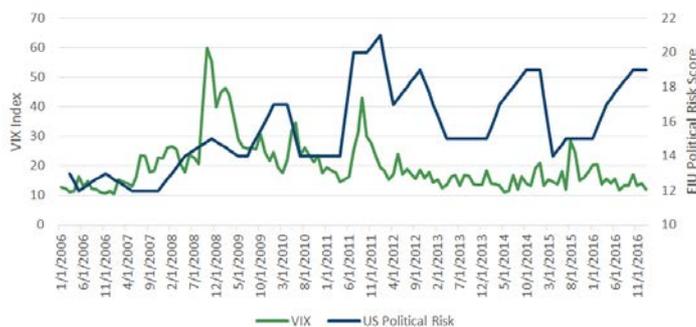


MISPRICING OF VOLATILITY IN A POST QE WORLD

Is Volatility too low and what re-pricing could mean for various asset markets

Low levels of market volatility in an environment characterised with high political and policy risk appears paradoxical. Nowhere is this more evident than in the US. As shown in Chart 1 the CBOE SPX Volatility Index is near decade lows while the EIU political risk index for the US is near decade highs. The former is commonly known as the VIX index and is a measure of market implied pricing of equity market risk across companies in the S&P 500 index. The VIX is usually considered a barometer of risk appetite not just for US equities but for assets globally. The EIU political risk index computed by the Economist Intelligence Unit attempts to quantify the degree of political uncertainty in the US.

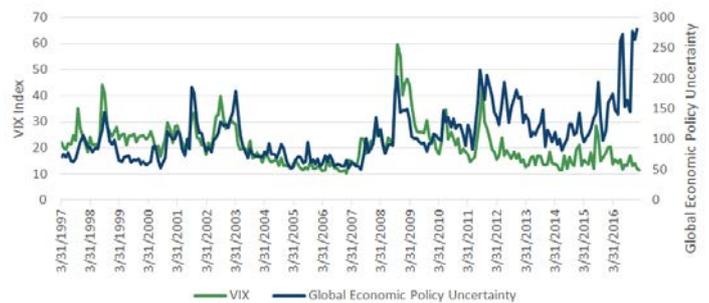
Chart 1: US Political Risk and CBOE SPX Implied Volatility Index (VIX)



Source: Bloomberg, Economist Intelligence Unit, 2017

Other quantitative indicators reveal a similar dichotomy between high levels of complacency in financial markets and a high level of uncertainty in the real world. For instance measures of realized volatility across equity markets are at all-time lows suggesting market complacency. On the other hand measures of policy uncertainty such as those published by the National Bureau of Economic Research appear to be trending towards all-time highs suggesting anxiety over the evolution of policies. These comparisons hold both within the US and globally. Chart 2 shows a comparison of the VIX and an index of global policy uncertainty.

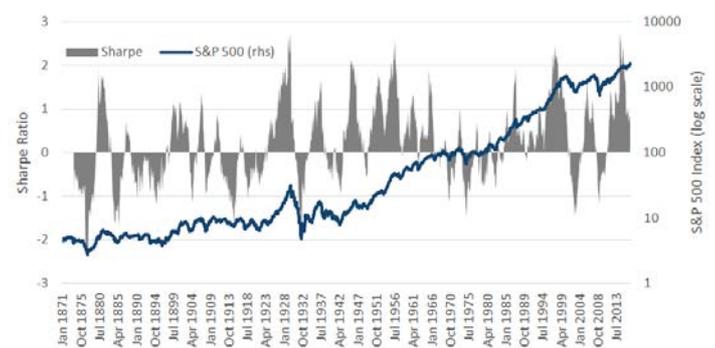
Chart 2: Global Policy Uncertainty and the VIX Index



Source: Bloomberg, Baker, Bloom & Davis, 2017

A recent article in the Financial Times titled "[Fear and Trembling in the digital age of Trump and Brexit](#)" noted that more Americans are reporting signs of stress and anxiety now than at any time over the last ten years. The article noted that this conclusion was based on recent polls of the American Psychological Association and was in itself a confirmation of similar concerns voiced by [psychologists and massage therapists in a Washington Post](#) article of a few months prior. Clearly this fear and trembling has not found its way into the US equity market. As shown in Chart 3 the S&P 500 index has recently posted some of the highest risk-adjusted returns seen at any time over the last 150 years.

