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RESEARCH ARTICLE

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The determinants of Black quarterback pay in the National Football League

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Abstract

This paper seeks to econometrically determine differences in salary returns to attributes of quarterbacks in the National Football League (NFL), by race. We analyse salary determination of 215 White and Black quarterbacks over 2006 through 2020 with separate equations estimated for each group. Our analysis indicates that top draft pick evaluations persist into future pay setting for each group. However, there is a faster rate of decay of early draft round salary premium for Black quarterbacks. This is found to be robust across different estimations. This result is indicative of differential treatment in pay setting for Black quarterbacks.

1 | INTRODUCTION

This paper seeks to econometrically determine differences in salary returns to attributes of quarterbacks in the National Football League (NFL), by race. Some African-American quarterbacks earn very high salaries. For example, in July 2020, Patrick Mahomes—an African-American quarterback with the Kansas City Chiefs—signed a 10-year contract that will keep him in Kansas City until the 2032 season (Brisco, 2020). At the time, this was the richest contract in the history of professional team sports.

The dollars in this contract are not that surprising. In the year prior to the COVID pandemic, the NFL reportedly took in more than $16 billion in revenue (Novy-Williams, 2021). This makes the NFL the most successful professional sports league in the world in terms of revenue generation. The NFL also appears to be a classic meritocracy. Lapchick (2019) reports that more than 70% of the league were people of colour. And in 2020, the list of highest paid players in the league was led by Dak Prescott and Russell Wilson.[1] Like Mahomes, these two are also African-American quarterbacks.

We will use data on salaries, performances and characteristics of NFL quarterbacks to assess whether pay of African-American players is determined differently to White players. In particular, we pay close attention to the importance of being selected in the first round of the draft along with the extent to which a salary premium attached to an early round draft pick deteriorates over time. Unlike most previous research on salary discrimination in sports leagues, we estimate separate equations for the two groups and use the results to explain whether salary discrimination exists in the NFL and, if so, the mechanisms driving this discrimination. By discrimination, we mean robust evidence of sustained differences in pay setting between two groups, here White and African-American.

2 | THE STRUGGLE FOR BLACK QUARTERBACKS TO FIND WORK

The early NFL, founded in 1920, was very different to what it is now. As Berri (2022) notes, from 1920 to 1935, there were 52 different NFL franchises. Of these, 44 eventually went out of business; a failure rate of 85%. Not only was the NFL failing financially, it was also not inclusive. According to the NFL Pro Football Hall of Fame, only 13 African-Americans participated in the NFL from 1920 until 1933.[2] And then in 1933—due to a gentlemen's agreement largely attributed to George Preston Marshall[3]—the NFL became an all-White league and remained so until 1946.[4]

At this point, integration did not happen in the NFL immediately for all teams, nor did it immediately happen across all positions. It wasn't until 1953 that a team finally put a Black quarterback in a

game.[5] On 18 October 1953, Willie Thrower—a rookie from Michigan State—entered a game for the Chicago Bears (Reid, 2017a). However, Thrower threw only eight passes that afternoon, and that effectively was the end of his NFL career as a quarterback. Despite the brevity of his career, Thrower—as Reid (2017a) notes—was 'a trailblazer'. But it took quite a long time for someone else to follow Thrower on that trail. The following 20 years is littered with examples of short-lived Black quarterback careers, and it is not until 1974 with James Harris, of the Los Angeles Rams, that we see a real success story.

As Reid (2017b) details, after five games of the 1974 season, Harris became the Rams' starter, leading them to a 7–2 record over the last nine games of the season, as well as their first playoff win in 23 years. For all this, Harris was named to the Pro Bowl where he earned MVP honours. One would think this success story would have proven to NFL decision-makers that teams could be successful with a Black quarterback. But that is not exactly what happened. Figure 1 illustrates the percentage of games started by Black quarterbacks from 1971 to 2020.[6]

After Harris, the progress was quite slow. By 1980, Black quarterbacks were still only given 5% of starts, and despite Doug Williams leading Washington to a Super Bowl victory in 1987, it wasn't until 1995 that Black quarterbacks were given more than 10% of all starts in a season. The 1999 draft, though, appeared to be a turning point. Three Black quarterbacks were taken with the second, third and 11th picks (Donovan McNabb, Akili Smith and Daunte Culpepper), who all became starting quarterbacks 2000. Consequently, in 2000, more than 26% of all quarterback starts went to Black quarterbacks. But over the next 10 years, progress was reversed. By 2010, the percentage of starts, pass attempts, total yards and plays was essentially back to where it was in the late 1990s. Since then, we once again see some improvement in the employment of Black quarterbacks, though, by 2020, we are not much further beyond where we were at the end start of the 21st century. In 2020, Black quarterbacks were given 26% of all starts; the same percentage as in 2000. In sum, it is still the case that White quarterbacks are given nearly 75% of all starts at the NFL's most prestigious position.

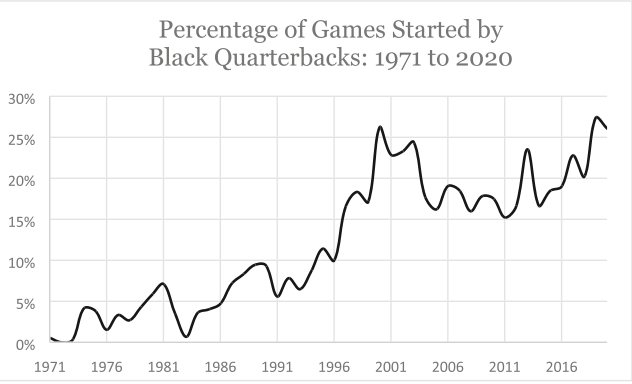

FIGURE 1 Percentage of games started by Black quarterbacks 1971–2020

All of this suggests that race could be playing a role in the evaluation of quarterbacks in the NFL. More specifically, it appears the NFL still maintains a very consistent and persistent preference for White signal callers.

3 | THEORETICAL BACKGROUND

At this point, it is worth considering some theories that may underpin the patterns described in Section 2. It is quite possible that discrimination takes place a long time before quarterbacks reach the NFL. Racial stacking, a process whereby minority athletes are segregated into particular positions based on assumptions around the association between race and athletic ability, means that White players are typically overrepresented in the quarterback position (see Bopp & Sagas, 2014). Moreover, Black players are typically described by professional scouts more in terms of their physical attributes (e.g., pace and strength) than White players, who are more likely to be described according to their mental attributes (e.g., leadership) (Woodward, 2004).

