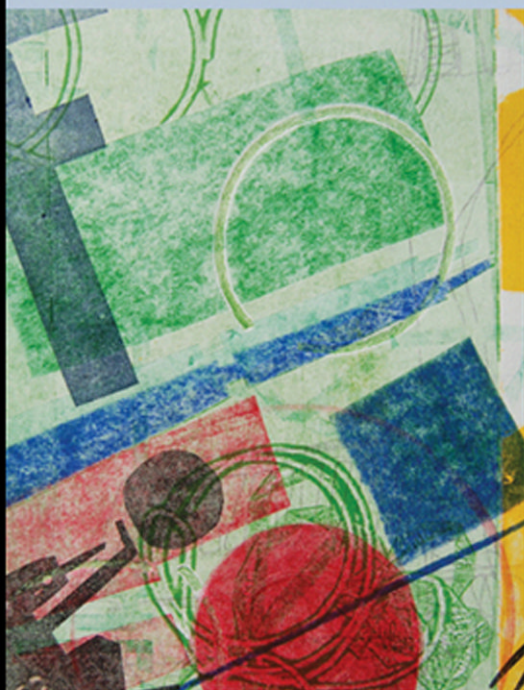


WILEY FINANCE



Financial
RISK
Management

Models, History, and Institutions

ALLAN M. MALZ

Financial Risk Management

Founded in 1807, John Wiley & Sons is the oldest independent publishing company in the United States. With offices in North America, Europe, Australia, and Asia, Wiley is globally committed to developing and marketing print and electronic products and services for our customers' professional and personal knowledge and understanding.

The Wiley Finance series contains books written specifically for finance and investment professionals as well as sophisticated individual investors and their financial advisors. Book topics range from portfolio management to e-commerce, risk management, financial engineering, valuation, and financial instrument analysis, as well as much more.

For a list of available titles, visit our Web site at www.WileyFinance.com.

Financial Risk Management

Models, History, and Institutions

ALLAN M. MALZ



WILEY

John Wiley & Sons, Inc.

Copyright © 2011 by Allan M. Malz. All rights reserved.

Published by John Wiley & Sons, Inc., Hoboken, New Jersey.
Published simultaneously in Canada.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning, or otherwise, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8600, or on the Web at www.copyright.com. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at www.wiley.com/go/permissions.

Limit of Liability/Disclaimer of Warranty: While the publisher and author have used their best efforts in preparing this book, they make no representations or warranties with respect to the accuracy or completeness of the contents of this book and specifically disclaim any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives or written sales materials. The advice and strategies contained herein may not be suitable for your situation. You should consult with a professional where appropriate. Neither the publisher nor author shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

For general information on our other products and services or for technical support, please contact our Customer Care Department within the United States at (800) 762-2974, outside the United States at (317) 572-3993 or fax (317) 572-4002.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books. For more information about Wiley products, visit our Web site at www.wiley.com.

Library of Congress Cataloging-in-Publication Data:

Malz, Allan M.

Financial risk management: models, history, and institution : models, history, and institution / Allan M. Malz.

p. cm. – (Wiley finance series)

Includes bibliographical references and index.

ISBN 978-0-470-48180-6 (cloth); ISBN 978-1-118-02291-7 (ebk);

ISBN 978-1-118-02290-0 (ebk); ISBN 978-1-118-02289-4 (ebk)

1. Financial risk management. I. Title.

HD61.M256 2011

332–dc22

2010043485

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

To
Karin, Aviva, and Benjamin
with love

Contents

List of Figures	xvii
Preface	xxi
CHAPTER 1	
Financial Risk in a Crisis-Prone World	1
1.1 Some History: Why Is Risk a Separate Discipline Today?	1
1.1.1 The Financial Industry Since the 1960s	2
1.1.2 The “Shadow Banking System”	9
1.1.3 Changes in Public Policy Toward the Financial System	15
1.1.4 The Rise of Large Capital Pools	17
1.1.5 Macroeconomic Developments Since the 1960s: From the Unraveling of Bretton Woods to the Great Moderation	20
1.2 The Scope of Financial Risk	34
1.2.1 Risk Management in Other Fields	34
Further Reading	41
CHAPTER 2	
Market Risk Basics	43
2.1 Arithmetic, Geometric, and Logarithmic Security Returns	44
2.2 Risk and Securities Prices: The Standard Asset Pricing Model	49
2.2.1 Defining Risk: States, Security Payoffs, and Preferences	50
2.2.2 Optimal Portfolio Selection	54
2.2.3 Equilibrium Asset Prices and Returns	56
2.2.4 Risk-Neutral Probabilities	61

