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# Asset and risk management

*Risk Oriented Finance*

LOUIS ESCH  
ROBERT KIEFFER  
THIERRY LOPEZ

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Preface by Philippe Jorion

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# Asset and Risk Management

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# Foreword

by Philippe Jorion

Risk management has truly undergone a revolution in the last decade. It was just over 10 years ago, in July 1993, that the Group of 30 (G-30) officially promulgated best practices for the management of derivatives.<sup>1</sup> Even though the G-30 issued its report in response to the string of derivatives disasters of the early 1990s, these best practices apply to all financial instruments, not only derivatives.

This was the first time the term 'Value-at-Risk' (*VaR*) was publicly and widely mentioned. By now, *VaR* has become the standard benchmark for measuring financial risk. All major banks dutifully report their *VaR* in quarterly or annual financial reports.

Modern risk measurement methods are not new, however. They go back to the concept of portfolio risk developed by Harry Markowitz in 1952. Markowitz noted that investors should be interested in total portfolio risk and that 'diversification is both observed and sensible'. He provided tools for portfolio selection. The new aspect of the *VaR* revolution is the application of consistent methods to measure market risk across the whole institution or portfolio, across products and business lines. These methods are now being extended to credit risk, operational risk, and to the final frontier of enterprise-wide risk.

Still, risk measurement is too often limited to a passive approach, which is to measure or to control. Modern risk-measurement techniques are much more useful than that. They can be used to *manage* the portfolio. Consider a portfolio manager with a myriad of securities to select from. The manager should have strong opinions on most securities. Opinions, or expected returns on individual securities, aggregate linearly into the portfolio expected return. So, assessing the effect of adding or subtracting securities on the portfolio expected return is intuitive. Risk, however, does not aggregate in a linear fashion. It depends on the number of securities, on individual volatilities and on all correlations. Risk-measurement methods provide tools such as marginal *VaR*, component *VaR*, and incremental *VaR*, that help the portfolio manager to decide on the best trade-off between risk and return. Take a situation where a manager considers adding two securities to the portfolio. Both have the same expected return. The first, however, has negative marginal *VaR*; the second has positive marginal *VaR*. In other words, the addition of the first security will reduce the

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<sup>1</sup> The G-30 is a private, nonprofit association, founded in 1978 and consisting of senior representatives of the private and public sectors and academia. Its main purpose is to affect the policy debate on international economic and financial issues. The G-30 regularly publishes papers. See [www.group30.org](http://www.group30.org).

portfolio risk; the second will increase the portfolio risk. Clearly, adding the first security is the better choice. It will increase the portfolio expected return and decrease its risk. Without these tools, it is hard to imagine how to manage the portfolio. As an aside, it is often easier to convince top management of investing in risk-measurement systems when it can be demonstrated they can add value through better portfolio management.

Similar choices appear at the level of the entire institution. How does a bank decide on its capital structure, that is, on the amount of equity it should hold to support its activities? Too much equity will reduce its return on equity. Too little equity will increase the likelihood of bankruptcy. The answer lies in risk-measurement methods: The amount of equity should provide a buffer adequate against all enterprise-wide risks at a high confidence level. Once risks are measured, they can be decomposed and weighted against their expected profits. Risks that do not generate high enough payoffs can be sold off or hedged. In the past, such trade-offs were evaluated in an ad-hoc fashion.

This book provides tools for going from risk measurement to portfolio or asset management. I applaud the authors for showing how to integrate *VaR*-based measures in the portfolio optimisation process, in the spirit of Markowitz's portfolio selection problem. Once risks are measured, they can be managed better.

*Philippe Jorion*  
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# Introduction

The rapid expansion of international finance is a prerequisite for growth of world trade in both goods and services. The risks associated with international investment should make us think of the desirability of creating a wider and more stable basis for our international financial system.

It appears that the stability of the whole financial system is conditioned by the capacity of those actively involved in economics, and especially in finance, to manage all types of risk more effectively. It is not just a matter of ensuring that the risks are properly diversified, but a matter of mastering each of them separately.

The aim of this publication is to deal with the issue at its root. In fact, preservation of our standard of living depends on the durability of the banking and insurance systems, because we confide our savings in the system and because we transfer our risks to the institutions that mutualise those savings. If the managers that we have trusted to return our savings to us cannot handle them, then the mutual funds to which we have transferred our risks will not be able to act properly in our place.

