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Level Reset Option Pricing Model Under the Geometric Average

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Abstract

Integrate the features of the geometric average in Asian option into level reset option, thus closed-form solution of geometric level reset options obtained through measure transformation and martingale pricing method. Numerical analysis results show that the geometric level reset call prices are increased with the increase of the number of level reset price, the risk hedge Δ value and the standard European call option are much closed, but there is no Δ jump phenomena of standard reset options.

Keywords: *Asian option; Geometric average; Reset option; Path option*

1. Introduction

Reset option is a kind of path dependent option, when the underlying asset price is achieved the pre-determined level, it can make investors gain more profit [1-3] by resetting exercise price. Among them, the resetting times of exercise price can be once and also can be more than once. In accordance with the different of reset characteristics, reset options can be divided into time-point reset option and level reset option.

Gray and Whaley [4], Cheng and Zhang [5] applied martingale method to respectively study under the risk neutral conditions, when the underlying asset price changes satisfied BS model, single time-point and multi-time reset option pricing problems, and the explicit solution of such option price was given. Results showed that, Δ jump phenomenon existed in the risk hedging of time-point reset option under the BS model; Tian, *et. al.*, [6] integrated the geometric average feature into time-point reset options on the basis of the BS model, and the explicit solution of time-point option price with geometric average feature was given. Results showed that, Δ jump phenomenon did not occurred in the risk hedging of time-point reset option with geometric average feature integrated; in addition, Zhang, *et. al.,* [7] had obtained the results of barrier option application under the risk neutral conditions, and studied the level reset option pricing problem at the condition of underlying asset price changes satisfied BS model. Results showed that, Δ jump phenomenon existed in the risk hedging of level reset option under the BS model.

For hedging investors, when Δ jump phenomenon of option risk hedge appears, namely, risk hedging is not a continuous state, hedging is difficult to operate. Given the consideration that the standard level reset options applies the minimum or maximum of underlying asset prices within option expiration date option as the statistics for measuring executive price reset; while minimum or maximum is unstable with larger changes, so the risk hedge of standard reset option will have Δjump problem. If the statistics of measuring exercise prices reset is changed to be the average value of option expiration date, and the stability of Asian features is integrated, will undoubtedly improve the stability of the minimum or maximum value and reduce hedging risks to investors. Based on this, this paper will study the level reset option pricing with Asian features, the paper structure arrangement is as follows: the level reset option model structure with Asian features and its pricing theorem will be introduced in the second part; and the risk hedging features of Asian type level reset option will be studied in the third part; the data analysis results will

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be given in the fourth part; The fifth part will summarize the characteristics of level reset option.

2. Geometric Level Reset Option Model

Assumed $T > 0$ if fixed, W_t is defined on one-dimensional Brownian movement applied by $\mathfrak{F}_t$ in complete probability space $(\Omega, \mathfrak{F}, \mathfrak{F}_t, P)$; the market is a no-arbitrage, friction-free and continuous trading financial market; and assumed that there are only two securities in the market : one is risk-free asset, bond, another is risky security.

Due to the market is no-arbitrage, therefore equivalent bullet test equivalent to P is existed, may set as P_0 as well.

Under the risk neutral measure P, we assume the risk bond (stock) price S_t satisfies

$$dS_t = rS_t dt + \sigma S_t dW_t, 0 \leq t \leq T \tag{1}$$

Where, $r > 0$ is risk-free interest rate, $\sigma > 0$ is fluctuation ratio.

Set n preset barrier level in option expiration date [0,T] as

And n reset exercise prices are defined as

$$\begin{cases} 0 < K_n < K_{n-1} \cdots < K_1 < K_0 \\ 0 < K_0 < K_1 \cdots < K_{n-1} < K_n \end{cases} \tag{3}$$

Where, K_0 is the initial exercise price, and require

$$\begin{cases} L_i \leq K_{i-1} (i = 1,2, \cdots n), \\ L_i \geq K_{i-1} (i = 1,2, \cdots n) \end{cases} \tag{4}$$

