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1 May 2018

ALTERNATIVE BETA MATTERS

Quarterly Newsletter - Q2 2018

Introduction

Welcome to CFM's Alternative Beta Matters Quarterly Newsletter.

Within this report we recap major developments in the Alternative Industry, together with a brief overview of Equity, Fixed Income/Credit, FX and Commodity markets as well as Trading Regulations. All discussion is agnostic to particular approaches or techniques, and where alternative benchmark strategy results are presented, the exact methodology used is given.

We have also included an extended academic abstract from a paper published during the quarter, and one white paper. Our hope is that these publications, which convey our views on topics related to Alternative Beta that have arisen in our many discussions with clients, can be used as a reference for our readers, and can stimulate conversations on these topical issues.

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Quarterly review

Quantitative overview of key developments in Q1 2018

Alternative industry performance

Global markets had a sizzling start to the year (S&P 500, boosted by tax reforms in the US, was up 5.6% in January, with the MSCI World Index close on its heels at 5.2%). However, no market nor region escaped the deep sell-off experienced during the first week of February, when, as has now been well-documented, a strong 'nonfarm payrolls' report from the US (notably the surprise increase in wage growth of 2.9% YoY versus 2.6%) acted, with universal agreement, as the catalyst for the rough-and-tumble sell-off that started February 2.

Commodity trading advisors (CTAs) and the wider alternative industry performance were not left unscathed, as the majority of benchmark CTA and hedge fund indices dipped into negative territory during the month: the HFRX Global Hedge Fund Index, SG CTA Index, and BTOP50[1] indices all registered negative performance of -2.4%, -6.3%, and -5.4% respectively. Despite improved performance in March, the heavy losses in February were too great and, as a result, all finished down over the quarter: -1%, -2.8%, and -2.5% respectively. Trend followers were particularly hard hit, with most gains from January forfeited during February. The SG Trend Index[2], a commonly quoted barometer, dropped 4.1% on February 5 (its biggest one day slide since February 2007) and finished the quarter 3.9% lower.

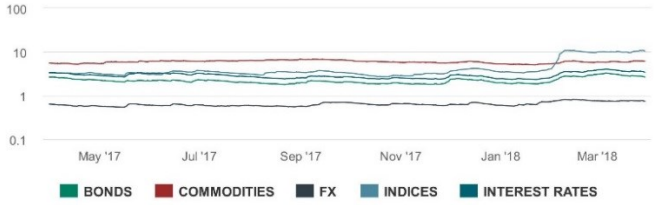
The HFRX Relative Value Arbitrage Index was the best performer within the HFR suite of indices, with a modest 0.9% gain, and, one of only a handful that showed gains over the quarter. More than three quarters of HFR indices had negative returns, with the HFRX ED Distressed Restructuring Index (down 5.7%) faring the worst.

The average absolute correlation between futures contracts, have, after a nearly 18 months downward slide, slightly picked up from the end-of-year low of 12%. The change was more acute between bonds and equities: the negative correlation between the futures of the 10-year US Bond and the S&P 500 decreased sharply in early February from approximately 35% to 25%. The correlation structure between the two contracts – with similar patterns observed in the German and UK markets – have gradually been drifting closer to zero since Q1 2015. Notwithstanding spells of noteworthy increases (Q1 and Q2 2016), the shift towards lower negative correlation seems to have accelerated.

Total return for Equity Market Neutral (EMN) and CTA hedge fund indices over the past year[3]

The principal implied volatility indices across four asset classes over the past year[4]

The log of the dollar risk weighted average daily volume across futures on the four asset classes over the past year[5]



The total return of the trender[6] defined in the text over the past year

[1] The BarclayHedge US Managed Futures Industry BTOP50 Index is an equally weighted index consisting of the largest, investable CTA programs as measured by AUM. For construction methodology and a full list of constituents, see: https://www.barclayhedge.com/research/indices/btop/

[2] The Société Générale Trend index is an equal-weighted index of the ten largest (as measured by assets under management) trend following CTAs. For construction methodology and a full list of constituents, see: https://cib.societegenerale.com/en/prime-services-indices/

[3] The EMN index is that calculated by HFR, while the CTA index is calculated by the Société Générale

[4] For the EUR/USD exchange rate we use the Bloomberg defined EURUSDV1M ticker. The VIX index is calculated and published by the CBOE

[5] We estimate effective FX volumes to be a factor of 5-10 more than this due to the extra liquidity available through the spot markets

[6] The trender used here is defined as the sign (either +1 or -1) of the difference of a 50 day exponentially weighted moving average (EWMA) and a 100 day EWMA

Equity indices

After most major indices clocked in their best performance since 2013 last year, the first quarter of 2018 proved less favourable for equities. Global markets endured a tumultuous quarter, with volatility across all asset classes reaching multi-year highs. The correction during the first weeks of February – and speculation as to the true cause – dominated news cycles as the majority of global indices suffered heavy losses. The MSCI World Index fell 4.3% in February – its worst month since January 2016. Market commentary was laser focussed on implied volatility that spiked: the CBOE VIX soared to 37 points, reaching levels not seen since August 2015. This jump, albeit from a prolonged and historically low level (the VIX averaged only 11 points during 2017) constituted the largest single one day move of the VIX – a 115.6% increase. A major casualty from the surge in volatility was a handful of Exchange Traded Products (ETPs) that provided investors with inverse exposure to the VIX, i.e. betting against higher volatility. As implied volatility soared, these instruments took on heavy losses and lead to a temporary suspension of trading in at least three listed ETPs. The value of some ETPs were almost completely wiped out, with the Credit Suisse VelocityShares Inverse VIX Short-Term ETN shuttering on February 20. (See our attached whitepaper for further insight on volatility and whether there is any evidence of volatility having entered a 'new normal').

Markets, seemingly unfazed by geopolitical uncertainty and purported high valuations, suddenly had to contend with business confidence having slumped (as measured by the CEO Economic Outlook Survey in the US), and a drop in the European Economic Sentiment Indicator[7] (sliding 1.9 points to 112.5 in March – a third consecutive pullback for the European Union as a whole).

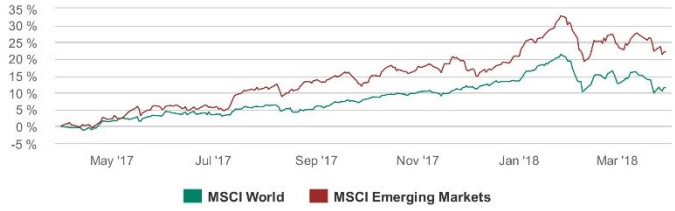
Markets, not out of the woods from the February drawdown, were once again tested by trade protectionist rhetoric coming from the White House, fretting that an escalation may impinge on the sustained rosy prospect for world trade and economic expansion. To exacerbate matters, stocks were seen slumping towards quarter-end as a deep technology sell-off in the US, led by the infamous 'FAANGs', also infected European and Asian markets (the NYSE 'FANG+ Index' witnessed its worst one-day loss since inception on March 27, falling 5.6% to round of its worst quarter in a year). The MSCI Emerging Markets Index, however, despite being dominated by technology shares (more than 25%) gained a modest, yet respectable 1.1% over the quarter. Despite all this, when applying our generic trender[6], the S&P 500 emerged as the best performing index over the quarter, albeit with very modest gains. The Australian SPI 200 showed the most negative returns with the generic trender applied, after having suffered two distinctive drawdowns (-5.3% and -2.6% returns for the weeks ending February 9 and March 23 respectively).

