

# Evolution of Probability Distributions: A New Convolution Algorithm

Yam Wing SIU

Department of Economics and Finance, The Hang Seng University of Hong Kong

## Abstract

Probability distributions play a fundamental role in many areas of science, from statistical inference and data analysis to modeling and simulation. Understanding how probability distributions evolve over time can provide valuable insights into the underlying processes and dynamics of various systems and can help us make predictions about future outcomes. Likewise, looking back at the worst scenario in the past can be useful in science, engineering and other fields. It helps practitioners to identify potential risks, flaws, or issues that need to be addressed in current or future projects. This information can help improve designs, safety protocols, or decision-making processes. In particular, lookback options are financial derivatives that give the holder the right, but not the obligation, to buy (in the case of a call option) or sell (in the case of a put option) an underlying asset at its lowest or highest price over a certain period of time. In this paper, a new convolution algorithm has successfully been developed that allows us to inspect the evolution of probability distribution that matches perfectly with either analytical solution or numerical simulation.

**Keywords:** Convolution, Probability Distributions, Value at Risk