

For professional investors - Marketing communication

# EQUITY RISK OVERLAYS

## MULTI-ASSET, QUANTITATIVE AND SOLUTIONS GROUP



May 2020



**BNP PARIBAS**  
**ASSET MANAGEMENT**

The asset manager  
for a changing  
world



**"For every complex problem there is an answer that is clear, simple, and wrong."**

**H.L. Mencken**

## EXECUTIVE SUMMARY

Hedging equity portfolios against losses has become crucial for many equity asset owners after the long rally of 2009-2019

- The rapid recovery following the Global Financial Crisis was the start of a prolonged period of robust equity market performance.
- Since the beginning of 2020 and with the onset of the coronavirus pandemic, we find ourselves again in a high-risk environment with extreme (and mostly negative) market movements and high implied volatility.

To avoid these extreme losses, we believe it is fundamental for institutional equity investors to use risk overlays, which can achieve one or more of the following objectives:

- A degree of protection that can be breached for limited periods, often referred to as Soft Floor Protection (SFP): The main goal of a risk overlay targeting an SFP is to protect X% of the initial net asset value of the portfolio (the floor), usually for an agreed period.
- Full protection that can be breached for limited periods but NOT at maturity, often referred to as Hard Floor Protection (HFP): The HFP offers a greater degree of protection against the possible gap risk created by the soft protection strategy described above.
- Other risk overlay strategies focus on controlling overall equity portfolio volatility: In Volatility Control (VC) strategies, the maximum acceptable level of observable/ realised volatility for the entire equity portfolio is set at inception. The portfolio manager reduces the exposure to all the assets if the realised volatility is above the targeted level and increases it if the realised volatility is below the targeted level

When addressing these objectives, traditional equity hedging strategies using options or futures in standalone structures have left equity investors facing uneasy trade-offs between the level of protection, the upfront premium costs, the opportunity costs (limited participation to the upside potential) and / or additional risks such as hedge execution timing and gap risks.

We believe these traditional (static or passive systematic) approaches are not fully adapted to the long-term investment objectives and risk tolerance limits of institutional equity investors as they do not offer access to the modern, sophisticated universe of hedging strategies and features currently available.

This White Paper sets out to present the next evolution in terms of recurrent and dynamic equity hedge structuring and implementation. It covers the integration of innovative concepts and features into traditional equity protection strategies and shows their impact on short-term risk management (for example, during the Global Financial Crisis) and longer-term investment performance. These innovative concepts and features include, among others:

- **A combination of equity index futures and options** that reduce the upfront and opportunity costs while ensuring a high protection level.
- **Safeguarding of past performance by defining a reset policy**, either periodically (usually annually) or when the recent performance has been sufficiently positive. This reset approach increases the level of the Soft or Hard Floor.
- **Forward-looking market indicators and risk triggers** to help decide when to monetise upside to raise premiums and reduce the opportunity costs.
- **Overweight / underweight** can be achieved through various volatility strategies to take advantage of adverse or favourable conditions.
- **Avoiding cash-out / cash lock** by splitting the risk budget between SFP (using futures) and HFP (protected with options) ensuring that the strategy also maintains exposure to equities and effective, cost-efficient, future-based protection (especially at the inception of the mandate).
- Beyond dynamic / systematic approaches, our strategies can include a layer of **discretionary structuring and execution** to embed market and fundamental views in their implementation. Here, tactical components are combined with more strategic / recurrent aspects and execution includes both recurrent and opportunistic hedging, depending on the likelihood and intensity of a bear market.

This document describes the entire implementation process, starting from the overlay design and the accurate understanding of the equity investor's risk budget and underlying risk exposures. We then move to traditional hedging strategies and their limitations before introducing innovative features and implementation approaches that help improve the hedge efficiency and effectiveness. Finally, we present an example of back-testing to show how the innovative features improve the hedge efficiency and effectiveness and actual impact of our recommendations.

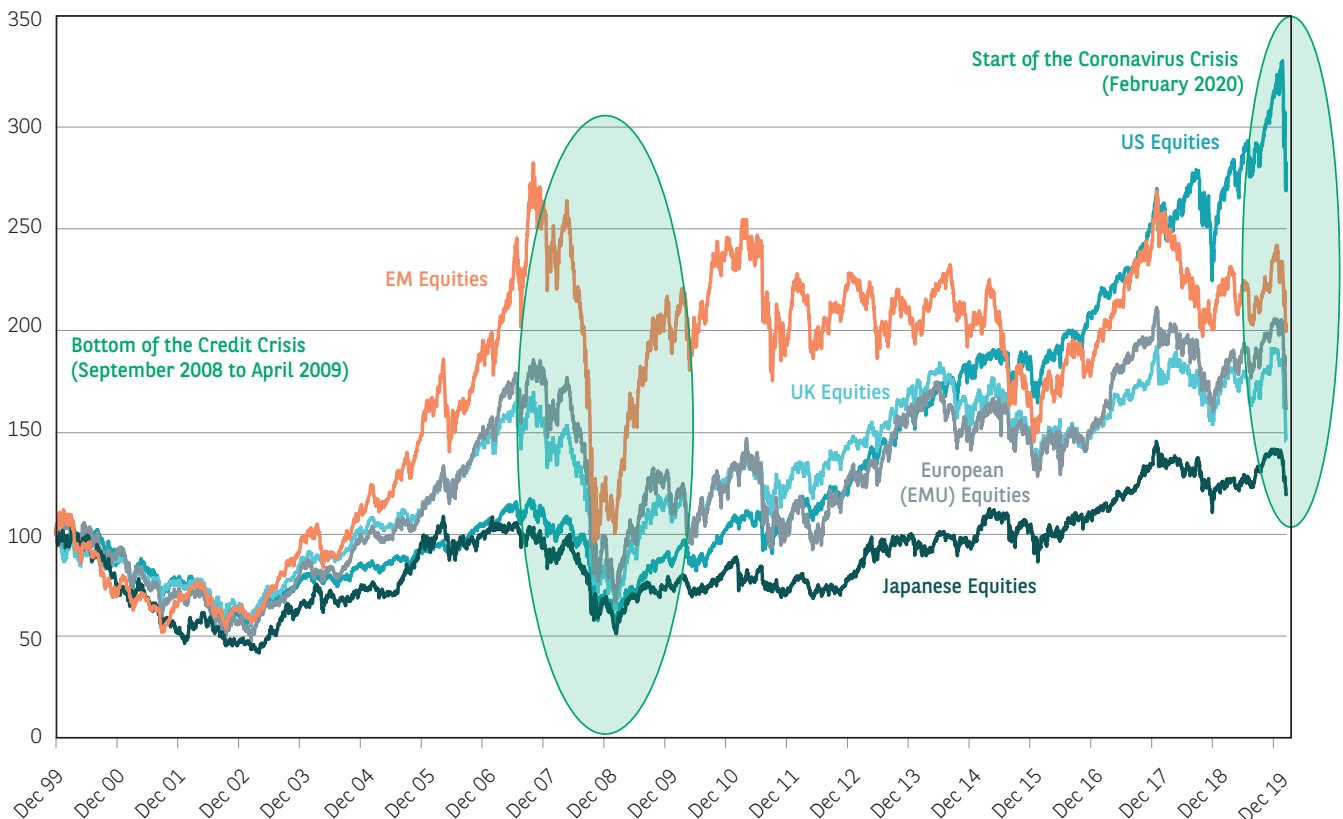
# EQUITY RISK

## BACKGROUND

In the period following the Global Financial Crisis until February 2020 the performance of equity markets was very strong and equity investors significantly increased their equity exposure. Unfortunately, they must now protect their allocations against the impact of the coronavirus pandemic and in particular avoid the adverse effects of extreme shocks that could further reduce the performance of the equities in which they are invested.

