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VOLATILITY ANALYSIS: GV <GO>

GV <GO>, Graph Volatility, is Bloomberg's newest function for charting both historically realized volatility, the volatility surface, and options' implied volatility for equity, index, and commodity underlyings. The function GV<GO> also provides the ability to chart the underlying price, implied forward-price, and, CDS-spreads for single-names.

This document will explain the following types of analysis most often performed by equity and option market participants;

1. Equity versus volatility
2. Realized versus implied volatility
3. Skew analysis
4. Calendar spreads
5. Volatility versus credit spreads
6. Relative volatility comparison
7. Bringing it all together

Equity versus Volatility

Empirically, stock prices most often move in opposite direction to options' implied volatility. Many equity investors will chart the historic pattern of an underlings' price movement compared to that of the at-the-money strike implied-volatility. This will help them measure the extent and magnitude of the relationship between equity prices and implied volatility. In this manner, investors can understand better their exposure to volatility merely from owning the underlying.

Shown is a price chart of Deere's stock and the historical implied volatility for the 100 percent-money strike, 3-month option from the volatility surface. Notice how the rolling 3-month correlation of its stock price to implied volatility becomes stronger (i.e., more negative) when the stock takes a precipitous fall. Indeed, the relation becomes even stronger during the period in which implied volatility, itself is volatile; look below at the movement in implied volatility experienced during October, 2008.

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Realized versus Implied Volatility

Many investors want to look to see if there are patterns in which the realized volatility (also known as delivered volatility, or historical volatility) was above or below implied volatility for the same time period. For example, today's 3-month historic implied volatility would be compared to the 3-month implied volatility, three-months ago. Investors will also compare current levels, of, say, 3-month implied volatility versus the most recent 3-months of realized volatility. Some also will look at historic relationships between the realized volatility and historic implied volatility. For example, perhaps there have been patterns whereby the realized volatility was "typically" below or above, the coincident implied volatility. GV enables this type of analysis, to determine whether current levels of implied volatility imply an increase or decrease on current levels of realized volatility.

Shown is a two-year GV chart, as of 26 November 2008, for CVS Caremark's daily 3-month 100%-moneyness implied volatility compared to its rolling 3-month realized volatility.

To synchronize the 3-month tenor of the implied vol to the actual volatility requires that the historic volatility ("Hvol") tenor be computed over its respective past 60 trading days. To make the historic volatility coterminous with the implied volatility's time period requires that the Hvol be shifted (or "lagged") by 3-months. For example, below is the Hvol, as of 26 Nov '08, shifted back three-months to 26 Aug '08. Naturally, the implied volatility during August 2008 was much smaller than the realized 3- month realized volatility between these two dates, due to the financial and economic crisis that exacerbated beginning September.

Skew

Skew, as a measure of the difference in implied volatility between two strikes. In GV, Skew is measured in three ways, percent money, delta, and sigma spaces. On the put side, skew measures the equity markets' view of bearishness. This is because one would only "bid up" an OTM put option if they have a bearish view on the underlying. On the call side, skew measures bullish sentiment, or maybe possible takeover. Skew is viewed not only by options professions, equity and credit investors look for clues as to the bearish sentiment and its strength by looking at options' relative implied volatilities. The typical parametric settings for skew are:

- Percent money: either 90-100%, or 90-110% of spot
- Delta: 25delta puts compared to 25 delta calls
- Sigma: -1 to +1

Shown is a one-year GV chart, as of 26 November 2008, for CVS Caremark's skew as measured by the implied vols from the 25-delta put and the 25-delta call from the volatility surface. Note that an increase in the level of skew, very noticeable in the spread chart, is accompanied by a precipitous fall in its stock price.

A useful feature within GV is the "Show Statistics" capability. In the skew chart below, one can see the (then) current skew was 15 vegas, whereas its average over the past, respective, year was 5.7 vegas, and the standard deviation of the skew was 3 vegas, implying that the current difference from the mean is 3 standard deviations away, which is very significant, statistically.

