The Utility of Collegiate and Combine Statistics for Identifying Potential in NFL Quarterbacks

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Abstract

Predicting potential is crucial for building a successful sports franchise. In the National Football League (NFL), the annual draft is a process in which franchises select athlete's that will presumably improve their team's chances of winning. Considerable resources are used to determine suitable candidates and to test those athletes in a controlled environment. The current study examined the relationship between pre-draft variables and their impact on draft selection of quarterbacks into the National Football League. Associations between measures of collegiate statistics and combine test scores with draft position were considered in order to determine their impact and significance to becoming a professional football player. The analysis showed low correlations between both collegiate and combine statistics to draft position, indicating that the measures used to predict talent are of low validity. Findings are discussed within the context of previous literature on the accuracy of pre-draft measures to draft selection.

Acknowledgements

My sincere thanks go out to my supervisor Dr. Joseph Baker for his acceptance and guidance throughout this project. I would also like to thank all my lab-mates for their help, friendship and humor which made my experience one I will never forget. Lastly, I'd like to thank the sport of football and all those who have been involved with it throughout my entire life, especially my father, for the inspiration to advance the game in any way possible.

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General Introduction

Predicting talent has an important place in sports teams, clubs, and organizations. The pursuit of sporting excellence involves talent identification ('TID' i.e. recognizing of participants with the potential to excel) and talent development ('TDE' i.e. providing the most effective learning environment for realizing potential) (Russell, 1989). The lack of established reliability in TID programmes has led many scientists to focus their attentions to TDE. Surprisingly, despite the lack of scientific rigor, top tier organizations and professional teams continue to invest their time and resources into early identification (Bartmus, Neumann, & de Marées, 1987). From a financial perspective, TID strategies could not only increase a team's competitive advantage, but also allow for better return on financial investment and a more focused commitment to a smaller number of high-potential athletes.

Cross-sectional TID models of physiological, physical, anthropometric or technical variables have proven problematic in multiple ways. For instance, their use of inappropriate markers for predicting talent (eg., jumping variables for determining skill level of quarterbacks at the NFL combine) may be misguided due to the dynamic nature of sport development (Régnier, Salmela, & Russell, 2001). Moreover, many TID programmes focus on a limited range of variables (Abbott & Collins, 2004) with a large number of researchers continuing to use a one-dimensional physical approach (including anthropometric and physiological) (Aitken & Jenkins, 1998). While this approach may be beneficial to sports involving a relatively small number of characteristics, (e.g., rowing and bodybuilding (Carlock, Smith, Hartman, et al., 2004), it may have limited utility in fast ball and team sports because excellence in these sports is not determined by a specific set of skills or physical attributes, and deficiencies in certain aspects of sport may be compensated for by strength in other aspects, noted as the 'compensation

phenomenon' (Williams & Ericsson, 2005). Furthermore, the variables in many tests batteries do not acknowledge the different positional demands involved in team sports (Williams, Ward, Smeeton, 2008). Too much attention to uni-dimensional approaches can result in athletes being removed from the selection pool when underperforming on a certain testing variable (i.e., a Type II error) or selection of athletes who score high in single areas but lack the global pattern of attributes necessary for long-term skill acquisition (i.e., a Type I error).

Nature versus Nurture and Models of Talent

Talent is an extremely complex concept that lacks an encompassing theoretical framework. Historically, the major framework in this area of research has been the relative importance of nature versus nurture on the development of talent. Although the lay-public continues to embrace this dichotomy, evidence has highlighted the importance of both innate and environmental factors, suggesting that a combination of both is important and that one can not exclusively describe talent over the other (Davids & Baker, 2007; Durand-Bush & Salmela, 2001). Most models of talent in sport and elsewhere are grounded in this assumption. For example, the Differentiated Model of Giftedness and Talent (DMGT) one of the more widely known models proposed by Gagné (1993) makes a distinction between constituent elements (giftedness) and end product (talent). *Giftedness* is described by the use of natural abilities that place an individual among the top 10% of same-age peers. These natural abilities consist of intellectual, creative, socio-affective and sensorimotor skills possessed by the individual and are often misjudged due to the predominant importance placed on physical traits (van Rossum & Gagné, 2005). On the other hand, *talent* reflects excellence in developed competencies that places an individual at the top 10% of peers active in the entire field. The development of gifts through learning, training and practicing are what ultimately become talent, yet are often

overshadowed by physicality and initial level of ability in an individual (van Rossum & Gagné, 2005). For example, the relative age effect (RAE) demonstrates the consequences of having children up to a year older than their counterparts competing against each other. This is a consequence of the common practice of grouping children by chronological age in order to allow for a developmentally appropriate learning environment (e.g., grades in school and of groups in sport). Children born early in the competitive year have a competitive advantage due to their more advanced physical development over their peers, which can play a role in both individual and coach perceptions of talent and the subsequent opportunities for further development (Musche & Grondin, 2001). Although created in the domain of education, the DMGT framework has been applied in the sport sciences (Gagné, 1993).

The importance of practice in developing excellence has also been highlighted in past work. Ericsson and colleagues (Ericsson, Krampe & Tesch-R*ö*mer, 1993) advocated that excellence in any domain is directly related to the amount of practice with ten years or 10,000 hours of dedicated practice often noted as general requirements for achieving expertise in a domain (Baker & Young, 2014). While acknowledging the importance of practice, other researchers have explored the factors that describe the ideal training environment or nature for practice that will lead to expertise (Williams & Hodges, 2005). In the DMGT, catalysts are factors that hinder or facilitate the development of skill. Intrapersonal catalysts include personal traits (physical and mental) and self-management such as volition and personality. Environmental catalysts include location, surroundings, events and support. Unlike other theories, the DMGT describes chance as an important element in the talent process. Uncontrollable events such as genes, injuries, socioeconomic status, and birth place (among others) can greatly enhance or hinder development (van Rossum & Gagné, 2005) and TID can

help reduce some of the negative effects of chance, such as injury prevention and proper coaching (Myklebust, Engebretsen, Braekken, et al., 2007). Overall, the DMGT proposes to not only examine the physical qualities within developing performer, but also their capability to learn and adapt (van Rossum & Gagné, 2005).

While these theoretical models have some value for understanding the general principles of talent identification and development, their value in 'real world' settings is unknown. The unique requirements of sport performance require specific TID models that reflect the demands of both sport and position in order to allocate time and resources by organizations to the right athletes (Vaeyens, Lenoir, Williams, & Philippaerts, 2008). This study focuses on understanding these factors in the sport of football.

