



CNB Investment Program

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Case for Crypto Investing

At CNB, we firmly believe in the disruptive potential of cryptocurrencies and blockchain technology. We recognize the profound opportunity they hold to revolutionize and transform resilient industries like the financial sector. Crypto has all the characteristics to be regarded as an emerging asset class, steadily gaining recognition as an increasingly vital building block for asset allocators. As institutional interest grows and regulatory frameworks evolve, cryptocurrencies are poised to play a significant role in shaping modern investment strategies and becoming an integral part of diversified portfolios. Institutional acceptance reflects faith in the asset class.

Evolution of the Crypto Market

- ✕ In excess of 10k¹ coins, with a current mkt cap of approx. \$1.24 trillion.
- Only a handful of coins have demonstrated real-world applications.
- Constance emergence of new coins supported by innovative technology.

Challenges and Transformations

Tough 2022 due to flawed models and operations.
Luna crash, FTX insolvency, and Three Arrows Capital exposed sector risks, triggering a painful cleanse of problematic players.
Challenges prompted better regulation, ensuring a secure crypto environment

Resurgence of Cryptocurrency in 2023

So far in 2023, Bitcoin rose around 85% from its 2022 lows. Financial giants (BlackRock, Fidelity, Invesco, WisdomTree among others) filing for BTC ETFs validate the asset class. Standard Chartered forecasts BTC to reach \$120,000 by 2024.² BlackRock² CEO's reference to BTC as 'digital gold' signifies growing institutional acceptance and faith in the asset class.

Crypto as an asset class

Financial institutions' interest signals crypto as emerging asset class with diversification and high return potential. The continuous technological innovation in the sector is likely to drive further growth and opportunities. The increasing regulatory attention leading to a safer and more stable crypto market.



The Sell-Side is getting ready...



In January 2022, MS announced it would be offering its wealthy clients access to cryptocurrency funds.



In February 2022, BNY Mellon announced that it would be providing custody services for cryptocurrencies.



In March 2022, GS announced that it would be launching a new cryptocurrency trading desk.



In April 2022, Citigroup announced that it would be launching a new unit dedicated to cryptocurrency and blockchain.



In June 2022, Standard Chartered announced that it would be launching a new cryptocurrency trading desk.



In July 2022, HSBC announced that it would be opening a research lab to explore the potential of blockchain technology.



In August 2022, Wells Fargo announced that it would be opening a new office dedicated to cryptocurrency and blockchain.



In September 2022, Bank of America announced that it would be launching a new digital asset research team.



J.P.Morgan

In October 2022, JPMorgan Chase announced that it would be launching a new cryptocurrency exchange.



In February 2023, UBS announced that it would be launching a new cryptocurrency trading desk.



The Sell-Side is getting ready...



In March 2023, Deutsche Bank announced that it would be opening a new office dedicated to cryptocurrency and blockchain.



In April 2023, Citigroup announced that it would be launching a new digital asset division.



In May 2023, HSBC announced that it would be partnering with a cryptocurrency exchange to offer its customers access to crypto trading.



In June 2023, EDXM, a new crypto exchange, announced its creation in September with investments from Fidelity, Schwab, Paradigm, Sequoia Capital and Citadel.



... and so is the Buy-Side

BlackRock

"Bitcoin offers some potential diversification benefits, particularly for investors who are already well-invested in traditional assets"
BlackRock's research note June 14, 2023



Vanguard, is *"open-minded"* about the potential of bitcoin and digital asset and Bitcoin *"could be a valuable asset class in the future."*
Vanguard's CIO, Tim Buckley, on CNBC on June 21, 2023.



State Street is exploring the potential of bitcoin and digital assets and it is "looking at how we can offer our clients exposure to this asset class."
State Street's statement on bitcoin was released on June 28, 2023.

Goldman Sachs

Goldman believes bitcoin could be a *"viable investment for some clients."* Bitcoin *"offers some potential benefits, such as its limited supply and its potential to act as a store of value."*
Goldman Sachs' research note on bitcoin was published on July 11, 2023

Julius Bär

Julius Baer believes bitcoin and digital assets could be a *"viable investment for some clients."* and bitcoin *"offers some potential benefits, such as its limited supply and its potential to act as a store of value."* Julius Baer also said that it is *"open-minded"* about the potential of other digital assets, such as Ethereum and XRP. The bank said that it is *"keeping a close eye on these developments and that it is considering how we can offer our clients exposure to this asset class"*
Julius Baer research note published on June 20, 2023

Asset Manager	Suggested Allocation
BlackRock	5%
Vanguard	1%
State Street	2%
Goldman Sachs	1 - 5%
Morgan Stanley	1 - 5%

BlackRock made this suggestion in a research note published on June 14, 2023.
Vanguard made this suggestion in an interview with CNBC on June 21, 2023.
State Street made this suggestion in a statement released on June 28, 2023.
Goldman Sachs made this suggestion in a research note published on July 11, 2023.
Morgan Stanley made this suggestion in an interview with Bloomberg on July 18, 2023.

CNB Digital Fund - Executive Summary

We have launched a Cayman fund as well as a Liechtenstein SICAV.
Both funds will be managed with the same investment process:



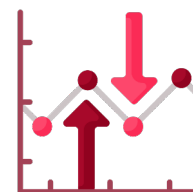
Long/short quantitative strategy trading Bitcoin and Ethereum futures and soon including the largest tokens by market cap and liquidity.



The primary objective is to deliver steady double-digit annual returns while mitigating the volatility associated with the digital asset class.



Our investment strategy employs a variety of quantitative strategies, some harnessing cutting-edge machine learning techniques and others utilizing more traditional quantitative methods.



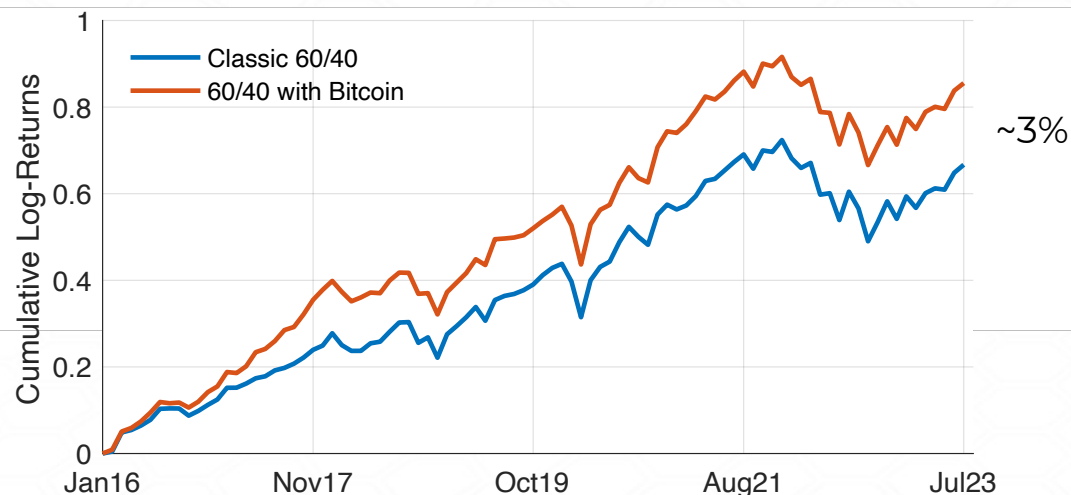
These strategies are geared towards capitalizing on market trends, mean reversion as well as pattern recognition, with a primary focus on short-term trading.



Our strategies are executed in a fully automated manner, leveraging on the strong computer science expertise at the roots of our fintech.

A New Building Block for Asset Allocation

Even a small allocation to crypto can significantly enhance portfolio performance without impacting the long-term portfolio objectives even when negative risks materialize.



The chart shows the monthly returns of the USA 60/40¹ portfolio, monthly rebalanced. It is compared against a similar portfolio with a 3% allocation to Bitcoin spot². The results show a remarked performance improvement and even during Bitcoin sells off, the impact at a portfolio level is limited.

¹ 60% equities (SPY US Equity) 40% fixed income using an equally weighted allocation to SHY US (Treasuries 1 to 3yrs) IEI US (Treasuries 3 to 7yrs) TLT US (Treasuries 20+yrs) LQD US (Investment Grade Bonds) and HYG US (High Yield). The portfolio is rebalanced back to the 60/40 allocation at every month end. No fees were included.

² Prices are sourced by Investing.com

	2016	2017	2018	2019	2020	2021	2022	2023	Ann. Return
60/40	9.2%	14.7%	-2.8%	23.1%	15.7%	16.1%	-16.7%	10.4%	8.6%
59/38 with Bitcoin (3%)	12.0%	26.6%	-5.5%	26.0%	21.2%	18.8%	-18.4%	12.0%	11.5%

Lower Correlations Lead to Greater Diversification

Enhanced portfolio diversification is explained by the lower correlation of Bitcoin with the other asset classes.

	S&P 500	Treasury 1to3	Treasury 3to7	Treasury 20+	Investment Grade	High Yield	Gold	Bitcoin
S&P 500	1	-0.10	-0.16	-0.25	0.29	0.79	0.03	0.23
Treasury 1to3	-0.10	1	0.89	0.59	0.49	0.09	0.39	0.04
Treasury 3to7	-0.16	0.89	1	0.80	0.61	0.07	0.43	0.02
Treasury 20+	-0.25	0.59	0.80	1	0.63	-0.04	0.33	-0.02
Investment Grade	0.29	0.49	0.61	0.63	1	0.52	0.35	0.12
High Yield	0.79	0.09	0.07	-0.04	0.52	1	0.14	0.18
Gold	0.03	0.39	0.43	0.33	0.35	0.14	1	0.11
Bitcoin	0.23	0.04	0.02	-0.02	0.12	0.18	0.11	1

Correlations are computed on the daily returns over the Jan 16 - Jul 23 period.



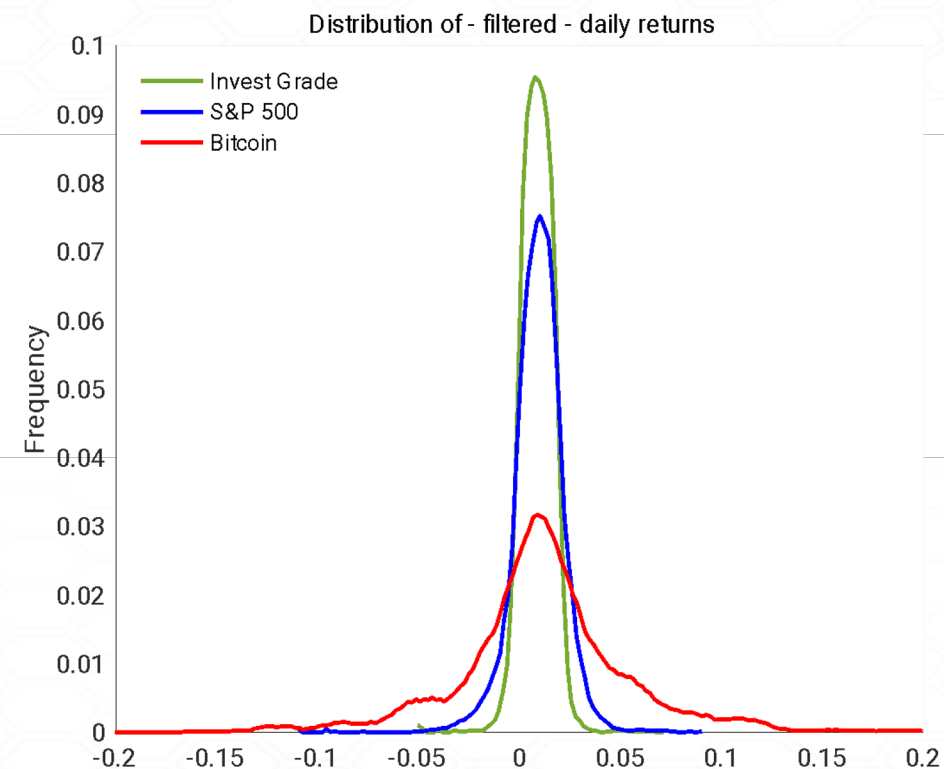
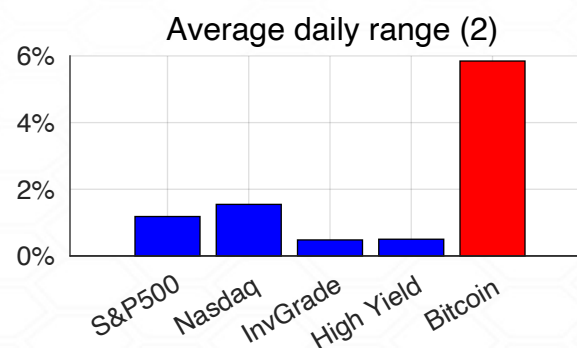
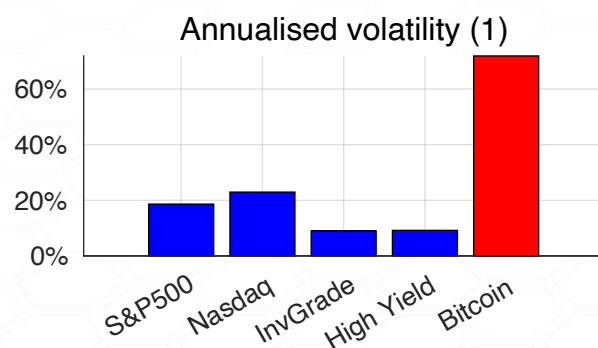
A Volatile Asset Class with a Fat-Tailed Distribution