Chart 3: No Fear and Trembling in the S&P 500 Index



Source: Robert Shiller, 2017

In this article we attempt to explain this paradox and the conclusions are likely profound. On the one hand, we could conclude that risk is currently mispriced in the financial markets and hence on the verge of exploding upwards to better reflect the uncertain and unknown realities of the real world. This would suggest increasing the level of defensiveness built into portfolios of global financial assets,

adding to downside risk mitigating hedges, perhaps selling equities and other risk assets and adding to safe haven asset classes such as gold and cash.

A conclusion to the contrary would be that markets are indeed pricing risk efficiently and are more cautious than suggested by low levels of implied volatility. In this case the logical course of action would be to stay the course on maintaining risk exposure across portfolios and perhaps even look to dial up exposure to assets that appear to be relatively well priced.

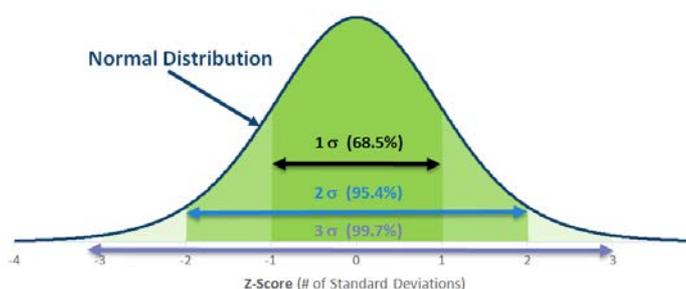
Low volatility does not mean low risk

The paradox is easily explained by noting that low volatility does not mean low risk. However, given the almost universal belief in volatility as a descriptor of risk, it is instructive to investigate from first principles why this might or might not be true.

The volatility, or standard deviation, of an asset is a statistical measure used to describe the distribution of its returns. Its historical, or realized, volatility shows what the distribution has been in the past while its forecast volatility is a prediction, usually model based, of what it might look like in the future. These are also referred to as ex-post and ex-ante volatility, respectively. It is important to note that ex ante volatility relies on the persistence of historical relationships used to arrive at the model forecast. Historically low levels of volatility do not imply that they will remain low in the future. Similarly a low ex-ante volatility forecasted by a model is no guarantee that actual future volatility will be low. Hence, when we define risk more broadly as the level of uncertainty around potential future market returns it becomes clear that low levels of volatility, historical or forecast, do not equate to low levels of risk.

The reason volatility is so embedded in financial thinking as a measure of risk follows from the observation that time series of financial asset prices typically exhibit a lognormal distribution of returns historically. This is true of stocks, bonds, currencies and other financial assets and means simply that a histogram plot of the natural logarithm of asset price returns resembles the well known bell curve shown in Chart 4. The standard deviation of this bell curve is a number that describes the width of this distribution, or the range of possible returns we would expect on the asset under a normal environment with a reasonable level of confidence. A standard deviation of 10% means that there is about a 68.5% probability that the return on the asset will be within +/- 10% of its mean or average return historically which is shown by the mid-point of the distribution.

Chart 4: Volatility, Risk and the Normal Distribution



Source: Nikko AM, 2017

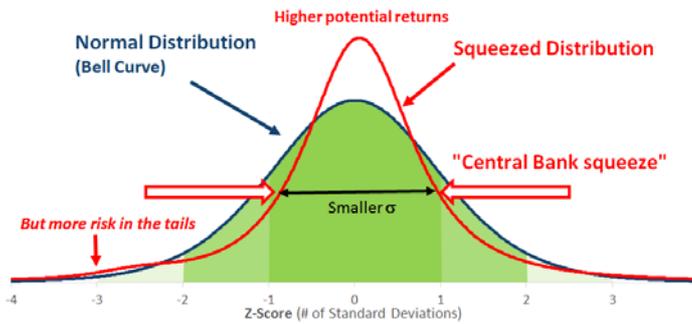
There is an increasingly small probability of achieving returns that are further away from the average. For instance there is a less than 5% probability that the returns on this asset will be more than +/- 20% from its average and less than 1% for +/- 30% from average. These probabilities appear so small and insignificant that we tend to overlook that they even exist. This focus on the centre of the distribution results in an elevation of the standard deviation to represent the set of all possibilities, not just the most likely possibilities. This is the biggest failing of relying on standard deviations and volatility as a measure of risk.

