A SFIR Approach to Financial Derivative Valuation

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An innovative SFIR (stepwise filtration and regression) approach is proposed for financial derivative valuation. The SFIR method is a recursive semi-parametric approach which is applicable to computing the derivative prices when the one-step transition probability function of the underlying process is given. Valuation problems of various financial derivatives including European options, American options, and convertible bonds can be solved by the SFIR method. The derivative values are obtained by an iterative procedure which consists of two parts, the first involves approximating the values of the derivative by a multi-piece regression function and the second involves computing the one-step-backward filtration of the regression function. The proposed schemes are performed to compute the European and American option values of the Black-Scholes, jump-diffusion, and GARCH models, as well as the convertible bond prices. The orders of approximation of the SFIR method are derived under continuity condition of the transition densities. And the backward filtration of the regression functions are derived for several well known models. Both the theoretical findings and the simulation results show the SFIR approach to be very tractable for numerical implementation and provides a unified and accurate technique for financial derivative pricing.

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