Bitcoin has a 'flatter' distribution than the S&P500 and the Corporate Bond ETF, suggesting one should expect large movements in either directions.

This poses several challenges:

- Passive approach – excessive downside risk.
- Active approach - lack of fundamental drivers.
- Market neutral strategies – strong trending component.

The high volatility environment is favourable to automated quantitative long/short strategies capable to harvest alpha systematically irrespective of market directions.

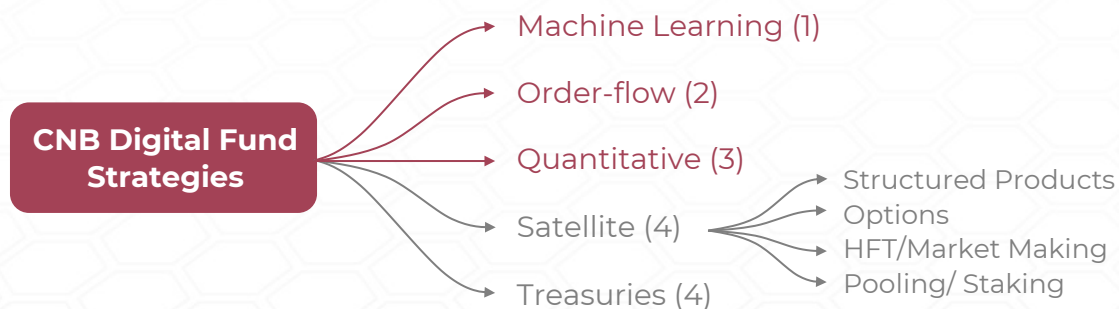
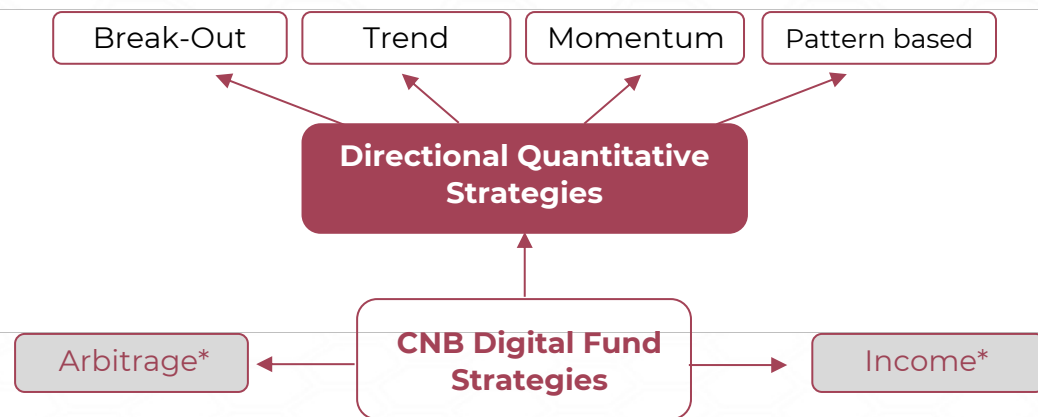


(1) The annualised volatility is computed on the ETFs tracking the indices (except for Bitcoin) and it is based on daily returns.

(2) The daily range is the average ratio between the high and the low. Period considered is May 2015 till July 2023.

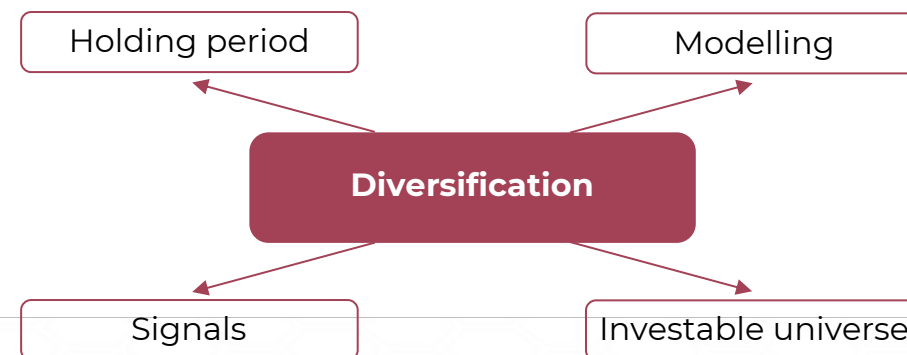
Investment Approach

At C&B we strongly believe a well-diversified investment process (i.e. methodology, signals, process) is an antecedent of high risk-adjusted returns.



* Greyed areas are work in progress

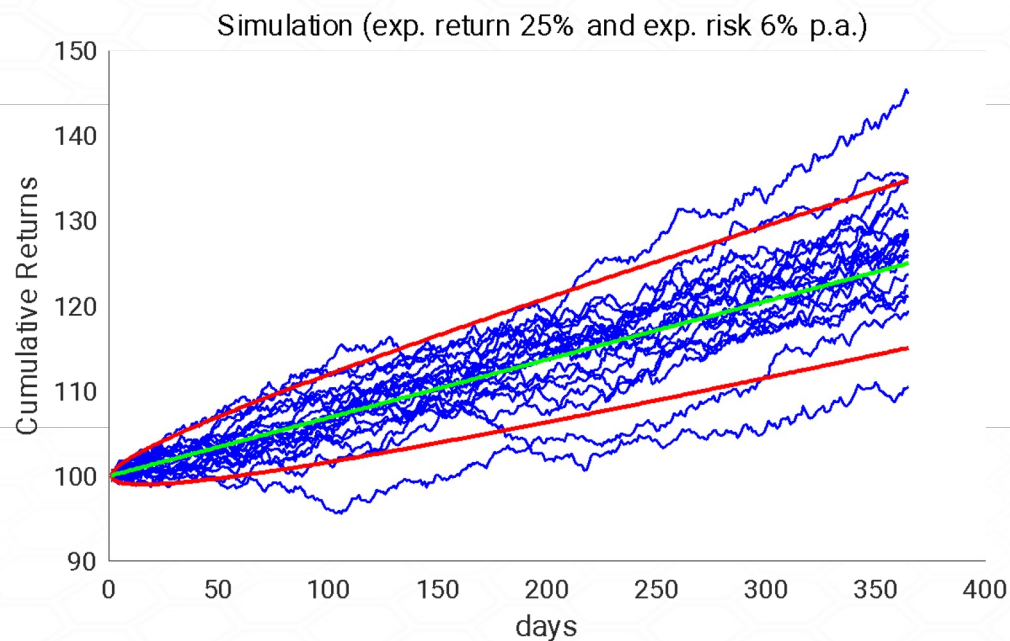
Diversification, to be effective, must be achieved across multiple dimensions:



- (1) Machine Learning models are researched to extract an investment process directly from the data without imposing any conditions.
- (2) Rule-based strategies based on order-flow signals.
- (3) Strategies where the researcher has validated his/her hypothesis on historical data.
- (4) There is a number of additional strategies under consideration and development.

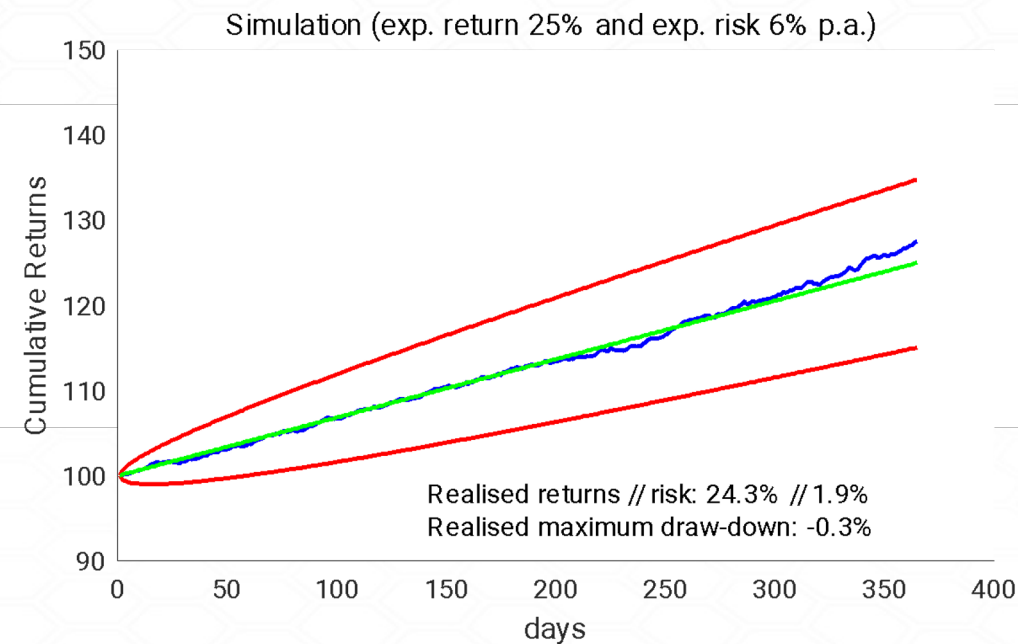


Risk Management - Focusing on Investment Risk



Using a Geometric Brownian motion¹, we simulate the possible path of a strategy expected to deliver an annual return of 25% with a volatility of 6%. The shape of the equity line may question those who thought that an expected Sharpe ratio in excess of 4x may have a straighter line! Using a simple VAR approach, we have drawn the red barbell shape which indicates where we expect such a strategy to be, using a 95% confidence level.

