

Preface

[T]here is ... considerable danger in applying the method of exact science to problems ... of political economy; the grace and logical accuracy of the mathematical procedure are apt to so fascinate the descriptive scientist that he seeks for ... explanations which fit his mathematical reasoning and this without first ascertaining whether the basis of his hypothesis is as broad ... as the theory to which the theory is to be applied.

Karl Pearson, 1889, speaking at the Men's and Women's Club¹

Financial risk management is in a state of confusion. It has become obsessively focused on measuring risk. At the same time, it is forgetting that managing risk is about making decisions under uncertainty. It also seems to hold on to two dangerous beliefs: first, that our risk metrics can be estimated to five decimal places; second, that once we have done so the results will self-evidently guide our risk management choices. They do not. Even if they did, our risk metrics cannot be anywhere as precise as they are made out to be. This is not because we must “try harder”—say, collect more data, or use cleverer statistical techniques. It is because, given the problem at hand, this degree of precision is intrinsically unattainable.

Given what is at stake, this state of confusion is dangerous. To get out of this impasse we must tackle the task from a radically different angle: we must revisit our ideas about probability in financial risk management, and we must put decision making back at centre stage. This is what this book is about.

Given the importance of the topic, I intend to reach both a specialist and a nonspecialist audience. I certainly have professional, and often quantitative, financial risk managers in mind. But I also intend to speak

*I intend this book to be of interest to both specialist and nonspecialist readers' perhaps?

¹Quoted in A. Desrosieres (1998), *The Politics of Large Numbers: A History of Statistical Reasoning* (Cambridge, MA: Harvard University Press).

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to their managers (and to the managers of their managers), to policy makers, and to regulators, who are unlikely to be as quantitatively inclined as the risk professionals. I want to engage students and academics, but also members of the general public who are interested in matters financial.

Changes to sentence OK?

Let me elaborate on the thumbnail sketch of what this book is about that I offered in my opening lines. The sound management of financial risk affects not just bankers, traders, and market professionals but the public at large, and more directly so than is often appreciated. Unfortunately, for all its apparent quantitative sophistication, much of the current approach to the management of financial risk rests on conceptually shaky foundations. Many of the questions posed in the quest for control over financial risk are not simply difficult to answer—I believe they are close to meaningless.

Changes to sentence OK?

In great part this is because in looking at the control and regulation of financial risk we are not even clear what “type of” probability is of relevance or when either type should be used more profitably. This matters because members of the species *homo sapiens* can be surprisingly good at dealing with certain types of uncertain events, but spectacularly bad at dealing with others. Unfortunately, this does not seem to be taken into account by much of current risk management, which, if anything, works “against the grain”: it pushes us toward those areas of probability where we make systematically poor decisions, and it neglects the domains where we are, after all, not so bad.

Changes to sentence OK? 'could' or 'can'?

There are more fundamental problems with current financial risk management. These are to be found in its focus on measuring risk and in its scant attention to how we should reach decisions based on this information. Ultimately, managing risk is about making decisions under uncertainty. There are well-established disciplines (e.g., decision theory) devoted to this topic, but these have, by and large, been neglected. To understand whether this neglect is justified or whether we are missing out on some useful tools we will have to look at what utility and prospect theory have to offer. My conclusion will be that a straightforward (and rather old-fashioned) application of these theoretical tools has limited applicability in practical risk management applications. This does not mean, however, that the decisional (as opposed to measurement) problems we are faced with are any less important.

'is'? Or perhaps rewrite sentence?

Not all is doom and gloom, though: I will argue in the last part of this book that there *is* a more satisfactory way to look at these matters, an approach that has been successfully employed in many of the physical and social sciences. This approach clearly distinguishes between differ-

ent types of probability and employs them appropriately to create risk management tools that are cognitively resonant. Probabilities-as-degree-of-belief and probabilities-as-revealed-by-actions will be shown to be the key to better decision making under financial uncertainty. If these probabilities will seem less “sharp” and precise than what current risk management appears to offer, it is because they are. They have one great advantage, though: they keep us honest and humble and can save us from the hubris of spurious precision. Not a small achievement if “ignorance is preferable to error and he is less remote from the truth who believes nothing than he who believes what is wrong” (Thomas Jefferson, 1781).

