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1. Isolating Market Risk (beta blockers)

What is it that differentiates Morpho Advisory (“Morpho”) from any other investment manager or hedge fund touting its services? **We have developed a systematic methodology to identify periods of Market Risk** in advance of them occurring. Conversely, this also means we also know when it is more favourable to increase exposure to *Market Risk*.

The implications of this will not be lost on investment professionals who are only too aware that *beta* is the single most important factor in determining investment returns. To consistently be in the right *beta* at the right time has long been the ‘Grail Quest’ of the investing industry. However, from Morpho’s perspective, it’s not just the increase in long-term returns that our unique process delivers but the corresponding improvement in risk metrics that makes our methodology superior - especially the reduction in the size

*Beta is the single most important factor in determining investment returns*

and duration of *drawdowns*. To be entrusted with the management of other people’s money is a responsibility we take seriously. Our strategy reduces the level of impairment (temporary or otherwise) that investor’s suffer through *drawdowns* in the value of their capital - at any point that it is under our management. This risk is central to our investment strategy.

*Our strategy reduces the level of impairment (temporary or otherwise) that investor’s suffer through drawdowns*

Observant readers will have noted that our approach to investing (i.e. positioning based on *Market Risk*) is high-level. This is yet another feature that sets us apart from the ‘specialist’ asset manager crowd such as hedge

funds, who typically focus on *factors* or a single *asset class* at the microscopic level with individual security selection based on quantitative or thematic drivers being their primary means of targeted value-add. By comparison, Morpho’s strategy systematically performs the function of the CIO or Investment Committee at an *Asset Allocation* level.

So, how has Morpho been able to do what many in the industry have desired but few achieved? By embracing complexity. We have viewed markets as a complex system rather than following the siloed (by sector, asset class, country etc), linear thinking and flawed standard industry practices. Observing markets as a *Complex Adaptive System* has enabled us to build upon 30 years of experience and key insights to understand market *morphology* (i.e. its shape and structure) at a macro level. At the highest level, market morphology represents the attitude of market participants toward Risk - and that attitude is contagious. Irrespective of *asset class*, *risk assets* move in unison (albeit to varying degrees) based on the collective perception of *Market Risk* as illustrated in Figure 1.1.

*Fig. 1.1 illustrates the comparative market price movements of (a) developed market equities; (b) emerging market equities; (c) high yield credit; (d) industrial metals & the mining sector; and (e) crude oil. The yellow boxes highlight periods when Morpho’s proprietary risk signal indicated (in advance) periods of elevated Market Risk.*



*At the highest level, market morphology represents the attitude of market participants toward Risk – and that attitude is contagious*

