CHAPTER 2
Introduction to Behavioral Analysis

1. The Behavioral Pitfalls box on page 36, which discusses the actions of Scott McNealy included the following passage.

> On March 8, 2001, Cisco announced that because the downturn looked like it would last much longer than expected, it was going to lay off 18 percent of its workforce. Some of Sun’s executives wanted to follow suit. One stated: “When times are hard, you’ve got to shoot activities that aren’t making money.” However, McNealy refused to do so.

Refusing to shoot activities that are not making money is evidence of being averse to a sure loss.

2. The situations are similar. During the late 1990s, both Sun and Merck were highly profitable firms whose market values were well in excess of their book values. The assets of both firms had large components that were intangible, residing in research and development. At the same time, both firms did have tangible assets, and could have held more long-term debt, thereby shielding some of their income from taxes. Both firms appear to have chosen to hold less debt than was optimal, thereby paying more corporate income tax than was necessary.

3. The valuation metric McNealy mentions is price-to-sales. His comment that Sun had monetized the valuation very well during this period is suggestive of catering or market timing behavior, presumably involving the issue of new shares at the time to exploit the overvaluation.

4. McNealy commented that he might have hired a chief operating officer during his tenure as CEO, rather than undertaking the responsibility himself, at a time in his life when he had four children with whom he also wanted to spend his time, and did. The comments suggests that he was overconfident about his ability, and experiencing the illusion of control, in judging that he could simultaneously be chairman, CEO, and COO at a time when Sun was experiencing major challenges in the wake of the collapse of the dot.com bubble, and when he was also preoccupied with family matters.

5. Sun's net income and cash position did increase substantially during 2000, but this is not the same as monetization stemming from having an overvalued stock. According to Sun Microsystem's Statement of Cash Flows, between 1998 and 2001, the dot.com bubble era, Sun spent more repurchasing shares than issuing new shares. Adjusting for stock splits, the total number of its shares outstanding increased intermittently, usually at the end of a quarter, by 1 or 2 percent. Therefore, the evidence does not support Sun engaging in market timing by issuing new shares. A summary of key financial statement variables appears below. Note that large increases in number of shares reflect stock splits.

$ millions	Jun-95	Jun-96	Jun-97	Jun-98	Jun-99	Jun-00	Jun-01	Jun-02	Jun-03	Jun-04	Jun-05	Jun-06	Jun-07	Jun-08	Jun-09
Income Before Extraordinary Items	355.8	476.4	762.4	762.9	1,031.3	1,854.0	981.0	-587.0	-3,429.0	-388.0	-107.0	-864.0	473.0	403.0	-2,234.0
Sale of Common and Preferred Stock	122.4	114.4	134.3	165.6	258.3	346.0	422.0	237.0	182.0	239.0	218.0	249.0	389.0	177.0	51.0
Purchase of Common and Preferred Stock	36.1	522.3	456.1	284.4	358.4	631.0	1,321.0	591.0	499.0	.	.	.	428.0	2,764.0	130.0
Cash and Cash Equivalents - Change	-20.1	115.0	131.3	162.1	266.7	748.0	-377.0	552.0	-9.0	126.0	-90.0	1,518.0	51.0	-1,348.0	-396.0
Number of Shares Outstanding	98,514	185,982	370,486	381,262	780,553	1,597,000	3,248,000	3,246,270	3,229,645	3,326,072	3,410,000	3,505,000	3,602,000	752,000	753,364

6. The Behavioral Pitfalls box discussing Merck includes the following passage:

> Surprisingly, Merck's post-approval study appeared to show that Vioxx actually caused heart attacks and strokes. However, the firm's executives resisted that interpretation and invested heavily in promoting the drug.

