Fixated and VIXated on Volatility

Option traders have long been fixated on implied volatility and other measures of volatility, such as the local volatility or the volatility surface, that are derived from the options prices quoted in the market. Now, it seems that there is a new fixation, the VIX, or, the volatility index on S&P500 stock index. Not only the options traders, but everybody else, from the financial journalists to the market commentators to the regulators, it seems, is now talking about the VIX index. Justin P., my friend and a long time options trader, recently lamented to me over the phone that we are now VIXated on volatility.

VIX is a volatility index computed from the options prices on S&P500 stock index. However, most investors, including some very sophisticated ones, think of VIX as simply the “fear gauge”. They believe that a high value of VIX signifies heightened worries of the option traders about an impending market crash or a significant rally. The reason for this is the somewhat erroneous interpretation on the part of these investors, and the broader public in the financial markets, that VIX measures the expected future volatility in the stock market (S&P500 index). If you had listened to the commentary on financial television for the past two weeks then you may have come out with the impression that VIX captures the expected movement of the S&P500 in the next one month. A VIX value of 41, for example, would more or less signify that S&P500 index is expected to move up or down by 11.83% in the next one month (this number is arrived at by dividing 41% by the square root of 12). Many traders and risk managers still think that since VIX is derived from liquid options prices on S&P500 stock index it somehow captures the implied volatility of at the money S&P500 options. Nothing can be further be further from the truth.

As Pablo Tirana, the veteran options trader explains, that even though VIX is computed from liquid option prices on S&P500 index, it is neither about implied volatility derived from these
option prices nor is it about expected volatility of the S&P500 index. His argument is that the best way to interpret the VIX, which is linked to S&P500 option prices across a large range of strikes, is as a measure of the level of volatility smile at any one point in time. In option parlance, a “smile” is plot of implied volatility across strike prices for a particular maturity. If the X axis represents strike prices of options for a particular maturity, say, 30 days, and the Y axis represents the implied volatility derived from these options then the XY plot will be that of a flattened parabola if the out of the money and in the money options have higher implied volatility than the at the money options, somewhat like a smiley face. According to Tirana, an increasing VIX signifies, on an average, a “happier” smile (of the S&P500 options) and a falling VIX signifies, on an average, a “sadder” smile.

Rahul Bhattacharya

**Tutorial #2.1**

**Does Historical Volatility have a Memory?**

In the last issue, we looked at how to compute the historical volatility of an asset. Let’s continue with that discussion and ask ourselves the question: does historical volatility have memory? Say, you are computing the historical volatility of an asset such as S&P500 index, Gold or Dollar-Yen. As per the algorithm described in the previous issue, you’d simply take a long enough time series of the price of that asset and calculate the standard deviation of the log returns to arrive at the historical volatility. But what is “long enough”? How long a time series should you choose? Should you choose a one month daily history of the asset price or a three month daily history of the asset price? Why not a one year daily history of the asset price?

The problem is that all the above choices for the length of the time series will give you different values for the historical volatility of the asset. And sometimes, the difference could be very significant, especially if the market has gone through a lot of turbulence in the recent past. Let’s take a very simple and stylized example. Say the normalized asset price history over the last 20 days looks like this:

100, 101, 100, 100.5, 100, 101, 101.5, 102, 102.5, 103.5, 101, 100, 99, 98.5, 97, 96, 94.5, 94, 93.5, 93.

You calculate the historical volatility of this asset by taking the entire 20 day history and calculating...
the standard deviation of this series. The value of historical volatility comes out to 0.98% daily volatility which is equivalent to 15.59% annualized volatility. Now say, you friend, a fellow trader, takes on the last 10 days history of the asset, i.e. the asset price time series from day 10 to day 20 and estimates the historical volatility. He would get a value of 0.63% as the daily historical volatility for the asset which is equivalent to 9.98% annualized historical volatility. Now, there is a significant difference between 9.98% and 15.59% vol. Which value is correct? To overcome this problem, many market practitioners use a method of filtering to estimate historical volatility. In a slightly more technical jargon we use what is known in Engineering as a Kalman Filter. The methodology also goes by the name of exponential decay or exponential smoothing within the econometric and risk management community. What this methodology does is that it assumes that the market has a memory and that this memory is built into the calculation of historical volatility. In fact, this assumption is a perfectly valid and every trader worth his salt will tell you the same. Markets do indeed have a memory and traders and investors remember what happened in the past. And just as in life our memories dim as time passes by, in the financial markets as well people tend to forget what happened in the very “distant past”. Therefore, events which have occurred in the “recent past” should have more influence on our trading decisions than the ones that have happened in the distant past.