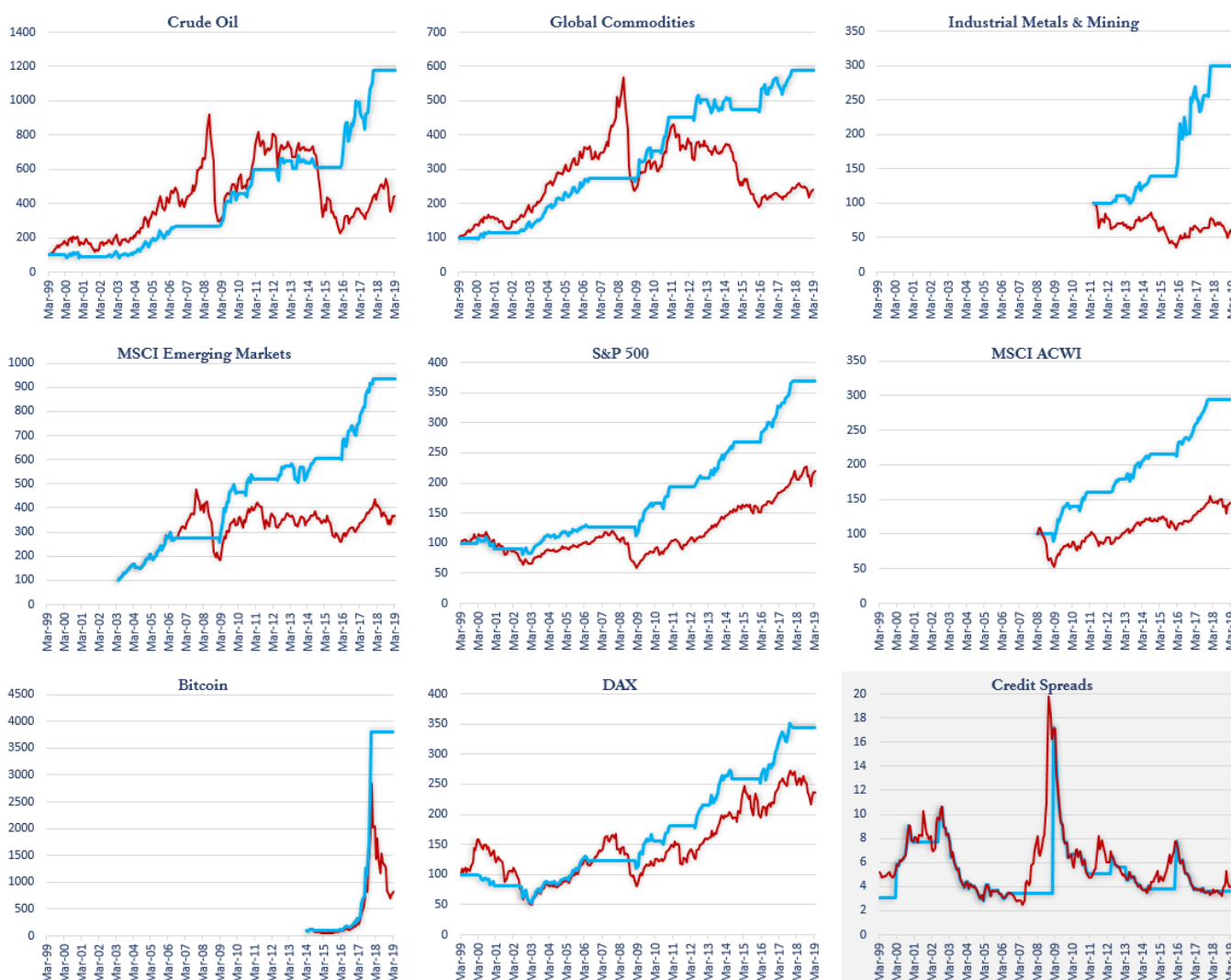
The ability to isolate *Market Risk* opens up a world of investing possibilities. Not only does it enable defensive positioning to protect against downside price movements, it also empowers investors to have confidence and invest at the riskier end of the asset spectrum.

These two sides of the same coin result in a consistent ‘stepped’ return profile when applied to *risk assets*. That is, the return

profile moves progressively upwards apart from periodic plateaus, forming a profile that looks like stairs (also known as “punctuated equilibrium”). This asymmetry in *Market Risk* can be evidenced by comparing various markets, sectors and assets with and without Morpho’s strategy applied. See Figure 1.2.

Fig. 1.2 illustrates various risky markets, sectors and assets with and without Morpho’s market risk identifying strategy applied. The red lines are those markets, sectors or assets without Morpho’s strategy while the blue lines are the markets, sectors or assets with Morpho’s strategy applied. The efficacy of Morpho’s strategy is further evidenced in that, for the 20 year period shown, Morpho was only invested in these risk assets 52% of the time and the blue lines do not reflect any income from defensive ‘risk free’ investments during the other 48% of the time.

The final shaded chart differs from the others in that it does not reflect a hypothetical investment. Rather, it demonstrates the ability of the Morpho strategy to identify marginally optimal periods for fixed income issuers and investors to fund their balance sheet and position their portfolio, respectively.



