Economics of Behavioral Finance

Lecture 8

A Guessing Game

- You are about to see 18 sequences of coin toss, generated by three types of coins
  - A fair coin: ½ chance head, ½ chance tail
  - Double-head coin: 100% chance head
  - Double-tail coin: 100% chance tail
  - There are as many double-headed coins as double-tailed coins—there might be none of both and at most 9 of each
- First, write down your guess on how many of each types of coins are there

A Second Game

- Imagine you have a fair coin, and you are generating a sequence of draws from it
  - Write down your first draw now
  - Write down your second draw
  - Write down your third draw
  - Write down your fourth draw

Analyst Recommendations

- Last week we talked about how analyst recommendation adds value only when the asset has good underlying characteristics, and that trading cost would erode any profit from following recommendations

- Today we will talk about why might analysts be over-optimistic in their forecasts, and why might investors be too willing to believe in analysts and fund managers' ability

Over-Optimistic Predictions

- De Bondt and Thaler 1990
  - IBES data from 1976 to 1984
  - Earnings per Share forecasts
- Eq.1,3,5: Regress actual EPS change on forecasted EPS change
  - <1 coefficients imply actual changes are smaller than the forecasted changes
- Eq.2,4,6: Regress Forecast revisions on forecasted EPS change
  - Negative coefficients imply more positive forecasts are followed by more negative revisions

Source: De Bondt and Thaler. 1990. "Do Security Analysts Overreact?", *American Economic Review Papers and Proceedings*.

TABLE 1—TESTS FOR THE RATIONALITY OF EARNINGS PER SHARE FORECASTS

Equation	Variables	Constant	Slope	Adj. R^2
1	*AC*1, *FC*1	−.094	.648	.217
		(−3.7)	(−21.7)	[5736]
2	*FR*1, *FC*1	−.120	−.181	.041
		(−6.7)	(−15.6)	[5736]
3	*AC*2, *FC*2	−.137	.459	.071
		(−2.3)	(−19.5)	[3539]
4	*FR*2, *FC*2	−.192	−.381	.074
		(−3.9)	(−16.8)	[3538]
5	*AC*12, *FC*12	.153	−.042	.000
		(2.4)	(−16.9)	[3520]
6	*FR*12, *FC*12	.348	−.439	.153
		(19.4)	(−25.3)	[3562]

Note: All variables are as defined in the text. The dependent variable is listed first. *T*-values appear in parentheses beneath the regression coefficients and test whether they differ from zero. However, for the slopes of equations 1, 3, and 5, the *t*-statistics test whether the coefficients differ from one. Note that the number of observations is given in brackets in the far right-hand column.

Do People Believe in Analysts?

A SUPERNOVA IS...

When a star explodes and the burst releases tremendous energy. Of course, supernovas are rare and can only take place if certain conditions exist...

Likewise, the unbelievable returns Motley Fool Co-founder and *Supernova* team leader David Gardner has directed his readers to over the years — from Amazon in the early days, to Baidu and Priceline, to Intuitive Surgical and MercadoLibre — could, and can only take place if these businesses possess certain qualities.

David has spent his entire investing career studying these Supernova *qualities and perfecting these techniques. And, you might say, preparing for this day.*

David is The Motley Fool's top performing stock-picker, bar none. And he has one of the most impressive, fully documented track records on the planet:

- David has directed members of *Motley Fool Stock Advisor* and *Motley Fool Rule Breakers* to two 20+ baggers... one 15+ bagger... and three 10+ baggers... all in the last 10 years.
- David's total average returns in *Motley Fool Stock Advisor* since March 2002 are 116%, compared to 25% for the S&P over the same period.
- David's total average returns in *Motley Fool Rule Breakers* since October 2004 are 59%, compared to 16% for the S&P over the same period.

Motley Fool Supernova **puts all of David Gardner's stock picks in one place for the first time.**

Inferencing from Small Sample

- How much information can one infer from a small sample?
  - Less than most people think

- Suppose you have run an experiment on 20 subjects, and have obtained a significant result which confirms your theory ($z = 2.23$, $p < .05$, two-tailed).

- You now have cause to run an additional group of 10 subjects. What do you think the probability is that the results will be significant, by a one-tailed test, separately for this group?

Inferencing from Small Sample

- On the “additional group of 10 after experiment on 20” question
  - Tversky and Kahneman. 1971. “Belief in the Law of Small Numbers”, *Psychological Bulletin*.
  - 89% of respondents indicate a probability around 0.85
  - 11% of respondents indicate a range between .4 to .6
  - True value is .473

Why Might People Over-Infer?