Calendar spreads

The difference in implied volatility for two options with the same strike is considered a calendar spread, or a partial term structure of vol. This measure is associated with an options-implied event risk, for a scheduled event, most often an earnings announcement. Option participants tend to focus on earnings announcements as they often create the opportunities for volatility. For example, an implied volatility for a nearby contract of, say 25%, compared to the next contract, of, say 20%, when the average difference has been, say 1 Vega (with the second contract having a higher vol), implies that the options market 'expects" a 6% move in the stock from an earnings surprise.

Shown is a one-year GV chart, as of 26 November 2008, of Intel's calendar spread measured between the 60-day and 30-day 100%-moneyness implied volatilities. Intel is scheduled to announce earnings on 15 January 2009. Note that the current value is ~4.6 percent. Option participants will compare this 'expected price surprise, to the historic surprises, using the function **SURP <GO>**.

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Volatility versus Credit Spreads

Single-name options implied-volatility is related to its respective CDS spread, particularly, the higher the leverage for a specific firm. This is due because selling credit-protection is similar in risk profile to selling a put option on the same company. GV provides flexibility to the user in providing choices of CDS tenors. More importantly, GV provides the ability to select any supported definition of moneyness and level, so that a user may compare CDS spreads to, say the -1 sigma/12-month implied volatility, as used in OVCR, or using 25-delta puts below. Using these model-driven parameters provide one the ability to compare levels across names. Many market participants prefer the 90-percent moneyness because it is easy to understand, though, does not adjust the strike distance from the underlying's spot price for the level of implied volatility.

Shown is a one-year GV chart, as of 26 November 2008, of Wal-Mart's 5-yr CDS spread, 25-delta put vols, and its stock price. One can clearly observe how the CDS spread and implied volatility for Wal-Mart trade with one another, especially when looking at the rolling correlation in the lower chart.

*Bloomberg provides additional functions to compare equity and credit: **ECCG <GO>** displays a firm's at-the-money vol, CDS spread, and stock price; **OVCR <GO>** provides a screen to identify anomalies between CDS spreads and the equity markets.*

Relative volatility comparison

GV is often used to compare volatilities (both historic and implied) between comparable companies, or between a company and the index of which it is a member. Shown is the 3-month, 100-percent money implied volatilities for both International Paper, and Weyerhaeuser, both forest product companies.

Notice how the implied volatility of Weyerhaeuser during the first part of 2008 was above, then touched International Paper's on 17-MAY-08, and traded-off relative to the implied vol of International Paper.

Did the credit markets act in a consistent manner during this time period?

Relative credit comparison

GV can be used to compare the CDS spread between two single-name underlyings. Shown are the CDS spreads for both Weyerhaeuser and International Paper, for the same time period on the prior page, 02-JAN-08 to 31-AUG-08.

Notice that Weyerhaeuser's implied volatility is above International Paper's, then crossed through International Paper's on 17-MAR-08. At this date, Weyerhaeuser's implied-volatility was above International Paper's, implying that credit investors were more bullish on this name, relative to Internal Paper, than were equity investors.

Later in the year, on 17-MAY-08, Weyerhaeuser's CDS spread started to consistently trade off relative to International Paper's. This was at the same time period as when Weyerhaeuser's implied-volatility traded off relative to that of Internal Paper's.

Perhaps the CDS market "saw" Weyerhaeuser's implied vol increased relative to International Paper's, and, decided to make a similar move, having "concluded" that its relative bullish sentiment was overly aggressive.

Putting it all together….

Shown is a chart that combines both the relative implied volatility and relative-credit analyses. The vertical white line highlights the date in which Weyerhaeuser's implied vol and CDS spread traded up, relative to International Paper's. Notice that prior to that date, the CDS spread was beneath that of International Paper's, a more bullish indicator from the credit markets, relative to the equity market.