¹ Any variable that varies over time in an uncertain way is said to follow a stochastic process. Stock prices are usually assumed to follow a Weiner process, referred also as Brownian motion. The model has been the backbone for the option pricing model and is widely used in physics and finance for modelling a random behavior that evolves over time: $dS_t = \mu S_t dt + \sigma S_t dW_t$. In very simple terms, the model assumes that future changes in the underlying price depends on a deterministic part, μ , the 'drift' or future return and W_t , the Wiener process or Brownian motion, used to model the future unpredictability (i.e. its volatility)



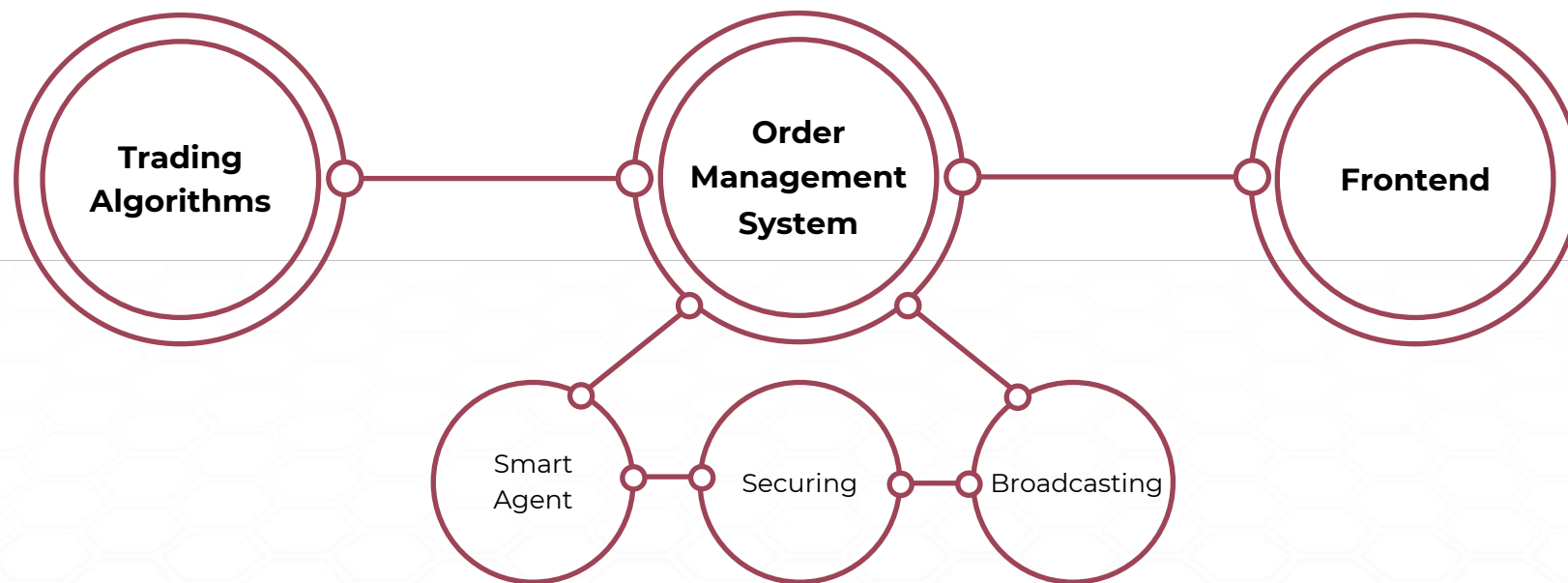
Once the strategies are blended by simply equally weighting the returns on a daily basis, the resulting line appears far more straight. In fact the volatility dropped from 6% to just under 2% and the draw-down to -0.3%. This shows that when multiple strategies, that share the same or similar, long term expected returns and risks and exhibit low correlation (we are assuming that negative correlation is nearly impossible to find) are merged together produce a much smoother and less risky result.



Tech-architecture

We are building a proprietary and state of the art technology which combines prem and cloud services to support the trading activity. We've established a three-stage environment to ensure the secure implementation of the algorithms. These stages include development (e.g. paper trading), pre-production (e.g. live trading on a prop account), and production (e.g. final deployment).

Please refer to the appendix for further explanations.



Our architecture is built upon **microservices principles**, ensuring that distinct systems and sub-systems operate in isolation on separate local or external servers. This approach safeguards against server-related issues that could potentially impact the system's performance

Research & Development

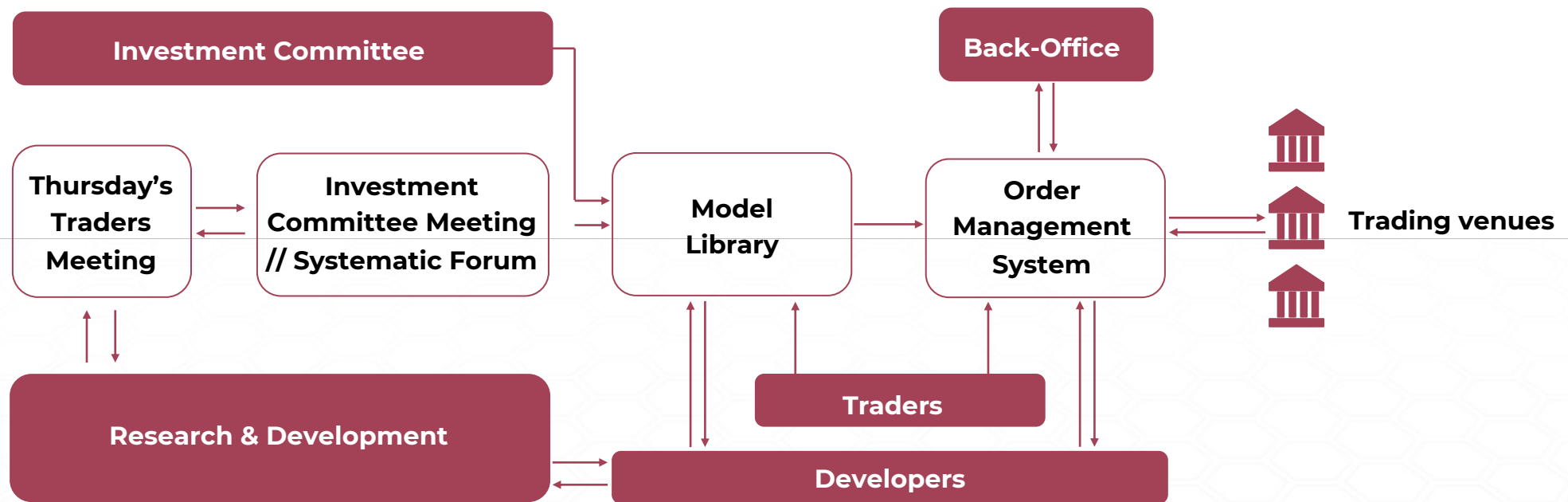
At CNB we carry out quantitative research as if we were tackling any real world data science project. We have established a very robust framework for the development and the maintenance of any of the models used for trading. Any model selected for trading goes through a through validation process.

Data	Source management; cleaning; outlier detection; effective/efficient storage and accessibility.
Features library	Signal constructions.
Features selection	Selection; combination; transformation; reduction.
Modelling	Model selection; hyperparameters optimization; stability checks.
Strategy	Risk management; position sizing.
Deployment	Efficient integration in the proprietary OMS.

Proposition	A trading strategy is presented to the team to gauge interest.
Validation	At least another member of the team has to re-code the strategy from scratch. No-code sharing!
Approval	The Investment Committee approves it at the Systematic Forum and decides on the next steps.
Deployment	The model is hard-coded in the C&B infrastructure and implemented according to the IC guidelines.
Supervision	The model is monitored and assessed relative to its expected risk/returns and its historical track.

Governance Structure

At CNB we have established a very simple but effective governance structure



A glimpse on some of the investment strategies we run in the funds...



The building blocks

The funds are allocated to different investment strategies, and the allocation is determined by the Investment Committee Meeting (ICM), which convenes on a weekly basis. The allocation strategy generally aims to achieve equal weighting among the strategies. However, deviations from equal weighting may occur based on the ICM's assessment of the prevailing market environment.

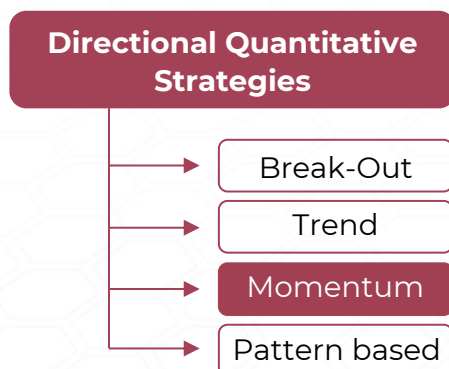
Directional Quantitative Strategies

Style	Name	Underlying	Investment	Frequency	Allocation
Pattern Based	Blend	BTC/ETH	Long-short	Daily	12.5% BTC 5.0% ETH
	Millennium	BTC	Long-short	Daily	20%
	Twilight	ETH	Long only	Weekly	10%
Break-out	Karama	ETH	Long-short	Intraday	15%
	Marasi Dr	BTC/ETH	Long-short	Intraday	7.5% BTC 7.5% ETH
Trend	BWFS	BTC	Long only	Daily	0-15%*
Momentum	Palm Jumeirah	BTC	Long-short	Weekly	22.5%

* When BWFS generates a trading signal it is implemented with a 15% allocation which means all the other trading strategies are scaled down proportionately



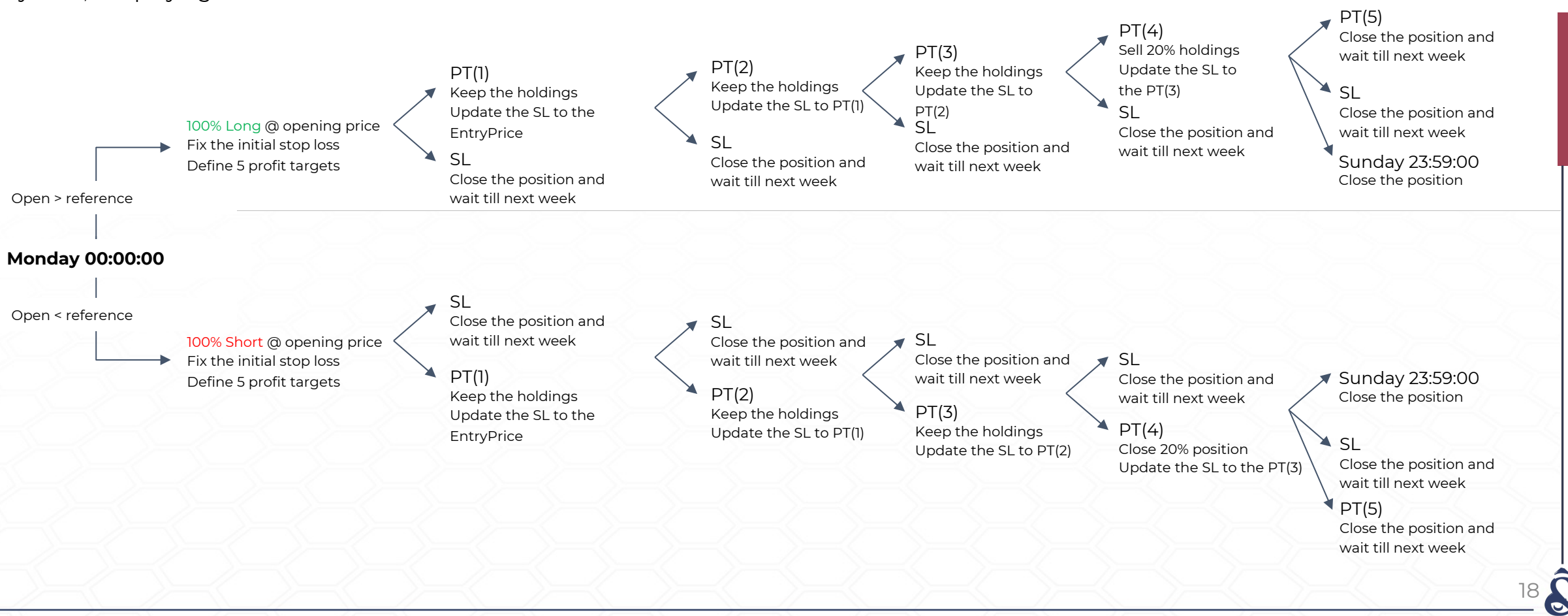
Palm Jumeirah



Strategy	Long-Short
Underlying	BTC Perpetual
Theme	Momentum
Holding Period	Up to a week
Trading Frequency	Once a week (Monday)
Modelling	Rule based
Entry condition	Triggered by time
Exit condition	PTs & SLs
Inputs	Price

Palm Jumeirah

Palm Jumeirah (PJ) is a systematic investment strategy which enters into a long or short position every Monday morning. The position is then managed with different profit targets and stop losses derived from the Pivot Points (PP). While PJ cannot be classified as a truly trend-following system, it is playing momentum.



