May 2020

'LUCKING UP'
Until beta fails

Executive Summary

Throughout the last decade, barring the most recent COVID-19 sell off, holding equity beta exposure would have been a tremendous strategy. The US equity market delivered a Sharpe ratio of ~1, with most all other asset class benchmarks trailing. At the same time, uncorrelated liquid alternative strategies such as trend following (CTAs) delivered modest returns, overshadowed by the strong performance of equities (and bonds). In this note we illustrate to what extent the equity market rally from 2010 was a statistical fluctuation. We furthermore illustrate that the addition of an uncorrelated strategy with a Sharpe ratio of ~0.5 in any period outside of an 'in-sample' large positive fluctuation, such as was observed in 2010-2020, delivers overall better risk-adjusted portfolio performance. The natural conclusion to draw from the study is that, in the absence of being able to forecast such fluctuations, allocating to uncorrelated, 'alternative' strategies delivers better forward looking outcomes.

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Introduction

In December 2007, a bet between Warren Buffet and Ted Seides of Protégé partners caught the imagination of the finance world: Mr Buffet wagered $1 million that the S&P 500 (shorthand for the US equity market) would deliver superior performance to hedge funds over a ten year period starting in 2008.

In May 2017, even before the conclusion of the bet (on 31 December 2017), Mr Seides conceded. His five funds-of-funds (constituted from a ~200 fund-pool of hedge funds) lost to the S&P 500 every year except 2008 – the first year of the wager.

Commentators were quick to applaud the astuteness of the Oracle of Omaha, and the folly of hedge funds. As shown in figure 1, nearly all who would have bet *against* the S&P 500 over the past decade would have lost. Not only Mr Buffett, but any investor long the market became a beneficiary of one of its market's most celebrated bull runs.

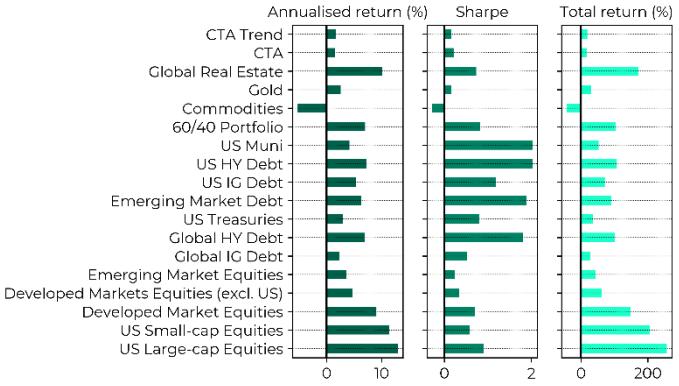
In Berkshire's annual letter to investors following his victory, Mr Buffett wrote: "Let me emphasize that there was nothing aberrational about stock-market behaviour over the ten-year stretch."[1]

One might argue, as the market delivered one of its best periods of ten year returns, the market did in fact deviate from its normal, usual, or expected average returns during this period.[2] However, as we will illustrate below, we wholly concur with the assessment of Mr Buffett – there was nothing statistically unusual about the performance of the market as such periods of outperformance can and do occur.

Many alternative asset classes, especially liquid alternative strategies such as trend following did in fact 'underperform' when compared to the market. Moreover, amidst the equity outperformance within this particular decade, non-traditional risks with uncorrelated returns would not have been, as we will illustrate, beneficial in providing diversification benefits.

However, the recent market turmoil following the outbreak and spread of the coronavirus have put into stark relief the consequence of considerable beta exposure during tail-risk events.

Now, perhaps, is therefore an opportune moment to remind oneself of the historical stylised properties of markets, especially equities, and highlight the importance of being diversified, by having uncorrelated assets in any portfolio.



Source: Bloomberg, CFM

Figure 1: The average Annualised return, Sharpe ratio, and Total (compounded) return of major asset classes over the period 2010-2020 using daily, total return data. The US equity market delivered a total compounded return of 250% over the decade, at an average annualised rate of 13%. Apart from other equity benchmarks, no other asset class delivered comparable performance (not adjusting for risk). Commodities were the worst performer, largely owing to the nosedive in commodity prices during 2014 on the then fears of a demand slump – especially from import giant China. The details of the reference benchmarks are specified in the appendix. (Note that the commodity spot index is not investable, and that these are all total, and not excess returns.)

Why the S&P 500 benchmark?