An **equity risk overlay**, which involves dynamically managing the risk of an equity portfolio, can provide the appropriate solution to the double challenge institutional clients' face with respect to their investment decisions:

- To fulfil their long-term commitments, which require investments in risky assets (especially in the current low-return environment); and
- To adhere to (short or medium-term) risk constraints imposed, for instance, by their investment policy (for example, maximum drawdown or maximum level of volatility) or by the regulator.



Source: Bloomberg, March 2020

Past performance is not an indication of future performance

## RISK OVERLAY DESIGN AND IMPLEMENTATION PROCESS

At BNP Paribas Asset Management, our risk overlay solutions provide our institutional clients with best-in-class investment and risk management methods and implementation.

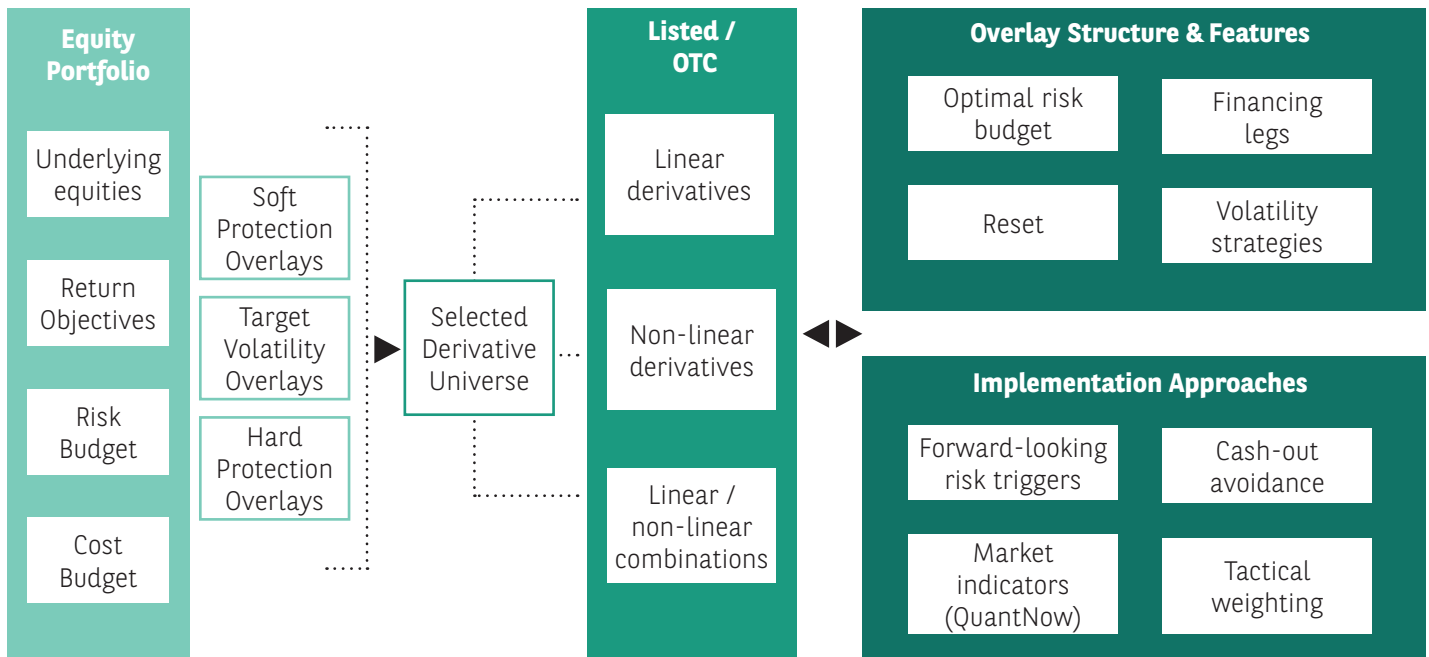
Our solutions are **customised to meet our clients' different objectives, needs and preferences**. We bring a high level of sophistication to the development, implementation and ongoing management of these solutions. We remain close to our clients during implementation and maintain a strict monitoring system based on a forward-looking governance approach.

These solutions revolve around the design of a risk management strategy which is modelled by BNP Paribas Asset Management's structuring and modelling teams. They often take the form of algorithms: a set of quantitative instructions to support the protection of our clients' equity portfolios. For example, the algorithm can be defined as:

- Shorting / selling more futures on a specific equity index if the volatility of the underlying portfolio or benchmark rises beyond a pre-defined level; or
- Rolling the existing put option protection at the end of each calendar month at 85% of an equity index's market level.

BNP Paribas Asset Management's "**Quantamental**" approach has been designed to combine proprietary quantitative expertise with fundamental research capabilities, underpinned by active risk management. Portfolio managers are closely involved in the decision-making process and have some leeway to override the algorithmic outcomes, should the need arise.

### Risk Overlay Design and implementation Process



Source: BNP Paribas AM, March 2020

No assurance can be given that any forecast, target or opinion will materialise.

## OBJECTIVES

Ensuring the risk overlay objectives are consistent with those of the equity portfolio is paramount. It ensures that the risk overlay structure and the risk management activities implemented by the portfolio managers help to reduce the overall equity risk exposure and protect against extreme (adverse) market movements.

In practice, risk overlay strategies can have multiple objectives depending on the risk tolerance and preferences of the asset owners. These objectives can be split into three categories:

1. A degree of protection that can be breached for limited periods, often referred to as **Soft Floor Protection (SFP)**: The main goal of a risk overlay targeting an SFP is to protect X% of the initial net asset value of the portfolio (the Floor), usually over an agreed period. The Floor is NOT to be maintained at all times. The SFP cannot be considered a guarantee and can be breached for short intervals of time. The advantage of this approach is that in periods of heightened market stress, the asset allocation and / or specific asset classes can be adjusted to lower risk levels.
2. Full protection that can be breached for limited periods but NOT at maturity, often referred to as **Hard Floor Protection (HFP)**: The HFP cannot be seen as a guarantee, either, but offers greater protection against the possible gap risk created by the soft protection strategy described above. The hard floor can be breached briefly in response to the mark-to-market of the options but at maturity, one expects the hard floor limit to be respected. The advantage of such a strategy is that in periods of heightened market stress, the absolute maximum potential loss of the entire asset allocation and / or specific asset classes is known ex ante.
3. Other risk overlay strategies focus on controlling overall equity portfolio volatility: **Volatility Control (VC)** enhances the protection / hedge level by setting target volatility levels to reduce or increase the actual exposure to an asset class. In most cases, the maximum acceptable level of observable/ realised volatility for the entire equity portfolio and / or for single allocation is set at inception. In practice, two approaches can be implemented to **under or overweight** part of the equity portfolio:
  - Portfolio target volatility: The portfolio manager can reduce the exposure to all the assets if the realised volatility is above the targeted level and, conversely, can increase it if the realised volatility is below the targeted level. The advantage of such an approach is that in periods of heightened market stress, the asset allocation and / or specific asset classes can be adjusted to lower risk levels.
  - Iso-volatility strategies: The portfolio manager maintains equal contributions of different equity strategies to the portfolio volatility by increasing or reducing their physical allocation / exposure to each strategy. In a portfolio of four different equity allocations (for example US, European, UK and Japanese equities), each contribution to the overall realised volatility is assumed to be 25%. If the volatility of one of the equity allocations is above 25%, its actual allocation is reduced so that its contribution to the overall risk budget returns to 25%. If it is below 25%, its actual allocation is increased back to 25% of the overall risk budget.

