

## ABSTRACT

This paper is dedicated to presenting the role that the Brownian motion, Markov processes and the Ito stochastic calculus have in derivative financial analysis, more specifically in the theory of options.

The paper “Stochastic processes in the study of derivatives and applications” is structured in 5 chapters.

**Chapter 1** contains a synthesis of the main notations, definitions, properties, on calculating probabilities, random variable. Although they appear fragmentary, there is introduced the martingale notion, and there are presented a few results of the martingale theory. The basic notions presented in this chapter will be later used in the paper.

The stochastic processes represents an important branch of the probability theory, with applications both in Mathematics and Physics, Economy, Finance, etc. Due to this aspect, in **Chapter 2**, there are presented the Brownian motion and the Markov processes, as part of the stochastic processes.

In **Chapter 3**, dedicated to the stochastic calculus, there is defined the Ito stochastic integral, there is highlighted a series of its properties, there is introduced the notion of Ito process and is presented Ito’s formula both for case 1\_dimensional and case n\_dimensional.

The chapter’s end presents the stochastic differential equations.

The **Chapter 4**, there are addressed issues relating to the options theory, the emphasis being on evaluation models of these derived financial products (the Black\_Scholes model, the binomial model, the Monte Carlo method). This chapter emphasizes the importance of using stochastic calculus in mathematical modeling of financial processes.

**Chapter 5** represents an implementation of the option’s assessment models, previously discussed in the paper. The purpose of this chapter is to illustrate, through the proposed case study, the role of the option’s assessment models.

The case study contains a Monte Carlo simulation of a European CALL option price, written on a Microsoft share, followed by an analysis of the correctness of the option’s trading price, because finally to be determined the optimal strategy which an interested trader should apply, in order to get profit.

For the case study analysis, the programme called CALL\_EU has been realized. The chapter ends with an analysis of the results obtained after the running the CALL\_EU programme.