In an exponential decay model – a volatility filter – we choose a decay factor, denoted by the Greek letter lambda, $\lambda$, and assign a value to this. Lambda should be close to one but always less than one. Then, we raise the decay factor to the power of days (or periods in the time series) but in the reverse order. For example, in the above example the 20th day would have a lambda raised to power 1, the 19th day would have lambda raised to power 2, the 18th day would have lambda raised to power 3 and so on until day 1, the first day in the time series has a lambda raised to power 20. This makes the value of lambda smaller and smaller as we move from day 20, i.e. yesterday, to day 1, i.e. twenty days ago. In other words, lambda decays as we move from day 20, recent past to day 1, distant past. We can call
this decayed lambda. Finally, we multiply the daily (periodic) squared returns generated from the daily (periodic) asset prices in the time series with the decayed lambda, sum up that value over the entire series then multiply it with one minus original lambda value and take the square root of that number. This gives us, what is known as the Exponentially Weighted Moving Average (EWMA) historical volatility. If we choose a value of 0.97 for the decay factor (lambda) and use the above EWMA algorithm on the 20 day time series of asset prices mentioned above we would get a value of 0.677% as daily historical volatility of the asset or 10.74% annualized historical volatility for the asset.

EWMA volatility is a measure of historical volatility where the recent asset price data has more importance than the distant asset price data. In other words, historical volatility has a memory.

Team Latte

Product Idea for the Equity Market Principal Protected Bull Note

A good equity product for markets such as these is the good old capital protected coupon paying note. In such a note the investor’s principal amount is protected and the payoff of the note is tied to the performance of a risky asset, usually a stock or an equity index. In a typical, and the simplest version of a capital protected equity linked bull note, an investor’s return is a sum of a minimum predetermined return given by a “floor” plus any upside generated by the asset. If the asset does not generate any upside due southward movement of prices or market crash then at maturity the investor walks away with the minimum guaranteed return, given by the floor. On the other hand if the equity markets do well and the asset moves up generating a positive return for the investor then his total return at maturity would be the sum of the minimum guaranteed return (floor) plus the positive return generated by the asset.

In essence the investor buys a coupon paying bond plus a call option on the asset. At maturity he either gets back his principal (plus all coupons) or he gets back his principal (plus all coupons) plus the profits generated by the call option on the asset. The coupon on the bond is given by the “floor” of the note. The strike of the call option is a function of both the participation rate and the floor.

Vanilla Times

www.risklatte.com
Participation rate is a constant and signifies the proportion of upside in the asset return that can be captured by the call option. The way the floor and the participation rate, the two pre-determined constants in the payoff equation, are set in most of the vanilla equity linked bull notes makes the option out of the money.

Team Latte

Trading and Markets Terminology

**Market Order:** An order to buy or sell a certain quantity of a security, such as a stock, at the best available price.

**Limit Order:** An order to buy or sell a certain quantity of a security at a particular price.

**Liquidity:** Aggregate size of the limit orders in a limit order book at a particular point in time.

**Slippage:** An alternate definition of liquidity and it is computed as a difference in the average execution price and the midpoint of bid-ask quote.

**Arbitrage:** It is mechanism via which a trader tries to make the expected value of a self-financing portfolio positive.

Excel™ for Financial Modeling (Intermediate Level)
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financing portfolio or strategy is made positive (though negative value cannot be ruled out). It’s a form of trading where a trader bets on the differential between the prices of securities with a belief that he will generate a positive return.

**Morgan Stanley and the Birth of Statistical Arbitrage**

Statistical Arbitrage is an umbrella term used for a broad range of quantitative trading strategies that use sophisticated statistical and mathematical models to analyze price differences and price patterns between securities to generate a higher than average profit for the traders.

Statistical Arbitrage was born out of the invention of “pairs trading” strategy that was pioneered by Gerry Bamberger and Nunzio Tartaglia at Morgan Stanley in the early 1980s.