## 2. What are complex Adaptive Systems?

As mentioned above, a key attribute of Morpho's strategy is based upon viewing markets as a *Complex Adaptive System*. But what are *Complex Adaptive Systems*? We don't hold ourselves out to be experts in this area in the same way that we aren't automotive engineers, but that doesn't stop us from driving a car. The following is an overview taken from Wikipedia:

*A complex adaptive system (CAS) is a system in which a perfect understanding of the individual parts does not automatically convey a perfect understanding of the whole system's behavior. The study of complex adaptive systems, a subset of nonlinear dynamical systems, is highly interdisciplinary and blends insights from the natural and social sciences to develop system-level models and insights that allow for heterogeneous agents, phase transition, and emergent behavior.*

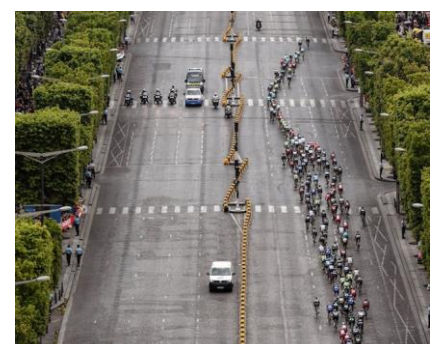
*They are complex in that they are dynamic networks of interactions, and their relationships are not aggregations of the individual static entities, i.e., the behavior of the ensemble is not predicted by the behavior of the components. They are adaptive in that the individual and collective behavior mutate and self-organize corresponding to the change-initiating micro-event or collection of events. They are a "complex macroscopic collection" of relatively "similar and partially connected micro-structures" formed in order to adapt to the changing environment and increase their survivability as a macro-structure.*

*Complex adaptive systems or complexity science is not a single theory—it encompasses more than one theoretical framework and is highly interdisciplinary, seeking the answers to some fundamental questions about living, adaptable, changeable systems.*

*What distinguishes a CAS from a pure multi-agent system (MAS) is the focus on top-level properties and features like self-similarity, complexity, emergence and self-organization. A MAS is defined as a system composed of multiple interacting agents; whereas in CAS, the agents as well as the system are adaptive and the system is self-similar.*

The following are some key characteristics of *Complex Adaptive Systems*, again from Wikipedia:

- *The number of elements is sufficiently large that conventional descriptions (e.g. a system of differential equations) are not only impractical, but cease to assist in understanding the system. Moreover, the elements interact dynamically, and the interactions can be physical or involve the exchange of information*
- *Such interactions are rich, i.e. any element or sub-system in the system is affected by and affects several other elements or sub-systems*
- *The interactions are non-linear: small changes in inputs, physical interactions or stimuli can cause large effects or very significant changes in outputs*
- *Interactions are primarily but not exclusively with immediate neighbours and the nature of the influence is modulated*
- *Any interaction can feed back onto itself directly or after a number of intervening stages*
- *The overall behavior of the system of elements is not predicted by the behavior of the individual elements*
- *Such systems may be open and it may be difficult or impossible to define system boundaries*
- *Complex systems operate under far from equilibrium conditions*
- *Complex systems have a history. They evolve and their past is co-responsible for their present behaviour*
- *Elements in the system may be ignorant of the behaviour of the system as a whole, responding only to the information or physical stimuli available to them locally*



A primary point of difference that our *Complex Adaptive System* approach to investing has compared to asset management industry convention is the high-level (macroscopic) nature of the methodology - unlike the fashionable but comparatively microscopic approaches such as *factor investing*, *smart-beta* and *alternative risk premia*. Yet, it is this very feature that makes Morpho's insights applicable across global risk asset markets.

The use of a *Complex Adaptive System* framework empowers our investment methodology and enables us to understand collective environment-shaped behaviours, leveraging our proprietary insights to isolate the triggers and timing of Risk-On and Risk-Off periods in markets.

### 3. Dynamic Asset Allocation, Alternatives or Overlay (your choice!)

In light of the macroscopic nature of Morpho's ability to isolate *Market Risk*, this presents investors with a variety of options in terms of application of our strategy. It can be used at a portfolio level as a means of *Asset Allocation*. It can be used as an allocation within an *Alternatives* subset of a portfolio. It can also be used as an *Overlay* to hedge the portfolio against Market or *Systematic Risk*.

