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Running Backs in the NFL Draft and NFL Combine: Can Performance be Predicted?

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RUNNING BACKS IN THE NFL DRAFT AND NFL COMBINE: CAN PERFORMANCE BE PREDICTED?

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Abstract

Berri and Simmons (2009) investigate the relationship between the NFL Combine and the NFL Draft. They find that a quarterback's performance in the Combine can have a significant impact on that player's draft position. However, they find that no known aspect of a quarterback before they are drafted is an indicator of success in the NFL. I examine if these relationships exist for the Running Back position. I find similar results to Berri and Simmons: that performance in the Combine does have an effect on that player's draft position, but that no aspect of a running back's pre-draft characteristics can be seen as a sign of future NFL success.

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1. Introduction

The National Football League (NFL) is the largest professional athletic league in the United States, with league-wide revenue of over 7.5 billion dollars[1]. The league consists of 32 franchises, comprised of no more than 53 players per team. Each season, teams play 16 regular season games, followed by a 12-team, single elimination playoff season.

After the conclusion of each season, the NFL holds a draft in which teams take turns selecting players from NCAA universities, or athletes that are three seasons removed from their high school graduation.[2] The order of this draft is determined by the success—or lack thereof—of teams during the previous regular season: teams with losing records are given earlier selections, while those teams that were more successful are slotted into later positions.[3] This reverse-order system is seen as a way to enhance a league's competitive balance, with the worst teams receiving the best new players, and theoretically improving over time.[4]

Such a system only works, however, if the franchises possessing the first picks in the draft are able to correctly identify prospects that will achieve success in the NFL. Massey and Thaler (2010) investigate this market for NFL draft picks, finding that the market value of high draft picks is much higher than the surplus value such picks add to the performance of the team, specifically because "teams overestimate their ability to discriminate between stars and flops" (p. 3). Berri and Simmons (2009) provide further

[1] *http://www.plunkettresearch.com/sports%20recreation%20leisure%20market%20research/industry%20statistics*

[2] *news.findlaw.com/wp/docs/nfl/**clarett**nfl20504opn.pdf*

[3] *http://www.nfl.com/news/story/09000d5d81d6b708/article/complete-order-of-first-round-of-2011-nfl-draft-determined.*

[4] Quinn, K. G. (2008). Player drafts in the major North American sports leagues. In B. Humphreys & D. Howard (Eds.), The business of sport (Vol. 3, pp. 191-218). Westport, CT: Praeger.

evidence that NFL teams are incapable of identifying prospects that will have successful careers by looking at what is widely viewed as the most significant indicator of future NFL success: the NFL Combine.

The NFL Combine is a multi-day event measuring the size, speed, strength, and other tangible skills of collegiate prospects. Commentators such as ESPN's Mel Kiper Jr. pontificate extensively on the outcomes of the NFL combine, with the belief that this event can in some way predict future success in the NFL. However, Berri and Simmons (2009) show that performance in this event has not been a significant predictor of future success in the NFL.

I look to expand the work of Berri and Simmons (2009) to a position that has not been examined in such a manner before: the Running Back. While Berri and Simmons investigate only the draft and combine characteristics of the quarterback position, I look at the relation of a running back's pre-draft and combine measurements to their draft position and future success. I begin by looking at the decision making process of franchises in the NFL draft, expanding the model established by Berri and Simmons to analyze the correlation between a prospect's performance in the NFL Combine as well as their college performance and their draft position. I then examine whether the factors teams base their draft decisions off of are indicators of future success in the NFL by a similar regression. Essentially, whether teams can accurately predict the success of a running back prospect based on factors known to them at the time of the draft, or if the selection process is more luck than skill, with no reliable way to predict NFL success in prospects.

I find similar results to Berri and Simmons' examination of quarterbacks, as several characteristics of running backs are related to their draft position. This suggests that teams base their draft decisions around certain tests in the NFL Combine for running backs as well as quarterbacks. However, these same measurements of Combine and college performance hold only a slight correlation to future performance in the NFL, suggesting that there is little way to accurately predict the success of a running back in the league, and that the NFL draft is mainly a random chance game.

The remainder of this paper is organized as follows. Section 2 describes relevant literature. Section 3 explains the data and variables used. Section 4 discusses the econometric theory behind the evaluation of prospects. Section 4 illustrates my findings and further analysis. Section 5 concludes the paper with a summary of findings and future recommendations.

2. Literature Review

The value and analysis of NFL draft picks has grown tremendously over past years. There are numerous studies on the NFL draft and the decision making process professional sports teams perform. My paper combines previously done work while implementing new measures to evaluate running backs in the NFL draft. I will look at literature examining the value of an NFL draft pick, as well as work discussing the evaluation of talent in the National Basketball Association. Furthermore, I will also look at how performance has been evaluated in the NFL and NCAA, amending certain procedures to include more relevant measures. These three strands of literature are linked by their relevance to my study, as I examine the NFL draft, as well as how prospects are evaluated.

