



Navigating changing
market conditions
through an adaptive
approach to portfolio
construction

Savernake Management Limited

An evergreen investment proposition

Executive Summary

Overview

- Over the past decade, the accelerating pace of strategy decay and changes to market conditions, predominantly due to technological advances, has made it increasingly challenging for CTAs to generate consistent returns.
- We address this issue by utilising a sophisticated self learning portfolio system, combined with access to thousands of potential trading strategies, to ensure that our clients are always trading the portfolio with the greatest likelihood of future returns.
- This allows us to navigate ever changing market conditions, delivering +30% in returns since inception in 2016.

The Problem

- Modern Portfolio Theory relies on long run historical correlations and does not consider or the fact that market conditions will change over time. This makes traditionally constructed portfolios vulnerable to decay (see page 4 for more information).
- Historically, this decay was relatively slow. However, the rate of decay is increasing as markets are changing more quickly and we believe this problem will only be exacerbated as technology continues to develop.

Our Solution

- Our solution is to take an adaptive approach to portfolio construction, regularly re-allocating and evolving as conditions change.
- We operate a highly sophisticated system which is asset-class agnostic, using neural networks and genetic algorithms to filter trading opportunities, identify alpha generating trades and adapt for changing conditions.
- We combine this with access to a vast library of potential trading strategies which we are constantly expanding through our connections to the wider quant community, offering ongoing access to new and cutting-edge strategies.

Our Edge

- Our portfolio system is continuously self improving and learning. It considers all conditions it has seen to date, across all time windows, and optimises for the conditions that we are experiencing. This ability to dynamically adapt as markets change, and learn from new experiences, is our edge.

About Savernake

Savernake is an Investment Manager specialising in adaptive machine learning.

We employ a **multi-strategy, systematic** trading approach, utilising bespoke technology to allocate across markets and **regularly evolve**.

We have **more than 20 years'** combined experience in developing trading systems and have been managing external capital under a fully regulated structure since 2016. The core team is predominantly made up of **quantitative analysts** and **computer scientists**, reinforced by an experienced Board of Directors who have operated billion dollar hedge funds and asset managers.

Our investment approach is entirely **asset-class agnostic** and utilises a **vast range of strategy types**, which we are **continually expanding**. Our framework allows us to operate with the R&D capacity of a very large firm without the associated cost base; continually incorporating new, cutting-edge trading strategies, applying **systematic risk management** to ensure that they adhere to our underlying principles.

This results in an enduring trading system that **negates the impact of strategy decay** and adapts to **changing market conditions**.



2006

2007

2012

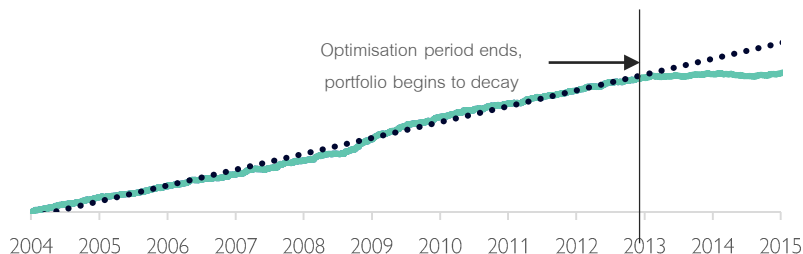
2016

2019

The Strategy Decay Problem

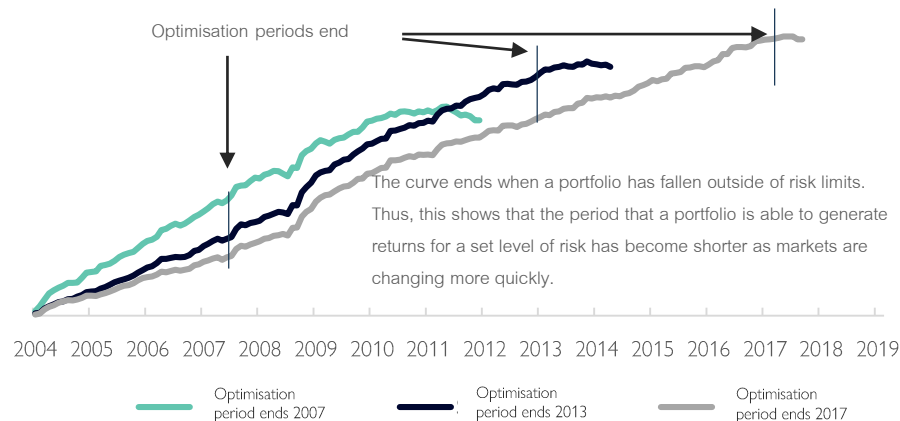
- Traditional portfolio construction is vulnerable to decay over time
- The pace of decay is accelerating due to technological advances

Traditionally, portfolios are constructed by combining a number of uncorrelated, low Sharpe components together at a single point in time, to **optimise the return potential for a given level of risk**. This is the basis of Modern Portfolio Theory (MPT). This approach relies on long run historical correlations, and does not consider that correlations (and therefore risk and return profiles) will change over time or in different market conditions. Using our **out-of-sample forward testing method** (see page 12), we have proved that this approach is prone to rapid decline in performance and increase in risk profile as conditions, and therefore correlations, change. This is known as **decay**:



Historically, decay was relatively slow. However, the **rate of decay is increasing as conditions change more rapidly** (due, in part, to the prevalence of technology).

Where a portfolio that was optimised in 2007 would not begin to decay until around 3 years later, in more recent years we are seeing signs of decay within as little as **6-12 months from implementation**. The chart below demonstrates this by showing how the period between the end of an optimisation period and the point when a strategy begins to decay has decreased over time:



In addition, traditional methods of combining low Sharpe components, rather than identifying the right components for the conditions (as our system does) means that **adapting to rapidly changing market conditions is more difficult for traditional CTAs**.

Our Solution

- Our solution is an adaptive approach to portfolio construction
- We use genetic algorithms and neural networks to increase our speed of adaptation and remove human bias

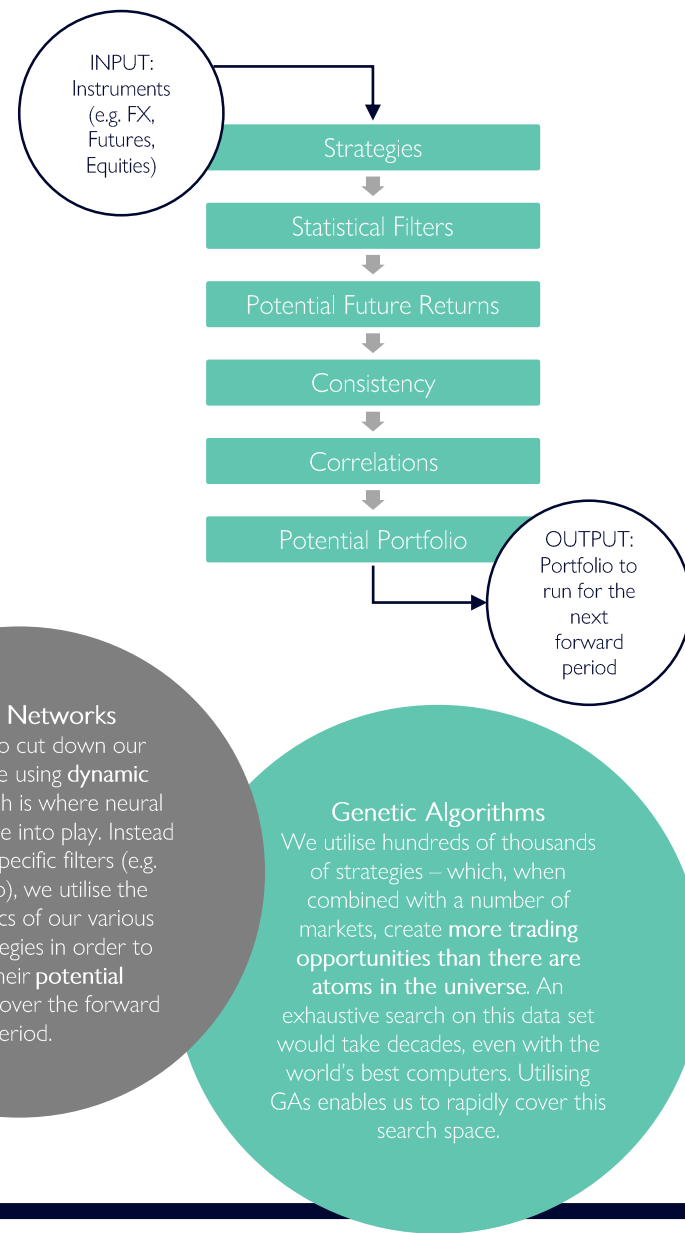
At the core of our portfolio selection and prediction system is our Portfolio Builder.