'keys'?

Remove 'will'?

I will keep longer footnotes as footnotes
Riccardo, but would you mind if I move very brief asides into the text like this?

Reading a book involves an investment in time and mental effort probably second only to writing it. Why should the nonspecialist reader find these topics of sufficient relevance to make this investment? And how can it be that risk-management professionals, students, and academics may find something of relevance in a nonspecialist book? Here is how I can answer these very good questions.

'one' or 'that book'? Or reword?

Remove 'can'?

These days, risk management appears to be pervasive in every area of human endeavor. We seem to think, speak, and breathe risk management. In short, we appear to be living in a risk-management culture. Presumably, we should be better at managing risk than we have ever been.

Your hyphenation of 'risk management' was inconsistent so I've hyphenated wherever it appears adjectivally but not where it is used as a noun. OK?

It is true that we have made remarkable progress in recognizing and handling risk. Some current developments in risk-management thinking, however, make me fear that we may have reached an inflection point, and that our attempts at managing risk may be becoming more complex and cumbersome, but less effective.

Let me give a few examples. One of the distinguishing and, from a historical point of view, unprecedented features of the current approach to risk management is its focus on low-probability but potentially catastrophic events. This novel attitude to risk makes us evaluate risky prospects in a very different way than we used to. Take the case of polio and smallpox vaccinations. With the medical knowledge and technology available at the time, administering a vaccine that was too virulent and that could cause a healthy subject to contract the illness it was supposed to prevent had a low, but certainly nonnegligible, probability. Being cautious is obviously commendable, but I sometimes wonder how much longer it would have taken for the polio and smallpox vaccinations to be developed under current safety and risk-avoidance standards—or whether, indeed, they would have been developed at all. This modern attitude to risk is by no means limited to the medical domain: in many

'approach'? Maybe not, but 'attitude' doesn't seem quite right.

Changes to sentence OK?

Changes to sentence OK?

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other areas, from nuclear energy to nanotechnology to the genetic modification of livestock and crops, we currently display a similar (and, historically speaking, very new) attitude to risk. Whether “new” necessarily equates to “better,” however, is debatable.

Changes to sentence OK?

The examples mentioned above share an important common feature: in a cost-benefit analysis, we currently place much greater weight on unlikely but catastrophic events than we used to. This is neither “right” nor “wrong” per se (in the sense that a mathematical statement can be). It indicates, however, a behavioural response to rare events that is difficult to reconcile with everyday experiences of risk taking. This attitude to risk, called the “precautionary principle,” in one of its milder forms states:

Changes to sentence OK?

Words added - OK?

[W]hen an activity raises threat of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not established scientifically.²

A stronger formulation is the following:

[T]he precautionary principle mandates that when there is a risk of significant health or environmental damage ... and when there is scientific uncertainty as to the nature of that damage or the likelihood of the risk, then decisions should be made so as to prevent such activities from being conducted unless and until scientific evidence shows that damage will not occur.³

I've corrected the name in the footnote from 'Blackwelder' to 'Blackwelder' and also corrected many other typos in names below ('Brealy/Brealey', 'Mac Neil/McNeil', 'Sherer/Scherer', etc.), but may well have missed some less obvious ones. Please could you carefully check throughout while proofreading (there will be time for this a bit later on in the process) as it will probably be easier for you to spot these than it will be for me?

'Unsurprisingly'?

This is not the place to launch into a critique of the precautionary principle.⁴ For the purpose of this discussion the most relevant aspect of this principle is its focus on the occurrence of events whose probability of outcome is either extremely low or so imperfectly known that the most we can say about them is that it is nonzero. Rightly or wrongly, we seem to be increasingly willing to sacrifice tangible and immediate benefits to avoid very remote but seriously negative outcomes. This response to risk *is* historically new, and is spreading to more and more areas. Not surprisingly, as we shall see, a variant of the precautionary principle has appeared in financial risk management.

²The Wingspread Declaration (1998), quoted in I. Goklany (2001), *The Precautionary Principle* (Washington, DC: Cato Institute).

