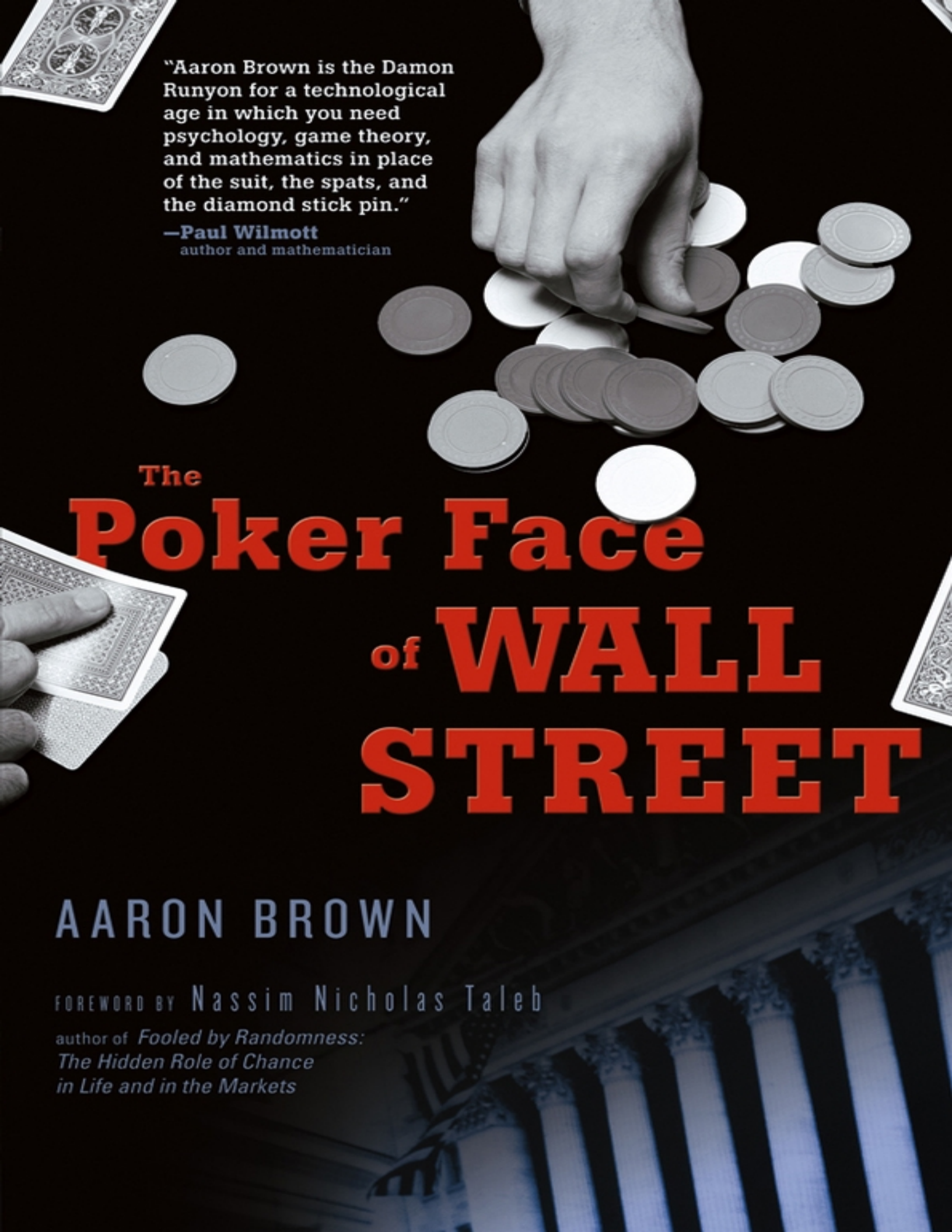

"Aaron Brown is the Damon Runyon for a technological age in which you need psychology, game theory, and mathematics in place of the suit, the spats, and the diamond stick pin."

