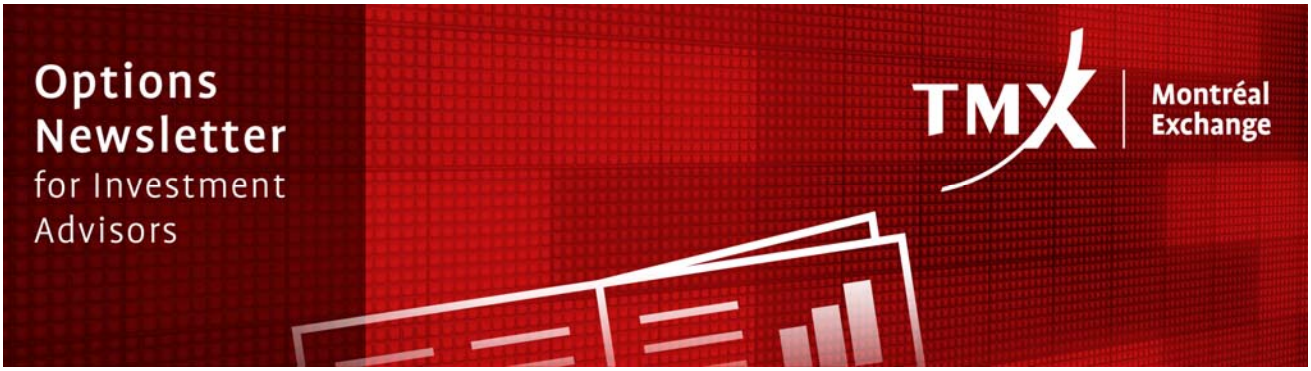


July 2011

Analyzing Volatility

We previously addressed the subject of volatility in the September 2010 issue of the options letter by showing the appropriate strategies to implement to reduce the impact of volatility on an investors' portfolio. In this edition, we analyze the behavior of volatility as a function of the strike prices of options, and as a function of the expiry months of options. The analysis of volatility with regard to the strike prices of options is referred to as the "volatility smile", whereas the analysis with regard to the expiry months of options is referred to as the volatility term structure.

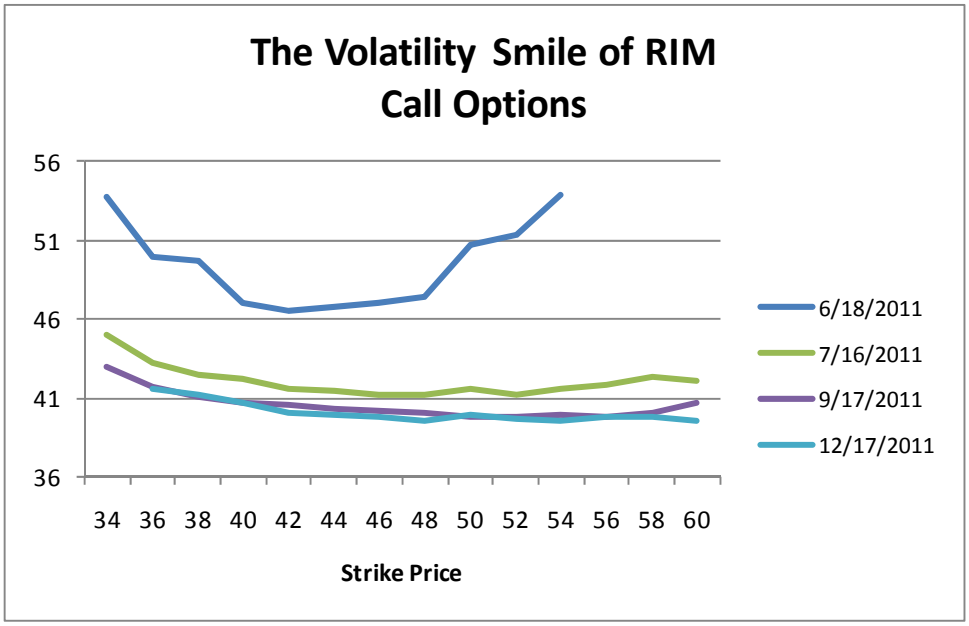
However, let us first revisit the two types of volatility that exist in the options market - historical volatility and implied volatility. Historical volatility is calculated using historical price data over a specific period of time. It is defined as the standard deviation of the returns of an asset over a specific period of time. It is a measure that indicates the capacity for the price of an asset to rise or fall. As the volatility rises (falls), the risk increases (decreases). Consequently the prices of options, for both call options and put options, increase (decrease) as volatility rises (falls). On the other hand, implied volatility is directly derived from the prices of the options quoted in the market. Whereas historical volatility is an acknowledgement of the past, implied volatility measures the market's expectation of future volatility. Implied volatility allows investors to find price equilibrium between the market price of an option and the theoretical price of that same option[1].