Palm Jumeirah Simulated Returns

Program	Palm Jumeirah
Inv Analyst:	InvTeam
Launch:	01-Nov-22
Strategy Type:	Long/short, daily rebalanced
Inv Objective:	Generate consistent positive returns across market cycles with a systematic long/short investment process
Description:	Systematic investment strategy based on weekly and monthly references
Assumptions:	Ability to manage PTs and SLs
Exchange:	Binance
Turnover:	NA
Leverage:	0
Currency:	USD

Palm Jumeirah - Cumulative Log returns



Source: Creed & Bear, Binance, Aug-23

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dec	YtD
2020		2.3 %	-6.2 %	20.5 %	-11.5 %	9.1 %	9.8 %	-3.7 %	2.9 %	7.8 %	19.8 %	7.2 %	68.4 %
2021	-8.7 %	10.1 %	-3.6 %	-3.1 %	-1.5 %	23.0 %	7.6 %	-6.4 %	-0.1 %	18.6 %	8.7 %	-8.8 %	34.5 %
2022	1.0 %	15.1 %	10.0 %	-0.6 %	5.8 %	1.6 %	-3.3 %	3.0 %	-0.9 %	5.0 %	0.0 %	-0.7 %	40.7 %
2023	19.5 %	1.8 %	14.6 %	-2.4 %	-1.4 %	15.6 %	-5.7 %	18.9 %					73.9 %

Sharpe ratio: 1.51

Calmar ratio: 2.10

Sortino ratio: 2.70

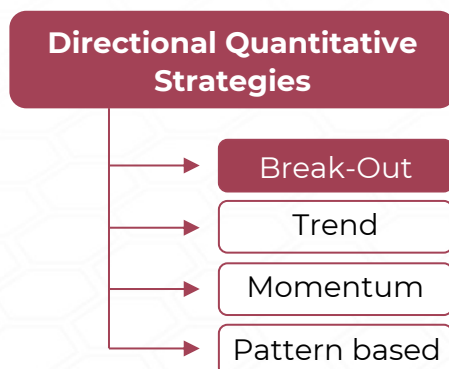
Max DrawDown: -14.76

Source: Creed & Bear, Aug-23. Please note this analysis contains simulated data and does not represent actual performance achieved by investors. **Past performance is not a reliable guide to future performance.** The performance is compounded and computed using daily gross returns in USD gross of execution fees. Management and performance fees will have a negative impact on investment returns.

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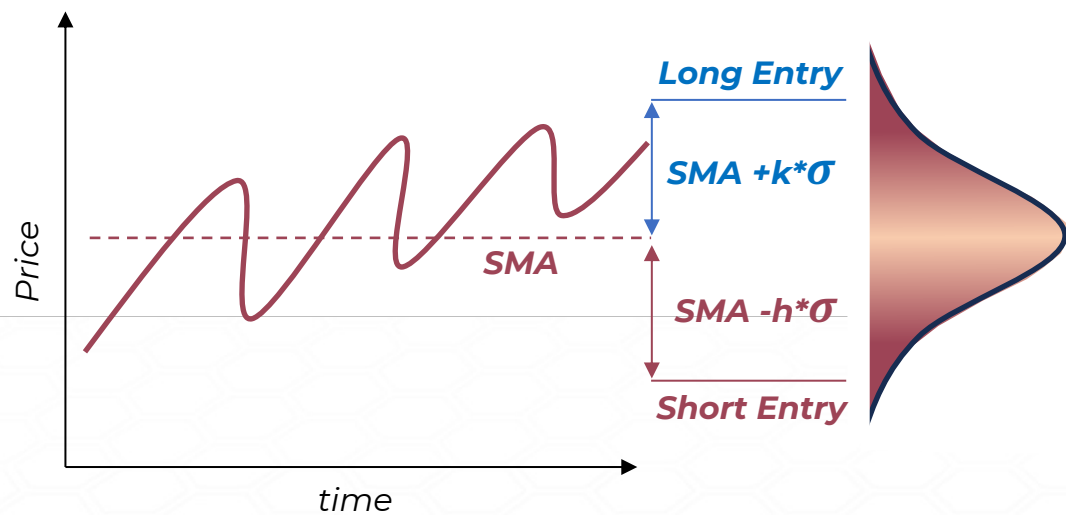


Marasi Drive



Strategy	Long-Short
Underlying	BTC 4h // ETH 1h Perpetual
Theme	Break-out
Holding Period	Intra-day
Trading Frequency	Daily
Modelling	Rule based
Entry condition	Price triggered
Exit condition	PTs & SLs
Inputs	Price

Marasi Drive is an intraday breakout strategy applied to Bitcoin and Ethereum. The model has two different configurations.



The condition to trade has to be satisfied at the end of the candle of the given frequency. The SL and PT are checked within the candle.

	BTCUSDT	ETHUSDT
Frequency	4h	1h
Long Entry	SMA + spread	SMA + spread
Long Stop Loss	SMA - SL	SMA - SL
Long Profit Target	SMA + PT	SMA + PT
Short Entry	SMA - spread	SMA - spread
Short Stop Loss	SMA + SL	SMA + SL
Short Profit Target	SMA - PT	SMA - PT



MarasiDr BTCUSDT 4h Simulated Returns

Program	MarasiDr BTC4
Inv Analyst:	InvTeam
Launch:	10-Aug-23
Strategy Type:	Long/Short BTC 4h
Inv Objective:	Generate consistent positive returns across market cycles with a systematic long/short breakout strategy
Description:	Systematic rules, which are activated in response to specific price references
Assumptions:	Ability to manage PTs and SLs
Exchange:	Binance
Turnover:	NA
Leverage:	0
Currency:	USD

MarasiDr BTC4 - Cumulative Log returns



Source: Creed & Bear, Binance, Aug-23

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dec	YtD
2020		8.3 %	1.0 %	8.4 %	-16.3 %	-5.4 %	12.5 %	5.7 %	10.0 %	7.8 %	25.2 %	23.0 %	103.8 %
2021	-7.0 %	18.8 %	1.3 %	9.7 %	18.8 %	8.1 %	-0.5 %	-3.7 %	11.4 %	22.1 %	2.4 %	6.1 %	123.2 %
2022	7.0 %	11.6 %	-12.5 %	5.8 %	19.2 %	7.4 %	2.4 %	3.2 %	18.1 %	-0.3 %	17.4 %	2.9 %	112.7 %
2023	29.0 %	0.0 %	16.4 %	3.9 %	6.5 %	12.2 %	-3.7 %	7.3 %					92.8 %

Sharpe ratio: 2.16

Calmar ratio: 1.45

Sortino ratio: 3.17

Max DrawDown: -30.77

Source: Creed & Bear, Aug-23. Please note this analysis contains simulated data and does not represent actual performance achieved by investors. **Past performance is not a reliable guide to future performance.** The performance is compounded and computed using daily gross returns in USD net of execution fees. Management and performance fees will have a negative impact on investment returns.

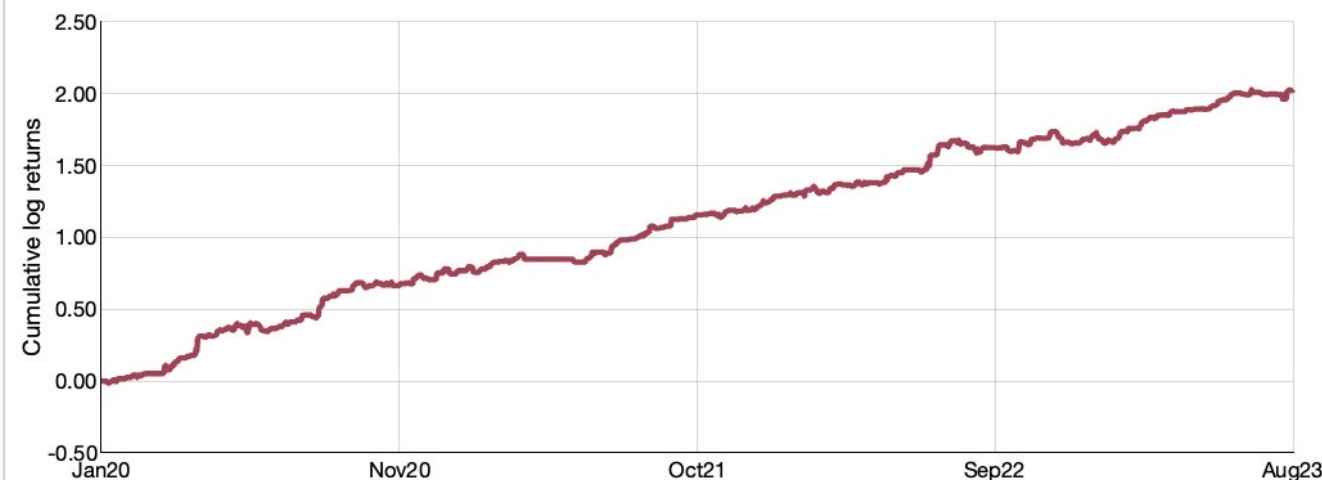
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MarasiDr ETHUSDT 1h Simulated Returns

Program	MarasiDr ETH1
Inv Analyst:	InvTeam
Launch:	10-Aug-23
Strategy Type:	Long/Short ETH 1h
Inv Objective:	Generate consistent positive returns across market cycles with a systematic long/short breakout strategy
Description:	Systematic rules, which are activated in response to specific price references
Assumptions:	Ability to manage PTs and SLs
Exchange:	Binance
Turnover:	NA
Leverage:	0
Currency:	USD

MarasiDr ETH1 - Cumulative Log returns



Source: Creed & Bear, Binance, Aug-23

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dec	YtD
2020		2.7 %	11.5 %	17.3 %	7.0 %	-3.3 %	5.9 %	4.1 %	19.5 %	3.4 %	0.1 %	5.2 %	99.2 %
2021	3.2 %	2.7 %	6.9 %	0.9 %	0.0 %	0.7 %	10.3 %	5.8 %	7.2 %	8.1 %	2.1 %	2.6 %	62.9 %
2022	8.8 %	4.3 %	1.0 %	4.7 %	1.8 %	7.0 %	18.9 %	-1.6 %	-1.0 %	3.8 %	8.3 %	-7.5 %	57.6 %
2023	-0.2 %	10.7 %	9.6 %	3.1 %	3.9 %	9.0 %	-1.0 %	3.7 %					45.2 %

Sharpe ratio: 3.15

Calmar ratio: 4.16

Sortino ratio: 5.69

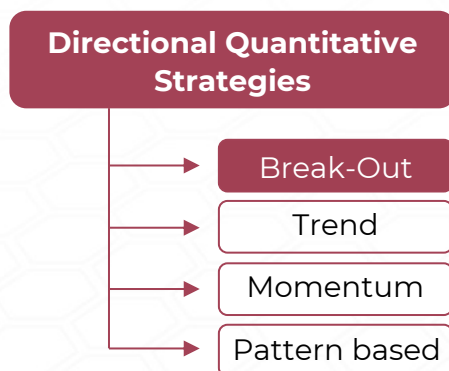
Max DrawDown: -8.65

Source: Creed & Bear, Aug-23. Please note this analysis contains simulated data and does not represent actual performance achieved by investors. **Past performance is not a reliable guide to future performance.** The performance is compounded and computed using daily gross returns in USD net of execution fees. Management and performance fees will have a negative impact on investment returns.

