

# THE VALUATION OF WARRANTS IN THAILAND: USING THE BLACK-SCHOLES MODEL

by

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## Abstract

*The study aims to examine the appropriate pricing model for valuating warrants traded on the Stock Exchange of Thailand. The Black-Scholes model and its extensions are examined with historical and GARCH volatilities by using the out-of-sample data. The relationships between pricing errors and model variables are also analyzed. Findings suggest that the dilution adjusted Black-Scholes model with historical volatility is the most suitable model to predict the warrant prices and most pricing models tend to overprice in-the-money warrants and overprice warrants when high volatility or high interest rate is anticipated. In addition, the dividend and dilution somewhat create pricing biases.*

## INTRODUCTION

Warrants are one of derivative instruments which are similar to call options. They are the rights to purchase corporate stocks in the future specified period. They are normally issued by the corporation on its stocks while the call options are arranged between two investors through a broker on any outstanding stocks. According to security trading strategy, if the investors can accurately predict the benchmark price of the warrants at the time investors execute orders, investors earn benefits.

Since warrants were often explained as the call options, the options pricing models are often used to price the warrants (Leonard & Solt, 1990). The warrant valuation was started by implementing the work of Black & Scholes (1973). It simply valued the warrants as they were the call options. Later, the Black-Scholes model was modified to fit with the features of the warrants and the firm's values because it was claimed to provide the pricing biases to the warrants. Merton (1973) then made an adjustment on the Black-Scholes model by including the effects of dividend yield. In addition, Galia & Schneller (1978) extended the Black-Scholes model with the adjustment on the dilution effects. Clearly, the results from many empirical studies relating to the Black-Scholes model and its modification were inconsistent. Recently, it is still questionable about which pricing models should be the most accurate ones to value the warrants. Thus,

this study examines the performance of the Black-Scholes model and its extensions in valuation of warrant prices in Thailand.

Furthermore, the volatility estimation is still in question. The historical volatility based on the assumption of constant variance in the Black-Scholes model was claimed to be problematic for the long-life warrants (Veld, 2003). To reduce this deficiency, the Generalized Autoregressive Conditional Heteroskedasticity model (GARCH) volatility became viable, assuming that the volatility changed over time (Bollerslev, 1986). Therefore, this study investigates whether the volatility estimated by historical stock return is superior to the GARCH model.

Based on the deficiencies of the Black-Scholes model, the study emphasizes on the valuation of four warrant pricing models which are (i) the Black-Scholes model (BS), (ii) the Black-Scholes model adjusted with dividend (BSM), (iii) the Black-Scholes model adjusted with dilution (BSGS), and the Black-Scholes model adjusted by both dividend and dilution (BSD). The volatilities of these models are estimated by means of historical stock return and GARCH model, separately. Particularly, to evaluate the performance of these pricing models, the out-of-the-sample data is employed. Balaban & Bayer (2005) suggested that the out-of-the-sample data should be used for the purpose of forecasting.

Moreover, this study performs the dominant test to investigate the systematic relationship between the