GRADUATE SCHOOL OF BUSINESS
STANFORD UNIVERSITY

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P527 – BEHAVIORAL FINANCE AND SPORTS BETTING

Motivation

By drawing on findings from psychology, economics and finance, the newly emerging field of behavioral finance has yielded important insights into the operation of financial markets. We have learned that the market is not perfectly efficient, that equilibrium prices reflect human foibles, and these insights can be used to derive profitable trading strategies. This course both introduces the mathematical and psychological tools of behavioral finance, and applies them to an intriguing new context - sports betting markets. We will first study the structure of these $200 billion per annum markets, examining the relevant institutions, and highlighting the parallel between betting on the ball game, gambling at the ponies, and purchasing stock in your favorite firm on the NYSE. We then turn to discussing recent advances in behavioral finance and cutting-edge attempts to apply these to sports betting. Assessing potentially profitable trading strategies with a critical eye, we will discuss not only investment opportunities, but what these findings reveal about both human psychology, and the operation of markets more generally.

This course will have both a classroom and a practical component. During the morning sessions, we will typically meet to discuss and extend the readings. In the afternoon, we will shift to the computer lab in order to get truly intimate with the data. Using theory as a guide, what can we learn about the efficiency of these betting markets?

Participants

A complete class list (current as at early August):

- Alex de Aboitz
- Michael Cibula
- Barrett Comiskey
- Jamey Cummings

- Eric Kroll
- Carie Lemack
- Louis Lipani
- Romi Mahajan
- Brown McCullough
- Jason Shamas
- Christopher Smith
- Delaney Steele
- Shawn Stoval

Obligations

Attendance: Attendance at each and every class session is mandatory. Missing two of our ten sessions would certainly lead to a failing grade; missing one may lead to a failing grade, but exceptions *may* be possible if cleared with me *in advance*.

Preparation: You are expected to have thoroughly read the assigned readings before class.

Participation: You will be expected to participate meaningfully and even vigorously in the classroom, and also to engage the quantitative part of the course seriously.

Presentations: You will be expected to present the results of your quantitative analysis to the class at several points. I expect these to be well-prepared, thorough, and to show evidence of substantial quantitative work. This may require substantial research effort beyond class hours.

Practical Component

The concepts that we will cover in class are meant to be quite general, applying across contexts, and as such, we will do practical work testing our theories using datasets from:

- NFL Football
- NCAA Football
- NBA Basketball
- NCAA Basketball
- MLB Baseball (both AL and NL)
- NHL Hockey
- British Soccer
- European Soccer
- US Horse Racing
- Tennis (ATP)
- Politics

This course aims to extend theory into practice, and hence each afternoon, we will divide into research teams to try to test our theories based on data that I have collected on each of these sports.

In order to enjoy the returns to specialization, I will ask each of you to choose a sport, and to make that sport the focus of your empirical work. If you are the only person who selects a particular sport, then obviously you will need to work alone. But students who are sharing a focus on a particular sport are encouraged to work together as a research team.

I expect each research team to make serious progress in analyzing each sports betting market.

Major Project

Each research team is to analyze the historical data for their chosen sport, in an effort to find evidence of profitable trading strategies, suggested by our readings in psychology. I shall provide the relevant data.

Importantly, your analysis should provide a psychological foundation for the hypotheses you test. (You should plan on testing several hypotheses.) Test the success of these betting strategies on your data, providing both general tests of robustness, and tests of statistical significance. Remember, evidence that the market efficiently prices in some information is just as useful as evidence of mispricing (although unfortunately, this knowledge will never make you rich).

The main output from this project will be a twenty minute in-class presentation of your major findings. Students are encouraged to use PowerPoint for this presentation, and to prepare handouts to outline their findings. Expect to take questions from the room, but please respect the time limit.

Course Materials

Class Readings: A course reader based on this syllabus will be distributed in advance.

Electronic Data Files: When you choose the sport that you plan to analyze in your empirical work, I shall send you an Excel data file containing several years worth of past data. I have put substantial effort into gathering these data and ask that you do not distribute them to others without my permission. (Some files are also copyright-protected.)

Course Website: This syllabus and relevant articles will be available on a course website that you can link to through my homepage: www.stanford.edu/people/jwolfers.