—Paul Wilmott
author and mathematician

The Poker Face of WALL STREET

AARON BROWN

FOREWORD BY Nassim Nicholas Taleb
author of *Fooled by Randomness: The Hidden Role of Chance in Life and in the Markets*

The Poker Face of WALL STREET

Aaron Brown

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Foreword

Nassim Nicholas Taleb[1]

I

One would tend to think that gambling is a sterile activity that is meant to occupy those who have not much else to do and others when they have not much else to do. You would also think that there is a distinction between “economic risk taking” and “gambling,” one of them invested with respectability, the other treated as a vice and a product of a parasitic activity.

This book shows that the distinction between what is called purely gambling and “productive economic activity” is one of those socially constructed ones that remain sticky in our minds. While many may disagree with the point (our economics culture is vitiated by these mental boundaries between activities), it remains that gambling injects currency into economic life in the form of the expectation of future cash transfers and *that,* and not just narrowly defined “productive” activities, may make the world advance. We may not accept it because economics is a narrative discipline and this appears to be the wrong narrative. It is not that gambling imitates economic life, but that economic life is largely modeled after gambling. That was the idea of the original thinker John Law, made infamous with his bankruptcy; Aaron Brown, another original thinker, revives it and takes it further.

II

Until the day when I opened the manuscript for this book, I was not interested in gambling, any form of gambling. I had taken the aggressive view that, contrary to what we were taught in all these probability volumes, and in the misguided books on the history of probability and "risk," gambling could not offer us lessons about real randomness, nor that it could be a laboratory where you could get actual training for the messy, *aPlatonic* real life. Just as we tend to underestimate the role of chance in life in general, we tend to *overestimate* it in these games, by the mechanism of the availability heuristic that makes things the more salient when they easily come to mind.

Indeed, I found it infuriating to listen to people who, upon being informed that I specialize in problems of Chance, immediately jump to references to dice. Two illustrators for a paperback edition of one of my books spontaneously and independently added dice on the cover (the cover illustrator) and below every chapter (by the typesetter), putting me in a state of rage. The editor warned them to "avoid the ludic fallacy" as if it were a well-known intellectual violation—amusingly, they both reacted with "ah, sorry, we didn't know." What I call ludic fallacy (after the Latin *ludus,* play) is the misuse of games as the wrong epistemological ground.

How does randomness end up disappearing in these games? Just consider that you know the probability, and that the payoff does not change throughout. The casino never surprises you by announcing that it will be paying you 100 times more, or a tenth of your take. Furthermore, the dice average out so quickly that I can say with certainty that the casino will beat me in the very near long run at, say, roulette, as the noise will cancel out, though not the skills (here, the casino's advantage). The more you extend the period (or reduce the size of the bets), the more

randomness, by virtue of averaging, drops out of these gambling constructs.

The ludic fallacy is present in the following chance setups: random walk, dice throwing, coin tosses, the infamous digital “heads or tails” expressed into 0 or 1, the “Brownian motion” corresponding to the movement of pollen particles in water, and similar examples. These generate a quality of randomness that cannot be even qualified as *randomness*—protorandomness, or Mandelbrot’s “mild randomness” is a more appropriate designation. At the core, all these theories ignore a layer of uncertainty. Worse, they do not know it!

The revelation was that poker differs greatly from the random walk—hence, one could learn from it; furthermore, it may be the sole venue for us to learn about randomness. How? Simply, it has other hidden higher layers of uncertainty—many of them. It has suckers, people who invite you to take advantage of them. It also has people for whom you are the sucker (of course, without your being aware of it). You are not flipping a coin and moving left or right. You are not betting against a large machine like a roulette wheel. You are not engaging in a blind draw. You are playing against *other* humans. You cannot easily control their maximum bet. Your betting policy matters far more than the probability of getting a given card. You can bluff your way, confuse other players, win in spite of a bad hand, or lose in spite of an unlikely good one. Not least, bets can escalate.

