ABSTRACT

In this paper, we use quality management and financial market tools to evaluate quarterbacks in the National Football League based on their performance during their NCAA careers. Specifically, we use control charts and Bollinger Bands to develop methods to predict the success of quarterback drafting decisions.

KEYWORDS: Control chart, NCAA, NFL, Quarterback, Performance measurement

INTRODUCTION

Drafting decisions in the National Football League (NFL) are an important part of team success, particularly for a position as critical as the quarterback. There are many criteria a team uses to pick a quarterback in the draft, but the selection is not always successful. There are examples of first round choices that went bust, and late round selections that became franchise quarterbacks. In this study, we adopt methods from quality management and financial market to evaluate the performance of quarterbacks during their National Collegiate Athletic Association (NCAA) careers and its implications for professional success in the NFL. We use NCAA data of the quarterbacks to discover patterns that can be identified to predict if a quarterback will be successful in the NFL. Instead of simply sifting through common performance stats in selecting draft picks, we examine the consistency and improvement over time as the indicator of the potential of a quarterback. Specifically, we use the control chart and the Bollinger Band as the main tools for this investigation.

In this paper, we use examples of quarterbacks who are successful first round picks, unsuccessful first round picks, and blooming late round picks to explore the ability to predict NFL success based on NCAA performance. To do so, we apply quality control charts and Bollinger Bands to track their performances over their NCAA career. An analysis of the results is expected to provide guidance to the overall selection and development of quarterback talent.
LITERATURE REVIEW

The use of control charts is an established method in the evaluation of process control in manufacturing and service operations. But there have only been limited efforts at using to understand player performance in the context of sports. Bracewell PJ (2003) analyzed the performance of individual rugby players using a modified control chart methodology. The study compared the observed performance of individual rugby players with “unattainable perfection” (rather than the average) using control charts. This approach may be used by coaches and selectors for player selection. In another study, Bracewell PJ & Ruggiero K (2009) use control charts to for monitoring a player’ batting performances in cricket using data from New Zealand first-class (premium league equivalent) batsmen in domestic three- day cricket over a four year period. Changes in the process reflecting player performance were detected using rules adapted from traditional control charts. Hurley (2005) used control charts to evaluate the accuracy of the place-kicker in targeting the goal in football. He also suggests other application of player evaluation using control charts in other sports, but there have been few efforts to do so. This study addresses this gap by extending the application of control charts to evaluate quarterback performance in the NCAA, and what it may indicate about their future performance in the NFL.

SAMPLE SELECTION

For this study, we select six quarterbacks as examples of the aforementioned three groups. We use Andrew Luck and Cam Newton to represent first-round success, Tim Tebow and Brady Quinn for first round bust, and Nick Foles and Russell Wilson for late round bloom. The following is a brief description of their career path from college to NFL.

Andrew Luck played for Stanford University from 2009 to 2011. In 2011, Luck led Stanford to a record of 11–2, a berth in a BCS bowl game (the Fiesta Bowl), and a # 7 ranking in the final AP Poll. He was the runner-up for the Heisman Trophy in both 2010 and 2011. He was named the Offensive Player of the Year in the Pac-12 (Pac-10) Conference in both 2010 and 2011. Andrew Luck was drafted first overall in 2012 by the Indianapolis Colts in 2012.

Cam Newton played for Auburn University in 2010 (after University of Florida experience in 2007 and 2008). He led Auburn to the SEC championship and BCS championship in that year, was named the 2010 SEC Offensive Player of the Year as well as the 2010 AP Player of the Year, and won the Heisman Trophy. He was drafted by the Carolina Panthers in the first round (1st overall) in 2011, and was named both AP Offensive Rookie of the Year and Pepsi NFL Rookie of the Year on February 4, 2012.

Tim Tebow played for Florida Gators from 2006 to 2009. His college career highlights include winning the Heisman Trophy in 2007, leading the team to a BCS championship in 2008, and a 13–1 season in 2009. In addition, he holds held 5 NCAA, 14 Southeastern Conference, and 28 University of Florida statistical records. He was drafted in the first round (25th overall) by the Denver Broncos in 2010, but drifted from Denver to the New York Jets to the New England Patriots. He is currently not playing in the NFL.

Brady Quinn played for the University of Notre Dame from 2003 to 2006, where he set 36 Fighting Irish records during his four seasons with the team. Quinn started to excel in his sophomore year, placed fourth in the Heisman Trophy voting. He was drafted by the Cleveland
Browns in the first round (22nd overall) in 2007 and signed a five-year deal with the Browns worth a reported $20.2 million. But he never blossomed, going from Cleveland to Denver to Kansas City, and eventually losing the starting quarterback job in 2013.

Nick Foles was selected by the Philadelphia Eagles in the third round (88th overall) of the 2012 NFL Draft. He played for University of Arizona before coming to NFL. During the 2011 season, Foles completed 387 of 560 passes for 4,334 yards and 28 touchdowns. He ranked first in the Pacific-12 Conference. In the 2013 season, Foles had 27 touchdown passes and only 2 interceptions, the best TD-INT ratio in NFL history and a 119.0 passer rating which was the best by any quarterback in the 2013 season. He led the Eagles to playoff in that season.