The trade-off between different applications of Morpho's strategies in the example shown in Figure 3.1 is the higher annualised returns and lower *maximum drawdown* of our Investment Strategy versus the likely saving due to reduced slippage in annualised returns from entry and exit spreads for our Overlay Strategy. The impact of ETF fees would also be a consideration depending on markets and ETF providers selected.

The use of an *Overlay* strategy depends on the availability of a suitably efficient futures market for the desired asset class with high liquidity, both in terms of volume and bid/offer spread, and low tracking error (or at least being highly correlated) to the underlying market exposure that an investor has in their portfolio.

Whether an efficient derivatives markets exists or not, Morpho's strategy can be implemented by direct investment in the 'physicals' market. The ability to use a synthetic *Overlay* just adds flexibility - and the potential for leverage. If leverage is to be used, then it would be best employed via futures. Leverage with 'physicals' does produce superior returns but that must be adjusted by the funding cost of that leverage, which we suspect would materially diminish returns relative to a synthetic *Overlay* - most probably to a level beneath simply using levered futures during 'risk-on' periods only. Leverage increases *drawdowns* and volatility of returns. The use of leverage is limited by the level of these risks that an investor is prepared to accept. See Figure 3.2.

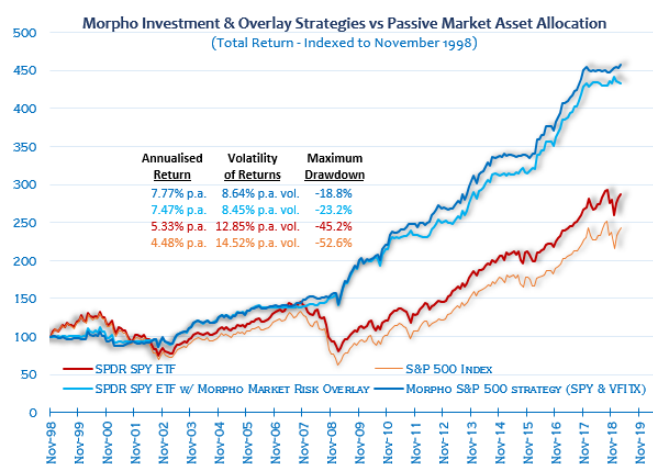


Fig. 3.1 illustrates a static sector allocation relative to Morpho's investment and overlay strategies by comparing indexed returns of (a) the S&P 500 Index; (b) the SPDR S&P 500 [SPY] ETF; (c) the SPDR S&P 500 ETF using Morpho's strategy; and (d) the SPDR S&P 500 ETF but with Morpho's overlay strategy using S&P 500 futures.

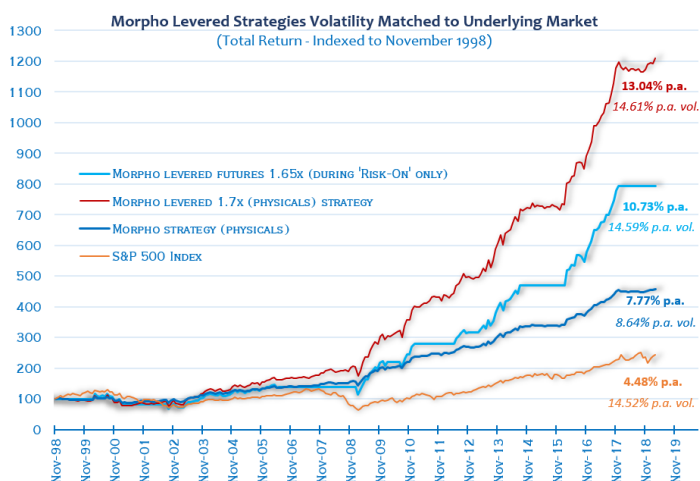


Fig. 3.2 illustrates the use of leverage on Morpho's strategies. Each strategy has been levered so that annualised volatility of returns approximately matches that of the underlying market (in this example the S&P 500). Applying leverage to a 'physicals' strategy increases returns in line with the leverage employed, but this does not account for funding costs. A levered futures strategy (during 'Risk-On' periods only) adds a material increase in returns for the additional volatility. These returns would be greater still if investor funds were invested in relatively 'risk-free' assets during 'Risk-Off' periods. A fully levered futures strategy would result in a similar outcome to the levered 'physicals' example illustrated (the red line).



