On a coupled Price-Liquidity regime switching model for equity modeling

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ABSTRACT

In this work we present a rigorous development of the model first introduced in Reference 2. We rely on the precise formulation of diffusion regime switching models presented in Reference 1. The regime switching models referred to may be those based on:

- a finite set of stochastic differential equations (SDE), all defined on the same bounded time interval and,
- a sequence of interlacing stopping times defined by the hitting threshold times of the trajectories of the solutions of the SDE.

In an alternative proposal the regime switching models may be defined by partitioning the phase space of the SDE in distinct regions and assigning to each region a different regime. The coupling between price and liquidity is assumed to be the following: the regime switching in the price variable occurs at the stopping times – or corresponding to a change of region – for the liquidity variable and, vice versa. The regimes may be defined parametrically – that is the SDE coefficients keep the same functional form with varying parameters – or the functional form of the SDE coefficients may change with each regime. By using the same noise source for both the price and the liquidity regime switching models – liquidity that, in general, is not a tradable asset – we ensure that despite incorporating information on liquidity, the price part of the coupled model can be assumed to be arbitrage free and complete.

REFERENCES

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