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Finance, Financial Analysis

The Black-Scholes model and the Cox, Ross and Rubinstein binomial model are the primary pricing models in the modern financial market. Both models are based on the same theoretical foundations and assumptions (such as the geometric Brownian motion theory of stock price behavior and risk-neutral valuation). Meanwhile, these option pricing techniques are often considered among the most mathematically complex of all applied areas offinance. Financial analysts have reached the point where they are able to calculate, with alarming accuracy, the value of a stock option.

By comparisons, most of the models and techniques employeed by today's analysts are rooted in a model developed by Fischer Black and Myron Scholes in 1973. Hence, the research emphasis is put on the Black-Scholes model, especially its implementation in China Financial Market. Research Objectives 1. To examine the function of the Black-Scholes model in modern financial market. 2. To develop the model with less assumptions. 3. To apply the model to the China financial market. 4. To make comment on the model within China financial market.

Literature Review What Is an Option: The idea of options is certainly not new. Ancient Romans, Grecians, and Phoenicians traded options against outgoing cargoes from their local seaports. When used in relation to financial instruments, options are generally defined as a " contract between two parties in which one party has the right but not the obligation to do something, usually to buy or sell some underlying asset". Having rights without obligations has financial value, so option holders must purchase these rights, making them assets.

This asset derives their value from some other asset, so they are called derivative assets. Call options are contracts giving the option holder the right to buy something, while put options, conversely entitle the holder to sell something. Payment for call and put options, takes the form of a flat, up-front sum called a premium. Options can also be associated with bonds (i. e. convertible bonds and callable bonds), where payment occurs in installments over the entire life of the bond, but this paper is only concerned with traditional put and call options. Origins of Option Pricing Techniques:

Modern option pricing techniques, with roots in stochastic calculus, are often considered among the most mathematically complex of all applied areas of finance. These modern techniques derive their impetus from a formal history dating back to 1877, when Charles Castelli wrote a book entitled The Theory of Options in Stocks and Shares. Castelli's book introduced the public to the hedging and speculation aspects of options, but lacked any monumental theoretical base. Twenty three years later, Louis Bachelier offered the earliest known analytical valuation for options in hismathematicsdissertation at the Sorbonne.

He was on the right track, but he used a process to generate share price that allowed both negative security prices and option prices that exceeded the price of the underlying asset. Bachelier's work interested a professor at MIT named Paul Samuelson, who in 1955, wrote an unpublished paper entitled " Brownian Motion in the Stock Market". During that same year, Richard Kruizenga, one of Samuelson's students, cited Bachelier's work in his

dissertation entitled " Put and Call Options: A Theoretical and Market Analysis". In 1962, another dissertation, this time by A.

James Boness, focused on options. In his work, entitled " A Theory and Measurement of Stock Option Value", Boness developed a pricing model that made a significant theoretical jump from that of his predecessors. More significantly, his work served as a precursor to that of Fischer Black and Myron Scholes, who in 1973 introduced their landmark option pricing model. The Black and Scholes Model: The Black and Scholes Option Pricing Model didn't appear overnight, in fact, Fisher Black started out working to create a valuation model for stock warrants.

This work involved calculating a derivative to measure how the discount rate of a warrant varies with time and stock price. The result of this calculation held a striking resemblance to a well-known heat transfer equation. Soon after this discovery, Myron Scholes joined Black and the result of their work is a startlingly accurate option pricing model. Black and Scholes can't take all credit for their work, in fact their model is actually an improved version of a previous model developed by A. James Boness in his Ph. D. dissertation at the University of Chicago.

Black and Scholes' improvements on the Boness model come in the form of a proof that the risk-free interest rate is the correct discount factor, and with the absence of assumptions regarding investor's risk preferences. In order to understand the model itself, we divide it into two parts. The first part, SN(d1), derives the expected benefit from acquiring a stock outright. This is

found by multiplying stock price [S] by the change in the call premium withrespectto a change in the underlying stock price [N(d1)]. The second part of the model, Ke(-rt)N(d2), gives the present value of paying the exercise price on the expiration day.

The fair market value of the call option is then calculated by taking the difference between these two parts. Assumptions of the Black and Scholes Model: 1) The stock pays no dividends during the option's life Most companies pay dividends to their share holders, so this might seem a serious limitation to the model considering theobservationthat higher dividend yields elicit lower call premiums. A common way of adjusting the model for this situation is to subtract the discounted value of a future dividend from the stock price.

2) European exercise terms are used European exercise terms dictate that the option can only be exercised on the expiration date. American exercise term allow the option to be exercised at any time during the life of the option, making american options more valuable due to their greater flexibility. This limitation is not a major concern because very few calls are ever exercised before the last few days of their life. This is true because when you exercise a call early, you forfeit the remaining time value on the call and collect the intrinsic value.

Towards the end of the life of a call, the remaining time value is very small, but the intrinsic value is the same. 3) Markets are efficient This assumption suggests that people cannot consistently predict the direction of the market

or an individual stock. The market operates continuously with share prices following a continuous It? process. To understand what a continuous It? process is, you must first know that a Markov process is " one where the observation in time period t depends only on the preceding observation. " An It? process is simply a Markov process in continuous time.

If you were to draw a continuous process you would do so without picking the pen up from the piece of paper. 4) No commissions are charged Usually market participants do have to pay a commission to buy or sell options. Even floor traders pay some kind of fee, but it is usually very small. The fees that Individual investor's pay is more substantial and can often distort the output of the model. 5) Interest rates remain constant and known The Black and Scholes model uses the risk-free rate to represent this constant and known rate.

In reality there is no such thing as the risk-free rate, but the discount rate on U. S. Government Treasury Bills with 30 days left until maturity is usually used to represent it. During periods of rapidly changing interest rates, these 30 day rates are often subject to change, thereby violating one of the assumptions of the model. 6) Returns are lognormally distributed This assumption suggests, returns on the underlying stock are normally distributed, which is reasonable for most assets that offer options.