It is this component that provides us with our competitive advantage by enabling us to continually adapt to changing market conditions, continuously self-learning and improving.

Our portfolio builder reviews all the profitable strategies that are available to it at a point in time, and applies an initial filter to determine which of these strategies has the greatest probability of forward return. It then utilises genetics to combine these strategies into a portfolio.

The system then changes and adapts based on what it learnt from the previous period, applying this knowledge to the next forward period's prediction methodology in order to continually improve.

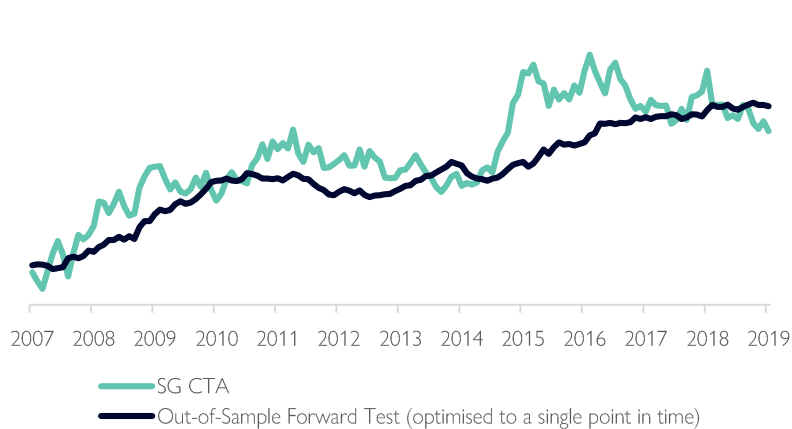
It is our portfolio builder's ability to combine these strategies into an optimal portfolio and evolve increasingly rapidly over time that sets us apart from others in the industry and makes our investment proposition truly evergreen.



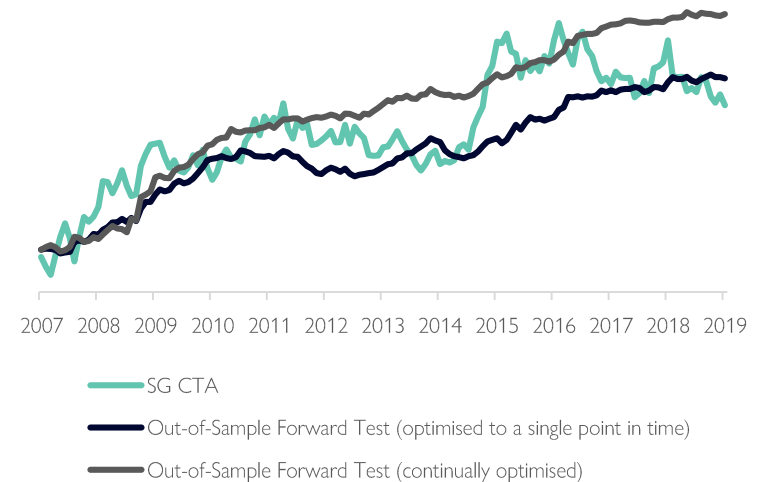
Our Edge

- We rapidly adapt to changing conditions and protect against decay
- This allows us to navigate ever changing conditions, learning along the way

The impact of this strategy decay is visible in CTA returns over the past few years. We can replicate a return curve similar to that of the SG CTA index by optimising to a single point in time (in this case, 2007) and then running this portfolio forward for a number of years:



However, if, rather than optimising to this single point or a given set of conditions, we continue to regularly optimise the portfolio, the **return curve continues to improve**. This demonstrates how our investment proposition can continue to **generate alpha** over a long period, **protecting against decay**:



Our portfolio system is continuously self improving and learning. It considers all conditions it has seen to date, across all time windows, and optimises for the conditions that we are experiencing. This ability to dynamically adapt as conditions change, and learn from new experiences, is our edge.

An Evergreen Investment Strategy

Savernake is a forest South East of Marlborough, UK – and is the birthplace of Savernake's CIO and founder, Sam Barry. Savernake forest has the largest concentration of "veteran" trees of any forest in Europe.

A "veteran" tree is one with unique or special traits, making it the perfect metaphor for our bespoke infrastructure.



"The Roots" are our team, incorporating specialists in machine learning and quantitative mathematics.



"The Trunk" is our trading system, the core of our methodology, philosophy and approach.



"The Branches" are our strategies, which we are continually expanding.



"The Leaves" are our returns, non-correlated to typical investments or many major indices.



The Roots: Our Team

At the heart of our trading philosophy is our belief that, by utilising technology, we can create an **enduring system** to generate consistent returns for decades to come.

However, we knew from early on that in order to solve this challenge, we'd need to surround ourselves with **incredibly smart individuals**. Our family tree incorporates a core team of specialists in their field, reinforced by an experienced Board of Directors with global expertise.

The Team

Our core team of five is predominantly made up of computer scientists and quantitative analysts.

Together, we have:

- Over 20 years' experience in machine learning and developing and operating trading systems
- More than a decade of trading experience
- Around 15 years of operational experience in hedge funds, banks and trading firms
- Graduate and post-graduate qualifications in Computer Science, Mathematics and Computational Mathematics from institutions including Manchester University & King's College

We also work closely with Cambridge University's Algorithmic Trading Society:



Cambridge University
Algorithmic Trading Society

Our CIO is frequently invited to speak or write on machine learning techniques for prestigious organisations, and was featured as an expert in the 2017 Parliamentary Finance Review.



Our Board

Our Board of Directors have global experience of managing large hedge funds, asset managers and other organisations.

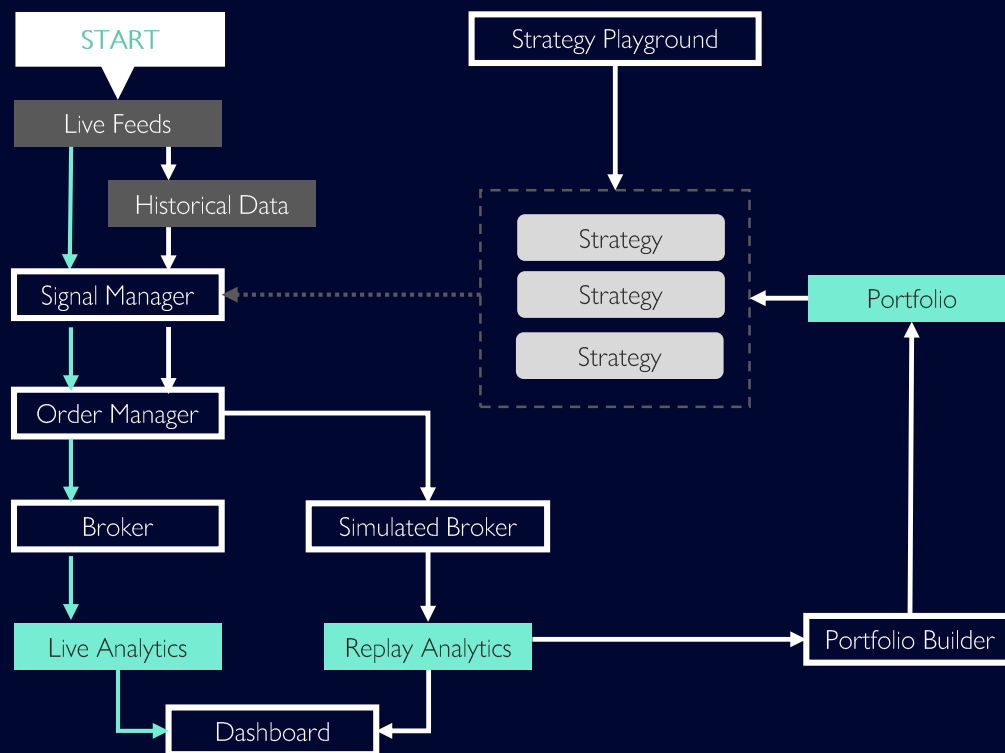
- Founder/CIO of Kicap Management
- Ex Tiger Management MD
- Current NED for JP Morgan Elect, Marex Spectron and the Post Office
- Ex-COO of Virgin Group

The Trunk: Our Bespoke System

This is a simplified representation to illustrate the journey through the live trading path and the research path which informs our portfolio allocation.

