Morgan Stanley

INVESTMENT MANAGEMENT

A Tale of Risk

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Managing risk is at the heart of investing, and an important component of risk management requires analysing the expected outcomes of economic events. In fact, much of financial theory depends on estimating the probability of outcomes. We devote considerable time to continually assessing potential risks, assigning probabilities to various potential outcomes and estimating how they will affect asset prices. But there is no crystal ball.

Frank Knight's prescient 1921 book *Risk, Uncertainty, and Profit* is remarkably relevant to today's market. Mr. Knight outlines distinct differences between "risk" and "uncertainty." He posits that economic events should be placed on a spectrum between the two: events with outcomes that have known probabilities would be on the 'risk' side of the spectrum and those where probabilities are unknown are on the 'uncertain' side *(Display 1)*.

DISPLAY 1
Spectrum of uncertainty

Concept based on Frank Knight's book: Risk, Uncertainty and Profit, 1921.

Knowns and unknowns

The mere phrase "known probabilities" might raise some eyebrows. Probabilities are never known with 100% certainty, but they can often be estimated quite well. For example, professional investment managers have become adept at predicting the direction and magnitude of interest rate movements, basing their probability of outcomes on input from Federal Reserve meeting minutes, economic factors and investment experience. Events with known probabilities fall on the risk side of Knight's framework—and the majority of events that investors must deal with are risk events.

It is the uncertain side of the framework that is trickier to manage. The first thing that ceases to exist with uncertain events is the expected value of outcomes. This is because the expected value of an outcome is defined by the probability weighted sum of potential outcomes (which have numerical values). If probabilities cannot be assigned then the expected value of the outcome does not exist. This means that any pricing techniques which are based on risk-adjusted expected values cease to exist and cannot be used to set prices.

While there are fewer uncertain events than risk events, the tail risks[1] of uncertain events can result in dramatic outcomes with serious consequences for investors. Over the last two years, investors have faced an unusually high number of binary events for which it is difficult to develop reliable probability estimates for the possible outcomes: the election of President Donald Trump, the U.S.-China trade tensions, the U.S.-Europe trade tensions, the Mueller investigation results, the tensions in Venezuela and even oil sanctions on Iran. Some of these events have already passed. For others, the outcomes are still pending.

Yet markets don't close in the face of uncertainty or just because one cannot estimate probability. Assets continue to be priced even though investors struggle to reasonably estimate probabilities of outcomes and resulting valuations. What's an investor to do? We examine some recent and upcoming uncertain events, with some possible solutions.

Three recent uncertain events

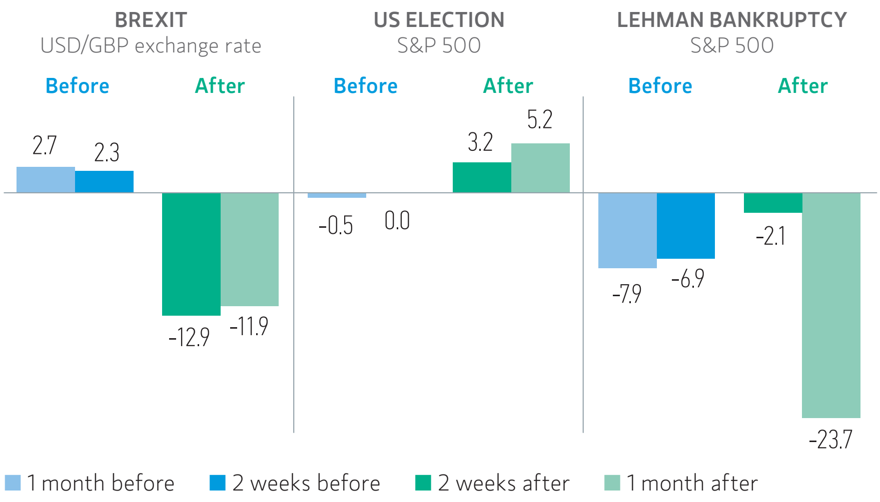
The following three scenarios support the notion that when outcomes are very uncertain (Brexit or US elections), one should position for the worst outcomes using options.