³B. Blackwelder, President of the Friends of the Earth, in a testimony in 2002 before the U.S. Senate.

⁴For a thorough discussion, see C. Sunstein (2005), *Laws of Fear* (Cambridge University Press).

Why have we become so preoccupied with managing the risk of very rare but catastrophic events? I venture two explanations. The first is that, throughout the history of the human species, we have always been subject to events of devastating power and consequences: earthquakes, floods, volcanic eruptions, epidemics, etc. In all these instances, *homo sapiens* has, by and large, been at the receiving end of the slings and arrows of outrageous fortune. On an evolutionary scale it has only been in the last five or so minutes of their lives that humans have found themselves able to create by their own actions catastrophes of comparable magnitude and import as the natural ones. Nuclear weapons are the most obvious, but not the only, example: think, for instance, of global warming, environmental pollution, antibiotic-resistant bacteria, etc. Indeed, sometimes it seems as though we feel startled by the ability of our actions to have far-reaching consequences—and in some domains we probably attribute to ourselves far more destructive power than we actually have: in Victorian times the “mighty agency ... capable of almost unlimited good or evil”⁵ was nothing more sinister than good old friendly steam; and Mary Shelley’s Frankenstein preyed on the then-current fears about that other terrible fiend, electricity. It is plausible to speculate that, given this new-found consciousness of the destructive power of our own actions, we may feel that we have a greater responsibility to control and manage the risks that they have given rise to. Hence, if this view is correct, we can begin to understand our interest in the management of risk in general and of the risk associated with catastrophic events in particular. There is more, though.

Changes to sentence OK?

There is a second, and probably linked, factor in our current attitude to risk management. As our control over our physical environment, over our biological constraints, over economic events, etc., has increased, we accept less and less that bad things may happen because of “bad luck.” Our immediate reaction to a plane disaster, to an unexpected financial crisis, to the spilling of a noxious chemical into a river, or to a train derailment is to set up a fact-finding commission to conduct an enquiry into “who was responsible.” In this respect, our attitude to “fate” has changed beyond recognition in the last one hundred years or so. To convince ourselves, just consider that when life insurance was first introduced in the nineteenth century, many households were reluctant to enter into

I've removed the capital from 'fate' here and below but kept it in the Hacking quote. OK?

Word added - OK?

⁵See Elizabeth Gaskell’s *Mary Barton*, quoted in D. Coyle (2007), *The Soulful Science* (Princeton University Press), in which the following example about Frankenstein is also provided.

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these contracts because it was felt that doing so would be tantamount to “tempting Fate.”⁶ We are separated from this attitude toward risk of the grandparents of our grandparents by a cognitive gulf that is difficult to fathom even for us. Fate has all but disappeared from our conceptualization of risk and, indeed, almost from everyday language.⁷ In general, we appear to be more willing and inclined to pursue the logical chain of causal links from a bad outcome to its identifiable causes much further than we used to.

Change to sentence OK? Otherwise, please clarify.

‘more ... much further’? Remove ‘much further’ and/or move ‘much’ before ‘more’ earlier in sentence?

Remove? And move ‘for instance’ either to beginning or end of sentence?

I understand that a similar trend toward the “responsibilization” of outcomes has occurred in the legal area as well. More numerous cases of negligence, for instance, are currently brought to court than ever before. And only twenty or thirty years ago the idea that someone could scald herself with a hot drink purchased at a fast-food outlet and sue the company would have struck one as ludicrous. In the legal area, this attitude may be the consequence of a much wider change: the growth of the tort of negligence that brought together previously disjointed categories (“pockets”) of liability related to negligent conduct inherited from the nineteenth-century body of English law. The judges active in the 1930s began to organize all these different pockets of liability as instances of one overarching idea, i.e., that we owe a duty of care to our “neighbor.” Much of the development of the concept of the tort of negligence has then been the refinement and, by and large, the extension of the concept of what constitutes our neighbor. But as we begin to think in terms of “neighbors” to whom a duty of care may be owed, the idea of impersonal “victims of fate” recedes in the background: *we*, not the wanton gods, become responsible.

Clarify sentence?

