Pulling Signal from the Noise: Trading AmberLens' Institutional Bitcoin Metrics

AMBERDATA RESEARCH

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Overview

AmberLens, Amberdata's market intelligence solution, provides analysts and investors with the tools they need to make important market judgments across the digital asset space. In this paper, we will leverage the AmberLens Institutional Bitcoin Metrics, to assess the value of each one in trading strategies. To do this, we will use the metrics as signals for trading strategies, backtesting each of them to identify winning strategies. We will then analyze the best and worst performing backtests to understand how to improve and develop a more effective strategy.

Follow along with our code samples here!

Introduction

The transparency of the digital asset space provides a wealth of information. AmberLens brings this information to the forefront, providing a quick and easy lens to identify the metrics that are driving the market. By utilizing these metrics, traders are given simple heuristics that allow them to make more effective decisions with regards to market cycles, sentiment and more.

We will evaluate the value of these metrics by running backtests on Bitcoin trading strategies that use AmberLens' Bitcoin Institutional Metrics. In all of our backtests we start with the same base assumptions: $100k in cash, and a 0.2% trading fee on every trade. All trading starts from January 1st, 2015, and terminates on July 9th, 2024. Furthermore, we will do simple trade strategies only: we will buy out all of our equity if a buy signal is reached, and we will close our position if the sell signal is reached – portfolio management strategies such as buy sizing can often increase the effectiveness of these strategies, but for simplicity we've opted to use the full weight of our portfolio on trades. Additionally, each strategy has two tests: the first with no stop-loss and the second with a 10% stop-loss on each position, in order to mimic more realistic trading conditions. We will be using backtesting.py to conduct our backtests.

Some key metrics we will explore are: equity final, return (%), Sharpe ratio, Sortino ratio, and the Calmar ratio, the max and average drawdown, and the expectancy:

- **Equity Final:** The final dollar amount after running the strategy.
- **Return (%):** The percent growth from the initial $100,000 starting equity.
- **Sharpe Ratio:** Measures reward relative to risk. A high, positive Sharpe ratio indicates a strong risk-adjusted performance, and a low, negative Sharpe ratio indicates that the risk-free benchmark would have outperformed the portfolio.
- **Sortino Ratio:** A variation of the Sharpe ratio that only considered the downside risk instead of positive risk. Interpretation is the same as the Sharpe ratio, but it does not penalize for positive volatility.
- **Calmar Ratio:** The Calmar ratio is similar to the previous two except that the denominator is maximum drawdown, which could be thought of as the fund's maximum loss from top to bottom over a period of time.
- **Max Drawdown (%):** Drawdowns are the percent difference between the peak and trough of an equity curve. The max drawdown is the largest peak to trough percent difference among all drawdowns.
- **Avg Drawdown (%):** This is the average peak to trough percent difference among all drawdowns in a backtest.
- **Expectancy (%):** This is the percent won times average win size minus percent loss times average loss. In simpler terms, this measures how much you could expect to make on each trade.

Designing a Strategy

Our trading logic for each metric is simple: if there is an inherent strategy (i.e. the metric is a top or bottom signal), we follow the signal behind that metric. For example, realized cap crossing market cap is a buy signal, so we will make a buy order using all of our capital (as per our trading strategy). If a metric is only a bottom indicator, then we may add a X% take profit price – closing positions to take profits if the gain is sufficiently high.

In some cases, a metric may not offer an inherent strategy: for example, the address balance buckets which indicate the number of addresses that hold some range of bitcoin do not inherently suggest a top and bottom signal and are more useful for market sentiment analysis. In these cases, we will do light data manipulation to come up with a simple strategy that utilizes these metrics. In some cases, we may also combine metrics to form a top and bottom strategy: for example realized cap crossover and pi cycle top indicator give us a bottom and top signal.

