

Evaluation of chooser option evidence from Alibaba

Yue Ruan*

Department of Mathematics, University of California San Diego, CA, US

*Corresponding author: yur001@ucsd.edu

Abstract. Due to the financial market's globalization, it has resulted in the growingly fierce competition and the international financial system's volatility in current financial market. This implies that it is growingly necessary to analyze the financial derivatives market's trend. To assess chooser option, Alibaba is selected. The way of trading a majority of the exotic options is generally determined by the financial organizations based on the customers' specific demands. Exotic options have three common types which are respectively lookback options, chooser options and binary options. In this proposed study, the Brown Motion Theory can be used to determine the prices of assets through applying Geometric Brownian Motion to simulate the prices of Alibaba's financial assets in order to calculate the financial assets' future value. This study offers valuable insights with both financial institutions and investors respectively creating more proper exotic options and making more appropriate investment decisions.

Keywords: Chooser option; Brown Motion Theory; Exotic options.

1. Introduction

In the financial derivatives sector, option plays an essential role and has become very mature. In the context of launching trading of options, although the potential revenues of buyers are uncertain, the potential loss of buyers has a limit, which means that the greatest risks of buyers can be considered as certain. On the other hand, from the dimension of the sellers, their potential revenues are certain. However, the potential loss of sellers cannot be estimated. Therefore, investors prefer the option trading. Gao & Yu [1] demonstrate that the option can be considered as a contract between a buyer and a shareholder, and the claim that the shareholder only provides the right to the buyer without giving the obligation. Based on the provided right, the buyer will agree the determined price to purchase the underlying asset provided by the shareholder. In the contract, the price agreed by both the buyer and shareholder is namely as a strike price. Meanwhile, in the contract, its date can be also understood as the date of expiration. Furthermore, derivative securities, to some extent, contribute investors to mitigating their risks and increasing their expected profits. Unlike the ordinary options, the exotic options can effectively meet the investors' different demands. This is because the exotic options have various ways to earn revenue because of the exotic options' diverse characteristics. Meanwhile, the way to trade a majority of the exotic options is via the counter. The conventional options do not have the diversity and flexibility, which is totally different from the exotic options which has a great level of diversity and flexibility. It needs to explore whether different varieties of exotic options will exhibit a significant influence on the same assets' return and to investigate whether the asset will have a great a significant difference due to the various exotic options in the same industry. This proposed study is structured as follows: literature review (consisting of a brief introduction of Alibaba, financial derivatives market; common types of exotic options; geometric Brown Motion), methodology (consisting of research design; data; method), results, and a conclusion.

2. Theoretical background

2.1 Alibaba overview

Currently, Alibaba has become a leading global brand in providing technologies, Internet, retail, and e-commerce, which is established in China on June 28th, 1999. The initial public offering of Alibaba has generated \$25 billion on New York Stock Exchange in 2014. The initial public offering

of \$25 billion is the greatest achievement on the history of initial public offering which provides Alibaba with a significant market value at \$231 billion [2].

2.2 Financial derivatives market

The global derivatives market plays one of the most essential roles in current financial market due to the active development of the global derivatives market. The providers of over the counter and derivatives exchanges have accounted from the biggest market share of the financial market because of their continuous efforts to innovate their technologies and products. As the financial derivatives market have attracted more investors' attention, there are a growing number of the financial derivatives market's regulators considering how to strengthen the financial derivatives market's regulations, which will increase the financial derivatives' security and transparency [3]

In addition, there are three types of common derivatives, which are respectively swaps, options and forwards. The three common derivatives (swaps, options and forwards) are highly popular in the financial derivatives market due to their attractiveness towards the investors. Due to positive liquidity in the financial derivatives market, the transactions of swaps, options and forwards are easy and rapid. For an investor, it is likely to sell the underlying assets in the financial derivatives market, and these underlying assets are not owned by the investor. Meanwhile, a larger leverage in the financial derivatives market results in investors losing or gaining more [4]. The main reason why the investors find different financial instruments in the financial derivatives market refers to the growing uncertainty suffered by the investors, which also leads to the growth of investment risk. In the financial derivatives, the investors need to abruptly respond to the financial derivatives market's changes and to rapidly adjust their investment strategies. Hence, in this context, it is necessary for investors to seek more new investment opportunities in order to rapidly satisfy the uncertain situations in the financial derivatives market, which can allow the investors to acquire more revenues from their investment strategies. When positive strategies are used to trade derivative securities, investors are likely to increase their expected revenues and decrease their risks while trading derivative securities. Among different derivatives, the option can be adopted to provide investors with different investment opportunities [5].

