

## **Group Project Descriptions**

### **Project Area 1: Player Performance**

#### **1a. Player Performance – Measurement**

Background: A criticism of standard statistics used for evaluating player performance is that they merely count things, and do not consider the importance or context of the action. For example, a three-run home run is, all else equal, more valuable than a two-run home run. However, a three-run home run in the bottom of the ninth when the home team is trailing seven to nothing is far less valuable than a 2-run home run in the bottom of the ninth when the game is tied. The criticism of standard statistics for being context-free is not limited to end-of-game or “clutch” situations, however. For example, Kirk Goldberry has argued that (i) a missed shot by Kobe Bryant is not as bad an outcome as a missed shot by other NBA players because after Kobe misses a shot there is a higher than average chance that his teammates get an offensive rebound and score and (ii) Kobe deserves some credit for this because by drawing frequent double-team coverage he frees up his teammates to get the offensive rebound.

Project Description: Pick a standard statistic for evaluating player performance and improve upon it by measuring its importance and/or putting it in the context of the game. Compare how ranking players changes when the improved statistic is used in place of the standard statistic. Determine if observed differences in players’ performance using the improved statistic are due to skill or merely chance. Evaluate the extent to which the improved statistic measures the performance of the player versus the performance of his teammates and/or the coaching strategy employed by his team.

#### **1b. Player Performance – Indirect Effects**

Background: A criticism of standard statistics used for evaluating player performance is that they merely measure the most direct aspects of a player’s contribution to a team. For example, standard measures of the value of an offensive player in baseball are based on that player’s output statistics (hits, slugging, RBIs, etc.). But a player can add value also

by improving the performance of other players. A better clean-up batter in baseball may improve the performance of the number three hitter by allowing that hitter to see better pitches or a player that is a threat to steal bases might improve or degrade the performance of those that bat behind him by affecting the pitches that batter gets or the approach that batter takes to protecting the runner. Another example of an indirect effect is the importance of having “veterans in the clubhouse” for the performance and improvement of younger players.

Project Description: Pick a sport and identify what you think might be an important channel for an indirect effect of a player’s contributions. Propose a way to measure the importance of this effect in terms of its contribution to team performance. Evaluate whether accounting for these effects helps explain important aspects of what you observe in terms of player evaluations, e.g. player salaries, player awards, etc.

### **1c. Player Performance – Prediction**

Background: Predicting player performance arises as a key element in many of the decisions a team has to make. A major league team that is drafting players needs to know how performance in a minor league or college league translates to the next level. A team that is trading player X for player Y needs to know how player Y’s performance will carry over to the new team. A team that is involved in salary negotiations with both player X (who specializes in skill 1 and has had a good year in performance) and player Y (who specializes in an equally valuable skill 2 and has had an equally good year in performance) needs to know if it should treat the players equally in terms of these salary negotiations. All of these situations involve predicting future performance not simply evaluating past performance.

Project Description: Pick a sport, identify a key decision that requires predicting player performance across leagues, across teams, across seasons or across matches, and determine the best method of prediction. Evaluate what types of performance can be predicted most accurately and those that are subject to the greater uncertainty. Describe how to quantify the degree of uncertainty about your prediction and how that uncertainty should affect your decision making.

## **1d. Player Performance – Variation within Game or Season**

Background: In many sports analysts and announcers typically talk about players being “on” or “hot” when they are doing well and “off their game”, “cold” or “in a slump” when they are doing poorly. In baseball this comes up when observers classify a pitcher as having his “good stuff” or “being wild.” Casual evidence suggests that coaches and players believe that players’ performance varies within a game and/or across games within a season. Coaches may insert the player who is “on a hot streak” into the lineup and a basketball team may try to “get the ball to the player who’s hot”. Since outcomes will vary even when expected individual performance is constant it is important to separate predictable variation in performance (i.e. variation in expected outcomes due to factors that can be measured in advance) from unpredictable variation in performance (i.e. random variation in outcomes that cannot be predicted in advance).

Project Description: Pick a sport and determine whether individual players in that sport have detectable “on” and “off” performances. For example, determine the extent to which one can reliably predict if players are likely to perform better or worse in the near future (e.g. the rest of the game or in upcoming games). You may also wish to examine the extent to which coaches and/or players are responding or not responding to both reliable and unreliable signals of upcoming future performance by adjusting playing time, the allocation of possessions, etc.

## **Project Area 2: The Game**

### **2a. The Game – Momentum**

Background: Announcers of sporting events frequently claim that “momentum” has switched from one side to the other and they often attribute the switch to a particular event or collection of events. Common “momentum switching events” are goal line stands and turnovers in football, getting a service break in tennis, getting a birdie or a bogey in golf, and failing to score after loading the bases with no outs in baseball.