METRIC	BUY SIGNAL	SELL SIGNAL
Buy & Hold	Buy on first day	-
Bitcoin Price & Moving Averages	10 day SMA crosses 30 day SMA	30 day SMA crosses 10 day SMA
Realized Cap	Realized cap is lower than market cap	Take profit at 10x position
Bitcoin Yardstick	Yardstick is below -1	Yardstick is above 2
MVRV	MVRV-Z < -1	MVRV-Z > 3
Reserve Risk	Reserve risk < 0.001	Reserve risk > 0.003
Pi Cycle Top	Buy if you have no position	111 MA and Pi Cycle cross while price is high
Realized Price	If realized price < market price	Take profit at 3x position
NUPL	If NUPL > 0.5	If NUPL < 0
Monthly Hold Net Position Change	If there have been two months of consecutive holds	If there have been two months of consecutive drops
Puell Multiple	If Puell Multiple < 1	If Puell Multiple > 4
Daily Address Activity	When daily passive addresses < daily active addresses	When daily passive addresses > daily active addresses

METRIC	BUY SIGNAL	SELL SIGNAL
Miner Supply Spent	When miner supply spent < 0.5	When miner supply spent > 2
Miner Position Index	When MPI < -1	When MPI > 5
Percent of Supply in Profit	30 day MA is < 45%	30 day MA > 80%
New Address Momentum	30 day MA > 365 day MA	30 day MA < 365 day MA
Liquid vs Illiquid Supply	Liquid relative growth < -0.05	Liquid relative growth > 0.1
BTC Hold Waves	When 1+ year Hold wave % is <40%	When 1+ year Hold wave % >50%
BTC Balance Buckets: # of Addresses	numWhales < -1000	numWhales > 1000
BTC Balance Buckets: Supply Held	Change in whale supply > 2000	Change in whale supply < -2000
Realized Cap + Pi Cycle Top	Realized cap is lower than market cap	111 MA and Pi Cycle cross

The table above shows a summary of our backtested trading strategies, with the **full code available on GitHub**. Some strategies were enriched by doing some basic manipulation in order to get a more informative metric. For example, in the BTC balance buckets, numWhales is the number of BTC addresses that hold more than 1 BTC. Whether this is a definition of a whale or not is not the important focus, we are simply choosing to bucket all users with more than 1 BTC to see how their movement impacts the market. Another example of an enriched metric is in liquid and illiquid supply, where we trade on liquid relative growth. Liquid relative growth is the percent growth of liquid BTC relative to the amount of liquid BTC in the month prior. This allows us to better capture changes in liquidity and overall trend of loss or growth in liquid BTC, which is known to impact price.