- Evidence suggests people believe that small samples have to resemble the underlying distributions

- The "generate-a-sequence-from-a-fair-coin" game
  - Rapoport and Budescu. 1997. "Randomization in Individual Choice Behavior". *Psychological Review*.
  - Solicited probabilities:
    - Pr(H|T) = 58.5%
    - Pr(H|HT) = 46.0%
    - Pr(H|HHT) = 38.0%
    - Pr(H|HHH…) = 29.8%
  - Subjects are clearly not generating the sequence with i.i.d. fair-coin draws

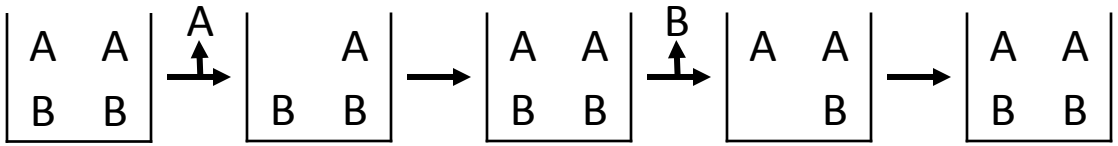
Belief in the Law of Small Numbers

- The Law of Small Numbers gets its name from the Law of Large Numbers, which you should have learnt
  - Sample mean converges in probability to population mean

- **The Law of Small Numbers**
  - The belief that a small sample mean should resemble the population mean to a high degree

A Model of LSN (Rabin 2002 QJE)

- Binary event {A,B}, with Pr(A) = θ
- The true process is i.i.d., but the decision maker mistakenly think it is made up of draws from a fixed number of A's and B's, *without replacement*
  - E.g. If there is 2A's and 2B's, after a draw of A the DM thinks there is only 1A and 2B's left
  - Captures the phenomenon observed in the "generate-a-sequence-from-a-fair-coin" game
- Prior on θ is π(θ). DM updates his beliefs according to Bayes' Rule
- For tractability reason, assumes the DM resets the number of A's and B's every 2 rounds



Source: Rabin, Matthew. 2002. "Inference by Believers in the Law of Small Numbers", *Quarterly Journal of Economics*.

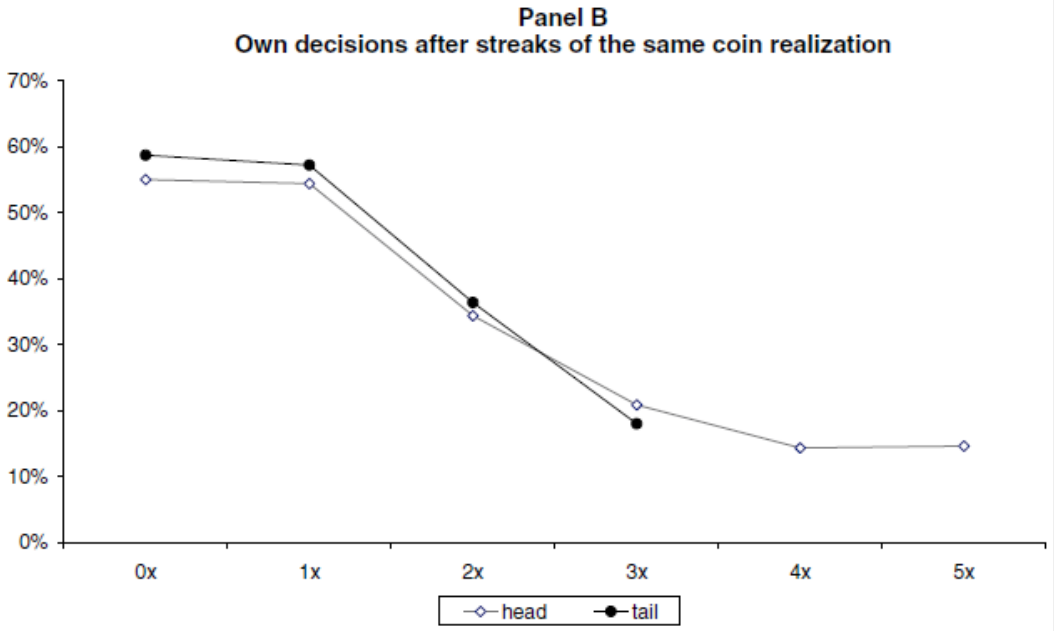
A Model of LSN - Example

- Consider an investor who believes that there are three types of fund managers (or analysts, etc.)—bad, average or good
  - Bad manager outperforms other managers ¼ of the time
  - Average managers: ½ of the time
  - Good managers: ¾ of the time
  - Prior: all three types equally likely
- After one successful year, what is the chance that a particular type of manager will succeed again?
  - Full Bayesian: Believer in LSN:

Predictions of the Model

- Because a LSN-investor believes that the sample distribution should resemble the population distribution, in the short run he expects mean-reversion

- Huber et al 2008
  - 6 sessions of 20 subjects each
  - One risky asset and one risk-free asset. Subjects were told that the risky asset is random walk



Source: Huber et al. 2008. "The Hot hand belief and the gambler's fallacy in investment decisions under risk", *Theory and Decision*.

A Model of LSN - Example

- What will the investor infers from two successful years in a row by a particular manager?
  - Full Bayesian:
  - Believer in LSN:

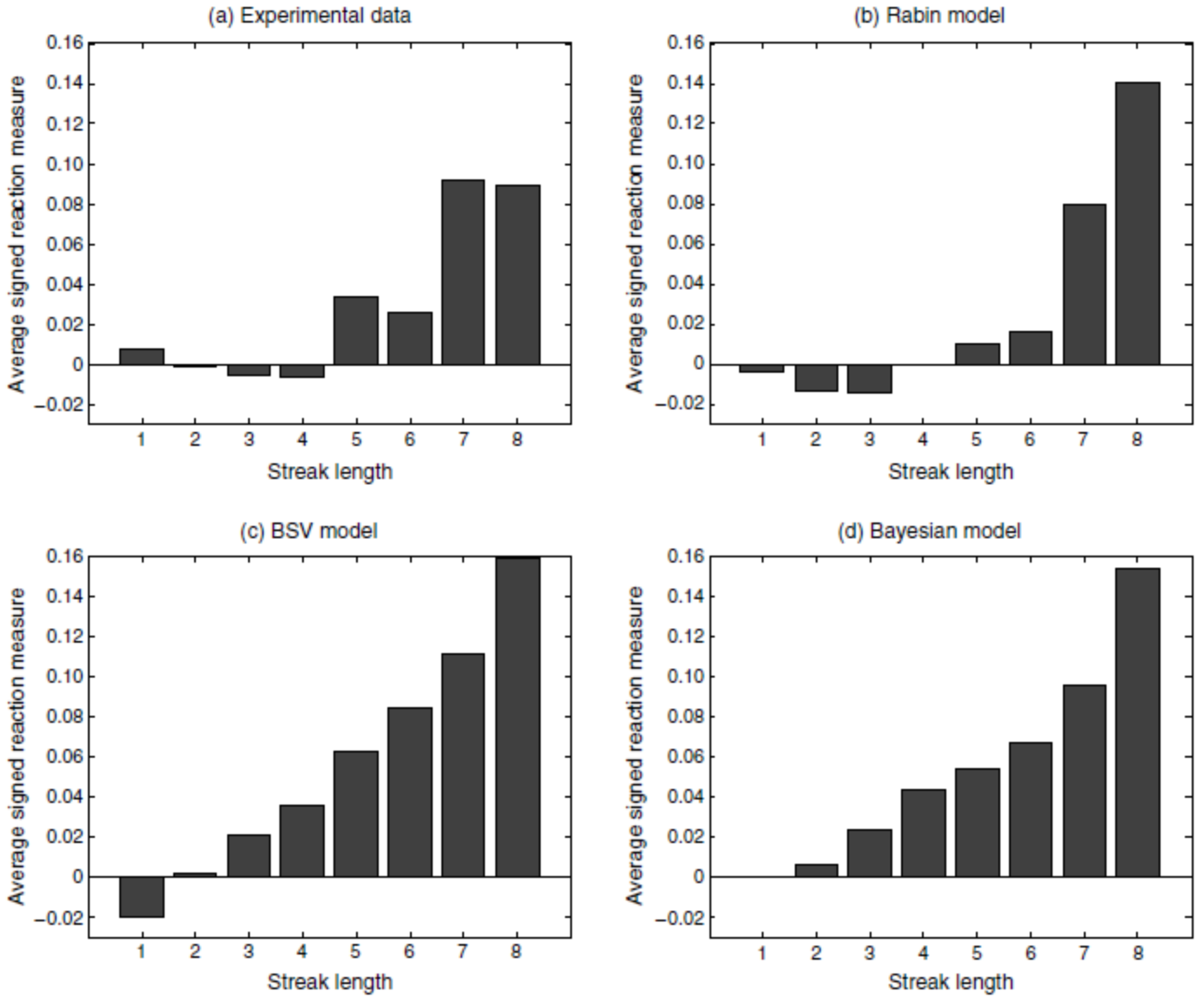
Predictions of the Model

- Notice how the investor's inference is skewed towards the type of manager that has a chance of success most resemble the realized outcome
  - It can be shown that the skewedness decreases as we approach full Bayesian
    - In the model, this is achieved by allowing for more and more A's and B's
- Because the LSN-investor is too willing to believe that he has observed an above or below-average manager, his posterior belief has a higher variance than the full-Bayesian investor