NFL Drafting Process

Over 100,000 high school seniors in the United States of America play football every year. Of them, only 0.2% will play at the American professional level (NFLPA, 2012). The National Football League (NFL) drafts approximately 250 players each year (www.nfl.com, 2014). The draft was created to allow each NFL franchise the opportunity to select top prospects, while distributing 'talent' across the 32 teams. This design prohibits any single team from monopolizing the best players. Additionally, a reverse order pick system allows teams with fewer wins in the previous season the opportunity to pick earlier in the draft (Popper, 2004). Currently, the draft consists of seven rounds in which each of the 32 teams are allowed to select a single player. In certain instances supplementary picks are given to teams due to the loss of compensatory free agents in the previous year. These extra selections are equal to the net loss of compensatory free agents, with a maximum of four (National Football League, 2012). This means that team's who have lost more free agents than they have gained, are given an extra draft

pick of equal value to the free agent lost. While various football positions are selected throughout, the most anticipated and crucial picks are traditionally the quarterback. As noted by Berri and Simmons (2011), quarterbacks are often the backbone and face of an entire franchise, and typically considered the most important position on the field. Bill Walsh, a hall of fame coach and claims a great quarterback must be courageous and intensely competitive as they are responsible for running the team as a leader. They are the foundation of the offence (Walsh, 1997). The importance of the position is shown in the devotion franchises give into decision making resources in order to get the selection right (Berri & Simmons, 2011). According to NFL draft history, 87% of NFL drafts from 1980 to 2012 resulted in a quarterback being selected in the first round, with 65% having a quarterback selected in the top three picks, and over half selected a quarterback as the first overall pick. More recently, this has increased even further; between 2000 and 2012, a quarterback has been selected in the top three picks every year and all but two years resulted in a quarterback being selected first overall (www.nfl.com, 2012).

The National Scouting Combine

In order to be drafted, athletes must display their abilities to scouts and coaches. The path taken towards selection generally involves the National Invitational Combine, more commonly known as the NFL Scouting Combine. The first scouting combine was in 1982, held in Tampa Bay, Florida. The purpose of this initial combine was to conduct a camp to ascertain medical information on the top prospects coming out of college. Teams that were members of National Football Scouting, Inc were invited and a total of 163 players attended. By 1985, all 28 teams were taking part in the camps with the goal of sharing the cost of medical examinations and information. After attempts in New Orleans and Arizona, the camp found its home in Indianapolis where it has been operating since 1987 (nflcombine.net, 2011). The present day

combine is part medical evaluation part tests designed to showcase the players' athleticism in order to demonstrate their capabilities to scouts and coaches. The participants in the combine are commonly college (university) seniors ready to advance their talents into the professional sports realm. While scouts can analyze game tape from the previous season, the combine is designed to demonstrate each player in a standardized setting, taking part in tests that would compare all players in an unbiased assessment environment (Kuzmits & Adams, 2008). Of approximately 10,000 college football players, roughly 3% are invited to take part in the four day drill, exercise, aptitude test, and interview process (Kuzmits & Adams, 2008).

Taller, smarter, and faster is the motto for many teams trying to improve quarterback capacity within their rosters and with that, the use of physical statistics has been heavily regarded when deciding who to acquire in the draft (Berri & Simmons, 2011). Thus, physical ranking is a deciding factor for many scouts when pursuing possible prospects, yet reflects a largely subjective analysis of physical potential and player characteristics (Lewis, 2003). Regardless, these statistical rankings are regularly taken into consideration when making assumptions about future performance (Berri & Brook, 1999). Logically, given the positive link between player statistics and team wins, recruiting players who outshine their peers should improve a team (Berri & Brook, 1999). Yet, the evaluation and assessment of these statistics have not been rigorous, nor have the tools used to acquire these statistics been evaluated in any systematic way (Amico, 2001).

Physical numbers may provide a superficial understanding of an athlete but the history of the NFL is saturated with instances where, in order to succeed, a smart mind must also be taken into consideration. Take for example Tom Brady, quarterback for the New England Patriots. Brady is an example of how the statistical evaluation and assessment of athletes is not a precise

science. As a University of Michigan graduate, Brady was invited to the NFL scouting combine where he presented himself poorly. Running a 5.28 second 40-yard dash left him as the runner-up to slowest of his draft class and he was never considered an athletic quarterback. Yet, he gained success through the understanding and preparation of his opponents, a capacity not considered throughout the classic scouting process. Testing poorly compared to his combine counterparts and appearing out of shape, Tom Brady was criticized and overlooked by scouts. His performance or lack thereof, resulted in Brady being selected late at the 199th pick in the 2000 NFL draft. Without the fluke injury of New England Patriot starter Drew Bledsoe, Brady would never have received an opportunity to play. From there he obtained the starting position and went on to win multiple Super Bowls, most valuable player trophies, and likely guaranteed himself a spot in the National Football Hall of Fame. His lack of statistical significance throughout the scouting process could have eliminated his future presence within the game of football. His example (among others) highlights the problems with validity of the scouting process (Kacsmar, 2013).

Draft Round as a Predictor of Performance

Issues within the drafting process have been considered before. For example, Massey and Thaler (2005) analyzed decision making in the NFL. More specifically, they looked at the value of the 1st overall pick and the compensation differences between early and late round draftees. Their argument was based on the combination of non-rational expectations and mis-pricing of players by both general managers and owners. In their perspective, over-valuing these prospects resulted from an inability to properly predict future talent and impact within the NFL. Through examination of the amounts paid to higher round picks, the authors concluded that the first selection within the NFL draft was the least valuable selection. Clearly, there is a higher

expected performance with the first round selection, yet the salary paired with this expectation, in per play performance value, was less valuable than second round selections (Massey & Thaler, 2005). Although insightful, Massey and Thaler only evaluated the relationship between draft selection and players' future career in the NFL. Missing from the study was the analysis of pre-draft measures such as collegiate statistics that could aid in providing a more complete evaluation leading up to draft selection. Collegiate football is a major stepping-stone to becoming a NFL professional. To this end, Hendricks and colleagues took a different approach to the drafting process by investigating statistical discrimination within the collegiate system. The college systems allows for varying degrees of talent, with Division IA at the top, followed by subdivisions such as Division II and Division III. On the one hand, this hierarchal system can leave some players at a disadvantage due to the lack of value the NFL places in their school and division. On the other hand, this process may also allow for a degree of risk-taking by teams. The possibility that an under-valued player may deliver a special edge over the opposition (i.e., the diamond in the rough scenario) could promote team success and aid in salary cap decisions. Players from a lesser known school come with a lower price tag and allow for franchises to cash in on a player that was overlooked, which grants them a competitive edge over other NFL teams (Hendricks et al., 2003).

Regardless of way in which the draft has been examined, there are clear criticisms. For example, while the combine may possess some face validity as a measure of future performance, its predictive validity is unclear (Kuzmits & Adams, 2008). A study involving 40 NCAA Division 1A collegiate football players examined eight running and strength measures. Their results yielded dismal results as only the vertical jump values were significantly correlated with football playing ability (Sawyer et al., 2002). Unfortunately, scientific inquiry of combine tests is

limited, raising important concerns about the validity in the measures (Kuzmits & Adams, 2008). Furthermore, the combine tests may not provide the most comprehensive profile of data available on players' capabilities. An important indicator of possible future talent may be reflected through collegiate statistics. Although these statistics are viewed by scouts to select players to attend the scouting combine, they may also provide some additional value relative to the field of competition that extend beyond the cross-sectional data provided by the combine tests. It is possible that a combination of combine numbers and collegiate statistics provide a superior measure of an athlete's initial potential to an organization.