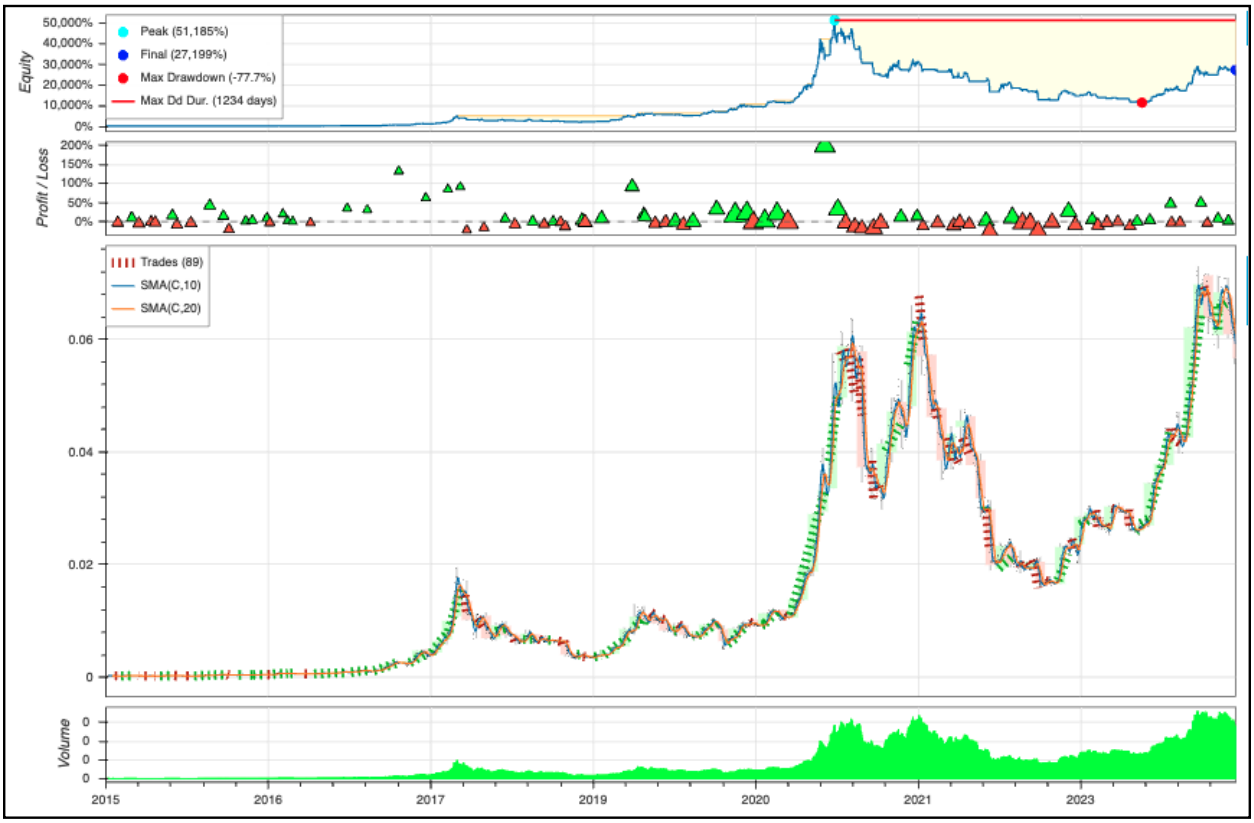
Strategy Case Studies

In this section, we will explore a few of the strategies we backtested to analyze and understand the strengths and weaknesses of each one. Each strategy will be accompanied by four graphs: an equity curve graph showing change in equity over time, a Profit / Loss graph showing whether trades were in profit or loss, a price chart with trades made overlayed on historical BTC prices, and a volume chart showing trading volume over time. The price chart with trades includes red and green dashed lines, which indicate whether that trade ended in a loss (red) or profit (green). The equity curve chart also shows the max drawdown period.

Buy and Hold & SMA Cross

Buy and Hold backtesting performance

We start our backtesting analysis with our baseline strategies. The first one, Buy and Hold, should be a very familiar strategy. Here there is only one trade, which is buying on the first day, and holding until the last day. This strategy performs markedly well, outperforming more than half of the other proposed strategies. With a strong return of 20,051%, it is relatively hard to beat buy and hold's strategy, which makes it a good baseline to compare against others. Of course, its Sharpe ratio is relatively low with a value of 0.53 since Bitcoin is a highly volatile asset, which strongly penalizes risk. The Sortino ratio, which only looks at the downside risk, is much higher since from the first trade most of the risk is in the positive direction.