There are two “journeys” through our system, both of which begin at live data feeds:

- **The live trading path:** On average, this journey takes less than 10ms from market information to trade execution
- **The research path:** During this journey, data from the live feeds are saved and run through our replay system. The results of this provide the basis for our portfolio builder to select a portfolio to run for the next forward period.



See page 27 for a complete architecture diagram, including our risk management component and alerting system.

The Branches: Strategies

"The branches" are trading strategies.

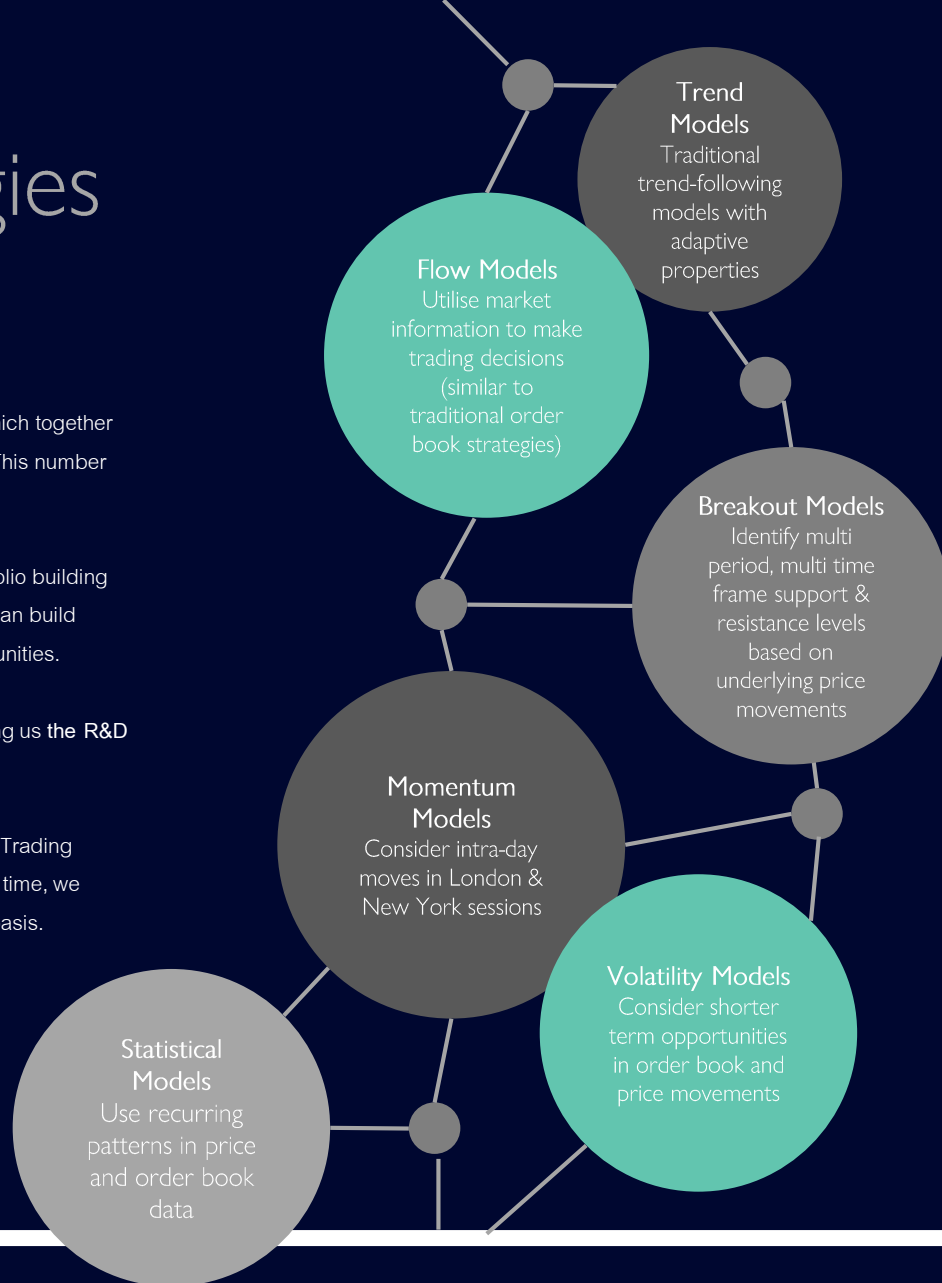
We currently trade six "buckets" of a combination of high and low value strategies¹, which together create hundreds of thousands of trading opportunities for our system to select from. This number increases exponentially as we apply the strategies across multiple instruments.

However, there is no limit to the number of strategies we can incorporate into our portfolio building method. We have developed a framework whereby both internal and external quants can build directly into our expansive library, continually expanding the number of trading opportunities.

This will enable us to utilise strategies from hundreds of alpha-generating quants, giving us the R&D capacity of an extremely large firm without the associated cost base.

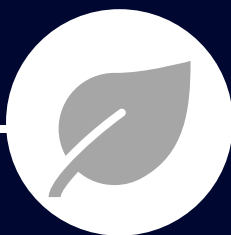
We partner with worldwide quant talent (including Cambridge University's Algorithmic Trading Society) to continually add more and new trading approaches to our proposition. Over time, we expect the system to be selecting from millions of strategies on a daily and intra-day basis.

¹High value strategies typically utilise advanced mathematical and/or unique data sources and are prone to more rapid decay and overcrowding. Low value strategies are more akin to traditional trading strategies, and tend to generate lower returns in very specific trading conditions.



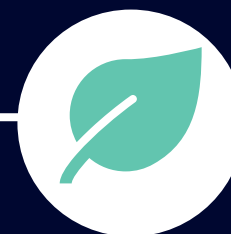
The Leaves: Client Returns

For detailed performance statistics, please refer to our fact sheets or Reporting System.



Award-Winning Performance

Recognition Awards for Excellence received in 2018 and 2019:



Uncorrelated Returns

	1m	3m	6m	From Inception ³
FX Programme	2.40%	6.89%	7.59%	36.05%
Benchmark ²	0.30%	1.89%	0.85%	-
Futures Programme	-3.43%	-5.28%	6.79%	6.92%
Combined Programme	-2.62%	-3.64%	7.01%	36.60%
Benchmark ²	3.55%	3.67%	8.39%	-

²Benchmarks are the Eurekahedge FX Index (FX) and the SG CTA Index (Futures/Combined).

³FX programme inception January 2016, Futures programme inception August 2018.