#### 4. Correlation (to be or not to be: that is the question)

Diversification is often touted as the “only free lunch in investing”. While we don’t dispute that true diversification is highly beneficial in an investment portfolio, this industry orthodoxy is premised upon the assumption that asset managers don’t know what is going to happen. For the most part this is an accurate assumption as there will always be varying degrees of uncertainty. On top of that is the industry orthodoxy of relatively superficial diversification based upon geography and *asset class*. Our research shows that, at the macro level, geographic spread does little to diversify exposure to *Market Risk* within a portfolio. Similarly, unless *asset class* exposure is delineated between *risk assets* and *risk-free assets*, then diversification by *asset class* does little to mitigate the detrimental impacts of *Market Risk* in a portfolio, except by magnitude. We have found that *risk assets* are highly correlated across the globe.

Morpho’s core investment strategies don’t attempt to remain uncorrelated from the general market when conditions are good and prices are rising. Correlation is not bad in an investment portfolio BUT ONLY IF you can identify periods of elevated or diminished risk. At Morpho, identifying and timing periods of diminished risk that sanction correlation to market is a high-conviction trade.

*Correlation to market is a high-conviction trade*

In the last 20 years our proprietary risk signal has been Risk-On 52% of the time and Risk-Off the other 48%. As you would expect, the correlation of our strategy to general market returns reflects this. For example, our S&P 500 strategy has a 54% correlation to the S&P 500 over that 20 years. Yet, when you separate the data into periods of positive and negative returns the correlations to our strategy become 50% and 22%, respectively. Looking at correlation from a risk perspective, 22% is the correct measure of correlation to the general market in this case. This asymmetry in correlation is a desirable attribute.

#### 5. In-Sample and Out-of-Sample (real world performance)

The history of Morpho’s proprietary *Market Risk* identifying methodology is relatively young being approximately only two years old. This automatically raises questions of historic optimisation, back-fitting etc.

Our methodology is insight based and was built upon this foundation. Because of this we did not need to run multiple scenarios to optimise the output based on historic data. On the contrary, we built our model and only when it was finished did we run historic market data through it. There was no real “in-sample” data as traditionally thought of nor has there been any subsequent ‘tweaking’. In fact, when we first built it we weren’t thinking of global risk assets, we were only thinking of one or two markets. It has been a voyage of discovery (and surprise) as we thought to test new markets in our model only to find that each time we generated the same results: a stepped profile of minimal drawdowns, reduced volatility and market-beating long-term returns. We also discovered that the further out along the risk spectrum we applied the model, the better the results.

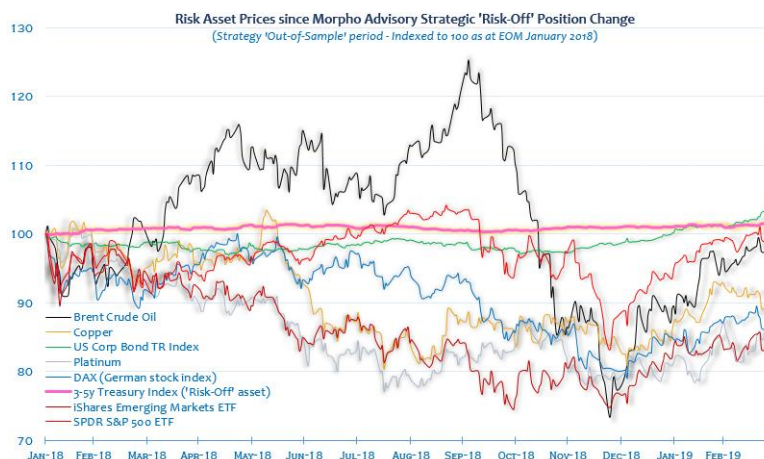


Fig. 5.1 compares the relative performance of various risk asset prices to our nominated ‘risk-off’ asset since our model indicated it was time to go ‘risk-off’ at the end of January 2018 (i.e. out-of-sample). Developed Market equities; Emerging Market equities; industrial metals; credit spreads; the mining sector; and oil have all weakened, underperforming our risk-off asset. More recently, the S&P 500 and credit have broken even but only after suffering significant drawdowns and increased volatility (poor risk/reward ratio), which we seek to avoid.....besides.....the risk-off period is not over yet.