2.1 Value of NFL Draft Picks

The organization of the NFL draft implies that earlier picks have a higher value to teams than do later ones. Massey and Thaler (2010) investigate the surplus value of a draft pick—the difference between the projected economic value of a pick and that pick's compensation cost, in this case salary—relative to other draft picks. Using draft data from 1991-2002, their research indicates that the surplus value of a draft pick peaks in the second round of the draft, and that NFL teams severely overvalue the early picks in the draft. Despite this fact, Massey and Thaler note that NFL teams do not act rationally by trading for lower draft picks, those with higher surplus value, but instead place a premium on those high picks.

To examine this, Massey and Thaler determine the 'market value' of draft picks by examining the trades that have taken place in previous drafts. In their research, Massey and Thaler estimated parameter values to determine the exponential decay in value of draft picks, relative to the first overall pick. Their research shows that the market value of draft picks determined by previous trades is extremely ordered—that is, the observed value matches the expected curve exceedingly well.

Massey and Thaler (2010) also discuss the steep drop in value seen throughout the picks in the first round. They note the drop in market value of picks in the first round is as great as 50% from the first pick to the 10^{th}, and market value drops another 50% from the 10^{th} pick to the end of the first round. Furthermore, they argue that this decrease in value is far too drastic. Massey and Thaler explain that the market value of picks has moved further away from rational pricing with time, as teams have placed even higher values on top picks in recent years. Massey and Thaler conclude that the market value of a draft

pick far outweighs the actual value added (surplus value) of the respective draft pick. It is worth noting that Massey and Thaler do not argue against the general principle that earlier picks perform better in the NFL, rather that the economic value of their performance is not as high as the bargain that later draft picks present.

Further research has been done on the value that the NFL draft holds for the success of teams in the league. Bienkowski (2009) noted the importance of drafting successfully in the first round of the NFL draft. Bienkowski explores the correlation between successful drafting and winning percentage for NFL teams between 1995 and 2004. By developing a rating system for draft picks from 1-5, with a player rating of 5 signifying a consistently great player at their position, the research determined that there is a positive correlation between a high draft score and a high winner percentage during the same period. Bienkowski concludes that one of the surest ways for a NFL team to win consistently is to get good value out of their first round draft picks. The fact that the draft holds such an importance, yet NFL franchises do not value their draft picks properly is cause for concern amongst teams in the league, and opens arbitrage opportunities for teams able to correctly value picks in the draft.

2.2 Evaluation of NFL Performance

The NFL draft has evolved into a multi-month process, wherein seemingly every characteristic of each possible prospect is measured and reviewed excessively. Although it is primarily the responsibility of each franchise's General Manager[5] to review and ultimately decide whom to draft, each team allocates an incredible amount of resources

[5] The general manager of a NFL football team is responsible for all player transactions, as well as coaching decisions.

towards player evaluation. A prospect's statistics in the NFL Combine are considered some of the most important characteristics in draft position. Indeed, multiple prospects have become known as "Workout Warriors," wherein their draft position increases significantly due to their performance at the Combine.[6] During the Combine, prospects perform in a set of standardized tests and evaluations, most notable measures of speed (such as, the 40 yard dash and 20 yard shuffle) and measures of strength (such as, the bench press).

Berri and Schmidt (2010) expand on the work of Massey and Thaler (2010), researching individual players chosen in the draft, as opposed to strictly the position of the draft pick. In their research, Berri and Schmidt designed a model to see what characteristics of quarterbacks most significantly determine their draft position, noting that although college performance does impact draft position, the characteristics measured in the NFL Combine explain much more of the variation in draft position. Their research indicated that each additional inch in a quarterback's height increased their draft position by more than one round. A similar gain in draft position can be made by a quarterback who can decrease their time in the 40 yard dash by 0.2 seconds. Furthermore, Berri and Schmidt note that increases in quarterback's BMI (Body Mass Index: a common indicator of weight) can actually increase their draft position, up to a certain measure. I look to expand the work of Berri and Schmidt to another offensive position: the Running Back. I will use a similar model as Berri and Schmidt, as well as combine statistics.

[6] http://sports.espn.go.com/espn/page2/story?page=schoenfield/060427

There is also literature that examines the performance of a draft pick in the NFL compared to their draft position. The hypothesis central to this literature is that players taken earlier in the draft should perform better in the NFL than those taken in later rounds. Berri and Simmons (2009) examine the performance of quarterbacks relative to their draft position. Berri and Simmons base their research on several determinants of quarterback success in the NFL including segments such as a 'QB Score,' as well as 'Wins Produced,' both measures of a quarterback's value to their team. Their research indicates that where a prospect is chosen in the draft impacts that prospect's success in the NFL in terms of aggregate career and per game numbers: quarterback's selected in later rounds of the draft fair worse in the league than those drafted in the early rounds on a per game basis. However, when they examine per-play numbers, quarterbacks chosen later in the draft (picks 11-90) actually outperform those chosen in the top 10 in QB score and QB Rating.