**Pairs Trading** exploits price discrepancies and correlation between a pair of stocks to buy and sell them and make profits.

In early 1980s, Morgan Stanely formed an independent, ultra secretive group, comprising traders and computer scientists to exploit the discrepancies in the stock prices to generate abnormal profits.

**Once Upon A Time...**

**Morgan Stanley and the Birth of Statistical Arbitrage**

Richard Bookstaber, the first market risk manager at Morgan Stanley in the mid-1980s and the author of the 2006 book, *A Demon of Our Own Design*, writes that “Statistical arbitrage is now past its prime. In mid-2002 the performance of stat arb strategies began to wane, and the standard methods have not recovered”. Was it pure coincidence or absolute prescience on part of Bookstaber that in less than a year after the publication of this book the global financial markets would unravel.

This month’s issue of Bloomberg Markets (August 2011) profiles Peter Muller, the star quant trader, who founded the Process Driven Trading (PDT) group at Morgan Stanley in 1993. Muller and his PDT group at Morgan Stanley have made most of their money from an algorithmic (quantitative) trading strategy called Statistical Arbitrage, or Stat Arb. Not only at Morgan Stanley but at many other investment banks and hedge funds, Statistical Arbitrage has been a hugely profitable quantitative trading strategy for the past 25 years.

Of course, Statistical Arbitrage is not just a single trading strategy. As things stand today, it is an umbrella term used for a broad range of quantitative trading strategies that use sophisticated statistical and mathematical models to analyze price differences and price patterns between securities to generate a higher than average profit for the traders. The math concepts used in Statistical Arbitrage range from Time Series Analysis, Principal Components Analysis (PCA), Co-integration, neural networks and pattern recognition, covariance matrices and efficient frontier analysis to advanced concepts in particle physics such as “free
The genesis of Stat Arb can be traced from a quantitative trading strategy called “pairs trading”. And 25 years after its birth, this strategy, which exploits price discrepancies and correlation between a pair of stocks to buy and sell them and make money, still lies at the heart of Statistical Arbitrage. It is believed that the notion of pairs trading had been around for many years prior to 1980; apparently, Paul Wilmott has claimed that this trading idea was discovered at his shop in 1980. However, the formalization of the concept of pairs trading and its implementation as an acceptable quantitative trading strategy happened in Morgan Stanley in 1982-83. There is a bit of a debate over who exactly discovered pairs trading. Some, including Bookstaber, believe that it was Gerry Bamberger, who hit upon this idea while working at Morgan Stanley & Co. in the early eighties. Bamberger, a computer science graduate from Columbia University, left Morgan Stanley in 1985 and disappeared from Wall Street around 1987. Others believe that it was Nunzio Tartaglia, a brilliant quan trader, working with a small group of researchers at Morgan Stanley in 1985 that discovered pairs trading. Putting the debate to rest, let’s just say that it was Gerry Bamberger and Nunzio Tartaglia at Morgan Stanley who discovered pairs trading in early to mid-1980s.

In the early 1980s Morgan Stanley was assembling a team of computer scientists and traders to work in an independent, ultra secretive group, which would exploit the discrepancies in the stock prices to generate abnormal profits. It would be a well-planned assault on the Efficient Market Hypothesis.
However, with the departure of David Shaw, Gerry Bamberger and many of other associates of Tartaglia, in the mid to late eighties this quant trading group at Morgan Stanley would fall apart in spirit, though traders would continue to use pairs trading on the firm’s trading floor. In 1993, the task of resuscitating the group would fall on the 29 year old Peter Muller, who would be hired by Derek Bandeen, a prop trader at Morgan Stanley. The group would be anointed with a new name, the Process Driven Trading (PDT), and Muller would recruit his own army of quants and computer programmers to work with him. Over the next decade, Muller’s PDT would make lots of money for the firm and establish Morgan Stanley as the leader in the field of Statistical Arbitrage.

Team Latte

Edson Mitchell

The Man who Once Ruled Deutsche Bank


On December 22, 2000 Mitchell died in a plane accident over the mountains of Maine in the U.S.

Mitchell was a celebrity within the investment banking community in London and New York and was a darling of the financial press.

