
Inside the Investor's Brain

*The Power of Mind
Over Money*

RICHARD L. PETERSON



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Inside the Investor's Brain

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To Sarah.

*Your grace, warmth, and ease light up my world.
You made this book possible.*

Contents

Preface	xv
Acknowledgments	xix
About the Author	xxi
Introduction	1
PART I Foundations	7
<hr/>	
CHAPTER 1 Markets on the Mind	9
Analysts and Dart Boards	11
Developing Better Expectations	12
“The Wisdom of the Collective”	13
Meteorological Anomalies and Other Animal Spirits	15
Sentiment	17
CHAPTER 2 Brain Basics	19
Damasio and the Iowa Gambling Task	21
The Brain: Structure and Function	23
The Brain-Damaged Investor	27
Research Methods	30
Neuroscience Preview	31
CHAPTER 3 Origins of Mind	35
Emotions and Perceptions	37
Expectations and the Comparator	39
Counterfactual Comparisons	40

Beliefs and Expectations: The Placebo Effect	42
Making Sense of the News	43
Self-Deception	44
Emotional Defense Mechanisms and Motivated Reasoning	45
CHAPTER 4 Neurochemistry	47
Introducing the Neurotransmitters	48
Serotonin	50
Dopamine	51
Norepinephrine	53
Opiates	54
Stress Hormones	54
Caffeine	55
GABA, Acetylcholine, and Omega-3 Fatty Acids	55
The Chemistry of (Financial) Mental Disorders	56
The Neurochemistry of Financial Performance	58
Serotonin and Market Bubbles	59
Recreational Drugs and Alcohol	61
Alcohol	62
Cocaine	62
PART II Feelings and Finances	65
<hr/>	
CHAPTER 5 Intuition	67
Analysis and Intuition	68
Investment Practice	69
What Does Your “Gut” Tell You?	70
Listening Without Thinking	71
Intuition and Emotion in Investing	72
Emotional Intelligence	73
Subliminal Emotion	73
Stirring the Unconscious	74
CHAPTER 6 Money Emotions	77
Emotional Biases	79
The Difference between Positive and Negative Feelings	80
Regret as a Self-Fulfilling Prophecy	82

An Amicable Divorce	84
Sadness and Disgust	84
Fear and Anger	86
Projection Bias	87
Managing Feelings	87
Summary	88
CHAPTER 7 Excitement and Greed	91
Brokers Kindle Irrational Exuberance	93
The Anatomy of Stock Hype	94
Greed: The Basics	95
The BIAS Task	97
The Nucleus Accumbens	101
Excited About a Good Deal	102
Improving Biased Decision Making	103
Greed in the Markets	104
CHAPTER 8 Overconfidence and Hubris	107
The Psychology of Hubris	108
Overconfidence	109
Illusion of Control	112
Winning Changes the Brain	112
The Neurochemistry of Exploration	114
One Who Knows: Christian Siva-Jothy	114
Confidence—the “Good” Kind	115
Solutions	117
CHAPTER 9 Anxiety, Fear, and Nervousness	119
Climbing a Wall of Worry	121
Dread in the MRI	122
Nature versus Nurture	123
It’s All in Your Head	124
Empathy Gaps	125
Pain Relief	126
Investment Lessons	127
Of Hurricanes, Risk Perceptions, and Opportunity	128
Summary	129

CHAPTER 10 Stress and Burnout	131
Stress	132
Cramer on Stress	133
Choking for Rupees	133
Which Goes Wrong—the Brains or the Brawn?	135
Stress and Trend Perception	136
Neurochemistry of Stress	137
Biological Effects of Stress	138
Adrenaline Junkies	139
Managing Investment Stress	140
Summary	141
CHAPTER 11 Love of Risk	143
Knowing When to Fold ‘Em	146
Pathological Gambling	147
The Gambler’s Brain	149
Ought to Know Better	150
Reducing Gambling	151
Summary	151
CHAPTER 12 Personality Factors	153
The “Big Five”	155
Extraversion versus Introversion	156
Neuroticism versus Emotional Stability	157
Conscientiousness versus Impulsiveness	157
Openness to New Experiences versus Traditionalism	158
Agreeableness versus Self-interest	158
The Genetics of Personality	158
Investing Personality	160
Neurotic Investors	162
Extraverted, Open, and Conscientious Investors	163
Other Personality Research	164
Trading Psychology	166
PART III Thinking about Money	169
<hr/>	
CHAPTER 13 Making Decisions	171
Expected Value and Expected Utility	172
The Jackpot Trap	173