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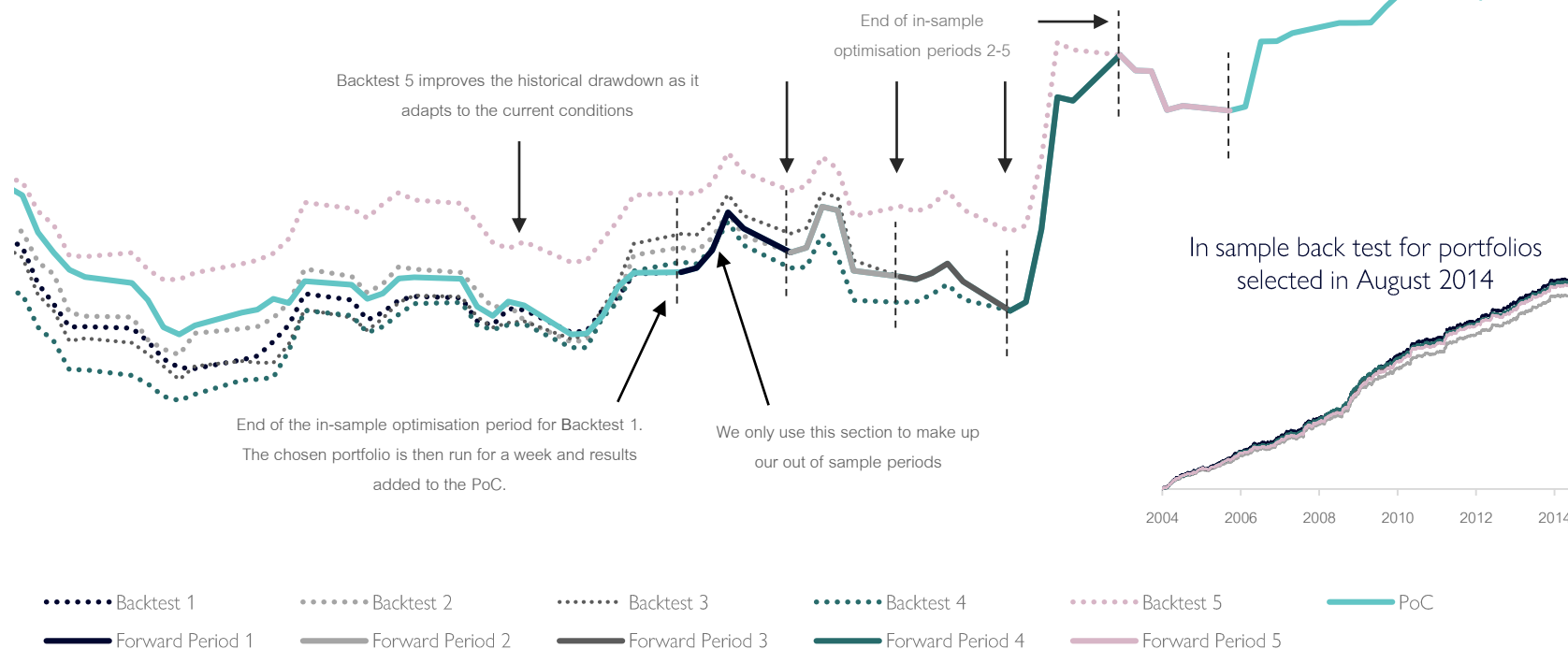
Out-of-Sample Forward Testing

In order to avoid the many pitfalls of back testing (for example, curve fitting) we use an **out-of-sample forward test process** to enable us to **record accurate simulated performance**. In order to do this, we run a series of backtests and extend them beyond their in-sample optimisation periods in order to test the system in periods where it does not have information.

We only record the results from this forward period.

Proof of Concept ("PoC")

PoC refers to the final test, generated by running each sample backtest beyond its optimisation period and combining the results.

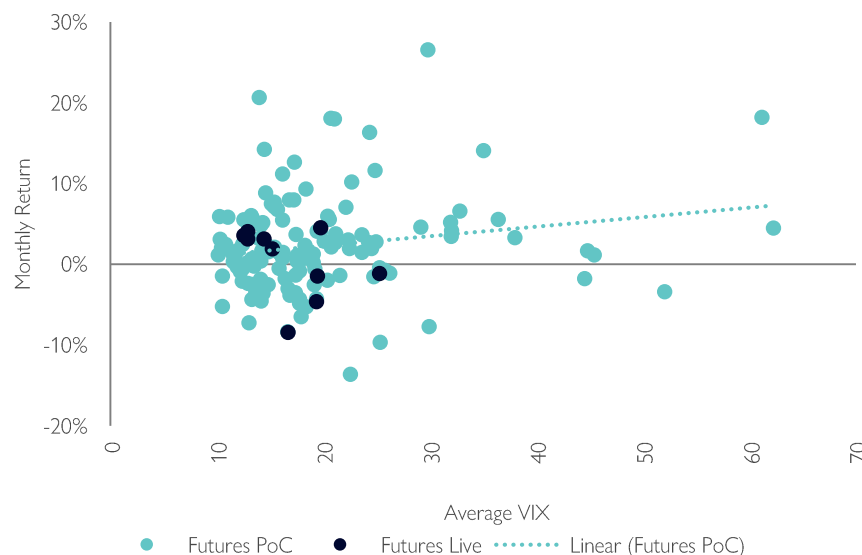
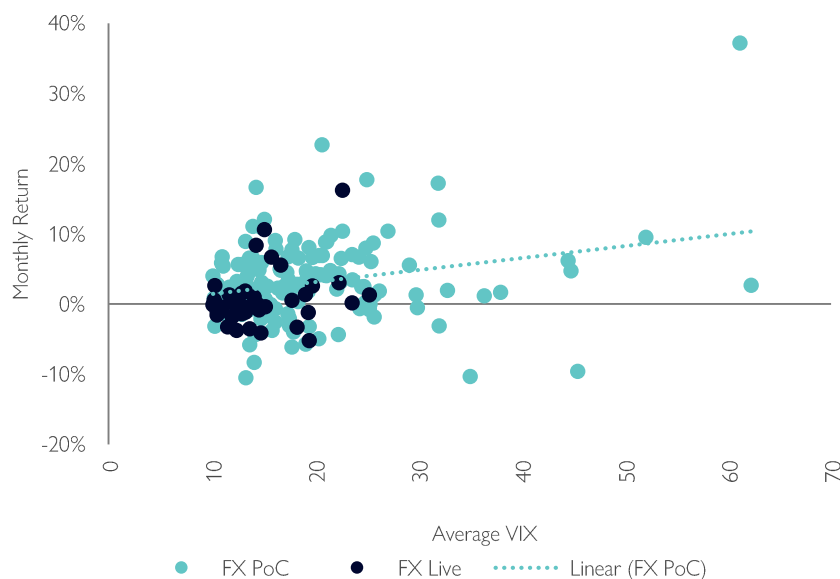


Correlation Profile:

Short-term correlation to the VIX

It is easier to generate returns when markets are moving, especially when considering risk and trading costs. Thus, our systems tend to be “long vol” as a natural consequence of the portfolio builder’s strategy selection. This could change over time depending on market conditions, but is likely to remain a key characterisation of our portfolios.

Correlation to the VIX	
FX	Futures
0.260	0.183



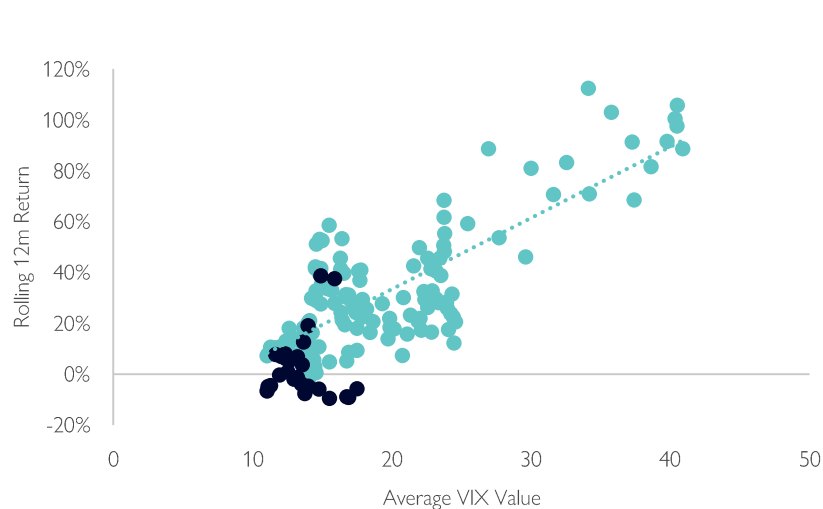
All data is correct as of May 2019.

Correlation Profile:

12-month rolling correlation to the VIX

The correlation to volatility holds over the long and short term, which enables our system to generate returns in both short term and longer term cycles.