In sum: there has been a general shift in attitude toward ascribing a responsibility or a cause of negative outcomes from fate to ourselves. We have also come to recognize that, for the first time in our evolutionary history, we can create our own “man-made catastrophes.” Taken together, these two factors go a long way toward explaining why we are more concerned than we have ever been before about risk management in general, and about the management of the risk connected with remote but catastrophic events in particular.

In this book I will deal with these broader topics in passing, but I intend to look mainly at a narrower and more specific aspect of risk

⁶I. Hacking (1990), *The Taming of Chance* (Cambridge University Press).

⁷For a discussion from an insurance perspective of the links between natural and economic disasters, see M. L. Landis (1999), Fate, responsibility and “natural” disasters, *Law and Society Review* 33(2):257-318.

management, namely, at the management of financial risk, as practiced by financial institutions and as suggested (or, more often, imposed) by regulators.

This admittedly narrower topic is still very wide-ranging and affects us in ways more direct than we imagine: if we are too lax or ineffective in mandating the minimum standards of financial risk management, the whole globalized economy may be at risk; if these standards are too strict, they may end up stifling innovation and development in one of the most dynamic sectors of the world economy. The financial regulators obviously share a great part of responsibility in this, but, as I will argue, the financial industry and the academic risk-management community share the burden at the very least to a comparable extent.

Clarify sentence?

It is important to understand that regulating and reducing financial risk (as with most instances of regulation and risk reduction) has obvious transparent benefits but also more opaque, yet potentially very great, costs. Excessive regulation or voluntary risk avoidance will, in fact, not only reduce the profitability of financial institutions (the public at large is more likely to display *schadenfreude* about this than to shed overabundant tears), it will also curb financial innovation.⁸ This matters deeply, because the benefits of this financial innovation are more widespread and more important for the general public than is generally appreciated. To quote one example out of many, Alan Greenspan marvelled in 2004 at the resilience of the banking sector during the economic downturn that followed the events of September 11, 2001. This resilience, many have argued, was made possible by the ability afforded to banks by new financial instruments (credit derivatives) to distribute credit risk to a wider section of the economy, thereby reducing the *concentration* of risk that had proved so damaging during previous recessions. As a result, banks were able to minimize the restrictions of credit to the economy that typically occur during economic downturns. This has been quoted as one of the reasons why the 2001 recession was so mild.⁹ And indeed, despite the many high-profile bankruptcies of those years (Enron, WorldCom,

Change 'could well' in footnote to 'would'? Last sentence of footnote needs clarification.

Clarify sentence?

⁸To get a feel for the depth and pace of financial innovation, the bank UBS announced in December 2005 that 50% of its revenue in the fixed-income area came from instruments that did not exist five years ago (*Financial Times*, December 29, 2005)—a statistics of which, as the LEX columnist says, a drug company could well be proud. By my estimate, the ratio of revenues due new to old instruments would be much higher for other areas, as credit derivatives.

⁹"The use of a growing array of derivatives and the related application of more-sophisticated approaches to measuring and managing risk are key factors underpinning the greater resilience of our largest financial institutions, which was so evident during the

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Parmalat, etc.), “not one bank got into trouble,” as Greenspan famously said.¹⁰ Interestingly enough, therefore, financial innovation (in this particular case in the form of credit derivatives) has indeed created new types of risk, but has also contributed to the reduction, or the diffusion, of other types.

Clearly, it is not just complex derivatives that have brought benefits to the financial sector and to its ultimate users, i.e., the general public: as the International Monetary Fund (IMF) and the Bank for International Settlements recently pointed out, the efficiencies brought about by “deregulation, new financial products and structural changes to the sector” have far outweighed the dangers posed by these developments.¹¹ What are these broadly felt benefits then? First of all, financial innovation has been useful to redistribute risk, and hence to diffuse its impact. This is, of course, extremely important, but still somewhat “intangible.” Financial innovation, however, has also brought about benefits directly felt by the man in the street, as new liquid financial instruments have offered new opportunities to the public at large. New types of mortgages in the United States, for instance, have allowed homeowners to access finance more efficiently and with smaller frictions and transaction costs than ever before in human history. More generally, “Innovation and deregulation have vastly expanded credit availability to virtually all income classes” (Greenspan, April 2005). This has clearly been advantageous for borrowers and, probably, for the economy as a whole. It also carries risks, however, to the extent that such easy finance may cause, say, a real-estate bubble or, more generally, an overheating of the economy.