In the period since our model has been “live” there has only been a single signal change. Our model signalled Risk-Off positioning as at the end of January 2018 (Figure 5.1). We were confident enough at that time to switch all our personal investments on this basis and to do the same for family and friends. In hindsight it has proved to be the right call and has validated application in the real world....where it matters.



## 6. Investing in non-income assets (the commoditisation of risk)

The initial design of our investment methodology was as an alternative to the flawed portfolio construction and academic theory utilised throughout the professional investment industry the world over (e.g. efficient market hypothesis; volatility equates to risk; static diversification by asset class and geography; 60/40 portfolios; passive index-tracking etc). This we have achieved, yet our process may still be applied within existing investment industry frameworks to outperform each component *asset class*. However, during the development of our methodology we discovered that we had created something more powerful than we had initially intended. The greater the risk, the greater the results of our process.

The implications of being able to identify periods of *Market Risk* and the global application thereof has led us inexorably to the outer reaches of the tradable financial risk spectrum. Namely, commodities.



Commodities have neither dividends nor yields. They merely have a price that is usually volatile and which also spends long periods in *drawdown* (see Figure 6.1). Applying Morpho's proprietary investment methodology to commodities alters this volatile and high drawdown profile to the customary low drawdown, rising 'stepped' profile observed whenever Morpho's strategy is employed (see Figure 6.2).

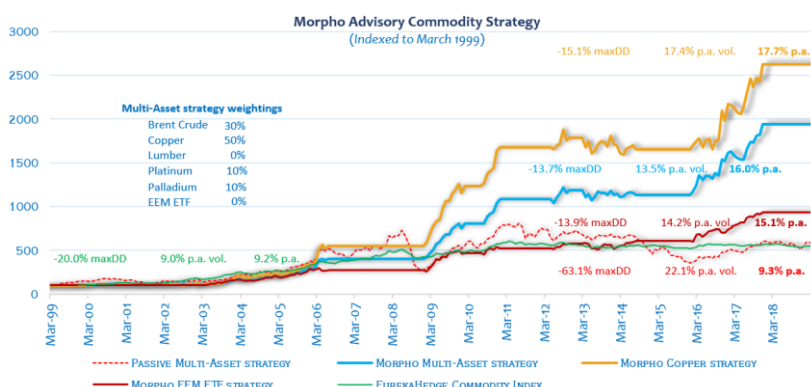


Fig. 6.1 illustrates the price history of multiple commodities (indexed to 100 as at March 1999) to show their volatile profile and that they do not rise steadily but often trade below their all-time high prices for long periods.

Fig. 6.2 illustrates the same assets shown in Fig. 6.1 but with Morpho's investment strategy applied (indexed).

It should be noted that there can be prolonged periods where, even during risk-on market phases, that returns are flat. Ultimately however, the upward movement in prices makes the wait worthwhile for long time-horizon investors.

A select multi-asset commodity strategy using Morpho's process further reduces *Maximum Drawdown* and volatility levels to below those of developed equity markets for multiple times the annualised return (see Figure 6.3). Leverage anyone?



This altered risk profile results in a stable and now investible *asset class* that delivers significantly superior returns compared to traditional *asset classes* and with annualised volatility similar to those seen in equity markets.

Asymmetry in risk as a result of Morpho's unique and proprietary strategy enables the addition of commodities to an investor's portfolio in a manner that enhances returns, and reduces both volatility and drawdowns despite the lack of dividend income generated by the *asset class*.

Fig. 6.3 illustrates Morpho's multi-asset commodity strategy, with (a) annualised return; (b) annualised volatility of returns; and (c) maximum drawdown.



