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SEEING
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TOMORROW

Rewriting the Rules of Risk

RON S. DEMBO
ANDREW FREEMAN



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This book is the product of a true collaboration. Andrew Freeman met Ron S. Dembo in 1995, when he was researching an article on risk for *The Economist*. He visited the offices of Algorithmics Inc., in Toronto, expecting to hear typical corporate PR. Instead, he was swept into a whirlwind conversation about Risk and Regret—concepts that had long preoccupied Dr. Dembo and formed the intellectual basis of his software business. Intrigued, the journalist and the academic-turned-entrepreneur debated whether they should try to write, together, a work that described new ideas about the way we all make decisions involving risk. Much cogitating and many late nights ensued. Ideas were swapped by telephone, e-mail, and fax, and even in posted letters, as the project grew in scope. The result is *Seeing Tomorrow*.

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Ron S. Dembo
Andrew Freeman

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Introduction

IT REALLY HAPPENED

Imagine for a moment that it is late 1994 and you are George Soros, one of the world's best-known investors. In keeping with your lofty status and your desire to diversify your investments, you have formed a joint venture with Paul Reichmann, one of the world's best-known property developers. The combination of your resources is staggering: between the two of you, skylines in several major cities have been reshaped, and governments have been brought to their knees. In this latest coup, you stand together on the brink of a huge deal in fast-emerging Mexico that will add hundreds of millions to your already substantial fortunes. At the last minute, however, there is a hitch. Your prospective local partner in the deal wants better terms, to reflect some turbulence in currency markets. The Mexican peso has suddenly fallen and could fall further. Will you agree to change the contract by 10 percent in your local partner's favor? How should you approach this decision? Do you lock in a sure thing today? Or do you wait, hoping that things will improve so that your returns become even better? Do you concede or do you play hardball?

Two of the world's shrewdest business brains, George Soros and Paul Reichmann, got this deal completely and horribly wrong—so much so, it fell apart. To their dismay, they never did gain the prime site in Mexico City that they had hoped to develop. The full story is an object lesson in how not to make decisions about risk (see Chapter 1). These titans went wrong because they made a classic error in thinking about their decision: they failed to take into account the possibility that

things could go from bad to worse. They underestimated the Regret that they would feel if the deal failed altogether.

Big players are not alone in making such mistakes. Average people may think in different terms, but they regularly face decisions about risk that can have a huge impact on their lives. Most readers probably know someone who lost everything in the housing market at some point in the past fifteen years. In London, New York, and Toronto, house prices have swung up and down with alarming speed. A safe equity cushion one day has become a yawning “negative equity” debt the next. Today’s expensive and desirable studio apartment can become tomorrow’s unsalable and poky white elephant. Even as this book was in preparation, one of the authors, who sold a house in 1994, watched in dismay as property prices in England defied expectations and rose to new heights. (In Chapter 6, we offer some telling examples of just how poor the thinking about house price risk can be.)

The truth is, calamities do happen. Sometimes, as was the case with Mexico in 1994, the reverberations are felt throughout the world’s financial markets and economies. Such events make palpable what we know to be true in theory but, like George Soros and Paul Reichmann, too often overlook or choose to ignore in practice. Risk lies ahead of us, not in the past. It is no use looking over our shoulder and assuming that we can find there all we need to know. In that stance, we will never see the vehicles that are bearing down on us. (Mexico’s apparently stable exchange rate fooled almost everyone.) Yet, looking over our shoulder is precisely what most of us do, in business and in our personal lives. How many of us have metaphorically kicked ourselves for wrong decisions that seem obvious and easy in retrospect? Chances are that we were guilty of poor thinking, a.k.a. past thinking.

For centuries, mathematicians, economists, and philosophers have sought ways to model how we make choices. Our behavior is governed by many things—our tastes, our budget, and our appetite for risk, to name a few. Our measurement and management of financial risk are

based on our ability to relate some central ideas. What is our risk exposure? Can we do things that will limit our risk? Are there potential controls that will protect us against suffering excessive loss? We all face risk decisions. Daily, we must make decisions that involve financial risks:

- Should we buy a house now?
- Should we invest in the stock our broker is suggesting?
- Should we pay the seemingly high charge for per-diem car rental insurance during a vacation? Should we take a \$1,000 deductible and pay \$800, or a \$50 deductible and pay \$3,000 for insurance on the car we own?
- Should we set aside a college tuition fund now, for our three-year-old daughter?
- Should we start a pension plan and, if so, how much should we set aside?
- Should we undergo an experimental medical procedure that might cure us of a long-standing illness?
- Should we refinance our mortgage now, or later?
- Should we buy a lottery ticket?
- Should we go on strike and risk losing our job?
- Should we, as owners, refuse a wage-increase demand and risk a strike that might destroy our business?

As we face and make many of these decisions, we will occasionally Regret our choices.