Berri and Simmons (2009) also comment on what characteristics of the performance of quarterback prospects in college are indicative of future success in the NFL. In contrast to their evaluation of which draft picks have more success in the NFL, Berri and Simmons look into which statistical measures of performance in college translate to success in the NFL. The duo looks at metrics such as completion percentage and yards per attempt of prospects in college, finding that college completion percentage has a significant impact on completion in the NFL.

Using a different theoretical approach than Berri and Simmons, Hendricks et al. (2003) look at the relative uncertainty in prospect's productivity in the NFL. Hendricks et al. look at the levels of risk teams are willing to take when drafting players of different

NCAA divisions. Their research finds that teams will more likely choose players from the most prestigious NCAA football universities in the early rounds, but reverse this discrimination in the later rounds, opting to take "riskier" picks from non-established, smaller universities. Hendricks et al. look at all positions drafted, proving that in the early round NFL teams are risk averse, while in the later rounds NFL franchises tend to opt for players from less visible universities. This reflects the theory that teams are more willing to gamble on prospects considered to be long shots at adding value in later rounds.

Much of the literature on the evaluation of NFL prospects is focused on the relationship between measurable statistics from the NFL Combine. This research is based almost primarily around one position: the quarterback. This research shows that a prospect's performance at the NFL Combine, as well as other personal characteristics, are strongly significant in determining a prospect's draft position. However, a prospect's college performance is more useful in predicting NFL productivity. I add to the literature by examining the relationship between combine and college performance of running backs and their subsequent position in the NFL draft and performance. I will use methods seen in the literature examining each of these fields.

2.3 Evaluation of NBA Prospects

In addition to their analysis of statistical predictors of success in the NFL, Berri and Schmidt (2010) examine the role certain performance characteristics of National Basketball Association (NBA) prospects have in their draft selection. Similar to their research in the NFL, Berri and Schmidt find that NBA executives also overvalue certain characteristics in players, most notably the scoring average, while undervaluing characteristics such as rebounding. Their research shows that teams in the NBA overpay

for players with high scoring averages in the Free Agency market, and that prospects for the NBA draft with excellent performance rebounding in NCAA basketball are routinely drafted far behind their actual value would indicate.

The research from this paper will seek to determine whether similar biases are present in the NFL draft with respect to other positions besides quarterback. Specifically, whether earlier draft picks perform better than those Running Back's taken in later rounds? And do measurements taken in the NFL Combine have any bearing on subsequent success on the NFL?

3. Data

The data for my study is from four primary sources: ESPN.com, NFLdraftscout.com, Totalfootballstats.com and Pro-Football-Reference.com. This data is ideal for my purposes because it includes precise and accurate measures of NFL performance, NFL Combine statistics, college statistics, and player characteristics.

I collected two types of data for my study: factors known by NFL teams before the NFL draft, and measures of player performance in the NFL. Factors known by teams before the draft include measurable physical characteristics, or data from the NFL Combine, as well as a prospect's collegiate football statistics. I restrict my analysis to Running Backs (RBs) drafted from 1998 to 2008. Because my analysis focuses on performance in the NFL in relation to the draft, those RBs that went undrafted during this time yet eventually played in the NFL were not included in the sample.[7] Furthermore, I eliminated those players listed as a fullback at some point during their career by

[7] While virtually all running backs in the NFL were drafted, notable exceptions include Super Bowl participants Ryan Grant and Willie Parker. However, due to the small number of undrafted running backs, I do not feel this will have an effect on my study.

NFL.com, because of the limited statistical impact their performance has on a football team. I also included only prospects that registered a performance in the NFL. That is, in order for a player to be included in the data set, they must have had at least one rushing attempt, or one pass caught in their professional career, during the years 1998 to 2008.

The most limiting aspect of my data was the lack of reported data within the Combine variables. Due to injuries, or in the case of some elite athletes, personal choice, not all prospects performed each test administered at the NFL Combine. To account for this, I looked at prospect's scores in these tests measured at events other than the official NFL Combine, such as their college Pro Day statistics.[8] If a prospect still had a missing data point, I substituted the median value of that score for the 10 players closest in weight to the prospect. The intuition behind this approach is that the prospect with the missing data point would have performed similarly to other prospects with corresponding physical characteristics. The elimination of fullbacks, as well as those players that were drafted but never actually performed in the NFL, left a final sample size of 154 RBs.

3.1 NFL Draft Data

The NFL draft currently consists of seven "rounds," within which each team is given one draft pick. The order of this draft is determined by the success—or lack thereof—of teams during the previous regular season: teams with worse records are given earlier selections, while those teams that were more successful are slotted into later positions. This reverse-order system is seen as a way to enhance the league's competitive balance by giving the worst teams the best incoming talent at a discounted cost. However,

[8] Colleges will routinely hold additional workouts to showcase their top prospects. While these workouts are not affiliated with the official NFL Combine, the prospects perform similar, often identical, tests to those used at the official NFL Combine.
http://www.nfl.com/draft/story/09000d5d81e5bfe7/article/2011-pro-days-schedule-recaps-by-school

such a system is only successful, if teams are able to accurately distinguish those prospects that will be the most successful in the NFL.

