Semi Markov migration process in a stochastic environment in credit risk

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In the present the idea of stochastic Market environment comes into play to express the changes in general economy, which affects any industry in small or great amounts of turbulence. We model the evolution of the Market among its possible -states as an *F*-inhomogeneous semi-Markov process. This idea leads us to modeling the migration process of defaultable bonds as different *F*-inhomogeneous semi-Markov process. The survival probabilities of a defaultable bond in every credit grade are found. The asymptotic behaviour of the survival probabilities is established under certain conditions. Also, it is proved under what conditions the convergence is geometrically fast. The stochastic foundation of the general stochastic discrete-time Market is provided, by proving that the market is viable, if and only if, there exists an equivalent martingale measure, from which we construct the forward probability measure and under which the discounted default free bond price process for all possible states of the Market is a martingale. The term structure of credit spread and the change of real-world probability measure to forward probability measure are studied. In the form of a Theorem it is proved that under certain conditions, changing the real probability measure to a forward probability measure, does not affect the inhomogeneous semi Markov process modeling the migration of defaultable bonds. That is, it is proved that it only changes the basic parameters and we provide a relation among the transition probabilities under the two measures. Finally, parameter estimation and calibration of the inhomogeneous semi-Markov chain in stochastic environment is being provided.