The changes run deeper. At a very fundamental level, banks had traditionally always been the main “accumulators” of credit risk. If one had to describe their role on the back of a stamp, one would probably write: “Lend the depositors’ money to people who may not pay it back.” The newfound ability afforded by financial innovation to relocate an important part of this credit risk outside the banking sector has fundamentally changed the nature of risk transfer in a modern economy. Since, as

credit cycle of 2001–02 and which seems to have persisted. Derivatives have permitted the unbundling of financial risks. Because risks can be unbundled, individual financial instruments now can be analyzed in terms of their common underlying risk factors, and risks can be managed on a portfolio basis,” Alan Greenspan, Risk transfer and financial stability, *Federal Reserve Bank of Chicago’s 41st Annual Conference on Bank Structure, Chicago, IL, May 5, 2005*.

¹⁰Greenspan answering questions after a lecture in Berlin, January 13, 2004.

¹¹J. D’Arista (October 2005), *Capital Flows Monitor* (Financial Markets Center Publication): see www.fmcenter.org/site/.

I explain in Chapter 5, banks are delicate and “resiliently fragile” institutions, this is a good thing. However, it is much easier to pass risk around than to make it disappear. It has been pension funds and life insurance companies that have increasingly acquired, thanks to new financial instruments, part of the credit exposure that traditionally “belonged” to banks. Since the ultimate direct beneficiaries of the pensions and of the life insurance policies are what economists call the household sector (i.e., you and me), the public have become the “shock absorber of last resort”¹² in the financial system. The IMF views this broadening of the risk-absorbing basis as beneficial—risk, in general, becomes less “toxic” the more it can be dispersed. The same organization, however, acknowledges the risks inherent in these developments. Interestingly enough, even as it acknowledges the existence of these risks, the IMF does not call for re-regulation, but suggests that new financial instruments, such as longevity bonds and inflation-linked bonds, may be created, or enhanced, to mitigate the households’ exposure to these risks. As far ahead as one can see at the time of writing, the philosophy of innovation, risk redistribution, and control of these new risks via further innovation has fully spread from the scientific and technological area to the financial domain.

Singular/plural issue in this sentence: ‘beneficiaries ... are ... the household sector’. Reword?

Tense problem in this sentence. Rewrite? Clarify?

All these new financial instruments, like powerful new medicines, are potentially risky. Striking a good balance between reaping all the advantages they can afford and containing their “side effects” is a formidable challenge. The outcome of this balancing act will have very deep consequences for the world economy: turn the dials too much in one direction and we will certainly be less well off than we could have been; turn them too much in the other direction and we run a small risk of a serious derailment of the economy. Finding the Goldilocks equilibrium is extremely difficult, especially when the incentives of the regulators and the managers of the financial institutions are imperfectly aligned.

Given the magnitude of the task, one may well ask the question, Are the tools at the risk manager’s disposal up to scratch? Have the many recent innovations in risk-management techniques made the world a safer place? Judging by the quantity of articles published in the risk-management literature, by the proliferation of books, journals, and magazines, by the attendance of international conferences, it would seem that this must certainly be the case. Indeed, when it comes to financial risk a new, highly sophisticated, and highly quantitative approach to risk management has become very widespread. Risk managers employed

¹²*Ibid.*, p. 7.

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even for junior positions by many large financial institutions are often required to have PhDs in the hard sciences. So widespread is the confidence placed in this relatively new approach to the management of financial risk that it goes virtually unquestioned.

'any serious thought?'