Correlation to the VIX	
FX	Futures
0.800	0.477



● FX PoC Rolling 12m Return ● Live FX Rolling 12m Return
 Linear (FX PoC Rolling 12m Return)



● Futures PoC Rolling 12m Return Linear (Futures PoC Rolling 12m Return)

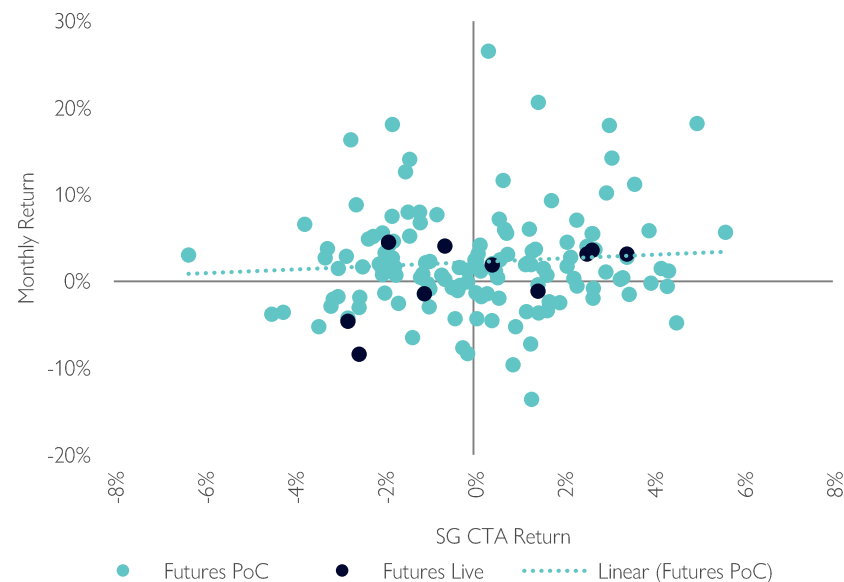
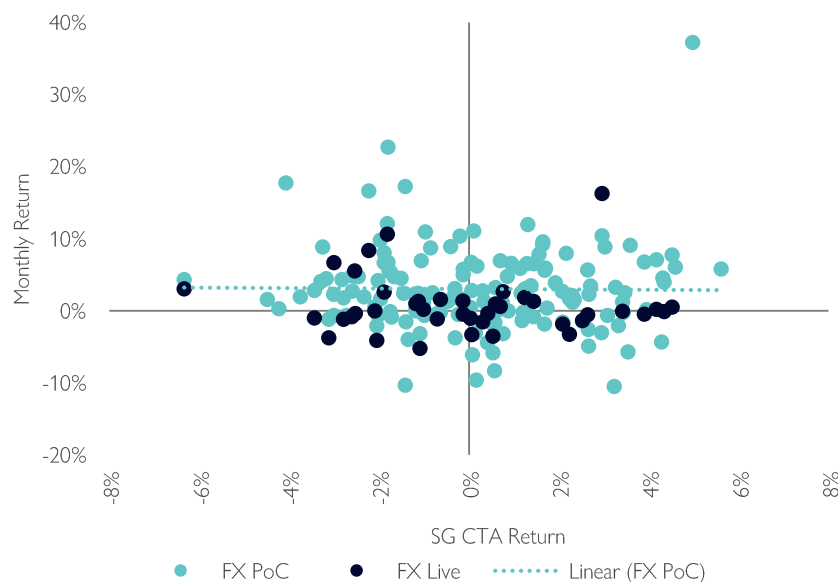
All data is correct as of May 2019 Live Futures data not presented due to insufficient data points.

Correlation Profile:

Correlation to the SocGen CTA Index

Correlation to the SG CTA Index	
FX	Futures
-0.012	0.081

Over the past year or two, many CTAs have taken a specific stance in response to recent market conditions, e.g. adding mean reversion strategies in low volatility markets. As our asset class and strategy agnostic approach flexes its approach and utilises a variety of trading styles, we remain uncorrelated to other CTAs as we do not favour a specific type of strategy nor make any discretionary judgements. This makes our programmes great additions to portfolios with long CTA exposure.



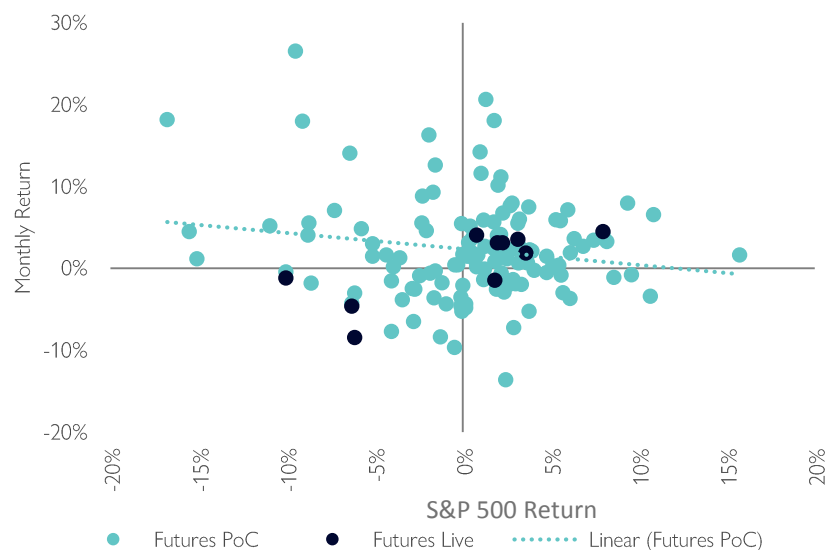
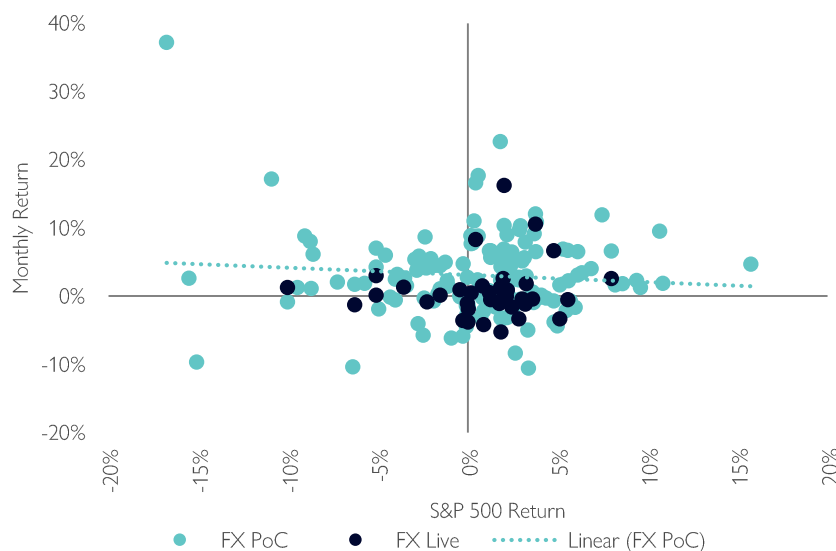
All data is correct as of May 2019.

Correlation Profile:

Correlation to the S&P500

Correlation to the S&P500	
FX	Futures
-0.092	0.167

Due to our ability to trade multiple markets (many of which are either uncorrelated or negatively correlated to the S&P500), we are typically uncorrelated overall. This makes our programmes great additions to portfolios with long equity exposure.

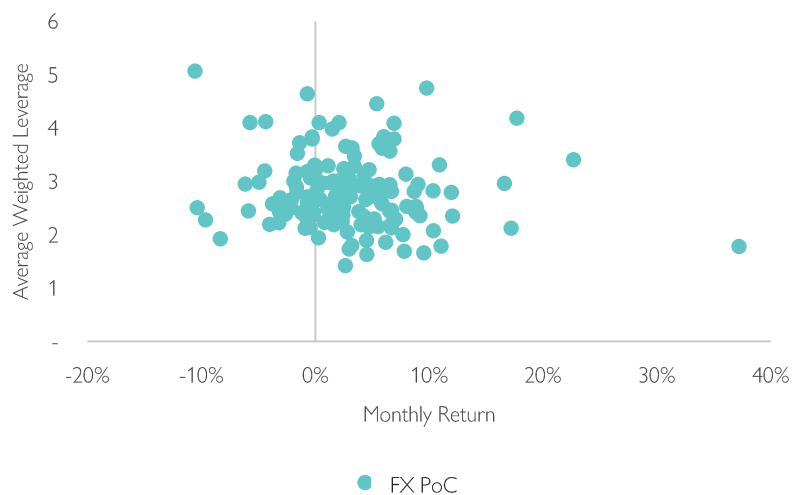


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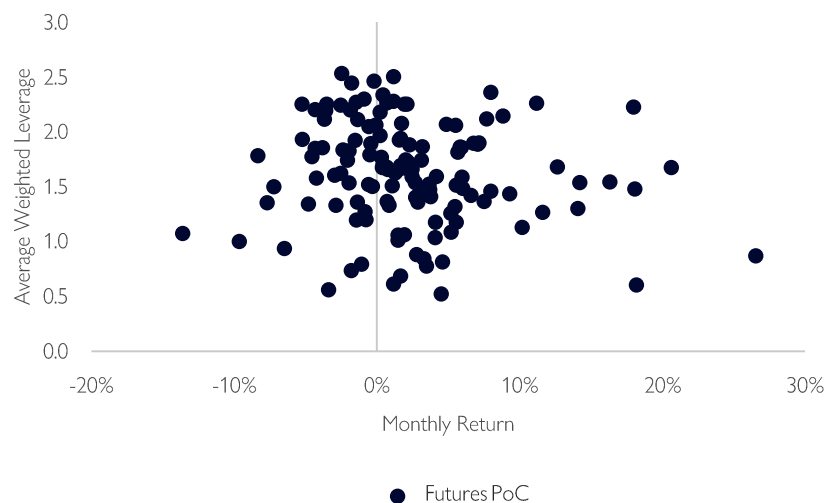
Leverage Profile

In both programmes, the system will reduce leverage during periods of volatility as less risk is required in order to capture returns.

