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Spectral Expansions for Structural Credit Risk Models Incorporating Occupation Area and Occupation Time

We develop structural credit risk models with liquidation barriers and hazard rates driven by occupation time, occupation area, and their combinations. Defaults are classified according to Chapter 7 (liquidation) and Chapter 11 (reorganization) of the U.S. Bankruptcy Code. For a firm's value modelled as a diffusion with killing, we obtain a general closed-form representation of the associated Green's function. Using spectral methods, we derive a discrete spectral expansion of the transitional density, which in the geometric Brownian motion (GBM) case can be written in terms of Airy functions. This allows us to derive liquidation probabilities and implied hazard rates through spectral expansions. The framework extends to other solvable processes, including the constant elasticity of variance (CEV) model and state-dependent volatility hypergeometric diffusion models.

This is a continuation of the joint work with Giuseppe Campolieti and Hiromichi Kato.