2.3	The Standard Asset Distribution Model	63
2.3.1	Random Walks and Wiener Processes	64
2.3.2	Geometric Brownian Motion	71
2.3.3	Asset Return Volatility	74
2.4	Portfolio Risk in the Standard Model	75
2.4.1	Beta and Market Risk	76
2.4.2	Diversification	82
2.4.3	Efficiency	85
2.5	Benchmark Interest Rates	88
	Further Reading	91

CHAPTER 3

	Value-at-Risk	93
3.1	Definition of Value-at-Risk	94
3.1.1	The User-Defined Parameters	97
3.1.2	Steps in Computing VaR	98
3.2	Volatility Estimation	99
3.2.1	Short-Term Conditional Volatility Estimation	99
3.2.2	The EWMA Model	104
3.2.3	The GARCH Model	106
3.3	Modes of Computation	108
3.3.1	Parametric	108
3.3.2	Monte Carlo Simulation	109
3.3.3	Historical Simulation	111
3.4	Short Positions	113
3.5	Expected Shortfall	114
	Further Reading	116

CHAPTER 4

	Nonlinear Risks and the Treatment of Bonds and Options	119
4.1	Nonlinear Risk Measurement and Options	121
4.1.1	Nonlinearity and VaR	123
4.1.2	Simulation for Nonlinear Exposures	126
4.1.3	Delta-Gamma for Options	127
4.1.4	The Delta-Gamma Approach for General Exposures	134
4.2	Yield Curve Risk	136
4.2.1	The Term Structure of Interest Rates	138
4.2.2	Estimating Yield Curves	141
4.2.3	Coupon Bonds	144

4.3	VaR for Default-Free Fixed Income Securities Using The Duration and Convexity Mapping	148
4.3.1	Duration	149
4.3.2	Interest-Rate Volatility and Bond Price Volatility	150
4.3.3	Duration-Only VaR	152
4.3.4	Convexity	154
4.3.5	VaR Using Duration and Convexity	155
	Further Reading	156

CHAPTER 5

	Portfolio VaR for Market Risk	159
5.1	The Covariance and Correlation Matrices	160
5.2	Mapping and Treatment of Bonds and Options	162
5.3	Delta-Normal VaR	163
5.3.1	The Delta-Normal Approach for a Single Position Exposed to a Single Risk Factor	164
5.3.2	The Delta-Normal Approach for a Single Position Exposed to Several Risk Factors	166
5.3.3	The Delta-Normal Approach for a Portfolio of Securities	168
5.4	Portfolio VAR via Monte Carlo simulation	174
5.5	Option Vega Risk	175
5.5.1	Vega Risk and the Black-Scholes Anomalies	176
5.5.2	The Option Implied Volatility Surface	180
5.5.3	Measuring Vega Risk	183
	Further Reading	190

CHAPTER 6

	Credit and Counterparty Risk	191
6.1	Defining Credit Risk	192
6.2	Credit-Risky Securities	193
6.2.1	The Economic Balance Sheet of the Firm	193
6.2.2	Capital Structure	194
6.2.3	Security, Collateral, and Priority	195
6.2.4	Credit Derivatives	196
6.3	Transaction Cost Problems in Credit Contracts	196
6.4	Default and Recovery: Analytic Concepts	199
6.4.1	Default	199
6.4.2	Probability of Default	200
6.4.3	Credit Exposure	201

6.4.4	Loss Given Default	201
6.4.5	Expected Loss	202
6.4.6	Credit Risk and Market Risk	204
6.5	Assessing creditworthiness	204
6.5.1	Credit Ratings and Rating Migration	204
6.5.2	Internal Ratings	207
6.5.3	Credit Risk Models	207
6.6	Counterparty Risk	207
6.6.1	Netting and Clearinghouses	209
6.6.2	Measuring Counterparty Risk for Derivatives Positions	209
6.6.3	Double Default Risk	211
6.6.4	Custodial Risk	211
6.6.5	Mitigation of Counterparty Risk	212
6.7	The Merton model	213
6.8	Credit Factor Models	222
6.9	Credit Risk Measures	226
6.9.1	Expected and Unexpected Loss	228
6.9.2	Jump-to-Default Risk	229
	Further Reading	229