FX Average Leverage



Futures Average Leverage

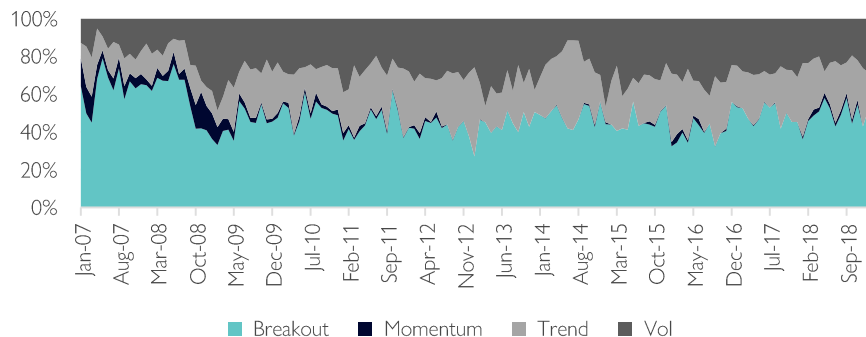


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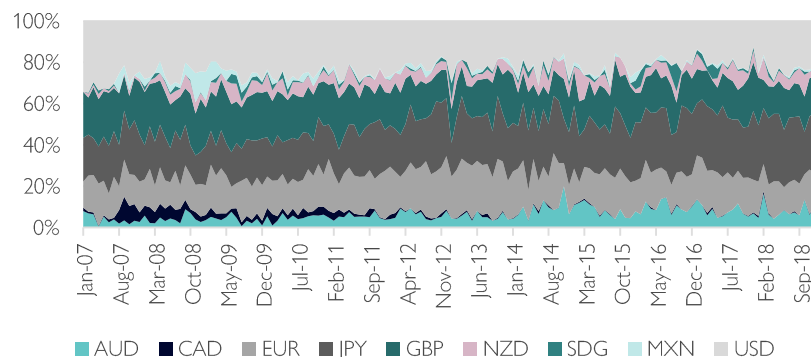
Allocation Profile Examples

NB: These are examples and will change over time as we add more strategies and instruments.

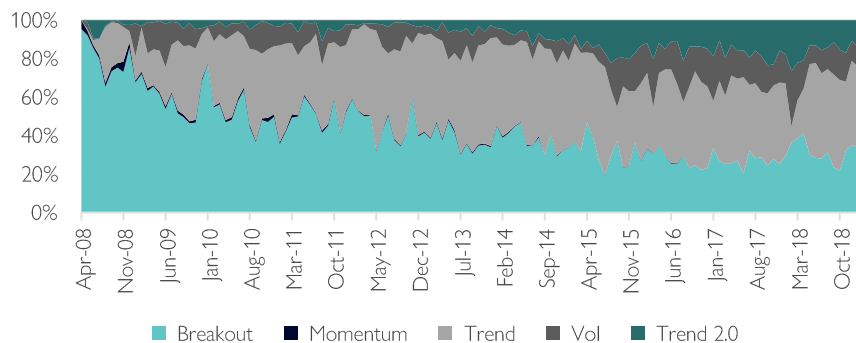
FX: Average Weighted Leverage: Bucket Allocation



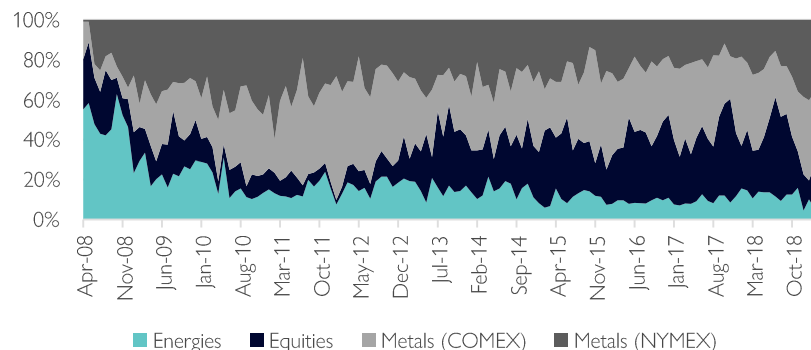
FX: Average Weighted Factor Exposure



Futures: Average Weighted Leverage: Bucket Allocation



Futures: Average Weighted Factor Exposure



Systematic Risk Management

We take a multi-layered approach to risk management, which is 100% systematic with 24 hour manual oversight. Our standard programmes have predetermined risk levels for every strategy, trade and instrument, which are actively managed and monitored on every tick. We can also apply specific risk parameters to individual accounts in order to reflect different clients' preferences.

- Layer 1: Portfolio Builder – In our portfolio builder, we apply leverage and volatility limits, optimising the reward to risk ratio in order to maximise return and return consistency for a level of risk.
- Layer 2: Exposure Limits – We apply further protection by limiting the amount of exposure to a single factor, strategy or 'bucket' of strategies.
- Layer 3: Stop Losses/Risk Rules – We have hard stop losses and risk rules, for example to cap losses at a maximum daily drawdown, or max loss per strategy.
- Layer 4: Operational Risk Management – We have resilient architecture with fail safes covering everything from execution management to server failures and catastrophic events.
- Layer 5: Alert System – Although our system manages risk entirely systematically, as a backstop we have an in-built alert system which issues warnings if we are approaching a risk limit, or if there is a problem with the system or a counterparty.

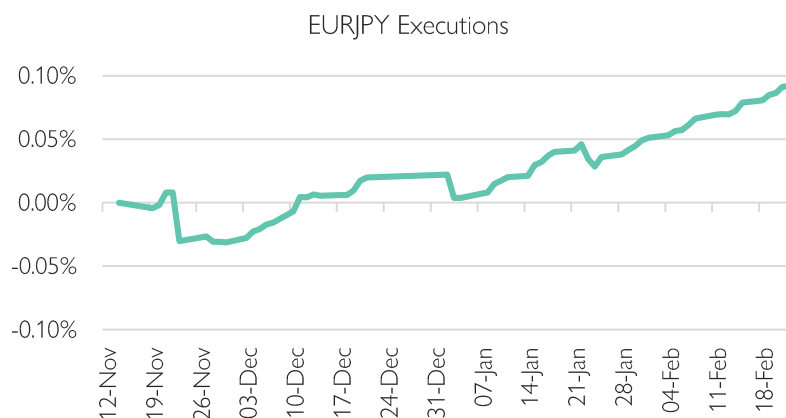


Integrity & Accuracy

Execution Accuracy

We have dedicated analytics and resources focused on ensuring we are executing as accurately as possible. We then utilise this information to capture maximum upside out of every trade by optimising our execution algorithms for the specific instrument, time of day, strategy, entry point, market and factor.

Below is an example of how our instruments can **increase the upside achieved** from specific instruments over time:



Data Integrity

We use the highest fidelity data we can access (typically **real time tick level data**).

We cross validate and clean our data using a number of different data sources from a number of different providers to **ensure maximum integrity**.

