Making Everything Easier!™

Financial Risk Management

FOR DUMMIES®

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Learn to:

- Recognize financial risk and successfully manage it
- Analyze the different risk methodologies and apply them effectively to your situation
- Utilize complex risk management tools such as stop losses, drawdown control and hedging
- Build upon your success by complying with risk regulations and understanding risk reporting

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Published by: **John Wiley & Sons, Ltd.,** The Atrium, Southern Gate, Chichester, www.wiley.com

This edition first published 2016

Registered office

John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, United Kingdom

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A catalogue record for this book is available from the British Library.

Library of Congress Control Number: 2015951253

ISBN 978-1-119-08220-0 (hardback/paperback) ISBN 978-1-119-08218-7 (ebk)

ISBN 978-1-119-08219-4 (ebk)

Printed in Great Britain by TJ International, Padstow, Cornwall

10 9 8 7 6 5 4 3 2 1

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Contents at a Glance

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Introduction

Risk management is about preparing for anything that might happen. People who try to predict the future are the enemies of risk management. They're the ones who say, 'Let's build a wall on the north side of town because that's where we predict the attack will come.' Risk managers know that leaving any gap in the wall means the attackers will exploit the gap.

Preventing disaster is easy – you just don't take any risk. Risk management is about surviving disaster, not preventing it. If there weren't disasters, you wouldn't call it *risk.* You need risk – and its attendant disasters – to learn, to grow, to excel.

If you want to be a risk manager, this book gives you a good start. You need practice at risk taking, plus some maths and financial theory, plus some practice at finance. If you already have all of those things, you should be writing this book, not reading it.

About This Book

People have been concerned about risk as long as there have been people. *Financial Risk Management For Dummies* explains the background and some theory about risk, quantitative analysis of risk and modern financial risk management and shows you how to apply them in practice, without jargon or mathematics. Okay, I throw in a few examples that require addition and multiplication, but they're clearly labelled and can be skipped, and I also give you lots of simple, specific illustrations.

This book tells you what financial risk managers do and why they do it.

Foolish Assumptions

I make three different guesses about who you are and why you're reading this book:

- You're currently, or hope to be, a financial manager, and you want to delve into the risk management aspect of your job. By itself, this book cannot teach you that, but if you already know the basic financial theory and mathematics or go elsewhere to discover them, this book can show you how to apply them properly to become a good financial risk manager.
- You work with financial risk managers and want to understand how they see things. This book can show you the world from their perspective, and help you form constructive partnerships.
- You have no professional connection to finance, but want to understand both the good risks in finance, the ones that help the economy grow and people realise their dreams, and the bad risks in finance, the ones that damage the economy and blight lives. This book can help you navigate the modern financial system to achieve financial security.

Icons Used In This Book

These little pieces of margin art bring your attention to exceptionally interesting or useful information. That is, except for text next to the Technical Stuff icon, which is information – usually maths – you may find helpful if you're interested.

Simple, standalone advice that you can take to improve your risk management.

Standalone stuff it pays to keep in mind.

Stuff I love and the *For Dummies* editors don't has this icon. You can skip it if you want, I promise all the important ideas are explained clearly in non-technical language elsewhere. But come on, this stuff is really fun and a little maths won't hurt you.

This icon marks stuff not to do. In risk management, if you do something you're not supposed to, it isn't usually actually dangerous. This icon marks situations that may seem attractive in the short run but that defeat the long-term goals of risk management.

Real-world scenarios, and sometimes real-life maths, get this icon.

Beyond the Book

Risk is a big topic, too big to fit entirely into the book or e-book you're holding at the moment. I put some additional material on the web. I created cheat sheets (`www.dummies.com/cheatsheet/financialriskmanagment`) with the key ideas for managing seven specific kinds of risk:

- **Market risk:** Uncertainty due to changes in market prices.
- **Credit risk:** Uncertainty due to a failure of an external entity to keep a promise.
- **Operational risk:** Institutional uncertainties other than market or credit risk.
- **Liquidity risk:** Uncertainty about terms and the ability to make a transaction when necessary or desired.
- **Funding risk:** Uncertainty about whether investors will provide sufficient funds.
- **Reputational risk:** Uncertainty about how your entity will be perceived.
- **Political risk:** Uncertainty about government actions.