Class Sessions

The first two hours of each day's class will follow a standard seminar-style format. I may spend the first twenty minutes setting up what I consider to be the most important issues covered in the readings, or even lecturing when covering a particularly important technical issue. But in the main, you should come to class with questions, points of view, and arguments prepared for a robust class discussion. Our main aim is to ensure that as a group we can learn more than we can as individuals. The study questions provided below each reading should give you some sense of how to prepare for our class sessions.

In the afternoon we will typically move to the computer lab, and confront theory with data.

In addition, I plan on making myself available for lunch each day and while it certainly is not compulsory, my hope is that we can get to know each other a bit better through these lunches.

Three non-standard sessions

- Monday September 15: We will have lunch as a class with Vince Monical, founder of www.flutter.com (now www.betfair.com).
- Wednesday September 17: We will host Fred Stanske, of Fuller-Thaler Asset Management (www.fullerthaler.com), arguably the leading behavioral finance fund around.
- Thursday September 18: If there is sufficient interest, we will visit Bay Meadows racecourse. Post time is at 1:05pm, so I suggest that we leave as a group from the GSB straight after class. Call my cellphone (415) 359-3407, in order to meet up when we get to the track. Our objectives: Some casual empiricism, but also a fun afternoon in the summer sun, perhaps with a few drinks. As such, significant others and friends are welcome.

Timetable:

Monday September 15

10am-noon: Introduction to Sports Betting (Building 160-Rm 322)
12:15pm-1:15pm Lunch with Vince Monical (Building 160-Rm 322)
1:30pm-2:30pm Lab Session: Analyzing the home team bias (MBA lab)

Tuesday September 16

1pm-3pm: Insights from Psychology (Building 160-Rm 322)
3pm-4pm: Lab Session: Analyzing the favorite-longshot bias (MBA lab)

Wednesday September 17

10am-noon: Behavioral Finance (Building 160-Rm 322)
12:15pm-1:15pm: Lunch with Fred Stanske (Building 160-Rm 322)
1:30pm-2:30pm Lab Session: Data analysis – Formulating your project (MBA Lab)

Thursday September 18

10am-12:40pm: Behavioral Sports Betting, (Building 160-Rm 322)

1:05pm post time for (optional) field trip to Bay Meadows racecourse

Monday September 22

10am-12:30: Student presentations (Building 160-Rm 322)

1:15pm-2:15pm: Research update by Professor Wolfers; Course wrap-up.

DAY ONE: INTRODUCTION TO SPORTS BETTING
Monday September 15

Morning Session: 10am-12am, Building 160-Rm 322

1.A Introduction and Motivation (30 minutes)

- Welcome and introduction
- Why sports betting?
- Psychology, economics and finance
- In-class experiment

Reading #1: "The Hot Hand in Basketball: On the Misperception of Random Sequences", by Tom Gilovich, Robert Vallone and Amos Tversky, Cognitive Psychology, 17, 295-314 (1985) and reprinted in "Heuristics and Biases: The Psychology of Intuitive Judgment", edited by Tom Gilovich, Dale Griffin and Daniel Kahneman (Cambridge University Press, 2002)

This paper serves as a simple introduction to the course's objectives. The paper highlights perception errors suggested by the psychology literature, documents that they affect our perception of sports contests, and even suggests that this might yield profitable betting strategies.

1.B Understanding the Institutions (90 minutes)

1.B.i Sports Bookmakers

Reading #2: "Race and Sports Book Management: A Guide for the Legal Bookmaker" by Michael Roxborough and Mike Rhoden, Las Vegas Sports Consultants

You are to read this entire book (126 pages), although you should use your judgment in deciding which bits to skim and which to pore over. (Interestingly enough, this is the assigned textbook in the nation's only college course for aspiring bookmakers – a course taught at Clark County Community College.)

Aims:

- Understand the types of wagers that are offered on different sports
- Understand how bookmakers set odds

- Understand the institutions involved in betting markets
- An introduction to some of the mathematics of sports betting

If this reading raises any unresolved questions for you, please email Professor Wolfers ahead of time so that he can integrate them into classroom discussion.

1.B.ii Illegal Bookmakers

Reading #3: "Illegal Sports Bookmakers", Koleman Strumpf (mimeo, UNC Chapel Hill, February 2003) Also available at: http://www.unc.edu/~cigar/papers/Bookie4b.pdf

Class discussion question:

- How does the illegal betting market differ from the legal betting market?