Project Description: Pick a sport and identify one or more candidates for momentum changing plays. Define what constitutes momentum and determine if the plays you identify do in fact have a statistically significant effect on momentum. Determine how long momentum lasts after it switches. Determine if changes in momentum have a meaningful impact on the outcome of the game. Determine if coaches/teams change their behavior in

response to these instances where you think momentum has changed or may be perceived to have changed.

## **2b. The Game – Risk**

Background: Within each sport there are “high-risk” and “low-risk” strategies. When compared to low-risk plays, high-risk plays typically have a lower probability of success, a bigger payoff if there is a success, and can have either a higher or lower expected payoff. In baseball, it is likely riskier to play for the big inning than to play for a single run. In football, it is likely riskier to throw a long pass than to select a running play. In basketball, it may be riskier to attempt a 3-point shot than a 2-point shot. In tennis, it may be riskier to attempt a services ace than to “just try to getting a serve in”. Depending on the game situation, the opponent and /or other factors, a team or individual competitor may find it optimal to select a high-risk or low-risk strategy. Thus the terminology, “protecting a lead” and “playing fourth quarter football.”

Project Description: Pick a sport and classify a set of plays as “high risk” and “low risk” in terms of the distribution of possible outcomes, the payoffs to those outcomes and the expected payoff to the play. Evaluate a team or teams’ decision making in light of your definition of “high risk” and “low risk” plays. For example, utilize a framework for predicting when teams will optimally choose “high risk” and “low risk” plays. Or, examine whether teams’ play calling matches what we should expect given your classifications and the game situation. In other words, do teams seem to be making appropriate risk reward tradeoffs? Be specific about what you are assuming about the team’s objective and what factors other than risk (e.g. optimal randomization) are playing a role in play selection.

## **2c. The Game – Skill vs. Luck**

Background: A popular way to view the outcome of a game is that it depends on both skill and luck. This relative importance of skill and luck can be expected to vary as individual games are combined into collections of games. For example the importance of luck in a single round of golf can be expected to be different than the importance of luck in a four-round tournament. The importance of luck in a single game of baseball can be expected to be different than the importance of luck in a one hundred and sixty two game season. The importance of luck in a single game of college basketball can be expected to be different than the importance of luck in the NCAA single-elimination tournament.

Project Description: Choose and/or develop a method or multiple methods for measuring the relative importance of skill and luck. Pick at least two sports and use your measure(s) to assess the relative importance of skill vs. luck in a single “game” of each sport. The sports can be either a team sport or an individual sport. Check to see if the relative importance of skill vs. luck has changed over time. If possible, determine if rule or other changes in the sport(s) have altered the relative importance of skill vs. luck. Measure how the relative importance of skill vs. luck in the sports changes as the games in each sport are combined into a meaningful common collection of games, e.g. a season or a tournament.

### **Project Area 3: Winning**

#### **3a. Winning – Winning and Ticket Revenue**

Background: Team owners presumably like to run teams that both win and are profitable. These two features are undoubtedly related in most instances, but the nature of the relationship between winning and team profitability is far from clear. One key element of the relationship, and one that may be easier than most to investigate empirically, is the connection between winning and ticket revenue. This connection includes both the link between winning and attendance as well as the link between winning and ticket prices. The connection between winning and ticket revenue is likely to be sensitive to the definition of winning. Regular season wins, playoff wins and league championships may all have a different connection to ticket revenue. In addition, home wins may matter differently than away wins, wins in close games may matter differently than wins in blowouts, wins in televised games may matter differently than wins in non-televised games, unexpected or upset wins may matter differently than expected wins, and wins against key “rivals” may matter differently than wins against other opponents. Wins from the previous season may or may not have a connection to current year ticket revenue. The connection between winning and ticket revenue may vary by sport and/or by team.

Project Description: Pick one or more sports and analyze in detail some aspect of the relationship between on-field success and ticket revenue. Some examples: What factors contribute to attendance? What factors contribute to price per ticket? Do these factors differ across sports? Why? Do they differ significantly across teams in a given sport? Why? You probably want to focus your analysis on a particular factor or set of factors rather than attempt to explain everything that drives ticket revenue. Whatever factors you pick, do your best to try and establish a *causal* link between winning and ticket revenue.

Make sure to separate this causal link from the reverse causal link, if there is one, between ticket revenue (or more generally profitability) and winning.

### **3b. Winning – Winning in the Regular Season versus in the Playoffs**

Background: One commonly hears that team performance in the playoffs is “a whole new ballgame”. There are a number of ways that the outcome of playoff games could be determined by different factors than regular season games, e.g. pitching might matter more in the playoffs, defense might matter more in the playoffs, effort may be different in the playoffs and having star players might matter more in the playoffs. There are a number of reasons why the importance of such factors might differ, e.g. what determines a winner in a seven game playoff may be different than what determines a winner in a 16, 82, or 162 game season, or in the playoffs a team plays only good teams whereas in the regular season a team plays both good and bad teams.