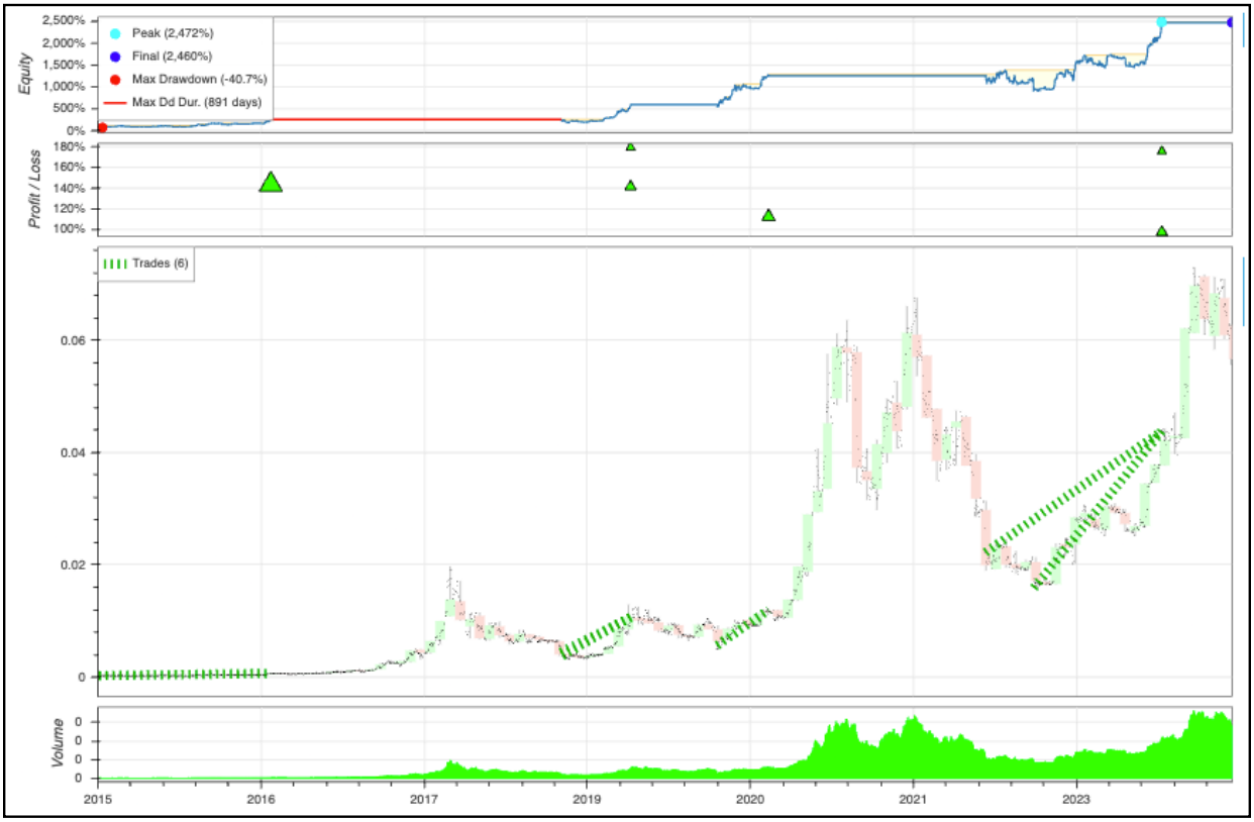


Simple Moving Average (SMA) Cross with 10% stop-loss backtesting performance.