CHAPTER 7

	Spread Risk and Default Intensity Models	231
7.1	Credit Spreads	231
7.1.1	Spread Mark-to-Market	233
7.2	Default Curve Analytics	235
7.2.1	The Hazard Rate	237
7.2.2	Default Time Distribution Function	239
7.2.3	Default Time Density Function	239
7.2.4	Conditional Default Probability	240
7.3	Risk-Neutral Estimates of Default Probabilities	241
7.3.1	Basic Analytics of Risk-Neutral Default Rates	242
7.3.2	Time Scaling of Default Probabilities	245
7.3.3	Credit Default Swaps	246
7.3.4	Building Default Probability Curves	250
7.3.5	The Slope of Default Probability Curves	259
7.4	Spread Risk	261
7.4.1	Mark-to-Market of a CDS	261
7.4.2	Spread Volatility	262
	Further Reading	264

CHAPTER 8

Portfolio Credit Risk	265
8.1 Default Correlation	266
8.1.1 Defining Default Correlation	266
8.1.2 The Order of Magnitude of Default Correlation	270
8.2 Credit Portfolio Risk Measurement	270
8.2.1 Granularity and Portfolio Credit Value-at-Risk	270
8.3 Default Distributions and Credit VaR with the Single-Factor Model	275
8.3.1 Conditional Default Distributions	275
8.3.2 Asset and Default Correlation	279
8.3.3 Credit VaR Using the Single-Factor Model	281
8.4 Using Simulation and Copulas to Estimate Portfolio Credit Risk	284
8.4.1 Simulating Single-Credit Risk	286
8.4.2 Simulating Joint Defaults with a Copula	288
Further Reading	295

CHAPTER 9

Structured Credit Risk	297
9.1 Structured Credit Basics	297
9.1.1 Capital Structure and Credit Losses in a Securitization	301
9.1.2 Waterfall	305
9.1.3 Issuance Process	307
9.2 Credit Scenario Analysis of a Securitization	309
9.2.1 Tracking the Interim Cash Flows	309
9.2.2 Tracking the Final-Year Cash Flows	314
9.3 Measuring Structured Credit Risk via Simulation	318
9.3.1 The Simulation Procedure and the Role of Correlation	318
9.3.2 Means of the Distributions	323
9.3.3 Distribution of Losses and Credit VaR	327
9.3.4 Default Sensitivities of the Tranches	333
9.3.5 Summary of Tranche Risks	336
9.4 Standard Tranches and Implied Credit Correlation	337
9.4.1 Credit Index Default Swaps and Standard Tranches	338
9.4.2 Implied Correlation	340
9.4.3 Summary of Default Correlation Concepts	341

9.5	Issuer and Investor Motivations for Structured Credit	342
9.5.1	Incentives of Issuers	343
9.5.2	Incentives of Investors	345
	Further Reading	346
CHAPTER 10		
	Alternatives to the Standard Market Risk Model	349
10.1	Real-World Asset Price Behavior	349
10.2	Alternative Modeling Approaches	363
10.2.1	Jump-Diffusion Models	363
10.2.2	Extreme Value Theory	365
10.3	The Evidence on Non-Normality in Derivatives Prices	372
10.3.1	Option-Based Risk-Neutral Distributions	372
10.3.2	Risk-Neutral Asset Price Probability Distributions	380
10.3.3	Implied Correlations	387
	Further Reading	390
CHAPTER 11		
	Assessing the Quality of Risk Measures	393
11.1	Model Risk	393
11.1.1	Valuation Risk	395
11.1.2	Variability of VaR Estimates	395
11.1.3	Mapping Issues	397
11.1.4	Case Study: The 2005 Credit Correlation Episode	399
11.1.5	Case Study: Subprime Default Models	405
11.2	Backtesting of VaR	407
11.3	Coherence of VaR Estimates	414
	Further Reading	419
CHAPTER 12		
	Liquidity and Leverage	421
12.1	Funding Liquidity Risk	422
12.1.1	Maturity Transformation	422
12.1.2	Liquidity Transformation	423
12.1.3	Bank Liquidity	425
12.1.4	Structured Credit and Off-Balance-Sheet Funding	429
12.1.5	Funding Liquidity of Other Intermediaries	432
12.1.6	Systematic Funding Liquidity Risk	434