Probability Misjudgments	176
Vividness, Imagination, and Desire	179
Ambiguity and Uncertainty	179
Ambiguity in the Markets	180
Neuroscience of Ambiguity, Risk, and Reward	182
The Possibility that You are Overweight	183
The Trusting Brain	184
Neuroscience of the Ultimatum Game	184
The Trust Hormone	185
Implications	186
CHAPTER 14 Framing Your Options	189
The Disposition Effect	190
A Father-Son Stock Sale	191
Teasing out the Problem	192
Framing Risk	194
A Frame in the Membrane	194
Holding Losers: “Double-or-Nothing!”	197
Differences in Aversion	198
Letting Winners Ride	199
Summary	200
CHAPTER 15 Loss Aversion	203
Neuroscience of Loss Aversion	205
The Equity Premium Puzzle	206
The Implied Put Option	207
Overcoming Loss Aversion	208
The House Money Effect	209
Lessons from the Pope	210
Comments from Soros, Tudor, and Cramer: “Booyah!”	212
CHAPTER 16 Time Discounting	215
Get Your Hand out of the Cookie Jar	217
Brain Basis of Delayed Gratification	218
Chemical Impulses	219
Monkey Business	219
Making a Killing in the Options Pit	220

Improving Self-Control	221
In Practice	223
CHAPTER 17 Herding	225
Herding	227
Social Proof	228
Social Comparison	230
Asch and Conformity	231
Information Cascades	232
Stanley Milgram and the Shocking Truth	233
Nice Clothes, Fast Cars, and Fancy Titles	235
The Neuroscience of Cooperation	236
Analysts' Abuse of Authority	237
The Herding Habit	238
Living the Contrarian Lifestyle	239
Advice for Herd Animals and Trend Followers	240
Advice for Investment Committees	241
CHAPTER 18 Charting and Data Mining	243
Artificial Neural Networks	244
Data Mining and Self-deception	245
Finding Patterns in the Noise	246
The Trend and Mean-reversion Biases in Chart Reading	247
Overreliance on Charts	250
The Gambler's Fallacy	253
Irrational Exuberance... Called Too Early	253
The Soochow Gambling Task	255
The Learned Caudate	258
Patterns in Earnings Reports	259
Fooled by Randomness	259
CHAPTER 19 Attention and Memory	261
Terminal Illness	263
Representative Returns	264
Fond Memories	265
Beating the Hindsight Bias	266
Attention Deficit	267

Keep Your Eye on the Pills	268
What's in a Name?	269
China Prosperity Internet Holdings	270
"All that Glitters"	272
CHAPTER 20 Age, Sex, and Culture	275
Emotional Memories	276
The Female Brain: Estrogen, Emotion, and Cooperation	277
Financial Planning for Divorcees	278
Male Overconfidence	279
Age	279
The Seattle Longitudinal Study of Adult Development	280
Culture (East and West)	283
Chinese Risk Takers	284
Biases Among Chinese Stock Traders	285
PART IV In Practice	287
<hr/>	
CHAPTER 21 Emotion Management	289
Do it for Love, Not Money	290
Money Changes You	291
Emotional Defenses	291
The Pursuit of Happiness	292
Neuroplasticity	293
Chemical Stabilizers	294
Self-discipline	295
Creating a Decision Journal	297
CHAPTER 22 Change Techniques	301
Dealing with Fearful and Overconfident Clients	302
Cognitive-behavioral Therapy and Stress Management	304
Yoga, Meditation, and Lifestyle	306
Simple Stress Reduction	307
Getting Out of a Slump	308
Trading Coaches	309
Flavia Cymbalista	310
Denise Shull	310

Modeling Others	311
Growing Happier	311
Neurofeedback	312
Maintain “Learning Goals”	314
CHAPTER 23 Behavioral Finance Investing	317
Harvesting Risk Premia	318
Risk Premia and Expectations	319
Value versus Glamour	321
Momentum, Size, and the Optimal Portfolio	322
“Buy on the Rumor and Sell on the News”	325
Limits to Arbitrage	326
Behavioral Finance Fund Performance	327
Behavioral Investment Products	328
Final Notes	329
Notes	331
Glossary	369
Index	383

Preface

This book isn't written for you. At least, it's not intended for the rational, *thinking* you who was thrown off by that last sentence. This book is for the parts of you that were perturbed, the feelings that you can't quite access. Those feelings arise from deep in your brain, and they're largely subconscious. To get to them, I have to go through you—you the reader.