While these issues are interesting and of no doubt important, they go beyond the scope of this current work, not least due to the difficulty in ascertaining information on players at a very young age, even before their college careers. As such, our results are conditional on quarterbacks reaching the NFL in the first place.

In the absence of any information about how rookie players will perform in the NFL, it is likely that pre-NFL assessments are important. Since teams have little first-hand information on the ability of rookies, they likely make use of past performance and the assessments of scouts. Over time, however, as teams accrue better information about a players' true ability, this old information should become less important. Nevertheless, in the context of Major League Baseball, Black and Vance (2021) show that initial assessments (as measured by draft position) are an important predictor of progressing through the various levels of the Minor Leagues for up to 6 years. This work, however, did not consider any potential different treatment by race. This is an avenue that we explore in the context of the NFL.

That first impressions continue to persist into future evaluations is often referred to as a 'halo effect' (Nisbett & Wilson, 1977; Lazear, 1999). While empirical tests of the effect have been carried out (Belzil & Bognanno, 2008; Lazear, 1999), they typically produce mixed results. Though, these tests of the halo effect typically suffer from poor measures of current and past performance, relying on past promotions and salary increases. Naturally, using NFL data can overcome this concern with the use of actual performance data.

Even upon reaching the NFL, players still may face discriminatory behaviour manifesting itself as differences in pay. Gary Becker defined three categories of taste-based wage discrimination: by employers, by consumers and by co-workers. While previous work has examined the role of discrimination by customers and co-workers (see Bodvarsson and Partridge (2001) and Kahn (1992)), we follow Berri and Simmons (2009) in that the most plausible source of wage discrimination is by employers, particularly given the labour market for football players is not fully competitive, with just 32 teams and infrequent expansion.

Volz (2017) demonstrated that Black quarterbacks are indeed treated differently in the labour market. Specifically, after controlling for a variety of factors that would cause a team to move on from a quarterback, Volz found that Black quarterbacks were still twice as likely to be benched as White quarterbacks.

The purpose of our study is twofold. We first return to a question originally addressed in Berri and Simmons (2009): Are Black and White quarterbacks treated the same with respect to wages in the labour market? In a novel treatment, we pay close attention to the role that NFL entry draft evaluations play in explaining pay, and the extent to which this may differ between Black and White quarterbacks in terms of magnitude and persistence over player careers.

4 | DIFFERENCES IN WORK, DIFFERENCE IN PAY

Our story of the NFL labour market begins with a result that has received little attention in the literature on salary determination in the NFL. For quarterbacks, Berri and Simmons (2009) found, using a dummy variable to capture draft round, signal callers picked in the first round earned a salary premium of 136% while a second-round pick received a pay premium of 92%, from median quantile regression estimates.[7] In a study of running backs, Simmons and Berri (2009) also found substantial and statistically significant salary premia for Round 1 and 2 draft picks for running backs. Keefer (2013), also using median quantile regression, found significant pay premia for early picks of linebackers, with magnitudes of 132%, 29% and 22%, respectively, for Rounds 1 through 3. These large premia reflect the considerable valuations placed by NFL on early round picks. But why should an early round draft pick pay premium persist through a player's career? We might expect that, as performances are revealed through game time, the draft round status of a player should matter less for salary determination as a player gains greater experience. We hypothesise that the early draft round pay premium should fall with experience. To our knowledge, this has not been investigated previously.

We can then extend Volz's (2017) argument that Black quarterbacks are more likely to be benched, and become backups, relative to White quarterbacks. Perhaps there are racial differences in the rate of decay of the early draft round pay premium. Since Black quarterbacks might be perceived as more expendable, so this group might exhibit a faster rate of decay if early draft round pay premium relative to White quarterbacks. This will be our main focus of econometric analysis.

Moreover, Black and White quarterbacks—on average—play the position differently. From 1971 to 2020 there have been 269 occasions where a Black quarterback participated in at least 100 plays for an NFL team in a given season. On average, Black quarterbacks across these 50 years ran with the ball on 12% of all plays.

This tendency has not changed across the years. In 2020, 11 Black quarterbacks participated in at least 100 plays for an NFL franchise. On average these quarterbacks ran on 15.3% of their plays. In essence, these Black quarterbacks were very much what Michael Lee (2021) of the Washington Post referred to as 'dual-threat' quarterbacks. And according to Lee (2021), these are the quarterbacks NFL teams increasingly want:

> Franchises are seeking more dynamos—dual-threat quarterbacks whose legs can do damage right along with a powerful throwing arm. The position is evolving and being redefined, forcing White quarterbacks to adapt to a game in which success depends on an ability to read defenses and elude them.

In the 2020 season, there were 33 White quarterbacks who participated in at least 100 plays. All of these quarterbacks ran less than 15.3% of the time. In fact, on average they only ran on 6.6% of their plays. Every Black quarterback in 2020 ran more often than this.

Yet rushing yards appears to be an important indicator of quarterback performance. In a study of college football, Craig and Winchester (2021) find, without considering race, that for those college quarterbacks who were selected for the NFL, college rushing ability is significantly correlated with future NFL performance while college passing ability is not. We would therefore expect NFL rushing capability to be rewarded in salary.

Kelly et al. (2020) showed that the (total) number of yards gained is an important predictor of offensive scoring. Yet a simple re-estimation of the model splitting total yards into rushing and passing yards reveals that both these measures contribute equally to offensive scoring. In other words, a yard is a yard, and it does not matter how these yards are produced.

All of this indicates that the job of a quarterback is different for Black and White quarterbacks, with respect to how they play the game and how they earn yards. Black quarterbacks are celebrated for being 'dual-threat' signal callers, but White quarterbacks are simply not often asked to run anywhere, even though both passing and rushing contribute equally to offensive production. We wish to know if this difference in workload is reflected in salaries for Black and quarterbacks.