Perhaps the second biggest failing of such statistical mean-variance risk analysis is to assume that the distribution of returns follows this perfect bell shape. Moving away from schoolbook statistics and back to our Bloomberg terminals, one can't help but notice that recent returns to risk assets have been extremely good. As shown in Chart 3, equity market returns have recently been well above their long term average. Bond returns have been even more attractive relative to their own long term history. Commodities and emerging markets have had a bit of a swoon over the last few years but they too look decent over a ten year horizon. As such we can say that the distribution of asset returns appears to have been squeezed such that the peak is now higher and the width is smaller. However, the flip side is that the tails of the distribution have become longer. There is a higher probability of larger losses than that indicated by a normal distribution. Think of it as a tube of toothpaste: when it is squeezed in the middle more of it goes to the ends.

The central bank squeeze

Squeezing of the toothpaste is exactly what a decade of exceptionally easy monetary policy and free money has done to asset prices. The width of the distribution of possible return outcomes, or the volatility, narrows due to the protective put of the central bank as shown in Chart 5. At the same time, the tails of the distribution become longer. More toothpaste in the sides means the probability of very large losses increases. In such an environment, volatility is just not as good a measure of risk as commonly supposed.

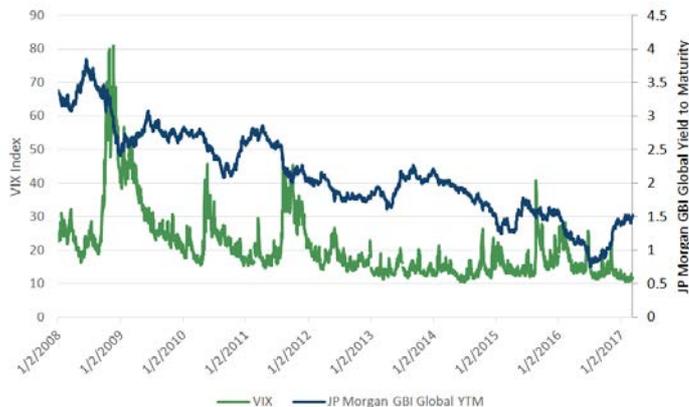
Chart 5: Volatility and Risk in a “squeezed” Normal Distribution



Source: Nikko AM, 2017

Easy monetary policies have been a primary driver, though not the only one, of the decline in bond yields globally over the last decade. As Chart 6 shows lower bond yields have also been accompanied by lower volatility. Is this coincidence or is there a causation? We believe that the cumulative effect of the central bank doctrine enshrined in the “Greenspan Put”, the “Bernanke Put”, “Helicopter Money” and Mario Draghi’s “whatever it takes” has been to instill among investors a Pavlovian response to financial market risks: each episode of higher risk is met with greater risk appetite in anticipation of further central bank action to mitigate risk. This would suggest the relationship is more of causation than coincidence.

Chart 6: Falling bond yields have dragged volatility lower



Source: Bloomberg, J.P.Morgan, 2017

Such belief in the omnipotence of Central Banks has been fading recently. This would suggest a new source of upward pressure on both yields and volatility. However, this is not a given as there are powerful forces beyond the powerful Central Banks that could keep both lower for longer.

Beyond the Central Banks: Demographics and the Volatility Risk Premium

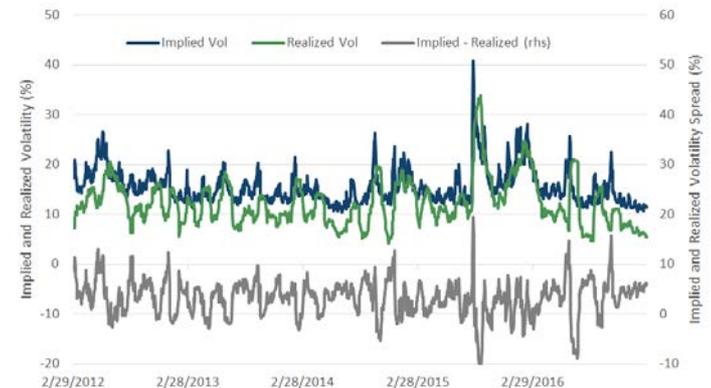
One school of thought is that bond yields could continue to remain suppressed due to the demographics of an ageing population and due to the economics of slower growth. The subsequent demand for yield would then continue to push income-seeking investors into alternative sources of yield.