Many gauges for the health of the economy are however stable: the US nonfarm payrolls gained an average of 202,000 in the first quarter, keeping the unemployment rate steady at a near decade low of 4.1%. US gross domestic product (GDP) has grown consistently, and its European cousins had their fastest growth in a decade in 2017: real GDP growth in the 28-country EU region was estimated at 2.4%, with 2.4% expected in 2018.

The S&P 500 clocked the highest relative strength index[8] (RSI) on January 29 with 78 points – only days before the sell-off in February. The Eurostoxx 50 registered the lowest RSI, with 39 points on February 12 (a near tie with the FTSE, which registered its lowest RSI on the same day).

Risk adjusted liquidity surged, in near perfect unison, across all asset classes – with Equity Indices witnessing the strongest upwelling. Liquidity, jumping on February 2, continued to swell and peaked on February 9 as the S&P 500 finished off its worst week since January 2016 (down 5.2%) as investors scrambled for the exits. Liquidity stayed elevated through to quarter-end.

The return of the MSCI World and the MSCI Emerging Markets indices for the past year



CBOE VIX Index

[7] The European Commission Economic Sentiment Indicator is an aggregated value calculated from the Commission's Business and Consumer surveys. It is constructed from, and differently weighted from the industrial confidence indicator (40%), the service confidence indicator (30%), the consumer confidence indicator (20%), the construction confidence indicator (5%), and the retail trade confidence indicator (5%).

[8] Defined according to https://en.wikipedia.org/wiki/Relative_strength_index using 100 day exponentially weighted moving averages. The RSI varies between 0 and 100 with 70 implying an instrument is overbought and 30 implying the instrument is oversold

Stocks and equity factors

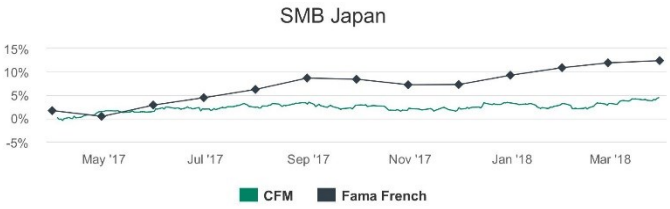
Amidst the significant market turmoil, Equity Market Neutral (EMN) strategies managed to eke out some gains. Borrowing the HFRX EH Equity Market Neutral Index as a proxy, the strategy gained 0.7% over the quarter, outperforming the broader HFRX Global Hedge Fund Index. Comparing the MSCI World Indices that employ a factor tilt (those of Momentum, Size, Quality, and Value), one had little to distinguish between their performance. Although Momentum showed decent returns (carrying forward with its strong performance of 2017), the others were largely flat, with the Value factor the worst (down 3.2% over the quarter). All indices declined in unison in February, with Momentum having the deepest drawdown – it also, nonetheless, recovered the strongest, nearly making up the losses by mid-March before the trade war spat reared its head.

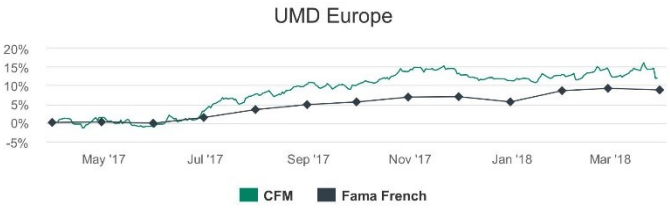
An in-house reproduction of the Fama-French-Carhardt factors showed a general outperformance by European equities, especially in the High Minus Low (HML) factor where European Value stocks gained, while US and Japanese stocks suffered significant losses.

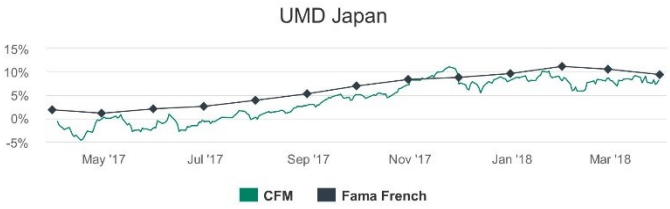
The Small Minus Big (SMB), or Size factor continued its strong showing in Europe since mid-Q4 2017, notwithstanding a reversal in mid-March. After a rollercoaster 2017 for US SMB stocks, a floor was found in February, with strong, persistent positive performance going into quarter-end. Japanese equities moved largely sideways.

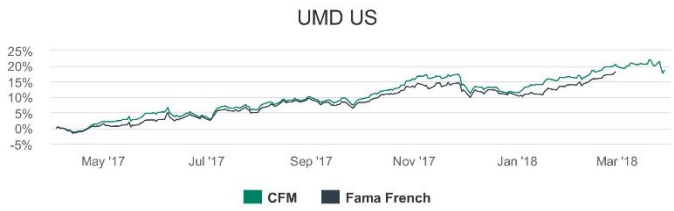
Momentum stocks struggled to find their feet, with a reproduction of our Fama-French-Carhardt Up Minus Down (UMD) factor showing neutral gains across most regions. The MSCI suite of total return Momentum indices showed the broad World index gaining a marginal 2.8% over the period, with the strongly correlated US version strong on its heels with a 2.7% return. European Momentum stocks lagged behind, with a 2.5% negative return. Similar results were seen in the UMD factor, with the US outperforming both European and Japanese markets.

The Fama-French factors for the last year in Europe, Japan and US









High Minus Low (HML) corresponds to a market neutral (MN) portfolio long the high book to price stocks and short the low book to price stocks. Small Minus Big (SMB) corresponds to a MN portfolio long the small market cap stocks and short the large market cap stocks. Up Minus Down (UMD) corresponds to a MN portfolio long the historical winners and short the historical losers. In each case, the grey line is downloaded from Kenneth French's website, while the green line is the CFM reproduction of CFM the Fama-French portfolios. The methodology can be attributed to Eugene Fama and Kenneth French and is not explicitly used in any CFM product.

Fixed income and credit

The unwinding of Central Bank quantitative easing (QE) experiments continued on divergent trajectories: the US Federal Reserve (Fed) have raised rates five times in the past 24 months, with the European Central Bank (ECB) and Bank of Japan (BoJ) yet to move rates. The Bank of England (BoE) has only had a single rate rise.

Investors also started the year unconvinced that monetary policy would tighten at breakneck pace, with only two (small probability of three) interest rate changes anticipated by the Fed in 2018. After deciding not to hike during the January 31 Federal Open Market Committee (FOMC) meeting, all eyes were on the first FOMC meeting chaired by incoming Yellen replacement, Jerome Powell, in March. The FOMC, as was commonly expected, raised the Fed funds target rate by 25 basis points to 1.75% (unanimously, 8-0). The minutes of the January meeting revealed a much more hawkish sentiment than expected, with members seeing increased economic growth (upward revisions of economic growth projections from the December 2017 meeting noting 'upside risks' owing to corporate and personal tax cuts) and an uptick in inflation. Markets have since shifted expectations to three (probability of four) rate rises this year, despite this trajectory having been tested following the February 5 stock market sell-off.

US Treasury yields rose accordingly – across the whole curve, but with the shorter dated maturities more impacted by the March rate hike, causing the yield curve to flatten slightly. The US 10-year benchmark yield rose 33 basis points to 2.74% at quarter end; with the 2-year yield surging 38 basis points to 2.27%. When applying our generic trender, we found the US 10-year that displayed a persistent, upward grind as the best performing contract in this asset class, which, along with its Canadian peer of the same tenure, represented the only contracts showing positive returns.