The findings of the studies described above highlight the need for more scrutiny and scientific research into the NFL draft process. While research into the draft is limited, a few researchers have explored important issues. Kuzmits and Adams (2008), for example, investigated the relationship between players of different positions who attended the NFL combine and their draft selection. Subjects included combine invitees at the quarterback, running back, and wide receivers positions from the years 1999-2004. A total of 306 drafted players were considered. The quarterback position yielded results stating that jumping ability was the most significant tool in predicting draft selection. For wide receivers and running backs, speed was the main predictor. The Kuzmits and Adams study suggests that standardized tests at the NFL scouting combine may not be beneficial to all positions (i.e., jumping being the greatest predictor for quarterbacks).

Focusing on the position of quarterback, it seems clear that many combine-related variables have limited relevance. While speed is an essential function for many positions on the field, the idea that the vertical jump is a predictor of a successful quarterback is controversial. The game is evolving at the quarterback position as the NFL has recently seen an increase of

8.5% in passing attempts and the pass to run ratio in play calling has increased from 1.29 to 1.4 over the past 15 years, thus increasing the importance of properly scouting the position. Financially, quarterbacks makeup on average, one-twelfth of a team's salary and general managers are under constant pressure to draft the next Peyton Manning or John Elway (Redemann, 2015). A poor early quarterback selection could result in the waste of a crucial draft pick and large salary commitments that could harm a team for many years (e.g., the Oakland Raiders are still suffering from drafting JaMarcus Russell 1st overall in 2007 who then went on to play poorly and exit the league.

Although quarterbacks are highly valuable assets to NFL teams, research has not been sufficient in providing foundation of the science behind successfully drafting the position. Berri and Simmons (2011) assessed the relationship between draft position and NFL performance, the factors teams consider when drafting, and future performance related to those factors. Using 331 quarterbacks drafted who played at least a single game in the NFL, they considered draft round and multiple aspects of performance (QB score, net points, wins, and QB rating). Their results demonstrated that earlier draft rounds were associated with increased performance in all measures. Yet, when looking at the per-play performance, quarterbacks chosen within the 11-50 and 51-90 pick range outperformed those selected in the top 10 suggesting that earlier picks do not have more potential, they simply receive more on field opportunities. This could be due to the sunk-cost effect in which teams are compelled to offer more opportunities to those whom they have already spent resources and time on (Staw & Hoang, 1995). A concern with these results is that because of the reverse order pick drafting system, top 10 quarterbacks are typically drafted by teams with poorer records that are in a rebuilding stage. When determining draft position, Berri and Simmons also regressed collegiate wins produced in relation to the two

combine exercises (Wonderlic and 40-yard dash tests) and showed no connection between these factors, again reinforcing the conclusion that the combine measures are of limited utility, perhaps for the quarterback in particular. Taking into account all their parameters, Berri and Simmons (2011) noted that the only measure that had a significant positive impact on NFL experience was completion percentage; those who maintained a solid collegiate passing percentage went on to do the same in the NFL.

The studies outlined above highlight the difficulty in determining player talent in general and for quarterbacks in particular. Moreover, existing data show little strong evidence that draft day decisions are positive forecasts of future careers (e.g., Berri & Simmons, 2011).

Rationale and Purpose

The draft process clearly attracts significant media attention. Nonetheless, according to research previous, it lacks a meaningful degree of predictive validity across most positions, especially the quarterback. The collective evidence suggests it is very difficult for NFL franchises to assess player talent at the point of the draft. The aim of this study was to inform more effective strategies to predict the ability of quarterbacks to perform at a professional level. More specifically, this study examined a) the validity of collegiate and combine performance to explain draft selection and b) whether significant correlates of draft selection explain performance in the NFL. The findings of this study may provide a stronger, evidence-based selection process for selecting quarterbacks into the National Football League. In addition, the findings will, indirectly, offer insight into the methods used by scouts and franchises, whether positive or negative, to assess collegiate players.

The Utility of Collegiate and Combine Statistics for Identifying Potential in NFL Quarterbacks

Introduction

Over 100,000 high school seniors in the United States of America play football every year. Of them, only 0.2% will play at the American professional level (NFLPA, 2012). The National Football League (NFL) drafts approximately 250 players each year (www.nfl.com, 2014). The draft was created to allow each NFL franchise the opportunity to select top prospects, while distributing the talent across the 32 teams. This design prohibits any single team from monopolizing the best players. Additionally, a reverse order pick system allows teams with fewer wins in the previous season the opportunity to pick earlier in the draft (Popper, 2004). Currently, the draft consists of seven rounds in which each of the 32 teams are allowed to select a single player selection. In certain instances supplementary picks are given to teams due to the loss of compensatory free agents in the previous year (National Football League, 2012). While various football positions are selected throughout, the most anticipated and crucial picks are traditionally the quarterback. As noted by Berri and Simmons (2011), quarterbacks are often the backbone and face of an entire franchise, and typically considered the most important position on the field.

According to NFL draft history, 87% of NFL drafts from 1980 to 2012 resulted in a quarterback being selected in the first round, with 65% having a quarterback selected in the top three picks, and over half selected a quarterback as the first overall pick. More recently, this has increased even further; between 2000 and 2012, a quarterback has been selected in the top three picks every year and all but two years resulted in a quarterback being selected first overall (www.nfl.com, 2012).

The *NFL invitational combine* is the premier event when it comes to pre draft evaluations. While initially intended solely as a medical evaluation, the present day combine is

part medical evaluation part tests designed to showcase the athleticism of the athletes in order to

demonstrate their capabilities to scouts and coaches. Standardized tests are performed by the

athletes and are then made available to NFL teams in order to ameliorate the drafting process.

Despite its prominence, the predictive validity that the combine possesses is unclear (Kuzmits &

Adams, 2008). For instance, a study involving 40 NCAA Division 1A collegiate football players

examined eight running and strength measures, showing that only vertical jump values were

significantly correlated with football playing ability (Sawyer et al., 2002). Unfortunately, the

scientific foundation for many of the combine tests is limited, raising important concerns about

the utility of these measures (Kuzmits & Adams, 2008).

Berri and Simmons (2011) assessed the relationship between draft position and NFL

performance, the factors teams consider when drafting, and future performance related to those

factors. Using 331 quarterbacks drafted who played at least a single game in the NFL, they

measured the quarterbacks on multiple aspects (QB score, net points, wins, and QB rating)

demonstrating that the earlier drafted players have higher values in all measures. Yet, when

looking at the per-play performance, quarterbacks chosen within the 11-50 and 51-90 pick range

outperformed those selected in the top 10 suggesting that earlier picks do not offer more, but

instead receive more on field opportunities (see the 'sunk-cost effect' noted by Staw & Hoang,

1995). One explanation for this equal performance across draft rounds is that the reverse order

draft system has the highest ranked quarterbacks being selected by the worst teams. Those

drafted later are given opportunities with better teammates and more successful coaches. When

determining draft position, the authors cross-examined specific college statistics alongside the

Wonderlic and 40-yard dash tests from the NFL scouting combine (which will be explained more

thoroughly in the methods section). Using complete data from 121 quarterbacks, they regressed

collegiate wins produced in relation to the two combine exercises and showed no connection between them. This again reinforces the conclusion that the combine measures are of limited utility, perhaps for the quarterback in particular. All the same, they concluded that those who are taller, faster, and considered smarter were more likely to be selected earlier.