1.B.iii Online Gambling

Web research: Visit several sports books online, and get a sense of how they work, what sports they bet on, and what wagering facilities are available.

Some suggestions:

- www.sportsbook.com: A large Caribbean bookmaker catering to US clients
- www.centerbet.com: A large Australian bookmaker
- www.betfair.com: A rather unique two-sided betting forum. No bookmaker is involved; rather the site matches those wanting to wager for a team with those wanting to wager against. This firm was started by a GSB alum.
- www.tradesports.com: Another "trading exchange", whose offerings extend beyond sports to include politics, current events, individual stocks and futures.
- www.biz.uiowa.edu/iem/: Iowa electronic stock market: Betting on elections: A so-called "electronic stock market", allowing one to bet on elections, Federal Reserve policy, movie releases and a range of other events.
- www.oddschecker.com: Shows current betting information across several books.

Class discussion questions:

- Do you observe difference in the odds offered across websites?
- Do you have a sense that some of these betting venues are more likely to be efficient than others?
- Any interesting observations about what is being bet on, and the types of bets that are offered?

Special Lunch Session: 12:15pm-1:15pm, Building 160-Rm 322

1.C Guest Speaker: Vince Monical, Founder of www.flutter.com
(flutter.com has recently merged to become www.betfair.com)

Vince and his co-founder, Josh Hannah (a GSB-alum), have been recently written up in:

- Business 2.0 (http://www.business2.com/articles/mag/0,1640,6854,FF.html)

- The Financial Times (http://specials.ft.com/ln/specials/sp9e82.htm)
- Red Herring (http://www.redherring.com/vc/2000/0517/vc-flutter051700.html)

Vince (a Wharton MBA) will give a short presentation about his company, their business model, and their website. He has indicated a willingness to take questions relevant to his company, their market, or sports betting more generally.

Afternoon Session: 1:30pm-2:30pm, MBA Computer Lab

1.D Initial Analysis of Sports Betting Data

Motivating example: Is it worthwhile to bet on the home team?

We will try to answer this question in the lab. Each research team will focus on their specific sport. The main aim is to become familiar with your data, and comfortable working with it. You will report on your findings in class tomorrow.

DAY TWO: INSIGHTS FROM PSYCHOLOGY & EXPERIMENTAL ECONOMICS
Tuesday September 16

Classroom Session: 1pm-3pm, Building 160-Rm 322

2.A Research teams report: (30 minutes)
Does the betting market correctly price the home-team advantage?

Members of each research team to report back on whether the market correctly prices in the home team advantage. You should be prepared to discuss both what you have learned, and aspects of your analysis that you remain unsatisfied with.

Each research team should be prepared to speak for up to three minutes. You should plan to distribute a one page handout summarizing your results.

2.B Heuristics and Biases in Individual Decision Making (90 minutes)

Reading #4: "Heuristics and Biases", Amos Tversky and Daniel Kahneman, Science 1974, 185, 1123-1131. Available at: http://links.jstor.org/sici?sici=0036-8075%2819740927%293%3A185%3A4157%3C1124%3AJUUHAB%3E2.0.CO%3B2-M

This is the seminal article by the two leading psychologists, reporting on a range of decision problems that yield behaviors contrary to the standard (rational) economics

paradigm. The behaviors that they discuss have since been confirmed in hundreds of experiments over the ensuing 25 years.

Reading #5: "Judgment in Managerial Decision Making", by Max Bazerman (5th ed., 2002). Chapters 1-3 (pp.1-58)

This article provides an accessible and up-to-date treatment of recent research on heuristics and biases. Read these chapters to get a sense of the evidence on the types of "mistakes" that people make when confronting tough decision problems.

Reading #6: "Individual Rationality as a Useful Approximation: Comments on Tversky", Al Roth, in "The Rational Foundations of Economic Behavior", K. Arrow, E. Colombatto, M Perlman, and C. Schmidt, editors, Macmillan, 1996, 198-202. Also available at: http://www.economics.harvard.edu/~aroth/rational.html

This article provides a useful overview of the debate between psychologists and economist as to the relative merits of the rationality assumption and the importance of non-rational (psychology-based) behavior in explaining the world around us.