The statistics of measuring reset exercise price is defined as

$$X_t = \exp\left\{\frac{1}{t}\int_0^t \ln S_u du\right\} = S_0 \exp\left\{\frac{1}{2}\left(r - \frac{1}{2}\sigma^2\right) t + \frac{1}{t}\int_0^t \sigma B_u \, du\right\} \tag{5}$$

The level reset call options exercise price at expiring date *T*

$$K^* = \begin{cases} K_0, & X_T \geq L_1, \\ K_1, & L_2 \leq X_T < L_1, \\ \ldots, & \ldots, \\ K_{n-1}, & L_n \leq X_T < L_{n-1}, \\ K_n, & X_T < L_n, \end{cases} \tag{6}$$

The level reset put options exercise price at expiring date *T*

$$K_* = \begin{cases} K_0, & X_T \leq L_1, \\ K_1, & L_1 < X_T \leq L_2, \\ \cdots, & \cdots \\ K_{n-1}, & L_{n-1} < X_T \leq L_n, \\ K_n, & X_T > L_n, \end{cases} \tag{7}$$

And the gains at expiring date *T*

$$\xi = \begin{cases} \max(0, S_T - K^*), & \text{call option} \\ \max(0, K_* - S_T), & \text{put option} \end{cases} \tag{8}$$

Theorem 2.1 assumed that the level reset put options with initial exercise price K_0 at expiring date *T* satisfied the corresponding conditions of (1)--(8), and the price of level reset call options at time 0 equals

$$C(S, 0, T) = S_0 N_2\left(d1, d2; \frac{\sqrt{3}}{2}\right) - K_0 e^{-rT} N_2\left(d11, d22; \frac{\sqrt{3}}{2}\right)$$

$$+\sum_{i=1}^{n-1}\left\{S_0\left[N_2\left(d3,d4;\frac{\sqrt{3}}{2}\right)-N_2\left(d5,d4;\frac{\sqrt{3}}{2}\right)\right]-K_ie^{-rT}N_2\left[\left(d33,d44;\frac{\sqrt{3}}{2}\right)\right.\right.$$
$$\left.\left.-N_2\left(d55,d44;\frac{\sqrt{3}}{2}\right)\right]\right\}+S_0N_2\left(-d6,d7;-\frac{\sqrt{3}}{2}\right)$$
$$-K_ne^{-rT}N_2\left(-d66,d77;-\frac{\sqrt{3}}{2}\right) \quad (9)$$

Where

$$d1=\frac{\sqrt{3}[\ln\frac{S_0}{L_1}+\frac{1}{2}(r+\frac{1}{2}\sigma^2T)]}{\sigma\sqrt{T}},\quad d2=\frac{\ln\frac{S_0}{K_0}+(r+\frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}},\quad d3=\frac{\sqrt{3}[\ln\frac{S_0}{L_{i+1}}+\frac{1}{2}(r+\frac{1}{2}\sigma^2T)]}{\sigma\sqrt{T}}$$

$$d4=\frac{\ln\frac{S_0}{K_i}+(r+\frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}},\quad d5=\frac{\sqrt{3}[\ln\frac{S_0}{L_i}+\frac{1}{2}(r+\frac{1}{2}\sigma^2T)]}{\sigma\sqrt{T}},\quad d6=\frac{\sqrt{3}[\ln\frac{S_0}{L_n}+\frac{1}{2}(r+\frac{1}{2}\sigma^2T)]}{\sigma\sqrt{T}}$$

$$d7=\frac{\ln\frac{S_0}{K_n}+\left(r+\frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}},\quad d11=d1-\frac{\sqrt{3T}}{2}\sigma,\quad d22=d2-\sigma\sqrt{T}$$

$$d33=d3-\frac{\sqrt{3T}}{2}\sigma,\quad d44=d4-\sigma\sqrt{T},\quad d55=d5-\frac{\sqrt{3T}}{2}\sigma$$

$$d66=d6-\frac{\sqrt{3T}}{2}\sigma,\quad d77=d7-\sigma\sqrt{T}$$

$N_2(a,b;\rho)$ represents the bi-normal probability distribution function with correlation coefficient of ρ.