12.2	Markets for Collateral	437
12.2.1	Structure of Markets for Collateral	438
12.2.2	Economic Function of Markets for Collateral	441
12.2.3	Prime Brokerage and Hedge Funds	443
12.2.4	Risks in Markets for Collateral	445
12.3	Leverage and Forms of Credit in Contemporary Finance	448
12.3.1	Defining and Measuring Leverage	448
12.3.2	Margin Loans and Leverage	454
12.3.3	Short Positions	455
12.3.4	Derivatives	456
12.3.5	Structured Credit	460
12.3.6	Asset Volatility and Leverage	460
12.4	Transactions Liquidity Risk	461
12.4.1	Causes of Transactions Liquidity Risk	461
12.4.2	Characteristics of Market Liquidity	463
12.5	Liquidity Risk Measurement	464
12.5.1	Measuring Funding Liquidity Risk	464
12.5.2	Measuring Transactions Liquidity Risk	466
12.6	Liquidity and Systemic Risk	469
12.6.1	Funding Liquidity and Solvency	469
12.6.2	Funding and Market Liquidity	471
12.6.3	Systemic Risk and the “Plumbing”	471
12.6.4	“Interconnectedness”	473
	Further Reading	474

CHAPTER 13

	Risk Control and Mitigation	477
13.1	Defining Risk Capital	478
13.2	Risk Contributions	480
13.2.1	Risk Contributions in a Long-Only Portfolio	481
13.2.2	Risk Contributions Using Delta Equivalents	485
13.2.3	Risk Capital Measurement for Quantitative Strategies	490
13.3	Stress Testing	499
13.3.1	An Example of Stress Testing	501
13.3.2	Types of Stress Tests	504
13.4	Sizing Positions	506
13.4.1	Diversification	506
13.4.2	Optimization and Implied Views	507
13.5	Risk Reporting	509
13.6	Hedging and Basis Risk	512
	Further Reading	516

CHAPTER 14

Financial Crises	517
14.1 Panics, Runs, and Crashes	519
14.1.1 Monetary and Credit Contraction	519
14.1.2 Panics	528
14.1.3 Rising Insolvencies	535
14.1.4 Impairment of Market Functioning	537
14.2 Self-Reinforcing Mechanisms	539
14.2.1 Net Worth and Asset Price Declines	540
14.2.2 Collateral Devaluation	542
14.2.3 Risk Triggers	543
14.2.4 Accounting Triggers	547
14.3 Behavior of Asset Prices During Crises	548
14.3.1 Credit Spreads	549
14.3.2 Extreme Volatility	551
14.3.3 Correlations	556
14.4 Causes of Financial Crises	562
14.4.1 Debt, International Payments, and Crises	563
14.4.2 Interest Rates and Credit Expansion	570
14.4.3 Procyclicality: Financial Causes of Crises	575
14.4.4 Models of Bubbles and Crashes	578
14.5 Anticipating Financial Crises	583
14.5.1 Identifying Financial Fragility	583
14.5.2 Macroeconomic Predictors of Financial Crises	585
14.5.3 Asset-Price Predictors of Financial Crises	585
Further Reading	591

CHAPTER 15

Financial Regulation	597
15.1 Scope and Structure of Regulation	598
15.1.1 The Rationale of Regulation	598
15.1.2 Regulatory Authorities	601
15.2 Methods of Regulation	605
15.2.1 Deposit Insurance	606
15.2.2 Capital Standards	608
15.2.3 Bank Examinations and Resolution	619
15.3 Public Policy Toward Financial Crises	621
15.3.1 Financial Stability Policies	621
15.3.2 Lender of Last Resort	628

15.4	Pitfalls in Regulation	635
15.4.1	Moral Hazard and Risk Shifting	636
15.4.2	Regulatory Evasion	643
15.4.3	Unintended Consequences	645
	Further Reading	647

APPENDIX A

	Technical Notes	653
A.1	Binomial Distribution	653
A.2	Quantiles and Quantile Transformations	654
A.3	Normal and Lognormal Distributions	656
A.3.1	Relationship between Asset Price Levels and Returns	656
A.3.2	The Black-Scholes Distribution Function	657
A.4	Hypothesis Testing	661
A.5	Monte Carlo Simulation	662
A.5.1	Fooled by Nonrandomness: Random Variable Generation	663
A.5.2	Generating Nonuniform Random Variates	664
A.6	Homogeneous Functions	664
	Further Reading	666