The volatility smile

Opportunities in the options market arise from fluctuations of implied volatility. Implied volatility is not static; it fluctuates with regard to the strike prices of options and the time remaining until expiry. The following table illustrates the implied volatility of Research in Motion (RIM) options on May 16, 2011 when the price of the underlying RIM shares was $41.72.

Implied Volatility		Calls				Puts			
Symbol	Strike Price	6/18/2011	7/16/2011	9/17/2011	12/17/2011	6/18/2011	7/16/2011	9/17/2011	12/17/2011
		JUN	JUL	SEP	DEC	JUN	JUL	SEP	DEC
RIM	34	53.76	45.02	42.96		49.45	42.07	40.41	
	36	50.02	43.22	41.71	41.53	47.38	41.19	39.91	39.80
	38	49.74	42.42	41.10	41.14	46.28	40.68	39.43	39.21
	40	47.04	42.17	40.75	40.64	45.22	40.17	39.35	38.97
	42	46.50	41.58	40.61	40.06	45.04	40.25	38.99	38.58
	44	46.78	41.47	40.33	39.96	44.53	39.70	39.05	38.45
	46	46.99	41.18	40.16	39.83	43.38	39.70	38.19	38.26
	48	47.44	41.25	40.01	39.55	44.32	39.33	38.68	38.08
	50	50.78	41.58	39.75	39.95	44.40	39.38	39.05	38.36
	52	51.36	41.20	39.83	39.72	45.55	39.90	38.95	38.44
	54	53.88	41.58	39.97	39.49		40.13	39.13	38.81
	56		41.87	39.82	39.75		39.73	39.77	38.91
	58		42.29	40.10	39.75		40.99	39.63	39.02
	60		42.11	40.64	39.49		41.67	40.53	39.51

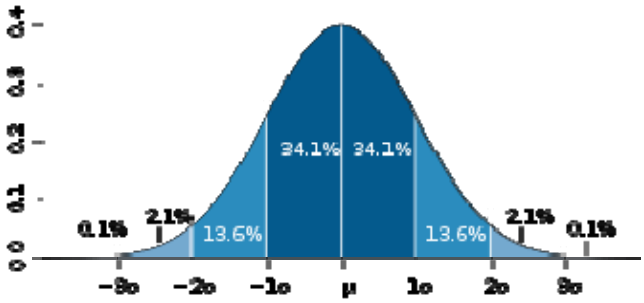
[1] For additional details, refer to the September 2010 edition of the options letter, http://m-x.ca/f_bulletins_en/September2010.pdf



The graph above illustrates the volatility smile of RIM call options for the expiry months of June, July, September and December 2011. One can easily observe that the implied volatility is not static and that it fluctuates with regard to the strike prices of the call options. The volatility smile of the RIM June call options stands out as it is more pronounced compared to the other call options expiry months. Now, what could possibly explain the shape of the volatility smile curve?

An explanation

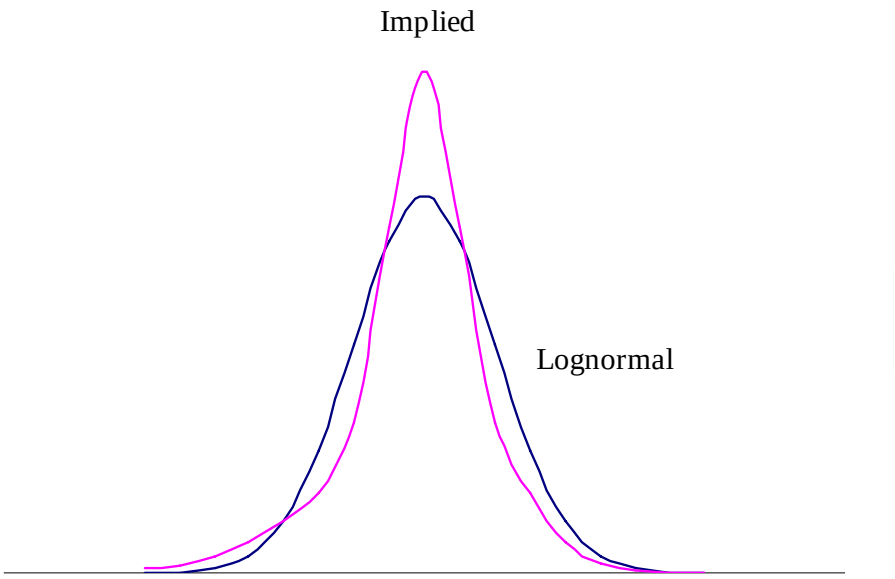
To find an explanation for the shape of the volatility smile curve one must look at the statistical concept of the log-normal (or normal) distribution of returns used by the Black-Scholes option pricing model.