And there's the catch. If thinking could make everyone a great investor, then there wouldn't be market bubbles and panics, poverty, addiction, or criminal greed. But we do have those problems—in part because the thinking brain evolved about 100,000 years ago, while the feeling brain is one of our most primitive endowments (something we share with our pets), and the two brains don't always get along. How to manage them both in the wild world of the financial markets is the subject of this book.

In the financial industry, most investment decision making follows a rational process until, often at crucial times, that process breaks down. Whether you're an individual investor, portfolio manager, financial adviser, trader, analyst, or member of an investment committee, odds are you've experienced the powerful effects of the psychological forces that move the markets. This book answers two questions for investors: What are the deep "irrational" forces driving investment behavior, and what can be done to better manage them?

GOOD INVESTING IS MORE THAN BOOK SMARTS

Good investing requires a basic financial education. That's the straightforward part. However, to really *excel* in investing, you've got to learn the skills to manage *yourself*. Book smarts aren't enough. You've got to understand both the terrain of the markets *and* the topography of your mind.

This book is intended for educated investors (individuals, portfolio managers, venture capitalists, and bankers), financial analysts (security research, fundamental and technical analysts), and traders. Readers of this

book will learn to identify subconscious mistakes (biases) in their financial decision making. Readers will develop an understanding of the brain origins of psychological biases, learn to recognize when they arise, and gain techniques for improving their financial judgment.

However, just because you *know* when you're likely to make a mistake doesn't mean you can stop yourself from doing it. Two methods are effective for learning to manage biases: personal experience and studying the examples of others. Gaining personal experience in the markets is costly. To enhance the study of others, this book contains examples of investors who have succumbed to biases, people who have overcome such mistakes, the decision-making tactics of great investors, and tips for creating an investment environment that supports effective decision making.

Much of the research on investor biases presented here is imported from the academic field of behavioral finance. Investigators in behavioral finance, in pioneering studies, have identified numerous systematic investing biases. Due to their origination in deep brain circuits, most biases influence investment decisions automatically and beneath awareness. When evidence from neuroscience, behavioral finance, and real-world practitioners is integrated, then a clearer picture of the fundamental issues and remedies is revealed.

ORGANIZATION OF THIS BOOK

Most chapters open with vignettes. Some are tragic, some uplifting, and some unusual. All are selected for the lessons they teach. The investors depicted in these stories are fabricated from my collective experiences with numerous individuals and through anecdotes I have heard from others. Any resemblance to real persons is completely coincidental.

In individual chapters, readers will learn to: (1) identify specific subconscious biases, (2) know when thinking and analysis will improve their investment process (and when it won't), (3) improve their emotional awareness, and (4) enhance the decision process.

One caveat: There is an emphasis on the neural origins of biases, yet few direct links between the brain and investment behavior have been proven. Nonetheless, this book attempts to simplify concepts and relationships as accurately as possible to make the discussion relevant to practitioners. In the introduction, the investment fallibility of Long-Term Capital Management, Sir Isaac Newton, and Samuel Clemens (Mark Twain) are used to illustrate some of the most basic and prevalent investor biases. Chapter 1 explains the challenges investors face in finding opportunities in a competitive marketplace, and it argues that the best remaining source of profits lies in understanding how other investors think. Chapter 2 educates the reader

about basic brain structure and briefly reviews the research tools used in experiments. Chapter 3 describes the roles of belief and expectation in shaping one's experience. Chapter 4 is a discussion of neurochemistry including the common medications and substances that alter neurochemical balance and influence financial decision making.

Part II describes how various emotions impact judgment. Chapter 5 demonstrates the tremendous value of intuition and "gut feel" in investment decisions. Chapter 6 explains how overt emotions such as fear, excitement, anger, and sadness bias financial judgment. Chapter 7 looks at the brain origins and pathological investment effects of excessive greed and excitement. Chapter 8 examines the dangers presented by overconfidence and the hubris that results from a series of successes. Chapter 9 describes how anxiety and fear affect investor decision making, while Chapter 10 is specifically about stress and burnout. Chapter 11 describes pathological gambling, which affects some day traders and institutional "rogue traders." Chapter 12 investigates the personality traits that contribute to investing excellence.