## COST CONSTRAINTS AND RISK BUDGET

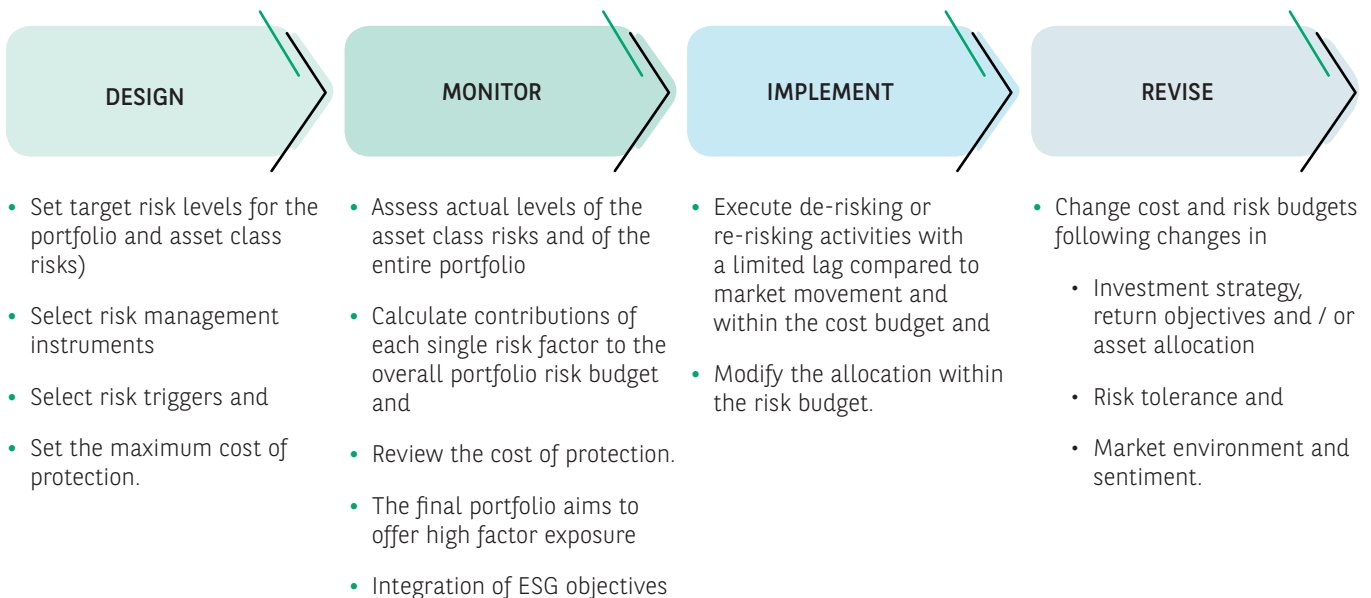
Understanding an investor's **cost constraints and risk tolerance limits** is the second step in structuring an appropriate equity protection.

- Although many investors have diversified asset allocations, in practice equity allocations drive a large part of the asset performance and of the risk budget, so de-risking triggers mainly affect equities.
- The required return to meet investors' long-term objectives has to be commensurate with the amount of its risk they are taking on the basis of their asset allocation.
- Likewise, the risk tolerance limits set by, for example, a pension scheme, must leave enough room to generate the expected return and at the same time ensure that potential downside remains under control.

The cost of protection against unwanted market movements must be analysed and compared between various alternatives.

- **Upfront costs:** A put option gives the buyer the right to sell a specified quantity of an underlying index at a pre-decided price; for this privilege the buyer of the put option pays an upfront premium to the put option seller or writer (i.e. the counterparty).
- **Opportunity costs** represent the benefits an individual, investor or business misses out on when choosing a hedged equity investment strategy rather than an unhedged one.

### Risk Budgeting Process



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Source BNP Paribas AM, March 2020

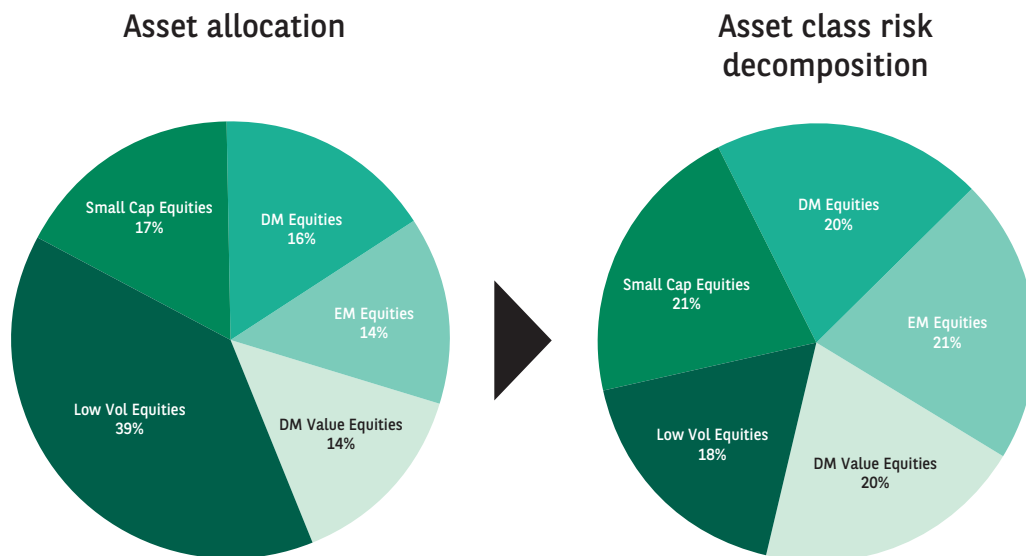
## UNDERSTANDING THE EQUITY EXPOSURES (I)

Risk exposures are quantified using varying measures. For illustration purposes, the main risk metrics which are monitored daily and considered in our strategies are the following:

- For **SFP**, we calculate the value at risk (VaR) of the benchmark (plus, whenever applicable, the de-risking position). We use a parametric 99% weekly VaR.
- For **HFP**, we calculate the potential maximum drawdown as well as the potential maximum upside.
- For **VC** strategies, we tend to focus on the average volatility of the portfolio.

The illustration below is based on an equity portfolio composed of Developed Market (“DM Equities”), Developed Market Value (“DM Value Equities”), Low Volatility (“Low Vol Equities”), Emerging Market (“EM Equities”) and Small Cap Equities. It compares the asset allocation and a risk decomposition based on liquid equity indices:

- The **risk exposures** of the five allocations contribute differently to the overall portfolio risk profile as they carry different levels of historical realised volatilities.
- Additionally, it is worth noting that the portfolio’s volatility is lower than the weighted sum of the volatilities of each of the components, thanks to **diversification benefits**.



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Source BNP Paribas AM, March 2020



## UNDERSTANDING THE EQUITY EXPOSURES (II)

The **decomposition of the equity portfolio** into the underlying regional or segment exposures enables us to identify which part of the portfolio:

- Can be hedged using identical or very similar equity options (i.e. US, euro zone, UK or Japanese large caps); or
- Requires a different treatment such as the use of proxy hedging (i.e. small caps, emerging markets or low-volatility equities).