In short, there is *autistic probability* and *social probability,* one that is made complicated (and interesting) thanks to the messes and convolutions of human relations. Poker and this book bring us to the latter.

So poker resembles real life, owing to uncertainty about the cards, uncertainty about others’ betting policy, and uncertainty about the perception by others of your own

betting policy. But it is even more similar to real life, as we saw, in quite unsuspected ways.

III

In spite of having known Aaron B. for several years, mostly as an empirical-minded intellectual of probability, I did not really know what he was about until I read this book. I knew that he has the unusual and valuable background of someone who engaged in the intellectual activity of risk management, but had experience in trading and gambling, therefore got to know uncertainty with more depth and an open mind—which is what uncertainty requires. In other words, a finance professor practitioners could talk to without getting angry.

But here is a person with a single, but large, idea, and who spent his life exploring it vertically and horizontally, maturing it, getting into its interesting wrinkles. This is far rarer than the already rare category of open-minded probability intellectuals. Pokernomics or just generalized gambling is what Aaron B. is about. He views the world from a prism, that of play.

In opposition to the ludic fallacy, there is the ludic virtue, the model of man as an agent of play, presented by Jan Huizinga's *Homo Ludens,* generalized by Roger Caillois's *Les Jeux et les Hommes* (Man, Play and Games), or, more recently, in Mihai Spariosu's *Dyonisus Reborn*[2]—though it remained difficult to make the leap between these literary and philosophical ideas and a modern explanation of economic life. What makes this a landmark book is that it does not just mix *Homo economicus* with *Homo ludens.* It tells us, quite convincingly, that *Homo economicus* is *Homo ludens.* Economic life is gambling.

I hope the reader will start viewing the world in a different manner, as I did.

1. Author, *Fooled by Randomness: The Hidden Role of Chance in Life and Markets.*

2. Johan Huizinga, *Homo Ludens: A Study of the Play Element in Culture.* New York: Roy Publishers, 1950; Roger Caillois, *Le Jeu et les Hommes* (Paris: Gallimard, 1958); Mihai Spariosu, *Dionysus Reborn: Play and the Aesthetic Dimension in Modern Philosophical and Scientific Discourse* (Cornell University Press: Ithaca, NY, 1989). See also Spariosu's *God of Many Names: Play, Poetry, and Power in Hellenic Thought from Homer to Aristotle* (Duke University Press: Durham, NC, 1991).

Preface

One January night in New York City, I was playing Texas Hold ’Em with some financial people who were attending the Global Association of Risk Professionals annual conference. I had spent the day teaching a course called “Using Credit Derivatives,” then rounded up some new and old friends for a poker game. One of them happened to be Bill Falloon, senior editor for finance and investment at John Wiley & Sons. Before long, we got to talking about some of the poker articles I had written. It took a few months, but Bill came up with a contract to write *The Poker Face of Wall Street.* Bill, his assistant Laura Walsh, marketing managers Kim Craven and Nancy Rothschild, and everyone else at Wiley have been incredibly helpful and supportive.

The best part about writing this book is the extraordinary amount of help volunteered by friends and strangers. Everyone loved the topic and dropped important work to explain things to me, give helpful advice, and introduce me to others. Rather than put in a long list here, I’ve mentioned them at the appropriate points in the text, to encourage them to read the book. A few people did not make it into the text, but their ideas did, and they were extremely generous and encouraging: poker guy-of-all-trades, player, writer, and pundit Dave Scharf; superstar financial risk journalist Rachael Horsewood and her equally talented colleague Nina Mehta, who specializes in quantitative finance writing; and noted poker columnist Amy Calistri. David Parlett, the world’s expert on indoor games, provided helpful answers. Tom MacFarland, a physicist turned hedge fund guy at Parallax Fund, provided helpful information and referrals, although he confessed to avoiding the high-stakes games encouraged by fund manager Roger Low. Michael Heneberry got tired of making suggestions and just rewrote, and vastly improved, three of the most important paragraphs in the book. In the process, he gave me the nine-word tagline that

crystallized my thinking. I received more essential support from people posting in the online forums at www.Wilmott.com, the best site for quantitative finance, and www.twoplustwo.com, the best site for poker. I'd thank the people who run these sites here, but they're mentioned in the text.

