Introduction

1.1 FAVORABLE BETTING SCENARIOS

The buy-and-hold strategies under efficient market dogma have shifted toward active trading strategies under adaptive market alternatives. Microeconomics appears to be back. It would be better if, as Keynes said, markets were not the by-product of a casino. But, in fact, they are.

In light of the greatest downturn since the Great Depression, the shift to active trading is not without critics. Under Saint Joan’s banner, French President Sarkozy has taken steps to instill moral values in the global market economy by urging policymakers to consider fresh ways of combating financial short-termism (Hall, 1/3/09). Perhaps Mr. Sarkozy has taken a perverse view of Keynes’ dictum that economics is a moral and not a natural science.

The recessionary angst of late 2008 saw many favorable betting scenarios in financial and sports gambling markets. Attractive bets included:

1In an effort to add intellectual glamor and impetus to his presidency, Sarkozy proposed that Albert Camus’ remains be moved from his simple village grave in Lourmarin to the Pantheon in Paris, burial place of France’s greatest heroes and intellectual leaders. Sarkozy has made an art of snatching high-profile figures from the left for his government to offset his occasional foray farther right on issues such as immigration and security (Thompson and Hollinger, 12/02/09).

Forecasting in Financial and Sports Gambling Markets: Adaptive Drift Modeling, By William S. Mallios
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establishing short positions on Goldman Sachs shares during November and betting on the Los Angeles Lakers (favored by 3 points) in their Christmas Day rematch with the Boston Celtics. (The Celtics embarrassed the Lakers in the previous National Basketball Association championship series). The attractiveness of each bet depended on the effectiveness of the gambler’s forecasting models—models that are assumed based on public information.

It has been argued that profitable modeling forecasts tend to favor the sports gambling markets since they are accommodated by greater regulation and surveillance, considerably less opacity, and public point spreads that reflect the gambling public’s expectations. For example, the New England Patriots’ loss to the New York Giants in the 2008 Super Bowl was an outcome that superseded the New York Jets’ upset win over the Baltimore Colts in the 1969 Super Bowl. The Patriots were prohibitive 12-point favorites; the bookmakers’ line on total points scored was 53.5. Relative to the lines on the difference and total points scored, the Patriots had vastly overperformed throughout the first half of the season, then underperformed but kept winning until the finale (see Figure 1.2.2). New England had clearly peaked by midseason.

In contrast, the Giants jelled in the second half of the season and peaked during the play-offs (see Figure 1.2.3). In the finale, the Giants won 17–14, an outcome that was easily amenable to effective forecasting; see Table 1.1.1 and the modeling procedure described in Section 10.2.

Relative to the line, the Giants’ expected winning margin of 3.4 points was a far more realistic estimate of the outcome. (See Section 11.2 for the calculation of the expected winning margin.) However, whether or not the line is realistic, there are always two groups of winners—those covering the bets and those betting on the winning side of the line—and one group of losers—those betting on the losing side of the line. Those covering the bets charge a commission per bet and are always the winners as long as

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Odds to $1</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patriots to win by more than 7 points</td>
<td>$2.01 to 1</td>
<td>0.33</td>
</tr>
<tr>
<td>Game decided by at most 7 points</td>
<td>$13.3 to 1</td>
<td>0.11</td>
</tr>
<tr>
<td>Giants to win by more than 7 points</td>
<td>$0.79 to 1</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Table 1.1.1 Super Bowl 2008: NE Patriots vs. NY Giants +12

NYG expected winning margin: 3.4 points. Outcome: NYG won by 3 points.

In the United States, the service of accepting or covering a bet is typically provided by the sports book at the casinos. In Europe the service is also provided by online bookmakers such as Ladbrokes.
the line splits the money wagered (i.e., losing bets pay off the winning bets after commissions). Thus, a bookmaker’s line is simply a measure of the gambling public’s expectation of a game’s outcome—regardless of whether or not that expectation is realistic.

A financial market analogy to Table 1.1.1 is illustrated in terms of Microsoft’s (stock symbol: MSFT) price movements during 1999–2000, a volatile period during final inflation and deflation of the NASDAQ bubble. From 3/27/00 to 4/3/00, the MSFT closing price dropped from $53.13/share to $44.53/share. Figure 1.1.1 presents weekly price changes and volumes through the January–June 2000 period, and Figure 1.1.3 presents these changes in terms of a candlestick chart (see Section 5.1 for detailed discussions).

In Figure 1.1.3, each week in Figure 1.1.1 is represented by a candlestick that depicts four summary prices for MSFT: the opening price (O), the high (H), the low (L), and the closing price (C) for the week. A candlestick is composed of a body and a wick that extends above and below the body. The body is white if \( C > O \) and dark if \( O > C \). The maximum (minimum) of the wick is the high (low) for the week; see Figure 1.1.2 for an illustration of three hypothetical candlesticks. The lower portion of Figure 1.1.3 presents the 25- and 100-day moving averages for \( C \) (where five trading days correspond to one week). The moving averages are based on successive days prior to each weekly candlestick.