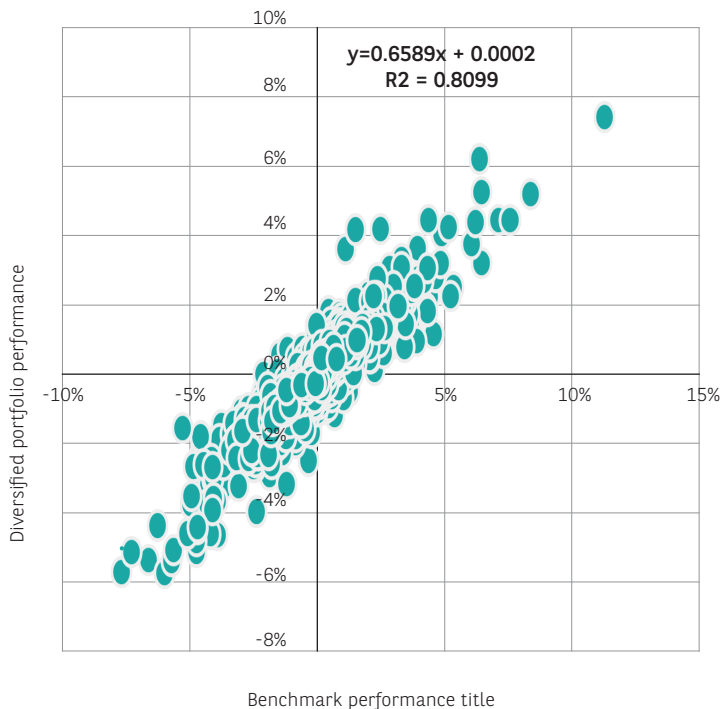
On that basis, the overlay / hedge can be structured to minimise:

- Basis risk with the underlying portfolio; and
- Transaction costs, by selecting more liquid and more frequently traded equity index options.

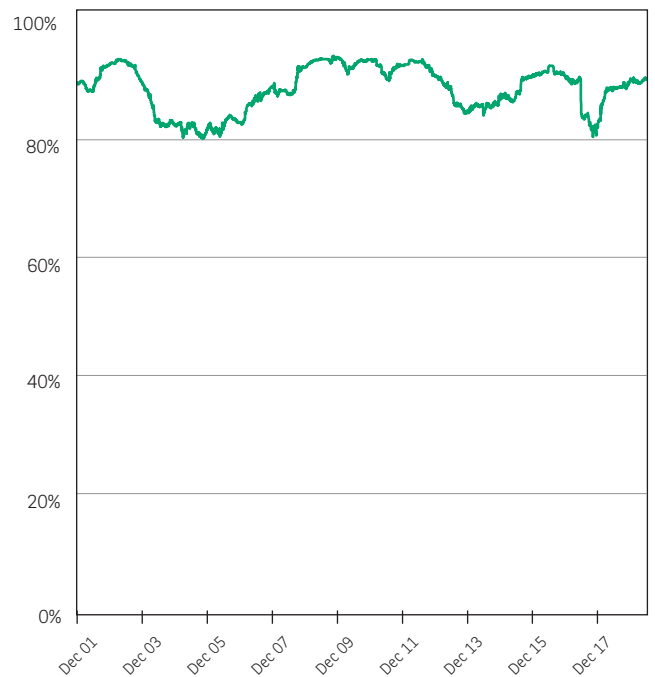
The graphs below show an example of the diversified equity portfolio introduced in the preceding section compared to a 45% S&P 500 / 55% Eurostoxx 50 benchmark portfolio between December 1999 and September 2019. An option structure based on the benchmark could therefore proxy-hedge the diversified portfolio with limited basis risk.

- Regression shows a R2 of 0.81 and correlation remains high (between 80% and 95%) with a positive bias: on average, the portfolio tends to outperform the hedge; and
- More liquid and much cheaper (in terms of transaction costs) options to trade.

**Weekly performance  
portfolio vs. benchmark**



**1-year rolling  
correlations portfolio  
vs. benchmark**



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Source BNP Paribas AM, March 2020

# TRADITIONAL SYSTEMATIC HEDGING STRATEGIES

## TRADITIONAL HEDGING STRATEGIES AND IMPLEMENTATION

Traditional systematic hedging strategies can be defined by objective:

- For risk overlays targeting an SFP, we tend to use linear and non-linear instruments such as futures, total return swaps (TRS) and options (on the basis of a partial hedge) to mitigate the cost of protection and ensure that in periods of stable and up-trending markets (no de-risking necessary) the portfolio is fully invested.
- For risk overlays targeting an HFP, we generally consider using non-linear instruments such as equity index options. Although the mark-to-market of an option varies until expiry and, depending on the time value and the market volatility, can theoretically be temporarily below a floor, the protection offered is much more reliable than with linear instruments. Options are only used to hedge highly liquid assets with low basis risk.
- For **volatility control strategies** we can use both options and futures, but in general the rebalancing of assets (overweight one asset class, underweight another simultaneously) within a portfolio is most efficiently done with linear instruments such as futures.

It is important to note that a hedging strategy can be implemented in different ways, the differences being the frequency of revision of the hedge and control of the hedge parameters. Traditionally, we encounter three types of implementation approaches.

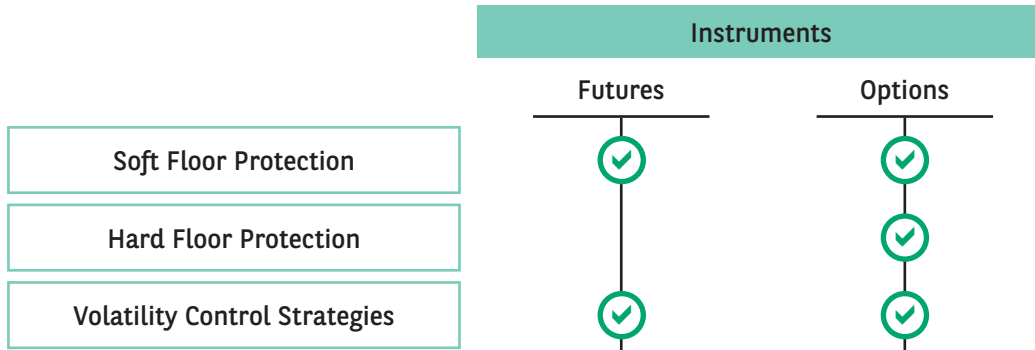
- 1. Static hedging:** The hedge (generally an option-based structure) is in place for a fixed period and is not changed during that period. A typical example would be a FTSE 100 index put at the 5 000 level for the next 12 months. This approach can be used for HFP.
- 2. Passive systematic option-based hedging:** The hedge is in place for a fixed period and its strike is regularly changed during that period. A typical example would be a FTSE 100 index put at 80% of market level with a weekly or daily re-striking for the next 12 months. This approach can be used for HFP.
- 3. Dynamic future-based hedging:** The hedge is in place for a fixed period and the protection can be updated during that period. A typical example would be a 90% FTSE 100 index future-based protection which is only implemented if the risk of floor breach increases above a given threshold for the next 12 months. This approach can be used for SFP and volatility control.

## INSTRUMENTS

The preferred instruments can be categorised into listed and Over-The-Counter (OTC).

- **Listed options and futures** are currently available on many major equity indices, including MSCI World and MSCI Emerging Markets as well as many country and regional indices. The liquidity in the main equity indices is in principle relatively high.
- **OTC instruments on equity indices** (Options, OTC forwards or Total Return Swaps) can improve the quality and potentially the cost of the hedge if a very specific index needs to be hedged or the amount to hedge is very large.