The Silent Mafioso - II

The Man who Once Ruled Deutsche Bank

For over a hundred years Grosvenor House was one of the largest private houses on Park Lane in the posh and exclusive Mayfair district of London. Today, many luxury hotels dot the landscape of Park Lane but none is more exclusive than the Grosvenor House hotel. Since 1929 this luxury hotel has been the destination of celebrities, royals and powerful business leaders. On Thursday, December 21, 2000, Deutsche Bank held its Christmas party at the Grosvenor House hotel, an opulent affair for the 1,800 subjects who worked for the lords of high finance. That evening, some of the guests at that party were no less royal or powerful; a coterie of investment bankers who ruled the world of global finance from the City of London.

One such powerful man, a celebrity within the investment banking community in the City of London and Wall Street and a darling of the financial press, was Edson Mitchell. That evening he was there with his French mistress, Estelle. Mitchell, a happy and a successful man with the whole world at his feet, was “in a brilliant mood” according to a colleague of his who attended the party. He would tell his minions that
The Story of Edson Mitchell

Mitchell grew up in Portland, Maine and was a devoted father of five. Despite his hectic travel schedule he found time to hook up with his family in the States.

He was a swashbuckling banking executive in the City of London who was also a risk taker. His risk taking activities included exotic financial derivatives as well as the game of golf, in which despite being a novice he would place large bets.

He had a deep knowledge of financial derivatives and human behavior and was able to successfully manage both.

No matter where we begin, we find a larger than life character. And there are many Edson Mitchells, each more intriguing than the other, each vying for the reader’s attention. Here’s a life woven in a perplexing potpourri of colours and themes that deepens the enigma and baffles the mind. The same question assails the mind: who was Edson Mitchell, after all? But what emerges is not an answer but a silhouette of a figure making rounds of the trading floor, hands behind his back, pensive yet alert to the men and the financial markets around him, knowing everything yet saying nothing. Here’s a banker who’s ruthless in his pursuit of profits and power and is not afraid to challenge the establishment. Here’s a man who had a deep knowledge of financial derivatives and human behavior and knew how to successfully manage both.

Here’s the story of The Silent Mafioso. The story continues in the next issue………..

Rahul Bhattacharya
The Handbook of Exotic Options, Instruments, Analysis and Applications, Edited by Israel Nelken

This week’s book is The Handbook of Exotic Options, Instruments, Analysis and Applications, edited by Israel Nelken and first published in 1995 by Irwin Professional Publishing. This book may not be very easy to get hold off these days. There is only one review of this book on Amazon and it is quite bad. Therefore, why are we trying to review this book? For two reasons: first, there are pockets of wisdom and intuitive clarity interspersed amongst the dense mathematical formulae that populate this book. Second, there are three chapters that really stand out and content of these three chapters are hardly found in any other book that we have come across.

Remember this is a book written – or, rather edited – in 1995 before Excel spreadsheet containing CD inserted in finance textbooks became fashionable. It is also essentially a collection of research or working papers compiled as chapters and bound together in a book form.

The first chapter by Michael Ong is a very good introduction to history of exotic options and catalogs large number exotic option payoffs and is a very good introduction to the taxonomy of the exotic option families (once again, remember this was written in 1995 when many of the funky single and multi-asset exotic options had not come into existence). The payoffs of some interesting products such as the “Madonna options” and “Pyramid options” are given.

The 7th chapter on The Log Contract is the best part of the book. This is written by Anthony Neuberger, who discovered this product in the mid-1990s. As we all know today the Log Contract lies at the heart of valuation and pricing of Variance swaps and Volatility swaps and therefore an understanding of the log contract is of paramount importance to all those who want...
to understand variance swaps. However, in most quantitative finance textbooks and research papers that explain the valuation of variance swaps, the log contract is mentioned only as a mathematical concept and it is the math behind this product that is emphasized. In this chapter of the book Neuberger tries to explain the log contract as an independent derivative product and it can be priced and hedged. He tries to intuitively explain the product and its advantages over conventional financial options.

Finally, the 9th chapter on Outperformance Option by Emanuel Derman is also very good. Outperformance options, a financial derivative product, was first conceived and developed by Derman and his team at Goldman Sachs. In this chapter, he takes us through the nuances of the product and as is the case with any good practitioner, tries to build an intuitive understanding around the mathematics of the product.

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   ii. The cover image of the book The Handbook of Exotic Options is courtesy of Google images.