The aim of this study was to inform more effective strategies to predict the ability of quarterbacks to perform at a professional level. Specifically, this study examined a) the validity of collegiate and combine performance to explain draft selection and b) whether significant correlates of draft selection explain performance in the NFL. Based on previous work in this area, we hypothesized that the strength of the relationship between pre-draft variables (i.e., collegiate statistics and combine results) and our outcome measures (draft selection and future NFL performance) would be low. The findings of this study may be helpful for developing stronger, evidence-based selection process for selecting quarterbacks into the NFL.

Methods

<u>Sample</u>

The sample for this study included quarterbacks drafted between 1999 and 2012 and/or who participated in the NFL Scouting Combine for those years and became free agents (i.e., players who are undrafted but available to be signed by a team; N=282). This sample was selected due to availability and accuracy of statistics available for collegiate career, combine performance and subsequent NFL career. Of the dataset, 176 quarterbacks were drafted of which 27 were drafted without attending the NFL Scouting Combine. Data were collected from official websites that provided accurate and reliable information (http://www.nfl.com/draft/history/fulldraft, http://www.totalfootballstats.com, http://www.sports-reference.com, http://espn.go.com, & http://www.sports-reference.com).

<u>Measures</u>

Several different categories of variables were used in the analysis. The dependent variable was draft selection, which refers to the round and selection number the athlete was taken in the draft by a franchise and team. It ranges from a first pick (Round 1, Pick 1) to a last pick (Round 7, Pick 32), with supplementary picks reaching up to a 256th pick (http://www.nfl.com/draft/history).

Collegiate Statistics: The first set of predictor variables were based on quarterback collegiate statistics and included passing attempts, passing percentage, and passing yards per attempt. These measures were available at http://www.sports-reference.com. Collegiate passing attempts are the measure of how many throws a quarterback made throughout his collegiate career. Collegiate passing completion percentage is the conversion rate on the number of passes completed, per passes attempted. Passing yards per attempt is the average amount of yards gained per every passing attempt made by the quarterback.

NFL Statistics: NFL statistics were also collected in order to contrast draft selection with future NFL performance. Similar to the collegiate statistics, passing yardage, pass attempts and completion percentage at the NFL level were collected. In addition, games played, interceptions (how many times they threw the ball to the opposing team), and passer rating (a highly complex mathematical formula that combines multiple game factors and measures in order to give a quarterback a numbered score for their performance) were collected. These data were collected from various reliable websites including http://www.ESPN.com and http://www.pro-football-reference.com.

Combine Tests: The second set of predictor variables were based on NFL combine tests. These tests include the 40 yard dash, shuttle, broad jump, vertical jump, bench press, and the Wonderlic Exam. These tests are used to assess all football positions. These data were retrieved from http://nflcombineresults.com. During the combine, quarterbacks also partake in coach interviews and certain artificial on field drills that display arm strength and accuracy at the combine, but these data were not available.

The **40-yard dash** is the marquee event at the combine. The athletes are timed at 10, 20 and 40-yard intervals. What the scouts are looking for is an explosion from a static start. In the past three years 81% of wide-receivers' who ran in the 4.3-4.4 seconds time frame were drafted.

Similarly, the **short shuttle** test assesses lateral speed. It is known as the '5-10-5'. What it tests is the athlete's lateral quickness and explosion in short areas. The athlete starts in the three-point stance, moves 5 yards to his right, touches the line, goes back 10 yards to his left, left hand touches the line, pivot, and he turns 5 more yards and finishes.

The **vertical jump and broad jump** are measures of lower-body power. In the vertical jump, the athlete stands flat-footed and his reach is measured. It is important to accurately measure the reach, because the differential between the reach and the flag the athlete touches is his vertical jump measurement. For the broad jump the athlete starts out with a stance balanced and then jumps forward as far as he can. It tests lower body power and balance, because he has to land without moving. These tests are very basic in the form of identifying athleticism in the athletes.

The **Wonderlic exam** is a 50 question exam taken in 12 minutes that is mainly designed to measure intelligence. A score of 20 indicates an IQ of 100. The Wonderlic was first used by

the Dallas Cowboys in the 1970s, and while highly debated and criticized, it is still being used every year at the NFL combine (Wonderlic.com).

In addition to the above tests, anthropometric measurements such as height and weight will be assessed.

Statistical Analysis

The statistical analysis will take two forms. First, bivariate correlation analyses will be used to determine the level of association between collegiate and combine variable with draft selection. In addition, this first step will be used to identify significant correlates for understanding performance at the NFL level using linear regression. For all analyses, alpha is set at $p \leq 0.05$.

Results

Table 1 presents the correlations of draft position to the various aspects of collegiate quarterback success. The strongest relationship with draft position was for passing yards ($r = -.238$, $p \leq .05$). College completion percentage was the next strongest predictor of draft position ($r = -.224$, $p \leq .05$). Finally, college attempts which had a strong relationship with passing yardage ($r = .974$) was the third highest correlated measure ($r = -.208$, $p \leq .05$). For all of these variables greater performance resulted in lower (i.e, earlier) draft order picks.

Table 1: *Correlations Between Draft Status and Collegiate Statistics (Note. * = Significant at the .05 level)*

	HGT	WGT	Year	Draft Round	College Comp. %	College Att.	College Pass Yards	College Rush Yards
HGT								
WGT	.486*							
Year	.158*	.192*						
Draft Round	-.170*	-.246*	-.076					
College Comp. %	.054	.008	.438*	-.224*				
College Att.	.037	.052	.242*	-.208*	.375*			
College Pass Yards	-.008	.040	.241*	-.238*	.466*	.974*		
College Rush Yards	-.177*	-.022	.188*	-.093	.145*	.036	.076	

Table 2 describes the relationship between draft position and the NFL combine test scores. The strongest correlation to draft order was with vertical jump (r = -.305) (p ≤ .05) followed by broad jump (r = -.219) (p ≤ .05), which suggests quarterbacks who can perform well at the jumping tests during the combine have a greater likelihood of being drafted in earlier rounds. On the contrary, the relationship between draft round and 40 yard dash time (a test of speed) was r=.189 (p ≤ .05).

Table 3 describes the relationship between the 126 quarterbacks who started a game between 1999-2012 and their draft round. Of the 41 quarterbacks drafted in the first round, 78% were given the opportunity to start a game in their 1st year of eligibility. Those drafted from the 2nd-5th round showed a similar starting opportunity pattern and roughly 80% of quarterbacks who started a game were given the opportunity within 2 years of being drafted.

Table 4 describes the statistics of quarterbacks who were given the opportunity to start an NFL game within 2 years of being drafted. The limit of 2 years was chosen due to the roughly 80% of quarterbacks starting a game within this time period (as shown in Table 3). Compared to later selections, earlier selections showed an increased amount of playing time and passing yardage, yet showed similar completion percentages ($t = 1.4$, $p = .173$).