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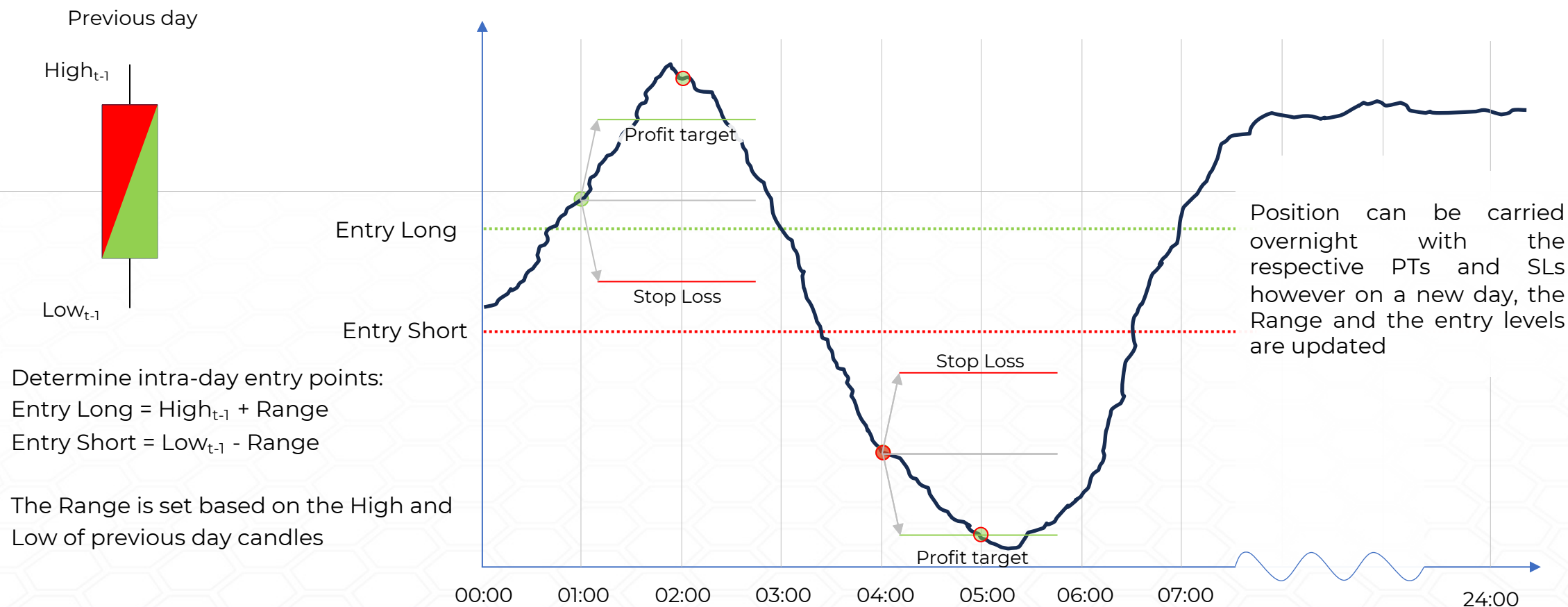
Karama



Strategy	Long-Short
Underlying	ETH Perpetual
Theme	Break-out
Holding Period	Daily
Trading Frequency	Daily
Modelling	Rule based
Entry condition	Price triggered
Exit condition	PTs & SLs
Inputs	Price

Karama

Karama is an intraday strategy designed for Ethereum that follows a systematic breakout approach. The entry points for both long and short positions are determined by adjusting yesterday's high and low levels by a specific range. Notably, in Karama, profit targets (PTs) and stop losses (SLs) are activated only at the end of each hour, rather than being triggered within the hour itself.



Karama Simulated Returns

Program	Karama
Inv Analyst:	InvTeam
Launch:	01-Dec-22
Strategy Type:	Long/short
Inv Objective:	Generate consistent positive returns across market cycles with a systematic long/short investment process
Description:	Systematic rules, which are activated in response to specific price references.
Assumptions:	Ability to manage PTs and SLs
Exchange:	Binance
Turnover:	NA
Leverage:	0
Currency:	USD

Karama - Cumulative Log returns



Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dec	YtD
2020		4.0 %	16.2 %	15.4 %	9.2 %	-0.3 %	6.0 %	11.7 %	0.1 %	6.0 %	3.1 %	18.3 %	132.6 %
2021	12.7 %	-6.1 %	-2.2 %	-4.8 %	29.3 %	-5.5 %	14.8 %	-9.8 %	4.7 %	9.4 %	-2.3 %	1.0 %	41.2 %
2022	12.4 %	-2.1 %	2.7 %	-6.4 %	6.6 %	10.6 %	30.2 %	14.7 %	5.7 %	3.4 %	8.0 %	-0.9 %	117.6 %
2023	11.7 %	9.5 %	15.3 %	-0.8 %	-5.3 %	11.5 %	-2.7 %	-2.7 %					39.7 %

Sharpe ratio: 1.86

Calmar ratio: 1.79

Sortino ratio: 3.37

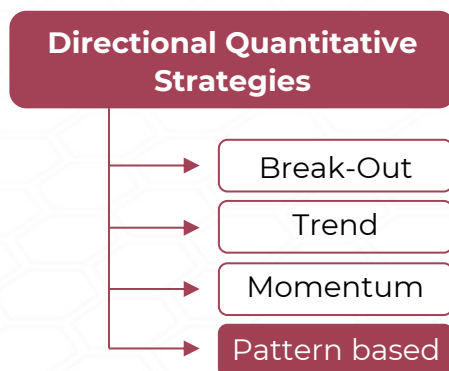
Max DrawDown: -21.62

Source: Creed & Bear, Aug-23. Please note this analysis contains simulated data and does not represent actual performance achieved by investors. **Past performance is not a reliable guide to future performance.** The performance is compounded and computed using daily gross returns in USD net of execution fees (4bps each way). Management and performance fees will have a negative impact on investment returns.

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The Blend



Strategy	Long-Short
Underlying	BTC & ETH Perpetual
Theme	Pattern-Based
Holding Period	24h
Trading Frequency	Every 3h (8 per day)
Modelling	Machine Learning (Supervised Learning)
Entry condition	Triggered by time
Exit condition	Triggered by time
Inputs	Price and Volume

Machine Learning Based Strategies - Overview

A blend of ① mid-frequency ② strategies designed to discover repeatable patterns ③ that lead ④ to profitable trades ⑤



①

>100 independently developed long=short models. Differentiation based on feature selection, machine learning model, hyperparameters, training period (length and selection). All models are running at the same time, using the same prices and only the netted outcome is executed.



②

Minimum holding period of 24h with 8 rebalancing points per day.



③

Focusing on directional predictability (prices moving up or down) over 24h.



④

The Machine Learning model is fed with historical sequences of patterns with the corresponding outcome (price up or down). Feature and model selection underpins the research efforts.



⑤

The model will detect input-output relationships with hierarchical, threshold and non-continuous linkages. When these relationships demonstrate consistency and stability, they will be the base for the investment decision process.



Machine Learning Based Strategies - Example

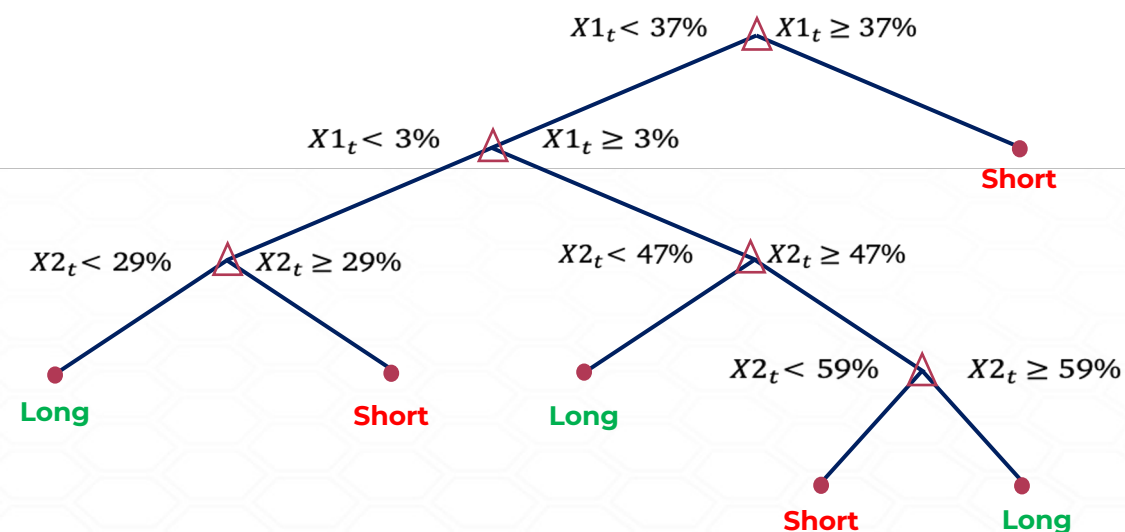
Machine Learning is an application of AI based around the idea that we should be able to give machines access to data and let them learn for themselves. At CNB we are agnostic about the methodologies adopted. We do strongly believe that also model diversification allows us to enhance the overall profitability of the investment program. Contrary to the general belief, the seed of success relies on intuition, which is human by definition. It is in selecting the right features, in setting-up the hyperparameters¹ and foremost in defining the right investment objective that one generates value.

Example – Building a long/short strategy for the Bitcoin future assuming a 24h holding period, reset at 24:00 UTC.
Intuition = The short holding period leads towards the selection of features that capture market sentiment, hence we define:

X1 – Bitcoin return over the past 25-days

X2 – Bitcoin volatility over the past 25-days

Model selection – A shallow decision tree, trained using the k-fold² validation method over 500 days. The model is trained by learning the relationships between the two inputs at time t and the bitcoin future direction (+/-1 depending on its return) at time $t+7$.

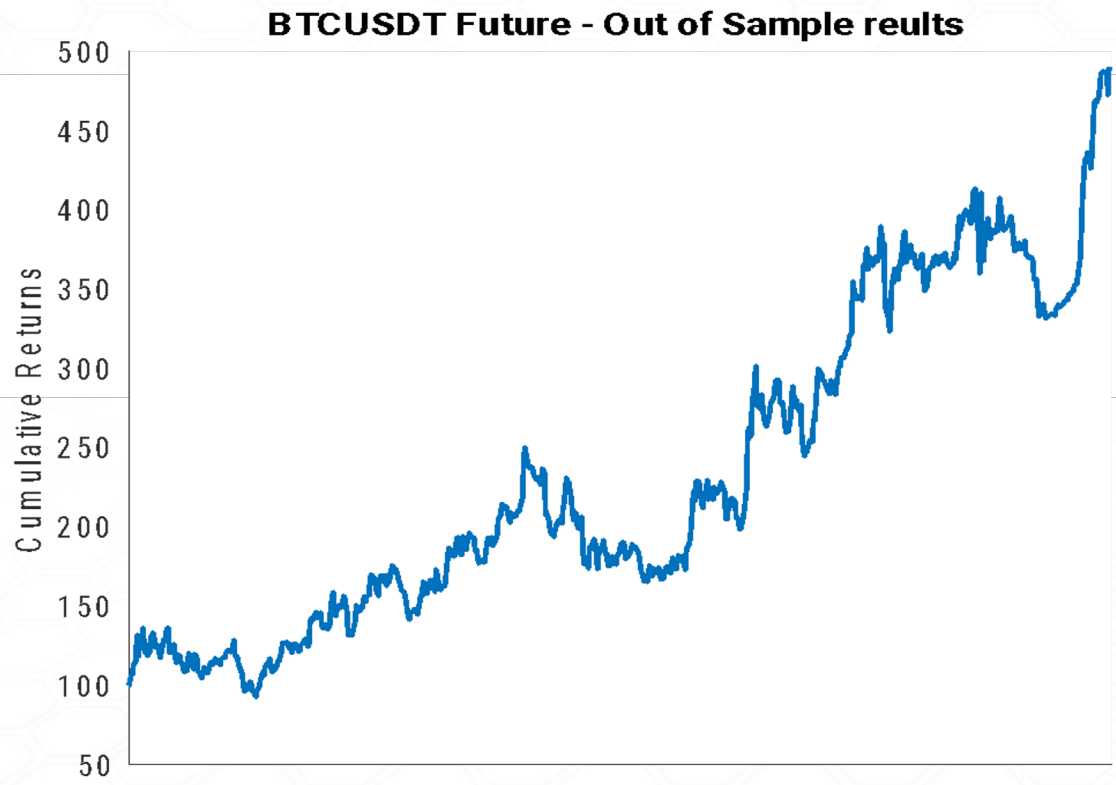


¹ In Machine Learning, the term hyperparameter is used to identify parameters whose values are learnt while training the model and it should not be confused with parameters.

