Valuation Method of Equity Incentives of Listed Companies Based on the Black-Scholes Model

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ABSTRACT
This article applies the classic Black-Scholes model (i.e. B-S model) and turnover rate adapted B-S model (revised B-S model) to equity incentive valuation of listed companies. Unlike other studies on equity incentive valuation which generally adopt historical volatility, this article applies the GARCH model to equity incentive valuation. The volatility of stock price is estimated by the GARCH model to improve the accuracy of equity incentive valuation. The turnover rate has an important impact on the equity incentive valuation of listed companies. Considering the turnover rate can improve the accuracy of the equity incentive valuation and reduce the error of equity incentive valuation. Through the case study of the equity incentive valuation of Infinova, the practicality of the equity incentive valuation method is further verified.

KEYWORDS
B-S model, Equity Incentive, GARCH Model, Listed Companies, Turnover Rate

1. INTRODUCTION
In 2006, China’s Enterprise Accounting Standards No.11-Share Payments made a unified regulation on the implementation of the expense treatment of stock options, this regulation requires the use of fair value to calculate the value of equity incentive instruments. Stock options are by far the most classic equity incentive tool. Stock option refers to the right granted to the option holder to exercise stock options at a pre-arranged exercise price in the future, without having to bear the obligation to exercise power. For the motivated object, if they choose to exercise their rights, their income is the difference between the market price and the exercise price, and the stock option is essentially a call option. In the abstract, the accounting treatment of equity incentives mainly has two concepts of expense and profit, but according to relevant regulations, the current accounting treatment is based on expense. The expense concept recognizes the stock option as the company’s expense, and it is recognized as a expense in the profit statement. According to the expense concept, the enterprise implements the equity incentive plan to obtain the employee’s labor at the expense of stocks or equity, and to transfer the economic benefits to compensate employees for their efforts. Equity incentives play the role of a contract, and the essence is another form of payment for employee wages. Therefore, financial statements should confirm the acquisition and consumption of resources, and the expenses related to stock option transactions are recognized as an expense of the enterprise. At the moment, the measurement method of the fair value of the equity incentive instruments of listed companies in China has been clearly stipulated, according to the regulations: “the fair value of equity instruments such as

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stock options granted shall be measured according to their market prices; if there is no market price, the market price of options with the same trading terms shall be consulted; if neither of the above can be obtained, the option pricing model shall be adopted to evaluate the value of equity instruments.” Since the fair value of China’s options generally does not exist in an active market and cannot obtain its market value, the fair value can only be calculated through option pricing models. Fair value, as an amortization fee of listed companies, will affect its profit for each year during the validity period. Xia Yingfeng (2016) pointed out that the amount of equity instruments granted by share-based payment is usually large, and the calculation method with different fair value will affect the confirmation of expenses, which will have a greater impact on profits. Therefore, when accounting treatment in the equity incentive plan, it is very important to make a reasonable valuation of fair value. This paper studies the valuation method of equity incentive, trying to further improve the valuation method.

Research on the relevant literature of equity incentives found that B-S model is the most used valuation model of equity incentives in listed companies. Ye Yinghong (2015) pointed out that most listed companies in China choose B-S option pricing model as commonly used in international markets to calculate the fair value of stock options. Liu Yantao (2017) used B-S model to calculate the fair value of stock options in the accounting treatment research. In addition, on the basis of the B-S model, Jennegren and Näsund (1993) proposed a pricing model for manager stock options considering the turnover rate. You Jianqiang (2006) considered that turnover rate is an important factor affecting employee stock options, and further revised the research conclusions of Jennegren and Näsund and applied them to employee stock option pricing. Further study of relevant literature on equity incentive valuation shows that the parameters of equity incentive valuation model, including exercise price, validity period, stock market price, risk-free interest rate and so on, are easy to obtain, but volatility needs to be estimated through a certain calculation. Therefore, the value of volatility is crucial to the accuracy of equity incentive valuation. At present, the research on equity incentive valuation of listed companies generally adopts historical volatility, which is confirmed by the statistical data of Ping Jing and Chen Chaohui (2014) on the parameter value criteria for listed company equity incentive valuation. The historical volatility is calculated using the past stock price data, while the volatility in the B-S model actually means the volatility of future stock prices. Therefore, the use of historical volatility in equity incentive valuation has great shortcomings.

For the sake of achieve the purpose of improving the accuracy of the equity incentive valuation, in other words, reduce the error caused by the use of historical volatility for volatility estimation, this paper chooses a more reasonable method to estimate volatility based on the current research status of volatility estimation, so as to help listed companies to calculate a more reasonable fair value to implement equity incentive plan, reduce the accounting treatment errors of listed companies. The GARCH model was proposed by Bollerslev in 1986. It can describe the heteroskedasticity and volatility aggregation effect of stock volatility more accurately, and simplify the ARCH model, which is widely used in volatility estimation. According to the different assumptions of the variance equation, different model forms are formed, including: IGARCH model, TGARCH model and NGARCH model. Since its inception, GARCH model has been applied in many fields, such as volatility forecasting, risk measurement and option pricing, and has achieved remarkable results. Wei Jie, Han Liyan (2015) applied the GARCH model to the pricing of stock index options. Wang Yitian, Chen Shuoyu (2015) used the NGARCH model to calculate the volatility to improve the accuracy of option pricing. For the sake of achieve the goal of improving the accuracy of stock option pricing, Zhang Qiwen et al. (2016) used the GARCH model to predict stock volatility. Liu Xiaodong, Chen Jun, Du Huan (2015) and Zhao Zhao, Li Baolin (2016) compared and analyzed the accuracy of GARCH model in predicting the VaR value of the return series under different confidence levels under different distribution assumptions. Yu Xiaojian, Wang Xiuhua (2018) further proved that the M-Realized GARCH model has the highest volatility prediction accuracy through a large number of simulation data and predictive analysis. Qu Manxue, Wang Pengfei (2017) is to analyze the information validity of the core index of China’s volatility index, and use the method including regression method to judge the forecasting ability of
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