Russell Wilson played for North Carolina State from 2008 to 2010 then for University of Wisconsin in 2011. Wilson finished the 2011 season with 33 passing touchdowns, which set the single season record at Wisconsin, and was voted ninth in the Heisman Trophy ballot. Wilson was selected by the Seattle Seahawks in the third round (75th pick overall) of the 2012 draft, and led the team to a Superbowl victory in 2014.

RESULTS AND DISCUSSIONS

We use the pass completion rate as the indicator for the effectiveness of a quarterback. Control charts of three different quarterbacks are first developed to examine their consistency. We then apply Bollinger Bands to further study the trends of their performance.

Control Chart Analysis

The examples of first-round success are Cam Newton and Andrew Luck. Figure 1 shows Luck’s p-charts of his passing completion rate in college.

![Figure 1. Andrew Luck’s p-chart](image.png)
We use Tim Tebow and Brady Quinn as examples for first-round bust. Both were drafted in the first round but failed to perform consistently. Tebow’s p-chart is shown in Figures 2.

The examples of late-round success are Nick Foles and Russell Wilson. Figure 3 shows Foles’ p-charts of his passing completion rate in college.
The control charts tell some interesting stories. All of them are trending higher (at various degrees), which is expected: since the quarterbacks are all in development stage in college, they are expected to improve over time. But they all show some distinctive traits. Luck’s chart trends higher the most in late stage, indicating that he may be “peaking” in his development thus most likely ready for immediate transition to NFL. Both Foles and Tebow have consistent p-chart with a relatively high average, implying their steadiness at the quarterback position.

Bollinger Bands Analysis

While control charts use overall average and standard deviation, Bollinger Bands (Bollinger, 1992) use moving averages to describe trends along with variability of performance. Bollinger bands are calculated based on standard deviation and originated as an oversold or overbought indicator for stock in financial markets. Ngan and Pang (2006) used this approach to detect defects in patterned fabric, with a nearly 99% accuracy of evaluating defect-free and defective images in patterns. They also found that the method provides an efficient, fast and shift-invariant approach to segment out the defective regions on the patterned fabric. In this paper, as an extension of using control charts, we develop two-sigma upper band and lower Bollinger bands around a five-game expected moving average (EMA) to evaluate quarterback passing completion rates. Figure 4 shows Andrew Luck’s Bollinger Bands for his NCAA career passing completion rate.

Figure 4. Andrew Luck’s Bollinger Bands

It is interesting to compare this chart with Fole’s Bollinger Bands in Figures 5:
Despite the difference in actual data, these two charts share striking similarities. Both Bollinger Bands exhibit (varying degrees of) upward trends and decreasing variability. (Among them, Luck shows better growth, while Foles has higher stability.) This combination—upward trend for improvement and decreasing variability for consistency—is likely a good indication for the maturity and readiness of a quarterback to play professionally. Indeed, Luck played well as starting quarterbacks in his rookie year, while Foles set some passing records while starting for the Philadelphia Eagles in his second year.

Tim Tebow is a somewhat different case. He was valued as a mobile quarterback - he sometimes ran more than he threw. Tebow’s Bollinger Bands tells this different story (Figure 6):
At first glance, Tebow was showing great consistency, although not much improvement. But his completion rate stayed at a relatively low level, compared to Luck and others. In other words, he showed consistent meritocracy in his throwing ability, and teams wanting his service would likely focus on his running plays instead. In his short NFL career, Tebow exhibited potential as a running quarterback but was never able to overcome his lack of throwing ability and had to sit out last (2013) season as a free agent.

CONCLUSIONS

Based on the control charts, the consistency, especially in the latter part of a quarterback’s college career, seems to be an important indicator of his success in the NFL. Bollinger Bands can further be used to select those that show readiness for NFL with upward trend and decreasing variability in their performance. Analysis of these limited samples shows that p-charts and Bollinger Bands can help teams make the correct draft picks. This preliminary investigation of the relationship between quarterback's performance in college and potential of success in the NFL points to the use of quality management tools for making the right draft decisions. It is also important to keep in mind, however, that the relatively small number of games each quarterback plays in college limits the statistical validity of these tools, and the interpretation of the control charts and Bollinger Bands would always have to be somewhat qualitative and subjective.

There are several areas that this study can be improved and/or extended. Although we selected some of the most representative cases, the most immediate extension would be to apply the same analysis to more quarterbacks to see if the results hold across the board. In analyzing quarterback performance, we focus on their passing plays. It can be argued that the value of a quarterback lies in how they execute plays based on the defensive formation and other environmental factors. Moreover, some quarterbacks also run the ball to gain yards. To evaluate the overall value of a quarterback, another measure, such as quarterback rating (QBR), might be used in lieu of completion rate. Finally, we believe that these tools can be applied to other positions as well, as long as the right performance measure is used.

REFERENCES