I define where a prospect was chosen in a given draft as PICK. As Berri and Simmons (2009) note, the lower a player's PICK (the earlier they were chosen in the draft), the higher the expectation is that the player performs well. In order to better classify the data, I separate my sample of 154 RBs into six groups. Players drafted in the first 25 picks were placed together, as well as those drafted from the 26^{th} to 54^{th} picks, 55^{th}-86^{th}, 87^{th}-117^{th}, 118^{th}-179^{th}, and 180^{th}-252^{nd}. By not grouping the players simply by the round they were drafted in, I was able to have approximately the same number of samples within each group, as each group contains 25 to 27 players, or roughly $1/6^{th}$ of my total sample. Table 1 summarizes the PICK position of every prospect in my sample, giving the number of observations in each group, as well as the mean and standard deviation amongst the grouping. The mean of each group is the average position a player is drafted in, relative to that grouping.

3.2 NFL Combine Data

The NFL Combine statistics used to evaluate RBS in this analysis follow those most commonly used by NFL franchises to predict running back success: the 40 yard dash, vertical jump, broad jump, and bench press. All of these tests are used to measure a player's athletic ability. The 40 yard dash is a measure of a player's speed, as it is designed as an all-out sprint for 40 yards. The vertical jump and broad jump are measures of a player's leaping ability, which franchises use to determine the athleticism and quickness of a prospect. The bench press is used as a measure of a player's strength. The intuition behind these four tests is that players who perform better than their counterparts

in these tests will perform better in the NFL. Players who run a lower 40-yard dash, have a higher vertical jump, a longer broad jump, and more repetitions in the bench press are seen as ideal athletic candidates.

A significant issue with the 40 yard dash time is that all 40 yard dash times are not easily comparable. As Day (2009) notes, all RBs are not equal in size, meaning that a heavier player running a slightly slower time may be more impressive than a small, light player running a faster 40 yard dash time. To account for this variation, Day creates a metric called "Speed Score" to better account for this discrepancy.[9] The speed score metric combines a player's speed and their weight, giving a clearer indication of the strength and power behind their running. Prospects with a higher speed score are seen as ideal candidates, meaning that they have a faster 40 yard dash time combined with an ideal weight. Because the Speed Score more accurately measures a player's inherent speed, I use this measure in my regression analysis instead of the more basic 40 yard dash time.

In addition to measures of a player's athleticism, I gathered data on each prospect's height, weight, and BMI.[10] I also include an indicator variable equal to 1 if the prospect's university was within a Bowl Championship Series (BCS) conference, and

[9] To find this measure, Day multiplies a player's weight by 200, and then divides that figure by their 40 time taken to the 4th power. The weight is multiplied by 200 to average the scores to approximately 100, and the 40-yard dash time is taken to the 4th power to account for the huge difference hundredth's of seconds have in a player's speed.

[10] Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI provides a reliable indicator of body fatness for most people and is used to screen for weight categories that may lead to health problems. Additionally, I will include a value of BMI squared, seeing as incremental changes in the BMI show marked differences.
http://www.cdc.gov/healthyweight/assessing/bmi/

zero otherwise.[11] This indicator variable is included because athletes from a BCS conference may be better prepared to succeed at the NFL level, due to the level of competition they have played against in their college career. Table 2 presents summary statistics for each Combine statistic discussed above, including a prospect's physical characteristics and university characteristics, by draft position (PICK). As Table 2 shows, a prospect's 40 yard dash time, vertical jump, broad jump, and speed score all improve as their draft position lowers. Additionally, players from BCS universities were taken more frequently in earlier rounds than later rounds. This indicates that there is a relationship between how well a player performs in the NFL Combine and their draft position, as well as the college they attended. This relationship is the basis of the first part of my regression analysis which formally examines the factors that determine where a prospect is drafted.

3.3 NFL and NCAA Performance

The performance of a RB is measured using many different variables. In order to simplify this measurement, I modified a variable developed by Berri (2010) to better explain the ability of a RB. In his evaluation of RBs, Berri (2010) proposed the following formula to measure RB performance

$$RBScore = TotalYards - 3(AllPlays) - 30(AllTurnovers) \quad (1)$$

[11] The Bowl Championship Series is a process by which the top college football teams are seeded to play in five different bowl games against each other, included the National Championship. Bowl Championship Series conferences are afforded automatic bids into these games, These conferences include the Atlantic Coast, Big East, Big Ten, Big 12, Pac-10, and Southeastern conferences, generally regarded as the most dominant athletic conferences in collegiate athletics.
http://www.bcsfootball.org/news/story?id=4819597

In this equation, *Total Yards* is equal to the sum of rushing and receiving yards gained by the RB. *All Plays* encompasses all rushing attempts, as well as all passes caught. *Turnovers* are fumbles by the RB. One of the advantages of this model is the simplicity with which it incorporates multiple aspects of a RB's performance, and the fact that it can be applied to both professional and collegiate RBs.