APPENDIX B

	Abbreviations	667
--	----------------------	------------

APPENDIX C

	References	671
--	-------------------	------------

Index

701

List of Figures

1.1	Disintermediation in the U.S. Financial System 1980–2010	4
1.2	Share of Financial Services Industry in U.S. Output	5
1.3	OTC Derivatives Markets 1998–2010	9
1.4	Intermediation by Sector 1959–2008	12
1.5	Traditional and Innovative Intermediation 1951–2010	13
1.6	Securitization of Commercial Real Estate Lending 1960–2010	14
1.7	Hedge Fund Assets under Management	18
1.8	Growth of World Income 1950–2006	21
1.9	Growth of World International Trade 1971–2009	22
1.10	U.S. Labor Productivity 1947–2010	23
1.11	U.S. Inflation 1958–2010	24
1.12	U.S. Current Account Balance 1960–2010	25
1.13	Growth of International Monetary Reserves	26
1.14	Real Fed Funds Rate 1971–2009	27
1.15	U.S. Growth Rate and Its Volatility 1947–2009	28
1.16	U.S. Savings Rate 1946–2010	29
1.17	Corporate Leverage in the United States	29
2.1	Approximating Logarithmic by Arithmetic Returns	48
2.2	Sample Path of a Random Walk	66
2.3	Convergence of a Random Walk to a Brownian Motion	67
2.4	Convergence of a Random Walk to a Brownian Motion	69
2.5	Geometric Brownian Motion: Asset Price Level	73
2.6	Geometric Brownian Motion: Daily Returns	74
2.7	Joint Distribution of EUR and JPY Returns	78
2.8	Correlation and Beta	79
2.9	Volatility and Beta	80
2.10	Diversification, Volatility, and Correlation	84
2.11	Minimum-Variance and Efficient Portfolios	87
3.1	Definition of VaR	96
3.2	The EWMA Weighting Scheme	105
3.3	Comparison of Volatility Estimators	107
3.4	Comparison of Simulation Approaches	112
4.1	Monotonicity and Option Risk Measurement	124

4.2	Delta-Gamma and VaR for an Unhedged Long Call	130
4.3	Delta-Gamma and VaR for a Hedged Call	132
4.4	Option Combinations	133
4.5	Delta-Gamma and Full-Repricing VaR for a Risk Reversal	135
4.6	Spot, Forward, and Discount Curves	145
4.7	Bond Price and Yield Volatility	152
4.8	Approximating the Bond Price-Yield Relationship	155
5.1	Time Variation of Implied Volatility	176
5.2	Option Vega	178
5.3	S&P 500 Implied Volatility Smile	181
5.4	EUR-USD Volatility Surface	182
5.5	Impact of Vega Risk	184
5.6	Euro Foreign Exchange Implied Volatilities	186
5.7	Vega and the Smile	188
5.8	Euro Implied Volatilities, Risk Reversals, and Strangle Prices	189
6.1	Default Rates 1920–2010	206
6.2	Merton Model	220
6.3	Asset and Market Index Returns in the Single-Factor Model	225
6.4	Distribution of Bond Value in the Merton Model	227
6.5	Credit VaR in the Merton Model	228
7.1	Computing Spread01 for a Fixed-Rate Bond	234
7.2	Spread01 a Declining Function of Spread Level	235
7.3	Intensity Model of Default Timing	238
7.4	CDS Curves	247
7.5	Estimation of Default Curves	258
7.6	Spread Curve Slope and Default Distribution	260
7.7	Morgan Stanley CDS Curves, select dates	261
7.8	Measuring Spread Volatility: Citigroup Spreads 2006–2010	263
8.1	Distribution of Defaults in an Uncorrelated Credit Portfolio	272
8.2	Distribution of Losses in an Uncorrelated Credit Portfolio	274
8.3	Default Probabilities in the Single-Factor Model	277
8.4	Single-Factor Default Probability Distribution	279
8.5	Conditional Default Density Function in the Single-Factor Model	280
8.6	Distribution of Losses in the Single-Factor Model	285
8.7	Density Function of Portfolio Losses in the Single-Factor Model	286
8.8	Estimated Single-Credit Default Risk by Simulation	287
8.9	Shifting from Uniform to Normal Distribution Simulations	288
8.10	Distribution of Losses in the Single-Factor Model	292
8.11	Simulating Multiple Defaults	294
9.1	Values of CLO Tranches	326