The chapter text also contains the following passage:

> Researchers at Stanford University, Harvard University, and the Cleveland Clinic wrote scientific articles that raised concerns about Vioxx' safety. Merck challenged these concerns, and continued to promote Vioxx as safe. In February 2001, the FDA issued a letter to Merck's CEO Ray Gilmartin, chastising the firm for deceptive promotional practices. In August 2004, a researcher from the FDA's drug-safety office presented data that showed that higher doses of Vioxx correlated with a tripled risk of a heart attack or sudden cardiac death. Merck responded by issuing a press release reiterating its confidence in the safety and efficacy of its drug.

Both of the above passages suggest that executives at Merck underweighted information that disconfirmed their views about Vioxx being both safe and efficacious. That information came from Merck's post-approval study, and the interpretation of the data from that study by prominent researchers.

7. If Judy Lewent exhibited behavioral bias in her sales predictions for Vioxx, that bias would be excessive optimism. The first indication of excessive optimism is her June 2001 qualifying statement that placed Vioxx sales at the lower end of her prediction range. Given Merck's past glory, her statement that Merck's pipeline was as strong as any other time is the firm's history seems very optimistic. Exhibit 1-4 displays strong growth in ROE between 1993 and 2000, but a decline in mid-2001. There is no reason to predict that the reduction in Vioxx sales that took place after the August 2001 publication of the *JAMA* article was predictable before the fact. At the same time, given that Merck executives appeared to exhibit confirmation bias, it would have been reasonable to predict that at some point such an event would occur.

8. If naproxen does not reduce the incidence of heart attacks, then in 1999 it might have been reasonable to expect that in the VIGOR study about 4 patients would have experienced a heart attack. (In fact, experts in the field suggest that on average about 3 out of 4000 patients in the VIGOR study would have experienced heart attacks, given that Merck had only included patients that were at low risk of a heart attack or stroke.)

Consider the use of a binomial probability model. Suppose that the probability that a patient in the VIGOR study would normally experience a heart attack is 4 out of 4000, or 0.001. If Vioxx did not increase the probability of a heart attack, with what probability would we expect to observe 20 patients taking Vioxx to experience heart attacks? The answer is

1 - the cumulative binomial probability associated with 19 heart attacks

given 4000 trials and a binomial probability of 0.001. The Excel function binomdist(19, 4000, 0.001, 1) gives the cumulative probability associated with 19 heart attacks. That number turns out to be 99.999999 percent. Therefore, the probability of observing that 20 patients who took Vioxx experienced heart attacks is 0.000001 percent.

In other words, the probability that the VIGOR result was a fluke is 0.000001 percent, one in 100 million.

9. If the editors' judgment reflected a behavioral bias, it would be bias stemming from availability. In this respect, the editors did *not* raise questions about the incidence of heart attacks in patients who took Vioxx but were not at low risk of a heart attack.

As for agency conflicts, the authors of the article had either received consulting contracts from Merck or were employees of Merck. That does not imply that they must have had a conflict of interest. However, the potential for such a conflict was definitely present. Remember that the VIGOR study took place well before November 2000, and featured 20 patients who were at low risk of having a heart attack taking Vioxx and subsequently experiencing a heart attack. Yet the authors of the article concluded that Vioxx did not increase the incidence of heart attacks among patients who did not appear to be at high risk of having a heart attack.

10. In its VIGOR study, Merck's subject selection criteria excluded subjects who were at risk of heart attacks and strokes, suggesting that they did have advance concerns about the risks when they launched Vioxx. The FDA was aware of the results of this study, and despite writing to Merck to express concerns it had, the agency did not suggest withdrawing Vioxx from the market, but instead raised issues about misleading marketing. Therefore, the major issue appears to relate more to labeling, and having promoted Vioxx as first line therapy instead of second line therapy, rather than marketing the drug or not marketing the drug.

Minicase

Case Analysis Questions

1**.** There are at least five important phenomena involved in the minicase, although a case can be made for at least seven. Real world cases are often complex, and unlike psychological experiments that seek to isolate single phenomena, feature several phenomena in ways that can be challenging to sort out.