## 7. Closing Credits

Putting all of Morpho’s findings together into a multi-asset class portfolio produces the delivery of superior returns for the same, or better, risk-metrics than standard benchmark asset classes that form the backbone of most investment portfolios.

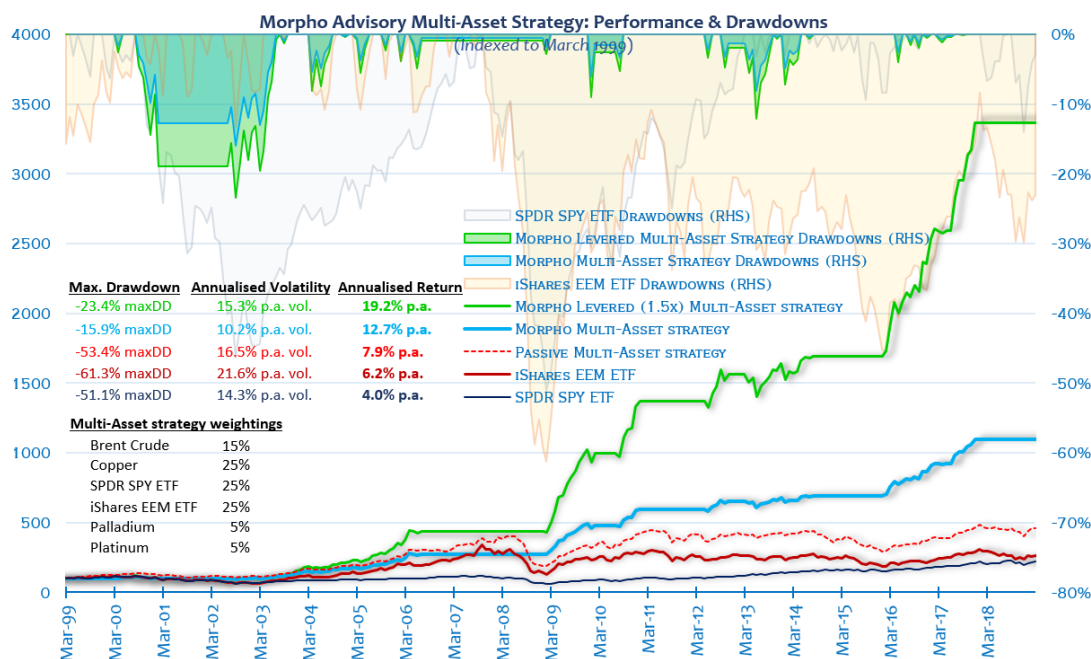


Fig. 7.1 illustrates Morpho’s multi-asset class portfolio – both levered and unlevered, along with summaries of (a) annualised returns; (b) annualised volatility of returns; and (c) maximum drawdown. For comparison, the performance of S&P 500 and Emerging Market proxies have been included as has the same multi-asset class portfolio but without Morpho’s process applied. A comparison of drawdowns for the S&P 500 and Emerging Market proxies over the last 20 years has also been included.

In this example, prior to the advent of the EEM ETF in April 2003, the SPY ETF was weighted at 50%.

The absence of *fixed income* and credit assets in Figure 7.1 is intentional. *Fixed income* assets (i.e. sovereign bonds or other forms of positive yielding relatively ‘risk free’ asset of high credit quality and modest duration risk) are our designated ‘risk-off’ asset. Income from these assets is accrued during risk-off periods, very often they also deliver capital appreciation in these periods. Those returns are excluded in Figure 7.1. Our proprietary investment methodology has historically indicated that markets spend almost equal periods of time in risk-on phases as in risk-off phases. However, the focus of Morpho’s strategy has been on making best use of risk-on periods because this is when investments make the majority of their returns. Risk-off periods by contrast are about being content with a minimal income while avoiding capital impairment through *drawdown*, and being ready for when the market enters its next risk-on phase.

### Morpho Advisory

Unique Investment & Market Risk Solutions

#### Market Risk

Actively managed

#### Tailor-made Solutions

Multiple methods of application

#### Reduced Drawdowns

Real-world risk management

#### Reduced Volatility

Academic risk management

#### Higher Returns

The ultimate objective