![Figure 1.1.1](Figure 1.1.1. Line chart of weekly per share closing prices, including weekly volumes, for Microsoft (MSFT).)
A short-term modeling objective was to forecast the change in the closing price from 3/27/00 to 4/3/00; see box 1 in Figure 1.1.1. Adaptive drift modeling led to the results in Table 1.1.2 (see Chapter 9). The forecast correctly projected a significant drop in price, although the actual loss was underestimated relative to the expected loss. The same modeling procedures were used to forecast losses correctly through mid-May and gains in the rebound that followed; see box 2 in Figure 1.1.1.
1.2 GAMBLING SHOCKS

A gambling shock (GS) is defined as the difference between the game outcome and the line. For example, if the line on the difference favors the Patriots by 12 points and they lose by 3 points, \( GS_{\text{difference}}(\text{NE}) = -3 - (12) = -15 \). If the line on the total points scored in the Giants–Patriots game is 51 and the total points scored is 31, then \( GS_{\text{total}}(\text{NE}) = GS_{\text{total}}(\text{NYG}) = GST(\ast) = 31 - 51 = -20 \). Larger values of \(|GS_{\text{difference}}|\) and/or \(|GS_{\text{total}}|\) for a particular team generally affect that team’s subsequent performance or performances in that they may reflect the effects of motivation, injuries, personnel problems, and so on—all of which translate into physiological, psychological, and sociological variables.

When, for example, the Giants suffered through two embarrassing losses to the Dallas Cowboys during the 2007–2008 regular season, the likelihood of a Giants’ upset win against Dallas in the play-offs was exceptionally high (especially in view of the Giants late-season performances). In fact, when the Giants lost a game throughout the regular season, they usually won their next game (as shown in Figure 1.2.3).

When there are marked differences in player talent between opposing teams, the GS may act as a surrogate for fans and teams in the evaluation of team and player performances. The home team fans may take consolation when their underdog team loses by less than the spread—especially if they’ve bet on their team.

_We play hard and cover. We lead the league in covering the point spread._


Figure 1.2.1 depicts game outcomes and accompanying gambling shocks for the 23 Los Angeles Lakers’ play-off games leading to their 2008–2009 National Basketball Association (NBA) title. The Lakers won...

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### TABLE 1.1.2 Odds on \( D(\text{MSFT}, t) \), the Change in the Closing Price per Share of Microsoft from 3/27/00 to 4/5/00

<table>
<thead>
<tr>
<th>Outcomes for ( D(\text{MSFT}, t) )</th>
<th>Odds to $1</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>$&gt; 6</td>
<td>$19.0 to 1</td>
<td>0.05</td>
</tr>
<tr>
<td>$[6, $2]</td>
<td>$11.5 to 1</td>
<td>0.08</td>
</tr>
<tr>
<td>$[$2, $2]</td>
<td>$7.33 to 1</td>
<td>0.12</td>
</tr>
<tr>
<td>$(-2, -$6]</td>
<td>$3.00 to 1</td>
<td>0.25</td>
</tr>
<tr>
<td>$&lt;-$6</td>
<td>$1.04 to 1</td>
<td>0.49</td>
</tr>
</tbody>
</table>

*Expected gain/loss for \( D(\text{MSFT}, t) = -\$4.24. Observed gain/loss for \( D(\text{MSFT}, t) = -\$9.60.\)
in five games against Utah, seven against Houston, six against Denver, and then five in the finale against Orlando. White bodies denote games in which the Lakers beat the line on the difference. The minimum value of the white body is the line on the difference for Lakers, and the maximum of a white body is the Lakers’ winning/losing margin. Dark bodies denote games in which the Lakers did not beat the line; that is, the maximum value of a dark body is the line on the difference, and the minimum value of a dark body is the winning or losing margin. A white (dark) body indicates that the Lakers overperformed (underperformed) relative to the line on the difference. The size (magnitude) of the body reflects (equals) the size of the gambling shock on the difference for the Lakers. An observed difference above (below) zero signifies a Lakers’ win (loss).

The size of the gambling shock for the total points scored is given by the wick (or stick) that extends either above or below each body. When the wick extends above (below) the body, \( G S_{\text{total}} > 0 \) (\( G S_{\text{total}} < 0 \)). For example, in the first play-off game against the Utah Jazz, the Lakers were favored by 12 points and won 113–100; the line on the total was 210.5. Thus, \( G S_{\text{difference(LAL)}} = 13 - 12 = 1 \) (a small white body) and \( G S_{\text{total(LAL)}} = 213 - 210.5 = 2.5 \) (a short wick extending above the
white body). In this game, the gambling public’s expectations were on the rational side.