2.3 Common types of exotic options

Firstly, in terms of lookback options, they are different from Asian options as they rely on paths. Meanwhile, the lookback options' payoff relies on the price difference over the period of validity between the greatest price and the lowest price. The holder of lookback options at the date of expiration is allowed to review the option and to execute the lookback options through selecting the best price. Unlike vanilla options, the lookback options as a type of exotic option have unique benefits such as performing well at the initial and middle processes of the option's entire life cycle [6]. Based on the previous demand and volatility associated with the lookback option, the seller can determine the price of the lookback option to reach the worst estimated gap of price [7].

Second, regarding the chooser option, it belongs to a type of exotic options. The chooser option has been traded since 1990, which is also named as options of as-you-like or you-choose [8]. More specifically, the path is associated with chooser options. For instance, the put or call cannot be determined prior to the maturity period when the investor purchases the chooser option. Meanwhile, different from the vanilla options, when investors are uncertain related to the change of the chooser option's direction, the chooser options are considered as more appropriate for financial products that are likely to sharply fluctuate [5].

Third, in terms of binary options, they are also named as the digital options. The binary options are considered as a type of exotic options which are none or all in nature. While purchasing the binary options, it is necessary for investor to estimate the amount change and direction of the binary options' prices. According to Benjamin [1], when the holders of options have gained the binary options, they cannot accurately determine that they should execute the binary options as the binary options should be executed automatically. Regarding the main benefit for the investors to trade the binary

options, it is that the risks of investors will not exceed the premium price determined by a contract in advance. In addition, the value of the binary options has been decided when the contract is signed, which will not be influenced by the underlying assets' price changes.

2.4 Geometric Brown Motion

Prior to the 19th century, Brownian motion has been understood as a theory related to physics, which focuses on explaining the variables of time movement. In addition, according to Reddy & Clinton (2016) [8], Brownian motion can also be adopted to describe the finance from the dimension of asset prices' movement. This implies that in the financial market, the stock price's change can be described based on the rule of Brownian motion, which state that the asset prices changes are randomly impacted by quantity. According to Brewer et al., 2012, the Brown Motion Theory can be used to determine the prices of assets, and the formula is exhibited as follows:

$$S_0 e^{(\alpha - \frac{1}{2}\sigma^2)T + \sigma\sqrt{T}} = S_T \quad (1)$$

3. Data and Methodology

3.1 Research design

In this proposed study, it integrates both qualitative and quantitative approaches. Regarding the qualitative approach, it emphasizes defining three types of exotic options (namely binary options, lookback options and chooser options) and describing characteristics of binary options, lookback options and chooser options. Concerning the quantitative approach, it refers to gathering the data of Alibaba's underlying assets, and the data source is from Yahoo Finance.

3.2 Data and Method

The gathered data includes Alibaba's risk-free interest rate and historical daily price over the period between 1st October 2018 and 31th September 2019, excluding weekends. More specifically, the estimated data in this proposed study includes strike price, maturity date and stocks' estimated return. The calculated data in this proposed study includes standard deviation which refers to the returns' historical volatility. Regarding simulation in this proposed study, it applies Geometric Brownian Motion (hereafter referred as GBM) to simulate the prices of Alibaba's financial assets in order to calculate the financial assets' future value, which can be seen in formula (2):

$$S_0 e^{(\alpha - \frac{1}{2}\sigma^2)T + z\sigma\sqrt{T}} = S_T \quad (2)$$

Where, S_0 refers to the asset's present price; σ refers to standard deviation; R refers to the interest rate which is risk free; T refers to the date of maturity; α refers to the stocks' expected return; S_T refers to the asset's future price; z randomly refers to a number.