I also stick in some concentrated summaries of four sections of this book: Measuring Risk, Communicating Risk, Managing Risk and Working as a Risk Manager. You can also access bonus material at `www.dummies.com/extras/financialriskmanagement`, including ten great links that illustrate ten financial risk management lessons is amusing and dramatic fashion, from killer molasses to an Olympic David versus Goliath tale.

Where to Go From Here

If you know nothing about finance or risk and want to be a financial risk manager, I recommend reading this book in order. But, you can jump around to whatever chapters and sections seem interesting. Switching back and forth between theory and practice, between high-level views of the forest and detailed descriptions of individual trees may be the best way to understand what modern financial risk management is all about.

If you know nothing about finance, risk or financial risk management and are walking into work for your first day as a financial risk manager of a major global bank, turn straight to Chapter 10 and follow the directions step-by-step through to the end of Chapter 13.

If you're really in a hurry, turn right to Chapter 20 and get all the really important stuff in ten minutes. Not ten minutes to *read*, ten minutes to *read and do*!

Wherever you start, I trust you'll find information you can put to use.

Part I

Getting Started with Risk Management

For Dummies can help you get started with lots of subjects. Visit www.dummies.com to discover more and do more with For Dummies.

In this part . . .

- Recognize risk and distinguish it from danger and opportunity.
- Choose the right framework to make risk decisions.
- Take charge of risk: identify the goal, consider the options, and make the decision.
- Manage risk in the front office of a financial institution: set limits, approve trades, approve portfolio strategies, and deal directly with risk takers.
- Manage risk in the middle office of a financial institution: determine risk appetite, set risk policy, deal with the board and senior management, and work with regulators.
- Manage risk in the back office of a financial institution: create control frameworks, compile reports, monitor constraints, and identify issues.

Chapter 1

Living with Risk

In This Chapter

- Exploring the idea of risk
- Managing financial risk
- Informing people about risk

Life is risk, and risk is life. Nobody knows what tomorrow may bring. As the poet Robert Burns famously put it, 'The best-laid schemes o' mice an' men, gang aft agley, an' lea'e us nought but grief an' pain, for promis'd joy!' (Roughly translated, Burns warns that careful plans can come to nothing.)

While most of us instinctively first think about bad risk, good surprises happen as well. 'Fortune favours the bold,' we are told, and, 'Sometimes things just go your way.' In fact, risk is more than just sometimes good, it is essential. As another saying goes, 'The only place with people and no risk is a graveyard.' Religions, philosophies and especially superstitions are deeply rooted in ideas about risk.

My topic is managing risk, not risk itself, which means that I don't cover all the risks you can't control – the sun going supernova tomorrow or being diagnosed with a genetic heart condition, for examples. Also, my topic is financial risk, so I don't talk about risks that aren't priced in the financial markets. That still leaves me with a large topic, but one I can cover in enough detail to be useful.

Understanding the Scope of Risk

Finance professor Elroy Dimson defined *risk* as meaning that more things can happen than will happen. Although stated in a folksy way, this idea is a deep one that comes from information theory and statistical thermodynamics. The tremendous range of future possibilities creates a kind of force – a tendency to disorder, a decay of information – called *entropy*. Entropy isn't a physical

force like gravity or magnetism, yet in the long run it determines both the fate of the universe and whether the 'best-laid schemes o' mice an' men' bring grief and pain or promised joy.

Everything humans try to do can be thought of as attempts to influence what will happen, but even the most precise and complicated plans are vastly simpler than the range of things that might happen. This essential feature of risk is lost when risk is reduced to probability distributions. These distributions require that the range of future outcomes is known exactly. In most cases of practical interest, probabilities can be estimated reliably only for outcomes that have actually happened in the past, and they only have much use if decisions are repeated often enough that each potential outcome actually happens.

This doesn't mean that conventional statistical analysis is useless – far from it. I'm a big fan of quantitative reasoning. But the risk in risk management is something distinct from the risk that can be modelled with probability distributions.