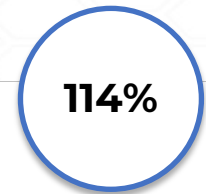
² The data set is randomly divided into k -folds of approximately equal size. One fold is kept for testing and the model is trained on $K-1$ folds.



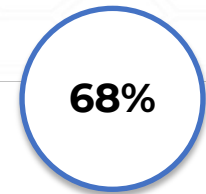
Machine Learning Based Strategies - Example



Source: Binance, Creed & Bear, Jan-23



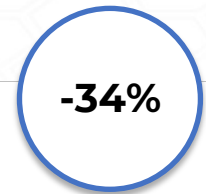
ANNUALISED
RETURN



ANNUALISED
RISK



SHARPE
RATIO



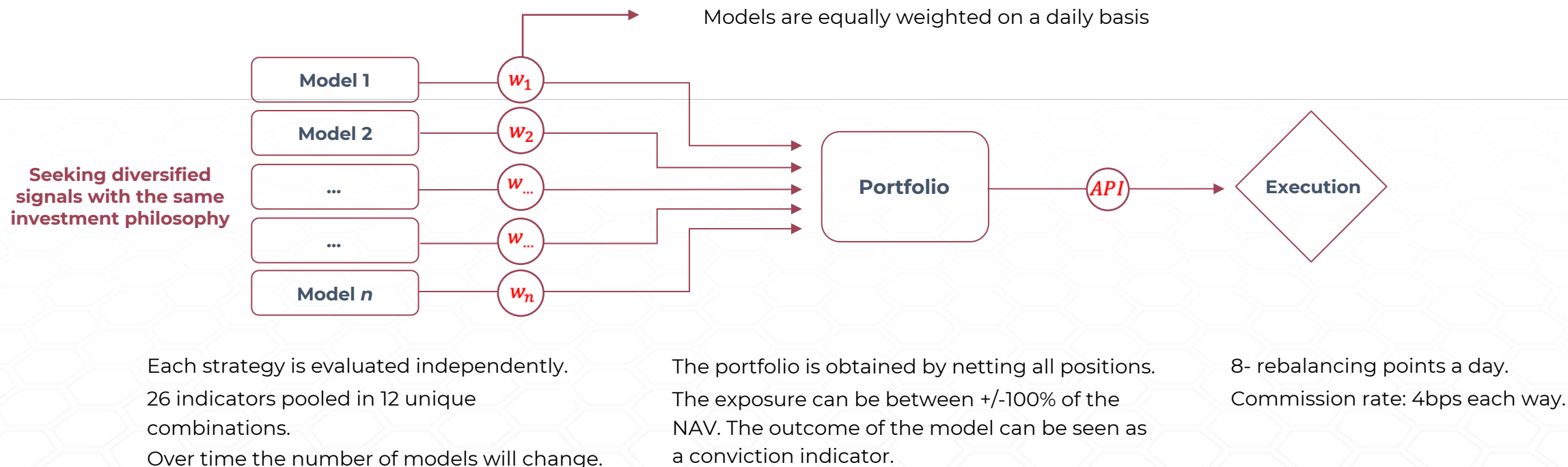
MAX DRAW-
DOWN

Despite the simplicity of the decision tree, the performance is strong but coupled with an undesirably high volatility and draw-down. While this may suggest the need for additional work on feature selection, model hyperparameters and training period, it poses a question on how to manage risk, more specifically the down-side risk. While it is possible to find a highly performing strategy, the **risk of over-fitting** remains a threat which needs to be avoided at all costs! Hence one way to achieve more consistent results, i.e. limiting the down-side risk, is to blend this model with new ones. Specifically we are looking for models capable to deliver similar long-term financial goals but exhibit a sufficiently low correlation to limit volatility.



Machine Learning Based Strategies - The Blend

Even the most successful quantitative trading strategies are not immune to difficult periods. When building a trading strategy, the focus is not to search for the winning formula, capable to capture every possible market movements because within the probabilistic space, good models will work for a certain percentage of times, but not all the times. Hence rather than investing time refining a model, which will most certainly lead only to over-fitting, one should aim to build a portfolio of strategies, developed on different assumptions and inputs and even if they are not capable to work well in isolation, when combined together will exhibit the well desired strength to smooth the risk profile of the entire strategy.

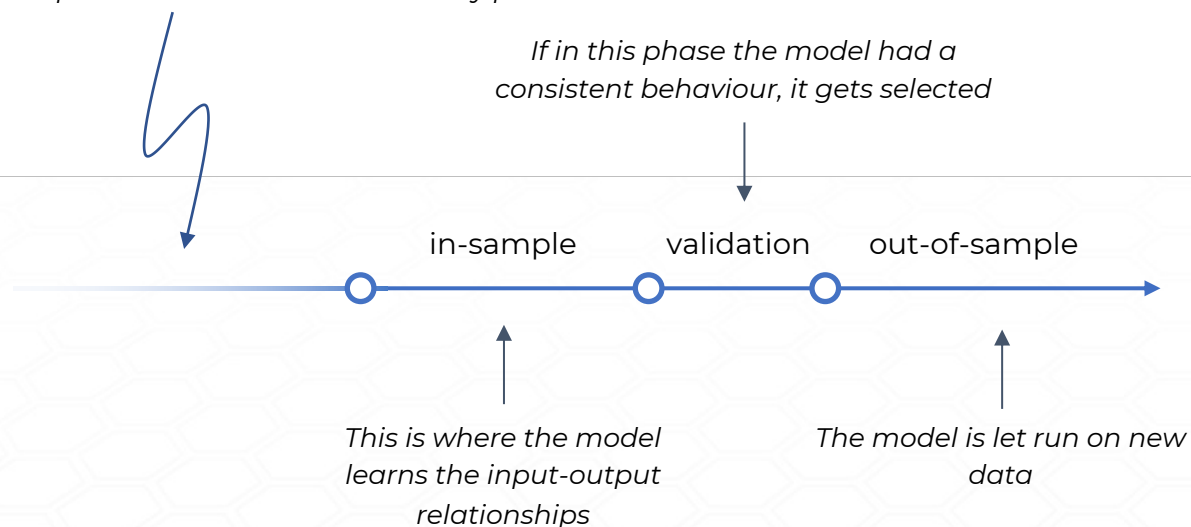


Machine Learning Based Strategies - The Training

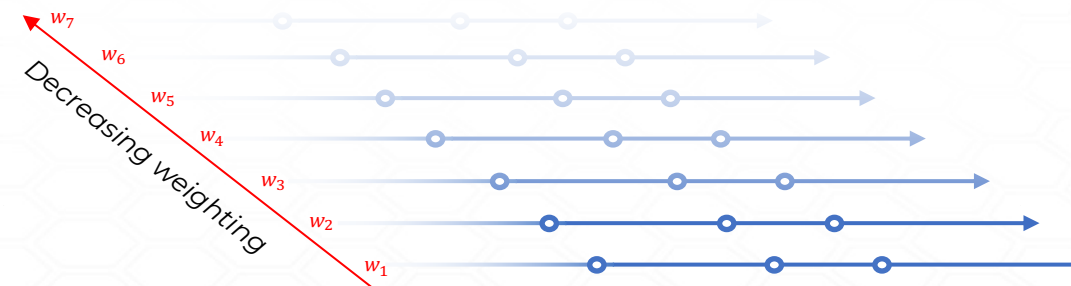
One of the key feature of supervised machine learning models is their ability to extract from a dataset the linkages between inputs and outputs. When using these models, the researcher needs to decide over what period of time the model should be trained and also how frequently the model should be re-trained.

Some old data may get removed as no longer representative of how the security performs.

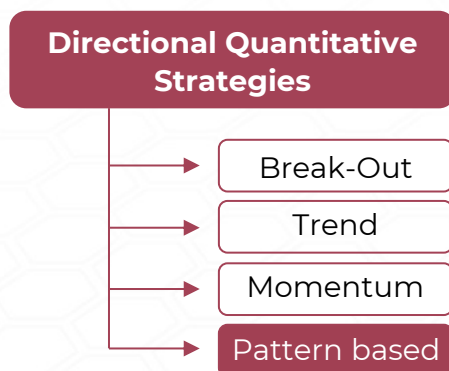
If in this phase the model had a consistent behaviour, it gets selected



Transfer learning has become a very popular topic in deep learning and more in general in machine learning. It refers to challenge in applying to a new similar problem the knowledge acquired solving a previous problem. At C&B we approach this challenge in keeping previously trained models but we assign a smaller weight. By doing so, the models in production benefit from the more recent data, however still keep in memory the previous training.



Millennium

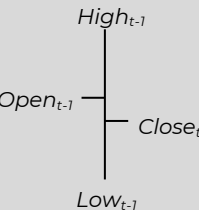


Strategy	Long-Short
Underlying	BTC Perpetual
Theme	Pattern based
Holding Period	Intra-day
Trading Frequency	Daily
Modelling	Rule based upon ML research
Entry condition	Price triggered
Exit condition	PTs & SLs
Inputs	Price

Millennium

Millennium is a simple systematic strategy that can trade only once a day, opening and closing the long or short position during the course of the day. There are five distinct signals which are checked in a priority order. This means that the system will start checking the entry conditions following a given order. Once a condition is met, the system will aim to execute a trade based on some rules, and if those conditions are not met, the rules to follow will not be checked and the system will see to trade on the following day.

Rule 1 - Long

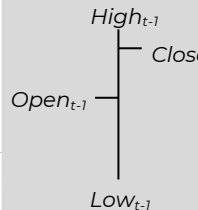


Rule 1 is triggered upon the identification of a specific pattern

If it is triggered, the entry long price is set below the entry price and it needs to happen before 23:00 UCT time.

If there is a price that satisfies this condition, the order is managed with a profit target and a stop loss. If none of the two are triggered the position is closed at 24:00 UCT time.

Rule 2 - Long



Rule 2 is triggered upon the identification of a specific pattern

If it is triggered, the entry long price is set below the entry price and it needs to happen before 23:00 UCT time.

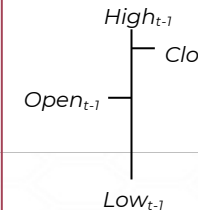
If there is a price that satisfies this condition, the order is managed with a profit target and a stop loss. If none of the two are triggered the position is closed at 24:00 UCT time.