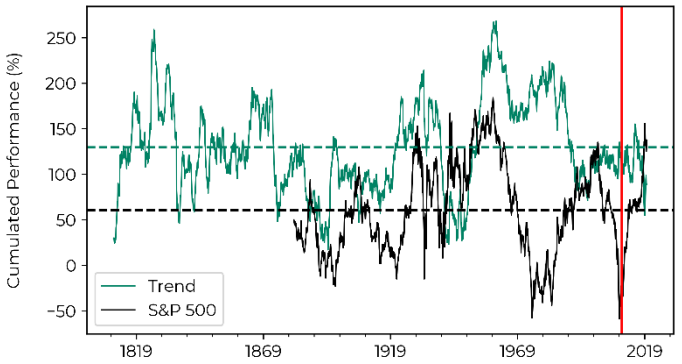
As the US equity market was enjoying its historic bull market, many alternatives delivered lacklustre performance in comparison. Along with the headlines made by Mr Buffet's winning bet, many an investor's hobby horse of comparing the performance of hedge funds vis-à-vis the market was rekindled.

However, merely one decade earlier (2000-2010), the equity market was slightly worse than flat (-5%), while the Société Générale Trend Index returned nearly 130%. Moreover, while the US equity market has on occasion delivered negative returns over a ten year period, a generic trend following strategy has not – evidence of its robustness through many different economic environments – see figure 2.[3]

[1] https://www.berkshirehathaway.com/letters/2017ltr.pdf

[2] The long term historical average return of equity markets is ~9-10% per year (total, not excess returns). However, the market rarely returns between 9-10% returns per year. The simplest, and most intuitive explanation (which, in fact, is moreover supported by a vast amount of academic research) is that markets are subject to *emotional excesses* – both on the up and downside. The jargon for this feature or characteristic of equity markets is fat-tailed returns.

[3] This result is based on an academic study, with results being gross of fees and costs (including execution and impact costs). It these are added, one might very well find a ten year period where a trend following strategy delivered negative performance.



Source: Bloomberg, CFM

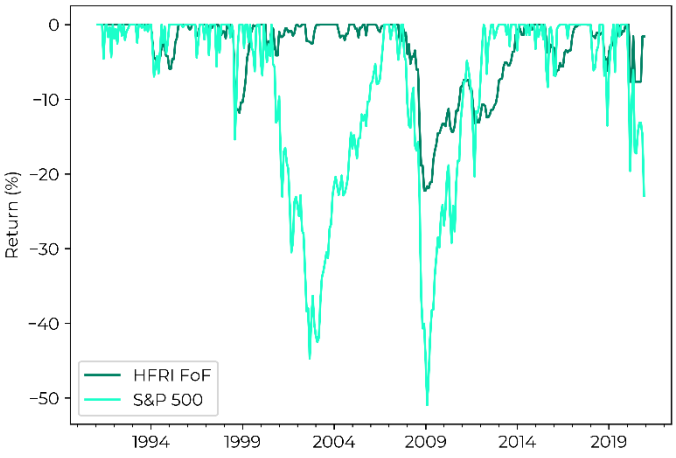
Figure 2: The 10-year cumulated performance of the US market (based on the excess returns of the S&P 500 Total Return Index since 1880), and a generic trend following portfolio since 1800. Returns of the generic trend following strategy is from our academic paper 'Two centuries of trend following',[4] and are gross of fees and costs (including execution costs). The red vertical line indicates the start of 2010, coinciding with a clear and dramatic increase in the performance of the market. The dotted lines indicate the long-term average of the cumulated performance of the two return time series.

While benchmarking is, and will remain a primary tool for comparing the *relative* performance of any investment, the key shortfall of using 'the market'[5] as a catch-all benchmark is that, for one, it does not necessarily match the same level of risk of many other strategies.

Furthermore, as most hedge fund strategies have a mandate to generate *absolute* returns, i.e. positive returns that are uncorrelated with the returns of traditional asset classes, matching risk characteristics is an important first step when evaluating the performance between various investment portfolios. It is our assertion that benchmarking the returns of alternative asset classes with the market is flawed for a variety of additional reasons:

1. Diversification and hedging

- Alternative asset managers typically invest in a much more diverse universe of risk. The S&P 500 is exclusively (more-or-less) the largest five hundred companies in the US, whereas hedge funds opportunistically seek a far broader set of risks, employ different strategies, and operate with different objectives. Of course, the reason for this is to provide diversification to investors and this diversification, one hopes, delivers financial benefit during normal periods of market performance and may help especially in periods of severe equity sell-offs. See figure 3 for a comparison of maximum drawdowns between the market and a benchmark fund of hedge funds.
- Some allocations go further than being a diversifier and are investments that may hedge exposure. This can mean a negative correlation with the hedged benchmark, or can also mean a negative correlation with big downside moves in the benchmark. In both cases comparing the performance of the hedge with a benchmark makes little sense as it is only the combination that should be considered.
- A well-documented feature of the S&P 500 is the considerable weight of the information technology sector in the benchmark (~25%). This feature, moving forward, is likely to make the S&P 500 a misleading indicator of the overall level of risk in the market.