Class discussion questions:

- What are the main biases that psychologists have documented regarding individual decision-making?
- What are the psychological foundations of these biases, and their real-world implications?
- In particular, which heuristics and biases do you think will be particularly relevant when people are betting on sports?
- Does this psychological evidence suggest to you any possible avenues to explore when looking for profitable trading strategies in sports betting markets (or financial markets more broadly)?

Lab Session: 3pm-4pm, MBA Computer Lab

2.C Econometrics of Sports Betting Analysis and the Favorite-Longshot Bias

Motivating question: Is there a favorite-longshot bias? That is, do the odds or point-spreads suggest that longshots are overbet and favorites are underbet?

Professor Wolfers will demonstrate some simple econometric techniques that one can apply in order to distinguish whether your results are statistically significant.

Each research team should formulate their approach to this question, and be prepared to confront the data. Try to think of innovative and interesting ways to present the data. Employing the techniques suggested in class, make sure that you test whether your results are statistically significant. Beyond tests of statistical significance, graphs, tables and qualitative results are worth pursuing.

DAY THREE: APPLICATIONS OF PSYCHOLOGY TO FINANCIAL MARKETS: REVIEW OF BEHAVIORAL FINANCE
Wednesday September 17

Morning Session: 10am-12am, Building 160-Rm 322

3.A Research teams report: (30 minutes)
What is the evidence of a favorite-longshot bias?

Research teams to report back on the evidence for their sport of a favorite-longshot bias.

- Is there a favorite-long shot bias in your sport?
- What was your approach?
- And your results?
- Statistically significant?
- Does this suggest a profitable trading strategy?
- What did you learn, and what open questions remain?

Each research team should prepare 4 minutes of comments, reporting back on what you learned in the lab yesterday. You should plan to distribute a two page handout summarizing your findings.

3.B Traditional Finance: The Efficient Markets View (20 minutes)

Reading #7: "The Efficient Market Hypothesis", by Burton Malkiel in "The New Palgrave Dictionary of Economics"

You should already have been exposed to the efficient markets paradigm in Finance 220. This short piece is just to remind you of the basic concepts.

Aims:

- Understand that the efficient market hypothesis suggests that stock price movements are not predictable on the basis of publicly available information. (More formally, excess returns to holding stocks should not be predictable.)
- Distinguish between weak, semi-strong and strong-form versions of market efficiency.
- What are the assumptions underpinning the efficient markets hypothesis?

Class discussion questions:

- Is the efficient markets hypothesis likely to be applicable to sports betting markets?

- What is the sports betting analogy of the random walk hypothesis?
- What are the implications of the efficient markets hypothesis for sports betting markets?
- What institutional and market factors lead you to be more or less confident that sports betting markets are (in)efficient?

3.C Behavioral Finance: Psychology Meets the Market (70 minutes)

Reading #8: "Beyond Greed and Fear: Understanding Behavioral Finance and the Psychology of Investing", by Hersh Shefrin (2000, HBS Press), Chapters 1, 4, 5, 7, 8.

These chapters provide a useful introduction and survey of the modern behavioral finance literature. These chapters will present a view of behavioral finance that sometimes feels quite piecemeal – a natural reflection of the current state of the field. As you read these papers, try to draw analogies from the financial market implications to possible implications for sports betting.

Reading #9: "The Efficient Market Hypothesis and Its Critics", by Burton Malkiel (2003), Journal of Economic Perspectives 17(1).

This article counters the behavioral interpretation of many of the phenomena discussed by Shefrin, arguing that they are compatible with market efficiency. By making the standards of proof clearer, Malkiel provides guidance for empirical work on market (in)efficiency.

Class discussion questions:

- Which behavioral finance anomalies do you think have analogies in the sports betting market?
- Does Malkiel's critique have implications for how we should approach our research on sports betting?
- What profitable trading strategies do these readings suggest are worth exploring in the sports betting arena?

Special Lunch Session: 12:15pm-1:15pm, Building 160-Rm 322

3.D Guest Speaker: Fred Stanske, Fuller-Thaler Asset Management
"Behavioral Finance in Action"

Fred Stanske is Senior Vice President and Portfolio Manager at Fuller-Thaler Asset Management (www.fullerthaler.com) arguably the first (and foremost) firm implementing investment strategies founded on behavioral finance. A Chicago MBA, Fred is an expert in behavioral finance, and also a keen sports fan. He plans to discuss how behavioral finance theory – and particularly work by his colleague Professor Dick Thaler – translates into real lessons for his fund.