Table 2: *Correlations Between Draft Status and Combine Statistics (Note. * = Significant at the .05 level*

	HGT	WGT	Year	Draft Round	Comb. 40yd Dash	Shuttle	Broad Jump	Vertical Jump	Wonder. Exam
HGT									
WGT	.486*								
Year	.158*	.192*							
Draft Round	-.170*	-.246*	-.076						
Comb. 40yd Dash	.195*	.181*	-.102	.189*					
Shuttle	.164*	.167*	-.015	.164	.514				
Broad Jump	.024	-.100	.121	-.219*	-.470*	-.280*			
Vertical Jump	-.196*	-.141*	-.060	-.305*	-.661*	-.453*	.465*		
Wonder. Exam	.150*	.099	.223*	-.098	.112	-.211*	.043	-.053	

Table 3. *Starting Year and Draft Round of All Quarterbacks That Started a NFL Game.*

	Start eligibility Year	1	2	3	4	5	6	7	8	**Total**
Draft Round										
1		32	6	2	1					**41**
2		7	5	2						**14**
3		7	5	1		1				**14**
4		5	2	2	1					**10**
5		6	4	0	1				1	**12**
6		6	3	3				1		**13**
7		2	5	2	3					**12**
Undrafted		3	1	3	1	1	1			**10**
Total		**68**	**31**	**15**	**7**	**2**	**1**	**1**	**1**	**126**

Table 4. *Statistics for Quarterbacks Who Started Within Their Initial 2 Years.*

	Draft Round				95% Confidence	Intervals
	1 (N = 38)	**2-5 (N = 41)**	***t* - value**	**Sig. (*p*)**	**Lower**	**Upper**
Avg Passing Yards	2098.1	1117.4	4.3	.000	526.4	1435.0
Avg Games Played	11.8	7.6	4.5	.000	2.4	6.1
Avg Yards Per Game	177.9	147.3	3.5	.001	16.9	62.4
Avg Comp %	57.6	55.9	1.4	.173	-.8	4.3

Table 5. *Linear Regression Analysis for First Year Passing Yards Per Game thrown by Quarterbacks (N = 98)*

Variables	B	SE(B)	β	Sig. (*p*)
Height	-4.013	6.035	-.127	.510
Weight	.511	.634	.134	.425
Coll.Comp.%	1.828	1.851	.174	.329
Coll.PassYds	.002	.003	.081	.640
Coll.RushYds	-.007	.016	-.083	.674
FortyYdDash	23.530	61.721	.072	.705
Broad Jump	.947	.577	.271	.108
Wonderlic	-.074	1.231	-.010	.952
R^2 = .113				

Table 6. *Linear Regression analysis for Draft Round for Quarterbacks that Started Within 2 Years (N = 98)*

Variables	B	SE(B)	β	Sig. (*p*)
Height	.329	.207	.288	.087
Weight	-.027	.022	-.195	.119
Coll.Comp.%	-.077	.063	-.203	.220
Coll.PassYds	7.107	.000	.096	.229
Coll.RushYds	.001	.001	.174	.555
FortyYdDash	2.918	2.113	.246	.352
Broad Jump	-.023	.020	.180	.174
Wonderlic	.056	.042	-.209	.194
R^2 = .211				

Linear regression was used (Tables 5 and 6) to consider the value of top correlates for NFL draft selection in predicting draft round and first year passing yards per game (a measure of future NFL potential, see Appendix B) in quarterbacks who eventually went on to play in the NFL (*N = 98)*. Based on the correlation analysis of variables from both college statistics and the NFL scouting combine, we included variables that emerged as significant correlates with draft round while also ensuring standards for multicollinearity and normality were met (e.g., collegiate passing attempts was not included in the regression due to its extremely high association with

passing yards). Pre-draft measures accounted for roughly 11% ($R^2 = .113$) of the variance in first year passing yards and 21% ($R^2 = .211$) of variance for draft round although no individual variable reached statistical significance.

Discussion

This study examined the relationship between pre-draft statistics and their effect on both draft round selection and future performance in the NFL. Generally, our results showed that both collegiate statistics and combine test numbers were weak predictors of draft position and future talent for quarterbacks in the NFL.

Collegiate Measures

Collegiate football plays a major role as a form of talent identification for scouts and general managers in the NFL. While scouting is highly skewed towards Division 1A athletes, both the combine and draft include players from every class of college football, including Division 3 and certain community colleges (Hendricks et al., 2003). The findings from this study highlight the low predictive validity of collegiate statistics as there are relatively low correlations between collegiate ability and draft round (college pass yards being the strongest correlation). College statistics are an indication of both experience and skill at the collegiate level as every player has roughly the same amount of time to play (1-5 years of eligibility). Yet, despite being a major statistic in college football, passing yardage and other passing measures showed little relationship with draft round.

Combine Measures

Each year the NFL conducts an evaluation camp for college seniors known as the combine. While this invitation only camp may possess some limited face validity (as it is the

only event in which all coaches and scouts attend simultaneously), there is little scientific

research supporting its predictive power (Kuzmits & Adams, 2008). Regarded as a vital event for

aspiring athletes (www.nfl.com/combine), the correlations between performance on the combine

tests and draft round for quarterbacks were surprisingly low. It is possible that the combine is

particularly ineffective at identifying the important elements of quarterback performance but

useful for other positions. Kuzmits and Adams (2008) for instance, found a positive link between

speed measures and future talent in running backs and receivers. The correlation analysis in the

present study suggests inappropriate markers (e.g., vertical jump had the strongest correlation)

are used to rank players and the lack of quarterback specific tests might significantly

compromise the level of accuracy of these rankings. The quarterback position is expected to be

tall, smart, and fast in the new era of the game (Berri & Simmons, 2011); however, despite this

common claim, our results show that slower quarterbacks at the 40-yard dash are drafted earlier

and the 'intelligence' test used, the Wonderlic exam, has little relevance to draft status. Jumping

ability, which may have little utility to actual quarterback game play, was found to be the

strongest predictor of draft status, although even this relationship was small. Given the high

percentage of early draft picks going to the quarterback position, the results of this investigation

emphasize the importance of developing a stronger evidence-based approach to understanding

the limits of pre-draft statistics and creating novel ways to improve draft accuracy.

Effects of pre-draft measures on predicting NFL statistics

As the NFL scouting combine continues to be the only place where scouts and coaches

from every team can witness potential prospects, and collegiate play being the only precursor to

this showcase, we examined their influence on quarterback play at the professional level. In

addition to having little value in explaining draft round, we see the same effect when it comes to

actual performance in the NFL (i.e., in first year passing statistics). Eight significant correlates of draft round (height, weight, collegiate passing yardage, collegiate rush yards, collegiate completion percentage, forty-yard dash, broad jump and Wonderlic score) accounted for only 11% of the variance in first year passing yardage, with no significant individual variables.

In the second regression, pre-draft measures accounted for only 21% of the total variance when deciding draft round in quarterbacks. The high degree of unaccounted for variance in draft round highlights the complexity of understanding this outcome. It is possible that greater variance is attributable to the opinions formed behind closed doors on draft day including factors such as personality or intangible measures of overall "fit" with the specific organization. It is also worth noting that a team's individual draft selection in a given year is not 'time independent'. For example, even though a highly capable quarterback might be available for selection, a team who does not need a quarterback (e.g., if they chose a good candidate for that position in last year's draft) would be less likely to select for that position.