Availability bias: Excessive reliance on information which is readily available. Earthquake risk is highly salient in Japan, as earthquakes frequently occur, but before 2011 tsunami risk much less so, as tsunamis occur much more rarely, even though "tsunami" is a Japanese word. In terms of event studies pertaining to tsunamis, the minicase states that there was but one primary event studied, which occurred not near Japan but near Chile. Specifically, the minicase states the following: "Originally, TEPCO and NISA agreed on a plant design in which the seawater intake buildings were located 12 feet (4 meters) above sea level and the main plant buildings were located at the top of a slope that was 30 feet (10 meters) above sea level. The basis for these decisions was an earthquake that occurred in 1960 off the coast of Chile, which generated a tsunami having a height of 10 feet (3.1 meters)." Relatedly, some might also point to *anchoring and adjustment* in respect to forming judgments based on the magnitude of the 1960 Chilean tsunami.

Confirmation bias: Downplaying, if not ignoring, information that disconfirms views held, and relative to information that confirms views held. TEPCO ignored lessons associated with the incident that took place at Blayais, France, involving risks from a storm surge. In addition, the minicase states that “both Japanese executives and regulators noted the presence of a general Japanese cultural bias against openly discussing worst case scenarios. Prior to the Fukushima Daiichi meltdown, there was little interest in public discussion or media coverage about tsunami safety.”

Overconfidence, Excessive Optimism, and Illusion of Control: Overconfidence in knowledge features establishing confidence intervals that are excessively narrow. Excessive optimism is attaching subjective probabilities that are too low for unfavorable events and too high for favorable events. The minicase states that TEPCO was faulted for having taken a series of prudent precautions to protect against damage from storm surges, let alone a severe tsunami. The minicase also states the following: “The Carnegie report communicates the views of some Japanese experts who stated that the accident at Fukushima Daiichi serves to illustrate “supreme overconfidence by decision makers that Japan’s nuclear power program would never suffer a severe accident.” Given the definition of excessive optimism, this last statement illustrates excessive optimism as well as overconfidence. Relatedly, some might also point to the *illusion of control*, suggesting that TEPCO overestimated the control they exercised to deal with extreme natural disasters. The assumptions about power interruptions being at most 30 minutes in duration is consistent with this illusion of control, as well as excessive optimism and overconfidence.

Risk seeking in the domain of losses: In the cleanup phase, the Japanese government built an expensive permafrost ice wall that some characterized as a “Hail Mary play,” meaning an action with a lottery-like feature involving only a low probability of a very successful outcome, but a high probability of failure. This behavior pattern is consistent with the fourfold pattern with risk seeking in the domain of losses.

Although probabilistic assessments are no panacea, given what we know about heuristics and biases, avoiding these assessments enhances the susceptibility to poor judgments and decisions as a result of phenomena such as availability, confirmation bias, and overconfidence. Using probabilistic assessments induces additional discipline, and conceivably could have generated some urgency that would have led to swifter action related to the 2008 computer analysis mentioned in the minicase about having underestimated tsunami risk. Avoiding probabilistic assessments increases reliance on instinct, gut feel, and the affect heuristic.

2. The binomial formula in Excel to solve the first part of this problem is =1-BINOM.DIST(2,15,000,0.0001,1). Here BINOM.DIST(2,15,000,0.0001,1) is the probability of 2 or fewer events (core meltdowns) in 15,000 reactor years when the probability of a core meltdown is 1/10,000 = 0.0001. Therefore,

1-BINOM.DIST(2,15,000,0.0001,1) is the probability of at least 3 events taking place.

1-BINOM.DIST(2,15,000,0.0001,1) = 0.19. For the second part of the problem,

1-BINOM.DIST(2,15,000,0.0000001,1) = 5.62E-10.

Behavioral Corporate Finance

Concepts and Cases for Teaching Behavioral Finance

SECOND EDITION

Hersh Shefrin

Chapter 2

Introduction to Behavioral Analysis

Learning Objectives

1. Identify the key **biases** that lead managers to make faulty financial judgments about risky alternatives.
2. Explain why reliance on **heuristics** and susceptibility to **framing effect**s render managers vulnerable to making faulty decisions that reduce firm value.
3. Recognize that investors are susceptible to the same biases as managers and that mispricing stemming from investor errors can cause managers to make faulty decisions that reduce firm value.

