Chapter 14
Do Behavioral Factors Explain Stock Market Puzzles?
Several big puzzles relate to aggregate stock market – behavioral finance has partial explanations for some of these puzzles:

- Equity premium puzzle: stock returns are higher than they should be given risk borne by investors in stock markets
- Bubbles: why do markets get so far out of line with fundamentals?
- Excess volatility: stock returns are more volatile than they should be given that stock prices are present values of future expected cash flows
Historically, a well-diversified portfolio of stocks has substantially outperformed fixed income securities.

Important to look at real returns which control for inflation effects.

Difference between expected equity return and fixed-income return is known as *equity premium*.

- This is return for bearing additional risk of stocks relative to bonds or bills.
Total nominal return indexes: 1802-1997

Total real return indexes: 1802-1997

Average historical real returns for stocks, bonds and bills

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<tr>
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</thead>
<tbody>
<tr>
<td>Stocks (Geometric)</td>
<td>7.0</td>
<td>7.0</td>
<td>6.6</td>
<td>7.2</td>
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<tr>
<td>Stocks (Arithmetic)</td>
<td>8.5</td>
<td>8.3</td>
<td>7.9</td>
<td>9.2</td>
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<td>Bonds (Geometric)</td>
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<td>4.8</td>
<td>3.7</td>
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<tr>
<td>Bonds (Arithmetic)</td>
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<td>5.1</td>
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<td>Bills (Geometric)</td>
<td>2.9</td>
<td>5.1</td>
<td>3.2</td>
<td>0.6</td>
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<tr>
<td>Bills (Arithmetic)</td>
<td>3.1</td>
<td>5.4</td>
<td>3.3</td>
<td>0.7</td>
</tr>
</tbody>
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Many theorists believe equity premium is too large for actual risk.

Especially clear when we look at longer horizons:
- At longer horizons stocks almost always outperform.
- Plus risk of stocks declines more quickly than would be expected.
- Latter is due to mean reversion of stock returns.
- Many say high premium since WW2 is probably not sustainable.
- Though 2008 had a large negative impact on overall postwar average!
Theorists have shown that realized equity premium implies an improbably large degree of risk aversion.

1) A reasonable level of risk aversion leads to an equity premium of 0.1%.

2) The coefficient of relative risk aversion needed to justify the observed equity premium would have to be a 30 to explain observed returns.

3) $P(0.50, \$50,000, \$100,000) = CE$ would need to be $\$51,209$, which seems unlikely that people are that afraid of risk.
What can explain this puzzle?

➢ Rational explanations
  – Survivorship bias:
  – E.g. golf tournaments: typically a group of players shoots two rounds. All players in the group w/ the lowest cumulative score continue on to play the third and fourth rounds → average score per round of all surviving golfers → downward biased
  – E.g. performance histories of national stock markets around the world.
What can explain this puzzle?

Rational explanations
- E.g. As of the beginning of the twentieth century, 36 national stock markets existed → more than half of these, either due to wars or nationalizations, have suffered at least one major break in trading → looking at continuous trading markets, the average market return will be upward-biased

Behavioral explanations
- Ambiguity aversion: we don’t know the mean of the return distribution → effective risk aversion increases
- Loss aversion and mental accounting
Researchers have linked prospect theory to equity premium puzzle.

- Key is to remember loss aversion (investors hate losing money) and to consider how often investors evaluate their portfolios.

- Intuitively, if you evaluate your position every day, there is a very good chance that by day’s end you will have lost money, so you find stocks very risky.

- But if you evaluate stocks once per decade there is a much smaller chance that you will lose money, so you will find stocks not so risky.
QUESTION: Given prospect theory approach, what evaluation period is consistent with historically observed market risk premium?

ANSWER: About a year – which is logically how often a typical investor gives his portfolio a careful look.

Reasons:
- Tax is paid annually
- Portfolio assessment and adjustments are often annual
Illustration

- Individual has 2 choices:
  - Invest $100 in a savings account (assume zero return)
  - Or buy stock with 50/50 distribution for net earnings of $200 or -$100

- If we assume loss aversion and linearity, value function is: \( v(z) = z \) for \( z \geq 0 \) and \( v(z) = \lambda z \) for \( z < 0 \) (\( \lambda > 1 \))

- If \( \lambda = 2.5 \), investor will not invest in stock (assuming she looks at portfolio once per year).