Individuals are not unique in facing such decisions. Financial institutions—banks, brokers, and insurers—are nothing more than risk traders who buy one risk and sell another. Their business is based on profit from risk, and they are barraged with opportunities for risk taking. In recent years, as financial markets have become dramatically

more complex, these institutions have had to develop innovative ways of controlling their risk exposures. But it is inherently difficult for these banks, investment firms, and insurance companies to understand the extent of the risks they are assuming at any given moment. Their ability to understand risk often lags seriously behind their urgent need to do so.

What guides people when they must make a decision in a financially risky setting? Why do different people place differing amounts on the same bet? Why do some people have larger exposure to mutual funds than others? Why do people change their strategy as the stakes change in a game? How do people measure risk? On what basis do they decide whether to accept a risky bet? Why do they buy lottery tickets or insurance policies even when the odds are against them? How should banks measure and control risk so that the financial system remains healthy?

There are no simple answers to these questions. However, in our increasingly complex world, we are forced to make decisions that, more and more, involve understanding and systematic assessment of these and other risks. Just think of how much more choice and complexity we encounter compared to our parents. How many options did they have to choose from when mortgaging their house, choosing life insurance, or investing? Mutual funds, or such exotic instruments as exchange-traded options, were scarcely available a generation ago. No one had yet dreamed of mortgage-backed securities. It was almost impossible to buy exposure to foreign markets. Today, these all exist; tomorrow the choices will multiply. So what are we to do? It is no longer good enough to operate on intuition alone. We require tools to help us quantify the options we face.

We have written this book because we think it is time to rewrite the rules on risk. Too many mistakes have resulted from outmoded and flawed approaches to its definition and management. Strangely, most people seem to have given up asking simple questions about risk.

It is true that some progress has been made in quantifying and measuring risk. Huge markets now exist in financial instruments known as derivatives, which are designed to lay off or assume risks of various kinds. Individual investors now take for granted information about their investments that was once unavailable or reserved for large institutions. But we believe that most of the methods available and in use today are inadequate for analyzing the types of risks that investors face.

In some respects, people are far more aware of the problem than they used to be. Masses of consumers have shifted their savings from low-paying bank accounts into money market accounts or more aggressive mutual funds. They have been actively assuming risk in exchange for greater returns on their cash. And people purchasing insurance can make much more finely calibrated decisions about how much risk they wish to anticipate (as we will see, this market remains frustratingly slow at developing useful new policies).

Yet much of this increased awareness and embracing of risk has been accompanied by a collective shrug of shoulders. People know they are exposed to more risk, but that's OK; nothing terrible will happen. In contrast, we think that many of the everyday ways in which we are exposed to risk are mistakenly overlooked. Moreover, they share common elements with the more formal risk disciplines that are associated with financial markets and banking.

Holding an investment or a portfolio of investments is like taking a gamble. At the end of the race (which could be tonight, next week, or years hence), we will either win or lose. Yet, as we all know, when we place a bet we are faced with a single, unique decision that will probably not be repeated or will only be repeated a few times. We need to make that decision despite the uncertainty the future brings, and we need to make it *now*.

We will show that many bankruptcies, bad deals, and large losses come about because scenarios under which we might lose in a big way were never considered. A few people, it is true, adopt a structured

approach to decisions that involve risk. They literally map out their options and assess the pros and cons implied by each one. Many more people tend to act intuitively. “Go with your gut” is a common approach, and, as often as it succeeds, it produces horrendous results that leave people in unhappy circumstances. It is revealing to analyze some of that intuitive process. By doing so, we can gain new insights into the role risk plays in our everyday lives.

Although questions about risk permeate our daily activities, many of our existing views of risk are too narrow and too formal. In fact, our knowledge about risk is still in its infancy. We lack accepted definitions and agreed-on ways of measuring risk. In particular, we too often assume that what has happened in the past will prove a reliable guide to the future. In the following pages, we will describe a number of concepts that will change all that. Some of these are the result of years of research by Ron Dembo. Through Algorithmics, his software firm, he has shown that apparently abstract ideas can have practical and powerful applications in the real world. Moreover, the framework set out in this book is no different from the one Algorithmics uses to help the world’s most sophisticated banks manage their risks.

The central concept we introduce is Regret—the neglected “R” behind Risk and Return. As we will see, Regret is a common enough idea in several branches of academic economics and finance. But its applicability to risk management has been almost entirely missed. We hope to show that Regret is a powerful tool for aligning how we intuitively judge risks with the more formal methods that we use for quantifying them.

But our purpose is far broader and more ambitious than this single concept. We hope to set out a convincing new way of thinking about risk, beginning with identifying the basic building blocks and then using them to construct a firm structure for risk management and risk-adjusted performance measurement. In the following chapters, we show ways of visualizing risk that help to explain the new rules. We also make a few calculations to illustrate how risk measures work in

practice. No one should be put off by the math involved. Where possible, we use words to augment and explain our use of symbols. Most mathematicians confess that they sometimes struggle with symbols; they must read and then slowly reread a proof of a theorem before they can be satisfied that it is correct. The process is not unlike reading a recipe several times before we relate the instructions to the ingredients that are needed to make a dish. Only the best chefs can hold an entire menu's recipes in their heads. For any reader who feels "stuck" or confused by a passage, we have simple advice: Don't be afraid to read it again!

