

Advances in Quantitative Asset Management

STUDIES IN COMPUTATIONAL FINANCE

Editor-in-Chief:

Apostolos-Paul Refenes, London Business School, UK

Editorial Board:

Y. Abu-Mostafa, CalTech, USA

F. Diebold, University of Pennsylvania, USA

A. Lo, MIT, USA

J. Moody, Oregon Graduate Institute, USA

M. Steiner, University of Augsburg, Germany

H. White, UCSD, USA

S. Zenios, University of Pennsylvania, The Wharton School, USA

Volume I

ADVANCES IN QUANTITATIVE ASSET MANAGEMENT

edited by Christian L. Dunis

Advances in Quantitative Asset Management

edited by

Christian L. Dunis

Liverpool Business School, UK

Springer Science+Business Media, LLC

Library of Congress Cataloging-in-Publication Data

Advances in quantitative asset management / edited by Christian L. Dunis.

p.cm.-- (Studies in computational finance; 1)

Includes bibliographical references.

ISBN 978-1-4613-6974-5 ISBN 978-1-4615-4389-3 (eBook)

DOI 10.1007/978-1-4615-4389-3

1. Capital assets pricing model. 2. Portfolio management. I. Dunis, Christian L. II. Series.

HG4636.A36 2000

332.6--dc21

99-086380

Copyright © 2000 by Springer Science+Business Media New York

Originally published by Kluwer Academic Publishers in 2000

Softcover reprint of the hardcover 1st edition 2000

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, mechanical, photo-copying, recording, or otherwise, without the prior written permission of the publisher, Springer Science+Business Media, LLC.

Printed on acid-free paper.

CONTENTS

Contributors	vii
Preface	xii
PART 1: ADVANCES IN ASSET ALLOCATION AND PORTFOLIO MANAGEMENT	
1. Introducing Higher Moments in the CAPM: Some Basic Ideas <i>Gustavo M. de Athayde and Renato G. Flôres Jr.</i>	3
2. Fat Tails and the Capital Asset Pricing Model <i>Chris J. Adcock and Karl Shutes</i>	17
3. The Efficiency of Fund Management: An Applied Stochastic Frontier Model <i>Walter Briec and Jean-Baptiste Lesourd</i>	41
4. Investment Styles in the European Equity Markets <i>Monica Billio, Roberto Casarin, Claire Méhu and Domenico Sartore</i>	61
5. Advanced Adaptive Architectures for Asset Allocation <i>Patrick Naïm, Pierre Hervé and Hans Georg Zimmermann</i>	89
6. High Frequency Data and Optimal Hedge Ratios <i>Christian L. Dunis and Pierre Lequeux</i>	113

PART 2: MODELLING RISK, RETURN AND CORRELATION

- | | | |
|-----|---|-----|
| 7. | Large Scale Conditional Correlation Estimation
<i>Frédéric Bourgoïn</i> | 139 |
| 8. | The Pitfalls in Fitting GARCH(1,1) Processes
<i>Gilles Zumbach</i> | 179 |
| 9. | Factor GARCH, Regime-Switching and the Term Structure of Interest Rates
<i>David Khabie-Zeitoune, Gerry Salkin and Nicos Christofides</i> | 201 |
| 10. | Hedging a Portfolio of Corporate Bonds Using PCA/GARCH Yield Curve Analysis
<i>Darren Toulson, Sabine Toulson and Abongwa Ndumu</i> | 235 |
| 11. | Analysis of Time Varying Exchange Rate Risk Premia
<i>Ramaprasad Bhar and Carl Chiarella</i> | 255 |
| 12. | Volatility Modelling in the Forex Market: An Empirical Evaluation
<i>Renato G. Flôres Jr. and Bruno B. Roche</i> | 275 |
| 13. | Five Classification Algorithms to Predict High Performance Stocks
<i>George T. Albanis and Roy A. Batchelor</i> | 295 |
| 14. | Forecasting Financial Time Series with Generalized Long Memory Processes
<i>Laurent Ferrara and Dominique Guégan</i> | 319 |

ABOUT THE CONTRIBUTORS

Chris Adcock is Reader in Finance and Financial Economics at the University of Bath and is Founding Editor of the *European Journal of Finance*. He worked for several years in quantitative investment management in the City. His main interests are in modelling asset returns and in portfolio selection.

George Albanis is a PhD student at City University Business School, London. He holds a BSc (Economics) from the University of Athens, and Master's degrees in Business Finance and in Decision Modelling and Information Systems from Brunel University. An experienced programmer, his research is focused on the application of advanced data-mining techniques for prediction and trader support in equity and bond markets.

Gustavo M. de Athayde is a PhD student at the Escola de Pós-Graduação em Economia, Fundação Getulio Vargas, Rio de Janeiro. He has a practical knowledge of the Brazilian financial markets and his present research interests are portfolio design, in static and dynamic settings, and the econometrics of risk management models.