To answer our two main questions on decay of early draft round pay premium and role of quarterback rushing, we collected salary and performance data for all veteran NFL quarterbacks from 2006 to 2020.[8] As noted, most quarterbacks are still White. Specifically, we began with a data set that included 216 White quarterbacks and 58 Black quarterbacks.[9]

Our focus dependent variable is *log cap value*. We obtained figures of cap value, or 'cap hit', from www.overthecap.com and cross-checked the data against www.spotrac.com. For 2006 to 2008, these data were supplemented by data from *USA Today*, reported on Rodney Fort's Sport Business web site. After 2008, *USA Today* ceased reporting of NFL salary data. We were able to establish consistency of values for the subset of quarterbacks whose salaries were reported on both *USA Today* and www.overthecap.com over 2006 to 2008. After matching with performance measures, we have a useable data set comprising 720 observations on 167 White quarterbacks and 175 observations on 48 Black quarterbacks.

In the NFL, cap value denotes the value of player compensation set against the team's salary cap. The NFL operates a hard salary cap as a global maximum payroll which is adhered to by all teams. Hence, there is very little variation of total salary cap value across the teams in a given season. Unless otherwise specified in a player's contract, base salary is not guaranteed. Signing bonuses are guaranteed, and these are pro-rated over the duration of a contract for purposes of salary cap evaluation. Performance bonuses are excluded from the cap value, but other bonuses, such as a 'roster bonus' or a 'workout bonus'—essentially appearance bonuses—are set against the cap value for a given player-season.

The breakdown of cap value is best shown by an example. Consider the aforementioned Patrick Mahomes. In 2017, Mahomes signed a rookie contract with the Kansas City Chiefs. And then—as previously noted—he re-signed in 2020 with Kansas City. An NFL player only qualifies for unrestricted free agent status after 4 years' service. Table A1 shows Mahomes' salary breakdown for 2019 and 2022. Mahomes' 2019 value is part of our data set. As a rookie in 2019, Mahomes was already above median pay for both Black and White quarterbacks. Of course—as noted—the $503 million contract he signed in 2020 puts him at the top of the list, at least at the moment. This new contract does not begin until the 2022 season and someone else could sign an even richer contract before then. In addition—given the prevalence of injuries in the NFL—Mahomes could see his career end at any time.

If Mahomes stays with the Chiefs in 2022, he will be one of the highest paid quarterbacks in the NFL, with a cap value of $36m. This is driven more by large bonuses than by higher base salary (only $1.5m in 2022).[10] Mahomes is clearly highly valued by the Chiefs, as shown by a 10-year contract. But this also presents a dilemma for the Chiefs as Mahomes' cap value is projected to be 17% of the team's total salary cap. To retain Mahomes, the Chiefs will have to allocate fewer financial resources to other positions on the team (Roach, 2018). The example of Mahomes shows that a Black quarterback can earn a large salary in the NFL. And as noted, there are other examples too. Nevertheless, these examples are not necessarily the norm.

Table 1 presents the overall distribution of quarterback salaries by race. The salary distribution is similar at deciles below median. But upper deciles show larger values for White quarterbacks compared to Black players. Skewness and kurtosis values are greater for Black quarterbacks. Thus, we have a small number of elite Black quarterbacks, like Patrick Mahomes, who earn very large salaries but the majority of Black quarterback do not get into top deciles of the salary distribution.

Early studies of discrimination against groups of players in sports leagues used regression analysis with log pay as dependent variable and typically included a dummy variable for group identity alongside covariates for player experience and performance and other covariates. For the NFL, Berri and Simmons (2009) extended this approach to include interaction terms between Black dummy and performance measures, including rush yards. They noted—as we do above—that Black quarterbacks over 1995 to 2006 tended to rush more than White counterparts. The lack of significance of the Black rush yards interaction term suggested that although Black quarterbacks contributed to team performances by rushing, this was not rewarded in salary.

TABLE 1 Descriptive statistics for cap value $m

	White $N = 720, 216$ players	Black $N = 175, 58$ players
Mean	6.75	5.70
Standard deviation	7.54	6.97
10th percentile	0.60	0.59
25th percentile	0.98	1.00
Median	3.06	3.01
75th percentile	10.54	7.30
90th percentile	18.58	16.00
Skewness	1.37	1.87
Kurtosis	4.19	5.97

Table 2 shows descriptive statistics for our samples of Black and White quarterbacks.[11] We see that, compared to White quarterbacks, Black players have fewer years of experience and fewer career pass attempts. For a given season, we see little difference between groups in terms of pass attempts and pass yards. This suggests similarity of performance between Black and White quarterbacks, conditional on playing. But Black quarterbacks have shorter careers and less playing utilisation over their careers. Table 2 also shows—consistent with what we noted in looking at all data from 1971 to 2020—that Black quarterbacks have higher mean rush yards than White counterparts, 193 versus 67.

5 | MODELLING QUARTERBACK SALARIES IN THE NFL

Berri and Simmons (2009) pooled observations for Black and White quarterbacks into a single sample for estimation. They had 435 observations for White quarterbacks and 95 for Black. Our sample sizes are considerably larger with 720 observations for White players and 175 for Black players. This increased sample size facilitates separate estimation for the two groups of players, which is preferable to pooled estimation as effects of particular covariates could vary across groups.

Our model follows Berri and Simmons (2009). We establish a standard Mincer-type earnings function.[12] Once again, *log cap value* is our dependent variable. Our findings are robust to using an alternative definition of salary, namely, *log total pay* (which accounts for all earnings, beyond those that count against the cap).