Source: Bloomberg, CFM

Figure 3: Drawdowns of the US equity market versus a common hedge fund fund-of-fund index computed using monthly data since 1990. The drawdown of the market is much deeper than those of hedge funds.

2. Fees

- The fees required to provide traditional benchmark exposure have been compressed drastically over recent years. Retail and institutional investors alike can buy ETFs and pay basis points per year for the service. Accessing this exposure has therefore become cheap with the developments in the world of financial engineering. Managers providing alternative investment exposure have also seen fee pressure, with many more strategies, such as trend following, becoming commoditised in a similar way to equity markets.

[4] Y. Lempérière, C. Deremble, P. Seager, M. Potters and J.P. Bouchaud, Journal of Investment Strategies 3(3), 41-61

[5] Common jargon when referring to the S&P 500 - a market capitalisation weighted index which therefore over-represents the largest companies trading in the US

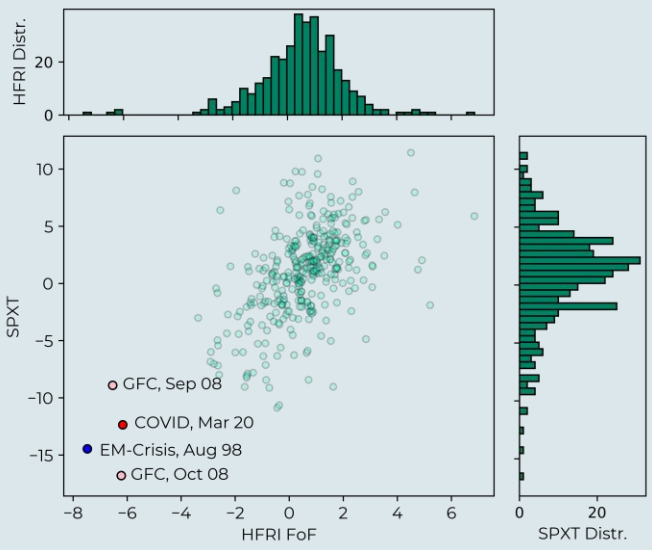
- The fees charged in any product reflect a combination of return expectation, correlation with traditional benchmarks, and strategy capacity. It is clearly the case that high return strategies command high fees no matter what! But correlation with traditional asset classes is also important in order to bring that crucial diversifying power to a portfolio. To produce returns that are decorrelated from the market mostly requires allocating to sophisticated instruments, involves the use of leverage, and requires having the skill and expertise of controlling trading costs – along with many other costly activities. A low capacity strategy can also command higher fees due to the inherent limited total revenue generated for the manager. For all these reasons benchmarking fees against those of ETFs makes little sense.

3. Sensitivity to statistical fluctuations

- We will expand on this point later, but any investment can go through extended periods (many years) of positive performance through sheer good luck (a positive statistical fluctuation in the language of statistics). It does therefore, when comparing two decorrelated strategies, not make a lot of sense to benchmark one against the other when one or the other can be *'lucking up'* in a non-significant way.
- The sensitivity to these fluctuations is enhanced by the fact that the level of return provided by either the market or by alternative investment managers is generally low. A consequence of this is that the amount of time needed to distinguish the performance of one over the other is often of the order of a typical career in finance!

The skilful management of active exposures that produce reasonable risk-adjusted returns, and that can protect against large drawdowns, is what many hedge funds are paid for. For investors with aversion to downside risk (i.e. all investors!), the equity market itself is the wrong benchmark. Cross-sectional performance comparison is often unsuitable. The only benchmark when comparing investments is the risk-free rate.

The diversification benefits of alternatives



Source: Bloomberg, CFM

A scatterplot showing the monthly return of the S&P 500 TR index (y-axis) and the HFRI Fund-of-Funds Composite Index (x-axis). Pay attention to the scale of the axes and those months where the market delivered its worst monthly returns, i.e. during the Global Financial Crisis (GFC) with dots in pink, as well as the recent coronavirus turmoil dot in red. During these particular events when the market suffered its worst monthly returns, hedge funds typically also suffered their worst monthly returns.

One can observe on the shouldering histograms, the much 'fatter' negative tails of the S&P 500 compared to the hedge fund benchmark.