Proof: it can be known from non-arbitrage principle

$$C(S,0,T)=E^p[e^{-rT}\max(0,S_T-K^*)]$$
$$=E^p[e^{-rT}(S_T-K_0)1(X_T\geq L_1,S_T>K_0)]$$
$$+\sum_{i=1}^{n-1}E^p[e^{-rT}(S_T-K_i)1(L_{i+1}\leq X_T\leq L_1,S_T>K_i)]$$
$$+E^p[e^{-rT}(S_T-K_n)1(X_T<L_n,S_T>K_n)]$$
$$\equiv I_0+\sum_{i=1}^{n-1}I_i+I_n, \quad (10)$$

Where,

$$I_0=E^p[e^{-rT}(S_T-K_0)1(X_T\geq L_1,S_T>K_0)]$$
$$=E^p[e^{-rT}S_T1(X_T\geq L_1,S_T>K_0)]$$
$$-E^p[e^{-rT}K_01(X_T\geq L_1,S_T>K_0)]. \quad (11)$$

To apply $It\hat{o}$ formula[8] in formula(1), then under measure P

$$S_t=S_0\exp\left\{\left(r-\frac{1}{2}\sigma^2\right)t+\sigma W_t\right\},\quad \forall 0\leq t\leq T. \quad (12)$$

To make measure conversion[9] for first half part of I_0

$$\frac{dQ}{dP}=e^{-rT}\frac{S_T}{S_0} \quad (13)$$

Easy to know $E^p\left[\frac{dQ}{dP}\right]=1$, therefore measure Q is the equivalent bullet measure P. It can be known from Giersonow theorem [10-11], $B_T=W_T-\sigma T$在 is still Brownian movement under measure Q. Under measure Q , formula(5) and (12) can be converted to

$$X_t = S_0 \exp\left\{\frac{1}{2}\left(r + \frac{1}{2}\sigma^2\right)t + \frac{1}{t}\int_0^t \sigma B_u \, du\right\} \tag{14}$$

$$S_t = S_0 \exp\left\{\left(r + \frac{1}{2}\sigma^2\right)t + \sigma B_t\right\} \tag{15}$$

and we have

$$I_0 = S_0 Q(X_T \geq L_1, S_T > K_0) - e^{-rT} K_0 P(X_T \geq L_1, S_T > K_0). \tag{16}$$

To substitute formula (12)(14)(15) into formula (16) and be simplified as

$$I_0 = S_0 N_2\left(d1, d2; \frac{\sqrt{3}}{2}\right) - K_0 e^{-rT} N_2\left(d11, d22; \frac{\sqrt{3}}{2}\right) \tag{17}$$

where,

$$d1 = \frac{\sqrt{3}\left[\ln\frac{S_0}{L_1} + \frac{1}{2}\left(r + \frac{1}{2}\sigma^2\right)T\right]}{\sigma\sqrt{T}}, \qquad d2 = \frac{\ln\frac{S_0}{K_0} + \frac{1}{2}\left(r + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}}$$

$$d11 = d_1 - \frac{\sqrt{3T}}{2}\sigma, \qquad d22 = d_2 - \sigma\sqrt{T}$$

For the calculation of correlation coefficients of two bi-normal probability distribution function $N_2\left(d1, d2; \frac{\sqrt{3}}{2}\right)$ and $N_2\left(d11, d22; \frac{\sqrt{3}}{2}\right)$ in formula(17), both procedures are similar, the calculation procedure of correlation coefficients of $N_2\left(d1, d2; \frac{\sqrt{3}}{2}\right)$ is given below.