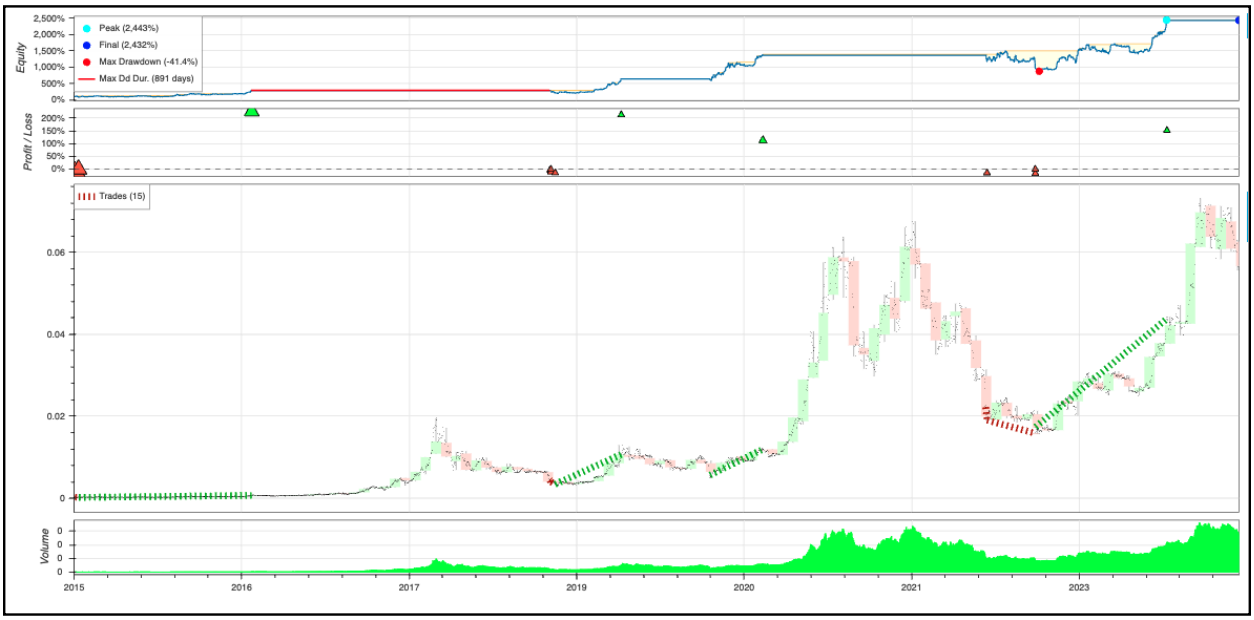
The next baseline we will analyze is the Simple Moving Average (SMA) Cross, a widely used and effective strategy that uses two moving averages (MAs) to determine buy and sell signals. For our backtest, we used a 10-day and 30-day MA. While these two periods were chosen because they are standard, it is common practice to do a grid search for the optimal period for each MA. Coincidentally, 10 and 30 is relatively performant, with SMA Cross serving as a strong baseline with a return of 14,984% and a stronger risk adjusted ratio than Buy and Hold in all three ratios (Sharpe, Sortino, and Calmar). When we add stop-loss to Buy and Hold, our strategy improves significantly with a return of 27,099%, which outperforms Buy and Hold.

Given the simplicity of these two trading strategies, it is important that any other strategy we test is able to outperform the returns on these baselines.

NUPL



Net Unrealized Profit Loss (NUPL) backtesting performance



Net Unrealized Profit Loss (NUPL) backtesting performance with 10% stop-loss

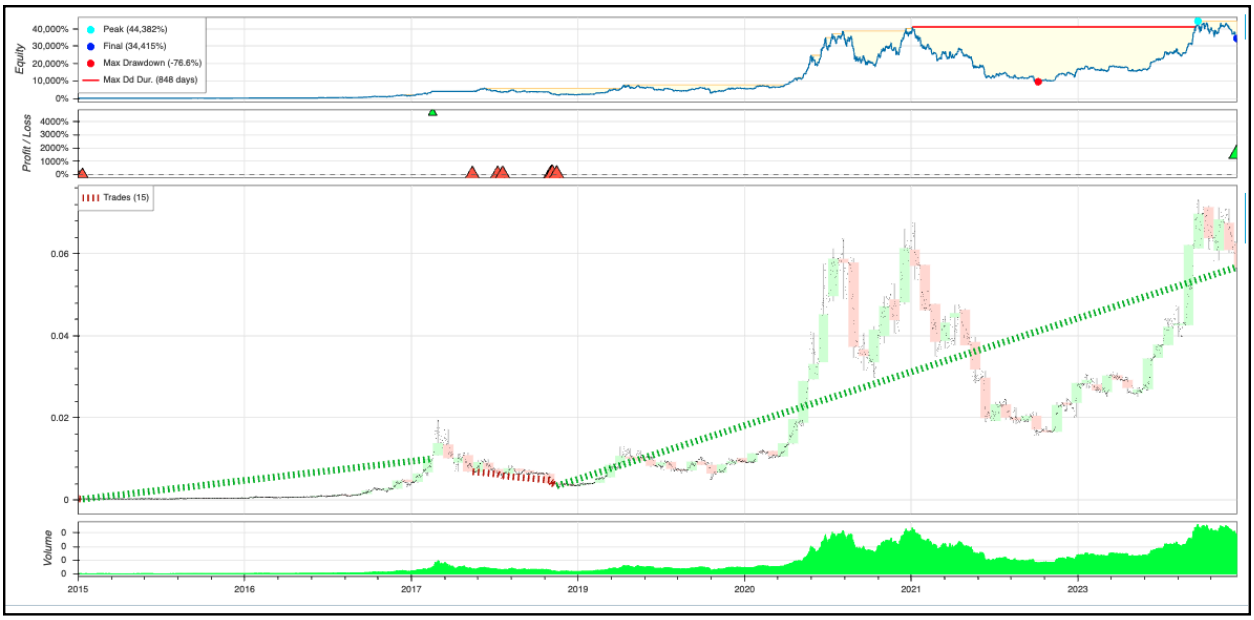
While this next strategy performs well, it fails to beat our baselines. The Net unrealized profit / loss (NUPL) strategy has a return of 2,360%, and a Sharpe ratio of 0.7. In our NUPL strategy, we buy when NUPL is less than -1, and sell when NUPL is greater than 3. NUPL can act as a measure of market confidence, and so when NUPL is subjectively low, indicating that most of the market is at a loss, we can consider the market to be at a discount. Likewise, if NUPL is high, then our metric indicates that most of the market is in profit, and so we should cash out our position.