However, Equation (1) has several important shortcomings that must be addressed. The first of these is that the formula does not accurately measure the performance of a player because of the value assigned to turnovers. While a value of -30 yards is generally accepted as correct for a turnover that is lost, with RBs turnovers do not result in a loss of possession. The value of a "lost fumble" or an interception by a quarterback is approximately -30 yards, but not all fumbles are "lost fumbles." Because the recovery of a fumble is seen as random[12] I divide each player's career fumbles by 2 for this calculation. Furthermore, I make one more addition to the model, accounting for the value of a player scoring a touchdown.

Using the average value of a touchdown as 18 yards,[13] my modified RB Score equation becomes:

$$RBScore = TotalYards - 3(AllPlays) - 30(AllTurnovers) + 18(Touchdowns) \quad (2)$$

[12] Schatz notes there is no correlation between a team's fumble recovery rate from one year to the next. http://www.footballoutsiders.com/info/FO-basics

[13] A recent article discussed the value of a touchdown, determining that the average value of a touchdown is roughly 18 yards. This is not to say that all touchdowns are worth 18 yards, but that on average, a touchdown scored is equivalent to the value of 18 yards. Although Berri et al. (2007) do not account for the value of a touchdown in their RB Score equation, the amount of times a player is able to produce a score is surely indicative of that player's value to their team. http://www.pro-football-reference.com/blog/?p=603

For Equation (2), *Touchdowns* is the sum of both rushing and receiving touchdowns a RB produced during their career. There is no need to distinguish between the two; a rushing touchdown is equal in value to receiving touchdown.

One of the better aspects of the RB Score equation is that it can be measured as an aggregate measure of a player's career performance, on a per game basis, and can even be explained as RB Score per play. I use this feature to examine the relationship between draft position (PICK) and a player's performance.

Table 3 provides basic summary statistics for NFL RB Scores by PICK. Table 3 lists RB Scores as an aggregate measure of a prospect's NFL career, as well as per game and per play measures. Because college RBs generally do not receive meaningful playing time until late in their college career, I gathered performance data for their last year in college, which is listed in Table 3 as well.

Table 3 reveals that there is an inverse relationship between PICK and both the number of NFL plays a prospect performs in, as well as their aggregate career RB Score. The earlier a RB is drafted, the higher their aggregate career RB Score and per game RB Score is. Players drafted in the first 25 selections have an average RB Score of 2948.19, while those players drafted with the picks 87-117 (PICK 4) have an average RB score of 1105.96, a decrease of over 150% in career performance. However, when one looks at the per play numbers, the evidence is different. Although RBs drafted in the later rounds have far fewer plays than those players drafted earlier, the later picks outperform those drafted earlier on a per-play basis, and the final 100 picks outperform all earlier draft picks when per-play measures are examined. When per play NFL performance is

examined, players drafted in the first 25 picks (PICK 1) have an average RB Score per play of 2.08.

Although players in the second grouping (PICK 2) do have a lower RB score per play than those in PICK 1, players in every other category of late draft picks have a higher RB score per play than those players drafted with the first 25 picks. This per play data goes against my hypothesis that players drafted in the earlier rounds perform better than those drafted in later rounds, but is consistent with the results of Berri and Schmidt (2010) when examining quarterbacks, as they find quarterbacks drafted in the later portions of the draft outperform those drafted earlier on a per-play basis.

Strictly on an intuitive basis, the fact that earlier draft picks play more than later ones makes sense due to the compensation structure of the NFL. As noted in Massey and Thaler (2010), earlier draft picks are paid disproportionately high salaries compared to players taken in later rounds, serving as a much larger investment for a team. Because of this, I argue that teams will want to see a return from such an investment, and dedicate more playing time to the player drafted earlier in the draft, or the player with the higher salary, regardless of their per-play performance. Additionally, players drafted earlier will likely have a significant reputation from college, one that franchises will want to capitalize on.

These results indicate that when a RB is drafted is an indicator of how much playing time they will receive, but not necessarily how well they will perform in that given playing time. As Berri and Schmidt (2010) mentioned, this weak correlation between draft position and future NFL efficiency implies that there is disconnect between the practices used to draft players, and the data available to these teams. The cause of this

divide warrants further examination. In order to do so, I look at the relationship between characteristics known to franchises on the day of the NFL draft, and the future performance of prospects in the league. My regression analysis focuses strictly on per play performance of running backs, the theory of which is detailed in Section 4.

4. Estimation and Results

This section discusses what factors determine where a RB is drafted, and once drafted, how well that RB performs in the NFL. First, I examine what characteristics known to NFL franchises on the day of the draft relate to draft position (PICK). I then compare a player's NFL performance to their college and NFL Combine performance—as well as their pick in the draft—to determine what characteristics of a prospect translate to success in the NFL.