- **INITIAL BREXIT VOTE:** The USD/GBP currency market failed to price in the probability of a "Leave" vote adequately, but the implied volatility on the currency pair peaked in the two weeks before the vote and thereafter remained elevated. In this case option markets priced in the risk of a bad outcome arguably before and better than the spot market *(Display 2)*.

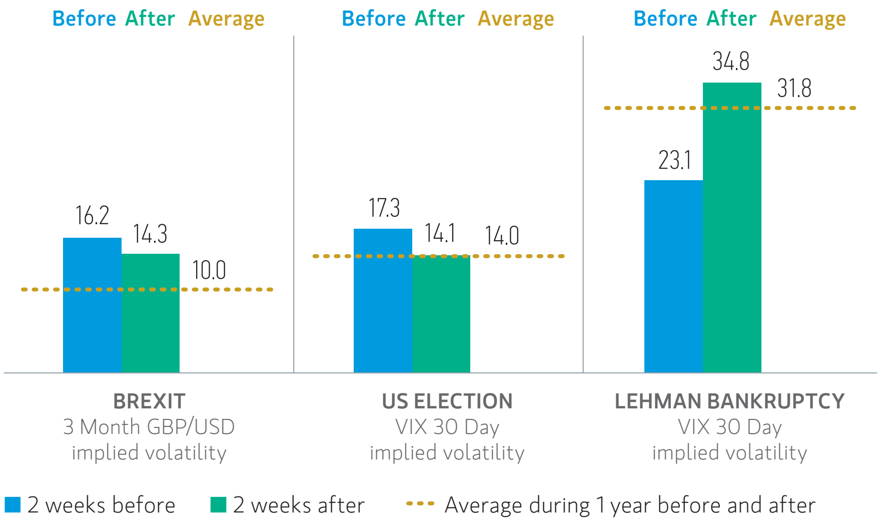
DISPLAY 2

Pricing Assets Is Tough for Uncertain Events

Returns before and after uncertain events (%)



Implied volatility before and after uncertain events

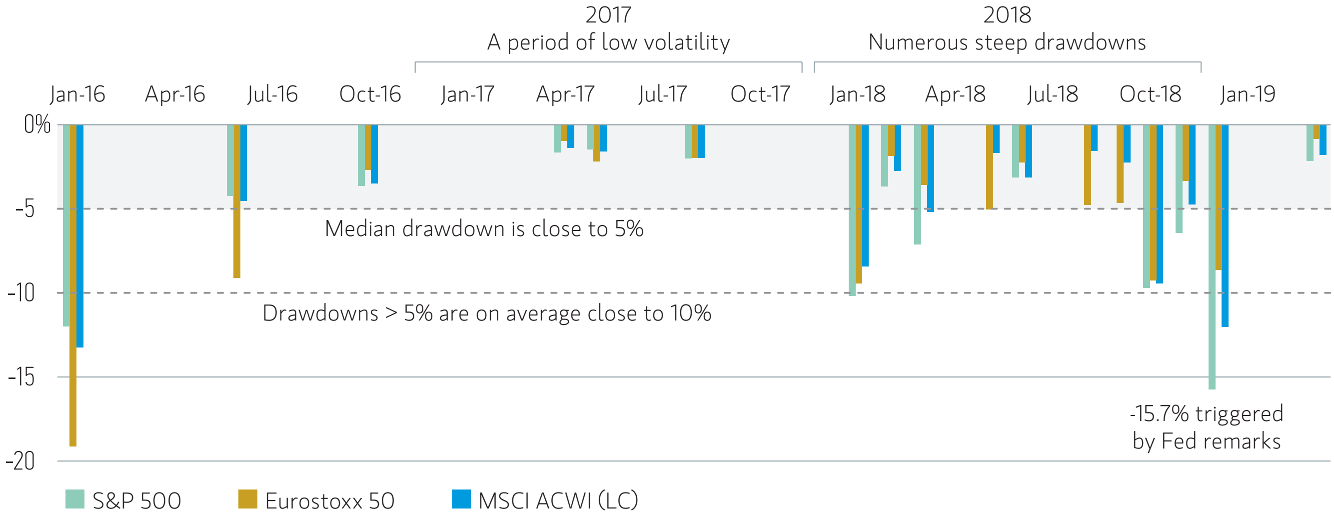


Source: Datastream. The dates from which each of the events are measured are as follows: Brexit vote – 23 June 2016; 2016 U.S. election – 8 November 2016; Lehman's bankruptcy – 15 September 2008.

