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Markov Representation of the Heath-Jarrow-Morton Model

13 Pages

Posted: 26 Mar 2001

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Abstract

This paper provides a derivation of an arbitrage free approximation to any HJM model as a continuous time Markov model with a finite number of state variables. Arbitrage freedom is maintained exactly at the cost of approximating any particular term structure of volatility. Using a large enough set of state variables, any ``reasonable" term structure of volatility can be approximated to any desired level of accuracy in a systematic fashion. The state variables fall into two sets. One set specifies the values of a finite number of forward rates of different maturities. The other set determines how to ``interpolate" to other maturities; their values depend on the integrated covariances of the variables in the first set. □□A restriction of the model to volatility term structures dependent only on time and relative maturity is derived: a general volatility structure with this property is approximated as a sum of exponentials in the relative maturity, weighted by arbitrary functions of the time and the current term structure. A three factor, 19 state version of this model is fitted to 12 years of weekly US Treasury yield curve data. The results indicate that it is possible to achieve an accurate representation of the empirical term structure factors with only two or three exponential terms per factor.□□NOTE: This paper is available in TeX (with macros) or postscript form.

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[A Theory of the Term Structure of Interest Rates](#)

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