If we look at the graph above, we can actually see that trading on NUPL does actually have good trades: every trade performed has a positive return. However, our sell condition is too aggressive and we attempt to take profit before Bitcoin has hit its peak. Therefore, we see a return that is much lower than SMA Cross and Buy and Hold. Things get even worse when we add stop-loss, as NUPL does not have a strong bottom indicator, it causes the strategy to sell too early before we can claim our gains. In a realistic trading scenario however, this is the most likely outcome as traders would not want to take on too much risk of a falling price of BTC. Not all is lost, of course, as we could improve this backtest by tuning our sell condition on NUPL, or possibly using a different top signal. This is a strategy that offers many different avenues to improvement, and is worth exploring further.

Puell Multiple

Puell Multiple backtesting performance

The Puell Multiple (PM), a metric created by David Puell, measures daily coin issuance over the 365 day MA of coin issuance. For our trading strategy, we buy when the PM is less than 1, and we sell when the PM is greater than 4, as a PM less than 1 indicates that miners are at a loss, while a PM of 4 indicates that miners are outperforming the market. Given the nature of this strategy, we only end up with two trades, but both trades perform well. This strategy yields a return of 28,279% only slightly beating out SMA Cross's 27,009% return. This is a good indication of how a simple, easy to use metric can provide valuable timing information with regards to market cycles. However, the Puell multiple does not do well at predicting market bottoms, so our threshold for selling ends up being too high and it fails to claim gains at market peaks.