[1] Tail risk refers to the relatively small probability that an extreme outcome will occur.

DISPLAY 3

Median drawdown > 5% very close to the 10% threshold for a technical "correction"



Source: Datastream. Summary of drawdowns between 2016-2018. **Past performance is no guarantee of future results.** See disclosure section for index definitions

- **2016 U.S. PRESIDENTIAL ELECTIONS:** Implied volatility[2] again rose before the vote, pricing in more uncertainty than the S&P 500, but this time the unexpected outcome caused a positive price move *(Display 2)*.

- **LEHMAN BANKRUPTCY:** The collapse of Lehman Brothers was the seminal event of the 2008 financial crisis and the largest bankruptcy in history. Yet, two weeks following the event the S&P 500 was down only 2%. In contrast, the CBOE Volatility Index (VIX) was elevated before the bankruptcy and skyrocketed to 35% in the two weeks following it *(Display 2)*.

Three looming uncertainties

Looking ahead, we see three uncertain events on the horizon:

- **A CHINA/U.S. TRADE DEAL:** While it is almost impossible to come up with a reliable probability of the China trade deal failing, the risk is not negligible. Markets are pricing in a successful deal, so if it were to fail we could see a significant sell-off of assets (possibly in the range of 5% to 10%).

- **EUROPEAN AUTOMOBILE TARIFFS:** President Trump's threatened, but unpredictable tariffs on European automobiles would be very negative for the markets, particularly in Europe.

- **VENEZUELA TENSIONS:** Venezuela is still producing about a million barrels of oil a day and any military intervention would likely trigger a disruptive spike in oil prices. Furthermore, Russia has troops in Venezuela and China has billions of dollars invested there, so a U.S.-led invasion could trigger a great power confrontation, with global consequences.

We believe that reducing downside participation in the face of uncertain events with significant tail risk is generally warranted. Given the unusually high number of uncertain events investors are faced with today, we examine some possible courses of action.

Game theory

There are situations where you have to make decisions and reliable probabilities don't exist. Decisions in chess, for example, are not driven by probability analysis, but rather by looking at the opponent's most potentially damaging move and then working to minimise the worst-case outcome. In game theory, this is called a 'minimax' rule—minimising the maximum loss.

While there are times when game theory is appropriately applied to investing, during high-risk low-probability scenarios, applying a minimax rule would lead investors to an all-cash position. Often political in nature, such scenarios can unfold during periods of strong economic growth and rising markets. Therefore, in their quest to minimise losses, investors applying a minimax rule could frequently miss out on significant market rallies.

[2] Implied volatility is the volatility that the market is forecasting for a security and is used in option pricing.

DISPLAY 4

Implied volatility drives options prices

Source: Bloomberg. As of 2 April 2019. **Past performance is no guarantee of future results.** See disclosures for index definitions.

Options: A better approach for investors

A more pragmatic approach to protect a portfolio in the face of events with extreme outcomes and uncertainty is to buy options. A commonly employed strategy is to buy put options which conceptually, is similar to taking out a short-term insurance policy for a portfolio: Downside risk is mitigated, but the potential to capture upside market moves is retained. Equally, to participate in a rising market, but with some downside protection, where permitted we also use call options in our portfolios.

Last year, 2018, is instructive. After an unusually calm environment in 2017, in 2018 markets saw a return to a more normal volatility environment. Consequently, the global equity markets, including the S&P 500, suffered several periods of steep losses in 2018. The year ended with a -15.7% drawdown in the final quarter, triggered by Federal Reserve's comments about quantitative tightening *(Display 3)*.