None of us can afford to ignore risk; it is always present in our lives, and all of us need a better framework for understanding and managing it. We offer the framework described in these pages as a step in the right direction. We think that it captures, much more than others, how we as individuals actually think about risk. Our framework is built around our view of the future, not modeled solely on the past. And it is adaptable enough to allow each of us to express our own forward-looking attitudes and fears, rather than relying on an assumption that other people share broadly similar views. Unlike some commonly used numerical and statistical measures of risk, our framework is also closely aligned to our intuitions about how we feel when we eye one risk relative to another. Finally, we suggest that our approach allows a consistent view of risk. It is coherent whether it relates to a single investment or an entire portfolio. Where other measures of risk break down or are manifestly inadequate, we suggest new and powerful ways of approaching the subject.

We take inspiration from the picture that so dramatically graces the cover of this book. Painted by Caspar David Friedrich around 1818, this highly Romantic image is called "Wanderer above a Sea of Fog"—an apt metaphor for how we face the future and the risks it will bring. If, like the subject in the painting, we look forward, the landscape is wild, indistinct, and hazy, as if obscured by fog. We can see vague outlines; occasional flashes of detail emerge, such as the trees that are startlingly

clear along some of the rocky outcrops. How should we travel in this mysterious landscape? From our vantage point, we can imagine different possible paths, but each is foggy, perhaps containing perils and travails. How can we navigate in such a world? Without seeing what tomorrow will bring, how we can manage our affairs with sufficient confidence today?

The effort to see tomorrow has ancient precedent. Raymond DeVoe, a stockbroker who writes a wry newsletter replete with history, points out that the Romans gave us the word “speculator,” derived from *specula*, a watchtower of the kind that ringed imperial Rome at strategic intervals and from which approaching danger could be spotted. By the apogee of the Roman Empire, the watchtowers stretched for thousands of miles, acting as an early warning system that allowed the swift dispatch of legions to wherever trouble was brewing. Thus, a pure definition of a speculator is: someone who tries to see dangers in the future and act upon them. Only more recently did the word “speculator” acquire a pejorative edge in financial markets! DeVoe also reminds us that Friedrich was not the only artist who has captured the sense of peering into the unknown. Frederick Remington painted a dramatic and famous picture called “Friend or Foe?” It shows an Indian brave on his horse atop a cliff. Amid poor light and swirling snow, he is focusing on a distant line of riders in the valley below. Whether they represent a threat or are returning friends is impossible to tell.

In one fundamental respect, decisions involving financial risk are different from other decisions that we face in life. Whereas many facets of daily life shift with glacial, almost predictable, slowness, financial markets can change in the blink of an eye. Think about it. Let’s say you wish to hire a carpenter to build some shelves. In this case, you can be pretty confident that the carpenter who was excellent six months earlier will still be at the top of his trade. In other words, history is an excellent guide. It is unlikely that someone who was very good then will be incompetent now.

Contrast this with finance. A brilliant fund manager can lose everything in a matter of days. Sometimes mere minutes can send a high-flying company's shares into free fall. History is no guide, or at best a guide that can be dangerously misleading. So rapidly can things change that complacency is extremely risky.

In sum, there are times when our intuitions about what is safe are unreliable. A good carpenter does not equate to a good investment. When we buy a share, we cannot relax and assume that we know exactly what we have bought.

As Kenneth Arrow, a Nobel laureate in economics, wrote, "[Our] knowledge of the way things work, in society or in nature, comes trailing clouds of vagueness." We can never know exactly what will happen in the future. But, like the wanderer facing a sea of fog, we can try to blow away some of the clouds of vagueness so that we can better understand and manage risk.

Chapter 1

HOW TO THINK ABOUT RISK

We have mentioned Paul Reichmann in our earlier comments. The Reichmanns are property moguls who bestrode the world until their huge empire collapsed in 1991. They provided rich material for one of the twentieth century's great business stories. Less well known is the fact that, in 1994, they very nearly pulled off a miraculous comeback. A few well-informed readers might recall that they entered a joint venture with George Soros, the famed speculator whose market-moving abilities have caused major controversies from Britain to Malaysia. But only a tiny number of people know that the Reichmanns disastrously blew a second chance to rescue themselves from oblivion, and they destroyed their venture with Soros in the bargain.

Having made and lost a fortune redeveloping vast swaths of cities such as New York, Toronto, and London, the humbled Reichmanns looked further afield in the early 1990s. In search of a new deal that would relaunch their operations, they hopped smartly onto a hot trend—the rise of new economies and so-called “emerging markets.” Their dream was a multibillion-dollar development in the capital of one of the fastest-growing economies in the world. Mexico appeared poised on the brink of emergence into an established and accepted economic force. Its trade links with America and Canada were about to be ratified and liberalized via the North American Free Trade Agreement (NAFTA) treaty (signed by President Bill Clinton in 1993). But the city had very few modern office buildings, and rents were high in those that did exist. What could be more appropriate than to