Behavioral Finance

Representativeness

Duke UNIVERSITY

Representativeness Introduction

The term Representativeness is a catch-all for a broad variety of biases, many of which act in opposition to one another. In fact, if there is one area of behavioral finance of which the "classical" utility theory adherents are most dismissive, it would be this one. Why? Because within representativeness, we can pull out effects that explain biases in both directions!

The traditionalists argue that there is no use in having a theory that cannot reliably predict the direction of an effect.

The behaviorists counter by noting that there is no point in having a theory that is simple and consistent, but does not reflect the way we actually behave.

In this Section we will look at how Representativeness – the human desire to see patterns, even where none exist – can generate a belief that we can predict the future, based on fallacies about what has happened in the past.

Representativeness:
The Portfolio Manager's Performance

Suppose that a particular portfolio manager is known to have beaten her benchmark two thirds of the time.

Consider the following three possible short-term track records for her portfolio's most recent performance. "B" denotes "beat benchmark." "M" denotes "missed benchmark".

(1) BMBBB (2) MBMBBB (3) MBBBBB

Which is the most likely of these three?

Please make a note of your answer before moving on

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Which is the most likely of these three?

Did you select (2)? This is the most common choice among respondents.

But look closely at (1). It has the same 5 letters, in the same order, as the last 5 letters in (2) (both are BMBBB). So if the manager achieved (2), she *also* achieved (1). In fact, (2) *additionally* requires an "M" *prior to* the BMBBB. So (1) *must* be more probable than (2).

So why do so many people pick (2)? It's because (2) appears *representative* of the long run pattern: that the manager beats her benchmark two thirds of the time.

We are inclined to *look for patterns*, and to assume that short-run sequences should show the same pattern as what we believe applies in the long-run.

Representativeness:
The Portfolio Manager's Performance
In case you are not convinced

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If you are still struggling with why (1) *must* be more probable than (2), you are in very good company. Here is some additional explanation that may help.

Consider the following two possible sequences: *M*BMBBB, and *B*BMBBB

Note that *both* sequences contain the 5-letter sequence: BMBBB. So BMBBB *must* be more probable than either of the two longer sequences (since both *include* it).

Representativeness:
Gambler's Fallacy

The Portfolio Manager error is an version of the classic mistake known as Gambler's Fallacy: the belief that, after the roulette wheel has generated a series of Red numbers, that a Black number must be "due." In reality, of course, each spin of the wheel is independent of the last.

Gambler's Fallacy manifests in the financial markets with participants believing that equity market returns should "regress to the mean" (return to a perceived long-run average) after a series of strongly positive years. There are, in fact, *two* fallacies here:

(1) The belief that we know the true "long run mean return" of the equity markets. We don't. We only know the long run *historic* mean (around 7% higher than putting your money in the bank, on average, over the last 50 years). No one can promise that this mean will stay consistent in future years (or decades, or centuries…)
(2) The belief that the "boom-bust cycle" (from the beginning of one bull market until the beginning of the next) has some pre-specified duration. It hasn't. It has varied considerably over the last few decades.

Gambler's Fallacy:
A conversation between market experts

The following is an excerpt from a Fortune Magazine interview on August 18, 1997, between Barton Biggs, then Chairman of Morgan Stanley Asset Management and widely regarded as a top strategist, and Robert Farrell, then Senior Investment Advisor at Merrill Lynch and considered a leading "market timer."

[Biggs]: My view is that we're at the very tag end of a super bull market…it's very late in the game. That means the prudent person…should assume that over the next five to ten years the total return from his equity portfolio is going to be in the 5%- to 6%-a-year range.

[Farrell]: Not the 15% - 20% we've come to love and expect?