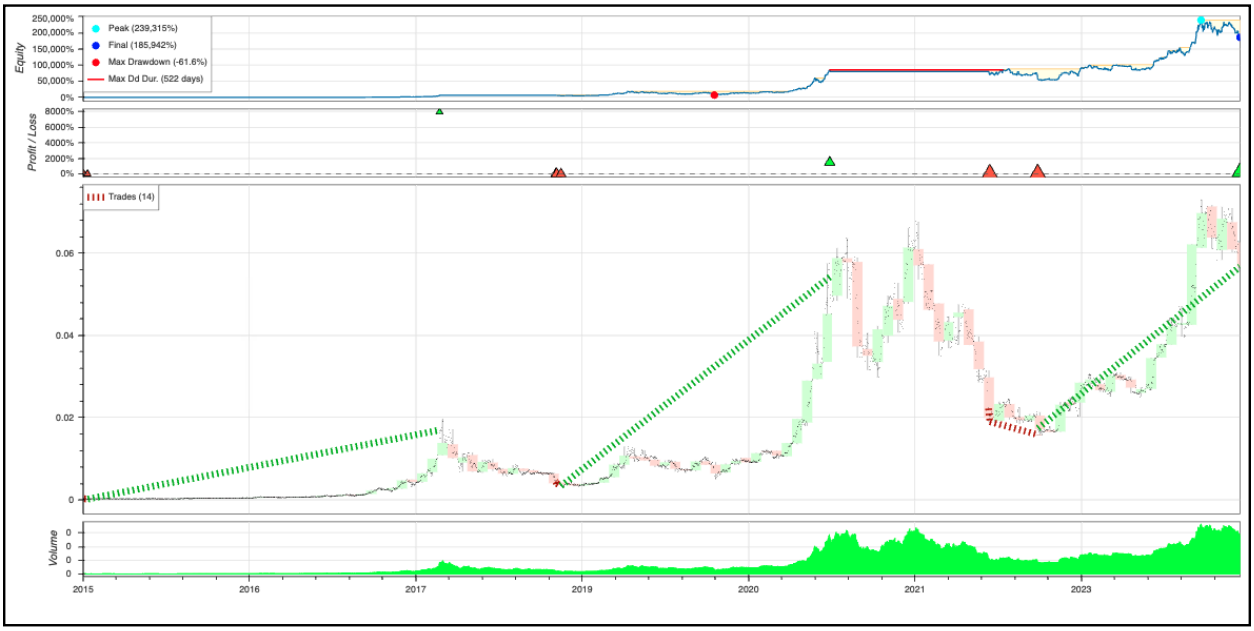
Puell Multiple with 10% stop-loss on each position

Things worsen significantly once we introduce stop loss. Because the PM entered on the downward slope of a market cycle, stop loss kicked in and closed positions as the price slid down 20% over the course of 2017. This is not unreasonable of course, since it is normal to protect one's position in the market. However, this results in a large drop in return from around 28,000% without stop-loss to roughly 23,000% with stop loss, meaning our stop loss version fails to beat out SMACross's return of 27,000%. Stop-loss is important in strategies to prevent overfitting: in retrospect, it is obvious that we should hold through the 2017 downward cycle, but at the time, it was not clear whether BTC would recover or not and taking a 10% loss on your BTC portfolio is unpalatable for most traders.

To improve this strategy, we can work on improving our sell signal via tuning. The current sell signal is not aggressive enough in predicting peaks, and so we can run a grid search in order to optimize for return. This can tune our sell parameter to a lower number so that we are able to capture the top of market cycles and claim our gains. The buy signal is also too early, and could potentially be tuned to be lower so that it enters at a lower part of the market cycle.

MVRV-Z

MVRV-Z backtesting performance



MVRV-Z backtesting performance with 10% stop-loss

The MVRV-Z is the Z-score of the ratio of market value to realized value, where high values of MVRV indicate market tops and low values of MVRV indicate market bottoms. For our trading strategy, we will buy whe MVRV is less than -1, and buy when MVRV is greater than 3.

Similar to the Puell Multiple, we have a relatively low number of trades, but it still produces great results with a high return of 185,842%, blowing our baselines out of the water. It is easy to see why as well: by looking at the graph above, we can see that our strategy does an amazing job of finding market lows, and predicting market tops. Adding stop-loss does markedly lower our return at 156,263%, nearly 30,000% less in return, but is still much better than our baselines and is more realistic in a live trading scenario. This strategy can also be greatly improved upon by adding order sizing and other market orders such as shorts. Shorting will allow us to take advantage of our knowledge of market tops by giving us an option to gain when we know the market will go down.

Realized Cap

Realized Cap + Pi Cycle Top backtesting performance. In both strategies with & without stop-loss, the trades remain the same.

For the last strategy which we describe here (see our results below and Github repo for the full list of strategies and code), we analyze our strongest performing backtest: composite strategy of realized capitalization and Pi Cycle top. Its performance resulted in an overwhelming 189,157% return, which makes a lot of sense considering this strategy is a mix of a bottom indicator and a top indicator. These two indicators together were able to identify the major market uptrends and downturns.

