Mini-Symposium on
Mathematical Finance: Theory and Practice

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Tomas Björk
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On the existence of finite dimensional realizations for nonlinear forward rate models
Room 6

We consider interest rate models of Heath-Jarrow-Morton type, where the forward rates are driven by a multidimensional Wiener process, and where he volatility is allowed to be an arbitrary smooth functional of the present forward rate curve. Using ideas from differential geometry as well as from systems and control theory, we investigate when the forward rate process can be realized by a finite dimensional Markovian state space model, and we give general necessary and sufficient conditions, in terms of the volatility structure, for the existence of a finite dimensional realization. A number of concrete applications are given, and most previously known realization results for time homogenous Wiener driven models are included and extended. As a special case we give a general and easily applicable necessary and sufficient condition for when the induced short rate is a Markov process. In particular we show that the only forward rate models, with short rate dependent volatility structures, which generically possess a short rate realization are the affine ones. These models are thus the only generic short rate models from a forward rate point of view.

Joint work with Lars Svensson.

Ernst Eberlein
Universität Freiburg
Application of generalized hyperbolic Lévy motions to finance
Room 6

In standard mathematical finance Brownian motion plays the dominating role as driving process for modelling price movements. In order to achieve a better fit to real-life data it is, however, preferable to replace Brownian motion by a Lévy process. Generalized hyperbolic Lévy motions are processes which allow an almost perfect fit to financial data. We discuss in detail what the consequences for asset price modelling, derivative pricing and interest rate theory are. We also touch on aspects of multivariate and intraday modelling.

Dilip B. Madan
University of Maryland
The fine structure of asset returns: An empirical investigation
Room 6

We investigate the relative importance of diffusion and jumps in a new jump diffusion model for asset returns. In contrast to the standard modelling of jumps for asset returns, the jump component of our process can display finite or infinite activity, and finite or infinite variation. Empirical investigations of time series indicates that the index dynamics are essentially devoid of a diffusion component, while this component may be present in the dynamics of individual stocks. This result leads to the conjecture that the risk neutral process should be free of a diffusion component for both indices and individual stocks. Empirical investigation of options

data tends to confirm this conjecture. We conclude that the statistical and risk neutral processes for indices and stocks tend to be pure jump processes of infinite activity and finite variation.

Stanley R. Pliska
University of Illinois at Chicago
Risk sensitive control with applications to fixed income management
Room 6

This paper presents an application of risk sensitive control theory in financial decision making. Specifically, we develop optimal, risk sensitive investment strategies for a long-term investor who is interested in optimal allocation of capital between cash, equities, and fixed-income instruments. The long-term fixed income instruments considered are rolling horizon bonds and can be viewed as mutual funds of zero coupon bonds all having maturities approximately equal to the same fixed number across time. In order to derive our fixed income results, we considerably extend the risk asset management results developed in our earlier papers. These new results involve continuous algebraic Riccati equations, as we illustrate with a numerical example.

Rainer Schöbel
Universität Tübingen
Backwardation, arbitrage and the hybrid model of commodity futures pricing
Room 6

In this paper I discuss the hybrid model of commodity futures pricing and its resulting partial differential equation. Using perturbation techniques I present an approximate closed form solution for the commodity futures price. Some numerical examples are given.
