

# Statistical inference for Markov chain European option : estimating the price, the bare risk and the theta by historical distributions of Markov chain \*

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## Abstract

In this paper we assume that the underlying asset follows an ergodic Markov chain with finite state space  $E$ , we observe the asset for  $m$  times and using this information we estimate the value of an European option, the associated "bare" risk and the theta too. We show that the proposed estimators are uniformly strongly consistent and properly centralized and normalized converge in distribution to normal random variables, then we give also the interval estimators.

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*Keywords* : Markov chain, delta method, asymptotic properties, Euro pean option.

## 1. Introduction

Markov chains have been successfully used in option pricing theory. In [9] it was used a time homogeneous Markov chain to approximate the underlying asset price process and the authors assert that this approach is flexible and easy to implement, it is not computationally demanding and get very good numerical results. [10] suppose that the underlying asset evolves as a discrete time homogeneous Markov chain. We have to note that the popular Cox-Rubinstein binomial model, as well the trinomial

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\*The work was supported by the grant MIUR PRIN 2002138899.4.

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