Part III is a review of the cognitive (thinking and perception) biases. While these biases are influenced by emotion, research has primarily focused on the mental mechanisms that underlie them. Chapter 13 briefly explains modern decision-making theory, and illustrates how information about outcome size, probability, and ambiguity biases choice. Chapter 14 investigates how the framing of a decision biases judgment. Chapter 15 explains loss aversion – which results in "holding losers too long" – both in amateur and professional investors. Chapter 16 is a discussion of how time perception, such as time discounting, generates investment biases. Chapter 17 is about the process of social influence and herding, and how it impacts investment decision making and investment committees. Chapter 18 explains the perceptual pitfalls that arise during chart reading and data mining. Chapter 19 is a discussion of biases in attention and memory that affect investors. Chapter 20 looks at investment risk taking from the perspective of the differing biology of women versus men and the aged versus the young. It also examines the (very limited) cultural differences between Eastern and Western investors.

Part IV presents techniques for managing biases. Chapter 21 summarizes the book's major conclusions and offers self-help exercises for reducing biases. Chapter 22 provides a more in-depth approach to emotion management in the markets. Chapter 23 teaches the reader how to incorporate "neural" insights into their investing strategy and explains how to identify and take advantage of collective biases in market prices.

Acknowledgments

I wrote this book over several years. So many people influenced its production that I cannot possibly do justice to their contributions here. I am very appreciative of my family and friends, who provided their love and encouragement. Thanks especially to Sarah, my amazing wife, for her unflagging optimism and patience during the writing of the book. My gratitude is profound.

I am extremely indebted to the efforts of hundreds of researchers and research assistants whose experiments form the basis of this book's content. Without their dedication and passion, human knowledge would not advance.

Many scientists shared their ideas in countless hours of fascinating discussions, most of which made it into the book in spirit, if not explicitly. Brian Knutson has been an extraordinary mentor to me, and the completion of this book would never have been possible without the time I spent learning from him. I have many neuroscientists to thank. Ching-Hung Lin graciously provided his lab's fascinating data on the Soochow Gambling Task. Carrie Armel taught me the basics of facial EMG. I'd like to express my gratitude to Paul Zak for sharing his macro insights into the intersection of economic behavior and individual biology. Hilke Plassman, Scott Huettel, Paul Slovic, Greg Berns, Elke Weber, Ernest Barratt, and Jamil Bhanji were encouraging and generous with their time during our long discussions and interviews.

On the finance side of the aisle, special thanks to Richard Peterson (my father), who introduced me to the markets at an early age and with whom I've had hundreds of enjoyable financial discussions over the years. Camelia Kuhnen kindly shared insights into the limitations and strengths of behavioral finance and neurofinance. Hersh Shefrin, Mark Seasholes, David Leinweber, Zhaohui Zhang, Andrew Lo, and Hank Pruden helped me gain an (admittedly still feeble) grasp of the basics of modern behavioral finance and behavioral investment strategy. Bob Olsen has made an extraordinary contribution to this book through his editorship of the *Journal of Behavioral Finance*, whose articles provide numerous insights into the real-world effects of psychological biases.

Investing psychologists Frank Murtha, Doug Hirschhorn, Denise Shull, Flavia Cymbalista, Alden Cass, and Janice Dorn shared fascinating stories and insights from their practices. Performance psychologist and coach, Howard Fleischman, provided valuable advice during the preparation of the self-help chapters.

Michael Mauboussin illuminated some of the psychological realities of fund management through our fascinating discussions and his excellent books and articles. I am very grateful for insights from financial practitioners including David Strong, Martin Auster, Carlo Cannell, Patrick Acasio, Rafael Drouhy, Sean Phelan, Faris Hitti, Dan Beale, John Cammack, Bill Miller, Arnold Wood, Dan Case, and Emily Wong. They contributed an essential applied perspective to this book. Numerous financial advisers also provided insights, including Shirley Mueller, Ken Winans, Michael Lauren, Santosh Keni, Adil Yousufzai, Michael McDonough, Nitin Birla, and Andy Byer.