The long-term equity beta of the HFRI Fund of Funds, i.e. measuring the sensitivity of hedge funds' performance to the equity market, is ~0.22 (calculated since 1990 using monthly return data). Beta exposure is not constant, of course, and was higher towards the end of the last decade. It is good to bear in mind that the long term beta of CTAs is ~0. The Sharpe ratio of the excess return of the HFRI Fund-of-Funds Index, i.e. when removing the market component, is 0.83 from 1990-2020. This, however, belies the fact the residual performance features a significant flat period after the GFC.

Is there anything unusual about the S&P 500 performance over the past 10 years?

It is our conjecture that the past ten years of the S&P 500, excluding the recent covid sell off, represented nothing more than a positive statistical fluctuation. In order to

demonstrate this we use random walk processes to show how the appreciation of this point is important in allocating capital to generate more robust portfolio outcomes.

GARCH random walks compared to the market

Forgive us now a minor mathematical detour …

We take a simplified GARCH[6] process with an EMA volatility:

$$\sigma_t = \sum_{t<0} e^{-t/\tau}\ \eta_t \qquad (1)$$

Where

τ = 3 months and t corresponds to daily increments

η = a random number drawn from a student distribution[7]

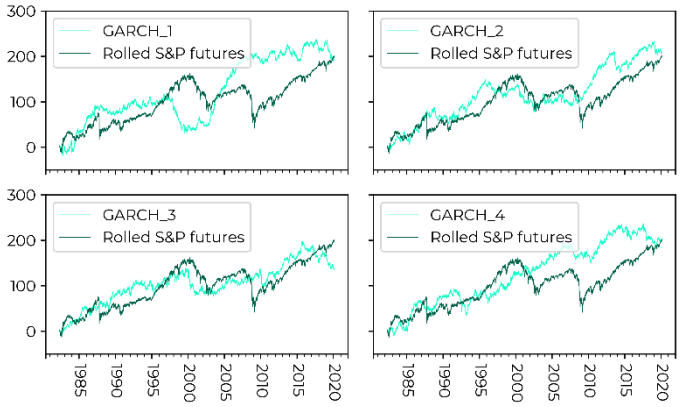
We introduce an asymmetry to η such that down moves are bigger than up moves (the leverage effect), and then plot the cumulative returns:

$$R_t^{GARCH} = \sum_t (k_1 + \eta_t \sigma_{t-1}) \qquad (2)$$

Where

k_1= a constant which is adjusted to get a Sharpe of approximately 0.3-0.4, consistent with that of long term equity returns.[8]

This resulting PnL has autocorrelated volatility, a negative correlation between returns and volatility (leverage effect), and risk-adjusted returns at a level comparable to those of equity returns. These well documented principal features and characteristics of the market now captured by this simple set up allow us to generate innumerable market outcomes that can be compared with the S&P 500 over the past 40 years – see panel 1.



Source: Bloomberg, CFM

Panel 1: Several unique, randomly selected realisations of the generated GARCH process random walks as described in (2) above.

These realisations show the result of such an approach. The past 40 years of the S&P 500 have been a rollercoaster ride! If we were to split up those 40 years into notable periods we should be on the lookout for a:

- ~13 year flat period such as that seen from the dot-com bubble onwards;
- ten year rally from the end of the GFC to pre-covid crisis 2020;
- 1987 crash-like event of similar depth;
- crash period similar to the worst months of the GFC

As shown in Panel 1, the four typical realisations of our simple GARCH process demonstrate that such long stretches of positive performance, mixed in with 'lost decades' and fast crashes are a feature of markets that have, and probably always will remain. In conclusion we show that, once capturing the main characteristics of the stock market, that in fact the ten year pre-COVID period of returns is consistent with expectations.

This feature of potentially long periods of outperformance is not isolated to GARCH models, but rather, is consistent with statistical fluctuations across a whole range of random walk processes. We argue below that benchmarking relative to a process that is prone to fluctuation is not only statistically flawed but can lead to inferior future outcomes.

[6] We use a GARCH model so as to simulate the 'heteroscedasticity' of volatility, i.e. the stochastic nature accompanied by clustering effect of volatility as observed in financial markets.

[7] We use a student distribution with 4 degrees of freedom to account for the fat-tailed return distribution of financial time series.

[8] We use additive returns for the purposes of simplicity in interpretation. These additive returns correspond to the result of investing with a fixed notional size rather than reinvestment that is modeled by multiplicative/compounded returns.

