Doctoral School of Information and Biomedical Technologies Polish Academy of Sciences

Subject
Pricing financial derivatives on the Bitcoin market

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Project Description

Bitcoin (BTC), created by a person or group of persons known under the pseudonym Satoshi Nakamoto in 2009, still remains a most popular cryptocurrency. The system of BTC transactions, which does not require a financial intermediary, is based on a peer-to-peer network, fixed rules and cryptography (see [1]). As it was mentioned in [1] and references therein, BTC behaves as a high volatility stock and the high volatility of its price may depend on sentiment about the BTC market.

Financial derivatives on BTC, including European options, have been recently traded on appropriate websites. In [1], the BTC price and dynamics of the BTC sentiment indicator are modeled by continuous stochastic processes, described by a system of stochastic differential equations. Moreover, the BTC sentiment indicator affects the BTC price at time t up to a certain time preceding t. The authors proved that, under appropriate assumptions, the model is arbitrage-free, derived a pricing formula for European style derivatives on BTC, and proposed an estimation method for the considered model. They also fitted the model to market data, assuming that the volume and the number of Google searches are proxies for the sentiment factor.

In traditional Black–Scholes (BS) model, the underlying asset price was described by a geometric Brownian motion. However, besides advantages of the BS approach, which are an analytical option pricing expression and the completeness of the BS financial market model, it has drawbacks (see [2]). Therefore, some alternatives for BS model have been proposed, including approaches using Levy processes with jumps to model underlying assets (see, e.g. [3–6]).

The proposed research work concerns introducing jump parts to the model considered in [1], derivation of the valuation expressions for financial derivatives on BTC as well as proposition of an estimation method for the generalized model. The process of fitting this model to market data will require application of various computational techniques. Additionally, it would be interesting to take into consideration features associated with the BTC technology, other than sentiment about the BTC market.

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