



MINERVA

INVESTMENT
MANAGEMENT
SOCIETY

MARKET UPDATE: VOLATILITY & VIX

by **Vito Antonio Amatulli**
Research, Minerva IMS

by **Antongiulio Frattasio**
Risk Management, Minerva IMS

03/03/2020





VOLATILITY OVERVIEW

Volatility is usually defined as a statistical measure of the dispersion of returns for a given security or market index. Therefore, it is often measured as either the standard deviation or variance of returns from that same securities and market index. When talking about securities markets, volatility is associated with big swings in both directions. For example, when the stock market rises and falls more than one percent over a sustained period of time, this is referred to as a “volatile” stock market. Hence, an asset’s volatility is a key factor in pricing option contracts.

One of the most widely recognized measures of volatility is the VIX volatility index. The VIX Index is a calculation designed to produce a measure of constant, 30-day expected volatility of the U.S. stock market, derived from real-time, mid-quote prices of S&P 500® Index (SPXSM) call and put options. In 2004, the CBOE Futures Exchange introduced cash settled futures contracts on the CBOE VIX Volatility index. Furthermore, in 2009 more than a dozen VIX futures Exchange Traded Notes (ETNs). As for the VIX futures, one contract is characterized by a multiplier of 1000x. Some basic facts about VIX futures: they are highly positively correlated with VIX itself; the short maturity contracts are more sensitive to moves in the VIX than long maturity contracts; they are hyper volatile; they have negative β . Whenever we look at the term structure of VIX futures, we could either have contango (positively sloping term structure) or backwardation (negatively sloping term structure). Contango and backwardation are related to the market’s risk neutral expectations of the VIX going respectively up and down. As stated before, in 2009 a number of ETF vendors have introduced VIX futures ETFs. The most common ones are:

- VXX, VIIX, VIXY: Long 30-day constant maturity;
- TVIX, UVXY: Double long 30-day constant maturity (i.e., levered 2:1);
- XIV, IVOP, SVXY: Short 30-day constant maturity;
- VXZ, TVIZ: Long 5-month constant maturity.

VIX



As we can observe in the chart above, the Cboe volatility index — known as Wall Street’s “fear gauge” — jumped to its highest level since August 2015, reflecting the heightened volatility in US stocks at a time of growing concerns over the SARS-Covid-19 outbreak. This reminds us of something worse than “Volmageddon” that happened on Feb. 5th, 2018. Going back to February 2018, the sudden spike brought an end to one of the calmest chapters in U.S. equities – a years-long stretch in which equity turbulence was stuck at about half its historical average. And the episode was characterized by the collapse of one of the most pervasive and popular trades in financial market history: being long on XIV. In fact, the XIV along with some other ETFs, give access to a spate of exchange-traded products to retail investors. Some of these products moved inversely to the Volatility Index, but their fortunes were nevertheless tied to its shifts. One of the most popular, the VelocityShares Daily Inverse VIX Short-Term note (ticker XIV), would blow-up spectacularly on Feb. 5, shrinking from \$1.9 billion in assets to \$63 million in one session. XIV’s demise was both symptomatic of the S&P 500 Index’s worst loss since 2011 and a partial contributor to its magnitude.

Recently instead, the market meltdown due to fears of coronavirus epidemic, combined with the increasing odds of a Bernie Sanders nomination as Democratic candidate for US presidential elections, offers another case-study of a sudden spike in VIX. The index moved from 27 to 34 between the 26th and the 27th of February, and then jumped to 48 in less than 24 hours.

VOLATILITY SMILE/SKEW

We have briefly analyzed the effect of this VIX increase on the shape of volatility skews in the equity market by looking at the SPY, which aims to track the S&P's 500 index. We recall that the volatility skew is the curve obtained by inverting Black Scholes formula to get implied volatility for options with a different degree of “moneyness” (i.e. strike price divided by underlying price). However, market prices incorporate different implied volatilities, leading to either “volatility smiles” or “volatility skews”. Theoretically, implied volatilities of calls and puts with the same strike should coincide if the put call parity holds. However, there might be bid-ask implied volatilities and the put-call parity may not hold perfectly. Hence, the most liquid options are ATM and OTM ones.

When analyzing equity skews, we could argue that those are more frequent for equity options and bond futures options for two possible reasons: non-lognormal distribution (extreme price falls more likely than predicted in the theoretical distribution); demand/supply factors («crashophobia» leading to greater demand for OTM put options as a way of protection against possible market crashes).

When analyzing equity smiles, those are more frequent for currency options and interest rate options for two possible reasons: non-lognormal distribution (extreme price movements more likely on both tails of the distribution); demand/supply factors (leading to great demand for OTM put options as well as for OTM calls, depending on currency exposure you could be either short or long and seek to hedge it).

Hundreds of papers have been written on the information that can be extracted from the volatility surface (i.e. volatility skew over time of expiration). While before the recent crash we have seen a sensible increase of OTM puts prices (thus a more steep skew in equities), now market operators are rapidly rebalancing their portfolio. Even though implied volatility has rapidly increased for all strikes, the skew is now flatter.