Combining alternatives with the S&P 500 over the past 10, 20 and 40 years

We would now like to simulate the returns of an alternative (or in other words uncorrelated) investment strategy and consider the outcomes *after* combination with the S&P 500. In order to simulate these alternative strategies we again take a minor mathematical detour (bear with us) and generate random walks with the following process:

$$R_t = \sum_{t<T}(k_2 + \eta_t) \quad (3)$$

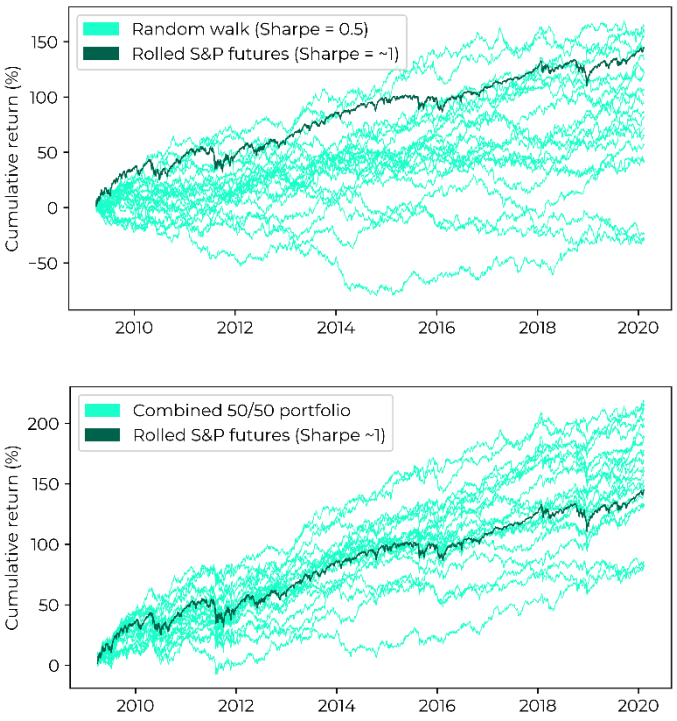
Where

η = a random number drawn from a student distribution (as before)

k_2 = a constant which is adjusted to get a long term Sharpe ratio of 0.5

Panel 2 (bottom) shows the outcome of combining the returns of the S&P 500 with these fictitious, uncorrelated investments each with a known Sharpe ratio of 0.5, a level of risk-adjusted return which is superior to that of the long term measured Sharpe ratio of equity markets at a level closer to 0.3-0.4 or so.[9]

We compare the returns of a portfolio holding only the S&P 500 with one holding a 50% allocation to the S&P 500 and a 50% allocation to the alternative investments. Over the past ten year period (from March 2009, the worst point of the S&P 500 at the end of the GFC), in the absence of the most recent sell off, the S&P 500 alone has outperformed approximately half of the outcomes from the 50/50 portfolio, testament to the magnitude of the positive fluctuation of the S&P 500.



Source: Bloomberg, CFM

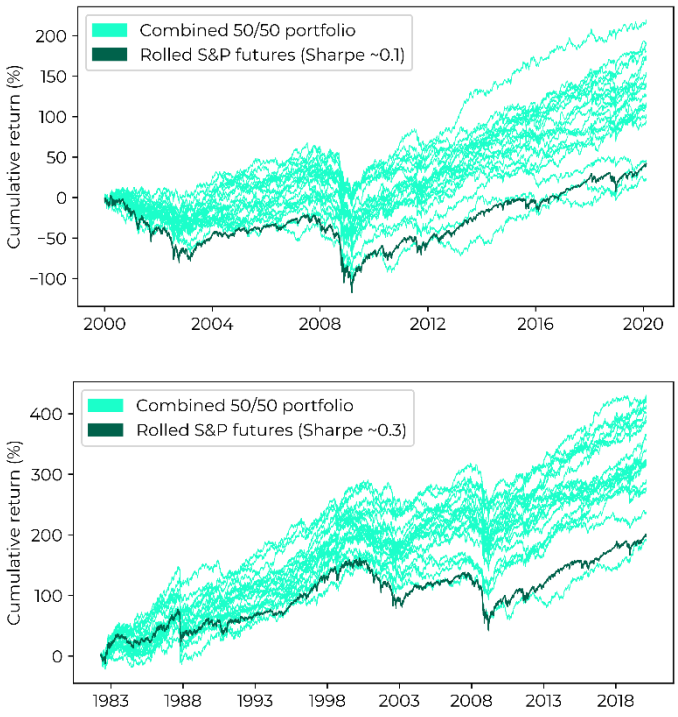
Panel 2: The S&P 500 outperforms more than half the equally weighted portfolio of 50% trend following and 50% the market (bottom). The combination of an uncorrelated strategy, while being beaten by the S&P 500 for the most part, still performs much better than the ~0.5 Sharpe process (top).