- What if investor only looks at portfolio every 2 years?
Now she will invest in stocks because:
\[0.25(400) + 0.5(100) + 0.25(-200*2.5) > 0\]

Note: we have assumed for simplicity that returns are additive (200% for 2 years is 400%).

Less frequent evaluation leads to:
- higher demand for stock
- higher price of stock
- Lower equity premium
An individual with cash to invest has two investment choices:

- Buy a stock fund which every year either earns 40% or -20% with a 50/50 probability.
- Buy a bond fund which every year returns either 5% or 0% also with 50/50 probability.
- Assume that the returns on the two funds are independent, and that returns from year to year are also identical. Also assume an initial portfolio value of $1. (The answers, however, will be unaffected if you use a different initial portfolio value.)
An individual with cash to invest has two investment choices:

- In addition, suppose the value function is linear and is specified as:
  
  \[ v(z) = z \text{ for } z \geq 0 \]  
  \[ v(z) = 3z \text{ for } z < 0 \]

a. Which fund does the investor prefer if he looks at his portfolio i) once a year; or ii) once every two years?

b. How does your answer to part a. help us understand the equity premium puzzle?
Experimental asset markets have provided new insights into how markets work.

One of most perplexing findings from this research is tendency of prices to rise far above fundamental value and then later crash.

First study to report bubbles in experimental asset markets was published in 1988.

Since then many studies have investigated factors that both mitigate and promote bubble formation.
In a typical bubbles design, subjects trade an asset over a fixed number of periods.

Asset has a common dividend that is earned on all units and determined at the end of a trading period using a known probability distribution.

If risk neutrality is assumed, we can easily compute fundamental value of asset by multiplying number of trading periods by expected dividend each period.

– Given risk aversion, correct value would be lower
### Dividend distributions

<table>
<thead>
<tr>
<th>Asset Dividend Distributions</th>
<th>Expected Value of Dividends</th>
<th>Fundamental Value in Period 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>Standard asset’s dividends</td>
<td>0.50</td>
<td>0.90</td>
</tr>
<tr>
<td>Lottery asset’s dividends</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note: The fundamental value in period 1 is the expected dividend per period multiplied by the number of trading periods (12).

This is Panel B of Table 1 from Ackert, Lucy F., Narat Charupat, Bryan K. Church, and Richard Deaves, 2006, “Margin, short selling, and lotteries in experimental asset markets,” *Southern Economic Journal* 73(2), page 424.
Focus on standard asset, leaving lottery asset for later.

Asset trades for twelve five-minute periods so if you buy one unit in period 1 and hold it until the end of the experiment, you would earn twelve dividends.

Expected value of dividend each period is sum of probability-weighted possible dividends:

$$0.48 \times 0.50 + 0.048 \times 0.90 + 0.04 \times 1.20 = $0.72$$
What is asset worth?

- If you are risk neutral:  \( 0.72 \times 12 = 8.64 \)
- Fundamental values in all subsequent periods can be computed just as easily by multiplying number of periods remaining times expected value of $0.72
Typical price paths

Source: This is Figure 1 from Ackert, L. F., N. Charupat, B. K. Church, and R. Deaves, 2006, “Margin, short selling, and lotteries in experimental asset markets,” *Southern Economic Journal* 73(2), page 427.
Interpretation

- Typical price pattern in bubbles markets is different from what one would expect.
- Solid line indicates fundamental value each period, beginning at $8.64 in period 1 and falling by $0.72 each period.
- Dashed lines show median transactions prices per period for four different bubbles markets.
What happened?

- Usually price in period 1 is below fundamental value but quickly rises high above this point

  • Price in first period may be low due to subjects’ initial risk aversion because they are trading in an environment in which they are inexperienced

  • Some of bubbles in this figure are quite persistent -- but all eventually crash back to fundamental value as remaining trading periods become small
Lessons from experimental bubble markets

- Though experimental bubbles markets are simple and do not include all important features of a complex market (like NYSE), they teach us how real bubbles might be generated.