One popular approach is to model risk as a casino game. This *frequentist* approach can yield insights, but it is very limited. Casino games can be played over and over, and have a known range of outcomes with known probabilities. Real risks only happen once, and you can only guess at the range of outcomes and probabilities. Author Nassim Taleb has dubbed this approach the *Ludic Fallacy*. If all risks were playing roulette or drawing cards, we wouldn't need risk managers.

Another popular approach, called *Bayesian*, treats all risk like bets on a sporting event. This is more accurate than the frequentist approach because it can handle events that only happen once, with some unknown potential outcomes and only guesses about probability. But it is still a limited model that does not capture all important aspects of risk. Risk managers draw on a broad spectrum of risk models, frequentist and Bayesian, plus models drawn from evolution, statistical thermodynamics, behavioural studies and game theory. And they know that even with all the different analytic approaches, important aspects of risk are missed.

Consider a teacup. You know that teacups can shatter into shards and dust, and also that shards and dust never spontaneously recombine into a teacup. Why? Because of all the possible arrangements of the atoms that make up a teacup, only a negligible fraction actually are a teacup. That's all you have to know to predict that a teacup is fragile. It can shatter, but it can't self-construct. Any sufficiently large change in conditions – impact, temperature or others – will destroy it. If I have a china shop, I know that it won't last forever; I don't need a bull to destroy it. Risk and time are enough.

Some things in the universe do come into being spontaneously – stars, for example, and people and crystals. In many cases these things gain from disorder and change. They can be destroyed, but they can also recreate without outside help.

The same thing is true of human plans and institutions. Some are fragile. Disorder and change only hurt them. Such plans will fail, however solid they seem. Perversely, people often respond to risk by building in more fragility, making the teacup heavier and stronger but no less exposed to risk and time. Risk managers don't ask how strong your teacup is, they ask how it will respond to the unexpected events that the future will bring. Will it gain or lose? That's what really matters, because although the events are individually unexpected, you can be certain that unexpected events will occur.

Risk management isn't about predicting or preventing disaster. Risk management isn't about estimating probabilities or outcomes. It *is* about constructing plans or institutions that will thrive under disorder. It's not about guessing what will happen – in fact, people who guess are the enemies of risk management. Risk management is preparing for anything that might happen. Preparing not just in the sense of having contingency plans to avoid problems, but also in the sense of being ready to take maximum advantage of opportunities.

Measuring risk

I don't talk much about measuring risk. For the most part, risk that can be measured can be insured, avoided, hedged or diversified away. Generally I insist that line risk takers do all the measurement and mitigation they can before I take over the job of managing the residual risk.

Of course, there's room for risk measurement in risk management but less than outsiders tend to think. In addition, it's definitely true that bad risk measurements, as well as inappropriate attempts by inexperienced risk managers to measure non-measurable risks, do a lot more harm in risk management than good risk measurements do good. (I talk about the various components of risk in Chapter 6.)

To see what I mean, consider the graph in Figure 1-1, which shows the distribution of daily returns for the S&P 500 index over the last 50 years.

You have various ways to measure the spread illustrated by this graph. You can compute a standard deviation, a mean absolute deviation, an interquartile range or something else. For that matter, you can just reproduce the graph. However, there's something misleading about representing the data this way: You cannot see the essential risk on this graph, and the risk you think you see is largely irrelevant.