I've had some wonderful teachers in finance and related fields. I learned a lot from social network theorist Harrison White (my advisor at Harvard); accountant Katherine Shipper; statisticians Fredrick Mosteller, Craig Ainsley, Miriam Green, Harry Roberts, Robert Engle, John Tukey, Arnold Zellner, Charles Stein, and his student Ed George (my advisor at Chicago); economists Kenneth Arrow, Graciela Chichilnisky, George Stigler, Gary Becker, and Milton Friedman; finance professors Eugene Fama, Jon Ingersoll, Merton Miller, Robert Jarrow, and Fischer Black (who was particularly inspirational for this book, although he strongly disagreed with about a third of the core idea). In more than one case, I returned the favor with some lessons at the poker table. If someone ever offers an award for lifetime net poker winnings from Nobel Prize winners, I would immodestly place my own name in nomination (I have no way of knowing whether I would win). I learned as much from my fellow students and students I taught as a professor, some of whom appear in this book. I met Marco Avellaneda, Peter Carr, and Emanuel Derman after my course-taking days were over, but I benefited enormously from the wonderful mathematical finance seminars they run in New York.

Some of the poker players whose talents are indirectly reflected in this book are John Aglialoro, Mike Caro, Bob Feduniak, and David Hayano; I list only the famous ones and omit many of comparable abilities who play mainly private games and might not thank me for the exposure. Stan Jonas and Mike Lipkin took the time to give me long interviews—

Stan had some great stories and Mike some great theories, all of which ended up on the cutting-room floor. I apologize, but I don’t throw writing away; I’ll use the material in articles. I never met James McManus, the author of the incomparable nonfiction poker novel *Positively Fifth Street,* but he provided some answers and encouragement for the book, as well as access to some of his unpublished poker writing. Not least, I thank him for a wonderful line I stole for a subchapter heading, which would have made a good title for this book.

Muhammad Cohen, the founder of Writing Camp, provided editing above and beyond the call of duty, taking random fragments of thought from me and returning what you will see in the following pages, putting in enough hours and changing enough words to almost justify a coauthorship. Inspired by Graham Greene novels to join and then smart-aleck his way out of the Foreign Service, this product of Yale and Stanford hides out from husbands of ex-girlfriends, Christmas music, people who wear suits—or file them—and government gunmen, in a part of Hong Kong that appears on no maps. If you find him, you’d better bring cards, chips, and Krugerrands. Copy editor Ginny Carroll improved the text immensely, one letter or punctuation mark at a time.

Writing a book is stealing from your family. Time, energy, attention, patience, and civilized behavior you owe them get shoveled down the black hole of the book. It doesn’t seem right to thank people for stealing from them. Fortunately, I can thank my wife, Deborah, as a partner. She took time away from her own work as a portfolio manager to track down interviewees (some of whom tried hard not to be found), research facts, and talk people into giving me quotes. I made a deal with my children, Jacob and Aviva, which they both kept better than most grown-ups I know. Now that I’m finished with the book, I can keep my end.

Aaron Brown

August 24, 2005

CHAPTER 1

The Art of Uncalculated Risk

This book is about how to gamble and win.

Gambling lies at the heart of economic ideas and institutions, no matter how uncomfortable many people in the financial industry are with that idea. Not surprisingly, the game most like the financial markets—poker—is hugely popular with financial professionals. Poker has valuable lessons for winning in the markets, and markets have equally valuable lessons for winning at poker.