Several predictive indicators are apparent in Figure 1.2.1—indicators that are revealed in analyses of Lakers’ regular-season games. (Note: The obvious purpose of adaptive drift modeling is to uncover such indicators so that they can be applied in successful forecasting of subsequent game outcomes relative to the lines.)

**Predictive Indicator 1: The Revenge Factor**  A Lakers’ (LAL) dark or white body loss is followed by an LAL white body win. (Note: There are no white body losses for LAL, but there is one for the New York Giants in Figure 1.2.3.)

**Predictive Indicator 2: The Complacency Factor**  An LAL dark body win is followed by an LAL loss.

**Predictive Indicator 3: The Exhaustion Factor**  An LAL larger-than-average white body with a large lower stick tends to be followed by an LAL red body (except for the last game).

Figure 1.2.1 Candlestick chart for the Los Angeles Lakers during the 2008–2009 play-offs, including the first round versus Utah (won in five games; see box 1), the second round versus Houston (won in seven; see box 2), the third round versus Denver (won in six; see box 3) and the finals versus Orlando (won the NBA championship in five; see box 4). Candlesticks are defined as follows: white body, LineDiff(LAL) > 0; dark body, LineDiff(LAL) < 0; upper wick, GSTotal(LAL) > 0; lower wick, GSTotal(LAL) < 0.

Predictive indicator 1, the revenge factor, reflects the motivation to win convincingly in the game following a loss. Predictive indicator 2 may reflect complacency on the part of the Lakers—in the sense that they won their previous game but by less than the expected margin and that this same complacency will characterize their performance in their subsequent game. Predictive indicator 3 represents a larger than expected win and a lower than expected total points scored—an outcome that tends to describe exceptional offense and defense effort on the part of the Lakers. To achieve both in a single game may presage fatigue in the following game. The exception to predictive indicator 3 is the sixth and last game of the play-offs—a point in the series where Orlando appeared to have thrown in the towel (analogous to the LAL loss in the sixth and last game against the Celtics in the finale of the 2007–2008 play-offs).
The three indicators frequently characterize exceptional NBA teams such as the 2008–2009 Lakers, the 2007–2008 Celtics, and the San Antonio Spurs during their recent championship seasons. For teams of lesser talent, predictive indicators tend to interact with a variety of other variables and often require more complicated explanations. The key point to be emphasized is that each team tends to be unique and that forecasting models should be team specific. Universal models that are said to apply to all teams are as useful as deterministic models of human behavior.

For the Giants’ 2008 Super Bowl win over the Patriots, the candlestick charts in Figures 1.2.2 and 1.2.3 depict, respectively, all regular and postseason games for the Patriots and Giants in 2007–2008 which culminated in the Giants’ Super Bowl win and the Patriots’ only loss of the season.

The Patriot chart in Figure 1.2.2 depicts a classic example of a team that had peaked by midseason. Specifically, white bodies dominate the first half of the season and dark bodies dominate the last half. Moreover, $GST > 0$ dominates in the first half and $GST < 0$ is overrepresented in the second half.

The chart for the Giants in Figure 1.2.3 contrasts sharply with that for the Patriots. The Giants began the season poorly, losing to the Dallas Cowboys
1.3 THE DARK SIDE OF SPORTS: THE FIXES

The only good thing that can be said about the dark side of sports is that it is pale in comparison to the dark side of finance.

Regarding the line on any given game, profits for those covering the bets are assured from rules such as the 11 for 10 rule: the gambler puts up

Figure 1.2.3 New York Giants: 2007–2008 regular season and four play-off games, ending with Super Bowl win over the New England Patriots.

35–45 in week 1 and to the Green Bay Packers 13–35 in week 2. These losses were followed by a succession of five white body wins, followed by a seven-week period of mediocrity, and ending in a succession of six white bodies.

With the exception of the first week, a Giants’ loss was always followed by a white body win, as was the case for the Lakers in Figure 1.2.1. Also similar to the Lakers, the single dark body win is followed by a dark body loss. Although not shown in the chart, a loss by the Giants was followed by a win against that team if they met for the second time during the season—with the exception that the Giants lost to Dallas twice during the regular season prior to beating the Cowboys in the play-offs (see the forecasts for the Giants’ play-off games in Section 9.1).
$11 for each $10 bet. Once posted publicly, the line is adjusted whenever necessary to balance the total amount that was bet. Kenny White of the Las Vegas Sports Consultants has been quoted as saying that the movement of the line by half a point typically indicates betting on one side of about $50,000.

