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# BACK-DATING OPTIONS: HOW BIG A SIN WAS IT?

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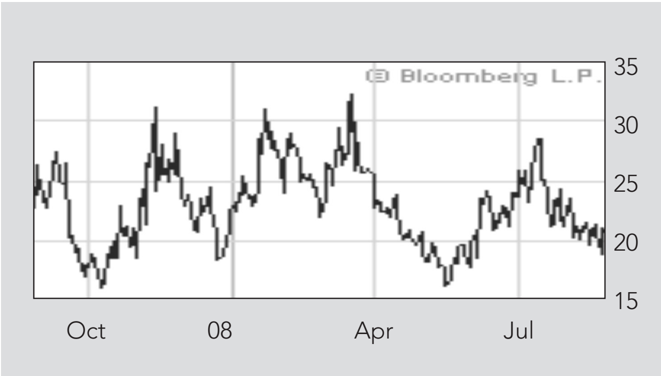
*Analyzing the materiality of equity options backdating received as part of a compensation or retirement award in last year's markets.*

It's interesting to note that, given the past year's reversal of fortunes in the stock markets, all the media rap about heated inquiries around back-dating options has stopped.

This is not surprising since most of the short-dated call options which were granted out-of-the money by 20 percent or more have turned worthless in the market downturn.

Looking at the VIX stock-market volatility graph for the past year, we note that the mean reversion principle applies over quarterly horizons, the mean over the full year being at 23.7 percent, but moderate dispersion exists in the swings. (see Graph 1)




Graph 1: Y-O-Y VIX index August 2007- August 2008, Source Bloomberg.

FAS 123 R and 157 require for public entities that every options, including those granted as part of compensation plans, be marked to model at fair value starting in 2006. Fair value is determined using an option-pricing model that takes into account the stock price at the grant date, the exercise price, the expected life of the option, the volatility of the underlying stock and the expected dividends on it, and the risk-free interest rate over the expected life of the option. The previous statement required compensation expense recognition only when the option got intrinsic value, namely when the market price exceeded the strike price; thus backdating options in the previous context would generate no accounting entries as regularly on the grant date the options are out-of-money.

Under the new rules, as the stock price at the grant date is an input in the model, backdating options could in theory cause swings in the option value, misstating the expense booked. However, under the new rules the option greek theta gains prominence; thus the passage of time to the expiration has accounting relevance, since an extra day to maturity gives the underlying the opportunity to have an extra day of swings within quarterly volatility bounds, but on a random path. Based on the past year volatility chart, backdating by a quarter would have not changed the volatility assumptions, since, as seen on the graph, mean reversion occurs quarterly, and the model's implied volatility is based on a one year data, therefore an outlying rough quarter in which the volatility would have doubled or halved—which actually did not happen—would only change the volatility assumption by 23.7/4/23.7=25 percent up or down, not a whole lot. Since in last year's market environment, the time value impact was subdued to the volatility impact (the absolute value of theta is in cases when volatility is higher than 20 percent, usually smaller than the absolute value of vega for short-dated options), backdating by a month or so within the same quarter would not be material to the value of the option since the volatility is quite high at nearly 25 percent, and nearly constant.

To illustrate that equity options keep a fairly constant fair market value under same high implied volatility if the equity price evolves over time within the same volatility environment, we will run different assumptions through a Black-Scholes standard model and attempt to backdate, in order to evaluate the expense misstatement magnitude.

> "IN LAST YEAR'S MARKET ENVIRONMENT, THE TIME VALUE IMPACT WAS SUBDUED TO THE VOLATILITY IMPACT."

To ensure that the equity price evolves over time within the same volatility assumption and also to not negate the lognormal distribution assumption for asset prices, we assume that the stock price evolves based on a Black-Scholes model as:

$$dS = \mu S dt + \sigma S dW_t$$

One run is set at the 25 percent volatility assumption, and then we set a second run by increasing the volatility by 25 percent, then a final third run by decreasing the initial assumption by 25 percent. Thus the different prices used at different times lie on the same path and volatility surface. We then backtest the random prices to make sure that there were actually securities on the market with the same price ranges at the respective times, and that those securities have had historically high betas.

Thus we will form option valuation vectors with the same fields: [underlying price, exercise price, days until expiration, dividend yield, volatility, rounding]. The equals sign between them means that the call options expiring on the same dates at the same price have the same model value. Here is an example of equivalent vectors:

[89,100,30,5,1,25,3]=[76,100,120,5,1,25,3]=[68,100,210,5,1,25,3]=[60.5, 100, 210, 5,1,32,3]=[73,100,270,5,1,18,3]

I keep on file 250 more simulations, which I can provide upon request, together with the respective securities' names, which I did not include for obvious space-saving reasons.

Of them, 48 have fallen to zero model value due to the fall in the markets.

Indeed we based these assumptions on the respective stock having a high beta. If the volatility high VIX ranges of the market would not hold for the respective stock, the mean reversion of those stocks' individual volatility may not have occurred at the same pace with the market, thus the backdating of compensation award options for the stocks with a low beta may have produced a more significant impact.

But since a majority of the stocks have a high beta, in last year's markets, the backdating tax understatement, which has been deemed to occur, is likely to have been not that material.

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