This book will give you insight into both kinds of gambling. We'll begin with basic information about poker and finance, then delve into the psychology of finance and the economics of poker. We'll review elementary and advanced tactics for winning. Along the way, we'll see how America's passion for gambling at poker and in the markets has shaped the country's economic success and national character, and spilled over to make the globalized world we live in today. I've stuck bits of my autobiography in the Flashback sections to make the points personal. Finally, we'll look at some of the cutting-edge work being done in these fields and some of the dangerous nonsense to avoid.

RISK

My first point is obvious but often overlooked. In order to win, you must take risk. Therefore, to someone who wants to win, risk is good. However, I have great respect for risk. It is real. Trying to make a living at poker or trading, or anything else that involves risk, means you might fail. You might end up broke or friendless and miserable or dead. Or worse. If you don't really believe that, if you think that God or the universe or a Hollywood scriptwriter guarantees a happy ending for a shrewd, good-hearted adventurer—or that nothing really bad ever happens to people like you—this book will do you more harm than good. Of course, since God's looking out for you, you don't have to worry about that.

It's easy to say that there's no alternative to gambling, that you take risk by getting out of bed in the morning or crossing a street. That's true enough, but you *can* try to avoid unnecessary risk. More important, you can avoid uncalculated risks; you can always look before you leap. It's hard to win much that way, though. Other people snap up the riskless profits pretty fast and bid the price of calculable risk opportunities to near their fair values. Things get a lot less crowded if you go for the incalculable risks, leaps of faith that cannot be inspected carefully before takeoff. So that is where you find extraordinary opportunities.

If you can tolerate what life offers in low- and calculable-risk opportunities, you should take it. That is the defining strategy of the middle class, but it can be adopted by anyone, rich or poor. Choose a career in a low-risk field, and get plenty of good training. Be nice to everyone. Select sound investments; make conventional choices; pay your taxes; obey the law. Do a little better every year than the year before, and raise children who will do a little better than you. For many people, this is the American Dream. For others, it's the only sensible choice, the only kind of life that

allows happiness without achieving it at the expense of someone else.

This book is for the rest of us, the ones who cannot imagine living that way. For some of us, conformity is the problem. We are sexual, political, or religious deviants, or uncategorizable eccentrics who just cannot fit into polite society. For others, born in war zones or under horrific governments, or abused as a result of caste or genetic aberration or other prejudice, the rewards of the limited safe choices on offer are too meager to merit consideration. Still others among us are just bored: Conventional comfort is too dull. But the most common reason for embracing risk among people I know is pure egotism. We believe we have some talent that must be nurtured and allowed to flower. We must write or act or research or explore or teach or create art or just be ourselves as an end in itself. This obsession puts us above the rules and justifies any risk or action. I've never met a successful poker player or trader who didn't believe he or she was better than everyone else. Some make it obvious, but for most it is a quiet article of unexamined faith. If you have it, it's impossible to settle for what everyone else gets, however comfortable that is in absolute terms.

To me, that's the real American Dream. For most of history, there wasn't a big middle class. There were rich and poor, life was risky for both, and everyone gambled. The growth of the middle class began in seventeenth-century Holland. Europeans who achieved middle-class security generally stopped gambling and soon afterward tried to get everyone else to stop. But in the United States, the middle class grew so large by the nineteenth century that a sizeable population began to try to escape it. Europeans were shocked to see the western frontier populated not only by drifters and refugees, but also by prosperous eastern farmers who wanted more land, who risked ruin and death

for the chance to get rich. Other successful people moved west to escape conformity—social, religious, or otherwise. Traditionally in world history, mines were worked by slaves or oppressed peasants. In the United States, college graduates, clerks, and men with property flocked to mining camps all over North America (to dig and play poker). Even more surprising, these same kinds of people often volunteered to serve as foot soldiers in wars (to fight and play poker). All of them threw away middle-class security to bet their lives and fortunes for wealth or freedom, and many of them found both. This unprecedented combination of opportunity and anarchy produced both poker and modern finance.