Asparouhova et al 2009

- 92 subjects
- 100 rounds per subject
- See 8 rounds of outcomes before guessing

Figure 2 Reaction Measure-Streak Length Graphs



Notes. Ending streak length is on the *x*-axis. Average signed reaction measure (averaged across all subjects' responses for the corresponding streak length) is on the *y*-axis.

Source: Asparouhova et al et al. 2009. "Inference from Streaks in Random Outcomes: Experimental Evidfence on Beliefs in Regime Sifting and the Law of Small Numbers", *Management Science*.

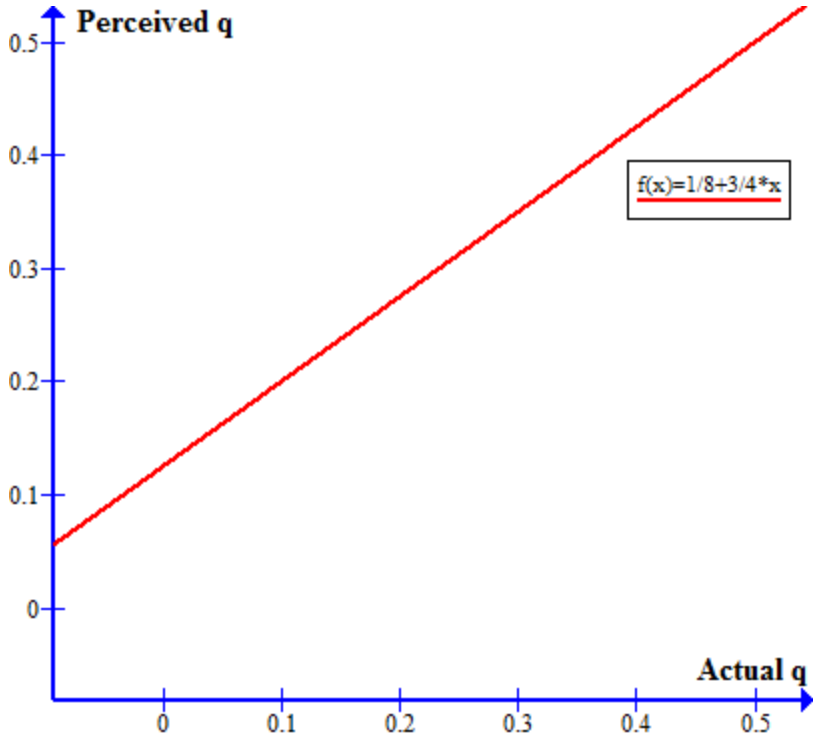
Multiple Sources

- What happens when a LSN believer faces small sample from multiple sources?
  - Example: there are hundreds of mutual funds and analysts, but the number of observations for each of them is small

- For tractability, consider the case where there are an infinite number of sources
  - Three types of managers, probability of performing well: {0,0.5,1}
  - True probability of {0} = probability of {1} = q, q < 1/2
  - Probability of {0.5} = 1 – 2q
  - Perceived q = $\tilde{q}$