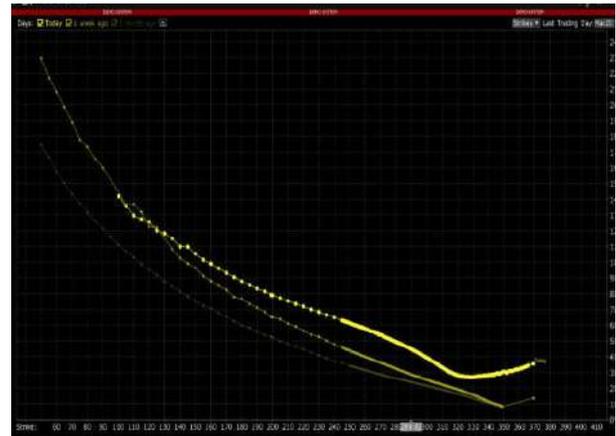


Figure 1 - Change in the SPY skew over time (28/02, 21/02 and 28/01). From top to bottom, we have: the IV curve on Feb 28th; the one of the week before; the one of a month before.

GLOBAL MARKETS

According to S&P Dow Jones Indices, global markets have lost \$6 trillion in value over the past six days. Stock markets around the world are plunging into correction territory as investors fear the surging of coronavirus cases outside of China will escalate the deadly virus to a pandemic (figure 2).

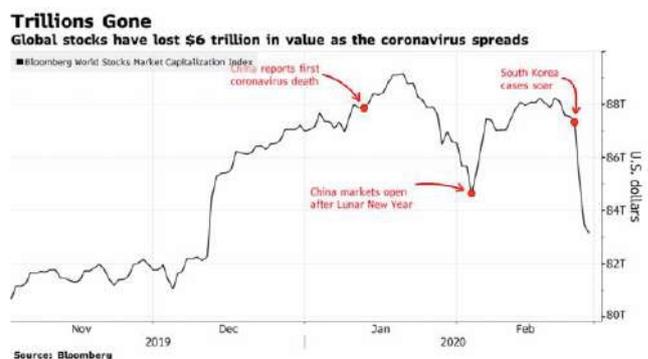


Figure 2 – Bloomberg World Stocks Mkt Cap Index

Moreover, investors flocked to the safety of government debt, pushing the yield on the US 10-year Treasury bond down to 1.095 per cent (close to its record low), as expectations grew that the Federal Reserve would be pushed to cut interest rates by April.

In particular, there are six companies that suffered from a \$1 trillion total loss in the last week: -Apple (\$263 billions); -Microsoft (\$232billions);

-Alphabet (\$170 billions); -Amazon (\$166 billions);
-Facebook (\$87 billions); -Visa (\$82 billions).

When analyzing the implied volatility curves on Interactive Brokers, we found out that Microsoft and Apple show two particular interesting shapes. The two used to have a skewed volatility (i.e. far higher implied volatility for lower levels of moneyness) but the recent turmoil changed their shape to a smile (i.e. almost equivalent implied volatility for “extreme” strikes), even though options with high strikes seems to be quite illiquid (implied volatilities do not follow a smooth line on the right). This change of shape comes from some positions betting/hedging against an improbable, but not impossible, market rebound for tech companies.

DISCLAIMER

This is an academic paper related to an academic project that doesn't pretend to represent any investment recommendation nor offer any solicitation to buy or sell securities or to adopt an investment strategy. The opinions expressed are subject to change. References to specific securities, asset classes and financial markets are for illustrative purposes only and are not intended to be and should not be interpreted as recommendations. Reliance upon information in this material is at the sole risk and discretion of the reader. The material was prepared only in regard to the specific objectives of Minerva Investment Management Society virtual portfolios.

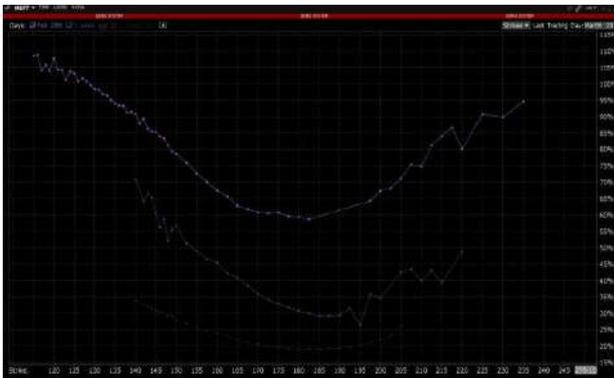


Figure 3 - Change in the Microsoft smile over time (28/02, 21/02 and 28/01); From top to bottom, we have: the IV curve on Feb 28th; the one of the week before; the one of a month before.

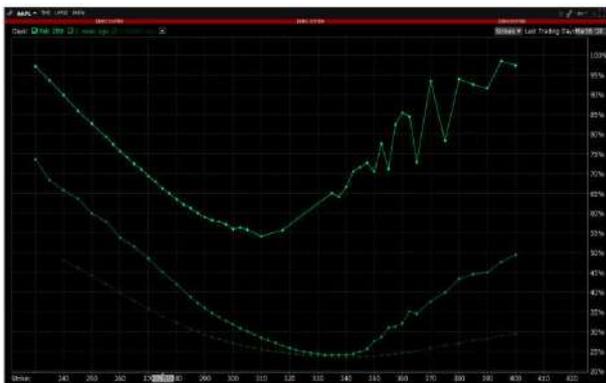


Figure 4 - Change in the skew (now smile) of Apple over time (28/02, 21/02, 28/01); From top to bottom, we have: the IV curve on Feb 28th; the one of the week before; the one of a month before.