That some risks cannot be calculated does not justify ignoring careful strategies or acting on blind hunches. In the last 15 years, the field of risk management in finance has developed sophisticated mathematics to transmute chaotic profits of traders into valuable revenue streams. For the first time, there is a legitimate science of uncalculated risk. The key is not minimizing risk, but managing it. A trading desk with good risk management can take on risks that would blow up an unmanaged desk. The same techniques can be used in poker and other risky endeavors. Poker players who understand risk management principles can play more aggressively in larger-stakes games with smaller bankrolls and have a better chance of succeeding.

RISK RULES

Here are four rules for taking incalculable risks. They apply to poker and trading, to getting married, to hitchhiking to New York to become an actress, and to devoting your life to developing a new theory of physics that everyone thinks is crazy.

1. *Do your homework.* Think like a middle-class person. Is there a safe way to get the same result? Can any of the risks be calculated? You don't stop figuring just because there's one aspect about which there is no useful information. Can you learn anything from people who have tried this before? Caution follows from my respect for risk. You must avoid unnecessary risks and, just as important, avoid taking risks blindly when they can be calculated. In traders' terms, you must take risk only when you're getting paid enough for it. In poker terms, you must extract all the value you can as a cardplayer before you start relying on your poker skills.

2. *Strike for success.* As Dickson Watts wrote in his nineteenth-century classic *Speculation as a Fine Art,* risk taking requires "Prudence and Courage; Prudence in contemplation, Courage in execution." If you do decide to act, act quickly and decisively. Go for maximum success, not minimum risk. Remember Macbeth's resolution after he decides to attack Macduff's castle: "From this moment, the very firstlings of my heart shall be the firstlings of my hand." If you want to learn to ride a bicycle, you have to get on and pedal. You might crash, but you might learn how to ride. If the risk is too great, don't get on the bike. Going slow guarantees both not learning and taking a fall.

3. *Make the tough fold.* A popular method for losing at poker is to become "pot committed." After deciding to put a large bet in the pot, a player refuses to give up, even when subsequent events make it wiser to fold the hand. To be even an average poker player, you must often throw away good cards, regardless of how much you have bet on them, even when there is a good chance that you could have won the pot if you kept betting. And you must learn to fold as early in the hand as possible. Traders know well: "Your first loss is your least loss." As

you attack incalculable risks, you learn things that help you calculate. If the result of that calculation suggests that you are not getting sufficient odds to justify further investment, give up just as quickly and decisively as you began. By the way, being willing to fold too soon rather than too late is one reason poker players sometimes make bad leaders. There are situations in which the leader should strive until all hope is gone, even dying on the battlefield or going down with the ship. That can be good for the cause, but it's bad poker and deadly sin for traders.

It should be obvious that application of rules 2 and 3, even moderated by 1, will leave you in a lot of tight spots. Rule 2 tells you not to hold anything back as you strive for success, and 3 tells you to give up often. If you keep anything in reserve, if you bet only what you can afford to lose, if you insist on a good plan of retreat, you should stick to risks you can calculate. But if you do choose to embrace incalculable risks, there is a safety net of sorts:

4. *Plan B is You.* The only assets you can count on after a loss are the ones inside *You:* your character, your talents, and your will. You don't have to relish the idea of being friendless and broke in a strange place, but the thought of it cannot fill you with despair. It's not quite this bleak: There are some social structures and economic institutions that can often soften your landing a little. You can form networks among like-minded adventurers or join an organization that truly supports risk taking. But the networks are not always reliable, and the organizations are rare and selective. However big the loss, the true gambler will survive. As the saying goes, no one commits suicide at the racetrack. They might miss the next race.

Let me emphasize that these four rules are not a recipe for success. I don't have one of those. At best, if you master all four of these points, you are not certain to fail. If your goals

are modest and you have adequate resources, you are likely to succeed. I can't quantify that, of course, because we're talking about incalculable risks, by definition. If your goals are wildly ambitious relative to your resources, you're likely to fail. But you might succeed. If having a real chance of succeeding—and a real chance of failing—is more attractive to you than what life offers in low-risk and calculable options, this book can guide you along the treacherous path you've chosen.