Traditional Treatment

- Standard textbook approach to project selection revolves around DCF.
- In theory, managers serve the interests of investors, the owners of the firm.
- Objective function is APV.
  - APV = sum of PV of firm's after-tax cash flows from operations and investment, the value associated with financing strategy, and net benefits associated with managerial interests such as compensation and perquisites.

Behavioral Treatment
Pitfalls Impacting Managers

EXHIBIT 2-1 How Psychology Affects Financial Decisions

Psychological Phenomenon	Example of Faulty Financial Decision	Resulting Outcome for Firm
1. Biases		
Excessive optimism	Delay cost cutting during a business recession	Lower profits
Overconfidence	Make inferior acquisitions when cash-rich	Reduce firm value because risk underestimated
Confirmation bias	Ignore information that is counter to current viewpoint	Lower profits from delayed reaction to changing environment
Illusion of control	Overestimate own degree of control	Incur higher costs than necessary
2. Heuristics		
Representativeness	Choose wrong projects based on biased forecasts	Reduce firm value because net present value (NPV) not maximized
Availability	Choose wrong projects based on biased forecasts	Reduce firm value because of misjudged priorities and risks
Anchoring	Become fixated on a number and adjust insufficiently	Reduce firm value because of biased growth forecasts
Affect	Rely on instincts instead of formal valuation analysis	Reduce firm value because negative NPV projects adopted
3. Framing effects		
Loss aversion	Losses loom larger than gains of the same size	Foregone tax shield benefits because of aversion to debt
Fourfold pattern	Throw good money after bad in losing projects	Reduce firm value because of a negative NPV decision

Managerial Response to Sentiment

- **Sentiment**: psychological pitfalls distort market prices.
- **Catering** entails actions that exploit sentiment in order to increase a firm's stock price.
- **Market timing** entails actions that take advantage of mispriced securities, such as issuing new equity when stocks are overvalued.

BPV

- Behavioral APV, **BPV**, incorporates the impacts of
  - psychological phenomena that impact managers directly; and
  - the effects that stem from catering and market timing.

Behavioral Pitfalls Box

- Examine the complete Behavioral Pitfalls box that appears on page 45.
  - Excerpt below identifies box.
- What behavioral phenomena come to mind as you read its contents?

Behavioral Pitfalls: Scott McNealy and Sun Microsystems

The cover story in the July 26, 2004, issue of *Businessweek* is about Scott McNealy, the chief executive officer of high-technology firm Sun Microsystems. Sun is known as a leading manufacturer of servers and for having invented the Internet software programming language Java. The *Businessweek* article uses the following adjectives to describe Scott McNealy: optimistic, smart, acerbic, cocky, and combative. These are all psychological traits that influenced McNealy's business decisions.

new projects. In justifying that decision, McNealy stated: "The Internet is still wildly underhyped, underutilized, and underimplemented. I think we're looking at the largest equipment business in the history of anything. The growth opportunities are stunning."

Cisco Systems is the leading producer of router products used on the Internet. On March 8, 2001, Cisco announced that because the economic downturn looked like it would last much longer than expected, it was going to lay

Behavioral Pitfalls
Scott McNealy and Sun

- *BusinessWeek* uses the following adjectives to describe Scott McNealy:
  - optimistic.
  - smart.
  - acerbic.
  - Cccky.
  - combative.

- McNealy became Sun's CEO in 1984.
- risk taker.
- resisted cost cutting in recession.
- Internet underhyped.
- Cisco.
- Cobalt.
- Sun’s stock price.