9.2	Distribution of Simulated Equity Tranche Values	328
9.3	Distribution of Simulated Mezzanine Bond Tranche Losses	328
9.4	Distribution of Simulated Senior Bond Tranche Losses	329
9.5	Default Sensitivities of CLO Tranches	335
10.1	Normal and Non-Normal Distributions	351
10.2	S&P 500 Daily Returns 1928–2011	353
10.3	Statistical Properties of Exchange Rates	356
10.4	Kernel Estimate of the Distribution of VIX Returns	360
10.5	QQ Plot of USD Exchange Rates against the Euro and Turkish Lira	362
10.6	Jump-Diffusion Process: Asset Price Level	364
10.7	Jump-Diffusion: Daily Returns	365
10.8	Elan Corporation Stock Price	366
10.9	QQ Plot of the S&P 500	367
10.10	Constructing a Long Butterfly	378
10.11	State Prices and the Risk Neutral Density	379
10.12	Fitted Implied Volatility Smile	384
10.13	Estimated Risk-Neutral Density	385
10.14	Risk-Neutral Implied Equity Correlation	389
11.1	Convexity of CLO Liabilities	401
11.2	Correlation Risk of the Convexity Trade	404
11.3	Implied Correlation in the 2005 Credit Episode	405
11.4	ABX Index of RMBS Prices	407
11.5	Chi-Square Distribution	410
11.6	Backtest of a Normal Distribution	411
11.7	Likelihood-Ratio Test	412
11.8	Historical Backtesting	413
11.9	Failure of Subadditivity	417
12.1	Short-Term Commercial Paper of Financial Institutions	430
12.2	Convertible Bond Cheapness	437
12.3	U.S. Broker-Dealer Repo 1980–2010	444
12.4	Repo Rates and Spreads 2006–2009	447
13.1	Risk Contributions in a Long-Only Strategy	486
13.2	Allocation, Volatility, and Constant Risk Contribution	487
13.3	Simulated Hedge Fund Strategy Returns	494
13.4	Citigroup CDS Basis 2007–2010	514
14.1	Net Borrowing in U.S. Credit Markets 1946–2010	520
14.2	Growth in U.S. Bank Credit 1947–2011	521
14.3	Tightening of Credit Terms 1990–2011	523
14.4	U.S. Bank Lending during the Subprime Crisis 2006–2011	524
14.5	Outstanding Volume of Commercial Paper 2001–2011	527
14.6	U.S. Bond Issuance 1996–2010	527

14.7	Institutional Investor Assets in MMMFs 2008–2010	529
14.8	Citigroup Credit Spreads during the Subprime Crisis	532
14.9	Three-Month TED Spread 1985–2011	533
14.10	Libor-OIS Spread 2006–2011	534
14.11	U.S. Dollar Overnight Rates 2006–2011	535
14.12	U.S. Commercial Bank Charge-Off and Delinquency Rates 1985–2010	536
14.13	Settlement Fails in the Treasury Market 1990–2010	538
14.14	U.S. Credit Spreads 1997–2014	549
14.15	U.S. Dollar Swap Spreads 1988–2011	551
14.16	S&P 500 Prices 1927–2011	552
14.17	U.S. Equity Implied Volatility 1990–2011	554
14.18	Equity Volatility Dispersion	554
14.19	Proxy Hedging and the ERM Crisis 1992–1993	557
14.20	On- vs. Off-the-Run Rate Correlation	558
14.21	Changing Equity Betas during the Subprime Crisis	559
14.22	Implied Credit Correlation 2004–2010	561
14.23	Gold and the U.S. Dollar at the End of Bretton Woods	568
14.24	Sterling in the European Monetary System	569
14.25	U.S. Leverage 1947–2010	583
14.26	Behavior of Implied and Historical Volatility in Crises	589
15.1	U.S. House Prices and Homeownership 1987–2011	623
15.2	Citigroup Credit Spreads during the Subprime Crisis	641
A.1	Convergence of Binomial to Normal Distribution	654
A.2	The Black-Scholes Probability Density Function	660
A.3	Transforming Uniform into Normal Variates	665

Preface

F*inancial Risk Management* started as one thing and has ended as another. I took up this project with the primary aim of making risk measurement and management techniques accessible, by working through simple examples, and explaining some of the real-life detail of financing positions. I had gotten fairly far along with it when the subprime crisis began and the world changed.