## Protection vs Risk Management Instruments

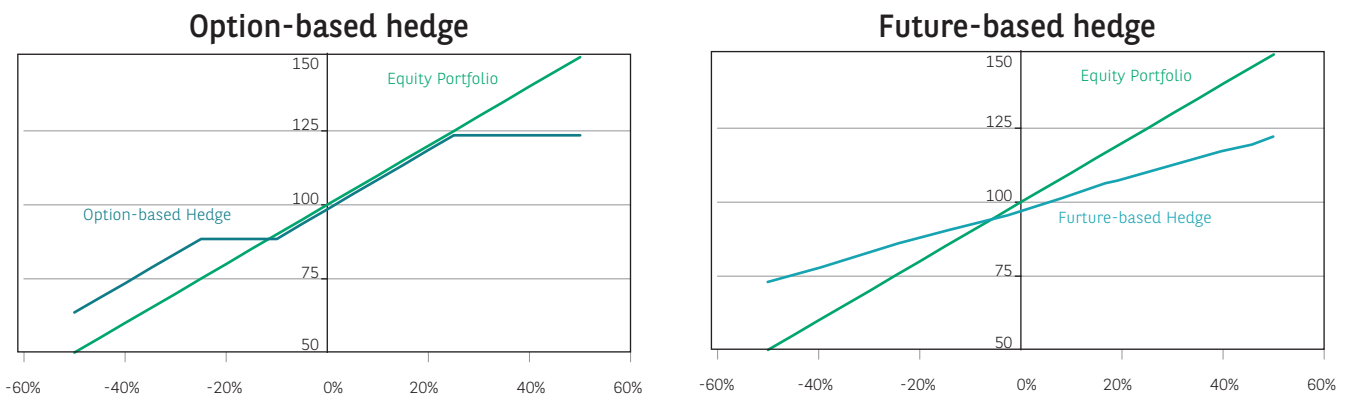


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Source BNP Paribas AM, March 2020

## HEDGING STRATEGY PAY-OFF PROFILES

Pay-off profiles vary with the type of instruments that are used.

- **Using futures for SPF**, we can remove all or part of the equity risk but also part or all of the potential upside. The opportunity costs can therefore be significant during an equity market rally. Futures are also faced with high timing and gap risks.
- **Using options for HPF**, we can remove part of the equity risk, retaining the upside for the first 20% and reducing part of the opportunity costs compared to a future-based strategy. However, the upfront premium can be expensive.



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Source BNP Paribas AM, March 2020.

- **Using volatility control**, you can reduce or increase the exposure depending on the market environment. However, depending on the volatility target, the level of protection may be more or less effective. Additionally, this strategy still faces (limited) opportunity costs, and gap and timing risks.

## HEDGING STRATEGY RISK PROFILES

Traditional pay-off profiles vary with the type of instruments used. But, as can be seen in the table overleaf, systematic or recurrent strategies by themselves are limited in terms of effectiveness (by how much they reduce the risk exposure), cost-efficiency (how much overall cost they imply) and risk profile (how they protect and what kind of residual risks remain).

They face a number of potential costs and risks that need to be taken into account when deciding which protection is best adapted to a particular situation:

- **Upfront costs:** How much does the protection cost in terms of premium. This is only applicable to option-based strategies and should be known at inception cost.
- **Opportunity costs:** By how much does the protection reduce the potential upside should the upside be capped – for example, when entering traditional futures or option collar strategies.
- **Timing risk** explains the potential for missing out on beneficial movements in price due to an error in the timing of the hedge. This could harm the value of an investor's portfolio resulting from hedging too early or too late. The general view is that more recurrent hedge revision can help reduce timing risk.
- **Gap risk** refers to a security's price changing from one level to another with no trading in between. Usually, such movements occur when there is severe adverse market stress, which can cause a hedge to be only partially implementable.
- **Roll risk** refers to the risk of entering into new futures and option contracts, similar to the expired ones, due to liquidity constraints. Roll risk tends to become particularly acute during periods of market stress, especially for equity index futures.
- **(Hedge) effectiveness** refers to the reduction in equity risk instigated by a risk management instrument or a hedging strategy. It is often calculated on the basis of extreme events or specific periods of time, with the expectation that a hedged strategy should show an improvement compared to the unhedged ones.
- **(Hedge) cost-efficiency** refers to the impact on the actual or expected return of a risk management instrument or a hedging strategy. In practice, this indicator measures the aggregated impact of upfront and opportunity costs on the overall return and compares it to the reduction in losses due to adverse market movements.
- **Risk / return profile** refers to the amount of return expected for a unit of risk of an instrument or a hedging strategy. It is generally represented by the Return-to-Risk ratio.

### Protection vs Hedging strategies

	Futures	Options	Volatility control
Upfront cost	✓	✓ ✗ *	✓
Opportunity Costs	✗	✓ ✗ *	✓
Timing risk	✗	✗	✗
Gap risks	✗	✓	✗
Roll risk	✗	✗	✗
<hr/>			
Effectiveness	✓	✓	✓
Cost-efficiency	✓	✓	✗
Risk profile	✓	✓	✓

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 Source BNP Paribas AM, March 2020

\* Upfront costs can be reduced by selling calls and foregoing some of the upside but this can at the same time give rise to opportunity costs.

- ✓ Extremely favourable
 ✓ Strongly favourable
 ✓ Favourable
- ✗ Strongly unfavourable
 ✗ Unfavourable

# INNOVATIVE DYNAMIC APPROACHES

## INNOVATIVE STRUCTURES: HYBRID OVERLAY

As we saw in the previous section, **purely systematic or recurrent strategies based on single objectives** (soft floor, hard floor or volatility control strategies) may not always match equity investors' objectives and constraints.

In many cases, a combination of soft floor, hard floor and volatility control strategies improves some or all of the performance and risk metrics mentioned above. The **hybrid overlay** offers a number of advantages. It can:

- Protect different allocations in different ways
- Offer significant diversification benefits (in particular when it comes to minimising opportunity costs)
- Reduce the upfront cost of acquiring options and the opportunity costs and pro-cyclicality of using futures; and
- Increase the flexibility and dynamic features of a risk overlay.

## INNOVATIVE FEATURES

There is a wide array of risk overlay features that can be added to a given hedging structure to optimise both the risk budget and the asset owners' investment objectives, and to minimise upfront and opportunity costs.

### Risk budgeting

When it comes to **risk budgeting**, one can reduce two of the main risks impacting overlay strategies:

- Increasing the execution frequency (from once a quarter to once a month) and reducing the traded notional can help limit timing risk.
- Using hybrid structures to reduce **timing and gap risks**.

### Investment objectives

When it comes to investment objectives, it is possible to achieve the expected return by including reset and cash-out avoidance features in the risk overlay structures:

- **Safeguard past performance** by defining a reset policy on a periodic (usually annual) basis, or when the past performance has been sufficiently positive. This approach increases the soft or hard floor. From the moment of the reset, BNP Paribas AM adjusts the risk budget to the agreed annual level.
- **Avoiding cash-out / cash lock** by also splitting the risk budget between a soft floor (using futures) and a hard floor (protected with options) ensuring that the strategy maintains exposure to equities as well as effective (and cost-efficient) future-based protection (especially at the inception of the mandate). Although this split may lead to slightly higher overall governance and upfront premium costs, it offers a shield against a cash-out / cash lock and maintains the upside potential.