Tom Samuels has been an optimistic and enthusiastic friend, psychotherapy mentor, and supporter since I first overconfidently told him I could write this book in 40 hours. Richard Friesen has been inspiring, honest, and helped me remain grounded since the beginning. Without the kind prompting and patience of Emilie Herman at Wiley, this book would not have been. Pamela van Giessen and Bill Falloon gave me my “big break” in writing this book, and Christina Verigan at Wiley helped keep me on track.

And a final thank you to the investors who have shared their personal stories with me. They must remain nameless. Whether through their tragic disappointments or spectacular successes, they inspired my search for a road-map to the investor's mind. I hope that by sharing their stories, those who follow can avoid their dangerous financial wrong turns and model their high-performance secrets.

R.L.P.

About the Author

Richard L. Peterson is founder of Market Psychology Consulting, where he trains financial professionals for improved performance. Dr. Peterson has developed five psychological testing products including the “Money and Investing Personality Test.” He is currently developing analytical market software and novel investment strategies for use in portfolio management.

Dr. Peterson received a BS in electrical engineering and a BA in Plan II Arts at the University of Texas in 1995. In 2000 he received a doctor of medicine degree from the University of Texas Medical Branch, with honors. He completed psychiatry residency training at San Mateo Medical Center in 2004, during which he was engaged in postdoctoral neuroscience research at Stanford University.

After completing his undergraduate studies, Dr. Peterson designed stock forecasting software and traded futures for an investment partnership. Thereafter, he investigated the role of emotions in financial decision making both during medical school and neuroimaging research at Stanford.

Dr. Peterson has published scientific papers in economics, finance, psychology, and neuroscience journals. He is an associate editor of the *Journal of Behavioral Finance* and is on the board of advisers of the Social Science Research Network (SSRN) in the experimental and behavioral finance area. He is a member of the Society for Neuroeconomics, the Institute of Psychology and Markets, and the American Psychiatric Association.

His primary professional interest is the role of emotion in investment decision making, and specifically, the arbitrage of neural-based anomalies in the financial markets. His long-term fascination with the markets grew out of his early investing (since age 12) and futures trading activities, and it continues with the application of psychological principles to investment strategy development. He plans to launch a quantitative psychology-based hedge fund in early 2008.

Dr. Peterson lives in the Los Angeles area with his wife and daughter.

Introduction

This introduction contains three vignettes about famous financial mishaps: the late 1990s hedge fund Long-Term Capital, Sir Isaac Newton and the South Seas bubble, and Samuel Clemens (a.k.a. Mark Twain) and the 1860s silver fever. There is a lot to be learned from such financial failures—both in the accounting facts and historical circumstances, but also in the psychology underlying the protagonists’ faulty decision making. Reading the stories that follow, take note of the investment choices of the main players as their success, and confidence, grow.

BRAINS OF STEEL . . . ARE NOT ENOUGH

In February 1994 the most esteemed hedge fund in history, up to that time, opened for business. Long-Term Capital Management (LTCM) was extremely secretive, though it was widely known that the fund’s partners included brilliant academics and extraordinarily successful traders. LTCM’s partners included Myron S. Scholes and Robert C. Merton, two Nobel Prize winning economists (one awarded in 1997) who were renowned both on Wall Street and in academia.

The founder of Long-Term Capital was John Meriwether. According to Michael Lewis, author of *Liar’s Poker* and a colleague of Meriwether’s on the bond desk at Salomon Brothers during the late 1980s, “[John] had, I think, a profound ability to control the two emotions that commonly destroy traders—fear and greed—and it made him as noble as a man who pursues his self-interest so fiercely can be.”¹ Meriwether not only kept his emotions under wraps, but he was also roundly acknowledged as intellectually brilliant.

Furthermore, Meriwether had proven to have high confidence in his market opinions. If he believed that an opportunity in the markets would go in his direction, and instead it moved against him, he might increase the size of his bet. He used mathematics to determine fair values of securities

and spreads. If his models identified a mispricing, he had confidence that it would return to fair value over time.

LTCM's launch was the largest in history at that time: \$1.25 billion was raised. While LTCM's fees were above the industry average (taking 25 percent of net returns), the profits over the fund's first four years were large, seeming to justify the high fees. By April 1998, \$1 invested in the fund at its inception in 1994 was worth \$2.85 (after fees).