Assessing the magnitude of historical drawdowns can help us gauge how and when to use options to help protect portfolios against these worst-case outcomes. An assessment of volatility over the past 3 years indicates that the magnitude of the median drawdown in major developed markets is around 4%. The median drawdown for pullbacks greater than 5% (i.e. more indicative of tail events) effectively doubles to around 9% (very close to the 10% threshold for a technical "correction") *(Display 3)*.

This implies that the use of options makes sense particularly when binary outcomes could trigger a drawdown similar in magnitude to a correction.

The price of protection

When permitted by clients, we use options in portfolios sparingly because they require paying a premium. Option prices depend, amongst other factors, on volatility—the higher the volatility, the more expensive the option.

Following the spike in volatility in December 2018, implied volatility has fallen back to subdued levels *(Display 4)*. This backdrop combined with a relatively high number of binary risks (i.e. US trade relations with China, European auto tariffs and tensions in Venezuela) has made using options to protect the portfolio against extreme outcomes an attractive alternative.

The options allow us to keep our portfolios positioned to benefit from the improving global economy while providing downside protection against a potential negative surprise. Indeed, positioning portfolios too conservatively at this juncture could pose the risk of missing out on economic growth and market rallies. Our recent commentary, *On the Road Again*, details how fiscal stimulus programmes could play a key supportive role igniting global economic growth.

Managing uncertainty—and investing happily ever after

Our tale of risk concludes with an understanding that the vast majority of risks that we analyse are what Mr. Knight would call 'risks' that lend themselves to probability analysis, not 'uncertainties.' We believe we can effectively manage these risks by adjusting our portfolios' allocations.

However, there are instances where the outcomes of major events are uncertain and managing risk becomes more complicated. In such cases—and in particular when implied volatilities are low—buying options allows us to participate in market upside while reducing the risk arising from a worst-case scenario.

Risk Considerations

There is no assurance that the strategy will achieve its investment objective. Portfolios are subject to market risk, which is the possibility that the market values of securities owned by the portfolio will decline and that the value of portfolio shares may therefore be less than what you paid for them. Accordingly, you can lose money investing in this portfolio. Please be aware that this strategy may be subject to certain additional risks. There is the risk that the Adviser's **asset allocation methodology and assumptions** regarding the Underlying Portfolios may be incorrect in light of actual market conditions and the portfolio may not achieve its investment objective. Share prices also tend to be volatile and there is a significant possibility of loss. The portfolio's investments in **commodity-linked** notes involve substantial risks, including risk of loss of a significant portion of their principal value. In addition to commodity risk, they may be subject to additional special risks, such as risk of loss of interest and principal, lack of secondary market and risk of greater volatility, that do not affect traditional equity and debt securities. **Currency fluctuations** could erase investment gains or add to investment losses. **Fixed-income securities** are subject to the ability of an issuer to make timely principal and interest payments (credit risk), changes in interest rates (interest-rate risk), the creditworthiness of the issuer and general market liquidity (market risk). In a rising interest-rate environment, bond prices may fall. In general, **equities securities'** values also fluctuate in response to activities specific to a company. Investments in **foreign markets** entail special risks such as currency, political, economic, and market risks. **Stocks of small-capitalisation companies** carry special risks, such as limited product lines, markets and financial resources, and greater market volatility than securities of larger, more established companies. The risks of investing in **emerging market countries** are greater than risks associated with investments in foreign developed markets. **Exchange traded funds (ETFs) shares** have many of the same risks as direct investments in common stocks or bonds and their market value will fluctuate as the value of the underlying index does. By investing in exchange traded funds ETFs and other Investment Funds, the portfolio absorbs both its own expenses and those of the ETFs and **Investment Funds** it invests in. Supply and demand for ETFs and Investment Funds may not be correlated to that of the underlying securities. **Derivative instruments** can be illiquid, may disproportionately increase losses and may have a potentially large negative impact on the portfolio's performance. The use of **leverage** may increase volatility in the Portfolio. **Diversification** does not protect you against a loss in a particular market; however, it allows you to spread that risk across various asset classes.

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