Our list of covariates begins with *experience* and *experience squared*. We expect positive and negative effects, respectively, to reflect diminishing returns as players get older. Beyond experience, we expect—perhaps surprisingly[13]—where a player to be drafted to

TABLE 2 Descriptive statistics

Variable	Mean	Standard deviation	Minimum	Maximum	Type
White					
Experience	7.66	4.54	1	22	Continuous
Career pass attempts	1635	2045	0	10,162	Continuous
Pass attempts	275	225	1	727	Continuous
Pass yards	1966	1673	0	5477	Continuous
Rush yards	67	93	−31	660	Continuous
4th quarter comebacks	0.98	1.27	0	8	Continuous
QB rating	79.15	22.73	0	158.3	Continuous
Top 10 pick	0.24				Dummy
Late 1st round	0.12				Dummy
Draft Round 2	0.13				Dummy
Undrafted free agent	0.15				Dummy
Change team	0.25				Dummy
Pro Bowl	0.35				Dummy
Black					
Experience	5.43	3.01	1	15	Continuous
Career pass attempts	914	1057	0	4746	Continuous
Pass attempts	255	204	1	626	Continuous
Pass yards	1850	1546	0	5109	Continuous
Rush yards	193	228	70	1206	Continuous
4th quarter comebacks	0.94	1.24	0	5	Continuous
QB rating	79.72	22.10	0	156.3	Continuous
Top 10 pick	0.32				Dummy
Late 1st round	0.20				Dummy
Draft Round 2	0.12				Dummy
Undrafted free agent	0.06				Dummy
Change team	0.25				Dummy
Pro Bowl	0.39				Dummy

matter. Previous studies have included dummy variables for draft round as a predictor of salary. Berri and Simmons (2009) found statistically and economically significant salary premia for first and second-round picks for NFL quarterbacks and running backs. We include dummy variables for *Draft round 2* and *Undrafted free agent*, to complete the set of hiring choices.

For first-round picks, though, we take an additional step. Specifically, we break down first round into two components: *Top 10 pick* for picks 1 to 10 in first round and *Late 1st* for picks 11 to 32 in first round. This finer classification allows us to examine different effects between early and late round draft picks. Table 2 shows that 24% of White player observations and 32% of Black player observations were attached to draft picks 1 to 10, so this is not a rare event. This preponderance of early picks for quarterbacks is indicative of the priority that NFL teams attach to this highly important and strategic position.[14] We experimented with alternative splits of first-round draft and found that a threshold of 10 gave the highest explanatory power in our regressions, from R^2 values.

Healy (2008) suggested that Major League Baseball teams might have excessively short memories when evaluating player performance. Previous season performance might be given too high a weight compared to performance 2, 3 or even 4 years before. In the NFL, we suggest an opposite problem facing teams. From previous studies, it appears that the salary premium for first-round draft pick applies regardless of length of playing experience. Being picked in first round is both a proxy and a signal for future performance. Moreover, it is clear that first-round draft picks receive more resources in training and development compared to later round draft picks. For quarterbacks, training and development involves learning and practising the plays designed by coaches, especially offensive coordinators. First-round picks will be nurtured until deemed ready for starting positions. However, once a first-round pick becomes a starter, it is not clear why the pick selection number should be relevant for player pay. As the player's career progresses, the impact of draft pick selection should lessen, perhaps to zero, while performance statistics gain greater influence on player pay.

In a novel treatment of impact of draft pick selection on pay, we introduce two interaction terms: *Top 10 pick * experience* and *Late 1st * experience*. We predict the coefficients on these terms to be negative. Dividing the estimated coefficient on *Top 10 pick* by the coefficient *Top 10 pick * experience* gives the number of years at which the impact of *Top 10 pick* decays to zero. We estimate the rates of decay separately for Black and White quarterbacks.

The next variable we consider is *Change team*. This variable is equal to one if a quarterback changes team. Following from Berri and Simmons (2009), we expect this to show players who changed teams received a salary penalty. This can be explained via signalling. Players who move between teams are those who did not receive offers of contract extensions from current clubs. In other words, the current club has essentially stated they have better options. Consequently, we predict a negative coefficient for this dummy variable.

Of course, a quarterback's pay is also impacted by what the quarterback does on the field of play. Our set of performance measures comprises *Career pass attempts*, *pass yards* and *rush yards*, in line with Berri and Simmons (2009). In addition, quarterbacks are often given credit when a team comes back to win a game after trailing in the 4th quarter. Whether or not such comebacks should be entirely attributed to the play of the quarterback, it is possible decision-makers might give credit to the signal caller for these outcomes. Consequently, we added to our model *4th quarter comebacks*, which is the number of times a quarterback succeeds in leading his team to a win after being behind in score at the end of the third quarter. We also consider a widely used metric for evaluating quarterback performance, namely QB passer rating. The variable is not always a perfect indicator of performance since—as the name suggests—it measures passing ability and does not consider running ability, which, as already demonstrated, differs between Black and White quarterbacks. Nevertheless, as this is a popular metric, it should be included in the model.

The final factor we consider is whether or not a quarterback has appeared in the Pro Bowl at any point in their career. Each year, fans, players and coaches vote for selection of preferred players into the all-star one-off Pro Bowl game played before the Super Bowl in February. Selection of players into the Pro Bowl game is an indicator of peer esteem and might enhance a quarterback's salary.

Our model is then:

$$\begin{aligned} Logcapvalue = {} & b_0 + b_1 Experience + b_2 Experience\ squared + b_3 Top10pick \\ & + b_4 Late\ 1st\ round + b_5 Top10pick * Experience \\ & + b_6 Late\ 1st\ round * Experience + b_7 Draft\ Round2 \\ & + b_8 Undrafted\ free\ agent + b_9 Change\ team \\ & + b_{10} Career\ pass\ attempts + b_{11} Pass\ yards \\ & + b_{12} Rush\ yards + b_{13} 4th\ quarter\ comebacks \\ & + b_{14} ProBowl + Season\ fixed\ effects + error. \end{aligned} \tag{1}$$

Our dependent variable is expressed as nominal values. Rather than deflate by a consumer price index, we allow any salary inflation to be picked up by season dummies. This allows for any underlying non-linear variation in salaries. We also experimented with a linear time trend, but results were identical. In pre-estimation, we included team fixed effects but these were jointly insignificant and were dropped from estimation. This result is unsurprising. With a hard salary cap and extensive sharing of NFL revenues across teams, we would not expect substantial underlying variation of player pay across teams. Employer ability to pay is similar throughout the league. Unusually, for salary models of sports leagues, we also report estimates of (1) with player fixed effects added to utilise our longitudinal data set and control for unobserved heterogeneity across players (Simmons, 2022). When we do this, the effects of time-invariant variables, that is, draft round dummy variables will drop out.