Volatility selling strategies have been one such alternative source of yield and hence a primary beneficiary of the reach for yield. Chart 7 shows why. On the left hand axis is shown the

implied and realised volatility on the S&P 500 index. The bottom line is the spread between the two and is plotted on the right hand axis. The spread is usually positive and is called the “volatility risk premium.” This is the premium that a buyer of downside risk protection on the S&P 500 index, i.e. buyer of downside volatility, must pay over the subsequent realised volatility on the index.

Equivalently this is the payoff that a provider of downside risk protection can harvest. This is not unlike the model of a traditional Insurance company. Such insurers typically hedge their own exposure by taking offsetting positions with other market participants such as re-insurers. This enables them to earn a spread rather than being outright short the protection. Similarly the volatility risk premium is a risk controlled approach to harvesting the spread between implied and realised volatility. It does not entail assuming exposure to either directional movements in the S&P 500 index or to outright changes in its level of volatility. The short position built in implied volatility is offset by a long position in subsequent realised volatility most commonly by selling call and put options on the S&P 500 index and delta hedging the exposure. As long as demand for downside risk protection keeps the price of implied volatility at which the options are sold higher than the level of subsequent realised volatility investors can harvest the spread as a source of alternative yield.

Chart 7: The Volatility Risk Premium as a source of Yield



Source: Bloomberg, 2017

A similar but radically different implementation of short-volatility strategies involves being short implied volatility on an outright or unhedged basis through taking short positions in the VIX futures contracts. The VIX term structure is typically upward sloping because the cost of insuring against adverse events further out in the future is usually higher than that of insuring against events in the near term. This results in an upward sloping term structure of volatility futures contracts and hence short positions on the curve offer very attractive roll-down characteristics. A comparison of the hedged and unhedged versions of the volatility risk premium is shown in Chart 8. The overall return profile is similar but being naked short-volatility has earned significantly larger returns.

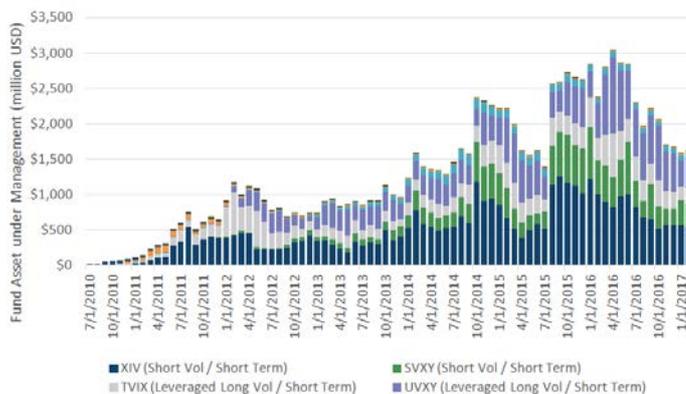
Chart 8: Unhedged Short Vol ETFs vs. Hedged Volatility Risk Premium



Source: Bloomberg, Goldman Sachs, 2017

Indeed, the strong performance of such naked short strategies combined with a proliferation of easy to invest Exchange Traded Funds (ETFs) passively tracking them has led to an exponential growth in total short-volatility exposure in the market. Chart 9 shows the growth across some of the more commonly traded short volatility ETFs. This steady inflow into short-volatility ETFs could be one factor behind the depressed levels of implied volatility in the past. Conversely, asset outflows from these strategies could also be a significant driver of higher volatility in the future.

Chart 9: Exponential growth in Volatility selling strategies



Source: Bloomberg 2017

The total amount of exposure in short-volatility strategies is likely to be a multiple of that shown in Chart 9 because significant volumes are also transacted over the counter between institutional investors and investment banks directly.

A broader perspective on the amount of short-volatility exposure can also be drawn from the exponential growth in hedge fund and multi-asset funds.

Both of these are also implicitly short volatility. Chart 10 shows rolling 3 year correlations between returns on the HFRX Aggregate Index, a commonly used benchmark of Hedge Fund performance, and the S&P 500 VIX Short Term Futures Inverse index, a performance benchmark of short-VIX strategy. This correlation has been high and has increased further recently. This could suggest perhaps that the trillions of dollars invested in hedge funds reflects a very large short-volatility exposure outstanding and asset growth across these market segments has been responsible too for keeping a lid on market volatility.