$$\begin{aligned} Cov\left(-\frac{1}{T}\int_0^T \sigma B_\upsilon d\upsilon, -\sigma B_T\right) &= E\left[\left(-\frac{1}{T}\int_0^T \sigma B_\upsilon d\upsilon\right)(-\sigma B_T)\right] \\ &= \frac{\sigma^2}{T}\int_0^T E[B_\upsilon B_T] d\upsilon \\ &= \frac{\sigma^2}{T}\int_0^T \upsilon d\upsilon \\ &= \frac{\sigma^2 T}{2} \end{aligned} \tag{18}$$

$$\begin{aligned} Var\left(-\frac{1}{T}\int_0^T \sigma B_\upsilon d\upsilon\right) &= E\left[\left(-\frac{1}{T}\int_0^T \sigma B_\upsilon d\upsilon\right)^2\right] \\ &= \frac{\sigma^2}{T^2} E\left[\int_0^T \int_0^T B_\upsilon B_\nu d\upsilon d\nu\right] \\ &= \frac{\sigma^2}{T^2} E\left[\int_0^T \int_0^\nu B_\upsilon B_\nu d\upsilon d\nu + \int_0^T \int_\nu^T B_\upsilon B_\nu d\upsilon d\nu\right] \\ &= \frac{\sigma^2}{T^2}\left[\int_0^T \int_0^\nu E(B_\upsilon B_\nu) d\upsilon d\nu + \int_0^T \int_\nu^T E(B_\upsilon B_\nu) d\upsilon d\nu\right] \\ &= \frac{\sigma^2}{T^2}\left[\int_0^T \int_0^\nu \upsilon d\upsilon d\nu + \int_0^T \int_\nu^T \nu d\upsilon d\nu\right] \\ &= \frac{\sigma^2 T}{3} \end{aligned} \tag{19}$$

therefore, the correlation coefficient is

$$\rho = \frac{Cov\left(-\frac{1}{T}\int_0^T \sigma B_\upsilon d\upsilon, -\sigma B_T\right)}{\sqrt{Var\left(-\frac{1}{T}\int_0^T \sigma B_\upsilon d\upsilon\right) Var(-\sigma B_T)}} = \frac{\frac{\sigma^2 T}{2}}{\sqrt{\frac{\sigma^2 T}{3}\sigma^2 T}} = \frac{\sqrt{3}}{2}. \tag{20}$$

And $I_i (i = 1,2, \ldots, n)$ can be calculated similarly.

Theorem 2.2 Set expiring date as T, the level reset put option with initial price of K_0 satisfies the corresponding conditions of (1)--(8), then the price of level reset put option at time 0 equals to

$$P(S,0,T) = K_{0}e^{-rT} N_2\left(a11, a22; \frac{\sqrt{3}}{2}\right) - S_0 N_2\left(a1, a2; \frac{\sqrt{3}}{2}\right)$$

$$+ \sum_{i=1}^{n-1}\left\{K_{i}e^{-rT}\left[N_2\left(a33, a44; \frac{\sqrt{3}}{2}\right) - N_2\left(a55, a44; \frac{\sqrt{3}}{2}\right)\right] - S_0\left[N_2\left(a3, a4; \frac{\sqrt{3}}{2}\right) - N_2\left(a5, a4; \frac{\sqrt{3}}{2}\right)\right]\right\} + K_{n}e^{-rT} N_2\left(-a66, a77; -\frac{\sqrt{3}}{2}\right) - -S_0 N_2\left(-a6, a7; -\frac{\sqrt{3}}{2}\right) \quad (21)$$

Where

$$a1 = -d1, \quad a11 = a1 + \frac{\sqrt{3T}}{2}\sigma, \quad a2 = -d2, \quad a22 = a2 + \sigma\sqrt{T}$$

$$a3 = -d3, \quad a33 = a3 + \frac{\sqrt{3T}}{2}\sigma, \quad a4 = -d4, \quad a44 = a4 + \sigma\sqrt{T}$$

$$a5 = -d5, \quad a55 = a5 + \frac{\sqrt{3T}}{2}\sigma, \quad a6 = -d6, \quad a55 = a5 + \frac{\sqrt{3T}}{2}\sigma$$

$$a7 = -d7, \quad a55 = a5 + \sigma\sqrt{T}$$

Proof: Refer to the proof of formula (2.9).

3. Risk Hedging

As is known to all, the numerical feature Δ of option played an important role in hedge and risk hedging, we will calculate Δ value of geometric level reset call options, and make analysis as follows.