## Cost structure

When it comes to **costs**, it is possible to minimise upfront and opportunity costs by including additional features in the risk overlay structures:

- HFP relying on options can have high absolute **upfront premium cost**, depending on protection and implied volatility levels. These can become a drag on returns.
  - **Monetising the upside and selling downside protection.** The premium cost paid to acquire equity put options can be fully or partially offset by out-of-the-money selling call options and / or far out-of-the-money put options.
  - **Splitting the risk budget** between equity index options and futures to capture diversification benefits from the two types of instruments reduces the amount of put options that need to be acquired and therefore the upfront protection cost. This saving can be achieved by either increasing the strike level for a part of the notional amount hedged or by maintaining the strike level for a larger notional amount.
- **Opportunity costs** can be high when using pro-cyclical instruments such as futures and / or when upside is monetised to reduce the upfront cost in the case of options. To reduce these risks, we have supplemented our structuring approach with the following methods.
  - **Splitting the risk budget** also makes available diversification benefits between the two types of risk management instruments and helps mitigate opportunity costs. Fewer equity index futures are required as the equity option contributes to the overall protection level.
  - **Using forward-looking risk triggers** (to help decide when to monetise upside to raise premium) can help reduce opportunity costs. These triggers can apply, for example, to the strike levels of the calls sold to generate additional premium and reduce the upfront protection costs. Deciding when to sell the calls requires the use of forward-looking risk triggers and valuation rules. The process followed to define these forward-looking risk triggers and valuation rules is described in the next section, dedicated to our proprietary QuantNow's equity market indicators.
  - **Assessing the optimal call strikes:** We have also undertaken a historical analysis of call strikes that support the forward-looking trigger assessment and that aim at further minimising the risk of being exercised, maximising the premium in-take (referred to as CapCall<sup>1</sup>). It is interesting to note that this analysis covers both a maximum and a minimum strike level.

## Implementation approach

From an implementation standpoint, we move from passive systematic and dynamic **to systematic / dynamic hedging** where:

- The hedge is in place for a fixed period and the protection can be updated during that period.
- The protection is structured around the use of both futures and options and of conditional call selling.
- A typical example would be a futures-based protection with a floor at 85% of market levels and a Put-Spread Collar with a strike set at 80%<sup>2</sup> of market levels, reset on a monthly basis with conditional call selling on the basis of QuantNow market signals and following CapCall metrics.

1 The strike of the call is floored and capped so that the unconditional probability of the call ending in the money does not drop below or increase above a predefined level.

2 As explained above, combining futures and options increases the hedge effectiveness. This increase can best be captured by reducing the long-put strike and therefore reducing the upfront premium cost. This is what is at play in the two hybrid solutions where the long put strike of the put-spread collar is lowered from 85% to 80%.

## SPECIAL FOCUS: QUANTNOW

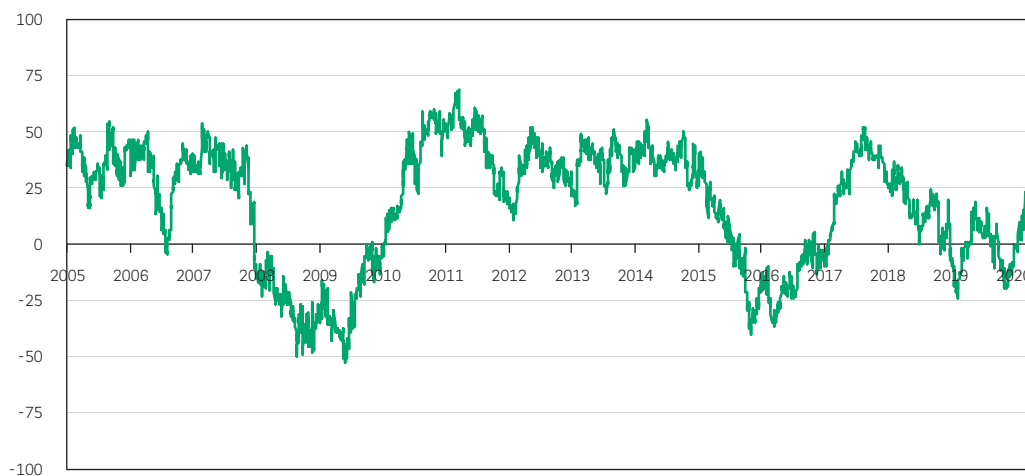
QuantNow is BNP Paribas AM's proprietary range of market timing models; it currently encompasses a model for the US, euro zone and Japanese equity markets. The model gives a signal that lies between +1 and -1 for each of these regions with +1/-1 representing a maximum long/short. Each regional model is comprehensive and contains four sub-models: macro, bottom up, behavioural and valuation. Each sub-model also contains a broad range of indicators. To limit the possibility of overfitting, each indicator contributes equally to the overall signal and the same type of indicator is applied to all three equity regions. In other words, the models exploit indicators that work across different equity markets.

Within the behavioural group, we can identify a sub-group covering risk aversion & positioning. Factors in this sub-group contain indicators such as liquidity, risk variance premium, fragility of the market, etc. This sub-group performs well when it comes to picking up rising sentiment in the market that could lead to over/under-pricing of options. Therefore, we focus on this indicator for one specific decision: if the signal is very positive on equity markets, we write the call option (which we use to finance the put-spread protection) further out of the money: i.e. the strike of the call is further away from current market levels to avoid being exercised and capped out. Similarly, if the signal is very negative about the market, we write the call much closer to the money: i.e. the strike of the call is close to current market levels, to raise more premium.

### Example: US Equity Quant signal

Macro	Bottom-up	Behaviour	Valuation
<ul style="list-style-type: none"> <li>▪ Anticipated labour</li> <li>▪ Output</li> <li>▪ Credit cycle</li> <li>▪ Inflation</li> </ul>	<ul style="list-style-type: none"> <li>▪ Quality</li> <li>▪ Earning momentum</li> </ul>	<ul style="list-style-type: none"> <li>▪ Sentiments</li> <li>▪ Positioning</li> <li>▪ Risk Appetite, ...</li> </ul>	<ul style="list-style-type: none"> <li>▪ Earnings Yield</li> <li>▪ Div Yield (Vol discount)</li> <li>▪ LT interest rates, ...</li> </ul>

### Overall output



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Source BNP Paribas AM, March 2020



## IMPACT OF ALGORITHM FEATURES

The impact of the equity hedging strategies varies with the type of features selected when the algorithm is built. The combination of all of them can provide material additional value to the equity asset owner. In particular, it is worth noting the following benefits:

- **Reduction of actual hedging costs:** Mixing futures and options increases the overall protection level (even though it can make it more difficult to structure a HFP) and reduces the upfront hedging costs. The risk of cash-out, which is prevalent in futures-based protection, is minimised.
- **Reduction of opportunity costs:** The risk of being capped out or of not participating in a potential upside – especially during a strong rebound – is significantly reduced compared to traditional option and futures-based protection strategies. In some market configurations, and depending on the signal received from QuantNow, this risk can be completely removed.
- **The effectiveness of the protection** is greatly enhanced, as both futures and option protection can, in some scenarios, be activated at the same time and the (negative) impact of extreme shocks is lowered.






Finally, thanks to its flexibility, **the effectiveness of the risk overlay approach** can potentially be increased as it enables the asset owner to include in his structuring and execution more discretionary aspects such as (see next section)

- Tactical positioning and
- Fundamental views

### Hybrid hedging strategies

	Reset policy	Cash-out avoidance	Market indicators (QuantNow)	Multiple features
Upfront cost	—	⊗	✓	✓
Opportunity Costs	—	✓	✓	✓
Timing risk	✓	✓	✓	✓
Gap risks	✓	✓	⊗	✓
Roll risk	✓	✓	⊗	✓
Effectiveness	✓	✓	✓	✓
Cost-efficiency	✓	⊗	✓	✓
Risk profile	✓	✓	✓	✓

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Source BNP Paribas AM, March 2020

-  Extremely favourable   
  Strongly favourable   
  Favourable  
 Strongly unfavourable   
  Unfavourable

## IMPACT OF IMPLEMENTATION APPROACHES

The **development and design of an algorithm** is only the first part of the work that a portfolio manager does when formulating an approach to equity protection.

The **components and features** which are managed dynamically under the governance of the asset owner can be used separately or together.

