

STUDY ON BLACK-SCHOLES OPTION PRICING MODEL BASED ON GENERAL LINEAR INVESTMENT STRATEGY (PART I: PUT OPTION)

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ABSTRACT. *This paper puts forward a new option pricing model based on the dynamic investment strategy. The new option assumes that an investor sets up a stock exchange strategy based on the changes of the stock price when the investor has held option. Within the valid period of the option, the investor may sell stocks based on an investment strategy for put option. This paper proposes several general linear investment strategies for put option, which are the linear investment strategy that the initial selling price is lower than the striking price, the linear investment strategy that sell a number of stocks at the striking price and the most general linear investment strategy. The intrinsic value functions deduce for the cases of put option. Based on the Black-Scholes option pricing theory, new option pricing models are finally obtained respectively by solving complex integral problems. Furthermore, the relationship and the disparity on the option prices between the new options and the classical ones are discussed.*

Keywords: Call option, Put option, Option pricing model, Linear investment strategy

1. Introduction. Since the proposal of the Black-Scholes theory in 1973, it has become one of the most important theoretical methods to tackle pricing problems of various financial derivative securities. This topic has been extensively investigated in the past by many researchers.

The main work of this paper falls into the category of new options. It is based on the classical European option and combined with certain investment strategies in the valid period of the option. The pricing theory on new options has been extensively investigated in many financial research fields and many researches use complex and recondite mathematical methods. Yet there has been no option that combines the option with certain investment strategies, ensuring the option having the same function of protecting from risks that the classical European option has and ensuring that the new option is bound to be less expensive than the classical European option. This paper is to do some research in this aspect.

The famous Black-Scholes option pricing model for put option is

$$V(t, S) = X_e \cdot e^{-r(T-t)} N(d_1) - S \cdot N(d_2)$$
$$d_1 = \frac{\ln \frac{X_e}{S} - (T-t)(r - \sigma^2/2)}{\sigma \sqrt{T-t}}, \quad d_2 = \frac{\ln \frac{X_e}{S} - (T-t)(r + \sigma^2/2)}{\sigma \sqrt{T-t}}$$

The connotative hypothesis of the standard Black-Scholes option pricing model is that an option purchaser need not exchange stocks and he uses the option to protect them from all the price risks. But it is common that the option purchasers carry out some rational