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MASTER THESIS

for the MASTER OF SCIENCE UZH ETH IN QUANTITATIVE FINANCE

Pricing Variance Swaps and Corridor Variance Swaps under General Dividend Streams

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Abstract

The standard replication theory for variance swaps and corridor variance swaps assumes that the underlying pays continuous dividends and that there are European call option prices available for a continuum of strikes and maturities. In this thesis, we present an approach that uses readily available quotes of traded options to price variance swaps and corridor variance swaps while assuming general dividend streams, i.e. the underlying may pay a combination of continuous and discrete dividends (both cash and proportional).

We first propose a versatile and fast pricing algorithm based on recombining binomial trees for assets under general dividend streams. It enables us to calculate the implied volatility of American options and to convert them to European option quotes. We then present a method that uses these quotes to construct a full call price surface that is arbitrage-free under general dividend streams and that has smooth implied risk neutral densities. We finally derive closed-form solutions for the pricing of variance swaps and corridor variance swaps under general dividend streams. Our results further indicate that the dividend modelling assumptions (continuous vs. discrete dividends) may have a substantial impact on the fair swap rates of variance swaps for stocks with high dividend yields.