Financial Engineering Report

subject: Pricing Shout Option of google

date:

**Shout option of Google (goog)**

A shout option is a type of exotic option, which allows the holder to shout the writer one time during the option life.

**Procedure: (Exhibit)**

1. To calculate the pricing for the option, first thing to do is to find the volatility from the historical data. Volatility is to measure the uncertainty about the returns provide by the stock, to calculate the volatility we have to get the historical data of the stock to find a return. Then we take the standard deviation of 3 months (90 days) at the beginning of the data, and take the average to find volatility per annum.
2. After we find the volatility per annum, we can find the approximate up and down movement.
3. After we get the up and down movement, we can set up a binominal tree(4 step)
4. We assume the strike price of the option is the average stock price for the recent 10 trading days.
5. We assume this is risk neutral valuation, so the expected return on the underlying asset is the risk free rate and can be discount by risk free rate. We took the yield of government bond as risk free rate.
6. After we get enough information, then we can calculate the probability that goes up and down.
7. We assume that the option holder will shout at the highest possible price during at the life of the option, we take the holder’s best situation on the maturity date of binominal tree and discount it backward to price both call and put option.

**The Price of the shout option of Google**

The Call Shout Option Price: $143.2 (four steps tree)

The Put Shout Option Price: $95.62 (four steps tree)

The Call Shout Option Price: $163.01 (five steps tree)

The Put Shout Option Price: $105.04 (five steps tree)

**Observation:**

The Option price increases when increasing number of steps.

The value of call and puts will increase when volatility increase.

**Error:**

Put Call parity does not hold in this case.

**Exhibit:**

Formula to measure volatility:

$$Logarithmic Return=ln \frac{Vi}{Vf}$$

$$Volatility per annum=Volatility per trading day (σ)\*\sqrt{Number of Calender day (σ\_{t})}$$

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Formula to measure up and down movement:

$$u=e^{σ \sqrt{∆t}}$$

$$d=\frac{1}{u}$$

The probability of up movement:

$$p=(e^{r∆t}-d)/(u-d)$$