We then carry out a thorough data cleaning process:



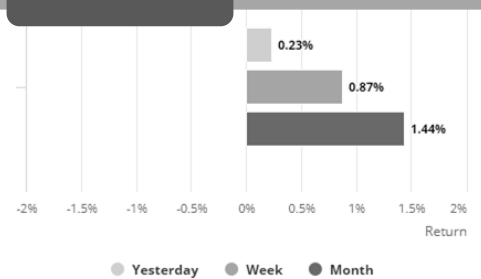
Real-Time Transparency

We believe you should have full access to monitor your investments in real time.

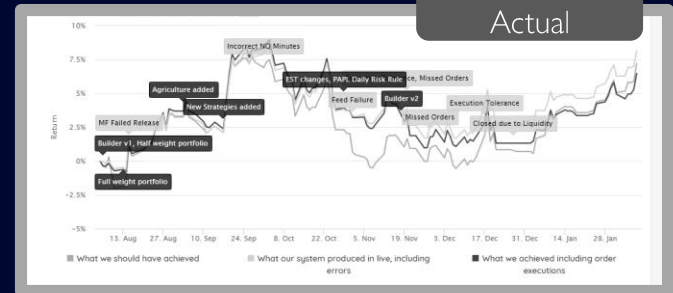
We have developed a **proprietary Reporting System** and Analytics Suite available to all clients, which provides real time information including:

- Daily, weekly, monthly and YTD performance figures
- Leverage & return statistics by instrument and strategy bucket
- A full trade list detailing positions, sizes, volume, leverage, duration, entry time and return
- Daily and monthly growth and drawdown charts
- Return and trade statistics including VaR, Sharpe, Sortino, Kurtosis and Standard Deviation – all updated in real time
- A breakdown of trades by market, strategy, factor or strategy bucket
- The ability to generate live fact sheets at any time

Performance



Prediction vs Actual



Daily Growth



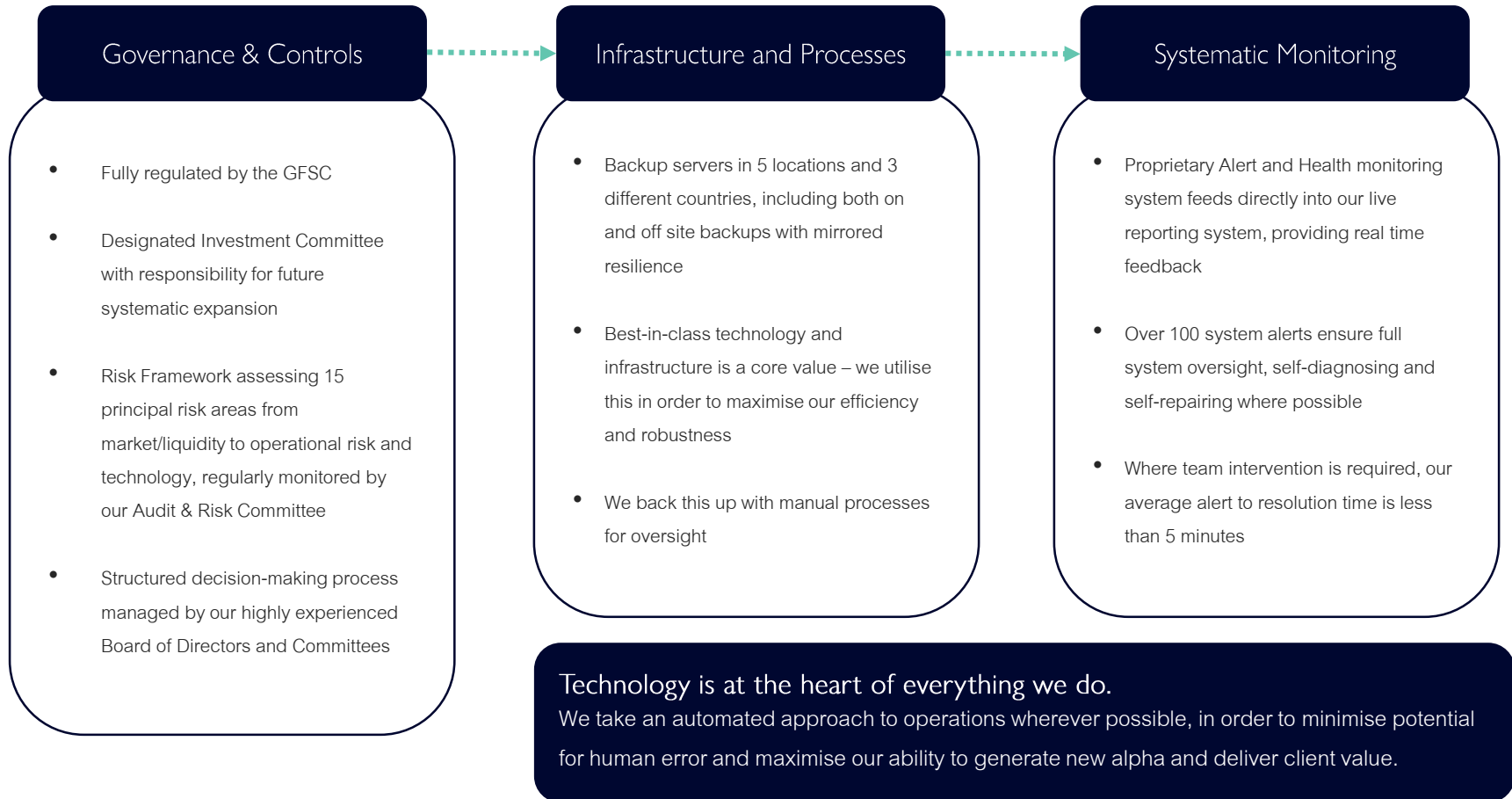
Statistics from Reporting System correct as of February 2019.

Savernake Management Limited

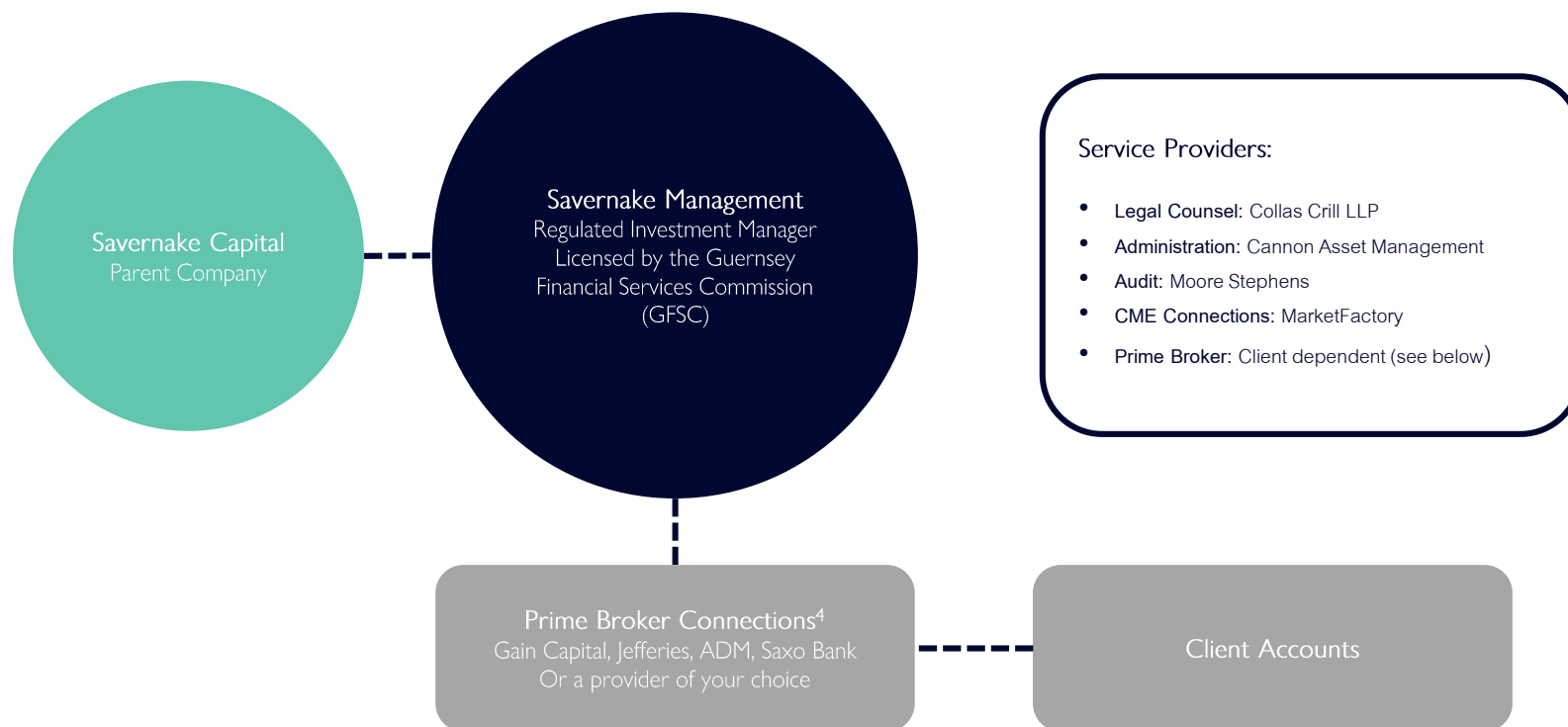
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Operational Excellence