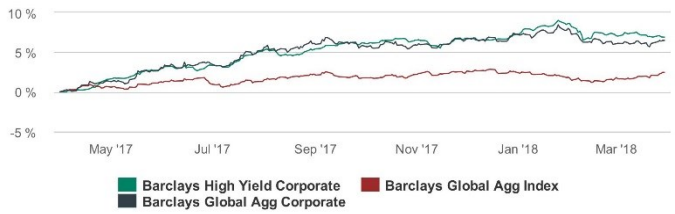
Changes were much less dramatic in Europe, where the European Central Bank (ECB) continues to grapple with perniciously low inflation consumer price index (CPI) dropped to a 12-month low of 1.1% in February; with Core CPI staying steady at 1%). Along with unemployment dropping to 8.5% in February (a 10-year low), the ECB faces mixed macroeconomic messages. With a situation of more slack in the economy likely, the ECB is expected to maintain monetary policy looser for longer. European bonds, although not severely animated by ECB policy, took strong cues from US markets. The German 10-year Bund was the worst performer with the generic trender applied, as the yield fluctuated from a low of 0.43% on January 8, to a high of 0.77% on February 2, only to fall back to 0.50% at quarter end.

Global credit markets did not escape the market chaos, but fared slightly better as the Barclays Global Aggregate Index (unhedged) returned 1.4% over the quarter (beating the 1.1% return of Q4 2017). The hedged and the Barclays Global Aggregate High Yield index versions of the same index, however, lost 12 and 25 basis points over the same period respectively.

Implied volatility was, analogous with Equity markets, amplified with the US Treasury Volatility Index (TYVIX) reaching a nine month high of 6.07 points on February 8, relaxing back to around 4 by quarter-end. Liquidity, however, saw a more modest hike as compared to equity indices. Not only were new issuances of bonds postponed, but demand at the auction of US treasury bonds on 7 February was weak – read as a clear indication that investors were mulling over their concerns of increasing inflation (and a rising budget deficit on the back of a large fiscal stimulus experiment).

While Japanese bonds attained the highest RSI for a third quarter in a row, the 58 points reached on March 26 were well below the threshold of 70 that is widely considered to be overbought territory. The US 10-year registered the lowest RSI of 34 points on February 5. In Short Term Interest Rates, the 3-month Libor reached the highest RSI, peaking at 56 points on January 8. The 3-month Eurodollar, meanwhile, recorded the lowest at 19 points on February 22.

The return of Barclays Global Aggregate Bond Indices for the last year



Commodities

Global trade worries acted as one of the main drags on Commodity performance during Q1 with the Bloomberg Commodity Index declining marginally (-0.79%), whilst the sister Bloomberg Spot Index was flat (+0.21%). The escalating US-China trade skirmish was largely to blame for the tame performance: traders, fearing lower demand for industrial metals such as Copper (a commonly used proxy for the health of the Chinese economy) sent the London Metal Exchange (LME) spot, and CME first maturity future price down 7.3% and 8.7% respectively. The benchmark contract for the world's most widely used metal, Iron ore (SGX Iron Ore 62%), dropped by a similar magnitude: 7.9% – from $71.50 to $64.41 per metric tonne.

As a consequence of a choppy quarter, overall returns for Commodities, when our generic trender is applied, declined 1.4%. Corn was the worst performer (in applying our generic trender), as the Soft Commodity was subject to large price swings: after reaching a six-month high after the US Department of Agriculture cut crop estimates for both Brazil and Argentina, strong selling pressure ensued in March as trade war rhetoric intensified. China, as the world's second largest consumer of corn, is a net importer and buys a large proportion from the US, stoking fears that the trade spat could spill over into a wider range of goods. Prices came under further pressure after good rains in the US towards quarter-end. Other soft commodities also declined, with the Bloomberg Commodity Index 'Softs' subindex dipping 10.5%. Sugar, however, was the exception amongst soft commodities (and the asset class in general) as it was the highest earner when our generic trender is applied.

Volatility in the asset class was slightly more muted than in Equites, but followed similar patterns: volatility in oil, as measured by the CBOE 'OIV' Index reached a quarter high on February 9 (30.14 points with quarter average of 23.82 points). Gold volatility (GVXX Index) followed suit, with a high of 14.81 points on the same day (quarter average of 11.68 points).

The highest RSI for the sector was recorded by Crude (66 points) on January 29 – shortly after breaking through the $70 per barrel threshold on January 15 as adherence to production curbs by Opec members continued. Commitment of Traders (CoT) data show that while steady, the total net long positions held by non-commercial traders have slightly increased. The lowest RSI was logged by Sugar on January 19 with 41 points.

The one year return of the S&P GSCI, GSCI Non-Energy, and Bloomberg Commodity Spot indices

FX

The greenback's seemingly relentless slide was not curtailed in Q1. Despite strong US economic performance (GDP expanded by an annualised rate of 2.9% in Q4 2017), and rising interest rates (Fed hiked in March and is likely to repeat in June), the currency is depreciating at the fastest pace in a decade. Consensus amongst economists points, thanks to the vast fiscal spending boost, to a sizeable increase in the US' budget deficit in 2019 (projected at 5% of GDP). This increase in the deficit makes US debt look much less attractive, putting downward pressure on the dollar. Politics are also playing a part: a visibly ramshackle White House and a rather pompous trade war are making investors, and trade partners edgy. When a report in early January suggested that China may slow or halt its purchases of US Treasuries (or even reduce its holdings), the dollar had one of its worst days in nearly eight months. China, as the largest holder of US debt (well in excess of $1 trillion), could – as was suggested from some quarters – reduce its holding of US Treasuries as a retaliatory measure against tariffs being introduced on its exports. China has made plain that this is unlikely. (The authenticity of the report was also drawn into questions, and, moreover, China would also find it difficult to diversify away from the deep and liquid US Treasury market). If China were to act, it would push up the US' borrowing costs, and put further downward pressure on the dollar.

Central banks have systematically reduced their holding of dollars, with their currency reserves denominated in US dollars at a four-year low. This, some point out, is as much to do with the ascendency of the yuan and the strong

euro as the unattractiveness of dollars. Nevertheless, the rout of the dollar, it would seem, may continue.

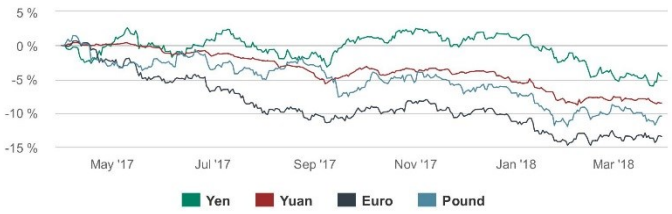
The Chinese yuan has made it a hat trick three-quarters-in-a-row as the best performing currency when we apply our generic trender. China's currency leapt to a two-year high in early January (mostly on the back of dollar weakness). It was offered another push as the German Bundesbank announced its decision to include the yuan in their currency reserves. With the People's Bank of China (PBoC) tolerating more volatility in yuan, and stating that markets will be allowed to play a bigger role in setting the exchange rate, all made for a potent mix in supporting the currency. GDP figures for Q4 released in January (6.8% against 6.7% projected consensus) underscored the health of the economy and the yuan ended the quarter 3.6% stronger against the beleaguered dollar.