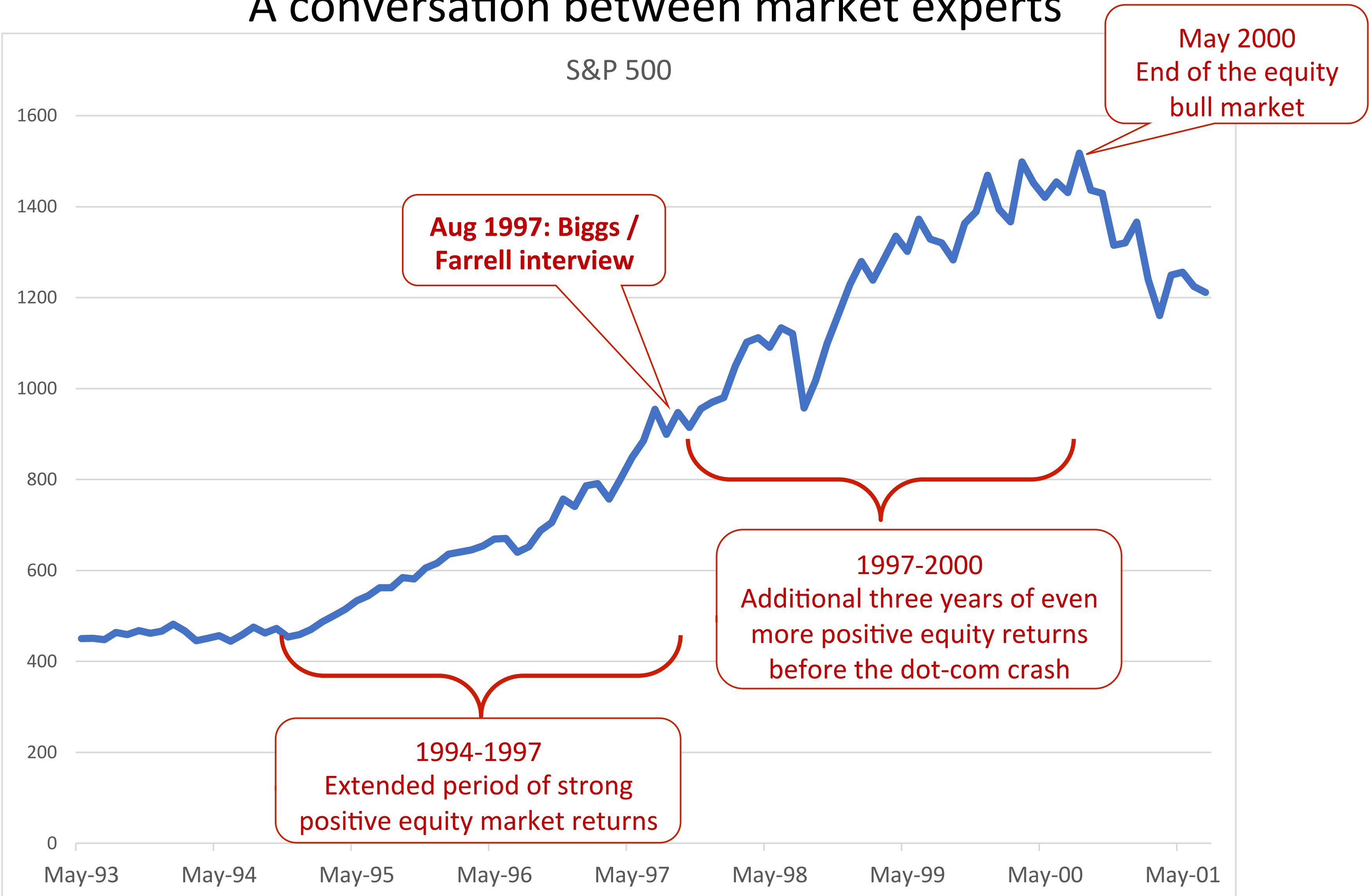
[Biggs]: Right. It's very late in the game.

[Farrell]: Trouble is, it's looked that way for a long time.

