International Journal of Innovative
Computing, Information and Control
Volume **7**, Number **2**, February **2011**

ICIC International ©2011 ISSN 1349-4198
pp. 709–718

A NOVEL OPTION PRICING MODEL VIA FUZZY BINOMIAL DECISION TREE

Shang-En Shine Yu[1], Kun-Huang Huarng[2], Ming-Yuan Leon Li[1] and Chen-Yuan Chen[3,4,*]

[1]Graduate Institute of Finance and Banking
National Cheng Kung University
No. 1, Ta-Hsueh Rd., Tainan 701, Taiwan

[2]Department of International Trade
Feng Chia University
No. 100, Wenhwa Rd., Seatwen, Taichung 40724, Taiwan

[3]Department of Computer Science
National Pingtung University of Education
No. 4-18, Ming Shen Rd., Pingtung 900, Taiwan
*Corresponding author: cyc@mail.npue.edu.tw

[4]Doctoral Program in Management
National Kaohsiung First University of Science and Technology
Kaohsiung 811, Taiwan

Received September 2009; revised April 2010

Abstract. *A binomial tree option pricing model has been widely applied to compute the optimal price of a warrant. Hence, many studies attempted to propose the variation of the model to improve the pricing capability. This study works on the volatility (fuzzy volatility) in the binomial tree option pricing model and proposes a fuzzy pricing model. Applying the fuzzy binomial option tree pricing model, more stock and call prices with their corresponding possibilities can be obtained. The richer information allows investors of different tendencies to adjust their portfolios. Meanwhile, the call price tends to be closer to the market price than its counterpart. Hence, the fuzzy model is favored.*
Keywords: Degree of membership, Fuzzy set, Pricing

1. **Introduction.** Warrants supply investors choices of financial leverage. When the price of the underlying asset rises, the owner of the warrant can buy the stock with the exercised price. The return can be a multiple of that from buying stocks. When the price of the underlying asset is down, the loss is only the premium at most. If the optimal range of an option price can be predicted, investors can make a profit and hedge from the derivatives.

Black-Scholes model [2] and binomial tree option pricing model (or called CRR model) [5] have been widely applied to compute the optimal price of a warrant. To improve both models, many recent studies of option pricing focused on how to relax the assumptions in both models, including those such as (1) the price of the underlying asset following the log-normal distribution, (2) the short-term risk-free rate of interest being constant and (3) the volatility of a stock being a constant. After relaxing these assumptions, new definitions can be rendered.

For example, Hull and White [7] released the assumption that the distribution of price of underlying asset and volatility were constant. Wiggins [11] and Scott [10] let go the assumption that the volatility was constant and, instead, assumed the volatility was