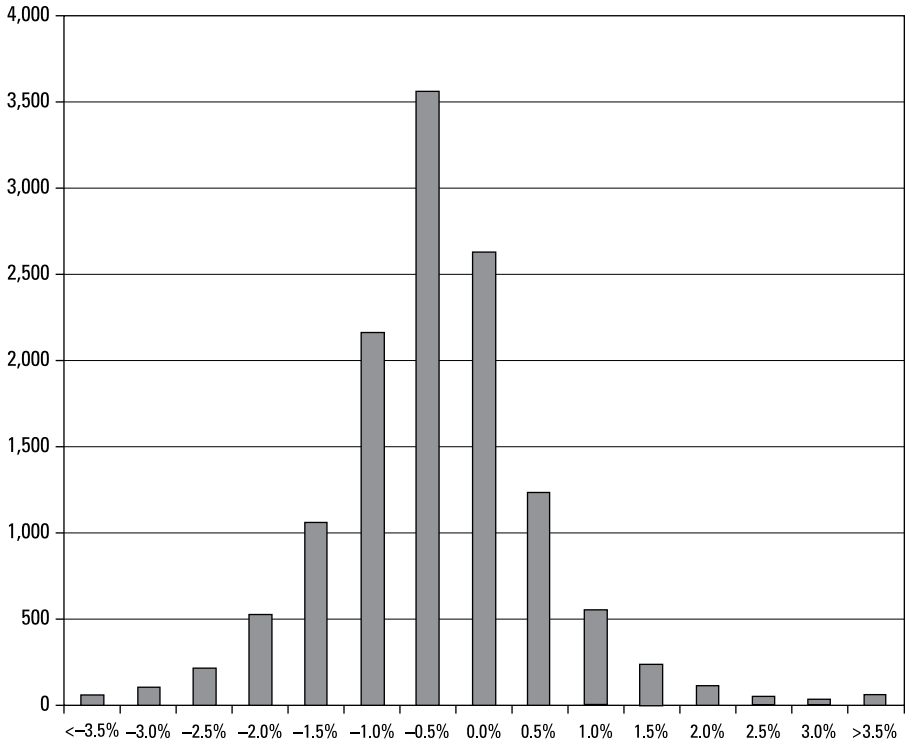

Figure 1-1: Daily returns on the Standard & Poor 500 stock index from 1965 to 2015.

In round terms, the stock market has turned £1 into £100 over the last 50 years. On about 99 days out of 100, the market moved less than 3.5 per cent in either direction. But consider the 80 days on which the market went up more than 3.5 per cent. They're barely visible on the chart, but collectively they caused about a 4,000 per cent increase in wealth. All other days were responsible for about a 150 per cent increase. If you consider the 60 days when the market went down more than 3.5 per cent, they collectively turned £1 into £0.03.

Now the 150 per cent increase from the 99 per cent of normal days isn't insignificant. However, most of the action, especially to a risk manager, happens in the 1 per cent of extreme days, which are nearly invisible. This percentage isn't true just of stock market returns, but also true of many important things in the world.

Consider the risk going forward, which of course is what matters. Suppose that you're considering an investment in stocks with a 1,000-day horizon – about four years of trading days. You expect to get 990 normal days in which

the market moves less than 3.5 per cent. You may get 996 or 987 or even 1,000 such days; but you won't get much different from 990. Also, getting a few days more or less won't matter much because the average return on these days is 0.04 per cent, and no day can make a difference of more than 3.5 per cent. With 990 or so events and limited range, you're highly likely to get something quite close to the expected outcome. Moreover, you have lots and lots of historical data on what happens on normal days, so you're reasonably confident you know what the expected outcome is. There just isn't a lot of risk in 99 per cent of the days, and what risk does exist can be easily handled by front-line risk takers. After all, if they couldn't handle the stuff that happens 99 days out of 100, you'd have noticed long ago.

You also expect to get about five days when the market loses more than 3.5 per cent, plus about five days when the market gains more than 3.5 per cent. However, there's a lot of potential variability around those numbers. You might get 2 or 8 or even 0 or 10 or more of either one. Each one of these days is significant as they average about a 5 per cent move, and may be as large as –28 per cent or +18 per cent. With only a few events, you can get outcomes far away from the mean. Moreover, you have little historical data, you don't really know how big these days can get; and you can't be confident that your front-line risk takers are prepared for them unless you check.

If you take a closer look, you have even more reason to be concerned about a small number of big days. Markets often don't function properly. You may not be able to trade the way you usually do or at all. Financial intermediaries may fail. Trades may be reversed after the fact. Events may trigger investigations and fines. Financial instruments don't move together as they usually do – correlations are different on big days.