Based on the value calculation of put option and call option at the data of maturity, respective S_T will be calculated. The regression of C_T or P_T based on S_T is exhibited in formula (3):

$$\frac{C_T}{P_T} = a + bS_T \quad (3)$$

In formula (4), the present value has been exhibited as follows:

$$\frac{C_0}{P_0} = ae^{-rT} + bS_0 \quad (4)$$

Meanwhile, the sensitivity analysis is launched in this proposed study. More specifically, sensitivity analysis includes changing a variable (i.e. the returns' volatility) to examine whether how the variable impacts the values and payoffs, which will significantly change the exotic options.

4. Results

Due to the gathered data includes Alibaba's risk-free interest rate and historical daily price over the period between 1st October 2018 and 31th September 2019, excluding weekends and the 3-month interest rates which are risk free determined by government, in this proposed study, the stocks' expected return is 9%, and the date of maturity refers to 1 year. The strike price (namely K) of Alibaba is determined by the historical daily price's last price at \$172.

Table 1. Alibaba's financial information.

	Risk-free Rate	Maturity	Strike Price	α	σ
Alibaba	1.79%	12 moths	\$172	9%	0.3609

Based on the Alibaba's financial information presented in Table 1, this proposed study will simulate the prices of stocks for 1,000 times in the formula (5):

$$S_0 e^{(\alpha - \frac{1}{2}\sigma^2)T + \sigma\sqrt{T}} = S_T \quad (5)$$

Through calculating the Alibaba's payoffs, the outcomes are exhibited in following sections.

4.1 Alibaba's chooser call options

For Alibaba, it will firstly calculate chooser options from the dimension of call. Based on the characteristics of chooser options, investors will determine whether the chooser options are put or call option since investors prefer to calculate the values prior to the date of expiration date. Therefore, when the strike price is lower than the future price, the chooser option will be executed as the position of call. The payoffs are calculated via the formula (6):

$$C_T = \max(S_T - K, 0) \quad (6)$$

The present value is calculated by the formula (7):

$$\frac{C_0}{P_0} = ae^{-rT} + bS_0 \quad (7)$$

In this study, C will be repeatedly calculated via 5 times to prevent accidental events, and the final results are adopted as the average values seen in Table 2.

Table 2. Alibaba's present value from the dimension of call options.

Present value	a	b
\$157.9873	-67.89	1.0029
\$167.7863	-79.93	0.8984
\$181.8946	-62.87	0.7843
\$173.3671	-70.98	0.9102
\$168.9642	-66.83	0.8902
Average \$169.9999		

4.2 Alibaba's binary call options

In terms of Alibaba's lookback options, when the strike price is lower than the future price, the call investors can acquire the fixed payoffs. Therefore, in this proposed study, the fixed payoff for Alibaba's investors are determined as 12% of Alibaba's strike price. Therefore, for lookback options with 12% of Alibaba's strike price as their fixed payoffs, the payoffs are exhibited in formula (8):

$$C_T = \text{if}(S_T - K, \$172, 0) \quad (8)$$

Through regressing C_T on S_T , the formula (9) is established:

$$C_T = a + bS_T \quad (9)$$

Based on the formula (9), the present value is exhibited in formula (10):

$$\frac{C_0}{P_0} = ae^{-rT} + bS_0 \quad (10)$$

In this study, the C will be repeatedly calculated via 5 times to prevent accidental events, and the results will be exhibited via the average values seen in Table 3.

Table 3. Alibaba's present value related to binary call options for Alibaba

Present value	a	b
\$77.0984	-73.98	0.8732
\$81.6834	-80.83	0.7984
\$71.7946	-69.32	0.8043
\$76.4521	-75.74	0.7392
\$76.9874	-74.39	0.7873
Average \$76.8032		

5. Sensitivity analysis

The sensitivity analysis in this proposed study focuses on the payoffs related to binary, lookback and chooser options. σ : sigma is used to describe the volatility in order to examine how the change of volatility impacts the payoffs related to binary, lookback and chooser options

