

Jump telegraph processes and a volatility smile

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We develop a class of financial market models based on inhomogeneous telegraph processes, i.e. random motions with alternating velocities and jumps occurring when the velocities are switching. While such markets may admit an arbitrage opportunity, the model under consideration is arbitrage-free and complete if directions of jumps in stock prices are in a certain correspondence with their current velocity and interest rate behaviour. Diffusion rescaling in this model gives a natural representation of volatility. Explicit formulae for prices of standard European options are obtained, which permits to calculate directly implied volatilities with respect to various moneyness of the option.