Ultimately, the goal of each player selected in the NFL draft is to become the starter at their position. With the quarterback being a focal point of every offense, many first round picks are given the opportunity to play right away. From our sample, 78% of quarterbacks who were drafted in the first round were given the starting position within their first year of eligibility. If we assume that players' potential subsequently decreases throughout the draft and the best quarterbacks are chosen first, opportunities for athletes to start in the NFL should decrease with each passing round. Although there was some evidence of this in the t-tests, differences were not as great as expected. For instance, quarterbacks drafted between the 2nd-5th rounds showed very similar starting opportunities throughout their first three years of eligibility. However, there were differences between players drafted in the first round and those drafted in rounds two to five.

First round picks played on average 11.7 games in their first year compared to 7.5 games from those selected between the 2nd and 5th rounds as well as an increased amount of passing yardage and average passing yards per game (although completion percentage was similar). The passing statistics reinforce the notion that those drafted earlier receive more opportunities to play (i.e., the 'sunk-cost' effect described by Staw and Hoang, 1995). An increased opportunity to play also comes with an increased amount of practice, one-on-one coaching and time on task. Research from the field of skill acquisition (e.g., Ericsson et al., 1993) suggests the earlier a player gains a starting position, the more advantageous their learning environment becomes. The lack of a strong statistical difference between early and late draft picks further emphasizes that lack of predictive validity in draft selection.

Limitations of this study and directions for future research

This initial analysis highlights several intriguing areas of future research in predicting talent in quarterbacks. For example, our results indicate the measures used to predict how athletes will perform at the professional level have low validity, although they continue to be used each year. For the quarterback position, scouts and trainers might consider implementing new measures of football IQ in order to capture the unique perceptual cognitive demands of the position. The progression into expertise relies heavily on pattern recognition and the development of decision making skills (Kirlik et al., 1996) as well as the ability to recall such patterns in a game environment. Individuals tend to adopt heuristic (experience based) simplification strategies in order to deal with complex, dynamic environments (Brehmer, 1990) and the speed in which quarterbacks recall these strategies could be the difference in success and failure at the professional level. Examining how capable quarterbacks are at a) deciphering defensive alignments, b) understanding of how the players move as the ball is set into play and c)

quickly reacting with the football could prove more valuable than current tests of largely physical attributes.

The combine is performed in an environment where all drills and movements are known months, even years before having to perform them. Absent from these tests are displays of mental quickness and flexibility. Mental processes may contribute more to overall speed in the athletic domain than the physical components (Abernethy, 1988) and the ability to understand a player's anticipation levels could result in greater accuracy when predicting talent. While physical qualities are undoubtedly essential to becoming a successful football player, mental capabilities reflect and 'untapped resource' for scouts and coaches, especially when considering the quarterback position. Caution must be taken by the NFL when determining the value and weight of collegiate statistics and combine test scores to future talent. Alongside the realization that college football statistics are not equivalent to the NFL, a restructuring of the scouting combine must take place in order to properly evaluate future players, especially at the quarterback position.

Although this study adds to a limited evidence base regarding the efficacy of talent selection decisions, analyses were limited due to the inability to be inside the meeting rooms as coaching discuss their selection options. In many cases players are not drafted by skill levels, but by team needs. The best players may go overlooked by a team that already has strong players currently on the roster. It was also not possible to determine the impact that personality and general impressions play on the decisions made by franchises which may contribute to the unaccounted for variance in draft selection.

General Discussion

The NFL instituted the reverse-order draft structure in 1936 to achieve a competitive balance across the league. The structure allows for the worst team of the previous year to select the first player in the draft under the premise that the best players from college football would then enhance the leagues economic and competitive health (Berri & Simmons, 2011). The draft includes athletes from all positions, although recent history suggests none is as important as the quarterback. The quarterback is the only position that is often credited directly with wins and losses (Berri & Simmons, 2011) and reflects the team leader and most vital position on the field (Walsh, 1997). As 87% of drafts from 1980 to 2012 saw a quarterback selected in the first round, the position is often a focus when it comes to the discussion of the first overall pick (www.nfl.com, 2012). Yet, despite the time and resources involved in evaluating athletes, the draft lacks a clear scientific foundation, particularly when it comes to selecting quarterbacks. Collegiate game play and the NFL combine are the main scouting environments available for scouts and coaches to judge future prospects. Evidence presented in this thesis concludes that there is generally low variance and a weak relationship between pre-draft variables and draft selection and future talent.

Collegiate football as a determinant of talent

College football is the gateway into the NFL. Dominated by the Bowl Subdivision (Division IA), top tier teams spend millions of dollars each year on coaching and training facilities in hopes of recruiting the best high school prospects and claiming a championship title. Beneath this division comes the Championship Subdivision, alongside Division II and Division III. Players from these non-Bowl Subdivisions receive less media attention and overall fewer scouting opportunities from the NFL, often leaving them at a disadvantage in the NFL draft

(Hendricks et al., 2003). Less coverage for these players means more uncertainty regarding the validity and reliability of their collegiate statistics. Students from these schools are often challenged that they did not play against the best teams. Franchises tend to be risk-averse as they draft from more recognizable schools, even though it has been shown that those taken from superior schools do not have stronger or longer career lengths (Hendricks et al., 2003). As noted in this thesis, college football statistics are only weakly correlated with draft position (college pass yards being the strongest correlation), and when considered as predictors of future talent, do not seem to be strong indicators of performance (at least measured by first year passing yards) in the NFL. Collegiate quarterbacks are progressing in all categories as years pass (see appendix A), thus having the position highly scouted for when discussing early draft selections. As many early draft picks are given starting positions, franchises tend to favor taller, smarter and faster quarterbacks who play for Division IA schools (Berri & Simmons, 2011), regardless of what past research suggests and the correlations shown in this thesis depict.

College football can generally be considered as a form of talent identification (TID), where professional clubs invest considerable amounts of resources into identifying athletes. Unfortunately, many TID models are associated with low predictive values and have little validity (Vaeyens et al., 2008). While college football should be considered as a necessary step to the professional level, caution should be taken when determining that value of college level performance statistics for predicting NFL performance. The college style of game play at the quarterback position is significantly different from that of the NFL. Collegiate quarterbacks are often encouraged to be athletic and extend plays, utilizing both speed and agility alongside their passing ability, while at the NFL level quarterbacks are encouraged to remain static and make the proper decisions quickly after the snap of the ball. Players such as Tim Tebow and Vince Young

are able to thrive at the college level due to extreme athleticism and strength, but then fail at the NFL level when they are asked to remain in the pocket (the space behind the offensive linemen) and rely on their passing abilities. This may be due to the lack of evaluation time made available to scouts and franchises. There are no other forms available to assess skill levels at the amateur level, as NFL personnel are not allowed contact with athletes until graduation or declaration for the draft. Thus, leaving all professional testing to take place during the months prior to the NFL draft.