A repeat of the exercise over the past 20 years (2000-2020), however, tells a different story! We now have to include the ten years preceding the most recent decade which experienced a statistical fluctuation *in the opposite direction*.

We now repeat the exercise including the previous decade from the dot-com bubble period at the beginning of the century. The comparison with the 50/50 portfolio, now, reveals better outcomes for all but one using the S&P 500 alone (see top plot in Panel 3). Including more data again and using the full history of the S&P 500 available to us in the study reveals that the S&P 500 alone is only able to outperform one such realisation of the 50/50 portfolio. Of course, knowing that the long term level of risk-adjusted returns of the S&P 500 is lower than those of our alternative strategy means that the longer the history the more difficult it will be to outperform just through shear luck.

[9] Interested readers can refer to our paper Risk Premium Investing: A tale of two tails for more details on the long term Sharpe ratios of equities and other strategies and instruments – available on our website.

For a more comprehensive reference, our academic paper Risk Premia: Asymmetric Tail Risks and Excess Returns (Lempérière et al. , Quantitative Finance , Volume 17, 2017 - Issue 1) can be consulted.



Source: Bloomberg, CFM

Panel 3: The benefits of adding an uncorrelated strategy becomes more evident over a longer time-scale. On the top plot, we plot the performance of the fictitious 50/50 portfolio against the S&P 500 over a twenty year period (2000-2020), and, in the bottom plot during a nearly forty year period from the 80s. In both instances, as the overall Sharpe ratio of the market decreases relative to the post-GFC Bull Run, it becomes more beneficial to add a diversifying, uncorrelated strategy to a portfolio.

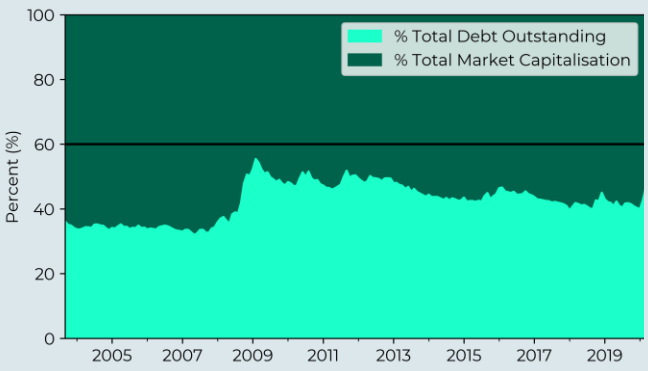
Entering the new decade.

The long post-GFC equity bull market came to a dramatic end in 2020. As global economies shuttered overnight, investors dumped risky assets nearly as quickly. The S&P 500 Total Return Index fell 33% from 21 February (the peak) to 24 March when stocks found a bottom (after vast monetary and fiscal measures announced by the Fed and US Congress in quick succession).

In times of market stress, a rotation into mainstay defensive safe-havens is expected, and this time was no different.

However, the effectiveness of bonds as a defensive measure was tested during the recent sell-off as various bonds, at various times fell in unison with equities. And while there are idiosyncratic explanations at the ready for the recent period of increased correlation, the defensive properties of bonds looked shaky. Moreover, a constant equity-bond balance is also looking distinctly arbitrary given how markets have changed over the past decade – see box 2.

US Equity – Bond Market Capitalisation Weight



Source: Bloomberg, CFM

The weight of the US equity market (total market capitalisation of all shares outstanding) with respect to all US Treasury debt outstanding. In periods of significant equity rallies, the share of the equity market is bound, mechanically, to increase vis-à-vis total debt (all things more or less equal). This was observed in the past decade, as it was in the decade leading up to the turn of the millennium (when the share of the equity market reached nearly 90% as the internet bubble was about to pop.)

An investor claiming a neutral market exposure by adhering to a 60-40 (or near-equivalent) allocation is in actual fact positioned either bullish or bearish depending on the real asset split of the market. Such a portfolio, as was the case over the last decade, would have been the beneficiary of outperforming beta, and not diversified alpha as some balanced-fund managers may want to claim.

Bonds as a mainstay hedge?

The classic, mainstay 60-40 portfolios so popular with many institutional investors have been hard to beat over the past decade, simply because both equities and bonds did exceptionally well. However, as interest rates have moved ever closer to zero, the hedging properties of holding bonds have, in some cases, reduced.

Let's reflect on the case of Japan.