4.1 Determinants of NFL Draft position

In this section, I determine the relationship between a prospect's draft position, and the pre-draft performance data of that prospect. Essentially, what statistics and measurements effect where a prospect is drafted. In order to determine the effect NFL Combine and college performance has on a prospect's draft position, I estimate a model of the following form

$$Pick_i = \alpha + \beta X_i + \beta Y_i + \varepsilon_i \quad (3)$$

where PICK is measured as the position a player was drafted in, and X is a vector of physical player characteristics and NFL Combine statistics including Height, BMI, as well as vertical jump, broad jump, bench press repetitions, and Speed Score. Y is a vector of a prospect's performance during their final college season (RB Score) and an indicator

variable for whether the prospect is from a BCS Conference. The term ε is an error term with the usual properties. The model captures the effect of the most common measures an NFL team has available to them before making their selection in the draft, and what many experts and fans look to as indicators of future success in the NFL. I estimate two models using Equation (3). In my first model, I regress only the combine statistics on PICK, to determine the effect of combine performance on draft position. In my second model, I regress both the combine statistics and a prospect's college performance and BCS variable on PICK.

Table 4 presents the results of both estimations of Equation (3). According to Table 4, Speed Score is negatively related to draft position; if a prospect's speed score increases one unit a RB can expect their draft position to improve by approximately three positions. The same relationship is found in a prospect's college performance, although the correlation is not as significant. Additionally, where a player attends college plays a huge role in determining their draft position. As Table 4 shows, prospects that attended a college that participates in one of the six BCS conferences experienced an improvement of their draft position by 55 picks, or around one and a half rounds of the draft, relative to prospects that did not attend a college that participates in BCS conferences.

These results are consistent with the work of Berri and Simmons (2009), who find that a quarterback's draft position is related to their height, 40 yard dash time, and the university the prospect attended. One of the more surprising aspects of my results is the fact that so few of the statistics measured in the NFL Combine had a significant effect on the draft position of a player. Indeed, from those measurements taken at the NFL Combine, only a prospect's Speed Score had any bearing on their draft position. I argue

this may not be that surprising as NFL franchises most likely perceive a RB's speed and size will translate to their ability to run away from, or through, the defense in the NFL. Because a prospect's performance in the Combine influences their draft position, I proceed to look at whether these same variables are indicative of future success in the NFL. That is, whether the measurements that NFL franchises are basing their draft decisions correlate to prospects that will perform well in the NFL

4.2 Determinants of NFL Performance

In this section, I determine whether factors known to teams at the time of the draft can act as indicators of future success in the NFL. Specifically, I estimate the effect the same characteristics examined in Section 4.1 have on the per-play success of RBs I determine what measures taken in the NFL Combine, combined with a prospect's college performance, can predict success in the NFL, or whether success is simply a product of when a prospect is drafted.

To examine the relationship between the performance of a prospect and their known characteristics, I estimate a model of the following form

$$NFLPerformance_i = \alpha + \beta X_i + \beta Y_i + PICK_i + \varepsilon_i \quad (4)$$

where NFL Performance is a RB's RB Score per play, X is a vector for the same physical characteristics and NFL Combine statistics presented in Equation 3, and Y is a vector of college performance data, similar to those found in Equation 3.[14] PICK is the prospect's draft position, and ε is an error indicator with normal properties. I estimate three

[14] Physical characteristics and NFL Combine Statistics: Height, BMI, Vertical Jump, Broad Jump, Bench Press Repetitions, Speed Score. College Performance measures: Collegiate RB Score, BCS Conference indicator variable.

different models of Equation (4). The first model explains the effect physical characteristics and combine statistics have on draft position. The second model regresses a prospect's college performance and choice, while the third model includes physical characteristics, combine statistics, college performance and choice, and a player's draft position on the prospect's RB Score per play.

As each set of variables is added to the models, there is a slight increase in the *R*-squared value of the model. Additionally, each of the different models shows that although combine factors have an effect on per play performance of running backs, where a player is drafted has no effect on their performance. This is a key point in Berri and Simmons (2009) study on quarterback performance—that players drafted earliest in the draft are not necessarily the best performers on a per play basis—and Table 5 shows that this relationship is also seen in running backs, as PICK is not related to per play performance at all. According to Table 5, aspects of prospect's pre-NFL makeup that are significant in determining their future success are BMI, vertical jump, and speed score. BMI has a beta coefficient of -0.144 in Model 3, meaning that a unit increase in a prospect's BMI will lead to a decrease of their per play NFL performance by approximately $1/10^{th}$ of a point. This is not a large change, but is still worth nothing that as a prospect becomes heavier with a higher BMI, their ability to perform in the NFL decreases. While this result is logical, the relationship between performance and vertical jump is the opposite. Model 3 of Equation (4) shows that as vertical jump increases, performance in the NFL per play decreases. Vertical jump, with a beta of -0.067, has the same negative relationship with performance as seen in BMI. However, I expected this relationship to be positive based on the fact that athletes with higher vertical jumps will

tend to be more athletic, and presumably more fit to play in the NFL. The only other factor that was significant in determining a player's performance in the NFL was their speed score, a combination of their weight and 40 yard dash time. Speed score is positively correlated to a player's RB score. As players increase in size and speed, their performance increases, which is intuitive given the nature of the running back position.