The wild fluctuations in the price of the Swiss Franc from the previous quarter, going from a low of 0.98 to a high of 0.92 against the dollar, made the currency the worst performer with the generic trender applied. The dollar ended the month stronger at 0.95, with reaffirmation from the Swiss National Bank (SNB) that the franc is overvalued, which came accompanied with threats to intervene if needed.

FX implied volatility (one month at-the-money) was highest, amongst major currencies, for the pound – surging in unison with implied volatility on all other asset classes and reaching a high of 10.3 points on February 9. The yen was not far behind with 10.2, with the euro far more muted: reaching its high over the quarter on 8 February with 9.4 points. All major currencies' implied volatility relaxed towards quarter-end, hovering back at long term average levels.

Having made strong gains against the dollar, the yuan emerged with the highest RSI over the period – reaching 75 points on February 8. The Loonie, being dragged down by negative real Canada-US interest rate spreads, was one of the worst performing major currencies in Q1. It also dipped to the lowest RSI, with 40 points on March 19.

The return of one US Dollar measured in Chinese Yuan, Japanese Yen, Euros and British Pounds

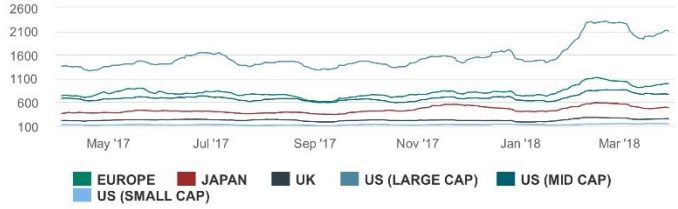


Trading news and regulation

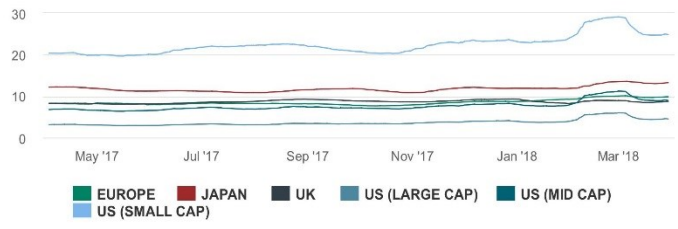
As was widely anticipated, the launch during January (albeit staggered and with certain delays) of Mifid II – Europe's ambitious regulatory overhaul – had asset managers reducing the number of brokerages they use after new rules compelled them to pay intermediaries directly for analysts' research. After an initial grace period that allowed banks and brokerages to continue to provide 'free' research, the trial period came to an end, with managers henceforth obliged to label the cost of their research – and either absorb it themselves or pass it on to their clients.

Another major element of the Mifid II regulatory package was the enactment of rules designed to funnel trading away from so-called 'dark pools' - private exchanges which became a mainstay for asset managers and institutional investors wishing to place large orders (commonly as a block). Dark pools offer the advantage for institutional investors of limiting their market impact on large orders, but, lack any transparency. After a delay in the implementation (owing to a stay of stock identification), it would seem that although the intent of shifting more trades to public exchanges was effective, it has not completely eliminated the use of dark pools. Nor has it completely solved the problem of transparency, since, in order to find a work around for volume caps in dark pools, investors increased their use of periodic auctions where orders are only made public when a specific volume threshold is reached. And, while these auctions are on a public exchange, many of the deals are pre-agreed, making them 'semi-dark'.

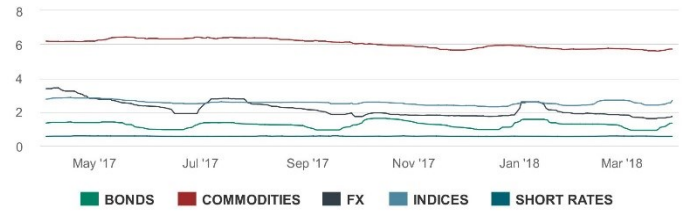
Average monthly dollar volume in billion USD



Typical bid-ask spread in six major groups of equities in basis points



Average bid-ask spread on five asset classes in basis points



Data science and machine learning

CFM, as part of our continued engagement with, and contribution to the data science community, hosted the French chapter of the global 'Pandas Documentation Sprint' in March. Pandas, a library that allows tabular data (ala Excel) to be efficiently handled in Python, which is one of the two main programming languages for data science (along with R). Fifteen CFM employees (along with a dozen from outside CFM) worked at CFM's offices in Paris to improve Pandas' documentation. With an estimated five million users, every singular improvement submitted to Pandas will contribute to a huge gain in collective productivity.

In the realm of machine learning, we continue to upskill most of our researchers through extensive hands-on machine learning programs. This enables our researchers to grow their skill set in order to tackle the current research projects where we explore the potential benefits that the latest AI techniques can bring. We are actively working on approximately 10 such projects that range from the automatic building of relevant performance indicators based on company fundamentals, to the optimisation of execution strategy (by seeing it as a game whose score is the execution cost), and through the automatic creation of indicators based on news articles with natural language processing (NLP) techniques.

We also continued to share our expertise with a talk about placement in an order book at the recent Machine Learning in Finance workshop (Paris Dauphine University), as well as by hosting multiple 'lunch and learn' events (Food for Systematic Thoughts) about machine learning and finance throughout North America for both consultants and investors.

Extended abstract

The short-term impact of trades is universal

Paper by Bence Tóth, Zoltán Eisler and Jean-Philippe Bouchaud

Trading impacts prices - this is an undisputable empirical statement. However, the interpretation of this observed impact is still debated. Is it observed because trades *forecast* future price changes that would have happened anyway, as Efficient Market theorists would argue? Or should one better think of markets as a kind of physical medium that reacts statistically to all trades, whether informed or not?

This question is key to assess the relevance of most empirical studies of impact, that are based on anonymised order flow, where all orders are *de facto* treated on an equal footing. The average impact extracted from these studies could be misleading if 'informed' and 'uninformed' trades have completely different impacts. This is especially relevant for the calibration of impact models. The standard practice is indeed to calibrate such models using public time series with anonymous orders, and deduce the average lag-dependent impact of market orders, with the hope of using this information to anticipate one's own market impact in future trading, and of timing executions accordingly.

In this study - to our knowledge the first of its kind - we aim to address this question by comparing the impact of the trades of Capital Fund Management (CFM) based on a proprietary dataset with the impact of the rest of the market. Perhaps surprisingly, we find no significant difference between the two. Our results strongly support the 'physical medium' picture of markets, that statistically reacts to all perturbations in a similar way. Interestingly, we find that the reaction is first of a 'copy-cat' type, where the initial trade is imitated by other market participants on very short time scales, while on longer time scales liquidity refill and/or trades in the opposite direction lead to impact reversion. On much longer time scales, the information motivating the trade (if any) is progressively revealed.

The conclusion of our work is that anonymous data can indeed be used to calibrate impact models, at least in a regime where orders are not outsized compared to the normal trade size.