I had already begun to appreciate the importance of liquidity and leverage risks, which are even harder to measure quantitatively than market and credit risks, and therefore all the more important in practice. In the subprime crisis, liquidity and leverage risks were dominant. Had the subprime crisis never occurred, they would have had an honorable place in this text. After the crisis erupted, it became hard to think about anything else. To understand why liquidity and leverage are so important, one needs to understand the basic market and credit risk models. But one also needs to understand the institutional structure of the financial system.

One aim of *Financial Risk Management* is therefore to bring together the model-oriented approach of the risk management discipline, as it has evolved over the past two decades, with economists' approaches to the same issues. There is much that quants and economists can learn from one another. One needs to understand how financial markets work to apply risk management techniques effectively.

A basic aim of the book is to provide some institutional and historical context for risk management issues. Wherever possible, I've provided readers with data from a variety of public- and private-sector sources, for the most part readily accessible by practitioners and students. One of the blessings of technology is the abundance of easily obtainable economic and financial data. The particular phenomena illustrated by the data in the figures are important, but even more so familiarity with data sources and the habit of checking impressions of how the world works against data.

Some themes are developed across several chapters, but can be read in sequence for a course or for individual study:

- Recent financial history, including postwar institutional changes in the financial system, developments in macroeconomic and regulatory policy, recent episodes of financial instability, and the global financial crisis are the focus of all or part of Chapters 1, 9, 11, 12, 14, and 15.
- Market risk is studied in Chapters 2 through 5 on basic risk models and applications. Chapter 7 discusses spread risk, which connects market and credit risks, Chapter 11 discusses model validation, and Chapters 12 through 15 discuss liquidity risk, risk capital, the behavior of asset returns during crises, and regulatory approaches to market risk.
- Credit risk is studied in Chapters 6 through 9, which present basic concepts and models of the credit risk of single exposures and credit portfolios, and in Chapters 11, 12, and 15, which study credit risk in the context of leverage, liquidity, systemic risk and financial crises.
- Structured credit products and their construction, risks, and valuation, are the focus of Chapter 9. Chapter 11 continues the discussion of structured credit risk, while Chapters, 12, 14, and 15 discuss the role of structured products in collateral markets and in financial system leverage.
- Risk management of options is developed in Chapters 4 and 5 in the context of nonlinear exposures and portfolio risk. Chapter 14 discusses the role of option risk management in periods of financial stress.
- Extraction of risk measures based on market prices, such as risk-neutral return and default probabilities and equity and credit implied correlations, is studied in Chapters 7, 9 and 10, and applied in Chapters 1, 11, and 14.

Financial Risk Management is intermediate in technical difficulty. It assumes a modicum, but not a great deal, of comfort with statistics and finance concepts. The book brings a considerable amount of economics into the discussion, so it will be helpful if students have taken an economics course.

Each chapter contains suggestions for further reading. Most of the texts cited provide alternative presentations or additional detail on the topics covered in *Financial Risk Management*. Some of them treat topics that couldn't be covered adequately in this book, or in some way take the story further. Others are suggested basic readings on statistics, finance, and economics.

I've had the good fortune of working with wonderful, smart people for the past quarter-century. The Federal Reserve System is home to some of the brightest and most hardworking people I've known, and the citizenry is

- [**Food from Your Forest Garden: How to Harvest, Cook and Preserve Your Forest Garden Produce pdf, azw \(kindle\)**](#)
- [read online Kuby Immunology \(7th Edition\) pdf, azw \(kindle\), epub, doc, mobi](#)
- [download Big Bend: Stories](#)
- [read Faster Harder \(Take Me, Book 1\)](#)

- <http://rodrigocaporal.com/library/Amateur-Photographer--UK---6-September-2014-.pdf>
- <http://paulczajak.com/?library/Kuby-Immunology--7th-Edition-.pdf>
- <http://www.netc-bd.com/ebooks/Big-Bend--Stories.pdf>
- <http://weddingcellist.com/lib/Faster-Harder--Take-Me--Book-1-.pdf>