Our priors for signs of estimated coefficients in (1) above are

$$\begin{aligned} & b_1 > 0, b_2 < 0, b_3 > 0, b_4 > 0, b_5 < 0, b_6 < 0, b_7 > 0, b_8 < 0, b_9 < 0, b_{10} > 0, \\ & b_{11} > 0, b_{12} > 0, b_{13} > 0, \\ & b_{14} > 0. \end{aligned}$$

The standard approach to assessing pay discrimination in labour economics is the Oaxaca–Blinder decomposition. After estimating salary models by group, this procedure distinguishes between returns to endowments (mean values of attributes) and returns to characteristics (via estimated coefficients in the salary models), by group. We do not follow this approach here. That is because we aim to assess differences between Black and White salary returns to specific attributes (especially premia for early draft picks and subsequent rates of decay). Also, the Oaxaca–Blinder decomposition cannot inform us about the *absence* of a salary premium for particular key skills, running plays in our case. We proceed to estimate Equation (1) separately for Black and White quarterbacks and then assess any differences between estimates of the effects of particular attributes on salary by ethnic group.

One final issue to consider is Table 1 reveals skewness and kurtosis in our dependent variable. A formal joint test for skewness and kurtosis rejected the null hypothesis of no skewness or kurtosis at the conventional 5% level, for both Black and White sub-samples. This gives rise to concern over non-normality of our dependent variable. The standard method to deal with this is quantile regression. Quantile estimates do not rely upon normality of the dependent variable. This approach was followed by Berri and Simmons (2009) in their earlier study of NFL quarterbacks. Here, we recognise the twin problems of non-normality of the dependent variable and unobserved heterogeneity among players. Machado and Santos Silva (2019) offer an estimation method, MM-QR (xtqreg in Stata), to deal with these dual problems. We follow Kempa's (2022) work on European football in applying this method to NFL quarterback salaries.

6 | EMPIRICAL RESULTS

6.1 | Baseline models

Before progressing to the main empirical results, we first present a simple pay gap estimate between Black and White quarterbacks. Results in Table 3 show this gap is insignificant, conditional on playing at least one snap. Even if the gap itself is insignificant, that is not to

TABLE 3 Simple pay gap estimation

Variables	(1) Log cap value
Black	−0.117 (0.108)
Constant	1.153*** (0.049)
Observations	906
R^2	.001

Note: Standard errors in parentheses.
*$p < .1$.
**$p < .05$.
***$p < .01$.

say that Black and White quarterbacks are rewarded identically for different performance measures.

We begin with OLS estimates of Equation (1), with and without player fixed effects. Our estimates are reported in Table 4. Estimation of player salary models with player fixed effects is unusual in the literature (Simmons, 2022). Drut and Duhautois (2017) and Kempa (2022) are notable exceptions that apply player fixed effects to salary data of European soccer players. The estimates from the MM-QR quantile regressions (at the median) with player fixed effects are shown in Table 5. Our focus is on estimated differences in effects between Black and White quarterbacks.

For each estimator in Table 4, the salary returns to experience exhibit the predicted concave pattern, with turning points estimated within sample. In the basic OLS estimates, the turning point for Black quarterback salaries is 15 years which is well above the 10-year figure for White quarterbacks. The turning point on experience for Black and White quarterbacks converges somewhat when player fixed effects are introduced (9.3 and 8, respectively).

Although the effects of career experience on pay of Black and White quarterbacks look broadly similar, once player fixed effects are considered, this is not the case for career utilisation. The returns to an extra 1000 career pass attempts are substantially higher for Black quarterbacks over White quarterbacks, approximately double for Black players when unobserved heterogeneity is controlled for in Table 4. This difference in returns does not carry over to recent performance. The salary returns to previous season pass yards are quite similar between Black and White quarterbacks. We conjecture that the result of high returns to career utilisation for Black quarterbacks is due to a greater rate of career attrition among Black quarterbacks compared to White, as shown by Volz (2017), and a subsequent scarcity of Black quarterbacks who can be relied upon to make plays in games. The issue of possible attrition is one we turn to in our robustness checks.

Although both Black and White quarterbacks are rewarded for career utilisation and recent passing performance, this is not the case for rushing yards. We noted above that Black quarterbacks tend to run with the football far more often than White quarterbacks. Even though rushing is an integral part of any NFL team offence and is expected to contribute to team production, our results show insignificant effects of extra rush yards on quarterback pay, for either group. The lack of significance of rush yards occurs for each of the three estimation methods shown in Tables 4 and 5. This is despite the fact that rush and pass yards contribute equally to team offence. As a further test as to the productivity of different types of yardage gained, we also examined the significance of two further variables, namely, passing yards per touchdown and rushing yards per touchdown. These both proved to be insignificant.[15]

Next, we turn to the question of whether or how a quarterback's draft pick salary premium decays over time. We split the first-round pick numbers into 1 to 10 and then 11 to 32 and create dummy variables for the two types. We also include dummy variables for second-round pick and undrafted free agent but coefficients on these categories are always insignificant.

In the basic OLS estimation shown in Table 4, both *Top 10 pick* and *Late 1st* have significant, positive effects on pay for each group. As expected, the effect is larger for *Top 10 pick* than for *Late 1st*. Players who subsequently switch teams suffer a salary penalty, in line with the finding of Berri and Simmons (2009). This penalty is similar for Black and White quarterbacks.

The rate of decay of top pick salary premium is found by dividing the coefficient on *Top 10 pick* by the coefficient on the interaction term *Top 10 pick * experience*. For the OLS estimates in Table 4, we find that the salary premium for top picks is eliminated after 11.7 years for White quarterbacks and 6.1 years for Black quarterbacks. This is a very large difference and suggests differential treatment of the two groups in pay setting. But the basic OLS estimates may not be reliable due to non-normality of our dependent variable. To check for robustness of this result, we estimated a Huber robust regression which is a weighted least squares estimator that corrects for outliers in the dependent variable.[16] Table 6 shows the resulting estimates of number of years after which top draft pick premium is eliminated.

Results in Table 6 demonstrate remarkable consistency for the period of decay for Black and White quarterbacks. The top draft pick salary premia for White quarterbacks is far more persistent than for Black quarterbacks. In other words, once NFL decision-makers have decided a White quarterback is special, based on draft pick priority, their decision is not changed very quickly, even when controlling for performance. This is consistent with a 'halo effect', a type of cognitive bias whereby judgement of a person's character can be influenced by one's overall (or usually first) impression (Hong & Liskovich, 2015; Nisbett & Wilson, 1977).