FINANCE AND GAMBLING

Finance can only be understood as a gambling game, and gambling games can only be understood as a form of finance. Many people have no trouble accepting the first part: They believe Wall Street is a big casino. When New York introduced offtrack betting (OTB) in 1971, it chose the slogan "If you're in the stock market, you might find this a better bet." Bernard Lasker, the chairman of the New York Stock Exchange at that time, sent a telegram protesting the comparison of horse race betting to stocks. New York City OTB president Howard Samuels replied, "I am sure that some of the 48,972 horses that raced in this country in 1970 feel they are a better investment than some of the dogs on the New York Stock Exchange." He may have been right: That month, April 1971, the Dow Jones Industrial Average closed at 941.75. That was the peak value in inflation-adjusted terms for the next 21 years. But even people who side with Lasker admit that many market participants are gambling.

However, I mean something different from the superficial comparison that you can make or lose money in Las Vegas or on the New York Stock Exchange. I mean that financial products have additional risk embedded in them, the same negative-sum, pure-random risk that underlies roulette and

craps. It’s true that a long-term buy-and-hold investor of a diversified portfolio of stocks is taking real economic risk, but that’s a tiny fraction of what goes on in the stock market. No one gets paid a lot of money to sit around worrying about what the average return on equity will be over the next 20 years; no one screams and shouts about it. People do get paid a lot of money, and scream and shout, to trade one stock versus another or buy a stock and sell it five seconds later. The average investor in the stock market gets the average return; everything else is just gambling. Anything you win comes from someone else who loses, all relative to the average return. The bets are negative sum because there are taxes and transaction costs from the exchanges, just like the house edge in a casino. And at least in the stock market there is some underlying economic risk; it’s not all one person winning from another. All other markets except commodity markets are zero sum. Every loan or bond has a borrower and a lender; every foreign currency transaction has a buyer and a seller; every derivative contract has one party paying another. For anyone actually working in the markets, all the excitement and opportunity come from these kinds of bets.

Economists sometimes argue that these transactions contribute to capital allocation and provide important price discovery. But most capital allocation takes place outside the trading markets and, anyway, is far too indirect to justify the amount of trading that takes place. While there’s no doubt that the price discovery function is useful, no corporate manager needs to know a different stock price every second or the prices of dozens of different securities that all add up to one economically unitary firm. There are far more important social questions whose answers can be provided with amazing accuracy by auction markets, yet these remain a hobby of academics rather than a major economic institution.

I think that risk is added to financial products for four reasons, in increasing order of importance:

1. *Risk makes products more attractive to investors.* People like to gamble, so financial institutions add risk the way a fast-food company sneaks extra fat, sugar, and salt into its offerings. This is the first reason that occurs to most people, and it's true, but it's the least of the reasons.
2. *Risk is essential for capital formation.* People have to be persuaded to take assets that could be used for consumption and think of them as sources of future income. You need risk for this the way you need heat for cooking.
3. *Risk creates winners and losers, and a dynamic economy needs both.* Everyone is born with a lot of options in life, and volatility increases the value of options. The concentrated capital of winners is a force for change, and losses have freed many a loser to exploit the value of options a comfortable person would ignore.
4. *Risk attracts traders.* Traders are not passive order takers, but a hugely important dynamic force in the economy. There is a reason the successful ones make so much money. Without enough risk, the right kind of people don't show up.

The reason I think these things are true is that they explain lots of details about how financial markets are organized that conventional accounts do not. They explain what things are traded and how markets are organized. They explain the level of volatility, the margin requirements, and the profit distribution among traders.

I hope I don't come across as a crank with a theory of economics that no one has thought of before. There are many different ways to view financial markets, and each of them can have some truth. I don't claim that every other explanation of financial institutions is wrong; I claim only

that it can be enlightening to traders and gamblers to consider their institutions from the other's perspective. Even if the analogy is not exact, it is illuminating and can serve as an antidote to the narrow thinking and blindness that can lead to disaster.