Project Description: Pick a sport and use economics or other theories to derive a hypothesis about why the factors affecting playoff performance should be different than the factors determining regular season performance for that sport. Empirically analyze the extent to which the factors responsible for winning playoff games are different than the factors responsible for winning regular season games and use that evidence to evaluate your theory.

### **3c. Winning - What matters beyond winning?**

Background: Much of sports analytics is focused on what leads to more wins. Player acquisition decisions, play calling and management are often evaluated on how much they contribute to winning games. However, there is no reason that winning is the only dimension of team performance that fans care about. Fans may prefer teams that are exciting to watch or possess other characteristics such as an offensive (or defensive) focus or have more well-known or more charismatic players. Fans may value home wins more than away wins, etc.

Project Description: Pick a sport and develop a hypothesis or hypotheses about what aspects might be appealing to fans beyond wins or losses. Develop a statistical framework and gather the data necessary to evaluate your hypotheses. Evaluate whether these aspects are statistically and/or economically significant and quantify the magnitude of any estimated relationships. Evaluate whether other evidence (team decisions in hiring,

strategy, etc.) provide support for and/or are explained by your hypothesized/estimated effects.

## **Project Area 4: Evaluating General Managers and Coaches**

### **4a. Evaluating General Managers**

Background: Team performance reflects the performance of players, coaches, and general managers, all of whom must be evaluated by team ownership. General Managers can be thought of as being responsible for drafting players, making trades, signing free agents, and making player salary and contract length decisions. Evaluating their performance can be done on an ex ante basis, i.e. on the basis of information they should have had at the time their decision was made, or on an ex post basis, i.e. on the basis of how their decisions turned out.

Project Description: Pick a methodology for evaluating one aspect of GM performance in a particular professional team sport, and apply that methodology. You can evaluate the methodology in terms of its ability to identify high performing General Managers (a normative evaluation) or in terms of its ability to predict how General Managers are actually evaluated by existing owners (a positive evaluation)..

### **4b. Evaluating Coaches**

Background: Team performance reflects the performance of players, coaches, and general managers, all of whom must be evaluated by team ownership. Coaches can be thought of as being responsible for allocating player time, making strategic decisions within a game, and motivating players. Evaluating their performance can be done on an ex ante basis, i.e. on the basis of information they should have had at the time their decision was made, or on an ex post basis, i.e. on the basis of how their decisions turned out.

Project Description: Pick a methodology for evaluating one aspect of coaching performance in a team sport, and apply that methodology. You can evaluate the methodology in terms of its ability to identify high performing Coaches (a normative evaluation) or in terms of its ability to predict how Coaches are actually evaluated by existing owners (a positive evaluation)..

## **Project Area 5: League Management**

### **5a. League Management – Competitive Balance: How is it determined?**

Background: There is a widely held conjecture that competitive balance in a professional sports league is beneficial for the league. Presuming this to be true, it is important to realize that there are many theories about what constitutes competitive balance and about what factors are important for establishing competitive balance. For example, at what level should competitive balance be measured- the closeness of individual games, the tightness of pennant races or variation across teams in long-term success? What matters in terms of causal factors - what role does the nature of the game play? What role does scheduling of games play? What roles do league rules such as salary caps, luxury taxes, and revenue sharing play?

Project Description: Pick a sports league and specify a method for measuring and evaluating the degree of competitive balance and whether the degree of competitive balance has changed over time. To the extent possible identify factors that would be expected to determine that league's competitive balance and evaluate the empirical importance of those factors. To the extent some of these factors have changed over time, evaluate their impact. Examine if the conjecture that competitive balance is good for the league, e.g. is positively correlated with league revenues, has any empirical support.

### **5b: League Management – Game Scheduling and League Incentives**

Background: League officials make schedules for the teams in the league and in doing so can have an important impact on the success of both individual teams and the league as a whole. For example, scheduling can have an impact on the home field advantage, which some have claimed affects league welfare. Also, the decision to give teams a balanced schedule (i.e. each team plays all other team the same number of times) versus an unbalanced schedule (i.e. teams play different schedules that vary by geographic location of opponent or previous performance of opponent) can have an impact on competition, team success and impact which teams make the playoffs. For example, the decision of major league baseball to begin interleague play was presumably done to benefit the league as a whole but also affected the welfare of individual teams. The NFL's decision to play an "unbalanced" schedule has also potentially affected teams and the league as a whole.



Project Description: Pick a team sport and identifying key elements of the scheduling practices of that league. Explain how the scheduling decisions in that sport affect both individual team welfare and the welfare of the league as a whole. Where possible, estimate how much these scheduling decisions alter outcomes and the welfare of the leagues and its teams. Identify where individual team welfare is aligned with league welfare and where it is in conflict with league welfare.