Another problem is that the big days in the market can seldom be tied to observable economic events. On normal days, some fraction of stock price movements occurs in discrete jumps after clear news events such as central bank actions or corporate earnings announcements. A lot of unexplainable *noise* (price movements that cannot be easily explained) is evident too (which doesn't stop commentators from jumping in with explanations after the fact), but it's possible to imagine that prices are changing in response to economic news. On many of the biggest days, no news turns up at all, and on others, the extent and timing of the price move is inconsistent with the news the market is supposed to be reacting to.

If that weren't enough, not all the days the stock market makes big moves are abnormal; some are just normal big moves. On the other hand, on some abnormal days, the market behaves strangely but prices don't move a lot by the end of the day, such as the Flash Crash of May 2010 or the Quant Equity Crisis of August 2007. In addition, you need to consider days missing from the graph because the stock market was closed, such as the days after the 9/11 attacks.

The point is that almost everything a risk manager is concerned about is missing from the graph in Figure 1-1, or is nearly invisible on it. Therefore, any measurement of the graph is of only marginal use to a risk manager. Doing sophisticated analytics on the 99 per cent of normal days can be useful to line risk takers, but it's false precision to a risk manager.

Consider Nassim Taleb's example of a casino that can measure the risks of the bets it makes with its customers at the roulette and craps tables. This risk averages out quickly, and a risk manager who focuses on it would be wasting his time. The three biggest losses of one particular casino in one year were:

- The star performer was mauled by a tiger.
- The owner's daughter was kidnapped and held for ransom.
- It was discovered that a long-time, low-level employee, for unexplainable reasons, had been stuffing tax reporting forms in his drawer rather than sending them in to the IRS for years, which resulted in large penalties.

None of these things would have shown up in a graph of profit and loss from table games bets. None of these risks could have been reasonably measured before the fact.

Never confuse risk measurement with risk management. If you can measure it, you probably don't have to manage it.

Calculating risk

People often like to segregate calculated risk from other types of risk. *Calculated risk* covers situations in which you know the possible outcomes and have good estimates of their probabilities. Examples are the risk of rolling a seven while trying to make your point in craps (one chance in six) or the chance of rain tomorrow. The more general *risk* covers situations where you can't even specify all the possible outcomes, such as starting a war or embarking on a course of scientific research, and have no basis to estimate the probabilities of the outcomes you can foresee.

University of Chicago professor Frank Knight famously labelled the calculated risk as *risk* and the second, more general condition, as *uncertainty*. Risk management is about the uncertainty that remains after front-office risk takers – traders, portfolio managers, lending officers and others – make the calculations that are possible. If you can calculate a risk, you almost always want to minimise it, subject to constraints. For example, a portfolio manager may select a portfolio that minimises annual volatility subject to a constraint that the expected annual return be 8 per cent or better.

Planning and plunging

The quotations here about planning and results emphasise a few of the ideas that a risk manager should absorb:

- 'In preparing for battle I have always found that plans are useless, but planning is indispensable.' General Dwight D. Eisenhower
- 'Everybody's got plans. . . until they get hit.' Boxer Mike Tyson
- 'If you wait until the right time to have a child you'll die childless, and I think filmmaking is very much the same thing. You just have to take the plunge and just start shooting something even if it's bad.' Filmmaker James Cameron
- 'Plunge, don't plan.' Instruction for commandos
- 'Earlier theorists aimed to equip the conduct of war with principles, rules, or even systems, and thus considered only factors that could be mathematically calculated (e.g., numerical superiority; supply; the base; interior lines). All these attempts are objectionable, however, because they aim at fixed values. In war everything is uncertain and variable, intertwined with psychological forces and effects, and the product of a continuous interaction of opposites.' General Carl von Clausewitz
- 'Plunge boldly into the thick of life, and seize it where you will, it is always interesting.' Philosopher Johann Wolfgang von Goethe

Careful planning is necessary, but don't count on anything ever going to plan, and recognise that success in anything requires risks.

Minimising risk isn't managing risk. This point is important because not many people know it beyond those with extensive day-to-day experience making significant financial decisions from a risk management – as opposed to a portfolio management – perspective.