Other news

- Jean-Philippe Bouchaud in collaboration with colleagues from the CFM-Imperial Institute of Quantitative Finance and others co-authored a book entitled 'Trades, Quotes, and Prices' which hit the shelves in March. Further details and how to order your copy can be found here: https://www.cambridge.org/core/books/trades-quotes-and-prices/029A71078EE4C41C0D5D4574211AB1B5?platform=hootsuite#fndtn-information
- CFM is honoured to be involved in the discussion on 'Rebuilding Macroeconomics' – a network of economist and academics brought together by the Economic & Social Research Council (ESRC). See details of the network and the first workshop on instability here: https://www.rebuildingmacroeconomics.ac.uk/
- CFM is delighted to have been a sponsor of the 11th Financial Risks International Forum where we presented some of our latest research: http://risk2018.institutlouisbachelier.org/?lng=EN
- See a must-read article for those interested in policy and big data published in the FT, where Philippe Jordan weighs in on the debate: https://www.ft.com/content/9f0a8838-fa25-11e7-9b32-d7d59aace167
- Agent-based economic models are rightly enjoying more attention in economic inquiry: See Jean-Philippe Bouchaud 's letter to the editor in the FT on the topic: https://www.ft.com/content/f653a4ee-2dce-11e8-a34a-7e7563b0b0f4
- The discussion on artificial intelligence in asset management is very much in vogue. See comments and our outlook for its uses and limitations here: http://www.pionline.com/article/20180416/PRINT/180419896/capabilities-key-to-firms-future-success
- February was a particularly challenging month for CTAs. See our take on how trend following performs under these circumstances in the words of Philippe Jordan in Bloomberg: https://www.bloomberg.com/news/articles/2018-03-06/trend-chasing-quants-post-worst-returns-in-17-years-in-vol-spike
- Our whitepaper in Alternative Beta Matters Q1 2018 was selected for publication in CTA Intelligence (HFM). Read it here in case you missed it: https://hfm.global/ctaintelligence/analysis/the-convexity-of-trend-following/
- A selection of our funds were shortlisted for the 2018 Investor Choice Awards: https://www.investorschoiceawards.com/london-2018.html
- Four of our funds, spread across three categories are shortlisted for the 2018 HFM European Hedge Fund Performance Awards: https://hfmeuropeanperformanceawards.awardstage.com/#Shortlist
- We are proud to be sponsoring the Data Science Summer School at École Polytechnique in June. For details and how to apply: http://www.ds3-datascience-polytechnique.fr/
- CFM will be hosting a selection of external researchers from academia and beyond at our bi-annual CFM Research Retreat in May. Remember to keep an eye on the next Alternative Beta Matters newsletter for interviews and a recap of the retreat.
- See the details of all our other upcoming events here: https://www.cfm.fr/events/
- Below is a selection of our recent papers:
  - You Are in a Drawdown. When Should You Start Worrying? https://onlinelibrary.wiley.com/doi/abs/10.1002/wilm.10646

Whitepaper

Is there a 'new normal' in Volatility Markets... Probably not!

Executive Summary

The spike in implied volatility this past February was more acute than what could typically be explained by normal market gyrations. The market correction along with the surge in volatility was more perceptible given, perhaps, the complacency that has taken hold amidst a prolonged period of historically low volatility. This got many observers very excited, in part owing to the volley of Exchange Traded Products that were specifically designed and sold to profit from a low and lowering volatility environment. These instruments subsequently faltered in dramatic fashion after the surge in volatility. Many felt compelled to opine, proposing theories such as 'volatility regime shifts' and a 'new normal' in volatility markets. We look at whether any of these ideas hold credence.

Introduction

After a sizzling start to 2018, global markets got roiled as the S&P 500 and most other equity indices suffered deep declines. The S&P 500 fell 3.9% in February, its worst monthly performance in more than two years. Market commentators were particularly tickled by the record 115.6% one day increase in the CBOE VIX – the market's de facto volatility indicator – on February 5.

Wide consensus suggests the genesis for the correction was, in all likelihood, the better than expected wage growth in the January Employment Situation Report (ESR) – more commonly known as the US nonfarm payrolls. Overshooting economists' expectations of a 2.6% increase, the 2.9% increase was seen as a harbinger of faster-than-expected inflation growth in the future, with the US Federal Reserve (Fed) perhaps likely to accelerate their monetary tightening schedule. The suggestion, as most observers have claimed, that the modest uptick in 'average hourly earnings' acted as the spark that set off the market sell-off is, in and of itself, dubious. For those who profess bottom-up fundamental analysis, a series that is notoriously seasonal and unstable should not have such a significant and profound impact on prices. This debate, however, will be left for a subsequent paper.

Traders also laid blame, owing especially to the speed of the correction, at the feet of electronic trading and obscure volatility funds. The relentless prattle on the upsurge of volatility and the rise-and-ruin of a myriad of newfangled Exchange Traded Products (ETPs) that were short the VIX was, to some extent, justified. These ETPs allowed investors to wager on the US stock market continuing to languish at the low volatility levels it has been languishing for the past two years by taking inverse bets, that is to say, shorting the two front months of the VIX future contracts (i.e. the two nearest maturing). The creation of these ETPs enabled investors of all stripes to trade volatility, itself now evolved into a unique, stand-alone asset class. Lured by eye-watering returns owing to the historically low volatility environment, the popularity of these VIX-related ETPs exploded from about 2010, with, now being easily accessible, retail investors piling in. The ETPs became evermore popular as investors kept betting on persistently tranquil markets.

After volatility spiked, however, many of these ETPs collapsed. The most widely cited of these doomed products was the 'XIV', or the somewhat cumbersomely titled 'VelocityShares Daily Inverse VIX Short-Term Exchange-Traded Note (ETN)'. The XIV nosedived from $99 on February 5, to $7.4 at close on February 6 – erasing 93% of its value. Credit Suisse, the issuer of the note, invoked an 'event acceleration', a provision enabling the issuer to board up the fund when the instrument loses more than 80% of its value from one day to the next. The XIV was duly liquidated on February 21.

The argument as to how these ETPs may have exacerbated market volatility lies in the nature of their construction: whereas futures contracts settle once, on a predetermined day, the XIV and other similar ETPs rebalanced the proportion of holdings in the first and second month future contracts on a daily basis. Since these ETPs hold short futures contracts, they had to buy more of these contracts to cover their short position when the VIX spiked, pushing up the price of these contracts, and, in turn moving a normally upward-sloping (positive) curve, into a downward sloping (negative) curve – see Figure 1. We intend to review in this note the claim that, amongst others, arcane levered volatility instruments caused the market to separate from past historical configurations. We also intend to look into a further claim that the market has been forced into a new paradigm, a 'new normal', unhinging well-known and accepted 'stylised facts' of implied and realised volatility.

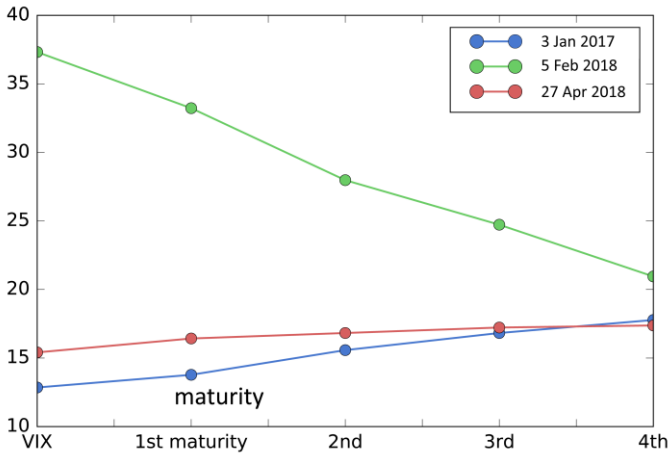


Figure 1 - During 'normal' market conditions, the term structure is upward-sloping: the VIX spot is lower than the first maturity, which in turn is lower than the next maturity and so forth. When the market undergoes periods of severe stress, the curve typically 'inverts', as happened in February and as is shown by the green line.

What is the VIX? The P&L of an option portfolio explained.