Chart 10: Correlation between Hedge Funds and Short-Volatility

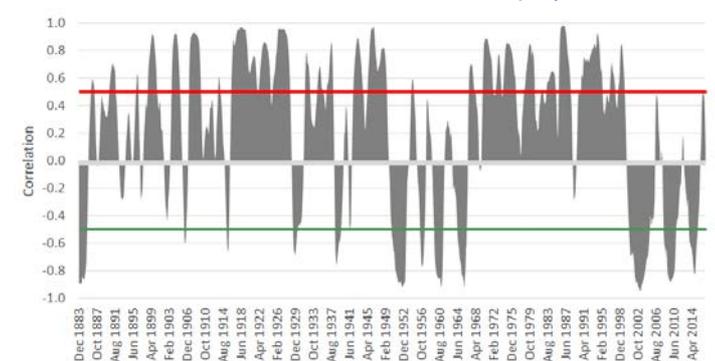


Source: Bloomberg, Hedge Fund Research, Nikko AM, 2017

It is true that asset growth in the hedge fund industry has stalled in the last few years. However, growth in risk parity, risk control and other multi-asset strategies may have more than compensated for this.

In Chart 11 we plot the rolling correlation between bond and equity yields in the US over more than 150 years. A negative number, as seen over the last decade and a half, indicates that bond and equity prices have been in general moving in opposite directions to each other. Most multi-asset strategies, and leveraged risk parity in particular, rely on a risk balanced allocation to bonds and equities to achieve their investment objective. This risk balance assumes that the negative correlation between bonds and equities will persist. Multi-asset strategies that target a specific level of volatility increase their leverage and risk exposure when volatility falls, and decrease it when volatility rises. Taken together, this results in multi-asset strategies being effectively short correlation and short volatility. Hence, the growth of assets under management in these strategies serves as yet another source of volatility compression.

Chart 11: Multi-Asset Funds are short Bond-equity correlation



Source: Robert Shiller, Nikko AM, 2017

As also shown in Chart 10, however, this negative bond-equity correlation has not been typical of market environments prior to the last couple of decades. In the past, whether it be the late 1800's or the first half of this century or the stagflation decades of the 1970's and 1980's, the norm was for bonds and equities to rise and fall together. As we have written previously we think the risk is that this correlation will begin to revert as further signs of inflation become evident. Bonds are not priced

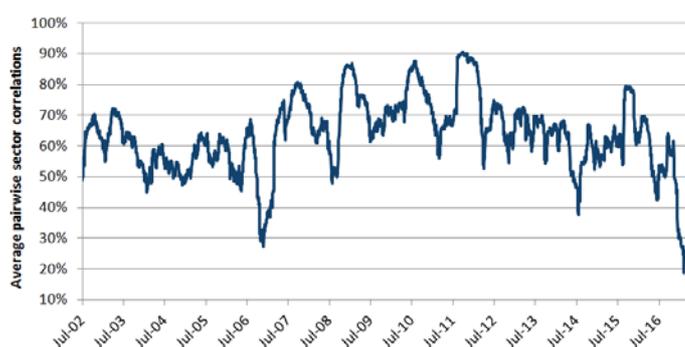
for any inflation at all currently. If bonds do re-price upward, equity yields will struggle to find support at current low levels of yields historically.

What we have described above are some market dynamics that very likely played an important role in systematically depressing volatility over the recent past. Risk control multi-asset strategies are just one of many such suppliers of short-volatility exposure but are more benign when compared with the naïve portfolio insurance strategies of the 1980's. The portfolio insurance strategies as then implemented followed systematic sell programs to reduce risk exposure and raise cash in falling markets. They are notoriously credited for perpetuating a vicious downward spiral of falling markets, rising volatility and further forced selling on Black Monday, October 19, 1987 when US equities lost a fifth of their value in one day. Those programs did seriously destabilise markets. The present day iteration of risk-control strategies are both more robust, and less market disruptive, because they usually incorporate a forward looking risk mitigation mechanism that reduces exposure and leverage on signs of increasing market stress hopefully ahead of such events actually happening. The risk mitigation discipline of these strategies can, however, be further improved on a keener appreciation of the role that volatility fails to play in the measurement of risk.

Transient factors: The correlation collapse

Trump's surprise electoral win has upended the status quo not just in politics but also across the relative economic prospects of companies and sectors in the US and internationally. This has caused investors to sell some of the likely losers such as pharmaceuticals and healthcare companies and buy others deemed to be likely winners such as Energy and Financials. Hence, while the market has moved up strongly since the election, the correlation of stocks and sectors has fallen to decade lows as shown in Chart 12.