Combine testing as a determinant of talent

As considerable media attention is focused on who runs the fastest 40-yard dash, or can bench press 225 pounds the most, many forget that the NFL national invitational combine is an artificial environment designed by scouts to gain a greater understanding of physical attributes a player possesses (Berri & Simmons, 2011). Athletes participate in drills that have been practiced and trained throughout their entire amateur career, most of which do not directly relate to football, yet possess value as a simulation for scouts. This simulation of game environment has shown some significance in predicting future talent in running backs. Combine sprint times are positively related to average yards per carry throughout the first three seasons in this position (Kuzmits & Adams, 2008). Importantly however, the scouting combine shows little significance to draft position and future performance in quarterbacks. The test with the strongest correlation to draft position in our sample was vertical jump, a score of how high a player can jump from a static position. While this test may reflect athleticism, there is no time in a game setting in which a quarterback would be expected to jump straight up before performing some game-related task. Similar to the conclusion made by Berri and Simmons (2011), the data from our analysis suggest combine tests do not capture key attributes of the quarterback position.

Of particular relevance to this discussion is the Wonderlic exam, designed to measure mental capacity and intelligence. Deemed as a cognitive ability assessment, the Wonderlic has been used not only to evaluate football players but as a means of screening military navigators and pilots during WWII, among others (Wonderlic.com). It has been considered a quick IQ test, showing success in the general employment screening process. It has demonstrated good psychometric properties and has been successfully relied upon in industries that require literacy and math skills (Tartar, 2015). Originally designed for businesses to evaluate potential employees, it was first introduced to the NFL by a handful of teams throughout the 1970s (Mirabile, 2005). A study by Mirabile (2005) on quarterbacks from 1989-2004, found that the modern-era quarterback does not benefit from the Wonderlic test. The relationship between the Wonderlic intelligence test and quarterback performance in both collegiate and professional players was not statistically related to draft position, nor did it increase a player's compensation from franchise. Our analysis (quarterbacks from 1999-2012) found that the Wonderlic exam resulted in the lowest correlation to draft selection across all combine measures, supporting the conclusion that either the quarterback position does not benefit from an intelligence exam or it does not benefit from *this* intelligence exam. It is possible the Wonderlic fails at evaluating football intelligence because it lacks football specific content. Research in skill development and expertise emphasize the high domain specificity of most cognitive and mental skills (see for example, Loffing, Schorer Hagemann & Baker, 2012). As players compete through physical tests in order to demonstrate their football ability, they are then shifted into a general examination that tests math, matching and problem solving skills. The history of the NFL highlights the limits of this approach. Vince Young was drafted as the third overall pick in 2006 with a Wonderlic score of 15 (a score of 20 indicates an IQ of 100 and is also the general average) while Ryan

Fitzpatrick who scored an impressive 49 waited until the 7th round to be selected. It is a tool, but possibly the wrong tool when evaluating prospects.

While the NFL scouting combine may be an effective forum for generating publicity for collegiate players attempting to become professional, it fails at properly predicting both draft status and future talent in quarterbacks. The drills are absent of quarterback specific actions and leaves the scores of vertical jump as the greatest predictor of draft position. While the notion of a standardized evaluation platform has merit, suggesting that the combine as a form of scouting should remain, the drills and tests used to evaluate athletes need to be modified to better reflect the current performance demands of each position.

Opportunity to Play

When examining the draft, quarterbacks selected in the first round tend to become the starters for their respective teams. Our sample showed that 78% of quarterbacks drafted in the first round receive a starting opportunity in their first year and 92% by their second year of eligibility. As suggested earlier, the draft process assumes that talent is regressed across draft rounds and that the better a quarterback is, the earlier they will be selected. This assumption becomes conflicted when taking into account the opportunity to play throughout each draft round. Quarterbacks across the second to fifth round of the draft show very similar starting opportunities throughout their first two years. Furthermore, our data show that the performance gap between those drafted earlier versus later is minimal as first round draft picks play on average 11.7 games in their first year compared to 7.5 games by those selected between the second and fifth rounds. Even more significantly, while early round selections threw for more total yardage and yardage per game, they showed similar completion percentages to those drafted later. This similarity in completion percentage but not yardage implies that those drafted earlier

receive more opportunities to throw passes, but are just as effective in completing passes as late round selections.

These results support those by Berri and Simmons (2011) who examined quarterbacks drafted from 1970 to 2007. They found that when looking at per-play numbers, quarterbacks selected 11-50 as well as picks 51-90 *outperformed* those selected in the top 10. This could be result of both the reverse order draft and the sunk-cost effect. The draft is ordered in a way that allows the worst teams from the previous year the first selections in order to help the competitive balance. Late picks tend to go to better teams and those scouted first are usually placed on struggling franchises trying to rebuild. While some quarterbacks may possess the abilities to thrive in that situation (ex., Andrew Luck turned around a dismal Indianapolis Colts team), those who are not prepared are at higher risk of failure than those drafted in later selections to playoff contention and even SuperBowl winning teams. Increased opportunity may also be a result of the sunk-cost effect (Staw & Hoang, 1995). Franchises may be inclined to keep a first round pick at the starter position longer than those drafted later due to the resources spent in acquiring the athlete. A first round draft pick is valuable alongside million dollar contracts for those selected early on, which may lead to the player receiving more on-field opportunity in hopes of cashing in on their investment.

Predicting future talent in the NFL

The purpose of the combine and collegiate statistics is to determine whether or not the play of an athlete will be beneficial to a franchise. It is surprising that as an employment selection device, pre-draft measures have not received more scientific scrutiny as a predictor of future talent in the NFL. This thesis has already shown how the combine and collegiate statistics do not impact draft selection at the quarterback position, and the same can be said about talent

prediction throughout an NFL career. By taking the most significant collegiate and combine measures to draft selection, we can regress first year passing yards per game and draft round selection of 98 quarterbacks. The eight highest correlated pre-draft variables to draft round (height, weight, collegiate passing yardage, collegiate rush yards, collegiate completion percentage, forty-yard dash, broad jump & the Wonderlic exam) accounted for only 11% of the variance in first year passing yardage. Alongside this, pre-draft measures contributed 21% of the total variance when deciding draft round in quarterbacks. In both regressions no individual variables reached statistical significance.

It is becoming clear that we cannot scientifically analyze a player using the current methods of evaluation and it is possible (even probable) that the only form of talent prediction comes from actual NFL game play. By using first year NFL quarterback game play to determine future talent, the NFL is voiding the combine and draft as a form of talent prediction. One way of doing so is by analyzing a quarterback's initial starting year. We can use a rookie quarterback's first year passing statistics as a general prediction of their future career (see appendix B). An example of these statistics can be shown in Jay Cutler, who started 5 games in his first year and threw for 200 yards per game. His career total now sits at 93 games played with an average of 229 yards per game. On the other hand, Kyle Boller who started 11 games in his first season threw for an average of 114 yards per game went on to play 67 games and throwing for an average of 133 yards per game.

Future research

The methods currently used to evaluate quarterbacks emphasize anthropometric measures and previous college game play statistics. While the introduction of the Wonderlic allowed for some intelligence based player information, it does not apply any actual football knowledge and

has been criticized for not having any direct relationship to draft round or future performance. The quarterback position involves much more than what can be measured on the playing field and cognitive and psychological aspects of the game are currently left out of the evaluation process. While a receiver or running back may only have to focus on their route or blocking assignment, the quarterback is responsible for knowing the responsibility and opportunities for every position on the field. Alongside communicating the play in the huddle, they are responsible for analyzing the defense pre-snap in order to make any adjustments (i.e., an audible). Following the snap they must anticipate the type of defense being played, decide the proper action to take with the football and finally deliver a pass accurately against a defensive back who is often the most athletic player on the field. Moreover, this must all be completed within a few seconds before they become pressured by the defense.