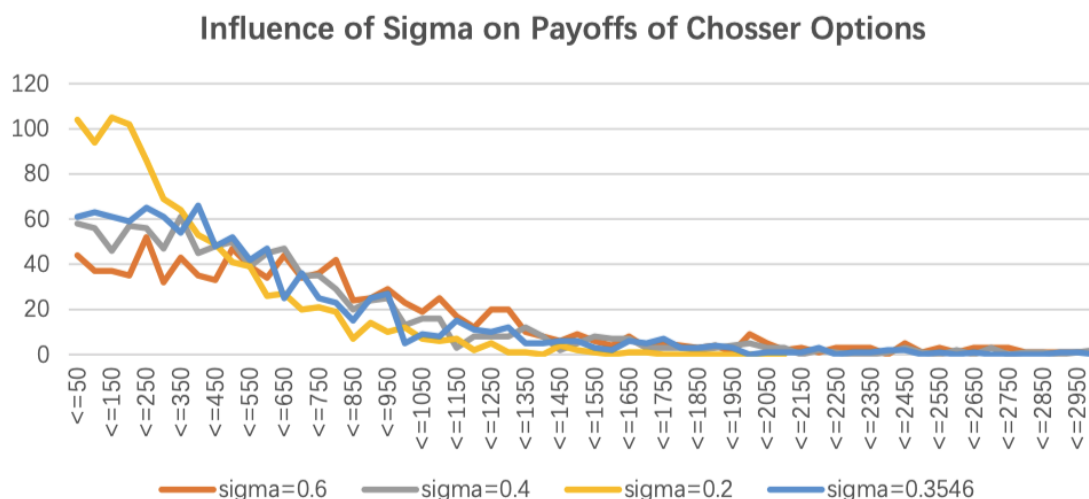


Figure 1. Impacts of volatility on chooser options' payoffs

In this proposed study, the first sensitivity analysis refers to exploring the impacts volatility on chooser options' payoffs. The changes of volatility are 0.2, 0.3546, 0.4, and 0.6, the chooser options' payoffs are position changes at put and call. This means that due to the growth of volatility, it will result in the growth of low returns.

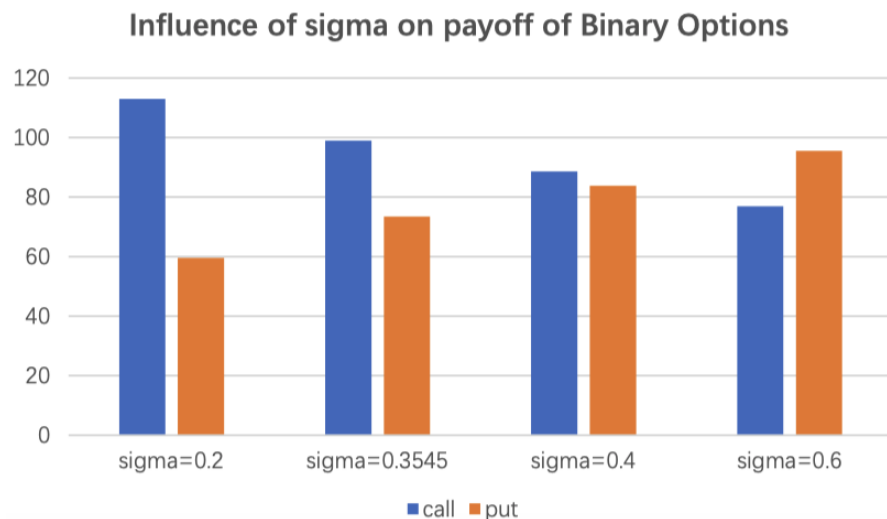


Figure 2. Impacts of volatility on binary options' payoffs

In this proposed study, the second sensitivity analysis refers to exploring the impacts volatility on binary options' payoffs. The changes of volatility are 0.2, 0.3546, 0.4, and 0.6, the binary options' payoffs are position changes at put and call. But due to the binary options' specific characteristics, their payoffs are considered as fixed. Therefore, the put and call present values will be examined rather than using payoffs.

6. Conclusion

This study explored how Alibaba's exotic options have been commonly applied through concentrating on the values and payoffs related to Alibaba's exotic options. The findings of this study including when the strike price is lower than the future price, the chooser option will be executed as the position of call and when the strike price is lower than the future price, the call investors can acquire the fixed payoffs can provide financial institutions and investors with benefits. For instance, in terms of financial institutions, it can contribute to understanding and analyzing this asset's characteristics, which will create more proper exotic options. Meanwhile, regarding investors, they can help investors to make more appropriate investment decisions through the simulation results of the exotic options' specific return.

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