Rule 3 - Long

Rule 3 is triggered if the annualised volatility as of the previous close, is less than a fixed threshold.

If it is triggered, you enter at the opening price. The order is managed with a profit target and a stop loss. If none of the two are triggered the position is closed at 24:00 UCT time.

Rule 4 - Short

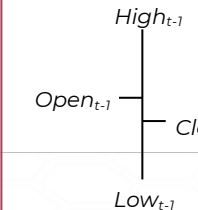


Rule 4 is triggered upon the identification of a specific pattern

If it is triggered, the entry short price is set above the entry price and it needs to happen before 23:00 UCT time.

If there is a price that satisfies this condition, the order is managed with a profit target and a stop loss. If none of the two are triggered the position is closed at 24:00 UCT time.

Rule 5 - Short



Rule 5 is triggered upon the identification of a specific pattern

If it is triggered, the entry short price is set lower than today's open and it needs to happen before 23:00 UCT time.

If there is a price that satisfies this condition, the order is managed with a profit target and a stop loss. If none of the two are triggered the position is closed at 24:00 UCT time.

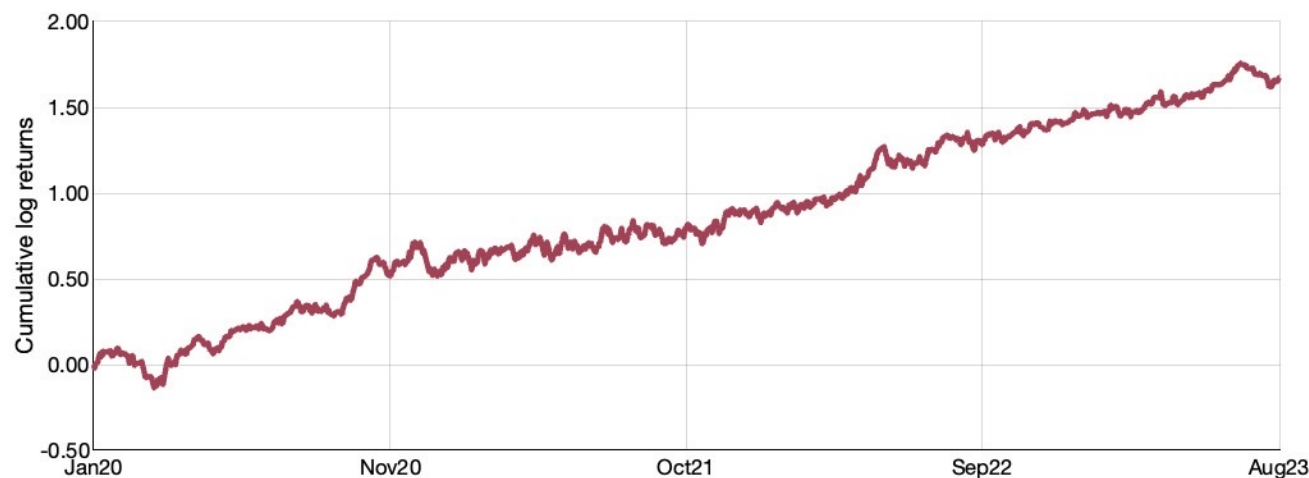
sequential check



Millennium Simulated Returns

Program	Millennium
Inv Analyst:	InvTeam
Launch:	25-May-23
Strategy Type:	Long/short
Inv Objective:	Generate consistent positive returns across market cycles with a systematic long/short investment process
Description:	Systematic rules, which are activated in response to specific price references.
Assumptions:	Ability to manage PTs and SLs
Exchange:	Binance
Turnover:	NA
Leverage:	0
Currency:	USD

Millennium - Cumulative Log returns



Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dec	YtD
2020		-12.6 %	9.0 %	14.0 %	2.1 %	5.4 %	2.4 %	11.0 %	-4.3 %	23.5 %	0.8 %	18.1 %	86.8 %
2021	-11.7 %	2.9 %	6.0 %	2.0 %	-5.5 %	6.6 %	12.8 %	4.7 %	-4.8 %	1.9 %	-0.2 %	9.1 %	23.4 %
2022	-0.3 %	5.7 %	2.4 %	2.3 %	21.7 %	1.7 %	3.9 %	6.8 %	0.1 %	2.8 %	7.4 %	-0.4 %	66.8 %
2023	5.7 %	4.0 %	1.0 %	1.5 %	6.0 %	7.7 %	7.0 %	-5.1 %					30.8 %

Sharpe ratio: 1.71

Calmar ratio: 1.33

Sortino ratio: 2.13

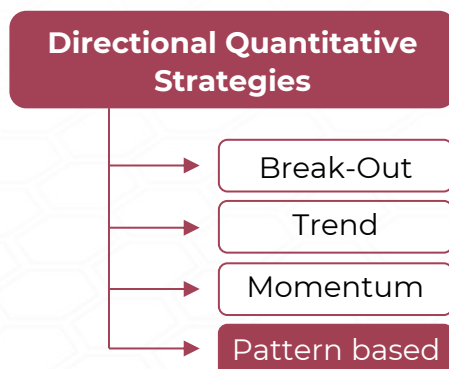
Max DrawDown: -20.64

Source: Creed & Bear, Aug-23. Please note this analysis contains simulated data and does not represent actual performance achieved by investors. **Past performance is not a reliable guide to future performance.** The performance is compounded and computed using daily gross returns in USD net of execution fees (4bps each way). Management and performance fees will have a negative impact on investment returns.

30-08-23 08:28



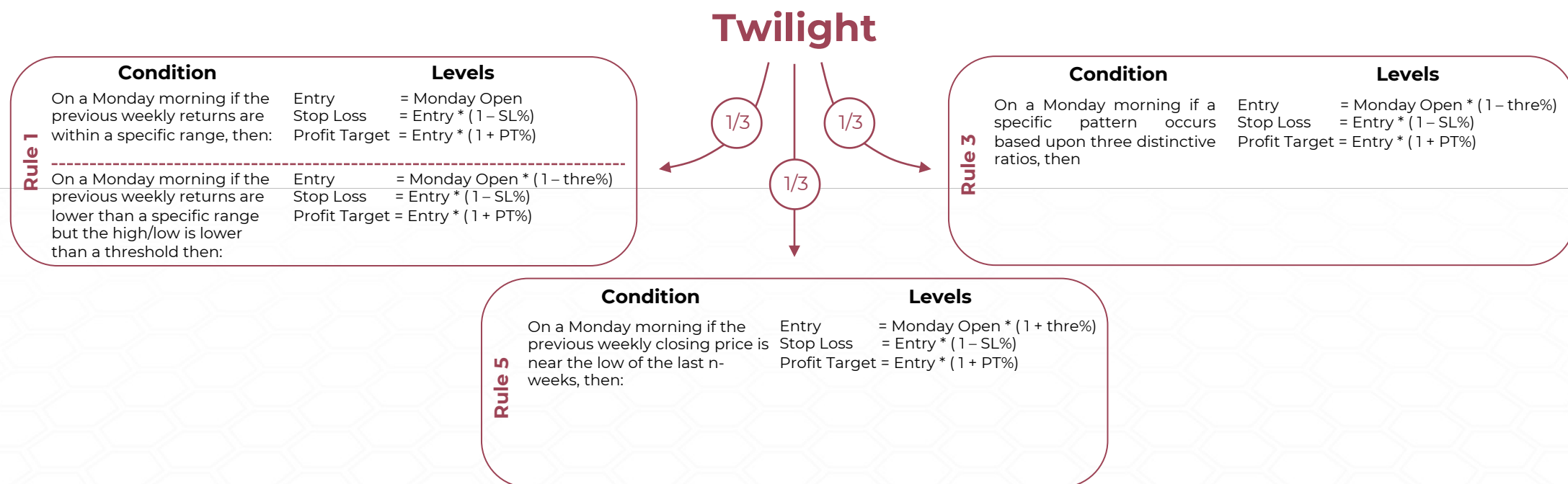
Twilight



Strategy	Long only
Underlying	ETH Perpetual
Theme	Pattern based
Holding Period	Weekly
Trading Frequency	Weekly
Modelling	Rule based
Entry condition	Price triggered
Exit condition	PTs & SLs
Inputs	Price

Twilight

Twilight, designed to trade **Ethereum**, is a long-only trading strategy, following a pattern-based approach with a weekly trading frequency. The strategy incorporates 5 rules derived from 6 key checks, serving as the foundation for its trading decisions. The conditions were identified through the use of decision trees (i.e. classification models) and implemented with the use of profit targets and stop losses.



The trade may only be initiated between Monday and Saturday, ensuring that no trades are opened on Sundays. Once a trade is activated, its Stop Loss (SL) and Profit Target (PT) are monitored and implemented daily. If the trade remains active throughout the week, it will be automatically closed at the Sunday market close.

SLs and PTs are not checked on the day the entry rule is triggered



Twilight Simulated Returns

Program	Twilight
Inv Analyst:	InvTeam
Launch:	20-Jul-23
Strategy Type:	Long-only Ethereum
Inv Objective:	Generate consistent positive returns across market cycles with a systematic long only investment process
Description:	Systematic rules, which are activated in response to specific price references
Assumptions:	Ability to manage PTs and SLs
Exchange:	Binance
Turnover:	NA
Leverage:	0
Currency:	USD

Twilight - Cumulative Log returns



Source: Creed & Bear, Binance, Aug-23

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dec	YtD
2020		13.9 %	10.2 %	28.1 %	-7.1 %	1.1 %	6.8 %	9.3 %	9.1 %	8.0 %	4.7 %	9.4 %	138.0 %
2021	-0.0 %	15.4 %	9.1 %	3.5 %	21.9 %	-4.8 %	-0.2 %	11.4 %	-5.7 %	18.5 %	8.8 %	-5.4 %	93.5 %
2022	0.9 %	6.1 %	3.6 %	-0.1 %	-1.8 %	-3.6 %	3.2 %	4.4 %	2.7 %	7.8 %	6.5 %	0.1 %	33.1 %
2023	10.5 %	-2.8 %	1.4 %	-1.6 %	6.0 %	3.2 %	0.8 %	-1.1 %					17.0 %

Sharpe ratio: 2.30

Calmar ratio: 3.02

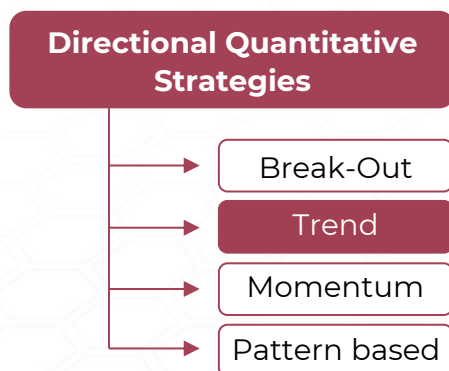
Sortino ratio: 3.75

Max DrawDown: -11.86

Source: Creed & Bear, Aug-23. Please note this analysis contains simulated data and does not represent actual performance achieved by investors. **Past performance is not a reliable guide to future performance.** The performance is compounded and computed using daily gross returns in USD gross of execution fees. Management and performance fees will have a negative impact on investment returns.



Big Whale Following System



Strategy	Long only
Underlying	BTC
Theme	Trend following
Holding Period	Dayly
Trading Frequency	Daily
Modelling	Rule based
Entry condition	Price triggered
Exit condition	PTs & SL.s
Inputs	Alternative

Big Whale Following System

The Big Whale Following System (BWFS) is CNB's first crypto investment strategy. It has been built upon the unique IP to acquire-read and process data in a very effective way. It is a long-only strategy that reacts to large market transactions that on an historical basis, are deemed to impact the market in a positive way. The BWFS relies on the identification of special market orders, and it can happen that it will stay out of the market for several months. Once a position is opened, a trailing Stop Loss set upon the confirmation of specific Profit Levels will manage the position. This means that the BWFS has a variable holding period which can span from hours to months.