Financial risk management is based on a different mathematical tradition than the one used in most economics and statistics. The conventional academic analysis of risk uses gambling games as models, and works only if the solution to the simplified game is a good approximation to the solution to the real-world decision. That works pretty well sometimes, and you don't need a risk manager to help you with it. But in other cases it leads to disastrous decisions, even when done properly and carefully. Risk management doesn't assume you know enough about possible outcomes and probabilities to treat decisions like actions in a casino game, and that you instead need to draw on concepts from information theory and other fields to improve your chances of long-term success.

I spare you most of the gory details of the calculations you use to manage risk – or at least segregate them in technical sections with clear warning

signs posted. You don't need to do the maths to understand the ideas. However, you do need to know that maths is an option. In other words, you need to understand that you can bring powerful mathematical tools to bear on incalculable uncertainty just as you can on calculated risk.

In my experience, people who are good at calculations tend to overanalyse the calculated risks and pretend that their models are an approximation to reality, which leads to disastrous risk management. People who aren't good at calculations tend to emphasise the unknown unknowns (in Donald Rumsfeld's famous phrase) – the deficiencies in the data, the un-modelled complexities of the situation and all kinds of other things that cause the calculated risks to be unreliable. This attitude is less problematic than the first, but is far from optimal. Risk managers provide a clear third voice, one that says, 'We may not be able to calculate enough of the risks to be useful, but we can calculate our actions. We may not be able to measure the risk, but we can manage it.'

Regenerating dinosaurs

The movie *Jurassic Park* does a great job of illustrating how risk management differs from conventional approaches to uncertainty. In the book, the point is even clearer. (Author Michael Crichton should be an honorary risk manager for the many insights peppered through his fiction. I consider him the most intellectually stimulating popular fiction writer of the 20th century. He was also an outstandingly successful director and producer for movies and television.) When investors in a park that brings extinct dinosaur species back to life get concerned about the risks of the venture, they demand a report from three experts: a palaeontologist (Sam Neill), a palaeobiologist (Laura Dern) and a 'mathematician with a deplorable excess of personality' (Jeff Goldblum).

A number of movie reviewers remarked on the implausibility of sending a mathematician, especially one calling himself a *chaotician*. But the palaeo-people can only calculate and analyse factors about dinosaurs; they have no particular training in risk and are unlikely to have the kind of life experiences that build risk wisdom. All they can do is double-check the calculations of the palaeo-experts who designed the park (which were probably double- and triple-checked already). Although some people tell you that an extra check is always prudent, I disagree. One person with clear responsibility for a decision is often more reliable than three people who all think someone else will catch any error.

The mathematician doesn't do the careful observation of the other two experts – the palaeontologist who scrutinises the pack dynamics of running gallimimus or the palaeobiologist who sticks her arms into triceratops excrement. However, he correctly predicts disaster, without knowing anything

about dinosaurs, genetics or park security. He understands that evolution is a powerful force powered by risk – far too powerful to be controlled by electric fences. (Evolution is also known as *natural selection of random variation,* and both random and variation are essential risk concepts.) He did not predict the specifics of disaster, only that the imperatives of life would easily win over the calculations of human experts.

Risk managers understand that risk is a powerful force that can be harnessed for great success or that can blast apart the best-laid schemes. Risk is not about laying better schemes; it's about making sure that risk is the wind in your sails, not the approaching hurricane that will swamp your boat. And generally speaking (although certainly not always), experts in specialised fields are bad at recognising risk. Experts usually get paid to take the risk out of decisions – or at least to reduce the risk by making things more predictable. Doing so is certainly worthwhile, but it never works perfectly, so you need risk managers as well. More importantly, experts often get paid to reduce the appearance of risk, not risk itself. And most important of all, reflexively taking the risk out of decisions eliminates opportunities as well as dangers.

Adding a little maths

As I say, you need no maths to understand this book. However, if you're willing to dip your toe into mathematical waters, you can get a deeper understanding of risk management more quickly. Feel free to skip this section if you're not interested in the maths at all.