Afternoon Session: 1:30pm-2:30pm, MBA Computer Lab

3.E Research teams to work on major project

Hopefully the last two days will inspired you with many ideas for ways to beat the market betting on your sport. Research teams are to set up a research plan, and start work. Professor Wolfers will provide detailed advice on testing your ideas. Cross-fertilization of ideas across research teams is strongly encouraged – behavioral biases discovered in one sport are highly likely to be relevant for other sports.

This is also the best time to ensure that you have identified a set of issues that you wish to analyze, and that your empirical approach is plausible, sensible, feasible and thorough.

DAY FOUR: BEHAVIORAL SPORTS BETTING: ASSESSING THE LITERATURE
Thursday September 18

***Morning Session: 10am-12:40pm*, Building 160-Rm 322** (Note longer class session)

4.A Behavioral Finance and Sports Betting

The readings for today will be structured a little differently.

All students read a common background piece:
Reading #10: Donald Hausch and William Ziemba "Efficiency of Sports and Lottery Betting Markets", Chapter 18, Handbooks in Operations Research and Management Science, Vol. 9 (Elsevier: 1995)

The strength of this reading is that it provides a comprehensive and relatively up-to-date summary of the sports betting literature. (The weakness is an overly strong focus on horse racing markets.)

Because much of the existing literature is so piecemeal, each student will have responsibility for one of the 26 topics below; each examines a specific aspect of the betting market. Most topics involve two readings from the literature. You will be responsible for:

- Reading the articles carefully and critically
- Preparing a five-minute presentation that contains an interesting analysis of your two articles. (You do not need to give each paper equal weight, and should use your judgment.) Remembering that your classmates will not have read these article, ensure that your discussion:
    - Makes the research question clear
    - Provides a useful motivation for the paper
    - Summarizes and synthesizes the main points
    - Highlights conceptual or technical innovations in the paper.

    - Provides critical analysis – of both conceptual and technical issues.
    - Finds commonalities, points of difference, or argument between the two papers (if applicable)
    - Be prepared to take a couple of questions on your presentation.
- Provide a two page executive summary of each article. You may choose to include relevant tables or charts from the paper. (Very short articles may not require two pages to summarize; if you have only one paper, then three pages may be appropriate.)

Copies of the following articles will be available from Professor Wolfers. Remember, you only need to read those assigned to you.

4.A.i Home Field Advantage

Vergin, R.C. and Sosick, J.J. (1999) "No Place Like Home: An Examination of the Home Field Advantage in Gambling Strategies in NFL Football", *Journal of Economics and Business* 51, 21-31.

Gandar, J.M., Zuber, R.A., & Lamb, R.P (2001) "The Home Field Advantage Revisited: A Search for the Bias in Other Sports Betting Markets" *Journal of Economics and Business* 53, 439-453. [Covers NBA and MLB]

4.A.ii Neglected Firm Effect

Kochman, L.M. and Waples, D.L. "Football Betting and the Neglected-Firm Effect: A Note", *American Business Review*

Colquitt, L.L., Godwin, N.H., & Caudill, S.B. (2001) "Testing Efficiency Across Markets: Evidence from the NCAA Basketball Betting Market", *Journal of Business Finance & Accounting* 28(1) & (2).

4.A.iii Favorite-Longshot Bias: Baseball

Woodland, Linda and Bill Woodland (1994), "Market Efficiency and the favourite-longshot bias: the baseball betting market", *Journal of Finance*, 49, 269-280. http://links.jstor.org/sici?sici=0022-1082%28199403%2949%3A1%3C269%3AMEATFB%3E2.0.CO%3B2-7

Gandar, J.M., Richard Zuber, R. Johnson and W. Dare (2002), "Re-examining the betting market on Major League Baseball games: is there a reverse favourite-longshot bias", *Applied Economics* 34(10), 1309-1317. http://cherubino.catchword.com/vl=1146031/cl=36/nw=1/fm=docpdf/rpsv/catchword/routledg/00036846/v34n10/s11/p1309

4.A.iv Baseball statistics

Albert, Jim 1994, "Exploring Baseball Hitting Data: What About Those Breakdown Statistics?" Journal of the American Statistical Association 89(427), 1066-1074.
http://links.jstor.org/sici?sici=0162-1459%28199409%2989%3A427%3C1066%3AEBHDWA%3E2.0.CO%3B2-H