Unfortunately for LTCM, mathematical genius was insufficient to reap consistent profits. Other traders figured out many of LTCM's strategies, piggybacking on their trades, and LTCM's profitability began to erode. The mathematicians at LTCM looked for new markets in which to apply their basic models. They made assumptions that those new markets operated similarly to the old. Gradually, they grew greedier, took increasing risk, and spread their positions too widely. The founding partners bought out a large proportion of the original investors' capital so they could increase their own stakes in the fund.

After April 1998, LTCM's performance began an accelerating slide. Within a period of five months, from April 1998 to September 1998, LTCM lost 90 percent of its assets and could not meet its margin calls on the \$1.3 trillion in outstanding positions it held. Many large Wall Street banks had loaned securities to LTCM on thin margin, and now some of those banks were threatened with catastrophic losses if they liquidated the fund's heavily in-the-red positions and triggered a "run on the bank."

Five months after the fund's peak, the original dollar invested in LTCM in 1994 was worth \$0.23, and the fund's collapse had nearly caused the meltdown of the global financial system.² Financially, LTCM's collapse was caused by excessive leverage in illiquid positions. But how did these conditions come to be?

In the media reports about the fund, the root causes of its rapid demise were identified as psychological. After several years of success, greed, hubris, and arrogance infected the partners' decision making and impaired their communication. In investment management, mathematical genius may perform well in the short term, but it is no substitute for *emotional* intelligence.

CALCULATING THE MADNESS OF MEN

Sir Isaac Newton was one of the most influential scientists in history. He laid the groundwork for classical ("Newtonian") physics. He was the first to demonstrate that the motions of objects on Earth and the movements of the celestial bodies are governed by the same set of mathematical laws. His investigations into optics and sound formed the basis for centuries of

research. Unfortunately, Newton's scientific acumen did not improve his investing decisions. On the contrary, he lost much of his wealth in the largest stock bubble of his age.

Like many members of the British aristocracy in the early 1700s, Newton owned shares of the South Seas Trading Company in 1720. The South Seas Company was organized with two missions: (1) as a monopoly over British trade with the Spanish colonies in America and (2) as a converter of British government annuities into long-term debt. The South Seas Company initially had a legitimate and profitable business monopoly courtesy of the British government. Furthermore, the Company was repeatedly successful in raising money on the British stock market for proposed expansions of its operations. As a result of their success, a series of corporate competitors arose and the Company's monopoly was placed in jeopardy.

Following the lead of the South Seas Company, joint-stock companies proposing a wide range of speculative ventures formed and began to raise money through share sales. Public enthusiasm for stock trading grew, and a price bubble formed among the traded shares. When the sometimes fraudulent promotions of new joint-stock companies became apparent to legislators, a law was passed by the British parliament in June 1720 (the "Bubble Act") to prevent non-royal-endorsed joint stock companies from issuing shares to the public. Even after the "Bubble Act" was passed, companies continued selling shares for absurd enterprises. One such offering advertised its business as follows: "For carrying on an undertaking of great advantage; but nobody to know what it is."³

In the midsummer of 1720, Newton foretold a coming stock market crash, and he sold his shares of the South Seas Company for a profit of 7,000 pounds. Subsequently, however, Newton watched the Company's stock price continue to rise, and he decided to reinvest at a higher price. Newton then remained invested as prices started a precipitous decline. Soon panic ensued, and the bubble collapsed. After the dust had settled from the stock market crash of August 1720, Newton had lost over 20,000 pounds of his fortune. As a result of these losses, he famously stated, "I can calculate the motions of heavenly bodies, but not the madness of people." Newton's fear of missing out on further gains drove him to buy shares as the price soared higher. His inertia during the panic led to the loss of most of his assets.

MARK TWAIN AND THE "SILVER FEVER"

The celebrated author and humorist Samuel Clemens (pen name Mark Twain) was the most widely recognized American in the last decade of the nineteenth century, both nationally and internationally.⁴ Clemens's

documentation of his experiences in the Nevada mining stock bubble are one of the earliest (and certainly the most humorous) firsthand accounts of involvement in a speculative mania.