Chart 12: Falling sector correlations drag volatility lower

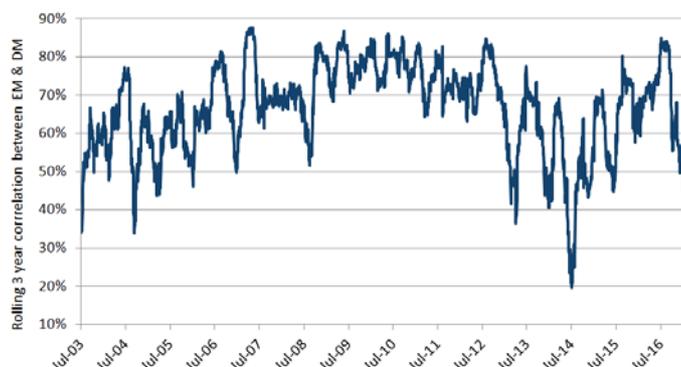


Source: Bloomberg, Nikko AM, 2017

The reduction in correlations at the bottom-up security level depresses market level volatility as a whole since movements up or down in one group of securities cancel out movements in the other direction in another groups of securities. This dampening effect in volatility from lower correlations is likely to be more transient than some of the structural effects discussed earlier. However, for now, the strong downward effect of falling correlations on volatility is evident globally, not just in the US, as shown by the correlation breakdown

between Emerging market and Developed market equities in Chart 13.

Chart 13: Falling DM/EM equity correlations drag volatility lower



Source: Bloomberg, Nikko AM, 2017

So volatility is low, but is risk high?

We think so, and for three reasons:

First, risk has not fallen in line with the lower levels of volatility seen in the markets recently but merely taken on a different form. As illustrated by our toothpaste analogy it has transferred from the middle of the distribution of possible outcomes to its wings. Instead of being lower it might actually be higher as tail risk is both more unpredictable and more sinister.

Second, we think volatility may be due a rebound from exceptionally low levels even if it remains in a secular downtrend. The very low levels of volatility currently may reflect the effect of transient factors that will likely wash out soon.

Third and last, volatility may not be as useful a measure of risk as it once was due to the changing nature of markets and market participants. Two measures related to volatility that are far more representative of the actual risk aversion in the market are the volatility skew and volatility term structure. Each of these measures is currently indicating a higher level of risk aversion than that seen from the level of VIX alone.

The volatility skew of the VIX is the difference in implied volatility between out of the money put and call options on the S&P 500 index. A high value indicates a high demand for buying downside risk protection on equity market declines. Investor risk aversion is visible from the high levels of VIX skew as shown in Chart 14.

Chart 14: VIX Skew on 25 delta Put and Call options



Source: Bloomberg, 2017

The term structure of futures contracts on the VIX index provides an insight into the expectations of traders on the future levels of the VIX. If the market expects VIX to rise the term structure is upward sloping, or “in contango.” This means the value of VIX futures expiring in say 3 months would be higher than the value of VIX today, or the spot level. Similarly the value of VIX 6 months out would be higher than 3 months and so on. Conversely, expectations of lower levels of implied volatility in the future would typically be reflected in a flat or downward sloping term structure. The steepness in the VIX term structure is at decade highs today as shown in Chart 15.

Chart 15: 3M Implied Volatility Term Structure



Source: Bloomberg, Nikko AM, 2017

Conclusion

The paradox in the apparently benign levels of financial market risk pricing amidst high political and economic uncertainty can be attributed to the changing nature of financial market risks. Risk has moved from the centre of the distribution of possible outcomes to its tails. This is not least due to excessively accommodative monetary policies of Central Banks over the last ten years which have dragged both bond yields and volatility lower.

Moreover, commonly used measures of financial market risk such as the realised equity market volatility or the volatility implied by the equity index options market (the VIX) convey only an incomplete picture of true market risk aversion. Measures such as the skew and term structure of VIX currently suggest a higher level of risk aversion in financial markets currently that is more consistent with the high levels of risk indicated by political risk and economic uncertainty indices.

However, it would be reasonable to expect at least some uptick in volatility (both realised and implied) as the recent collapse in cross-asset correlations proves to be transient and bond yields start to return to more market driven levels.

In conclusion, the low levels of market volatility today are perhaps less of a paradox and more an opportunity. The opportunity is multi-faceted and includes the ability to build in exposure to an inexpensive asset class, exploit market mispricing to earn a scarce source of alternative yield and to build more robustness in multi-asset portfolios through incorporation of a long volatility and long convexity risk profile.

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