For Huber robust regression and for each quantile estimate in Table 6, we see a substantial difference in number of years for which the top draft pick premium persists for each group.[17] For White quarterbacks, the top pick premium lasts for 10.5 to 13.2 years. For Black quarterbacks, the top pick premium is sustained for 6.1 to 7.7 years. The smallest gap between the estimates is 3 years (from 0.1 quantile estimate) while the largest gap is 6.3 years (from 0.9 quantile estimate). Hence, on this particular variable, located on high pick quarterbacks, we find a substantial difference in pay setting between Black and White players. This is a new result which can only be revealed by separate salary estimation across the two groups of players.

TABLE 4 OLS estimates with and without player fixed effects

	(1)	(2)	(3)	(4)
Variables	**OLS White**	**OLS Black**	**OLS/FE White**	**OLS/FE Black**
Experience	0.240*** (0.026)	0.300*** (0.083)	0.191*** (0.035)	0.354*** (0.121)
Experience squared	−0.012*** (0.002)	−0.010 (0.006)	−0.012*** (0.002)	−0.019** (0.008)
Top 10 pick	1.214*** (0.164)	1.534*** (0.259)		
Late 1st	0.574*** (0.192)	0.754** (0.301)		
Top 10 pick * experience	−0.103*** (0.018)	−0.252*** (0.060)	−0.114*** (0.033)	−0.337*** (0.070)
Late 1st * experience	−0.036* (0.021)	−0.159** (0.078)	−0.068* (0.035)	−0.209 (0.142)
2nd draft round	0.162 (0.149)	−0.158 (0.317)		
Undrafted free agent	−0.015 (0.122)	−0.244 (0.301)		
Change team	−0.448*** (0.081)	−0.544*** (0.176)	−0.455*** (0.087)	−0.450** (0.195)
Career pass attempts/1000	0.202*** (0.048)	0.491*** (0.149)	0.348*** (0.072)	0.711*** (0.257)
Pass yards/1000	0.266*** (0.038)	0.270*** (0.065)	0.232*** (0.043)	0.258*** (0.086)
Rush yards/1000	0.261 (0.415)	0.709* (0.374)	−0.353 (0.612)	0.147 (0.554)
4th quarter comebacks	0.042* (0.022)	−0.025 (0.058)	0.041* (0.022)	−0.035 (0.063)
Pro Bowl	0.277*** (0.093)	−0.151 (0.190)	0.145 (0.209)	−0.193 (0.357)
QB rating	0.004** (0.002)	−0.001 (0.002)	0.001 (0.002)	0.002 (0.002)
Constant	−1.118*** (0.160)	−1.027*** (0.363)	−0.069 (0.197)	−0.513 (0.382)
Season FE	Yes	Yes	Yes	Yes
R^2	.730	.727		
R^2 (within)			.354	.605
R^2 (overall)			.535	.248
N	720	175	720	175
N players	167	48	167	48

Note: At least one pass attempt in previous season. Dependent variable is log cap value. Cluster robust standard errors in parentheses (clustered at the player level).
*$p < .1$.
**$p < .05$.
***$p < .01$.

When we include player fixed effects, the dummy variables for draft status necessarily drop out from the model as these are time-invariant. Nevertheless, we can consider whether the coefficient on *Top 10 pick * experience* is larger in absolute value for Black as opposed to White quarterbacks to infer any differences in treatment. We estimated equation (1) with player fixed effects by OLS and MM-QR at the median. The coefficients on *Top 10 pick * experience* are very similar for each estimation at 0.34 and 0.11 for Black and White groups respectively. This reinforces our point that the differences in decay of top draft pick premium between groups are systematic and substantial regardless of estimation method.

6.2 | Robustness checks

Our first check involves using an amended definition of pay. As discussed already, pay is split into guaranteed and non-guaranteed portions, as well as portions that do and do not count against the cap. The amended definition of pay we use here is *log total pay*, which includes base pay, plus pro-rated signing bonus plus roster bonuses. Results are shown in Appendix Table A2. They are remarkably similar to those presented in Table 6. Most importantly for our work, the coefficients reveal it takes an estimated 12.3 years for the first-round draft pick salary premium to disappear for White quarterbacks, and 6.3 years for Black quarterbacks. Moreover, coefficients on the effects of yardage are very similar.

We also attempt to investigate the role of survivorship bias in our estimates.[18] We earlier noted work by Volz (2017) which showed Black quarterbacks were twice as likely to be benched as White quarterbacks. Our approach involves a simple re-weighting procedure, by first predicting quarterback survival into the following season using variables such as their experience, performance and race. We then use the inverse probabilities in a re-weighted version of the OLS regressions equivalent to Columns 1 and 2 in Table 4, in an attempt to strip out the survivorship bias from our estimates. Estimates can be found in Table A3. Interpretations of our main findings remain intact. The estimated deterioration of first-round salary premia is 13.7 years for White quarterbacks and 5.9 years for Black quarterbacks.

TABLE 5 Fixed effects quantile estimates of separate models for White and Black quarterbacks

	(1)	(2)
Variables	**White**	**Black**
Experience	0.187** (0.076)	0.350 (0.321)
Experience squared	−0.011*** (0.004)	−0.019 (0.027)
Top 10 pick * experience	−0.112** (0.054)	−0.335* (0.188)
Late 1st * experience	−0.066 (0.059)	−0.212 (0.310)
Change team	−0.441** (0.173)	−0.442 (0.599)
Career pass attempts/1000	0.347** (0.139)	0.715 (0.571)
Pass yards/1000	0.228*** (0.074)	0.260 (0.311)
Rush yards/1000	−0.328 (1.151)	0.159 (1.856)
4th quarter comebacks	0.041 (0.054)	−0.037 (0.215)
Pro Bowl	0.128 (0.398)	−0.197 (1.423)
QB rating	0.001 (0.004)	0.002 (0.009)
Season FE	Yes	Yes
N	720	175
N players	167	48

Note: At least one pass attempt in previous season. Median estimates. Dependent variable is log cap value. Standard errors in parentheses.
*$p < .1$.
**$p < .05$.
***$p < .01$.