After a brief stint as a Confederate militiaman during the beginning of the U.S. Civil War, Clemens purchased stagecoach passage west, to Nevada, where his brother had been appointed Secretary of the Territory. In Nevada, Clemens began working as a reporter in Virginia City, in one of Nevada's most productive silver- and gold-mining regions. He enviously watched prospecting parties departing into the wilderness, and he quickly became "smitten with the silver fever."⁵

Clemens and two friends soon went out in search of silver veins in the mountains. As Clemens tells it, they rapidly discovered and laid claim to a rich vein of silver called the "Wide West" mine. The night after they established their ownership, they were restless and unable to sleep, visited by fantasies of extravagant wealth: "No one can be so thoughtless as to suppose that we slept, that night. Higbie and I went to bed at midnight, but it was only to lie broad awake and think, dream, scheme."⁶

Clemens reported that in the excitement and confusion of the days following their discovery, he and his two partners failed to begin mining their claim. Under Nevada state law, a claim could be usurped if not worked within 10 days. Clemens lost his claim to the mine due to inattention, and his dreams of sudden wealth were momentarily set back.

But Clemens had a keen ear for rumors and new opportunities. Some prospectors who found rich ore veins were selling stock in New York City to raise capital for mining operations. In 1863, Clemens accumulated stocks in several such silver mines, sometimes as payment for working as a journalist. In order to lock in his anticipated gains from the stocks, he made a plan to sell his silver shares either when they reached \$100,000 in total value or when Nevada voters approved a state constitution (which he thought would erode their long-term value).

In 1863, funded by his substantial (paper) stock wealth, Clemens retired from journalism. He traveled west to San Francisco to live the high life. He watched his silver mine stock price quotes in the newspaper, and he felt rich: "I lived at the best hotel, exhibited my clothes in the most conspicuous places, infested the opera. . . . I had longed to be a butterfly, and I was one at last."⁷

Yet after Nevada became a state, Clemens continued to hold on to his stocks, contrary to his plan. Suddenly, the gambling mania on silver stocks ended, and without warning, Clemens found himself virtually broke.

*I, the cheerful idiot that had been squandering money like water, and thought myself beyond the reach of misfortune, had not now as much as fifty dollars when I gathered together my various debts and paid them.*⁸

Clemens was forced to return to journalism to pay his expenses. He lived on meager pay over the next several years. Even after his great literary and lecture-circuit success in the late nineteenth century, he continued to have difficulty investing wisely. In later life he had very public and large debts, and he was forced to work, often much harder than he wanted, to make ends meet for his family.

Clemens had made a plan to sell his silver stock shares when Nevada became a state. His rapid and large gains stoked a sense of invincibility. Soon he deviated from his stock sales plan, stopped paying attention to the market fundamentals, and found himself virtually broke.

Clemens was by no means the first or last American to succumb to mining stock excitement. *The World's Work*, an investment periodical published decades later, in the early 1900s, was beset by letters from investors asking for advice on mining stocks. The magazine's response to these letters was straightforward:

Emotion plays too large a part in the business of mining stocks. Enthusiasm, lust for gain, gullibility are the real bases of this trading. The sober common sense of the intelligent businessman has no part in such investment. [1907a, pp. 8383–8384]⁹

While the focus of market manias changes, the psychology of speculators remains remarkably similar over the centuries.

Mathematical brilliance and Nobel Prizes (in the case of LTCM), scientific genius (in the case of Newton), and creativity (in the case of Clemens) do not insulate against investment failure. As we'll see in this book, accolades and success can actually impede investing success. In all three cases, as warning signs became apparent, the investors remained in an overconfident worldview, dismissing risks and turning their attention away from prudent money management. Then, as their wealth evaporated, they remained passive in the face of losses.

Regardless of their professional standing, the vast majority of investors underperform the markets, often for the same reasons as the three cases above. Emotions easily overwhelmed reasoning when money is at stake. When times are good, investors take them for granted and do not prepare for risks. When markets turn sour, they are not paying attention, often holding on to their positions too long while hoping for a comeback or denying that there is a problem.

WHAT'S THE USE OF NEUROFINANCE?

In neuroscience laboratories, revolutionary new tools are available for investigating investor behavior. These technologies enable researchers

to watch changes in brain function in real time, allowing the precise characterization of the decision-making process. As researchers have come to better understand the brain, some fascinating and important findings have come to light regarding how people make good, and bad, decisions with money.

“Neurofinance” is the name for the interdisciplinary study and application of neuroscience to investment activity. Finance, psychology, economics, and neuroscience collaborators are exploring common questions, such as why and how people make nonoptimal financial decisions. Furthermore, with the contributions of clinical psychologists, psychiatrists, and neurologists to recent research, it has become apparent that some “neural” biases can be corrected by implementing therapeutic techniques.