The VIX is the most commonly quoted implied volatility index and is constructed by the CBOE by:

"Aggregating the weighted prices of S&P 500 Index (SPX^{SM}) puts and calls over a wide range of strike prices. Specifically, the prices used to calculate VIX Index values are midpoints of real-time SPX option bid/ask price quotations."[9]

The VIX itself is therefore purely a measure of implied volatility and is not a physical instrument that can be held. Its constant maturity nature actually removes the premium from the P&L and the long term performance of the VIX is flat.

The physical profit and loss (P&L) from selling delta hedged options can generally be considered as arising from two terms: the P&L from the changes in the implied volatility which is noisy and flat, plus a component proportional to implied-realised volatility:

$$P\&L_{short} \sim -A\Delta\sigma_I + B(\sigma_I - \sigma_R) \sim \text{random walk} + \text{drift}$$

Equation 1

The negative sign in front of the first term accounts for the fact that the insurer (option seller)[10] loses when the event being insured against actually occurs, that being a surge in realised volatility, which, habitually occurs when equity markets fall quickly. The second term gives the premium demanded – if more people are willing to buy than sell, then the option seller stands to make more money. This expansion of the P&L is exact for a variance swap[11] which can be replicated with a basket of options. The extra complication of considering the P&L of a variance swap should not distract us from the general model of option portfolio P&Ls being a combination of noise and a risk premium (RP). This is illustrated in Figure 2 where we show the P&L for a variance swap and the P&L of the VIX.

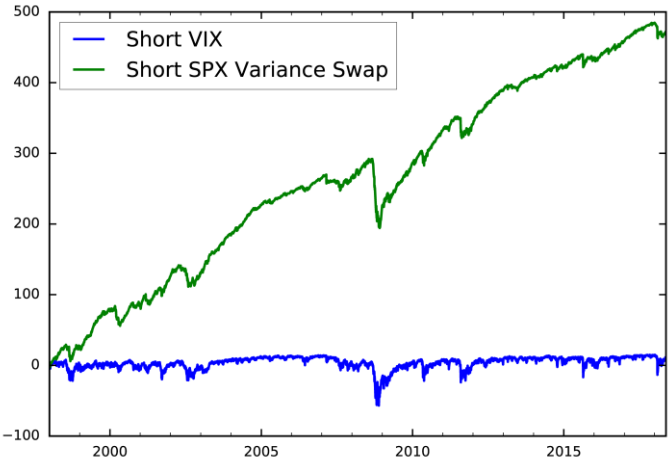


Figure 2 - Short SPX variance swaps is the cumulated P&L of being short one unit of 'vega'. Short VIX illustrates a cumulated P&L of being short VIX (i.e. assuming VIX is an investable security). The VIX P&L shows no drift, proving that first term of Eq. 1 has no drift in this case and that the source of drift is the second term, the volatility risk premium.

What is the VIX future?

The VIX future is a more recent innovation in capturing volatility premium. Futures on volatility indices payoff instead with a roll down in the volatility forward curve, similarly to interest rates. A position which is long a future on the VIX can be loosely thought of as 'long a portfolio of delta hedged one month options' which will be delivered at the expiry of the future. One can replicate such a portfolio by holding a portfolio of options that expire one month after the expiry of the future and shorting a portfolio of options that expire at the expiry of the future. Instead now the effective model is as follows:

$$P\&L_{short} \sim -A\Delta\sigma_I + B\ Rolldown \sim \text{random walk} + \text{drift}$$

Equation 2

[9] From the CBOE website: http://www.cboe.com/vix

[10] See the appendix for a more thorough explanation of how the VIX is calculated and how options are related to the insurance business.

[11] See the definition and interpretation of variance swap: https://en.wikipedia.org/wiki/Variance_swap

Again, one loses money with such a short if the VIX increases but the drift term is positive all the while the volatility curve is upward sloping. This is illustrated in Figure 3. As tension in the market increases, the forward curve tends to change shape giving a negative P&L contribution from the 'Rolldown' term above. The premium for the VIX future is a term premium, i.e. a premium received to account for the fact that volatility is stochastic and therefore can strongly increase in the future. The premium arising from holding a rolled position in VIX futures is however much weaker than that obtained from holding hedged option portfolios. The world of Exchange Trade Products (ETPs) has grown around the idea of providing a replicated VIX future, long or short.

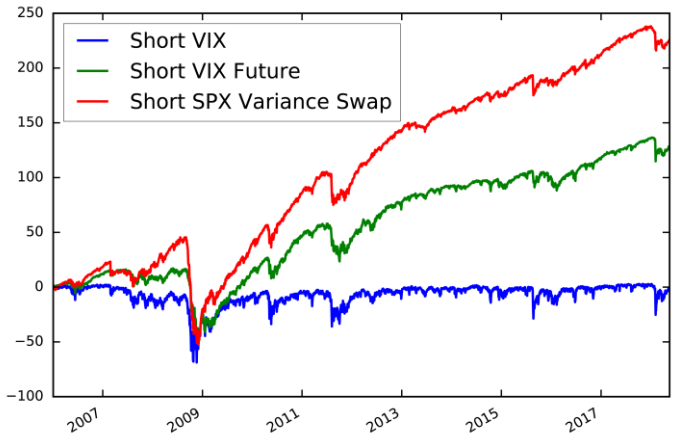


Figure 3 - A comparative illustration of volatility premia: Short VIX (zero drift) vs. Short VIX Future (positive drift due to rolldown the curve, i.e. VIX Futures in contango) vs. Short SPX Variance Swap (positive drift due to implied > realised). Note that these 3 P&Ls are obtained by investing $1 (one unit of Vega) in each strategy.

Are we witnessing a new normal in either implied or realised volatility?

Sophisticated and unsophisticated investors alike have been attracted to the short volatility trade. Access to these markets has been eased by the prevalence of ETPs that provide exposure to a short volatility play with the providers hedging their exposure through the VIX futures market. It is sensible to question whether this has changed the way implied volatility trades and behaves, and, to what extent it also feeds through to realised volatility. We look at this from three different angles to judge whether markets have changed or whether in fact the existence of a new normal simply satisfies a human desire to rationalise market dynamics with explanations based on statistically insignificant patterns.

1. Has the Risk Premium changed?

The existence of a RP, defined as the excess demanded in implied volatility relative to realised volatility, may have changed with the persistent low volatility regime of the past few years and with an excess of short volatility providers entering the market. In Panel 1 we plot the RP of volatility for S&P 500 options, along with a selection of well-known global indices. We calculate the realised (forward) volatility by taking the log returns of the S&P 500, as shown in Equation 3:

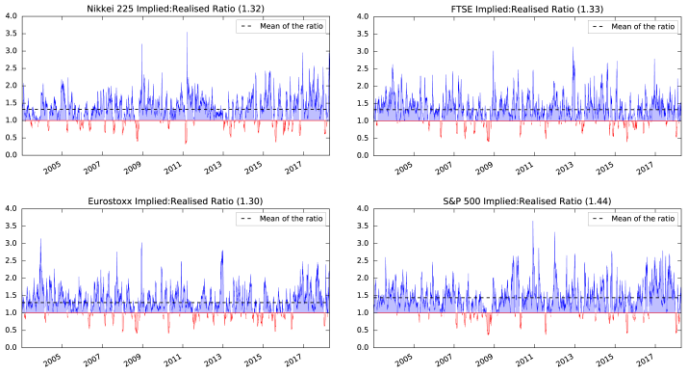
$$Realised\ Forward\ Volatility\ (t) = \left[\sum_{i=1}^{30} r^2\,(t+i)\,.\frac{365}{30}\right]^{\frac{1}{2}}.100$$

Equation 3

Where:

$$r(t) = \log\big(Index(t)\big) - \log\big(Index(t-1)\big)$$

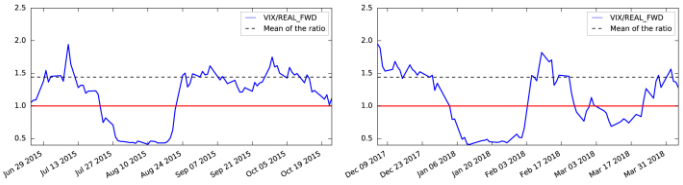
The relationship between the two measures has been exceptionally stable, and, has been characterised by implied volatility habitually exceeding realised volatility, in the case of the S&P 500, 87% of the time. This relationship holds across a diverse range of equity indices.