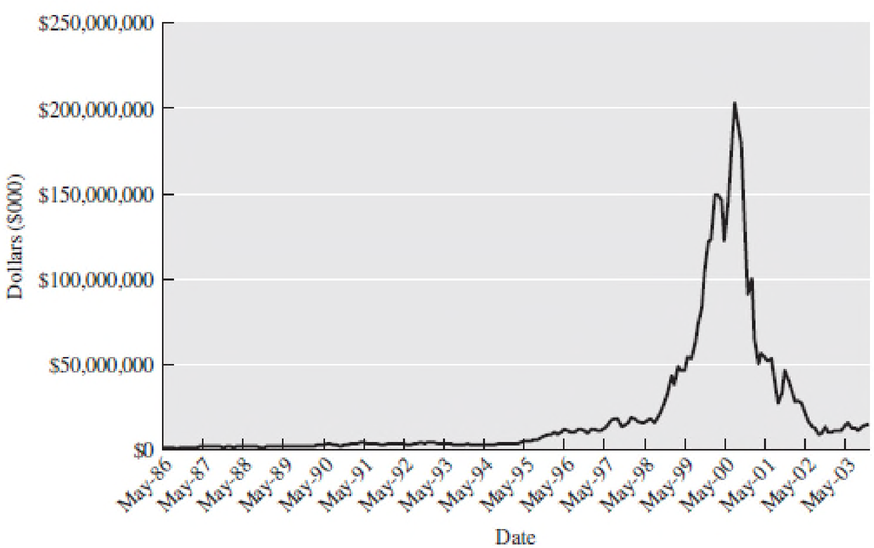
Excessive Optimism
A Short Recession

- McNealy predicted that the 2001 recession would be short and he delayed cutting costs.
- U.S. economy entered recession in March 2001, and lasted 9 months, a period that was neither brief nor atypical.
- Between World War II and 2000, the average length of a U.S. recession was 11.6 months.
  - The recession before 2001 occurred in 1990-1991, and featured two consecutive quarters of negative growth in real GDP.
- Was McNealy excessively optimistic?

Excessively Optimistic Investors?

- During the stock market bubble between January 1997 and June 2000, irrational exuberance drove up the prices of both the S&P 500 and Sun's stock.
- No firm the size of Sun has historically merited a price-to-earnings ratio (P/E) over 100.
- In March 2000, at the height of the bubble, Sun's P/E reached 119.
- Were investors excessively optimistic?