When the line is rational, as in the rational expectations hypothesis (see Section 2.1), the market is efficient. Irrational lines are indicative of market inefficiency. There is no comparable line in financial markets\(^3\) for the simple reason that prices could easily be manipulated to beat such a line.\(^4\)

While involvement of players in fixing games in the U.S. professional ranks is highly unlikely, there are understandably concerns by the NCAA in college sports. College athletes are not salaried, and many are in school for the express purpose of participating in their athletic specialty. In addition, many of these athletes are from low-income areas of inner cities. As such, college sports are susceptible to violations and scandals and fixes that include point shaving.

Regarding NCAA violations, the following allegations are said to represent the tip of the iceberg:

1. The Memphis men’s basketball program was charged by the NCAA with major violations during the 2007–2008 season.
2. Wolfers (2006) suggests that point-spread shaving may have influenced outcomes in nearly 500 games over a 16-year period. Wolfers looked at point-spread favorites of 12 or more points and

\(^3\)In proposing changes in compensation incentives for business executives, Martin argues that a stock price in business is the moral equivalent of a point spread in football betting. However, while National Football League players are forbidden from betting on the spread and are compensated, not on the line, but on their field performances, business executives are compensated primarily on increases in stock prices... instead of real-market measures such as revenue growth, market share, profits and book equity return (Martin, 5/12/09).

\(^4\)In sports gambling markets, there are strong arguments for discounting the possibility of a fix. To assure a “fix” one would have to bribe or threaten a player who plays the majority of the games and [whose earnings are in the millions]. The size of the bribe required to induce a player to forgo this salary for the rest of his career if caught therefore would be very large. This, in turn, would require that an extremely large amount of money be bet on the game in question to cover the bribe and make a profit... It is very unlikely that any bookmaker would take such a large bet and if one attempted to break up the bet into a more reasonable size... the level of activity on a single game clearly would be noticed by the bookmakers and probably would lead them to call off all bets on the game (Dobra et al., 1990). Although there have been no recent allegations of fixes by players in the professional ranks, the same is not true for referees and umpires. This topic is discussed in Section 11.4, where surveillance procedures are proposed for detecting possible referee and umpire irregularities in Major League Baseball (MLB), National Basketball Association (NBA), and National Football League (NFL) games.
concluded those teams tend to cover the point spread at a lower rate than they should. While that one statistic isn’t enough to conclude there is something unusual going on, Wolfers also mentions the NCAA survey where eight out of 388 basketball players admitted to taking money in exchange for playing poorly or at least had knowledge of teammates who did (Alan Moody, About.com).

3. In 1951, City College of New York, the collegiate basketball champion, became the symbol of corruption when its players were among 33 players from seven universities arrested for fixing 86 games.

4. In 1961, North Carolina State was involved in point-shaving scandals. Everett Case, then N.C. State coach, blamed it on players from the north that he had recruited. Sport writer Red Smith wrote that Case got integrity confused with geography. Congress then passed the Interstate Wire Act in 1961 to prevent sports gambling. In simple terms, the Wire Act makes it illegal to book bets on the phone or through the Internet. Whittier law professor Nelson Rose said: The Wire Act was designed to cut “the wire” which was the telegraph that every illegal bookie had to have to know who won a horse race before his patrons (Bowe, 7/24/06).

NBA referee Tim Donaghy officiated in 772 regular-season games and 20 play-off games from 1994 to 2007. Donaghy was alleged to have bet on games that he officiated during his last two seasons and to have made calls affecting point spreads on those games. Donaghy pleaded guilty to two federal charges related to the investigation and was sentenced to prison. However, he could face more charges at the state level if it is determined that he deliberately miscalled individual games. According to data obtained from a Las Vegas company, Donaghy refereed in 11 games after 1/1/2007 in which the consensus Las Vegas line moved two points or more. The team on which bettors wagered heavily enough to move the line that far won seven of those 11 games. . . . A 7–4 record would not be compelling to a statistician, who would consider the good possibility of that happening randomly. But Jimmy Vaccaro, the chief oddsmaker for American Wagering, which runs 60 sports books across Nevada, said that such performance would leave any gambler giddy. . . . If you win seven out of 11, more than 60%, you’d be a billionaire in about a year⁵ (Schwarz, 7/21/07).

⁵Graphical methods for monitoring individual referee performances in terms of game outcomes relative to point spreads on those games are presented in Section 10.8.
More recently, in November 2009, match fixing in European football was faced with a startling revelation. The Union of European Football Associations, soccer’s governing body in Europe, reported *without a doubt the biggest fraud scandal to ever hit European football*. The game had seen bribery scandals almost since the rules of the game were codified in 1863. Investigations identified approximately 200 games in which there was suspected fraud. *Sports authorities have been slow to realize the scale of the problem. If fans come to believe that the product they are watching is rigged, then they may turn off. It happened to other once-popular sports: rowing was a phenomenon in Britain in the 19th century before it became tainted by match-fixing* (Kuper and Blitz, 11/21/09).