Panel 1 - The Implied to Realised volatility ratio of the S&P 500 and three other major global equity indices. The realised volatility is calculated as described in Equation 3, with the start date of all indices set as 2003 (The mean of each index is indicated in brackets). All of these indices display a similar, and consistent volatility risk premium, where the ratio turns sharply, and abruptly negative in times of severe financial market stress.

One observes that, despite the low volatility regime of the past few years, a persistent premium continues to be present. This demand for insurance does not seem to have changed and, even if the supply of insurance has increased, continues to pay a premium to the insurance seller.

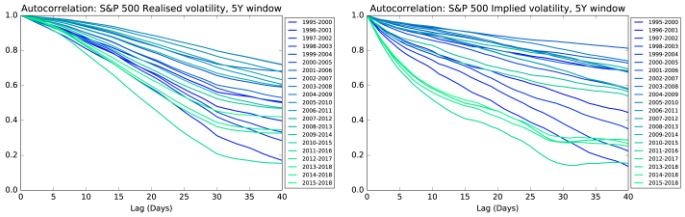
Comparing the February volatility spike with the most recent similar high market stress events, i.e. the August 2015 China crash, we see, as illustrated in Panel 2, a remarkably similar pattern of the S&P 500 implied to realised volatility ratio sinking below one, only to return to above one after the 'event' or correction to pre-spike levels.



Panel 2 - The implied to realised volatility ratio of the S&P 500 plus/minus two months from the peak of the VIX during the 2015 'China crash' (left) and plus/minus two months from the peak of the VIX during the February 2018 correction (right). One can see the evolution of the volatility risk premium (VRP) where these plots suggestively show how implied volatility (VIX) tends to exceed realised volatility of the same underlying asset during market drawdowns. This phenomenon also holds universally across option markets on other equity indices and asset classes. The VRP tends to turn negative during periods of severe market turmoil, before reverting to the long-term mean.

2. Has volatility clustering changed?

The clustering of volatility allows firms such as CFM to control P&L risk and exists in both realised and implied volatilities. This clustering simply means that if today's volatility is high/low then tomorrow's volatility will also likely be high/low. One can translate this into what is called an autocorrelation function – correlating the volatility of today with yesterday, today with the day before yesterday, today with the day before that etc.[12] An example of this autocorrelation function can be seen in Panel 3. A comment that our clients often make is that volatility does not seem to persist like it used to and that volatility spikes are much more short-lived than before. This is something that will be noticeable in measuring the correlation of volatility with itself in the form of the said autocorrelation function.

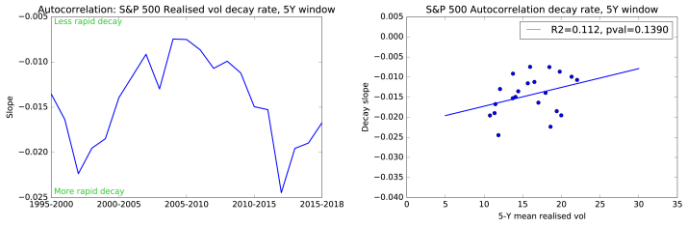


Panel 3 - The autocorrelation n function of both the realised (left) and implied (right) volatility of the S&P 500 captured in overlapping, rolling 5-year windows from 1995 to the present. The plot shows how the current autocorrelation function of implied and realised volatility does not feature a unique decay pattern, since a similar pattern was observed in the early to mid-90's.

We measure the autocorrelation function of both the realised and implied volatility with a lag up to 40 days over a rolling 5-year window. We further measure the steepness of the autocorrelation function for each of the 5-year windows. If the slope of the function is steep then volatility persists for shorter periods while a flatter function reveals longer term correlation (or clustering). As one can see in Panel 4, the slope of the autocorrelation seems to loosely correlate with the level of realised volatility, while the qualitative behaviour of implied volatility displays similar features.

We focus our attention on the short end of the autocorrelation of both implied and realised volatility, meaning we ignore observations that are separated by long periods of time. It is this part of the spectrum that is of interest and the level of noise in the measurement of correlation is reduced compared to points separated by large periods of time.

It seems that autocorrelation in low volatility periods is shorter-lived, making volatility spikes followed by a quick relaxation more likely. High volatility periods, meanwhile exhibit long lived persistent volatility. This feature is fitted in the data, in Panel 4, where we plot the slope of the autocorrelation as a function of the level of the volatility itself to reveal a weak dependence (right-hand plot).



Panel 4 - The slope of the decay of the autocorrelation function of the realised volatility of the S&P 500 from 1995 to present (left). The flatter (less negative) the slope of the autocorrelation curve (as shown in Panel 3), the slower the autocorrelation (or clustering) of volatility decays. One observes a loose relationship between the autocorrelation and the level of volatility in the right-hand plot. This implies that in high volatility environments volatility spikes persist while in low volatility environments, as has been the case in recent times, volatility spikes are shorter lived.

[12] Autocorrelation function can be expressed as $(\tau) = \frac{E[(X_t - \mu)(X_{t+\tau} - \mu)]}{\sigma^2}$, where τ is the lag (40 days in our calculation); μ the mean; and σ the standard deviation.

3. Has the VIX forward curve changed?

The various VIX future maturities allow us to study whether the forward curve has changed in its behaviour compared to a longer history. The forward curve, or term structure, illustrates the market's expectation of future volatility: an upward sloping term structure (in commodity markets the forward curve is said to be in '*contango*') indicates an expectation of *increased* volatility in the future, whereas a downward sloping term structure (in commodity markets the forward curve is said to be in '*backwardation*') indicates the opposite. The term structure is typically upward sloping, but is known to flip between upward and downward sloping as a function of volatility, while a RP is received through the upward sloping curve compensating short volatility positions for the possibility of an increase in volatility. In Figure 4 we show the slope as fitted through the first few expiries at the front of the curve as a function of time and in comparison to the level of the VIX. One clearly sees a strong correlation between the two quantities with little change in behaviour with more recent data.

When we calculate the term structure of the VIX, we observe that the forward curve is typically upward sloping, i.e. the ratio between the first and second expiring futures is greater than one, but, tend to turn negative in spells of market distress. The historical mean of the VIX term structure (that is to the say, the ratio of the front: second future contracts is ~ 1.05, i.e. an upward sloping term structure on average). This pattern repeated itself in February, akin to other well-known and extreme market sell-offs. A comparison with the most recent correction of similar magnitude – 'China's Black Monday' in August 2015 – exhibits stark similarities. In both cases the term structure transformed from contango to backwardation in the week preceding the market sell-off. However, when the markets calmed in subsequent weeks, the term structure returned to close to its long term average.

