

Contents

1	Robustification of an On-line EM Algorithm for Modelling Asset Prices Within an HMM	1
	Christina Erlwein-Sayer and Peter Ruckdeschel	
1.1	Introduction	1
1.2	Hidden Markov Model Framework for Asset Returns	3
1.3	Essential Steps in Elliott's Algorithm	4
1.3.1	Change of Measure	4
1.3.2	Filtering for General Adapted Processes	4
1.3.3	Filter-Based EM Algorithm	7
1.3.4	Summary of Algorithm	8
1.4	Outliers in Asset Allocation Problem	8
1.4.1	Outliers in General	8
1.4.2	Time-Dependent Context: Exogenous and Endogenous Outliers	9
1.4.3	Evidence for Robustness Issue in Asset Allocation	10
1.5	Robust Statistics	12
1.5.1	Concepts of Robust Statistics	12
1.5.2	Our Robustification of the HMM: General Strategy	14
1.5.3	Robustification of Step (0)	15
1.5.4	Robustification of the E-Step	15
1.5.5	Robustification of the (M)-Step	18
1.6	Implementation and Simulation	23
1.7	Conclusion	24
1.7.1	Contribution of This Paper	24
1.7.2	Outlook	26
	Appendix	27
	References	29

2	Stochastic Volatility or Stochastic Central Tendency: Evidence from a Hidden Markov Model of the Short-Term Interest Rate	33
	Craig A. Wilson and Robert J. Elliott	
2.1	Introduction	33
2.2	The Model	36
2.3	Maximum Likelihood Estimation	37
2.4	The Likelihood Function	37
2.5	The Interest Rate Model	39
2.6	Data	40
2.7	Results	45
2.8	Conclusion	51
	References	52
3	An Econometric Model of the Term Structure of Interest Rates Under Regime-Switching Risk	55
	Shu Wu and Yong Zeng	
3.1	Introduction	55
3.2	The Model	58
3.2.1	A Simple Representation of Markov Regime Shifts	58
3.2.2	Other State Variables	59
3.2.3	The Term Structure of Interest Rates	60
3.2.4	Bond Risk Premiums Under Regime Shifts	61
3.2.5	An Affine Regime-Switching Model	63
3.2.6	The Effects of Regime Shifts on the Yield Curve	66
3.3	Empirical Results	68
3.3.1	Data and Summary Statistics	68
3.3.2	Estimation Procedure	70
3.3.3	Discussions	74
3.4	Conclusion	80
	References	80
4	The LIBOR Market Model: A Markov-Switching Jump Diffusion Extension	85
	Lea Steinrück, Rudi Zagst, and Anatoliy Swishchuk	
4.1	Introduction	85
4.2	Mathematical Preliminaries	87
4.3	The Log-Normal LIBOR Framework	90
4.3.1	An Introduction to the LIBOR Market Model: The Log-Normal Dynamics	91
4.3.2	Pricing of Caps and Floors in the Log-Normal LMM	93
4.4	The Markov-Switching Jump Diffusion (MSJD) Extension of the LMM	94
4.4.1	Presenting the Extended Framework	95
4.4.2	The Measure Changes and Its Consequences	97
4.5	Pricing in the MSJD Framework	100
4.5.1	Determining the Characteristic Function of Y_{N-1}	101

4.5.2	Determining the Characteristic Function of $Y_j, j = 1, \dots, N - 2$	105
4.6	Calibration	105
4.6.1	The Data	106
4.6.2	Discussion of the Results of the Calibration	108
4.7	Conclusion	112
	References	114
5	Exchange Rates and Net Portfolio Flows: A Markov-Switching Approach	117
	Faek Menla Ali, Fabio Spagnolo, and Nicola Spagnolo	
5.1	Introduction	117
5.2	The Model	119
5.3	Data	120
5.4	Empirical Results	122
5.5	Conclusions	129
	References	130
6	Hedging Costs for Variable Annuities Under Regime-Switching	133
	Parsiad Azimzadeh, Peter A. Forsyth, and Kenneth R. Vetzal	
6.1	Introduction	134
6.2	Hedging Costs	136
6.2.1	Derivation of the Pricing Equation	137
6.2.2	Events	139
6.2.3	Loss-Maximizing Strategies	141
6.2.4	Regime-Switching	142
6.3	Optimal Consumption	143
6.3.1	Utility PDE	144
6.3.2	Events	144
6.3.3	Consumption-Optimal Withdrawal	145
6.3.4	Regime-Switching	146
6.3.5	Hyperbolic Absolute Risk-Aversion	147
6.4	Numerical Method	147
6.4.1	Homogeneity	147
6.4.2	Localized Problem and Boundary Conditions	150
6.4.3	Determining the Hedging Cost Fee	151
6.5	Results	151
6.5.1	Loss-Maximizing and Contract Rate Withdrawal	151
6.5.2	Consumption-Optimal Withdrawal	154
6.6	Conclusion	159
	Appendix	160
	References	165

7	A Stochastic Approximation Approach for Trend-Following Trading	167
	Duy Nguyen, George Yin, and Qing Zhang	
7.1	Introduction	167
7.2	Problem Formulation	168
7.3	Asymptotic Properties	171
7.4	Numerical Examples	176
	References	183
8	A Hidden Markov-Modulated Jump Diffusion Model for European Option Pricing	185
	Tak Kuen Siu	
8.1	Introduction	185
8.2	Hidden Regime-Switching Jump-Diffusion Market	188
8.3	Filtering Theory and Filtered Market	192
8.3.1	The Separation Principle	192
8.3.2	Filtering Equations	194
8.4	Generalized Esscher Transform in the Filtered Market	198
8.5	European-Style Option	203
8.6	Conclusion	207
	References	207
9	An Exact Formula for Pricing American Exchange Options with Regime Switching	211
	Leunglung Chan	
9.1	Introduction	211
9.2	Asset Price Dynamics	213
9.3	Problem Formulation	215
9.4	A Closed-Form Formula	219
9.5	Conclusion	224
	References	224
10	Parameter Estimation in a Weak Hidden Markov Model with Independent Drift and Volatility	227
	Xiaojing Xi and Rogemar S. Mamon	
10.1	Introduction	227
10.2	Modelling Background	230
10.3	Filters and Parameter Estimation	231
10.4	Numerical Implementation	235
10.5	Conclusion	239
	References	239
11	Parameter Estimation in a Regime-Switching Model with Non-normal Noise	241
	Luka Jalen and Rogemar S. Mamon	
11.1	Introduction	241

11.2	Model Set Up	242
11.3	Reference Probability Measure	243
11.4	Recursive Estimation	244
11.5	Parameter Estimation	246
11.5.1	EM Algorithm and the Estimation of Transition Probabilities	247
11.5.2	Student's t -Distributed Noise Term	248
11.6	Numerical Application of the Filters	252
11.6.1	Filtering Using Simulated Data	252
11.6.2	Application of the Filters to Observed Market Data	258
11.7	Conclusions	260
	References	261

Hidden Markov Models in Finance

Further Developments and Applications, Volume II

Mamon, R.S.; Elliott, R.J. (Eds.)

2014, XXII, 261 p. 47 illus., 39 illus. in color., Hardcover

ISBN: 978-1-4899-7441-9