It can be known from Chain of driring principle that

$$\Delta = \frac{\partial C(S,0,T)}{\partial S_0} = \frac{\partial I_0}{\partial S_0} + \sum_{i=1}^{n-1}\frac{\partial I_i}{\partial S_0} + \frac{\partial I_n}{\partial S_0} \quad (22)$$

And because

$$\frac{\partial I_0}{\partial S_0} = \frac{\partial\left[S_0 N_2\left(d1, d2; \frac{\sqrt{3}}{2}\right)\right] - K_{0}e^{-rT} N_2\left(d11, d22; \frac{\sqrt{3}}{2}\right)}{\partial S_0}$$

$$= N_2\left(d1, d2; \frac{\sqrt{3}}{2}\right) + S_0\left[\frac{\partial N_2\left(d1, d2; \frac{\sqrt{3}}{2}\right)}{\partial d1}\frac{\partial d1}{\partial S_0} + \frac{\partial N_2\left(d1, d2; \frac{\sqrt{3}}{2}\right)}{\partial d2}\frac{\partial d2}{\partial S_0}\right]$$

$$-K_{0}e^{-rT}\left[\frac{\partial N_2\left(d11, d22; \frac{\sqrt{3}}{2}\right)}{\partial d11}\frac{\partial d11}{\partial S_0} + \frac{\partial N_2\left(d11, d22; \frac{\sqrt{3}}{2}\right)}{\partial d22}\frac{\partial d22}{\partial S_0}\right] \quad (23)$$

$$\frac{\partial I_n}{\partial S_0}=\frac{\partial\left[S_0N_2\left(-d6,d7;-\frac{\sqrt{3}}{2}\right)-K_{n}e^{-rT}N_2\left(-d66,d77;-\frac{\sqrt{3}}{2}\right)\right]}{\partial S_0}=N_2\left(-d6,d7;-\frac{\sqrt{3}}{2}\right)+$$
$$S_0\left[\frac{\partial N_2\left(-d6,d7;-\frac{\sqrt{3}}{2}\right)}{\partial(-d6)}\frac{\partial(-d6)}{\partial S_0}+\frac{\partial N_2\left(-d6,d7;-\frac{\sqrt{3}}{2}\right)}{\partial(d7)}\frac{\partial(d7)}{\partial S_0}\right.-K_{n}e^{-rT}\left[\frac{\partial N_2\left(-d66,d77;-\frac{\sqrt{3}}{2}\right)}{\partial(-d66)}\frac{\partial(-d66)}{\partial S_0}\right.$$
$$\left.\left.+\frac{\partial N_2\left(-d66,d77;-\frac{\sqrt{3}}{2}\right)}{\partial(d77)}\frac{\partial(d77)}{\partial S_0}\right]\right] \tag{24}$$

$$\frac{\partial I_i}{\partial S_0}$$
$$=\sum_{i=1}^{n-1}\frac{\partial\left\{S_0\left[N_2\left(d3,d4;\frac{\sqrt{3}}{2}\right)-N_2\left(d5,d4;\frac{\sqrt{3}}{2}\right)-K_{i}e^{-rT}\left[N_2\left(d33,d44;\frac{\sqrt{3}}{2}\right)-N_2\left(d55,d44;\frac{\sqrt{3}}{2}\right)\right]\right]\right\}}{\partial S_0}$$
$$=\sum_{i=1}^{n-1}\left[N_2\left(d3,d4;\frac{\sqrt{3}}{2}\right)-N_2\left(d5,d4;\frac{\sqrt{3}}{2}\right)\right]$$
$$+\sum_{i=1}^{n-1}S_0\left[\frac{\partial N_2\left(d3,d4;\frac{\sqrt{3}}{2}\right)}{\partial d3}\frac{\partial d3}{\partial S_0}+\frac{\partial N_2\left(d3,d4;\frac{\sqrt{3}}{2}\right)}{\partial d4}\frac{\partial d4}{\partial S_0}\right]$$
$$-\sum_{i=1}^{n-1}S_0\left[\frac{\partial N_2\left(d5,d4;\frac{\sqrt{3}}{2}\right)}{\partial d5}\frac{\partial d5}{\partial S_0}+\frac{\partial N_2\left(d5,d4;\frac{\sqrt{3}}{2}\right)}{\partial d4}\frac{\partial d4}{\partial S_0}\right]$$
$$-\sum_{i=1}^{n-1}K_{i}e^{-rT}\left[\frac{\partial N_2\left(d33,d44;\frac{\sqrt{3}}{2}\right)}{\partial d33}\frac{\partial d33}{\partial S_0}+\frac{\partial N_2\left(d33,d44;\frac{\sqrt{3}}{2}\right)}{\partial d44}\frac{\partial d44}{\partial S_0}\right]$$
$$+\sum_{i=1}^{n-1}K_{i}e^{-rT}\left[\frac{\partial N_2\left(d55,d44;\frac{\sqrt{3}}{2}\right)}{\partial d55}\frac{\partial d55}{\partial S_0}\right.$$
$$\left.+\frac{\partial N_2\left(d55,d44;\frac{\sqrt{3}}{2}\right)}{\partial d44}\frac{\partial d44}{\partial S_0}\right] \tag{25}$$