This result is quite different than seen in Berri and Simmons (2009) who found that Combine statistics of quarterbacks do not significantly explain any portion of their future NFL performance. I argue this inconsistency can be explained by the skills required by the positions. Quarterback's are entrusted to make many more decisions and are required to react to more situational differences in their performance than is a RB. Generally, RBs are required to be more physically skilled than other positions. Being a fast quarterback who is in the absolute peak physical condition will not help that player as much as a RB with the same characteristics, due to the nature of the position. Therefore, it is reasonable to expect RB's who are faster, more athletic, and in better shape to excel in the NFL, which the results do show.

While the model does find aspects of a prospect that are significant in terms of the future success of players, it is important to note that very little of the variation in NFL performance is explained by this model. With an *R*-squared value of less than 0.1, there are numerous other factors that contribute to a RB's success. The lack of significance of the model can be explained by the difficulty in accurately rating a player's performance in the NFL, especially that of a running back. Berri and Schmidt (2010) note that a quarterback's performance, most notably Sacks and Interceptions, have a large part to do with the ability of that quarterback's teammates. A RB's performance is also dependant

on the ability of their teammates, specifically the offensive line. The offensive line's importance cannot be understated, as it is the line that blocks for the RB at the beginning of each play, looking to clear away the defense so that the RB may gain yards from scrimmage. This may partially explain the performance of RBs drafted later in the draft, as those RBs are taken by the better teams, as opposed to the first RBs drafted, which go to some of the worse teams in the NFL.

5. Conclusions

It is important to understand the characteristics of prospects that lead to their success in the NFL because of the importance the NFL draft has to each franchise. As the primary way to improve performance of a team both financially and athletically[15], the examination of the valuation of characteristics of draft picks is worthy of study. Furthermore, as the cost for top draft picks increases[16], teams must become increasingly accurate in their evaluation of prospect, or else face the prospect of further financial failure. Indeed, with a lockout looming as a definite possibility for the NFL, owners have been outspoken for the need to change the way rookies are paid across the league.

In this paper, I look to improve on the methodology found in Berri and Simmons (2009). I find that the performance of running backs in the NFL Combine as well as their college performance impacts their draft position. I then find that these same measures, the NFL Combine and college performance, have only a limited correlation to NFL performance. I add to the existing literature by examining the running back position using

[15] http://helmet2helmet.net/2009/04/23/the-importance-of-drafting-well-in-the-first-round/
[16] 2010 First overall draft pick Sam Bradford signed a record contract worth over $50 Million in guaranteed money, up from the $41.7 million received by 2009 number one pick Matthew Stafford.

improved measurements of a player's speed, as well as their performance in the form of Speed Score and RB Score.

There is the possibility for further examination with the results of my paper. The quality of a running back's teammates could be factored into the examination of their performance. The lack of such a control was by far the most limiting factor of my analysis. Furthermore, different combine measurements could be taken into account, specifically the 10 yard and 20 yard dash, although the lack of reported data in these events makes such an analysis difficult.

My paper explains part of the decision making process by NFL franchises during the NFL draft, showing that the process by which running backs are evaluated and subsequently drafted does not necessary relate to their future success in the league. The implications of the lack of predictability in the draft are substantial. Teams not capable of drafting well may face increasing hard times both financially as well as their record on the field.

Tables and Figures

Table 1: Distribution of Draft Picks in Sample

	Number	Mean	Standard Dev
Total Sample	157	98.03	71.43
PICK1 (<25)	27	12.26	8.00
PICK2 (25-54)	25	40.56	9.91
PICK3 (55-86)	25	70.80	9.39
PICK4 (87-117)	26	100.96	8.71
PICK5 (118-179)	25	143.36	17.84
PICK6 (180-252)	26	222.04	23.44

Period: 1998-2008

Table 1 shows the separation of all draft picks in my sample, as well as the mean and standard deviation of those groups.

Table 2: **NFL Combine Statistics by Draft Position**

	Total	**PICK (<25)**	**PICK (25-54)**	**PICK (55-86)**	**PICK (87-117)**	**PICK (118-179)**	**PICK (180-252)**
40 Yard Dash	4.53	4.46	4.48	4.53	4.52	4.57	4.61
	(0.11)	(0.10)	(0.10)	(0.10)	(0.08)	(0.11)	(0.10)
Vertical Jump	34.99	35.69	36.12	34.42	35.77	34.32	33.62
	(2.97)	(3.17)	(2.33)	(2.62)	(2.69)	(3.31)	(2.98)
Broad Jump	118.37	121.04	119.30	118.06	118.89	116.88	116.27
	(5.20)	(5.03)	(3.89)	(5.43)	(5.68)	(4.93)	(4.45)
Bench Press	19.72	20.67	20.00	18.64	19.63	18.79	20.56
	(3.88)	(4.41)	(3.89)	(3.90)	(2.99)	(3.46)	(4.32)
Speed Score	103.64	112.36	107.58	102.58	103.82	97.95	96.70
	(9.98)	(7.91)	(9.62)	(8.23)	(7.83)	(8.51)	(9.09)
Height	70.97	71.67	71.28	70.92	70.69	70.44	70.81
	(1.77)	(1.27)	(1.90)	(1.68)	(2.35)	(1.71)	(1.39)
BMI	30.30	30.47	30.03	30.03	30.42	30.33	30.49
	(1.82)	(2.29)	(1.63)	(1.69)	(1.86)	(1.74)	(1.67)
University	0.21	0.07	0.12	0.16	0.27	0.28	0.38
	(0.41)	(0.27)	(0.33)	(0.37)	(0.45)	(0.46)	(0.50)
Number of Observations:	157	27	25	25	26	25	26

Table 2 shows combine statistics, as well as the indicator variable for whether a player attended a school in a BCS Conference, relative to a prospect's draft position (PICK).