EXHIBIT 2-2
Sun Microsystems' Market Capitalization 1986–2003



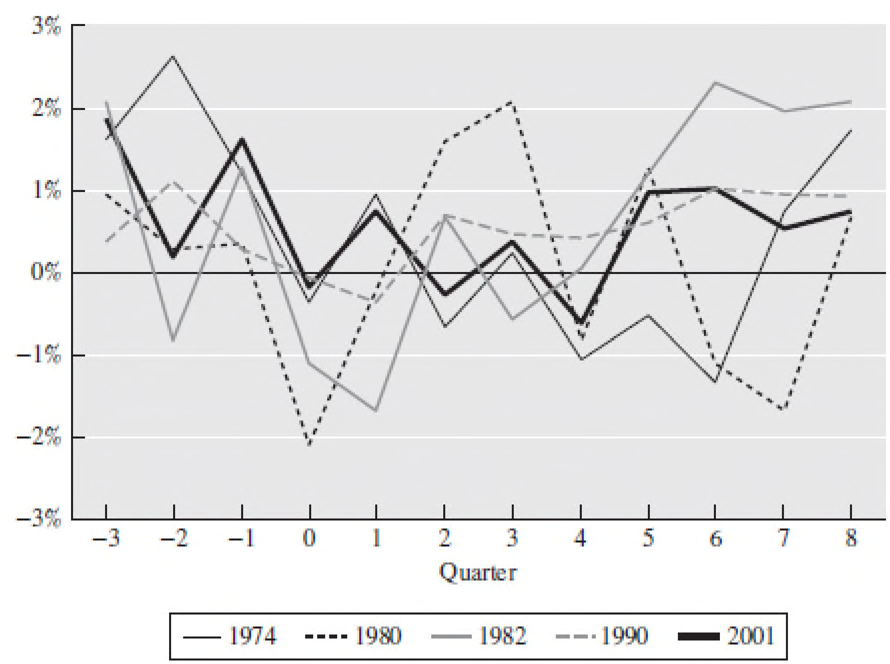
Overconfidence About Ability

- People who are overconfident about their abilities think they are better than they actually are.
- Cockiness is a symptom of overconfidence.
- Overconfident managers make poor decisions about both investment and mergers and acquisitions, when their firms are cash rich.
- Consider Sun's increased spending on research and development in 2000 and its acquisition of Cobalt are cases.
- Does this behavior suggest overconfidence about ability?

Overconfidence About Knowledge

- McNealy was confident that the 2001 recession would be sharp-edged.
  - a sharp downturn followed by a sharp upturn.
- Was it, and was McNealy overconfident about his knowledge?

EXHIBIT 2-3
GDP Growth Rates During U.S. Recessions (Inflation Adjusted)



Confirmation Bias

- In late 2000, some Sun executives proposed a cost cutting program for Sun, after learning that industry leader Cisco Systems' revenues were declining dramatically.
- In March 2001, Cisco Systems laid off 18% of its workforce.
- Did Cisco’s announcement disconfirm McNealy’s view about recessions being short?
- Did confirmation bias play a role in McNealy’s refusal to approve any cost cutting at Sun?

Illusion of Control

- In 1997, Sun could purchase Intel’s chips for 30% less than what it cost them to produce their own comparable chips.
- Despite the desire of some Sun executives to “buy” Intel chips instead of “making” their own, Scott McNealy felt that Sun’s chip design group exerted enough control to close the gap.
- In retrospect, McNealy describes his decision about using Intel chips as one of his biggest regrets.
- Is McNealy’s behavior consistent with the illusion of control?

Representativeness

- The Internet represents the overall economy.
- Representativeness-based reasoning might lead someone to conclude the following.
- The U.S. economy as a whole will experience brief sharp swings rather than rolling waves because of
  1. the growing importance of the Internet in the economy; and
  2. Internet firms experience brief sharp swings in business conditions.
- Is this train of thought consistent with representativeness-based reasoning?

Availability

- Sun's upper level executives communicated their concerns that the Microsoft suit had distracted McNealy from focusing on the needs expressed by Sun's customers.
- Customers had been asking for low-end servers in order to cut costs during the downturn.
- With Microsoft on his mind, McNealy paid little attention to customers' requests, they were not salient.
- Is McNealy's behavior consistent with availability bias?

Anchoring and Adjustment

- During its most successful period, Sun's earnings growth rate reached 50% per quarter.
- In forming forecasts going forward, how to adjust relative to the 50%?
- Suppose Sun's executives became anchored on the 50%.
- If true, what would the impact of anchoring be on Sun executives' forecasts of earnings growth?

Affect Heuristic

- Michael Lehman joined Sun’s board of directors in 2002, and before that he was Sun’s CFO.
- In 2000, Lehman described Sun’s decision process for making acquisitions as follows:

  Now, in determining the price we are willing to pay for such acquisitions, we are not nearly as formal as the corporate finance textbooks suggest we perhaps ought to be. Our approach to acquisition pricing is more intuitive.

- Is Lehman’s statement consistent with his relying on the affect heuristic?