I will argue in this book that, unfortunately, some central aspects of this approach are conceptually flawed. The questions that are being asked are not hard ones. I will claim that they are ill-posed ones. It is not that the techniques are “wrong,” of course, but that often they have been, and are being, applied without some serious thinking about their applicability to the problem at hand. We are doing a lot of risk-management engineering as if the pillars of risk-management science were so well-established as not to require much questioning. An aircraft engineer does not question the correctness of the physical laws underpinning the technical prescriptions on how to build safe planes every time he has to redesign the profile of a wing. He just gets on and does it. We are behaving in a similar way in the management of financial risk, developing more and more sophisticated pieces of statistical plumbing without asking ourselves if the foundations are indeed as solid as, ultimately, Newton’s laws are for the aircraft engineer. Unfortunately, I think that we risk managers have not thought deeply enough about the foundations of our discipline. We are not even clear about the appropriate meaning, in the risk-management context, of the most central concept of all: that of probability. If I am correct, and given that what is at stake is the good functioning of the world economy, both practitioners and regulators should pause for thought.

Remove?

Changes to sentence OK?

How is this possible? How can the scores of hard-science PhDs employed by banks as risk managers be guilty, of all things, of an *unreflective* approach to their discipline? If even they are unable to think deeply enough about these problems, who possibly can? Paradoxically, just there, in their finely honed quantitative skills, lies the heart of the problem. Most of the PhDs employed by banks, some for derivatives pricing, some for risk management, obtained their doctorates at the top U.S., U.K. and European universities, and were excellent in their original field of study—very often, physics or mathematics. Why this choice of subjects? Because their employers found that there was no substitute for the rigorous and demanding technical training that these “hard” sciences *par excellence* impart. As for these young physicists and mathematicians, many, for a variety of reasons, decide that physics, or mathematics, would not suffer unduly if they were to part ways with it and

knock at the door of a bank. When the last interview has been successfully handled, a “quant” is born.

So, very hard, but well-defined, technical problems are relatively easy for these quants: finding an efficient technique to solve a very-high-dimensional integral, combining Fourier transforms with Monte Carlo simulations, employing wavelets for signal decomposition, carrying out complicated contour integrals in the complex plane, etc., is just what they have been trained to do for all those years. Especially in the early years of their new career, however, quants are “ignorant experts”: they are experts, because of the bagful of analytic tricks they carry over from their original areas of expertise; they are also ignorant because they know, and understand, very little about how a financial institution works, and about finance in general. They often like to be given well-defined, self-contained, and fiendishly difficult tasks, without concerning themselves too much about the “bigger picture.” They tend to be impatient about the nuances, and cannot wait to sit down and write some good C++ code and crack the problem. (Lest I offend anyone, I can safely say that, as I write this I am thinking of myself some fifteen to twenty years ago.) The good quants, of course, do make the transition from being mere technicians to building a broader picture of where all their complex calculations “fit in.” But all too often the financial dimension of what they are doing remains, if not outside, at least at the boundary of their “comfort zone.”

When it comes to financial risk management the results of this are, at best, mixed. Those who do understand well the financial questions that need answering (and who often are the bosses of the bosses of the quants) are often not quantitatively proficient and have to take on faith that the quantitative approach chosen will not only be technically correct, but will also “make sense” for the problem at hand. As for the quants, they love nothing more than having to tackle technically difficult problems—the more difficult, the better. Not only will the pleasure in solving the puzzle be greater, but, at least as importantly, the quants’ indispensability to the firm will be further confirmed. So, it is not so surprising after all that the quant suggesting that a simpler, less quantitative approach should be used to solve a problem is only slightly less rare than a turkey voting for Christmas.¹³

¹³It should be added that software vendors and “impartial” management consultants, seeing some of the largest contracts in decades dangled before their eyes, are unlikely voices of dissent in this debate. The quantitative management of risk has long ceased to be pure or applied science—it is now big business.

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Clarify sentence?

This has had unexpected consequences. In the last decade or so the international regulators have tried to inspire their rule books to what they have perceived to be the current cutting-edge industry practice. This approach to regulation has been innovative, refreshing, and laudable. Unfortunately, it has been difficult for the regulators, who were “looking in from the outside,” to appreciate the degree of disconnect that occurred in many banks between the quant departments and senior management. In observing that thousands of quants had been employed around the world to crack tough risk-management problems, the regulators were perfectly justified in concluding that this was indeed the way senior bank managers thought about and managed their risk. As the mantra became that financial regulation should be aligned with best industry practice, who could blame the regulators when they tried to cast their rules using the same language they were hearing being employed by the banks’ quants? If, in the case of market risk, estimating the 99th loss percentile seemed to be the way many bank risk managers looked at and managed risk, why should it be so unreasonable to ask for the 99.9th percentile, or even for the 99.99th percentile, for credit risk? What are a couple of nines between friends, after all? Who could criticize these industry-aligned regulators, when some of the banks’ own quants claimed that the way of the risk-management future lay in gaining intellectual control over these once-in-ten-thousand-years events. Were these not the smartest kids on the block, after all? And had they not been allowed to play with the most powerful computers available? If this isn’t “best practice,” what is?