Suppose someone offers you a proposal that has a 50 per cent chance of a +20 per cent return and a 50 per cent chance of a –18 per cent return. A standard approach in economics for analysing this choice begins by asking how much happier a 20 per cent increase in wealth would make you and how much unhappier an 18 per cent decrease in wealth would make you. Because the probabilities are equal, you take this gamble if the happiness increase from 20 per cent is greater than the happiness decrease from –18 per cent. With certain qualifications, this approach can be reasonable for front-office risk takers, and it's the usual approach in academic portfolio management (although economists prefer to speak about abstract *utility* rather than practical happiness). In this book, I refer to this approach as the portfolio management approach.

Most non-economists would find such a gamble too risky for 100 per cent of their wealth, but the risk gets more attractive if it can be repeated many times. With many repetitions, this gamble seems like being the casino – statistically certain to win in the long run due to a built-in edge.

The chart in Figure 1-2 shows a random simulation of 20 risk takers who repeat this bet 250 times, starting with initial wealth of 1. The solid black

curve shows the growth of wealth at the expected rate of 1 per cent per bet (maths alert: 50 per cent probability times 20 per cent plus 50 per cent probability times –18 per cent equals 10 per cent – 9 per cent = 1 per cent expected growth of wealth) and the 20 other lines show individual paths.

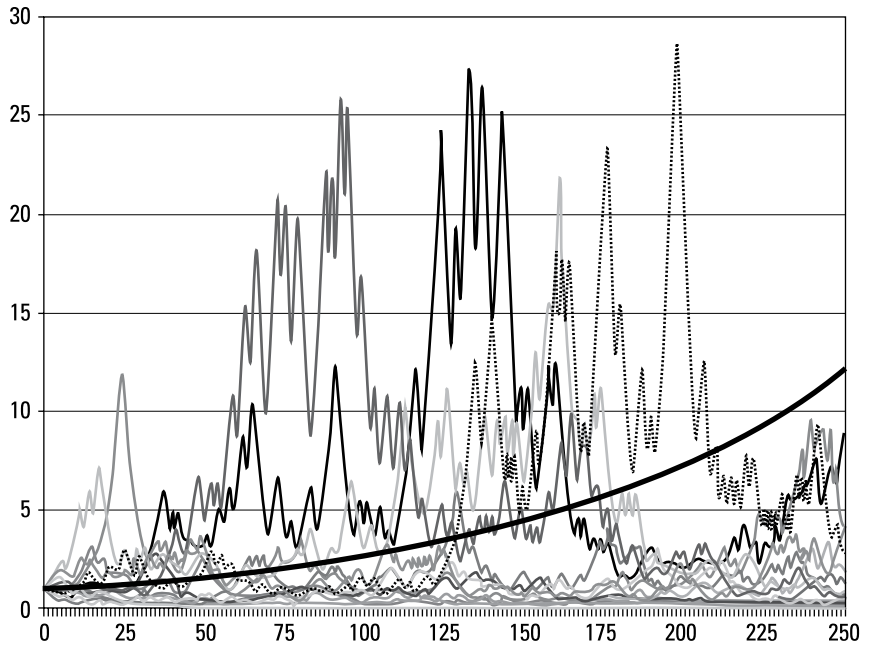

Figure 1-2: Charting growth in wealth.

Most paths go quickly to near zero. A few soar up far beyond the expected one per cent rate for a while, but all eventually crash. If you run the simulation longer, all paths would become indistinguishable from zero. To a risk manager, this bet is terrible – one that leads to certain disaster. The more times you repeat it, the worse it gets, not the better. Your psychology, your risk appetite, has nothing to do with it. This bet is worse than just losing all your money quickly because the paths that soar attract imitators and cause all kinds of foolish overreactions.

The problem is simple. If you win half your bets, you lose money. If you win 20 per cent, you turn £1.00 into £1.20. If you then lose 18 per cent, your £1.20 falls to £0.984. (The order doesn't matter. If you first lose 18 per cent to turn £1.00 into £0.82, then a 20 per cent win turns £0.82 to the same £0.984.) Every pair of win and loss costs you 0.6 per cent of your wealth. In the long run, you're virtually certain to have nearly 50 per cent wins and losses, so you're virtually certain to wipe out your wealth.