Examining quarterbacks should begin with the understanding of their perceptual cognitive skills. Skilled performers rely heavily on heuristic based strategies in order to cope with complex situations. The use of task simplification strategies are what separate novice and expert athletes and is based largely on pattern recognition skills (Kirlik et al., 1996). The ability to scan a defense and trace it back to previously seen formations and game footage allows for quicker decision making and reaction from a quarterback. Expert performers appear to be predominantly domain specific and rely on attributes such as the capability to recall complex patterns, anticipate forthcoming events, and produce movement patterns in an automatic and less effortful way (Abernethy, Baker, & Cote, 2005). Major components of decision making during complex situations are dominated by these perceptually guided (automatic) processes and not cognitively intensive (controlled) processes (Brehmer, 1990). By understanding the levels of pattern-recognition heuristics in quarterbacks, there can be an assessment of defensive

knowledge and defensive player movement. A possible way in which this could be examined would be by modifying a study done by Kirlik and colleagues (1996) in which participants played the role of a quarterback with the task of locating and throwing to an open receiver. The test was done on a computer and required no passing skill or previous football knowledge. The participants viewed players as X's and O's that would move along the screen in order to simulate football plays. Some participants received knowledge on how to identify open receivers depending on the movement of the defense and some also received on screen visual aids. Results yielded that those with an understanding of the rules and who received enhancement out-performed those with no aid. Modifying this study could benefit scouts when evaluating elite quarterbacks. By increasing the amount of player movement, play design and speed of the test, there could be recordings of both decision making skills and reaction speed when reading a defense both pre and post-snap. Given the domain specificity of most cognitive skills, the test could be done in an environment where full size screens display moving targets and track body movement and eye position (e.g., similar to that provided by services such as Axon Sports – www.axonsports.com). Quarterbacks could drop-back and analyze the defense, all while their cues and body positions are monitored. This type of test could take a college quarterback and place them into an NFL paced situation before ever being given a contract. Moreover, the test could also examine anticipation, which is crucial from the quarterback position as movement from one side of the field could be the result of an opening on the complete opposite side. Displaying a blitz on screen would show the anticipation of a quarterback to quickly adjust their pattern recognition skills in order to find the right receiver. This paired with the understanding of how powerful and accurate a quarterback's throwing skill is, could help separate athletes on both a mental and physical scale.

Conclusion

The results of this thesis are intended to provide more scientific evidence into the pre-draft measures used to rank NFL quarterback prospects. With draft selection offering an increased opportunity to play, the measures used to evaluate talent are crucial to both player and franchise success. Variables from collegiate career and combine tests are the main form of talent identification, yet they consistently fail to show a strong relationship to draft selection. With increased pressure on the quarterback position to aid struggling franchises, proper scouting must expand beyond the classic combine tests or amateur game-play. Research stemming from this thesis will be useful for forming new TID strategies for quarterbacks. Increased accuracy in the draft can help ensure that exceptional players are not being overlooked and that quarterback talent is utilized effectively.

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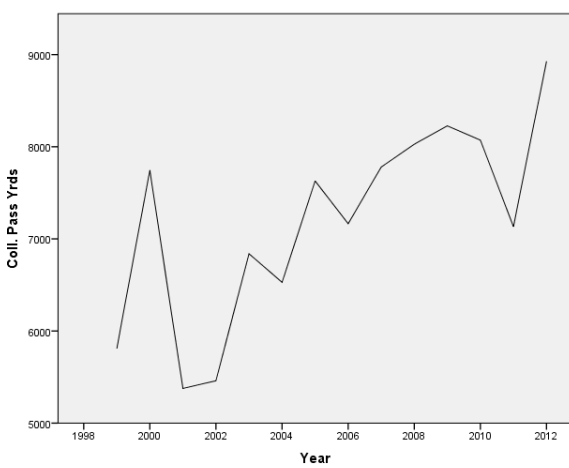
Appendices

Appendix A: Changes over time in college performance: completion % (a), passing attempts (b), passing yards (c) and rush yards (d).
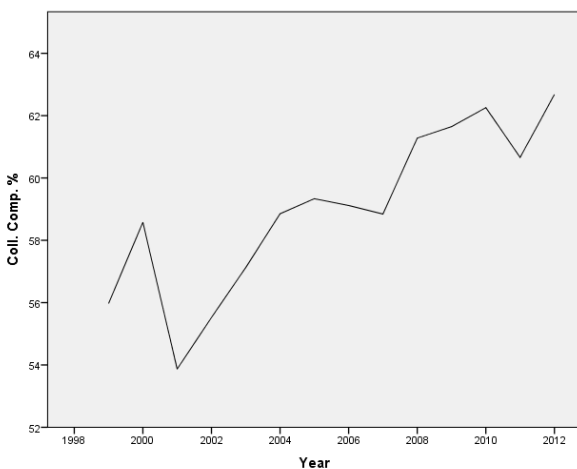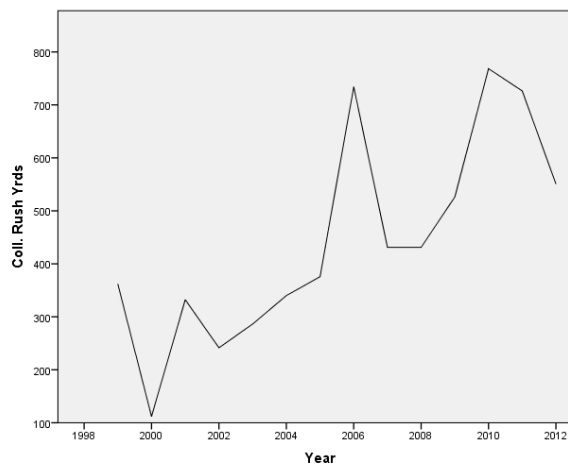

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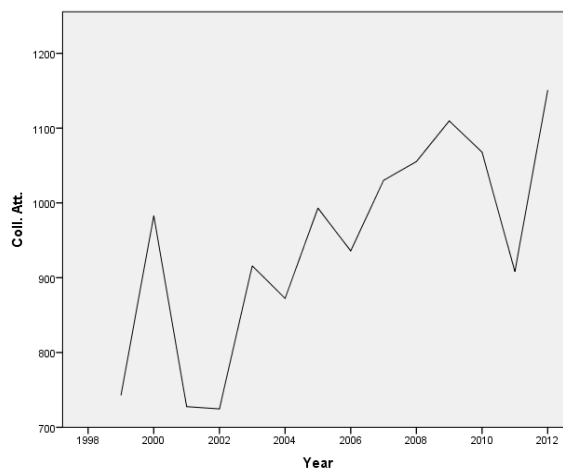
B

C

D

Appendix B: Descriptive Comparison of Career Per Game Yardage and First Year Yardage of QBs Who Threw for Over 50 Yards in a Single Game.

	N	Minimum	Maximum	Mean	Standard Deviation
Career Passing Yards Per Games Played	118	50.2	284.6	153.83	58.09
First Starting Opportunity Passing Yards Per Game Played	107	55.0	273.4	151.72	51.9