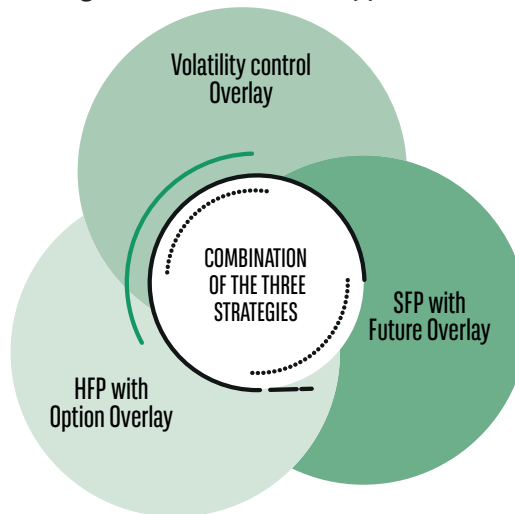
- The type of protection – soft or hard floor
- The risk budget split, and
- The periodicity of resetting the protection or any of the other features & parameters.

The **fundamental and quantitative market views**, which are also considered in a dynamic framework, offer another dimension that can be integrated during implementation upon agreement with the asset owner.

Finally, and this is important to note, this approach can easily be extended to an investors' aggregate **multi-asset portfolio**, with portfolios of fixed income index futures covering government bond and corporate credit allocations as well as proxy hedging for alternative investments.

### From design to implementation

#### Algorithm – Rule-based approach



Structures & features – Improvements on the algorithm	Implementation – Fundamental and quantitative market views
Protection level periodically reset	Anticipative de-/re-risking before rule-based approaches triggered
Cash-out / lock-out avoidance strategies	Financing of the call options not systematic but based on market views
Split Risk Budget	Overriding of the model for tactical considerations
Combination of equity index options and futures in hybrid hedges	

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Source BNP Paribas AM, March 2020

In most cases, we rely on recurrent / dynamic hedging, which aims to provide protection at all times even against unexpected shocks. However, due to its flexibility, our innovative approach can also be structured as **opportunistic** hedging, which is based only on a bear conviction. Operationally, this distinction allows for:

- Better consistency between the hedging structure and the drawdown that needs to be hedged
- A more productive use of the premium spent on protection: by first determining the maximum total amount that can be spent on the protection, we can better calibrate how much we can spend on each option
- Further gains in flexibility, allowing profit to be taken when the market starts to rebound.

In practice, we note that:

- **Recurrent / dynamic hedging** is based on the 'need' to have a reactive form of protection against adverse market scenarios. For instance, if the fund performance has been positive and protection is cheap, or the market seems over-enthusiastic, then it can make sense to spend part of the realised performance to buy protection. To that effect, we have developed an indicator that represents the equity hedging 'need' of each investor. This 'need' depends on various parameters such as past performance, exposure to equities, cheapness of protection or market excesses.
- **Opportunistic hedging** is based on a conviction that equities will likely struggle under what we see as the most probable market scenarios. Our conviction is based on fundamental analysis and market dynamics. We also give a score to the level of our conviction, which helps us further calibrate our hedge.

So, the discretionary implementation approach provides **an additional layer of flexibility** in dealing with various market configurations:

- In a stable / low volatility environment, this enables the equity investor to further reduce the overall hedging costs; while
- In an extremely volatile environment, the equity investor can increase the level of protection and potentially better capture any rebound.

## BACK-TESTING HEDGING STRATEGIES






Five strategies have been back-tested (two traditional and three which include more innovative features) and compared against an equity portfolio that has no protection:

- **Risk overlay @85% floor:** A traditional equity index futures-based protection with an SFP set at 85% of the initial portfolio value level
- **Put-spread collar @85% strike:** A traditional capped zero-premium equity index option-based HFP with the long put strike set at 85% of the initial portfolio value level
- **Put-spread collar @85% strike + QuantNow + CapCall:** A capped equity index option-based protection with a strike set at 85% of the initial portfolio value level, with conditional call selling and change in strike depending on the strength of the market signal
- **Hybrid 1:** A futures-based form of protection with a floor at 85% of market levels and a put-spread collar with a strike set at 80% of market levels, reset on a monthly basis, with conditional call selling on the basis of QuantNow market signals and following CapCall metrics
- **Hybrid 2:** A futures-based form of protection with a floor at 88% of market levels and a put-spread collar with a strike set at 80% of market levels, reset on a monthly basis, with conditional call selling on the basis of QuantNow market signals and following CapCall metrics;

### Traditional vs Hybrid Hedging strategies

	Equity Portfolio	Risk overlay @85% strike	Put Spread @85% strike	Put Spread Coll @85% strike + QuantNow + CapCall	Hybrid 1	Hybrid 2
Upfront cost	NA	✓	✓	✓	✓	✓
Opportunity Costs	NA	✗	✓	✓	✓	✓
Timing risk	NA	✗	✗	✓	✓	✓
Gap risks	NA	✗	✓	✓	✓	✓
Roll risk	NA	✗	✗	✓	✓	✓
Effectiveness	✗	✓	✓	✓	✓	✓
Cost-efficiency	✗	✓	✓	✓	✓	✓
Risk profile	✗	✓	✓	✓	✓	✓

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Source BNP Paribas AM, March 2020

 Extremely favourable
  Strongly favourable
  Favourable
  Strongly unfavourable
  Unfavourable

## EQUITY RISK OVERLAY – BACK-TEST SUMMARY

The back-tests undertaken on the entire portfolio on the basis of the proxy hedging show very good results:

- The amount of risk in an extreme market environment can be significantly reduced
- Return can be enhanced by up to 0.50% per annum over a 15-year period
- Hybrid solutions outperform thanks to an efficient protection strategy.

	Equity portfolio	Risk overlay @85% floor	Put Spread Collar @85% strike	Put Spread Collar @85% strike + QuantNow + CapCall	Hybrid 1 Risk overlay @85% floor applied on Put Spread Collar @80% strike with QuantNow and CapCall	Hybrid 2 Risk overlay @88% floor applied on Put Spread Collar @80% strike with QuantNow and CapCall
Averaged return *	9.3%	8.8%	8.9%	9.3%	9.8%	9.4%
Averaged Excess return over cash	8.1%	7.6%	7.6%	8.1%	8.6%	8.2%
Volatility (annualized, computed on monthly data)	13.7%	11.0%	10.9%	9.9%	9.5%	9.2%
Sharpe Ratio	58.9%	69.0%	70.1%	81.8%	90.2%	88.9%
Return in year 2008	-39.7%	-15.1%	-29.0%	-22.8%	-14.0%	-11.0%
Return in year 2009	40.5%	24.5%	39.0%	40.4%	37.3%	34.5%
Average Opportunity Cost (all years)	0.0%	0.5%	0.5%	0.0%	-0.5%	-0.1%
Average Opportunity Cost (excluding 2008-2009)	0.0%	1.2%	1.2%	1.2%	1.1%	1.5%
1 <sup>st</sup> maximum drawdown	-55.8%	-29.9%	-42.5%	-36.0%	-26.4%	-22.7%
2 <sup>nd</sup> maximum drawdown	-20.6%	-20.4%	-17.5%	-15.2%	-16.0%	-15.8%
3 <sup>rd</sup> maximum drawdown	-18.4%	-17.3%	-15.6%	-14.6%	-15.5%	-14.6%