[Biggs]: Yes, but it's never looked as much that way as it does right now.

[Farrell]: This is the longest period we've ever had with such high returns from equities…I don't know if returns going forward will be 7% or 8%, but I'm pretty sure they will be below average.

Gambler's Fallacy:
A conversation between market experts



Gambler's Fallacy vs Non-Regressive Prediction

- Biggs & Farrell's "super bull market" continued – and returns increased even more – until the crash of the dot-com boom in early 2000

- US equity market returns remained above 20% annually for 1997, 1998, and 1999 (despite a brief correction in 1998 following Russia's debt default)

- Now: let's go in the opposite direction. and compare this belief that "returns must regress to the mean" with a "Non-Regressive Prediction" bias.

- Non-Regressive Prediction, in the context of the financial markets, is the conviction that a particular market will *not* see a correction, because of the perception that a correction has never happened before.

Can you think of an example of a market that experienced "Non-Regressive Prediction" bias" for a period of time?

Representativeness:
Sample Size Neglect

Which of the following series of coin tosses appears more “random” (i.e., likely to be the outcome of a genuine series of 21 coin tosses):

HTHHHTTTTHTHHTTTHHHTH

HTHTHTTTHHTHTHTHHTTTH

Please select which of the two series you think is more random

Representativeness:
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HTHTHTTTHHTHTHTHHTTTH

In the first series, the probability of alternating between H & T is about 50% - it's truly random. An H is equally likely to be followed either by another H, or by a T.

In the second series, the probability of alternating between H & T has been increased to 70%. An H is noticeably more likely to be followed by a T than by another H.

Most people think that the second series is more likely; they expect frequent "flips" from H to T in short sequences because, over the long run, we know that there will be equal numbers of the two.

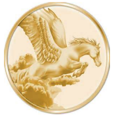
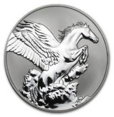
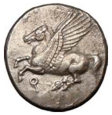
Representativeness:
Mutual Fund Manager Game

Let's play another game…

Suppose there are 3,000 mutual fund managers, each of whom has been allocated a gold, silver, or bronze coin. We know that there are 1,000 of each type of coin (i.e., one-third of the managers has each type), and we also know that the gold coins fall Heads 55% of the time, the bronze fall Heads 45%, and the silver coins are "Fair" (Heads 50%). We do not know which manager has which type of coin. We might view these coins as proxies for different levels of investing ability (perhaps "skilled" vs "average" vs "below average").

The mutual fund managers play a game in which each tosses his coin ten times, and records whether it falls Heads or Tails. For each **H**, he receives $1, for each **T** he receives $0. At the end of the game, a rating agency evaluates each manager relative to a benchmark of *expected* gains from the game. The expected (benchmark) level is, of course, $5.

Once the first round of this game is complete, we can observe how much money each manager made relative to the benchmark. On that basis, we will try to select with which manager to invest our money for Round 2 (for which we assume that each manager keeps the same coin).

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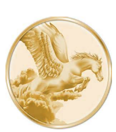
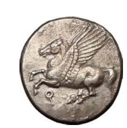
Suppose we identify a manager who earned $7 in the first round: he has beaten the benchmark by $2. In deciding whether to invest with him, we need to answer the following two questions:

(1) What is the probability that this manager does, in fact, have a gold coin?
(2) What is the probability that, if he *does* have a gold coin, that he will beat the benchmark again in the next round?

Please come up with answers to (1) and (2) before moving on

Representativeness:
Mutual Fund Manager Game

Suppose we identify a manager who earned $7 in the first round.