Table 3: NFL and NCAA RB Scores by Draft Position

NFL RB Scores						
Career	Observations	Games	Attempts	RB Score	Average RB Score	Standard Dev.
Total Sample	157	8874	102558	212816	1381.92	1613.54
PICK1 (<25)	27	2258	40244	79601	2948.19	2150.38
PICK2 (25-54)	25	1672	19093	38249	1529.96	1392.67
PICK3 (55-86)	25	1542	16754	35685	1427.40	1447.89
PICK4 (87-117)	26	1232	12948	28755	1105.96	1438.85
PICK5 (118-179)	25	1167	7591	17535	701.40	780.21
PICK6 (180-252)	25	1003	5917	12991	499.65	755.01
Per Play	Observations				Average RB Score	Standard Dev.
Total Sample	157				2.08	1.05
PICK1 (<25)	27				1.98	0.58
PICK2 (25-54)	25				2.00	0.72
PICK3 (55-86)	25				2.13	0.76
PICK4 (87-117)	26				2.22	0.92
PICK5 (118-179)	25				2.31	1.23
PICK6 (180-252)	25				2.20	1.72
NCAA RB Scores						
Last College Season	Observations		Attempts	RB Score	Average RB Score	Standard Dev.
Total Sample	157		37765	145331	943.71	400.41
PICK1 (<25)	27		7522	31391	1162.63	332.85
PICK2 (25-54)	25		6249	25072	1002.88	395.64
PICK3 (55-86)	25		6330	24114	964.56	401.65
PICK4 (87-117)	26		6371	24272	933.54	384.13
PICK5 (118-179)	25		5620	20809	832.36	390.65
PICK6 (180-252)	25		5673	19673	756.65	402.72

Table 3 shows the performance of running backs, using both aggregate RB Score, and RB Score per play, as defined in Section 3.3.

Table 4: Determinants of Draft Position (Coefficient and Standard Errors)

	Model 1 b/se	Model 2 b/se
Height	1.014	-0.51
	(3.20)	(2.92)
BMI	3.12	-0.199
	(3.15)	(2.93)
Vertical Jump	-1.415	-1.371
	(2.06)	(1.86)
Broad Jump	-1.297	-1.41
	(1.22)	(1.10)
Bench Press Repetitions	-0.415	-0.575
	(1.34)	(1.21)
Speed Score	-3.121***	-2.550***
	(0.64)	(0.59)
College Performance		-0.057***
		(0.01)
BCS Indicator Variable		55.021***
		(11.53)
Constant	466.234	672.349*
	(288.64)	(265.20)
R-Squared	0.249	0.398
Number of Observations	154	154

* p<0.05, ** p<0.01, *** p<0.001

Table 4 shows the relationship between NFL Combine statistics and NCAA performance and a prospects draft position through the following model:

$$Pick_i = \alpha + \beta X_i + \beta Y_i + \varepsilon_i \quad (3)$$

Table 5: Determinants of Per-Play NFL Performance (Coefficient and Standard Error)

	Model 1	Model 2	Model 3
	b/se	b/se	b/se
Height	-0.087	-0.100	-0.100
	(0.05)	(0.05)	(0.05)
BMI	-0.122*	-0.144**	-0.144**
	(0.05)	(0.05)	(0.05)
Vertical Jump	-0.066	-0.068*	-0.067*
	(0.03)	(0.03)	(0.03)
Broad Jump	0.018	0.019	0.020
	(0.02)	(0.02)	(0.02)
Bench Press	-0.006	-0.004	-0.004
	(0.02)	(0.02)	(0.02)
Speed Score	0.020	0.024*	0.027*
	(0.01)	(0.01)	(0.01)
College Performance		0.000	0.000
		(0.00)	(0.00)
BCS Indicator Variable		0.105	0.051
		(0.21)	(0.22)
Pick			0.001
			(0.00)
Constant	9.949*	11.503*	10.840*
	(4.71)	(4.79)	(4.90)
R-Squared	0.073	0.092	0.094
Number of Observations	154	154	154

* p<0.05, ** p<0.01, *** p<0.001

Table 5 shows the relationship of combine statistics and college performance to future NFL success through the following model:

$$NFLPerformance_i = \alpha + \beta X_i + \beta \mathrm{Y}_i + PICK_i + \varepsilon_i \quad (4)$$

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