Roy Batchelor is HSBC Professor of Banking and International Finance at City University Business School, London. He has published widely in financial economics and forecasting, has acted as advisor to a number of City firms and governmental organisations, and as Associate Editor of the *International Journal of Forecasting*. In addition to work on nonlinear classification methods, current research projects include the evaluation of technical analysts, and fuzzy logic models of equity style rotation.

Ramaprasad Bhar has a Master's degree in Computer Science and a PhD in Quantitative Finance. His main research interests are in advanced econometrics, investment theory and practice, numerical techniques for financial applications, hidden Markov models, and global contagion in speculative prices. He has published in journals such as *Applied Mathematical Finance*, *Review of Quantitative Finance and Accounting*, *The European Journal of Finance*, *Financial Engineering and the Japanese Markets*.

Monica Billio is Assistant Professor of Econometrics at Università Ca' Foscari in Venice. She graduated in Economics at Università Ca' Foscari di Venezia and holds a PhD degree in Applied Mathematics from the Université Paris IX Dauphine.

Frédéric Bourgoin is an Associate in the Active Fixed Income Portfolio Management Team at Barclays Global Investors in London. Prior to joining BGI, he was Risk Manager at UBK Asset Management. He holds a MSc in Finance from ESSEC Graduate Business School and a post-graduate degree in Econometrics from Paris II University.

Walter Briec holds a Diplôme d'Etudes Approfondies and a Doctorate in Economics from Ecole des Hautes Etudes en Sciences Sociales in Marseille. He is Lecturer in Economics at the University of Rennes. His interests are theoretical and empirical microeconomics, and particularly the theory of efficiency and its applications to asset management. He has published a number of articles on these topics in international journals, and presented invited papers at several conferences, especially in Brazil and in the United States.

Roberto Casarin is an Econometric Analyst at GRETA Associates (Gruppo di Ricerca Economica Teorica e Applicata) in Venice. He graduated in Economics at Università Ca' Foscari di Venezia, specialising in the economics of financial markets and financial institutions. He has focused his research on financial and economic topics at CDC Asset Management in Paris.

Carl Chiarella holds a PhD degree in both Applied Mathematics and Economics. He is Professor of Finance at the University of Technology, Sydney. He researches and teaches in finance, economics and applied mathematics and has published in journals such as *Applied Mathematical Finance*, *European Journal of Finance*, *Macroeconomic Dynamics*, *Economic Modelling*, *Journal of Nuclear Energy* and *Mathematics of Computation*. His research interests cover all aspects of quantitative finance and economic dynamics.

Nicos Christofides is a Professor at Imperial College in London and a Director of its Centre for Quantitative Finance. His background in operations research and combinatorial optimisation have furnished him with powerful tools which he has used to tackle many difficult problems in finance in innovative ways, from option pricing theory in incomplete and imperfect markets to optimal multi-period asset and liability management.

Christian L. Dunis is Girobank Professor of Banking and Finance at Liverpool Business School, and Director of its Centre for International Banking, Economics and Finance (CIBEF). He also works as a consultant to City firms and as Official Reviewer attached to the European Commission for the evaluation of applications to Finance of emerging software technologies. He is an Editor of the European Journal of Finance and has published widely in the field of financial markets analysis and forecasting.

Laurent Ferrara is a PhD student in Statistics at the University of Paris XIII and he is working for the Commercial Department of RATP, the company which manages public transportation in the Paris area. His research interests are nonlinear time series modelling, parameter estimation and forecasting, especially using long memory processes.

Renato G. Flôres Jr. is Professor and Research Director at the Escola de Pós-Graduação em Economia, Fundação Getulio Vargas, Rio de Janeiro. His fields of interest are dynamic econometrics and international finance and trade, where he publishes regularly.

Dominique Guégan is Professor of Statistics in the Department of Mathematics at the University of Reims (France). She works also in the laboratory of statistics of CREST (Paris). Her research concerns time series modelling (heteroscedastic and long memory models) and dynamical systems (chaotic processes). Most of her publications are on identification theory, estimation, tests and prediction and also probabilistic aspects of dynamical chaotic systems. She is regularly invited in international conferences and workshops to lecture on these topics.

Pierre Hervé holds a postgraduate DESS diploma in Economics from Paris XIII University. He has been successively a fund manager at Caisse des Dépôts et Consignations, the Head of fixed income fund management at Cholet-Dupont Gestion, and is now in charge of quantitative research at AXA Investment Managers.

David Khabie-Zeitoune studied Mathematics at Cambridge University, where he also completed a Master's in Probability Theory, Martingales and Stochastic Analysis. He then moved to the Centre for Quantitative Finance, at Imperial College, where he wrote his PhD dissertation on multivariate models of foreign exchange and interest rates applied to Value-at-Risk. He now works as Market Risk Analyst for Citibank, N.A.

Pierre Lequeux is an Independent Consultant in the City and an Associate Researcher with CIBEF at Liverpool Business School. He was

previously Head of BNP Quantitative Research and Trading Desk where he researched and developed trading models and portfolio management techniques which were implemented by the bank on a proprietary basis. Pierre is a frequent contributor to academic investment conferences and publications. He is an Editor of *Derivatives Use, Trading & Regulation* and a member of the AIMA Currency Advisory Group.