TABLE 6 Years after which positive pay premium for Top 10 draft pick is eliminated

Method	White $N = 720$	Black $N = 175$
OLS	11.7	6.1
Huber robust regression	11.4	6.3
Quantile regression		
0.1	10.7	7.7
0.25	10.5	6.6
0.5	12.7	6.3
0.75	12.9	6.7
0.9	13.2	6.9

Note: Quarterbacks with at least one pass attempt in previous season.

7 | CONCLUDING OBSERVATIONS

Across the past 50 years, it appears progress has been made with respect to race and the quarterback position in the NFL. It is now not uncommon to see Black quarterbacks start in the league. In addition, Black quarterbacks have won Super Bowls, been named league MVP and even become the highest paid players in the league. All of that suggests the NFL does not consider race in the evaluation of quarterbacks.

Both White and Black quarterbacks have been selected as top draft picks. Our analysis indicates that these evaluations very much persist into future pay for White quarterbacks. Once decision-makers decide a White quarterback is special that view does not seem to change very quickly. That is true even if the White quarterback does not quite offer special performances on the field.

In contrast, Black quarterbacks seem much more likely to be evaluated in terms of 'what have you done lately?' The halo effect from being a top draft pick seems to vanish much more quickly for the Black quarterback compared to White counterpart. The difference in rate of decay of early draft pick pay premium is substantial. Whereas it takes around 10 to 12 years for the early draft pick pay premium to vanish for White signal callers, a comparable Black quarterback sees his early round pay premium only last for 6 to 7 years.

Whereas the majority of the players in the NFL are Black, it remains true—just as it was at the start of the century—that more than 70% of starts go to White quarterbacks. In sum, no real progress has been made in 20 years with respect to the race and the quarterback position. This may not be good news for Patrick Mahomes. He did just sign the richest contract in professional sports history. But quarterback performance is remarkably inconsistent (Berri & Burke, 2012). It is not unheard of for top quarterbacks having sub-par seasons. If that happens for Mahomes, will Kansas City want to keep paying him to lead their franchise? Our analysis suggests there may be a reason to think a bad season from Mahomes may not be treated the same as similar bad seasons by legendary White quarterbacks.

Patrick Mahomes was Draft Pick 10 in the first round of the 2017 draft. Hence, he fits the description of early round draft pick in our study. As an African-American quarterback, Mahomes is likely to experience a negative impact on pay as the premium from his early draft pick status is eroded by experience. This is over and above any ageing effect and represents a larger predicted adverse impact on pay compared to a similar White quarterback. Patrick Mahomes would then need to utilise other attributes such as stellar performances to sustain his pay levels over his future career. A comparable White quarterback faces less of a disadvantage from decaying salary returns to draft pick status.

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CONFLICT OF INTEREST

No conflicts of interest declared.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ENDNOTES

[1] This is in terms of the impact a player's compensation has one each team's salary cap (i.e., the 'cap hit'). Data on salaries can be found at Spotrac.com. The 2020 quarterback salaries can specifically be found https://www.spotrac.com/nfl/rankings/2020/quarterback/.

[2] There were four African-Americans who played professional football before the NFL. Charles Follis—who played for the Shelby Athletic Club from 1902 to 1906—is considered the first African-American to play professional football. For more, see https://www.profootballhof.com/football-history/african-americans/.

[3] This was noted by Keyshawn Johnson in an interview with NPR (2021). George Preston Marshall was the owner of the NFL team in Washington.

[4] In 1946, the Cleveland Rams intended to relocate to Los Angeles. As a requirement to lease the Coliseum Stadium, the Rams had to racially integrate their team. For more, see Fox Sports (2016).

[5] As Stuart (2020) notes, George Taliaferro did pass the ball for the New York Yanks of the NFL in 1950. But Taliaferro was not listed as a quarterback, and was instead considered a 'utility' player.

[6] We also did the same analysis with pass attempts, total yards and plays.
Total Yards = Passing Yards + Rushing Yards − Yards Lost from Sacks
Plays = Pass Attempts + Rush Attempts + Sacks
The results were virtually identical. All performance data are taken from Pro-Football-Reference.com. For the list of Black quarterbacks, we primarily relied on looking at pictures of Black quarterbacks. We also utilised the research presented by Stuart (2020) and also this page from Wikipedia: https://en.wikipedia.org/wiki/List_of_starting_black_NFL_quarterbacks.

[7] Figures based on β coefficients of draft round dummy variables were obtained using the formula $\exp(\beta) - 1$.

[8] A quarterback was included in our data set if he had at least one pass attempt in the season prior to salary specification. This inclusion restriction necessarily eliminates rookie quarterbacks from our sample (Berri & Simmons, 2009). It also eliminates quarterbacks with zero passing activity in a given season prior to salary being observed.

[9] Virtually, all quarterbacks are either 'Black' or 'White' (which we ascertained by looking at pictures). Two quarterbacks of Pacific island origin were omitted from analysis.

[10] We later show that models using total pay or cap value are identical.

[11] For a salary value at season t, the performance statistics refer to season $t - 1$ while career pass attempts refers to season $t - 2$, to avoid collinearity with prior season performance in the regression model.

[12] For a general survey of salary models in sports leagues, see Simmons (2022).

[13] As we note below, this may be surprising since we are looking at non-rookie quarterbacks. NFL decision-makers have already seen these quarterbacks play in the NFL. Therefore, we might expect what they thought about the players before their NFL career to no longer matter. Nevertheless—as we note—previous research has shown that draft position does persist in the evaluation of NFL decision-makers.

[14] Since first picks overall are thought of as the very best college players, are much sought after and attract extreme publicity, we experimented with a further classification of Picks 1 and 2, Picks 3 to 10, then 11 to 32. There was no significant difference in estimated coefficients between our two-way and the alternative three-way classifications. We also varied the threshold between early and late round either side of 10. The 10th pick threshold gave superior goodness of fit to other threshold choices.

[15] With regard to our two final performance measures, QB rating proved to be insignificant across specifications. Selection to the Pro Bowl was significant for White quarterbacks in OLS models but not for Black quarterbacks. However, we for models including player fixed effects, the significance disappears. This is likely due to Pro Bowl appearances being correlated with unobserved player ability, as well as selection on a small number of elite quarterbacks, such as Tom Brady, Peyton Manning and Drew Brees.