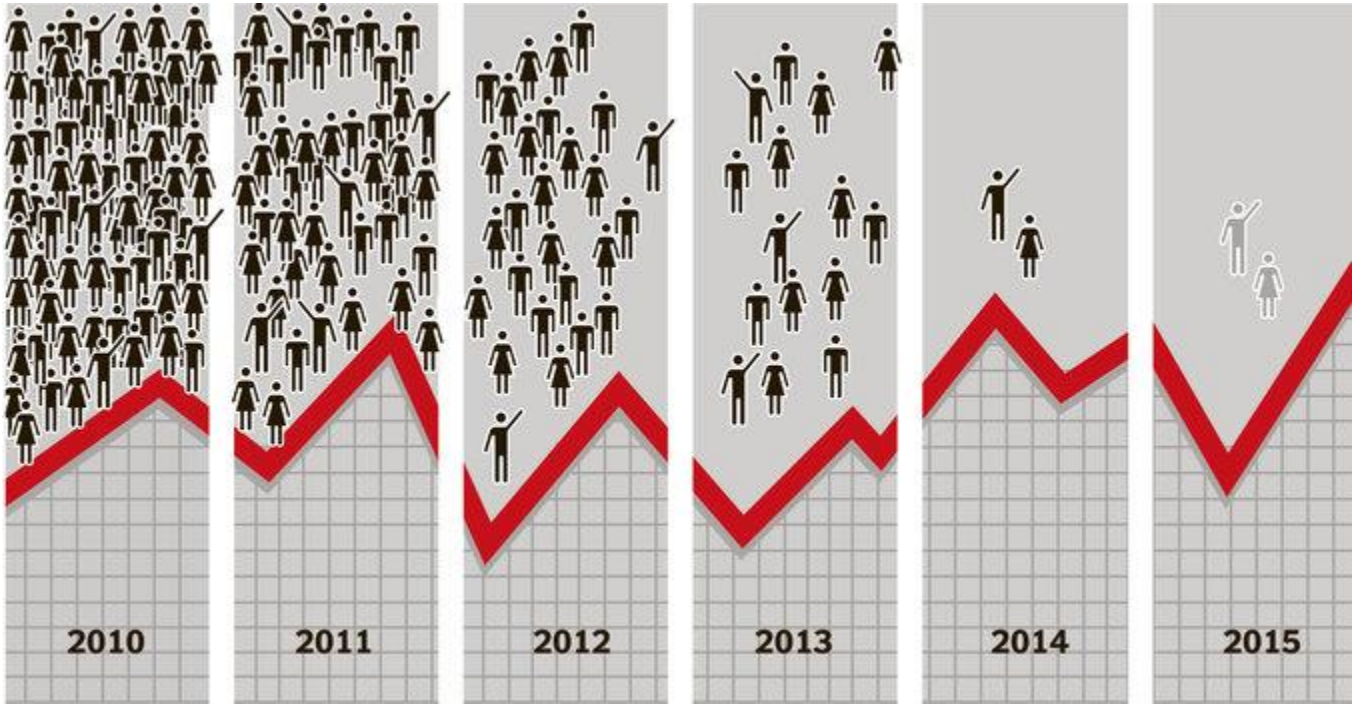
Multiple Sources - Example

- How often, in terms of probability, does the investor expect to see two good years in a row?
  - Actual probability/Full Bayesian:
  - Believer in LSN:
  - Inference by Believer in LSN:



The New York Times

How Many Mutual Funds Routinely Rout the Market? Zero



"Does Past Performance Matter? The Persistence Scorecard,"...is conducted by S.&P. Dow Jones Indices twice a year. The edition of the study that I focused on began in March 2009, the start of the bull market.

It included 2,862 broad, actively managed domestic stock mutual funds that were in operation for the 12 months through 2010. The S.&P. Dow Jones team winnowed the funds based on performance. It selected the 25 percent of funds with the best returns over those 12 months — and then asked how many of those funds actually remained in the top quarter in each of the four succeeding 12-month periods through March 2014.

The answer was remarkably low: two.

http://www.nytimes.com/2015/03/15/your-money/how-many-mutual-funds-routinely-rout-the-market-zero.html?_r=0

Multiple Sources

- A LSN believer exaggerates how common extreme θ's are
  - A LSN-investor would think there are more good managers and more bad managers than there actually are
  - Reason: his belief of extreme outcomes happening for an average manager is too low
  - The exaggeration increases with the fraction of average managers there are
- If a LSN believer uses his previous inferences as prior in a new situation, his prior will have a more dispersed support than the truth distribution

Endogenous Observations

- What happens when a LSN-investor base his manager choice on observed outcome?
  - Suppose the investor only observes the performance of the managers he invested with
  - Assume further than all managers are average, generating good performance ½ of the time
- Because of over-inferencing, the investor will switch away with poorly-performing manager very quickly
- He stays with good performing managers
  - Eventually LLN kicks in
- So the investor observes a combination of poor and average managers, and he will conclude that
  - The average performance is below ½
  - Because there are poor managers, there is value in shopping around

Experimental Evidence

- Huber et al 2008
  - 5 “expert opinions” were provided
  - Subjects stay with experts with winning steaks and switch away from those with losing steaks
  - Did the subjects not understand the concept of random walk, even when it was explained in plain terms?

“there are five ‘experts’ in the market who claim that they are able to predict the market development (the coin) better than the majority of all market participants”