Lindsey, G.R. 1961, "The Progress of the Score During a Baseball Game", *Journal of the American Statistical Association*, 56(295), 703-728.
http://links.jstor.org/sici?sici=0162-1459%28196109%2956%3A295%3C703%3ATPOTSD%3E2.0.CO%3B2-G

4.A.v Baseball hitting streaks

Albright, S. Christian (1993), "Statistical Analysis of Hitting Streaks in Baseball", *Journal of the American Statistical Association*, 88(424), 1175-1183.
http://links.jstor.org/sici?sici=0162-1459%28199312%2988%3A424%3C1175%3AASAOHS%3E2.0.CO%3B2-U

Albert, Jim (1993), "Statistical Analysis of Hitting Streaks in Baseball: Comment", *Journal of the American Statistical Association*, 88(424), 1184-1188.
http://links.jstor.org/sici?sici=0162-1459%28199312%2988%3A424%3C1184%3AASAOHS%3E2.0.CO%3B2-S

Stern, Hal S. and Carl N. Morris (1993), "Statistical Analysis of Hitting Streaks in Baseball: Comment", *Journal of the American Statistical Association*, 88(424), 1189-1194.
http://links.jstor.org/sici?sici=0162-1459%28199312%2988%3A424%3C1189%3AASAOHS%3E2.0.CO%3B2-N

Albright, S. Christian (1993), "Statistical Analysis of Hitting Streaks in Baseball: Rejoineder", *Journal of the American Statistical Association* 88(424), 1194-1196.
http://links.jstor.org/sici?sici=0162-1459%28199312%2988%3A424%3C1194%3AASAOHS%3E2.0.CO%3B2-P

4.A.vi The Hot Hand in Basketball

Camerer, C. (1989), 'Does the Basketball Market Believe in the "Hot Hand"?' *American Economic Review*, 79, 1257-61.
http://links.jstor.org/sici?sici=0002-8282%28198912%2979%3A5%3C1257%3ADTBMBI%3E2.0.CO%3B2-%23

Brown, W.O. and Sauer, R.D. (1993), 'Does the Basketball Market Believe in the Hot Hand? Comment', American Economic Review, 83 (Dec.), 1377-86.
http://links.jstor.org/sici?sici=0002-8282%28199312%2983%3A5%3C1377%3ADTBMBI%3E2.0.CO%3B2-C

4.A.vii Basketball Market Efficiency

Brown, William O. and Raymond D. Sauer (1993), "Fundamentals or Noise? Evidence from the Professional Basketball Betting Market", *Journal of Finance* 48(4), 1193-1209.
http://links.jstor.org/sici?sici=0022-1082%28199309%2948%3A4%3C1193%3AFONEFT%3E2.0.CO%3B2-W

Sauer, Raymond D. (1998) "Player Injuries and Price Responses in the Point Spread Wagering Market", *mimeo* Clemson University.
http://hubcap.clemson.edu/~sauerr/work/injury.pdf

4.A.viii NFL Football Market Efficiency

Dana, J.D. and Knetter, M.M. (1994), "Learning and Efficiency in a Gambling Market", *Management Science* 40(10)
http://links.jstor.org/sici?sici=0025-1909%28199410%2940%3A10%3C1317%3ALAEIAG%3E2.0.CO%3B2-T

Gray, Philip K. and Stephen F. Gray (1997), "Testing Market Efficiency: Evidence From the NFL Sports Betting Market", *Journal of Finance* 52(4), 1725-1737.
http://links.jstor.org/sici?sici=0022-1082%28199709%2952%3A4%3C1725%3ATMEEFT%3E2.0.CO%3B2-M

4.A.ix NFL: Modeling Fundamentals

Zuber, Richard A., John M. Gandar and Benny D. Bowers (1985) "Beating the Spread: Testing the Efficiency of the Gambling Market for National Football League Games", *Journal of Political Economy* 93(4), 800-806.
http://links.jstor.org/sici?sici=0022-3808%28198508%2993%3A4%3C800%3ABTSTTE%3E2.0.CO%3B2-2

Sauer, Raymond D., Vic Bajer, Stephen P. Ferric and M. Wayne Marr (1988), "Hold Your Bets: Another Look at the Efficiency of the Gambling Market for National Football League Games", *Journal of Political Economy* 96(1), 206-213.
http://links.jstor.org/sici?sici=0022-3808%28198802%2996%3A1%3C206%3AHYBALA%3E2.0.CO%3B2-A