Change OK?

You may have noticed Riccardo that I’m removing most of the ‘hadn’t’, ‘isn’t’, etc., but not all. Where I think the sentence can be changed without making it sound unidiomatic, I am doing so, but here, for example, ‘isn’t’ is, I agree, the only option. OK?

The less-than-perfect result of this combination was transparent in the terse comments made at the Geneva 2005 ICBI risk-management conference by a very senior official of one of the international regulatory bodies. (For once, I will leave the comment unattributed.) In looking over the hundreds of pages of the brand new, highly quantitative, bank regulatory regime (Basel II), he sighed: “It does read a bit as if it has been written without adult supervision.” This is just what I was referring to when I mentioned above that in recent risk management, extreme attention has been devoted to the plumbing without worrying too much about whether the structural plan was sound. We have been doing a lot of very sophisticated engineering without asking (or, for the reasons given above, wanting to ask) whether the underlying “physics” warranted such precision. Everybody knows Keynes’s dictum that it is better to be approximately right than precisely wrong. Alas, in my opinion, I believe that in quantitative financial risk management some of the answers have at times

been precisely meaningless. With this book I intend to explain not only to the quants but also to the nonquantitative bosses of their bosses and, hopefully, to the regulators and policy makers why I believe this is the case.

I also think that a more meaningful, yet still strongly quantitative, way of looking at risk management *is* possible. Hard quantitative skills, and the logical *forma mentis* that comes with them, are therefore not useless—if anything, the technical challenges for a more meaningful approach to risk management (that takes at its root Bayesian analysis and subjective probabilities) are even greater than for the current, more traditional, probabilistic approach. However, these techniques should be used in a *different* way than they have been so far and we should reason about financial risk management in a *different* way than we often appear to now.

Change OK?

Changes to sentence OK?

So, the quantitative approach probably remains the high route to financial risk management. I will argue, however, that a lot of very effective risk management can be done with a much simpler approach, and that this approach constitutes a reasonable and meaningful “approximation” to the quantitatively correct answer. This way of looking at risk-management problems should have two advantages: it is congruent and resonant with the way human beings actually do think and feel about risk; and, if my suggestions are found useful and convincing, they can be extended without intellectual break into a precise quantitative treatment. Most importantly, the risk managers (quantitative or not) who find my way of looking at these problems convincing should be able to ask themselves whether or not they are asking a meaningful question. This is no small feat, and, I believe, is not too difficult. It just requires fewer formulae (less plumbing) and more thinking. In this book I have therefore deliberately avoided going over the quantitative aspects of these topics, because I really want to keep company with the senior, nonquantitative manager who has to provide the “adult supervision” that the current risk-management project has sometimes lacked so far. As a consequence, this will be my first book without formulae. Since I will try to show that a particular *quantitative* approach to risk management is flawed, and yet I want to reach a *general*, i.e., not necessarily quantitative, readership, I have set for myself an unusually difficult task. I have tried to tackle it by employing a qualitative and discursive style, while still keeping the reasoning as clear and honest as I could. This is difficult, but should be possible. After all, probability, as Laplace said, “is in the end only common sense reduced to calculation.” In trying to pull off

Clarify sentence?

Changes to sentence OK?

‘can’? Tense issues in these couple of sentences.

Word added - OK?

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Clarify sentence?

Repetition.

In the footnote, I stumbled over the use of 'correct', twice. Not sure what wasn't 'correct'. Rewrite? Also, 'impassioned' rather than "impassionate" meant? Are there any endnotes Riccardo?

this feat, I have religiously kept in Stephen Hawking's words: "Someone told me that each equation I included in the book would halve the sales. I therefore resolved not to have any equations at all."¹⁴ I have religiously followed the same piece of advice.