Modern finance is not an ancient or natural economic system, nor is it only what can be bottled in the form of financial models and analysis. It was developed in the area drained by the Mississippi River between the time steamships opened the vast natural resources for exploitation in the early 1800s and the completion of railroad networks in the last decades of that century. It combined the economic insights of John Law, a Scottish gambler turned French banker, with an extraordinary economic system based on dynamic self-organizing networks used by the Native Americans in the region, catalyzed by some innovations imported with natives of the Congo River and Niger River economies. The first person to publish an explanation in mathematical terms was the finance professor and banker Fischer Black.

A river network with dispersed population and difficult overland transportation induces a far more flexible and dynamic economic system than is found in areas where trading is dominated by roads and ports connecting towns. The American economic miracle was born in the futures exchanges of the West, not in the banks and stock exchanges of the East. It is no coincidence that poker was invented in the same time and place.

AN EXAMPLE OF THE TRADING GAME

Consider the price of a share of stock. An economist might point out that the stock represents an interest in the profits

of a company and try to predict its value by analyzing the probable future profits and when they might be transmitted to investors. This is called *fundamental analysis.*

Finance professors emphasize a different view. They do not deny that stocks and other securities represent economic fundamentals, but valuation from first principles is too hard. No one seems to be able to arrive at a more accurate price than the current market price. Therefore, it makes sense to treat the stock price as a gamble, a number that can go up or down with some probability. This is called the *random walk theory.*

It's perfectly possible that both fundamental analysis and the random walk theory are sound. When a roulette ball is spun around the wheel, the laws of physics will dictate where it ends up. But the results are so hard to predict that for most purposes you can analyze roulette spins as random numbers. Claude Shannon (the father of information theory) and Ed Thorp (the mathematics professor who invented blackjack card counting) and their wives were just the first of a line of inventors of electronic devices that predict roulette spins. Claude also built a mechanical hand that could flip coins that landed reliably heads or tails, whichever he specified. For these people, roulette and coin flips are fundamental events to be analyzed by physics. However, most of us are content with treating them as random.

But there is another type of behavior that is important for trading that cannot be explained either by fundamental economics or by statistical theory. It doesn't contradict those views; it is just another way of viewing the same price movements. It helps some people but not others. It is sometimes called technical analysis, but that term has acquired a taint from people who use it outside its area of applicability and make it into a mystical faith rather than an everyday money-making tool.

One common traders' rule is that before any large move, the market takes out the stops. The best-known kind of stop is a stop-loss order (technically, a *stop-sell* order). An investor tells her broker to sell a stock if the price drops below a certain level. This is a technique for limiting losses from investing in stocks. There is also a stop buy, an order to buy a stock if it rises above a certain price. This is more popular with professional investors. The traders' rule does not just refer to formal stop orders filed with brokers or exchanges; there are also people who will choose to sell if a price falls or will jump in to buy if a price rises. Others will be forced to do those things—we call them "weak hands." An investor may have borrowed so much money to buy stock that if the price declines, his creditors will force him to sell. Or a portfolio manager who failed to buy a popular stock may be ordered to buy it by his boss if it continues going up.

To oversimplify a bit, suppose a stock is selling for $25 and there are stop-sell orders for a million shares at $23 and stop-buy orders for a million shares at $27. These orders will make for a nervous market. If the price starts falling, traders will want to sell before the million share orders to sell at $23 hit. So they'll start selling at $24, which will push the price down to $23.75, which will induce more selling, which could trigger the stops. As soon as one share trades at $23, a million stop sells become market sells (unconditional orders to sell at whatever price is available), and the price might drop to $22.

After the million shares have been absorbed, the price should start moving back up to $24. After all, there was no reason other than fear of the stops that pushed it down from that point. As it increases, traders will start to get greedy about the million buy orders that kick in at $27. Everyone will want to buy before those orders hit. That could push the price up to $27, triggering a million buys and pushing the