And

$$\frac{\partial N(x,y;\rho)}{\partial x}=\frac{1}{\sqrt{2\pi}}exp\left\{\frac{-x^2}{2}\right\}N\left(\frac{y-\rho x}{\sqrt{1-\rho^2}}\right) \tag{26}$$

Therefore, the expression of Δ can be obtained by substituting formula (23)(24)(25)(26) and correlation parameters into formula (22), and it will not given here due to space limitations.

4. Numerical Result and Analysis

It is given in table 1 that, in case of $n=1,2,3$, when S_0,σ,r and K_1,K_2,K_3 take different values, the corresponding results of the geometric level reset call option and standard European call option from table 1 shown that the risk-free rate r and fluctuation coefficient σ have significant influence on option price, and present the following features

(1)Under the condition of parameters are the same, level reset call option price is higher than that of standard European call option;

(2)Under the condition of S_0, σ, r, n are the same, option price is decreasing with the increase of exercise price;

(3)Under the condition of S_0, σ, n and exercise price are the same, the option price is increasing with the increase of interest rate;

(4)Under the condition of S_0, r, n are the same, the option price is increasing with the increase of fluctuation coefficient σ;

(5)Under the condition of S_0, σ, r and exercise price are the same, the option price is increasing with the increase of the number of reset price;

The variation condition of Δ values of the geometric level reset call option and standard European call option with current underlying asset （shares）price is given in Figure 1, in case of $n = 1,2,3$, where the parameter $K_0 = 100$, $L_1 = 95$, $L_2 = 85$, $L_3 = 75$, $K_1 = 90, K_2 = 80$, $K_3 = 70$, $T = 1, r = 0.1, \sigma = 0.5$. it can be known in Figure 1 that, Δ values of the geometric level reset call option and standard European call option are very closed, while the geometric level reset call option has no Δ jump as standard reset option.

Table 1. Numerical Results of Level Reset Call Option Price （$K_0 = 100$, $L_1 = 95$, $L_2 = 85$, $L_3 = 75$, $T = 1$）