## AREAS COVERED

Our publication therefore aims to study three essential components of *modern finance*, namely *risk management*, *asset management* and *asset and liability management*, together with the *links that bind them together*. To do this, we have divided the book into five parts:

1. The context, the regulations and the market.
2. Asset management.
3. Risk management.
4. The complementary aspects of risk management and asset management.
5. The strategic aspect of risk management – that is, asset and liability management.

*Part I* is called *The Massive Changes in the World of Finance*.

- *Chapter 1* sets out the *regulatory context* (precautionary surveillance, the Basle Committee, harmonised accounting standards) in which financial institutions are developing today.

- *Chapter 2* shows the ways in which the *risk management* function has *developed* in financial institutions, in the context of a tense insurance market and a prolonged financial crisis together with a crisis of confidence. This function is becoming more and more important right across the financial sector, and its area of skill is increasing (in addition to the traditional credit and market risks, there is now a need to consider not only the threefold risk of operations, BCP and insurance, but the liquidity risk, the legal risk inherent in financial transactions, and others). The chapter explains how this area of work provides the decision-makers with a contribution that is largely strategic in nature.

*Part II* is dedicated to the theories that underlie asset management, and deals with the *evaluation of financial assets*.

- *Chapter 3* concentrates on *equities*. The basics (that is, return and risk, market efficiency etc.) are of course explained before the principle of diversification linked to portfolio management is touched on; the models produced by Markowitz, Sharpe and Elton, Gruber and Padberg (EGP) are all presented in detail. The theory of utility and optimal portfolio selection is also covered, as are market models. Next comes the financial asset equilibrium model, which analyses the capital asset pricing model (CAPM) and arbitrage pricing theory (APT), performance evaluation, and equity portfolio management strategies. Finally, the chapter examines share development (deterministic and stochastic models).
- *Chapter 4* deals with *bonds*. After describing their characteristics and developments, it touches on the question of their inherent financial risks. The issues of deterministic interest rate structure, passive and active bond portfolio management strategies, and stochastic bond development models (arbitrage models with one state variable, Vasicek model, Cox, Ingersoll and Ross model and stochastic duration), are all addressed in separate sections.
- *Chapter 5* is dedicated to *options*. After describing their characteristics and areas of use, we look at their value and the various models for evaluating them (the binomial model, Black and Scholes model and others). The last section in this chapter introduces the simple and more complex strategies for options.

*Part III* deals with the central theory of *risk management*, the general theory of *Value at Risk* or *VaR*.

- *Chapter 6* is a general presentation of *VaR theory* (starting from the concept of risk per equity, the *VaR* for a single equity is studied before being extrapolated to cover an entire portfolio according to whether or not the typology of the evaluation models is linear), and also introduces extensions for the use of that theory (components of *VaR* and incremental *VaR*).
- *Chapter 7* deals with the *techniques for estimating VaR*. It analyses the estimated variance-covariance matrix method, the Monte Carlo simulation and the historical simulation in succession, together with an extension (extreme values). The advantages and disadvantages of each of these methods are compared.
- *Chapter 8*, together with the attached CD-ROM, sets out the stages necessary for *setting up a VaR methodology* (putting together a database, calculations for treasury and bond portfolios, normality hypothesis study).

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*Part IV* is the point at which *asset management* and *risk management* meet.

- *Chapter 9* introduces the *portfolio risk management* method, which relates to private management. It deals with the application of risk-management methods (value of one basis point, *VaR* etc.) to portfolios managed in the classic way.
- *Chapter 10* proposes an *optimisation of a global portfolio using VaR*. More specifically, we deal with methods of optimising asset portfolios that verify the hypotheses of normal law, which is, under certain circumstances, the case with equities. In particular, we adapt the Sharpe and EGP simple index methods to the *VaR*, in order to find the extent to which *VaR* improves the optimisation process.
- *Chapter 11* deals with *institutional management*. Here we will see the significance of applying the APT method to investment funds in terms of behavioural analysis.

*Part V* is the point at which *risk management* and *asset and liability management* (ALM) meet.

- *Chapter 12* introduces *techniques for measuring structural balance sheet risks*. It sets out the tools for analysing risks in asset and liability management together with simulations, the use of *VaR* in ALM, repricing schedules, and replicating portfolios.

## WHO IS THIS BOOK FOR?

This book is aimed at two sections of the public.

The work is aimed at *professionals working in the market* (private or business fund managers or pension managers, market operators and business managers), *risk managers* and *asset and liability managers, auditors* and people working generally in the field of risk management.

This book also provides a very useful teaching tool suitable for use by both *undergraduates* and *postgraduates*, who have chosen to include a *financial* element in their studies. There are many numbered illustrations and a CD-ROM for practical application.

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