BW has been trained to identify large volume orders capable to cause upwards movements in the Bitcoin spot price

When large volume orders are identified the system enters into a long position

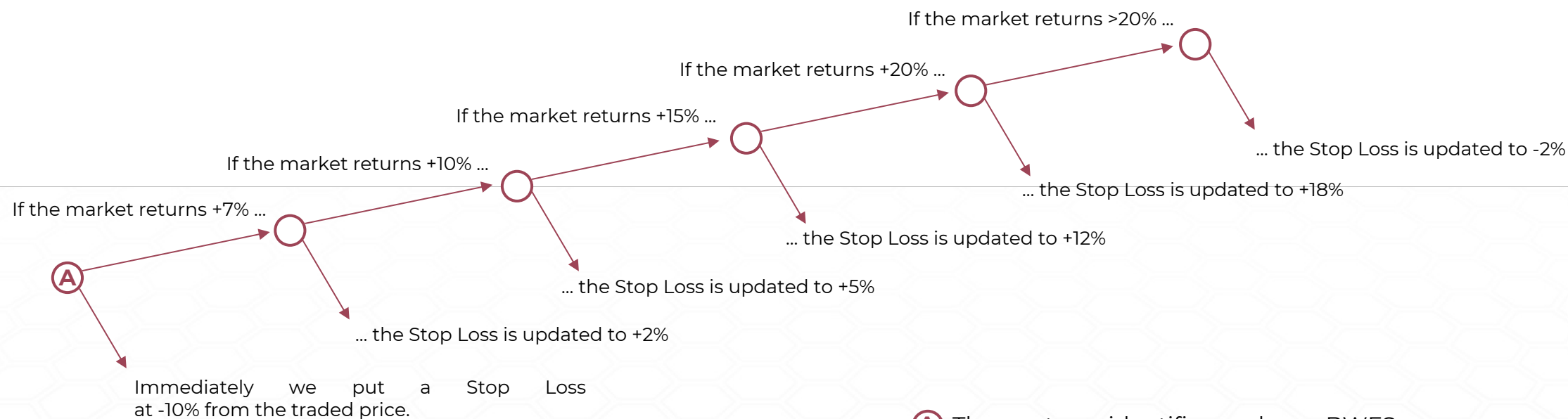
The exist signal is based upon a combination of Profit Target with a trailing Stop Loss

The strategy was researched in 2018 by analyzing all transactions (order-flow) and their interaction with the order-book, on Binance

The strategy has been running, in a fully automated way, since 2019

Big Whale Following System - Managing the Order

The BWFS manages its positions with a trailing Stop Loss (SL) system based on some pre-defined Profit Levels (PL). The PLs and the SLs are based on the size of the signal.



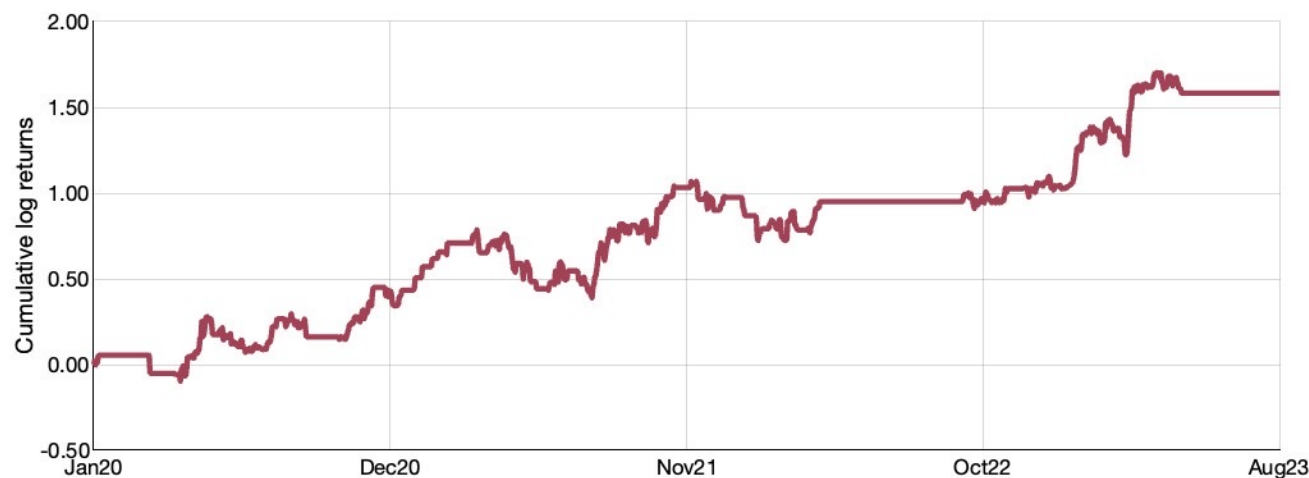
A The system identifies a long BWFS transaction and puts a buy market order in the market.



BWFS Simulated Returns

Program	BWFS
Inv Analyst:	InvTeam
Launch:	31-Oct-19
Strategy Type:	Long-only
Inv Objective:	Generate positive returns by trading systematically Bitcoin based on whales activity
Description:	Long-only strategy detecting transactions with meaningful price impact
Assumptions:	Ability to manage PTs and SLs
Exchange:	Binance
Turnover:	NA
Leverage:	0
Currency:	USD

BWFS - Cumulative Log returns



Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dec	YtD
2020			-10.1 %	9.2 %	15.1 %	-8.7 %	14.2 %	2.4 %	-7.8 %	11.1 %	20.1 %	-1.6 %	46.1 %
2021	25.0 %	5.4 %	1.0 %	-12.0 %	-13.8 %	11.1 %	15.8 %	7.6 %	4.5 %	24.8 %	-6.6 %	1.1 %	71.8 %
2022	-16.7 %	10.3 %	2.2 %	3.8 %	0.0 %	0.0 %	0.0 %	0.0 %	1.1 %	6.7 %	3.5 %	-3.6 %	5.0 %
2023	39.8 %	0.0 %	32.0 %	2.9 %	-8.0 %								74.8 %

Sharpe ratio: 1.31
Sortino ratio: 1.73

Calmar ratio: 0.72
Max DrawDown: -32.80

Source: Creed & Bear, Aug-23. Please note this analysis may contain simulated data and does not represent actual performance achieved by investors. **Past performance is not a reliable guide to future performance.** The performance is compounded and computed using daily gross returns in USD net of execution fees (4bps each way). Management and performance fees will have a negative impact on investment returns.



Final Remarks

We believe the digital asset class, exemplified by cryptocurrencies, is here to stay

Crypto is going to become a crucial building block for asset allocators

The recent regulatory actions coupled with financial giant taking stage is an auspicious omen for the digital industry

We firmly believe:

- AI, machine learning, and quantitative methods are well-suited for the crypto industry due to its pronounced behavioural component.

- A long/short investment approach is the optimal investment style for investors seeking to achieve absolute returns from the asset class.

- A strong emphasis on diversification needs to be at the core of the R&D engine.

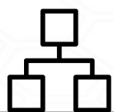
- Automation achieved within a secure environment and operating under human supervision.

The two investment funds (Cayman & Liechtenstein SICAV) aim to achieve ambitious double-digit annual returns with a fraction of the volatility of the asset class. They are well-suited for qualified investors who seek to achieve positive returns over the medium to long term, with robust risk-management controls in place.

The Funds



CNB Digital Cayman Fund



STRUCTURE

Open-end
investment fund
(Cayman Fund)



TAX

Tax-efficient



DOMICILE

Cayman Islands



EXPECTED LIQUIDITY

Monthly



MINIMUM INVESTMENT

100,000 USD



FEE STRUCTURE

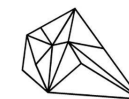
2% // 20%

Administrator



FORMIDIUM

Investment Manager



FUNDROCK
management company

CNB Cayman SPC

Custodian

MidChains

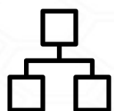
Custodian



SEBA
BANK



CNB Digital SICAV



STRUCTURE

Open-end
investment fund
(SICAV)



TAX

Tax-efficient



DOMICILE

Liechtenstein



EXPECTED LIQUIDITY

Monthly



MINIMUM INVESTMENT

125,000 EUR



FEE STRUCTURE

2% // 20%

Risk Manager
Administrator
Investment Manager
AIFM License



Auditor



Grant Thornton

CNB Liechtenstein SICAV

Custodian



BANK FRICK

Banking/Execution
Regulatory oversight
Transfer agent



Appendix



Tech-architecture – *Trading Algorithms*



LOCATION

All the algorithms are stored in the premises



WORKFLOW

1. Collect data from various sources
2. Compute the inputs
3. Generate the output (i.e exposure)
4. Pass the output to the OMS



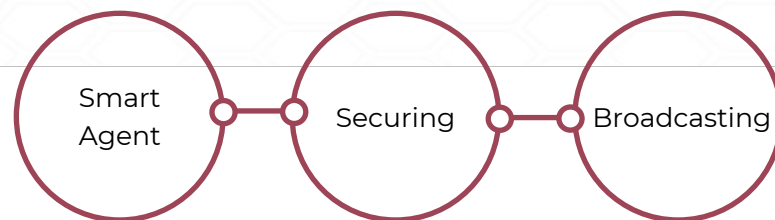
FEATURES

1. Low-level programming language
2. In excess of 130 variables
3. Using 5+ years of hist data



Tech-architecture – Order Management System (OMS)

LOCATION The OMS is Cloud based (Digital Ocean)



WORKFLOW

Smart Agent

1. Receive the trading algo's output (i.e. new exposure)
2. Verify where it has to be implemented
3. Update the NAV
4. Generate the trade instruction
5. Send the order to the appropriate exchange
6. Collect all order related information

Securing

1. Gather incoming data
2. Arrange the information systematically to maintain consistent organization and simplify accessibility
3. Establish efficient relationships between different sets of data, enhancing usability and optimizing retrieval processes

Broadcasting

1. Provides and structures information for utilization by other systems via the Rest API protocol

FEATURES

1. Manage up to 100 portfolios in parallel
2. Connected to 5 exchanges
3. Manage a large number of orders
4. Work with HFT algos
5. Auto troubleshooting system

1. Scalable (multi terabytes)
2. Flexible to adjust to different requirements
3. Secure
4. High-performance

1. Seamless flow of communication
2. Responsive to incoming requests
3. High speed data transmission
4. Resilient to disruptions
5. Versatile integration

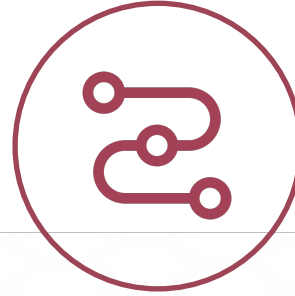


Tech-architecture – *Frontend*



LOCATION

The frontend is cloud based



WORKFLOW

Connected to different microservices to retrieve data



FEATURES

1. Supporting different Frontends (internal and external use)
2. Unique token connectivity
3. User-friendly interface
4. Updated security certificates
5. Live streaming



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- a trust (where the trustee is not an accredited investor) whose sole purpose is to hold investments and each beneficiary of the trust is an individual who is an accredited investor,

securities (as defined in Section 239(1) of the SFA) of that corporation or the beneficiaries' rights and interest (howsoever described) in that trust shall not be transferred within six (6) months after that corporation or that trust has acquired the securities pursuant to an offer made under Section 305 except:

- to an institutional investor or to a relevant person defined in Section 305(5) of the SFA, or to any person arising from an offer referred to in Section 275(1A) or Section 305A(3)(i)(B) of the SFA;
- where no consideration is or will be given for the transfer;
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