			r=0.05				r=0.1			
			n				n			
S_0	σ	K_1 K_2 K_3	0	1	2	3	0	1	2	3
		85 75 65		5.8624	6.2879	6.2885		7.3539	7.5536	7.5537
90	0.1	90 80 70	1.6806	3.6097	3.7786	3.7787	3.3619	5.3919	5.4830	5.4830
		95 85 75		2.2486	2.2838	2.2838		4.0324	4.0553	4.0553
		85 75 65		7.3333	7.3353	7.3353		10.5771	10.5776	10.5776
100	0.1	90 80 70	6.8050	7.0088	7.0092	7.0092	10.3082	10.4242	10.4244	10.4244
		95 85 75		6.8490	6.8490	6.8490		10.3370	10.3371	10.3371
		85 75 65		15.2153	15.2153	15.2153		19.6136	19.6136	19.6136
110	0.1	90 80 70	15.2101	15.2114	15.2114	15.2114	19.6121	19.6126	19.6126	19.6126
		95 85 75		15.2102	15.2102	15.2102		19.6122	19.6122	19.6122
		85 75 65		10.6131	11.4861	11.7772		12.4804	13.2900	13.5386
90	0.3	90 80 70	8.6611	9.7228	10.2765	10.4359	10.5199	11.6011	12.1273	12.2674
		95 85 75		9.0897	9.4176	9.4969		10.9620	11.2815	11.3532
		85 75 65		15.3239	15.6616	15.7326		17.7620	18.0553	18.1121
100	0.3	90 80 70	14.2313	14.8071	15.0067	15.0421	16.7341	17.2839	17.4617	17.4908
		95 85 75		14.4563	14.5659	14.5818		16.9519	17.0521	17.0655
		85 75 65		21.5283	21.6298	21.6437		24.5440	24.6271	24.6376
110	0.3	90 80 70	21.0610	21.2981	21.3537	21.3600	24.1298	24.3433	24.3900	24.3949
		95 85 75		21.1503	21.1785	21.1811		24.2113	24.1357	24.2377

			r=0.05				r=0.1			
			n				n			
S_0	σ	K_1 K_2 K_3	0	1	2	3	0	1	2	3
		85 75 65		17.3306	18.1632	18.6643		19.0800	19.8870	20.3586
90	0.5	90 80 70	15.8209	16.7005	17.3193	17.6660	17.5740	18.4557	19.0611	19.3910
		95 85 75		16.2051	16.6571	16.8915		17.9609	18.4071	18.6324
		85 75 65		22.8886	23.4179	23.6883		24.9950	25.4963	25.7449
100	0.5	90 80 70	21.7926	22.4239	22.8075	22.9886	23.9267	24.5451	24.9119	25.0803
		95 85 75		22.0653	22.3384	22.4568		24.1951	24.4586	24.5699
		85 75 65		29.2445	29.5556	29.6919		31.6975	31.9860	32.1088
110	0.5	90 80 70	28.5152	28.9301	29.1499	29.2383	31.0014	31.3995	31.6053	31.6858
		95 85 75		28.6923	28.8447	28.9007		31.1722	31.3163	31.3678

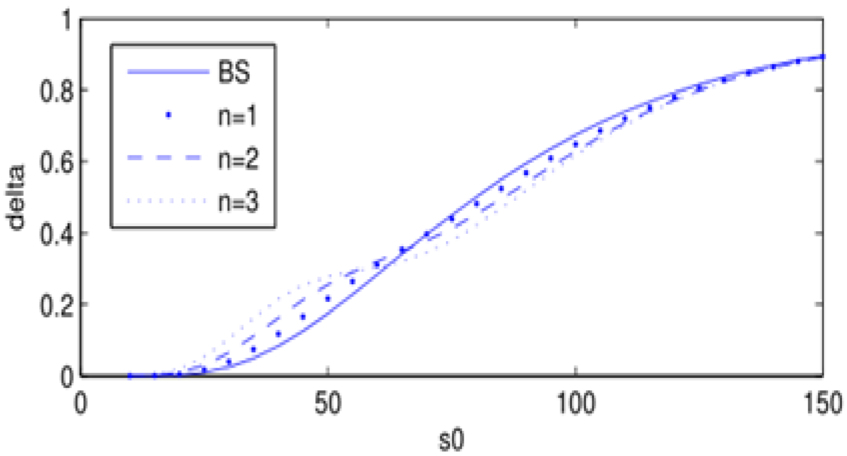

Figure 1. The Result of Delta Value Compassion of Standard European Call Option and the Geometric Level Reset Call Option

5. Conclusion

When other parameters of model were constant, the geometric level reset call option price is the increasing function of current underlying asset price, fluctuation coefficient, which was the features of public option contracts; when other parameters of model were constant, the geometric level reset call option price was the increasing function of the number of reset exercise price, but the price difference was very small, which combined the features of the reset option and Asian option contracts; In real life, the arithmetic average reset options are widely used, but there is no accurate expression of the option price, using the relationship between the geometric average and arithmetic average to solve the expression of arithmetic average level reset option price is a worthwhile method.

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