4.A.x NFL: Further analysis

Golec, J. and M. Tamarkin (1991) "The Degree of Inefficiency in the Football Betting Market", *Journal of Financial Economics* 30(2), 311-323

Gandar, John, Richard Zuber, Thomas O'Brien and Ben Russo (1988) "Testing Rationality in the Point Spread Betting Market", *Journal of Finance* 43(4) 995-1008.
http://links.jstor.org/sici?sici=0022-1082%28198809%2943%3A4%3C995%3ATRITPS%3E2.0.CO%3B2-2

4.A.xi NFL: Market structure and efficiency

Levitt, Steven (2003) "How do Markets Function: An Empirical Analysis of Gambling on the National Football League." NBER Working paper No. 9422.
http://www.src.uchicago.edu/users/levit/w9422.pdf

4.A.xii Soccer Market Efficiency

Cain, M., Law, D. and Peel, D. (2000) The Favourite-Longshot Bias and Market Efficiency in UK Football Betting, *Scottish Journal of Political Economy*, 47(1), pp. 25-36.

Pope, Peter F. and David A. Peel (1989) "Information, Prices and Efficiency in a Fixed-Odds Betting Market", *Economica* 56(223)
http://links.jstor.org/sici?sici=0013-0427%28198908%292%3A56%3A223%3C323%3AIPAEIA%3E2.0.CO%3B2-6

4.A.xiii Other Sports

Woodland, Linda and Bill Woodland (2001) "Market Efficiency and Profitable Wagering in the National Hockey League: Can Bettors Score on Longshots?" *Southern Economic Journal* 67(4), 983-995.

Brailsford, T.J., Gray, P.K., Easton, S.A., & Gray, S.F., "The Efficiency of Australian Football Betting Markets" *Australian Journal of Management*, 1995.
http://www.agsm.unsw.edu.au/eajm/9512/pdf/gray.pdf

4.A.xiv Election betting markets

Wolfers, Justin and Andrew Leigh (2002), "Three Tools for Forecasting Federal Elections: Lessons from 2001", Australian Journal of Political Science, 37(2), 223-240, available at: http://faculty-gsb.stanford.edu/wolfers/Papers/AJPS%20Three%20Tools%20Article.pdf

Berg, Joyce, Robert Forsyth, Forrest Nelson, Thomas Rietz (2001), "Results from a Dozen Years of Election Futures Markets Research," forthcoming in Charlie Plott and Vernon Smith (eds) "Handbook of Experimental Economics Results", available at: http://www.biz.uiowa.edu/iem/archive/BFNR_2000.pdf

4.A.xv Political Risk

Leigh, Andrew, Justin Wolfers and Eric Zitzewitz (2003), "What do Financial Markets think of War in Iraq?", NBER Working Paper #9587
http://faculty-gsb.stanford.edu/wolfers/Papers/iraq.pdf

4.A.xvi Game Shows

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4.A.xxii Microeconomic theory and gambling: A survey

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4.B (Optional) Field Trip: Bay Meadows Racecourse

If there is sufficient interest, we will visit Bay Meadows racecourse today. First post time is at 1:05pm, so I suggest that we car pool to the race course directly after class. (The Caltrain also stops at the racecourse.) Upon arrival, call my cell phone (415) 359-3407, so that we can meet up.

Our objectives: Some casual empiricism, collegiality, and also a fun day with a few drinks. As such, significant others and friends very welcome.

DAY FIVE: WHAT DO THE DATA SAY?
Monday September 22

Morning Session: 10am-12:30, Building 160-Rm 322

5.A Class Presentations: What have we learned?
This is the main assignment of your class. Each study group will be asked to present the results of their analysis of data on their chosen sport.

Please focus your presentation on the following questions:

- What betting systems did your investigate?
- Why investigate these systems? (That is, what was the motivating psychology behind your choices?)
- What did you learn?
- Conclusions
- Direction for further research

Afternoon Session: 1:15-2:15pm, Building 160-Rm 322

5.B Recent Research: Sports Betting and Corruption in College Sports
Professor Wolfers will present an update on research-in-progress documenting the extent of point-shaving in NCAA basketball.

5.C Summary and Wrap-up