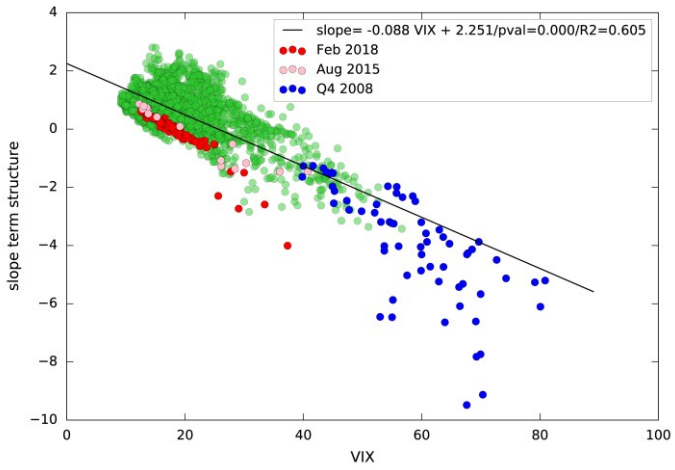


Figure 4 - A scatterplot illustrating the relationship between the slope of the term structure, whether it is positive or negative (positive sloping with maturities in the future having higher values than the spot) and the level of the VIX. The term structure exhibits, most of the time, a positive slope (as indicated by values > 0 on the y-axis) but turns negative when the level of the VIX increases. The points in blue (Q4, 2008) constitute the overwhelming majority of outliers, with the points in pink (August, 2015) and red (February, 2018) displaying similar levels (and behaviour) that are well within the perimeters of the cloud of observations.

Conclusion

Volatility markets provide an environment for investors to speculate and hedge using options and futures. These markets have become some of the most liquid in the world and are a good source of the RP in selling financial insurance. Shorting volatility is however a risky business! Even sophisticated institutional clients should be wary, but, controlled in the appropriate manner diversifying across such sources of RP seems an essential portfolio addition for institutional investors such as pension funds. Retail money, on the other hand, is less suited to such markets. The arrival of products allowing investors with modest intentions and expertise to invest (speculate) in vehicles that are in essence leveraged equity market bets, where they can lose up to 100% of the notional, will attract those looking for a fast buck and will probably end in tears.

It is difficult to deny, however, that the existence and growing popularity of these implied volatility ETPs may potentially have an effect on implied volatility and indeed the direction of equity markets (which could then affect realised volatility). It seems superficially that the persistent nature of volatility has remained relatively unchanged and indeed, anecdotally, the ability of constant volatility products to achieve and control risk would suggest that

volatility remains autocorrelated. The frequency of short-lived volatility spikes seems to be related to the level of volatility and a persistent feature of markets. The RP in short volatility has remained unchanged and, despite a recent stretch of low volatility, it seems investors still seek out insurance and push implied volatility higher than realised. The forward volatility curve as implied by VIX futures also seems relatively unchanged when comparing recent data to a longer history.

Appendix

What is an option and how is it related to insurance?

Implied volatility is calculated using the price of call and put options on an underlying equity index at an average expiration of 30 days, which serves as an estimate of how volatile the underlying (the S&P 500 in the case of the VIX) will be (how much the price may vary), based on the prices of the options on the underlying between the current date and the option's expiry date.

A call/put option is a financial derivative instrument that gives the buyer the option to buy/sell an underlying instrument at a given strike price on a given date. Options now represent some of the most liquid derivatives in the world, in particular on such ubiquitous underlying indices such as the S&P 500. Options are difficult to price – how does one put a fair value on something that might pay off in the future, or, maybe expire worthless? Fischer Black, Myron Scholes and Robert Merton solved the problem by considering the underlying price as a random walk with Gaussian returns to give the Black-Scholes-Merton (BSM) option pricing equation.[13] Though this equation offers an analytical solution to the problem it comes with many assumptions and does not necessarily provide us with an intuitive description of what happens when one buys or sells an option.

At the heart of the BSM framework is the notion of *implied volatility*. The BSM option price is dependent on the volatility of the underlying, a higher volatility increasing the probability of the option expiring in the money and therefore demanding more premium. The logic of the BSM price is commonly reversed to obtain a volatility implied by the price of the option as seen in the market. This implied volatility is commonly seen as the market estimate of risk and its level quoted in the financial press at times of stress.

In a BSM world, options are priced such that the average payoff for both seller and buyer is zero – a price which is considered *fair*. Options can finish in or out of the money for any given case, but the average over all scenarios is a zero payoff. This fair price is, in reality, not the price at which options trade. This is due to the insurance nature of the option payoff.

Options can be, and are used to hedge and are therefore similar in nature to buying an insurance contract: consider a portfolio manager who wants to hedge downside exposure for an equity portfolio prior to the Fed's Federal Open Market Committee (FOMC)[14] meeting – he can purchase put options that will pay off if the market falls or will expire out of the money if nothing happens, in which case the option premium is lost.

Implied volatility is as such characterised by a tendency to rise before scheduled and potentially significant market moving announcements (such as FOMC meetings, elections, referendums, etc.) only to drop sharply after the 'event' because of an immediate removal of uncertainty (and lower demand for options) as soon as the announcement has occurred or following the release of results. The UK's Brexit vote serves as a useful, and recent example to illustrate the point. Leading up to the referendum on June 23, 2016, the key implied volatility indices all rose above their respective 20-day moving averages reaching, in the case of the FTSE 100 volatility index (VFTSE), its highest level of the year on June 16 (32.49 points), only to fall below the historical average by July 1.

The insurance business is one with which we are all familiar. Society obliges us in many cases to take out insurance against certain events such as car accidents and house fires, but also appeals to the very risk averse nature of the human psyche. It comes as no surprise to hear that the insurance seller is in it for the money, and the insurance premium paid by the buyer is not the fair price as previously defined. In fact, as has been shown by articles written by CFM[15], the premium charged over and above the fair price is proportional to the risk assumed by the seller which is captured in the level of negative skewness of the insurance sellers' returns. In the insurance world these premia are calculated once at the inception of a contract and vary little over time. In the financial world,

[13] The formula was introduced in their 1973 paper entitled 'The Pricing of Options and Corporate Liabilities'. Their work was ultimately awarded the Nobel Memorial Prize in Economic Sciences in 1997 for shaping 'a new method to determine the value of derivatives'.

[14] The FOMC is the primary monetary policy setting body of the US Federal Reserve. They meet periodically to decide on the level of the fed funds rate – the effective interest rate of the United States.

[15] See our paper 'Risk premium investing – A tale of two tails' available on the CFM website. For a deep-dive into the topic, please refer to our academic paper entitled 'Risk premia: Asymmetric tail risks and excess returns' also available on the CFM website.

however, options are priced based on supply and demand dynamics. In such a world the premium demanded for owning an option with its inherent potential insurance like payoff depends on how many people want to buy options and how many are willing to sell them. Again, due to the risk averse nature of investors, there tends to be more demand than supply which is then reflected in a divergence between the volatility implied by the option market and that actually realised by the underlying. This difference – implied volatility versus realised volatility – is then considered a *Risk Premium* (RP). In the absence of this difference, options are priced fairly and neither the option buyer nor seller, averaged over a large range of outcomes, makes money. This difference can be considered as the profit for an option seller who can in turn be considered the insurance seller.

Disclaimers

CFM has pioneered and applied an academic and scientific approach to financial markets, creating award winning strategies and a market leading investment management firm.

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