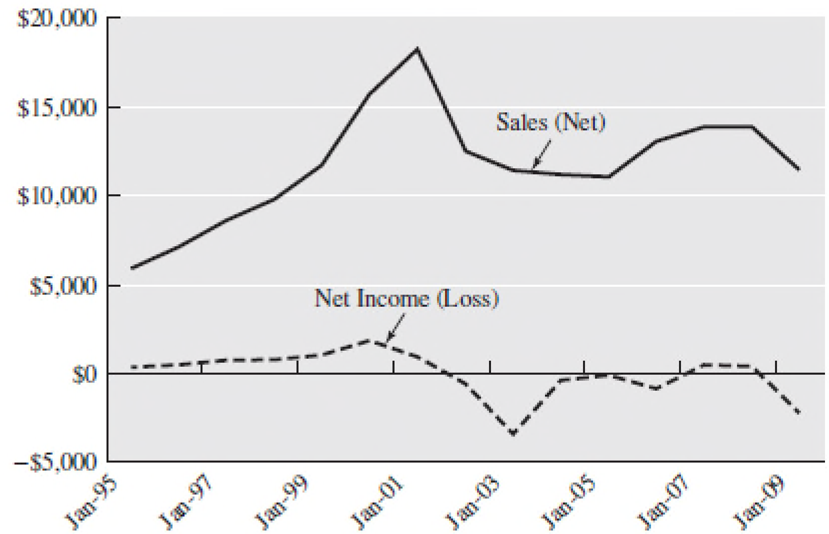
Sun’s Endgame

- Subsequently, Sun’s losses continued to mount, with net income still negative in 2005.
- In 2006, Scott McNealy resigned as CEO and was replaced by Sun’s chief operating officer Jonathan Schwartz.
- Sun announced that over the subsequent six months it would lay off 4,000 to 5,000 employees, comprising 11 to 13% of its work force.

Acquired by Oracle

- In May 2009, Sun agreed to be acquired by software firm Oracle for $7.4 billion.
- In June 2009 its net income.
- was again negative, at –$2.23 billion.
- Sun announced that it planned to reduce the number of its employees by 6,000, from 33,000.

EXHIBIT 2-4
Sun Microsystems Sales and Net Income, 1995–2009



Fortune Magazine Interview With McNealy

- McNealy stated that during the technology bubble, Sun's stock price was about 10 times its revenue, which for a hardware company was unsustainable.
- He pointed out that Sun had monetized the valuation very well.
- He also said that perhaps he might have tried to talk the analysts into not running up Sun's stock to the extent that they did.

Behavioral Pitfalls Box

- Examine the complete Behavioral Pitfalls box that appears on page 45.
  – Excerpt below identifies box.
- What behavioral phenomena come to mind as you read its contents?

Behavioral Pitfalls: Judy Lewent and Merck

Judy Lewent joined Merck in 1980, and became its CFO 10 years later. In doing so she became the first woman in the United States to serve as CFO of a major corporation. And Merck was undeniably a major corporation. During the 1980s and 1990s, it was recognized as America's Most Admired Company in *Fortune* magazine's annual survey, winning that honor seven times, more frequently than any other firm.

At the same time, there were dark financial clouds on the horizon. Pharmaceutical products typically receive patent protection for a period of 17 years. By the end of 2001, all five of the major drugs mentioned were due to go off patent.

The pharmaceutical industry is also regulated. In the United States, the Food and Drug Administration (FDA) must approve all new drugs as being safe and effective. To estab-