[16] We also ran quantile regressions on Equation (1), applied to quantiles 0.1, 0.25, 0.5, 0.75 and 0.9. Full results tables for these models are available on request from the authors.

[17] In short, the quantile regressions show that for both Black and White quarterbacks, the coefficients on *Top 10 pick* and *Top 10 pick * experience* are statistically significant at 1% and economically meaningful at all estimated quantiles, with the expectation of the 90th quantile for Black quarterbacks, where *Top 10 pick * experience* is significant only at 10%.

[18] We also considered the possibility that Black quarterbacks could be more susceptible to injuries (given they run more, and thus risk muscular and contact-related injuries, etc.), which in turn could affect their survivorship in the league. Nevertheless, when a quarterback runs, they are allowed to (and actively told by coaches) to slide to the floor to avoid contact. On the flip side, when a quarterback stays in the pocket, they are surrounded by opponents actively trying to sack them, so it is also reasonable that it is actually pocket passers who are more susceptible to injuries. To test both these possibilities, we regress the number of games spent on the Injured Reserve list during the regular season (data attained from https://www.pro-football-reference.com/, dating back to 2009) on a host of performance measures along with an indicator for whether the quarterback is Black. Results from a simple OLS regression in Table A4 show that there is no significant difference in the length of time spent on injured reserve between Black and White quarterbacks, while none of the performance metrics are significant predictors of injuries.

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APPENDIX A

TABLE A1 Patrick Mahomes' salary breakdown

Component	2019 $m	2022 $m
Base pay	0.65	1.50
Pro-rated signing bonus	2.52	6.34
Roster bonus	1.31	27.40
Workout bonus	0	0.55
Cap hit	4.48	35.79
Percentage of team cap	2.4	16.9

TABLE A2 Models using total pay

	(1) OLS White	(2) OLS Black	(3) OLS/FE White	(4) OLS/FE Black
Variables	Log Total Pay			
Experience	0.252*** (0.029)	0.312*** (0.087)	0.205*** (0.036)	0.279** (0.135)
Experience squared	−0.012*** (0.002)	−0.015** (0.007)	−0.012*** (0.002)	−0.018* (0.009)
Top 10 pick	1.149*** (0.151)	1.283*** (0.310)		
Late 1st	0.545*** (0.198)	0.588* (0.315)		
Top 10 pick * experience	−0.091*** (0.019)	−0.203*** (0.066)	−0.118*** (0.035)	−0.335*** (0.072)
Late 1st * experience	−0.020 (0.023)	−0.142* (0.085)	−0.056 (0.038)	−0.134 (0.144)
2nd draft round	0.237* (0.130)	−0.261 (0.277)		
Undrafted free agent	−0.047 (0.119)	−0.420* (0.241)		
Change team	−0.408*** (0.077)	−0.502*** (0.176)	−0.376*** (0.085)	−0.467** (0.202)
Career pass attempts/1000	0.152*** (0.046)	0.498*** (0.150)	0.323*** (0.072)	0.765*** (0.228)
Pass yards/1000	0.254*** (0.040)	0.276*** (0.065)	0.219*** (0.043)	0.247** (0.093)
Rush yards/1000	0.283 (0.373)	0.702* (0.371)	−0.263 (0.569)	0.198 (0.600)
4th quarter comebacks	0.028 (0.021)	−0.068 (0.055)	0.029 (0.018)	−0.056 (0.063)
Pro Bowl	0.247** (0.096)	−0.307 (0.204)	0.176 (0.207)	−0.202 (0.335)
QB rating	0.004*** (0.002)	−0.001 (0.002)	0.002 (0.002)	0.001 (0.003)
Constant	−1.083*** (0.170)	−0.822* (0.463)	−0.136 (0.186)	−0.052 (0.448)
Season FE	Yes	Yes	Yes	Yes
R^2	.741	.721		
R^2 (within)			.377	.610
R^2 (overall)			.532	.230
N	689	164	689	164
N players	159	47	159	47

Note: Cluster robust standard errors in parentheses (clustered at the player level).
*$p < .1$.
**$p < .05$.
***$p < .01$.

TABLE A3 Weighted OLS models

Variables	(1) OLS White	(2) OLS Black
Experience	0.241*** (0.036)	0.305*** (0.083)
Experience squared	−0.013*** (0.002)	−0.008 (0.007)
Top 10 pick	1.095*** (0.226)	1.607*** (0.256)
Late 1st	0.477** (0.240)	0.917*** (0.283)
Top 10 pick * experience	−0.080*** (0.030)	−0.272*** (0.057)
Late 1st * experience	−0.038 (0.026)	−0.197*** (0.067)
2nd draft round	0.399** (0.171)	0.070 (0.289)
Undrafted free agent	−0.033 (0.153)	−0.563* (0.287)
Change team	−0.440*** (0.118)	−0.438*** (0.162)
Career pass attempts/1000	0.228*** (0.062)	0.392** (0.148)
Pass yards/1000	0.279*** (0.050)	0.349*** (0.069)
Rush yards/1000	1.149* (0.599)	0.431* (0.232)
4th quarter comebacks	0.031 (0.039)	−0.021 (0.062)
Pro Bowl	0.285** (0.119)	−0.007 (0.200)
QB rating	0.004** (0.002)	−0.002 (0.002)
Constant	−1.224*** (0.276)	−1.095*** (0.365)
Season FE	Yes	Yes
Observations	720	175
R^2	.730	.838

Note: Robust standard errors in parentheses.
*p < .1.
**p < .05.
***p < .01.

TABLE A4 Quarterback injury records

Variables	(1)	(2)	(3)
	Days on IR		
Black	−0.048 (0.283)	0.096 (0.309)	0.061 (0.323)
Rush yards/1000		−1.059 (0.919)	−0.390 (2.850)
Pass yards/1000		0.071 (0.076)	0.015 (0.481)
Drop backs			0.002 (0.020)
Rush attempts			−0.009 (0.017)
Pass attempts			−0.003 (0.020)
Number of sacks			0.020 (0.030)
Number of times hit as threw			0.030 (0.048)
Constant	0.853*** (0.127)	0.789*** (0.184)	0.769*** (0.199)
Observations	671	671	664
R^2	.000	.002	.007

Note: Standard errors in parentheses.
*p < .1.
**p < .05.
***p < .01.