Writing precisely without using formulae is hard: I have waved my hands, sometimes rather furiously, and I have cut numerous corners, but I have tried not to cheat (too much) while doing so.¹⁵ I have tried to post pointers to more quantitative treatments on the way—usually in footnotes or endnotes. These can be skipped by the impatient or non-quantitative reader without loss of continuity.

Finally, a word about the choice of the picture that graces the cover of this book, a painting by Caravaggio called, in English, *The Cardsharps*. It shows a handsome, rosy-cheeked and, by his looks, probably very naive young man who is engaging in a financially rather risky activity: gambling. We become aware of how risky this game of cards really is when we note that a not-so-handsome, not-so-young, and certainly not-so-rosey-cheeked man is looking over the shoulders of the young player and communicating to his fellow cardsharp the cards in the young man's hands: unfortunately, a lowly "three." And, when our attention is drawn by the action of the playing cardsharp to the dagger concealed in the waist band, we begin to fear that what the young man is risking may be more than a few ducats. There are some obvious parallels between what is happening in the painting and the contents of this book. There is of course a reference to financial risk. A bit more subtly, however, both the painting and the book try to alert us to the dire consequences in miscalculating the odds of a risky activity. The parallels should not be pushed too far, though. I do *not* intend to suggest, for instance, that financial markets

¹⁴From the acknowledgement section of S. Hawking (1988), *A Brief History of Time* (New York: Bantam Books).

¹⁵I feel, however, that I have to come clean at least in three respects. First, I have failed to distinguish clearly in this book among probability as degree of belief, Bayesian probability, and subjective probability. This is in general not correct. It is correct enough, however, in the context of this book.

Second, I am aware that the concept of probability as degree of belief (which I implicitly use in this book) is not uncontroversial. I cannot go into the objections and possible defences. For an impassionate (and in my opinion convincing) defence of probability as degree of belief see E. T. Jaynes (2003), *Probability: The Logic of Science* (Cambridge University Press). For a critique, see, for example, K. Binmore (1994), *Game Theory and the Social Contract*, volume I (Cambridge, MA: MIT Press).

Third, I do not discuss in this book the Laplacian definition of probability based on symmetry. It can be very powerful, but its domain of applicability is somewhat restricted and is of little relevance to risk management. It is also not without its logical problems.

PREFACE

are a den of gambling vice, where unsuspecting young men are fleeced by unscrupulous “cardsharps.” I simply find the painting very attractive, and more interesting than the usual covers with bulls, bears, dollar signs, and price charts. I am grateful to the publisher for agreeing to reproduce it.

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First and foremost, I thank my wife, Rosamund Scott, for careful and insightful reading of this book, and for precious suggestions and discussions. I also thank the friends and colleagues who were kind enough to read this manuscript at various stages of its writing and to offer their comments. I am grateful to the delegates at various conferences (in Geneva, Boston, and New York) with whom I have discussed some of the topics covered in the text. Their encouragement and comments have been invaluable. Two referees (one of whom was Prof McNeil) helped me greatly with their suggestions and constructive criticism. It has been a pleasure to work with Princeton University Press, and with Richard Baggaley in particular. Thanks to their efforts this book is much the better. Needless to say, all remaining errors are mine.

Might need to say who this is? Could it be Alex McNeil? (I worked with him and his co-authors on their last book (which I see you cite) if it is!)

Plight of the Fortune Tellers

What this Book Is About (and Why It Matters)

But what I... thought altogether unaccountable was the strong disposition I observed in [the mathematicians of Laputa] toward news and politics, perpetually enquiring into public affairs, giving their judgement on matters of state, and passionately disputing every inch of a party opinion. I have indeed observed the same disposition among the mathematicians I have known in Europe, although I could never observe the least analogy between the two sciences, unless those people suppose that because the smallest circle hath as many degrees as the largest, therefore the regulation and management of the world require no more abilities than the handling and turning of a globe.

Jonathan Swift, writing about the mathematicians of Laputa