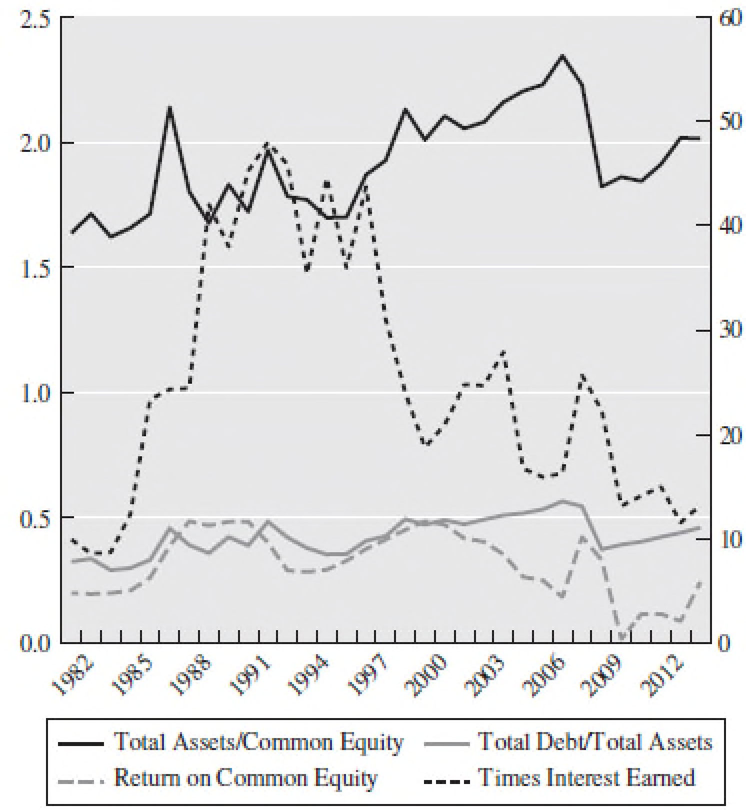
Framing Effects
Judy Lewent and Merck

- In 1994 Judy Lewent, the CFO of pharmaceutical firm Merck & Co., was one of the most respected CFOs in the United States.
- In 2004, *CFO* magazine ran an article entitled "What Will Judy Do?" asking whether she would be able to keep her job.
- What happened?
- Merck was forced to withdraw its blockbuster drug Vioxx after findings that it caused heart attacks and strokes in some patients.

Loss Aversion, Aspirations?

- In the traditional approach to debt policy, managers balance the benefits of additional tax shields against the costs of possible future financial distress stemming from excessive debt.
- Does Merck's debt policy suggest the influence of loss aversion or aspiration-based risk behavior?

EXHIBIT 2-5
Merck's Capital Structure and ROE 1983–2014



Aversion to a Sure Loss

- In 1999, five of Merck's most successful products were due to go off patent in 2000 and 2001.
- The results from its post-approval clinical study, indicated that Vioxx might actually cause heart attacks and strokes.
- Did Merck choose to try and beat the odds and go for high revenues by targeting the whole population instead of being conservative and only targeting those with sensitive stomachs?

Aftermath

- In August 2005, a Texas jury found Merck liable for the death of a 59-year-old marathon runner, and awarded the victim's family $253 million.
  - This was the the first of the Vioxx trials.
- Merck's market capitalization fell by 7.7%.
  - Analysts' estimate of the value of Merck's legal liability increased to $30 billion, raising questions about Merck's long-term ability to survive.

Frazier to the Rescue

- In the end, Merck's chief counsel Kenneth Frazier crafted a strategy that framed the scientific issues for juries in ways jury members found intuitive.
- Merck won a series of important Vioxx cases, and in 2007 reached a $4.85 billion settlement with most of the remaining plaintiffs.
- Two years after having withdrawn Vioxx, Merck's stock price rebounded.

Corporate Nudges

1. View decision tasks broadly, rather than narrowly, remembering that over the course of a lifetime, risks are faced repeatedly.
   – Because of the law of averages, accepting an actuarially unfair risk as a policy is likely to produce inferior results over the long term.
2. Reframe by resetting reference points in order to accept losses and treat sunk costs as sunk.
   – Try using stock phrases such as “that’s water under the bridge” and “don’t cry over spilled milk” as helpful reminders.

Summary

- Heuristics, biases, and framing effects impede managers from making the best use of the traditional tools of corporate finance, causing them to make faulty decisions that destroy value.
- Managers are inclined to choose negative net-present-value projects because they are
  - excessively optimistic about the future prospects of their firms;
  - overconfident about the risks they face;
  - discount information that does not support their views; and
  - exaggerate the extent of control they wield over final outcomes.

Summary, Cont.

- Avoiding bias by means of corporate nudges is a major challenge that generally requires a sophisticated, disciplined approach.
- Managers need to be aware of sentiment, psychological phenomena impacting investors that can result in the mispricing of the securities issued by their firms.
  - Mispricing raises issues about catering behavior and market timing.