ultimately pay dividends in his later years when compared to an otherwise similar QB that started games as a rookie.
- 18. As our models would suggest, Trey Lance earned the starting role at the beginning of the sophomore campaign. Unfortunately, he sustained a season-ending injury in just his second game, jeopardizing his role with the 49ers.

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