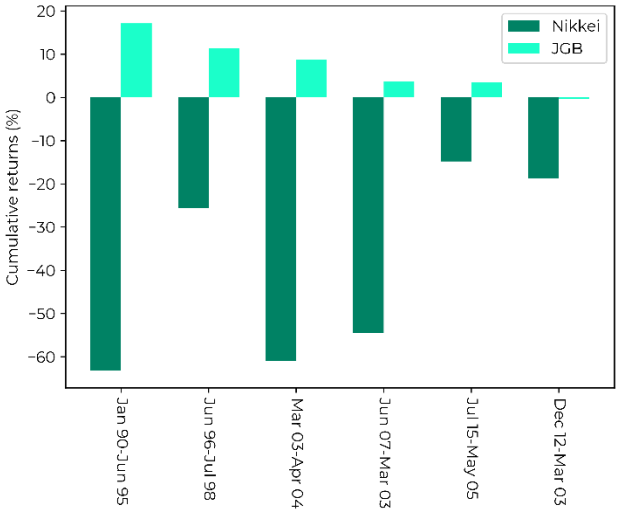
A clear pattern is discernible in the protective characteristics of risk free fixed income during severe equity drawdowns in Japan over the past three decades: it has steadily decreased – see figure 4.

This pattern, although particularly acute in Japan, is not exclusive to Japan.

With yields crashing to new record lows in the US and allocation to bonds – the classic hedge against spells of

equity underperformance or deep sell-off – becoming less of a sure thing, investors may well question how to diversify their equity risk?[10]

In short, as holding uncorrelated risk exposure is becoming more valuable than ever, alternative risks may become more appealing diversifiers.



Source: Bloomberg, CFM

Figure 4: The comparative performance of Japanese equities and Government bonds. We selected the most acute equity drawdowns in the Japanese equity market since 1990, and plotted those chronologically along with the performance of the Japanese 10-year government bond over the same period as the equity drawdowns. With interest rates falling, so have the protective characteristics of bonds.

Alternatives as a hedge?

When markets are on a tear, investors crave relative returns – or something to complement very profitable beta. However, during severe market sell-offs, investors typically rush to find protection, instead craving absolute returns.

During the recent COVID-triggered sell-off, and in chorus with bonds selling off, investors sought out protective measures especially in the form of put options. These derivatives act like an insurance policy, offering buyers the right to sell stocks at a pre-agreed price. With markets in a tail-spin, various broker surveys highlighted put options as the most popular hedging alternative, and, as demand for protection intensified, so did the cost to insure.

Trend following programs in particular, exhibited their protective abilities in Q1 2020 (as they did during the GFC), with the SG CTA Index and the SG Trend Index delivering -0.5% and 2.3% respectively.[11]

At appropriate fee levels, trend following is, and has proven to be – through the vast majority of history – a good diversifier. The addition of an uncorrelated strategy with an average, long term Sharpe ratio of ~0.5 (typical CTA program and hence our estimate of forward looking returns for a well implemented trend follower) has been shown to improve the overall risk-adjusted performance of a portfolio during all but those periods where the market has enjoyed a large positive fluctuation.

However, we have often argued that trend following is wrongly branded as a downside protection strategy. Trend following does protect against equity sell-offs, but, as we have written in the past, "perhaps not as much as you would like."[12]

For those investors who are unable or unwilling to be exposed to dramatic volatility and equity sell-offs; are willing to accept a lower overall risk-adjusted return over the long run; and be protected during sell-offs, adjustments can be made to a higher Sharpe ratio, medium-to-long term trend following system to improve the downside risk protection properties of a generic trend following system.

Such programs, enhancing the protective nature of trend following against equity sell offs provide a valuable extra weapon to the arsenal of any equity holder.

Conclusion

The past decade has been exceptionally good for holders of long equity beta exposure, with nearly all other strategies and/or asset classes trailing.

As a consequence, it was easier than usual to critique the lacklustre performance of alternatives (and the perceived high fees they demand).

And while blindly comparing the performance of a wide array of strategies with the market can surely be employed as a guide, we have highlighted the dangers of doing so as scripture. Any investment should, rather, only be fairly benchmarked against the risk free rate (equity investments and alternative investments alike) and investment decisions taken based upon the outcome

[10] The yield of the US 10-year broke through the 1% level for the first time on 3 March, and reached a record low of 0.3% on 9 March – the point after which the familiar pattern of equity and bond prices moving inversely to each other unravelled, with both asset classes suffering falling prices. While bonds failed to deliver protection throughout the recent COVID-19 induced sell-off, the reasons for this was not only less diversification, but was brought about by an intense rush for liquidity.