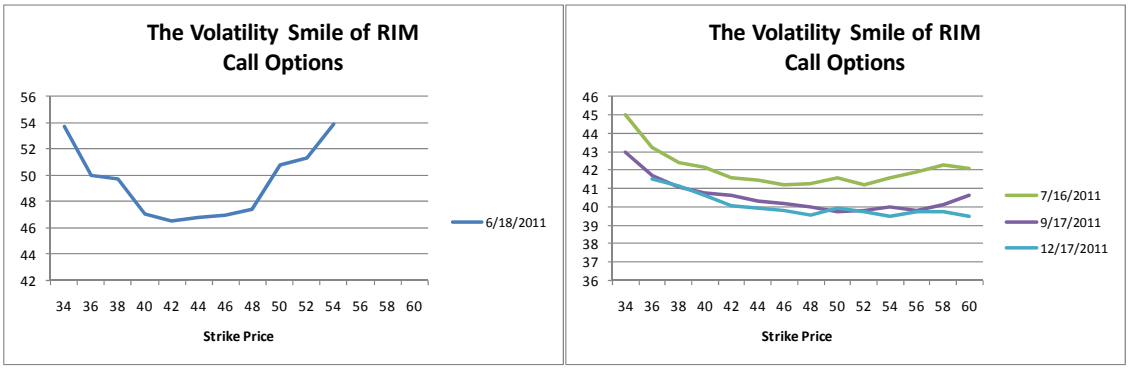
Graphical representation of a normal distribution. Each colored strip represents one standard deviation.
Source: Wikipedia

The figure above is a graphical representation of a normal distribution of returns - commonly referred to as a “bell curve”. We observe that 68.2% of the returns are contained within one standard deviation, up or down (1 standard deviation = 1σ). The distribution of returns is symmetrical on each side of the mean (μ). Real life trading has shown that the log-normal distribution underestimates the probabilities for extreme returns to occur (left side of the graph). This underestimation was the source of the large losses suffered by options traders during the crash of 1987. There is a clear demarcation in terms of options valuation. There is “pre 1987” and “post 1987”. Prior to 1987, options traders were more or less using the same volatility for all options strike prices. It was shown that the probability of losses greater than 10%, and even 20% for that matter, was much greater than what the normal distribution predicted. According to this model, the probability for such an event to occur was one in every 500 years, whereas in reality, crashes tend to occur on average every 20 years or so. It follows that based on the underestimation of the probability for extreme returns, options traders underestimated implied volatility and consequently the prices of out-of-the-money (OTM) put options were strong largely underestimated as well. Therefore, following the crash of 1987, options traders refused to sell OTM put options

at such low prices. The result was higher implied volatilities for OTM puts, i.e., for strike prices lower than the market price of the underlying stock. The following figure illustrates the implied volatility distribution compared to the log-normal volatility distribution.