- Price bubbles are more moderate and disappear faster when traders are experienced.

- Potential for short-selling leads to bubble dissipation.
Lessons from experimental bubble markets cont.

- In some experiments, two assets are traded in order to investigate whether pricing differs across the assets.

- One study allowed trading of two assets: a standard asset and a “lottery” asset.

- Second asset is referred to as lottery asset because its payoffs are similar to a lottery.
  - Payoff usually zero, but 4% of the time asset earns large dividend payment of $18.00
Lessons from experimental bubble markets cont. ii.

- Although standard and lottery assets have identical expected values, traders were willing to pay *more* for lottery asset.

- Suggests that traders may be subject to probability judgment error (overweighting small probabilities).

- Another possible explanation is that speculation or gambling plays into how people determine what they will pay to acquire an asset.
  - Willing to pay more for lottery asset because they become more risk taking as trading heats up
What explains real-world bubbles?

- *Irrational Exuberance* by Robert Shiller first came out in 2000 when Dow was approaching 12,000.
- Main argument of book was that market at end of 1999 was in grip of a major bubble!
- Events proved to be on Shiller’s side.
S&P 500 P/E

Historical P/E ratios

- Market levels out of line with earnings levels.
  - Seen by looking at P/E ratio

- Market run-up during this bull market was unprecedented.

- Three other major peaks in stock market history: 1901; 1929; and 1966.
  - From these peaks subsequent performance turned out to be sub-par
Excess volatility puzzle

- It seems that often market movements are not obviously explained by *new information*.
- In other words, *excessive volatility* exists.
- One study examined important news events and major stock price movements over a 50-year period and to try to ascertain connections.
- First looked at *major news events (as reported in the NY Times)* and whether they induced *major market movements*. 
Example 1: The Japanese attacked Pearl Harbor (Dec. 8, 1941).
   – Market dropped dramatically (down by 4.37%)
Example 2: Johnson defeated Goldwater in presidential election (Nov. 4, 1964).
   – Market hardly moved (up by 0.05%) b/c Johnson was widely anticipated to win by a landslide
Another study looked at the 50 biggest price moves and tried to relate them to material information.

While in many instances this task was easy, in other cases there seemed to be no compelling reason for a market reaction

- On Sept. 3, 1946, the market dropped by 6.73% and the NY Times wrote that there was no basic reason for the assault on prices.

Suggests excess volatility…

- Driven by changes in market sentiment
Shiller and theory

- Shiller tackles excess volatility taking a theoretical approach.
- He showed that it is difficult to explain the historical volatility of stock returns
  - Assuming investors are rational and discount rates are constant
- PV of actual dividends: “ex post rational stock price” b/c if it is the price if you know all future dividends
Shiller and theory, cont.

- Shiller’s inequality: the s.d. of the stock price is bounded above by the s.d. of the ex post rational stock price
  - The price should be the expectation of the ex post rational stock price
  - And, b/c the latter will move based on unexpected information, the volatility of the price should be lower
Shiller tested his inequality using the real S&P 500 stock price index.

- To compute the ex post rational stock price, he assumed a long-run growth rate in dividends
- Solid line: the *observed* value of the S&P 500 index (p)
- Broken line: the ex post rational stock price (p*)

Stock prices are much **too volatile** to be justified by the PV of future dividends
(existing volatility implies a great deal of variation in dividend growth rates – which is fine if these expectations are realized.

Using constant growth model, he considered growth rate forecast changes needed to justify realized changes in stock prices.

Given a constant discount rate these would be unreasonably high.
Consider a stock. Investors *think* (wrongly) that dividend growth changes are *permanent* rather than transitory.

- For this reason they overreact
- When they figure things out mean reversion sets in
- High returns are followed by low returns -- and vice versa
- Recency plays a role: recent high earnings growth makes people think that future growth is going to be higher than it actually turns out to be

A similar story can be told for overall market.