[11] The SG CTA and SG Trend (a subset of the SG CTA) Indices are well-known and commonly cited CTA benchmarks. For further details, including the methodology and constituents of these indices, please refer to the provider's website: https://wholesale.banking.societegenerale.com/en/prime-services-indices/

[12] See our whitepaper: *The Convexity of Trend Following. Protecting your assets but perhaps not as much as you would like!* availaible on our website: https://www.cfm.fr/assets/Uploads/PDFs/2018-The-Convexity-of-trend-following.pdf

relative to the objective, best estimate for the level of return prior to investment.

The S&P 500 is the preferred benchmark workhorse of many an investor, but very few (if any) – retail or institutional – *only* invest in US large cap stocks, recognising that diversification is important. Recent events have again highlighted the importance of diversification, especially if exposure to beta was an investors' principal risk. Investors with a 60-40 like portfolio would also have been exposed to a tumbling of equities and bonds in unison during the March 2020 "dash for cash".

While the magnitude of the equity and fixed income sell-off in Q1 2020 was unique, the diminishing protective properties of bonds is not. By using the example of Japan, we highlighted this shifting dynamic. With yields having fallen dramatically, and now closer to zero than ever (in the US), and at or below zero in other developing countries (Japan, Germany, Switzerland, France amongst others), investors can rightly be unnerved by the expectations of bond protection.

However, investors need not fret, for we have shown that other than in periods of extreme upward fluctuations in equity markets, the addition of an uncorrelated strategy with a modest Sharpe ratio will boost risk-adjusted performance and generate better investment outcomes.

And while the addition of an uncorrelated diversifying strategy would have been detrimental to a portfolio's overall returns over the past decade, given the exceptional performance of equities, we have shown that the combination of non-traditional risks with an equity portfolio is to the benefit of investors during most periods except those where the market enjoys a "lucking up" period.

For investors not succumbing to attractive, but myopic considerations, the strategic allocation to long-term non-traditional risk exposures, which are diversifying, can be complementary – especially during periods of high uncertainty. Trend following, as we have yet again highlighted, can offer some protection, but not as much as many investors expect or would like. However, it is possible to enhance these features of trend following to produce a better complement to an equity portfolio.

While the past decade was characterised by exceptional equity performance, one has to consider the likelihood of the market repeating its ten year tear as less likely than an outcome consistent with long term expectations – a Sharpe ratio of 0.3-0.4. For investors unable or unwilling to accept those odds, it is good to know that, as we have shown, adding an uncorrelated strategy with a modest Sharpe ratio *does* improve risk-adjusted returns over longer timescales.

Disclaimer

Appendix

Reference benchmarks

	Description	Bloomberg Ticker
US Large cap Equities	S&P 500 Total Return	SPXT Index
US Small cap Equities	Russell 2000 Total Return	RU20INTR Index
Developed Market Equities	Morningstar Global Allocation TR Index	MSAAGAT Index
Developed Markets (ex. US)	Morningstar Dev Mkts ex-US PR USD	MDXUS Index
Emerging Market Equities	Morningstar Emg Mkts PR USD	MEMM Index
Global IG Debt	Bloomberg Barclays Global-Aggregate Total Return Unhedged	LEGATRUU Index
Global HY Debt	Bloomberg Barclays Global HY Total Return Unhedged	LG30TRUU Index
US Treasuries	Bloomberg Barclays US Treasury Index Total Return Unhedged	LUATTRUU Index
Emerging Market Debt	Bloomberg Barclays EM Aggregate Total Return Unhedged	EMUSTRUU Index
US IG Debt	Bloomberg Barclays US Corporate Total Return Unhedged	LUACTRUU Index
US HY Debt	Bloomberg Barclays US Corporate HY Total Return Unhedged	LF98TRUU Index
US Muni	Bloomberg Barclays Municipal Bond Total Return Unhedged	LMBITR Index
60/40 Portfolio*	Vanguard Balanced Index Fund Institutional	VBAIX US Equity
Commodities	S&P Goldman Sachs Commodity Index Total Return	SPGSCITR Index
Gold	S&P Goldman Sachs Commodity Index Gold Index Total Return	SPGSGCTR Index
Global Real Estate	S&P Global REIT USD Total Return Index	SREITTGL Index
CTA	SG CTA Index	NEIXCTA Index
CTA Trend	SG Trend Index	NEIXCTAT Index

Benchmark indices are daily, total return price time series (all in USD).

* Data only available from 28 November 2011. The time series is backfilled to January 2000 using US Large Cap Equities and Global IG Debt as the respective proxies for a 60-40 portfolio.

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