\* arithmetic average of yearly returns

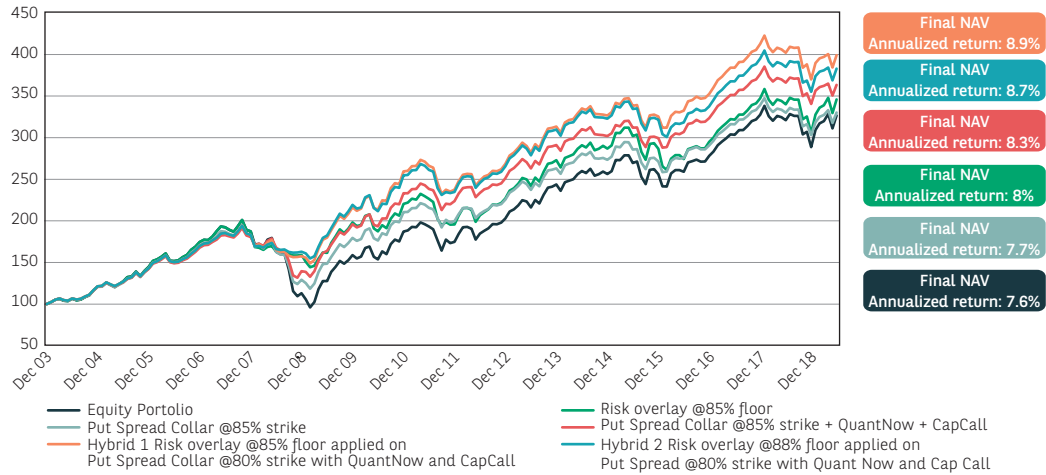
Source BNP Paribas Asset Management and Bloomberg

Back-test over the period January 2014 to June 2019. The back-tests are simulated and are not a guide to future actual performances. BNP Paribas Asset Management doesn't provide any formal capital guarantee. No information given or any term used herein shall be interpreted to provide such a guarantee.

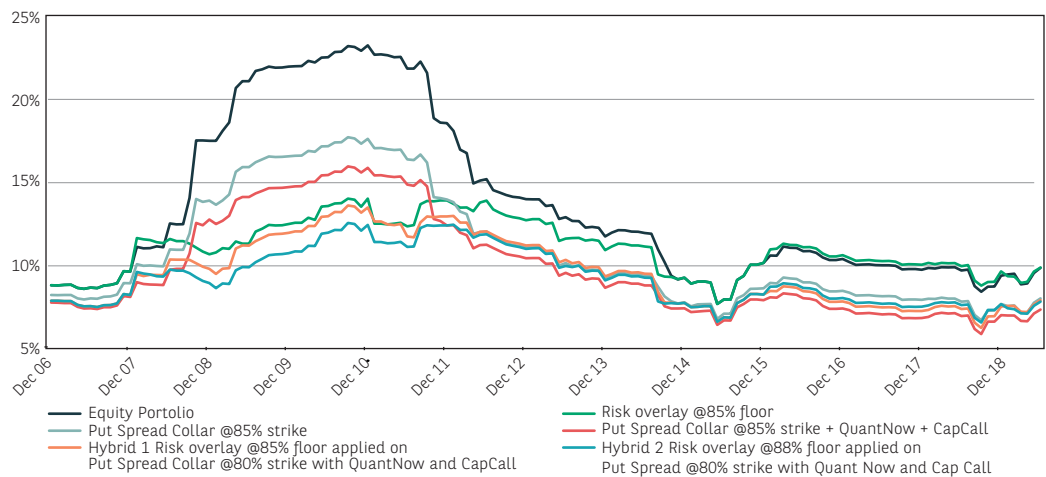
The results reflect performance of a strategy or methodology to historic data. Back-tested performance is developed with the benefit of hindsight and has inherent limitations

## BACK-TESTING HEDGING STRATEGIES

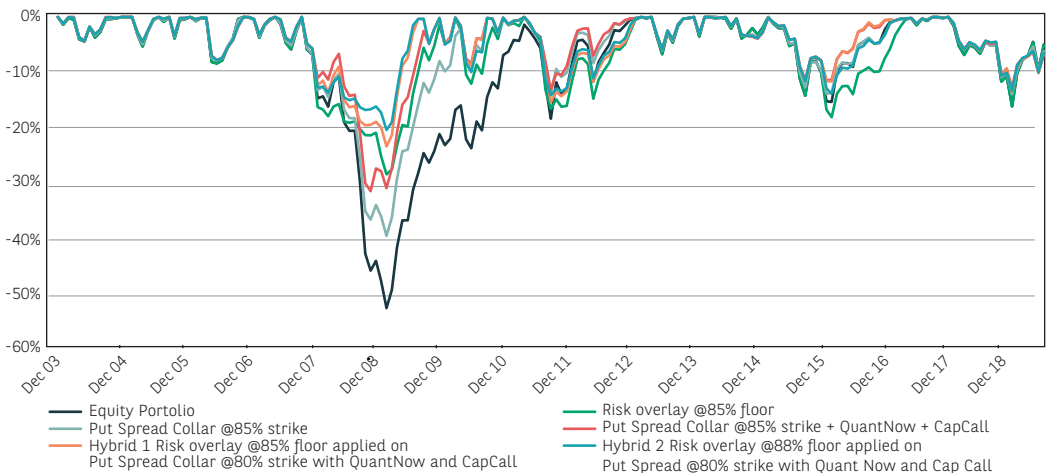
### Comparing performance of the various hedging strategies



### Comparing volatilities of the various hedging strategies



### Comparing drawdowns of the various hedging strategies



Source BNP Paribas Asset Management and Bloomberg  
 Back-test over the period January 2014 to June 2019. The back-tests are simulated and are not a guide to future actual performances. BNP Paribas Asset Management doesn't provide any formal capital guarantee. No information given or any term used herein shall be interpreted to provide such a guarantee. The results reflect performance of a strategy or methodology to historic data. Back-tested performance is developed with the benefit of hindsight and has inherent limitations.

## CONCLUSION



Our innovative hedging strategies aim to bring an array of benefits to the protection of equity portfolios compared to traditional approaches. They include:

- Higher average returns
- Lower volatility
- Lower opportunity costs
- Better protection at times of extreme market stress (such as the Global Financial Crisis); and
- Reduction in timing, gap and cash-out risks.

From an implementation standpoint, they offer a high level of transparency as each component contributes differently to the overall performance of the hedge structure.

Finally, it is important to emphasise that our innovative approach also opens the possibility of discretionary structuring and implementation, which in extreme market environments can materially improve the overall hedge performance.



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## EQUITY RISK OVERLAY – RISKS

- **Equity risk:** The risks associated with investments in equity (and similar instruments) include significant fluctuations in prices, negative information about the issuer or market and the subordination of a company's shares to its bonds. Moreover, these fluctuations are often amplified in the short term. The risk that one or more companies suffer a downturn or fail to grow can have a negative impact on the performance of the overall portfolio at a given time. There is no guarantee that investors will see an appreciation in value. The value of investments and the income they generate may go down as well as up and it is possible that investors will not recover their initial investment. There is no guarantee that the investment objective will actually be achieved.
- **Derivative risk:** In order to hedge (hedging derivative investments strategy) and/or to leverage investment risk, institutional investors can use derivative investments' techniques and instruments under the circumstances set forth in Appendices 1 and 2 of the prospectus (in particular, warrants on securities, agreements regarding the exchange of securities, rates, currencies, inflation, volatility and other financial derivative instruments, contracts for difference [CFDs], credit default swaps [CDSs], futures and options on securities, rates or futures). The investor's attention is drawn to the fact that these financial derivative instruments include leveraging. Because of this, the volatility of these sub-funds is increased.
- **Basis risk:** By their nature, there is a difference between the actual equity exposure and the option underlying equity indices.
- **Liquidity risk:** There is a risk that derivatives may become illiquid if the economic or market situation deteriorates; consequently

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