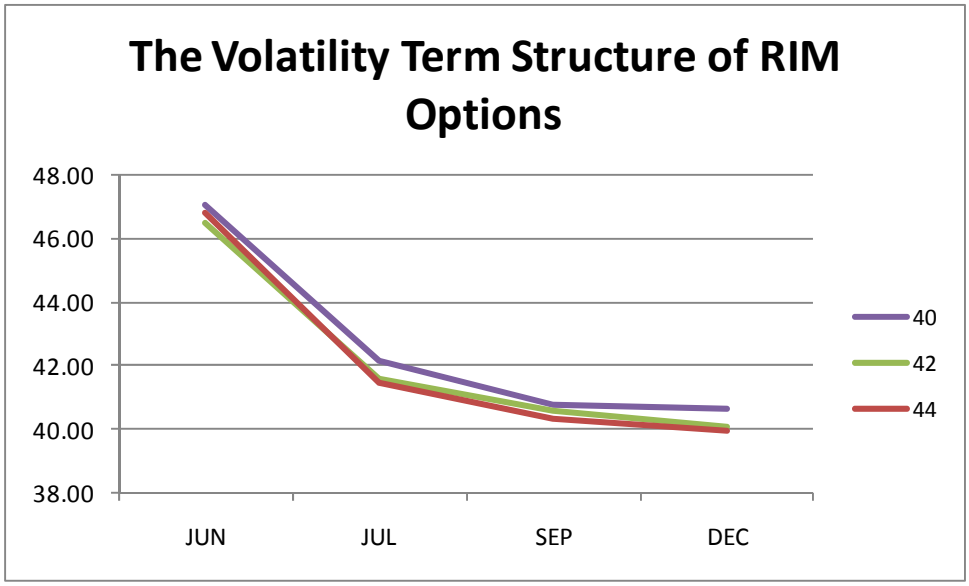
One can observe that the left side of the implied volatility distribution is larger compared to the log-normal distribution. This is the result of the adjustments made by the market to reflect the level of the implied volatility after 1987.



The volatility smile for the RIM June call options (left graph) shows a higher level of implied volatility for the OTM call options (in addition to the OTM put options), i.e. for strike prices greater than the actual price of RIM shares of $41.72. This is an indication that options traders are not willing to sell call options at low prices. One can observe as well that traders are valuing the risk of seeing large price increases to the same extent of seeing large price decreases. The astute investor will notice that RIM usually publishes its quarterly earnings in the months of March, June, September and December. The last earnings report was published on June 16, 2011 following the market close. Therefore, one month prior to the earnings report, options traders were anticipating a large move in the price of RIM shares, up or down. The shape of the volatility smile (such as the volatility smile of the RIM June call options depicted above) is typical of what investors may be expected to observe when important news are anticipated by the market. The volatility smile for the subsequent months (right graph) is less pronounced. We can observe that the implied volatility for the OTM put options is greater than the OTM calls since, in absence of news, the market fears a much higher potential for a crash compared to a large move up. The market will go up in a more regular fashion and over a longer period of time compared to when the market crashes which generally occurs over a very short period of time. Hence, the need to buy put options as insurance becomes more important for investors.

The volatility term structure

The implied volatility fluctuates as well with regard to the time remaining to expiry. The following figure illustrates the implied volatilities for different strike prices for the expiry months of June, July, September and December 2011.



The volatility term structure represents the future level of volatility expected by options traders. In the figure above, one can observe that traders are expecting the implied volatility to fall for the more distant expiry months. The higher level of implied volatility for the June expiry month is due to the publication of the earnings report. For the more distant expiry months, implied volatility falls to a lower and more stable level. The next earnings report will be published in September. If the earnings report is published prior to the expiry of the September options, one should see a rise in the implied volatility for the September options. Otherwise, the implied volatility for the October expiry month will be impacted.

Analyzing implied volatility should be an important criterion of a trader's game plan. The observation of an anomaly in the implied volatility of the expiry month of a specific option is an indicator that something unexpected in the price of the underlying stock is likely to occur. It must be noted that if one observes a high level of implied volatility in a particular option, it does not mean that the price of the same option is overvalued. One must find the reason why the implied volatility is high? In the case analyzed above, the "overvaluation" of the RIM June call options was due to a known event and not due to a market anomaly. The risk of seeing a large price movement, up or down, was very real indeed following the publication of the earnings report. Neglecting to realize the reasons of this overvaluation could lead complacent investors to wrongly conclude that there exists a free opportunity to make a profit. For example, investors could be tempted to establish a covered call strategy in order to take advantage of the presumed inflated premium of the call options. If investors can show that the premium of the option is inflated (i.e., that the options price is overvalued) then there is no problem, investors will likely realize a profit. Otherwise, investors are entering into a position where the risk is much greater than anticipated. In the case of RIM options, the proof came right after the publication of the earnings report by RIM on June 16th when the price of the stock fell by more than 20%. Was this really the outcome that investors were anticipating? Or did investors believe there was a quick profit to be realized? A simple observation of the implied volatilities[2] of the options would have made it possible to find and understand the reasons for this "overvaluation".

[2] Please take note that the vast majority of trading platforms provide information on implied volatilities. Furthermore, one can find this information on the Montréal Exchange website at the following address: http://m-x.ca/nego_cotes_en.php.