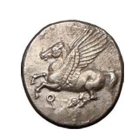
(1) What is the probability that this manager does, in fact, have a gold coin? **46%**

This answer is higher than most people expect – when the odds are hard to compute, we are inclined to *underestimate* the probabilities (we think the outcomes should be more random, like the coin tosses).*

(2) What is the probability that, if he *does* have a gold coin, he will beat the benchmark again in the next round? **50%**

This answer is *lower* than most people expect – we assume that a gold coin holder (i.e., a skilled manager) will outperform the market more than half the time…





* This problem can be solved relatively simply using Bayes Theorem

Conservatism:
Stock Picker Game

One more game…

Suppose you have 100 bags, each of which contains 1,000 poker chips:

55 bags contain 300 red chips and 700 black ones

45 bags contain 700 red chips and 300 black ones.

One bag is chosen at random:

(i) What is the probability that the bag has predominantly red chips?

(ii) Now suppose there is a random draw of 12 chips, with replacement, from the chosen bag. These 12 draws produce 8 red chips, and 4 black ones. What is your revised estimate of the probability that the bag has predominantly red chips?

Please come up with answers to (i) and (ii) before moving on

Conservatism:
Stock Picker Game

- Suppose each bag is equivalent to companies that may, in the future, operate in the black or in the red.

- Analysts begin by forming their initial beliefs about whether a company will be a positive or negative earner
  - More than half (55%) of companies are assumed to have an above average (70%) chance of positive earnings
  - The remaining companies are assumed to have a 70% chance of negative earnings

- We picked a company at random, knowing that it is slightly more likely to be a positive earner. The draw of 4 Blacks, 8 Reds, however, is equivalent to a negative earnings report. How do we update our beliefs when we get a negative earnings report?
  - Given that we don't know precisely how to incorporate the new information, we typically *under-react* to it (conservatism).

With this in mind, would you like to update your estimate for the probability that the selected bag has predominantly red chips?

Conservatism:
Stock Picker Game

- We picked a company at random, knowing that it is slightly more likely to be a positive earner.
- The answer to question (i), the probability that the bag has predominantly red chips is, of course, 45%

- The draw of 4 Blacks, 8 Reds, however, is equivalent to a negative earnings report. How do we update our beliefs when we get a negative earnings report?

  - Given that we don't know precisely how to incorporate the new information, we typically *under-react* to it (conservatism).
  - In fact, the probability that the bag is red, given the draw of 4 Blacks, 8 Reds, is: **96%**

Did you under-react to the new information?

Representativeness

Which of the following two scenarios seems more likely?

(1) The S&P 500 jumps 5% in a single day

(2) Economic problems in Europe are finally brought under control, with Greece's bailout package approved, and other at-risk countries (such as Spain) finally showing economic improvement. Global equity markets rally strongly, with the S&P 500 up more than 100 points, further buoyed by unexpected improvement in the US wage growth rate.

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By now, you are probably wise to our methods, and no doubt stopped yourself before jumping to the conclusion of the majority of respondents: that (2) seems more likely.

In fact, this is similar to the earlier Portfolio Manager Performance puzzle. (2) *includes* the fact from (1) that the S&P 500 jumps 5% in a day; but *adds more detail*, and therefore it *cannot* be more probable. It just feels more probable because, as human beings, we *like stories more than statistics*.

What have we learned?

In this section, we have learned about how our natural, human desire to see patterns can cause us to make significant errors in our assessment of probability. This is a particularly complex problem because the bias can work in opposite directions, depending on the individual and on the circumstance. This complicates our ability to predict the direction of the biased judgment.

Gambler's fallacy: we expect short-run sequences to be representative of a long-run mean

- Portfolio manager's performance (MBMBBB more likely than BMBBB)
- Biggs & Farrell market commentary in 1997, just prior to the dot-com boom

Non-regressive prediction: under other circumstances, we expect trends to continue indefinitely

- Did you come up with an example of this?

Sample size neglect: we are sometimes inclined to infer patterns based on too little information

- The mutual fund manager's probability of being "skilled" because he got 7 Heads

Conservatism: in other cases, we *under*-react to data that does not tally with our view on how the data "should" behave

- The stock picker game – we underestimate the significance of a negative earnings report