Jean-Baptiste Lesourd is Research Professor in Economics at Université de la Méditerranée in Aix en Provence, and part-time Lecturer at Ecole Supérieure des Sciences Economiques et Commerciales (ESSEC) in Cergy. He has been a visiting Scholar at the Massachusetts Institute of Technology, as well as a visiting Professor at the University of Geneva and at the University of Western Australia. His research interests are the modelling of organised markets, such as commodity and financial markets, and, more generally, microeconomic modelling. He has published widely in these fields.

Claire Méhu is a Quantitative Analyst at CDC Asset Management in Paris. She graduated in Finance at Université Paris IX Dauphine where she received an MSc in International Economics and Finance. She previously worked for 3 years in the research team of CAR, the research subsidiary of Caisse des Dépôts et Consignations.

Patrick Naïm is an engineer of the Ecole Centrale de Paris. He is the founder and chairman of Elseware, a company specialized in the application of nonlinear methods to financial management problems. He is currently working for some of the largest French institutions and coordinating research projects in the field at the European level.

Abongwa Ndumu holds a BEng in Engineering and a PhD in Neural Networks. He is the author of a number of papers on the use of neural networks. He joined Intelligent Financial Systems Limited (IFS) in 1998 and has been involved in the recent integration of a number of volatility modelling techniques into IFS's Internet systems.

Bruno B. Roche is a part-time PhD student at the École de Commerce Solvay, Université Libre de Bruxelles, Brussels. He has developed a risk management research group within a major multinational company and his current interest focuses on volatility modelling, high-frequency data and risk management.

Gerry Salkin is a Director of the Centre for Quantitative Finance at Imperial College, London. He has published widely in all aspects of capital

markets and corporate finance, and his breadth and depth of experience make him a regular advisor to many City firms and investment houses.

Domenico Sartore is Professor of Econometrics at Università Ca' Foscari of Venice. Previously he taught at the Universities of Milan and Padova. He previously held a two-year Research Fellow position at the London School of Economics and has been Visiting Professor at UCLA.

Karl Shutes is Research Fellow in Finance at Westminster Business School, London. He also works in the areas of portfolio selection and return modelling and has a specific interest in development of models of investor behaviour.

Darren Toulson is a Director of Intelligent Financial Systems Limited, a company developing financial forecasting and trading systems. He holds a BSc in Mathematics and Physics and a PhD in Neural Networks and Time Series Analysis from King's College, London. He is the author of a number of papers on neural networks applied to time series analysis, image processing and financial forecasting.

Sabine Toulson is a Director of Intelligent Financial Systems Limited. She reads Economics and Mathematics at University College, London and holds an MSc with Distinction in Neural Networks from King's College, London. She has published several papers on exchange rate analysis using neural networks and portfolio management.

Hans Georg Zimmermann obtained a PhD in Economics from the University of Bonn in 1987. Since 1990, he has been leading the project 'Neural Networks for Financial Applications' at the Department for Corporate Research and Development of Siemens AG in Munich and has become an international expert with extensive publications in this field.

Gilles Zumbach did his graduate studies and PhD in Physics at the Swiss Federal Institute of Technology in Lausanne. Subsequently, he held postdoctoral positions at the University of Roma, at the Max Planck Institute of Stuttgart, and at Harvard University. In the beginning of 1996, he joined the research team at Olsen & Associates to study financial markets. Through various collaborations, he worked on several topics in condensed matter theory, mathematical physics, statistical mechanics, computational physics and finance. He is author or co-author of more than 20 scientific papers published in refereed journals in physics and finance.

PREFACE

This book contains selected articles which, for most of them, were presented at the 'Forecasting Financial Markets' Conference in May 1999 (FFM'99).

'Forecasting Financial Markets' is an International Conference on Quantitative Finance which is held in London in May every year. Since its inception in 1994, the Conference has grown in scope and stature to become, after six years of continued success, a key international meeting point for those interested in Quantitative Finance, with the participation of prestigious academic and research institutions from all over the world including major central banks and quantitative fund managers.

The FFM Scientific Committee is composed of both academics and quantitative market professionals to ensure the methodological soundness of the selected contributions and also retain the practitioner's perspective at the same time. Over the years, the Committee has ensured that the presentations were original, high quality *and* practical.

With about fifty papers presented each year, a choice had to be made as to which papers would be selected for this volume. I have chosen to concentrate on Advances in Quantitative Asset Management and, accordingly, the papers in this book are organised around two major themes: Advances in Asset Allocation and Portfolio Management, and Modelling Risk, Return and Correlation.

I would like to thank the members of the Scientific Committee of the FFM Conference for their help in selecting the papers presented each year and the Conference sponsors whose support is so important. Special thanks go to Patrick Naïm and his team at Elseware: their help in putting the FFM'99 Conference together was most appreciated.

Christian L. Dunis
FFM'99 Organiser
Girobank Professor of Banking and Finance
Liverpool Business School