Structure & Service Providers



⁴We can support connections to a number of brokers and liquidity providers, allowing you to select the provider that works best for you.
New connections may be subject to minimum AUM requirements in order to cover our operating costs.

Standard Programmes

Our standard programmes offer **simple, efficient onboarding processes** via brokers we have established relationships with (including Gain Capital, Saxo Bank and ADM) or **your choice of broker**, subject to minimum initial investment.

You will benefit from returns designed to be **uncorrelated to traditional investment streams** and CTAs, and our **standard, pre-determined risk limits**. Your portfolio will include all strategies and instruments in our trading universe, continuously expanding over time:

Futures

Investment Universe⁵: E-mini S&P500/NASDAQ 100, S&PMidCap400, Nikkei/USD, Live Cattle, Lean Hogs, Crude Oil, Natural Gas, Gasoline, NY Harbor ULSD, Platinum, Palladium, Gold, Silver, Copper, EuroDollar Interest Rates, FX Futures

FX

Investment Universe⁵: AUDJPY, AUDNZD, AUDUSD, CADJPY, EURAUD, EURGBP, EURJPY, EURUSD, GBPJPY, GBPUSD, NZDUSD, USDCAD, USDJPY, USDMXN, USDSGD

⁵Investment Universe correct as of February 2019. Instruments will be continually expanded.

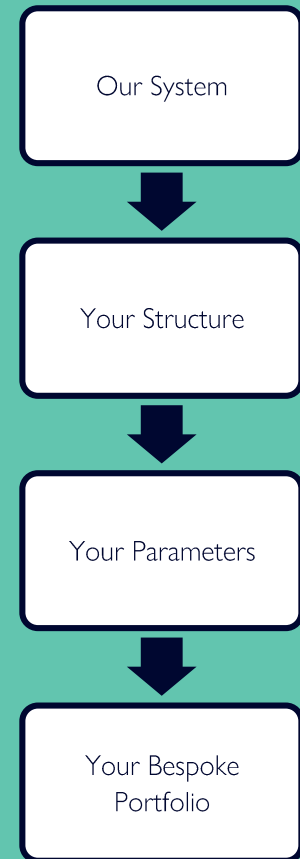
Bespoke Programmes

Our standard programmes offer an extremely strong, uncorrelated return stream to most portfolios. However, our bespoke infrastructure and flexible approach means that in addition to our standard programmes, we can offer investment programmes tailored to your objectives (restricted to large allocations only due to capacity⁶).

You select the structure and parameters you want your account to operate within, including:

- Prime broker
- Risk, leverage and drawdown limits
- Exact instruments and strategies to be traded
- Factor exposures
- Correlations to specific return streams or indices
- Trading exposure (for example, you may choose to hold a % of your account in alternative financial instruments such as T-bills, offering additional security)

We can create portfolios based on your exact requirements, offering maximum flexibility.



⁶Our system is not capacity constrained and we are not limited by AUM capacity constraints. However, bespoke programmes require additional work from our infrastructure and onboarding teams and are therefore subject to minimum AUM levels in order to ensure that they are financially viable for us to run. Exact AUM limits will depend on your specific requirements – our onboarding team can discuss the various options in detail with you.

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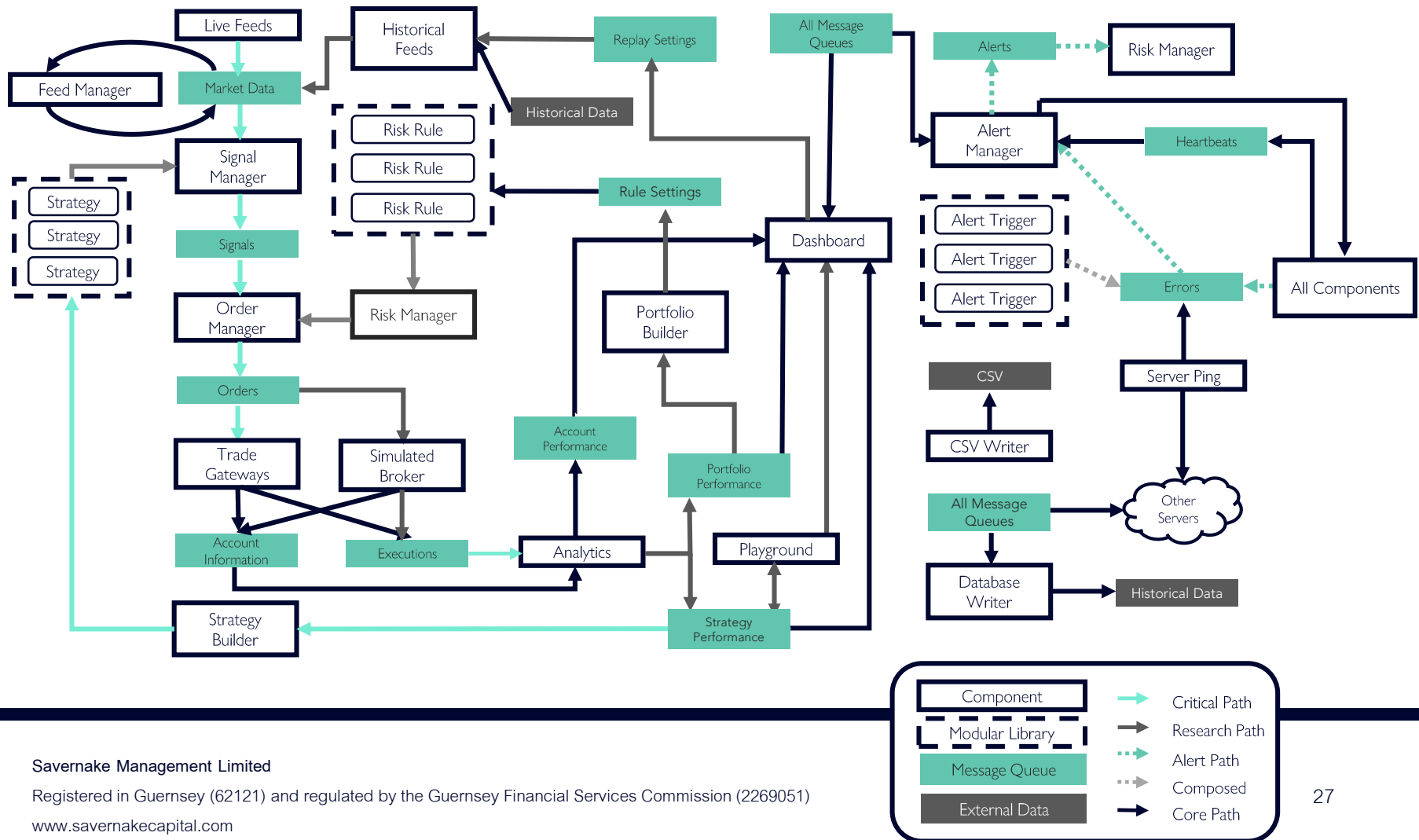
Liquidity

As part of our bespoke offering, we provide connections to your choice of broker.

Current providers include:

- [Gain Capital](#)
- [Jefferies](#)
- [ADM](#)
- [Saxo Bank](#)

Detailed Infrastructure Diagram



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