Interestingly, this strategy performs identically well with and without stop loss. Also note, this backtest makes an extremely low amount of trades – only three – but all three have very high returns, essentially predicting market tops and bottoms almost perfectly. The last trade made in 2022 has not closed yet, so only time will tell how this trade performs in the long-run. Despite this, our risk adjusted ratios show that this is a promising strategy: a Sharpe ratio of 0.92, and a Sortino ratio of 3.40 indicating a strong strategy even when risk adjusted. Similar to MVRV-Z, this strategy can likely be improved by adding order sizing and different types of market orders such as shorting to take advantage of our knowledge of cycle tops, not only adding to the performance of the strategy but also improving exposure risks.

Results

While we've expanded upon just some of the trading strategies we tested, the results from each can be found below:

Metric	Equity Final	Return (%)	Sharpe Ratio	Sortino Ratio	Calmar Ratio	Max. Drawdown (%)	Avg Drawdown (%)	Expectancy (%)
Buy & Hold	20151706.62	20051.70662	0.53	1.55	0.89	-83.48	-11.88	20051.70663
Bitcoin Price and Moving Averages	15084293.07	14984.29307	0.75	2.06	1.09	-63.43	-10.14	12.90406109
Realized Cap	15829989.43	15729.98943	0.83	2.25	1.14	-61.56	-7.05	281.159503
Bitcoin Yardstick	9364931.783	9264.931783	0.63	1.61	0.92	-66.36	-9.23	81.26146415
MVRV	185942014.8	185842.0148	0.86	3.18	1.95	-61.56	-7.75	684.5030841
Reserve Risk	13177388.88	13077.38888	0.73	1.91	1.09	-61.56	-8.22	157.8568411
Pi Cycle Top	22887571.93	22787.57193	0.55	1.62	0.92	-83.55	-11.69	1173.602452
Realized Price	1553266.812	1453.266812	0.60	1.23	0.54	-61.56	-7.28	79.3770609
NUPL	2431649.4	2331.6494	0.73	1.63	0.96	-41.36	-7.52	41.80544117
Monthly HODL Net Position Change	483705.0331	383.7050331	0.35	0.59	0.23	-77.96	-12.70	25.51067177
Puell Multiple	34414884.71	34314.88471	0.62	1.90	1.10	-76.63	-10.55	409.0248776
Daily Address Activity	10820053.71	10720.05371	0.64	1.73	0.82	-77.04	-9.09	3.991623507
Miner Supply Spent	6606292.422	6506.292422	0.52	1.34	0.66	-83.48	-10.83	64.69263708
Miner Position Index	200499.2562	100.4992562	0.19	0.30	0.09	-80.62	-9.36	9.204715866
Percent of Supply in Profit	2602135.957	2502.135957	0.54	1.18	0.66	-61.56	-9.38	52.12517542
New Address Momentum	343424.4876	243.4244876	0.41	0.73	0.23	-60.18	-11.34	21.06345028
Liquid vs Illiquid Supply	238536.38	138.53638	0.39	0.67	0.21	-45.21	-8.41	7.828329924
BTC HODL Waves	89837.25968	-10.16274032	0.00	0.00	0.00	-82.04	-9.99	-10.16274065
BTC Balance Buckets: # of Addresses	664202.9218	564.2029218	0.40	0.77	0.29	-75.92	-8.38	2.428041637
BTC Balance Buckets: Supply Held	245841.7085	145.8417085	0.42	0.83	0.26	-37.70	-11.26	3.24580075
Realized Cap + Pi Cycle Top	189257729.7	189157.7297	0.92	3.40	1.96	-61.56	-7.39	2453.559394

Backtesting strategies without stop-loss. Realized Cap + Pi Cycle Top performs the best while Liquid vs Illiquid supply performs the worse

Metric	Equity Final	Return (%)	Sharpe Ratio	Sortino Ratio	Calmar Ratio	Max. Drawdown (%)	Avg Drawdown (%)	Expectancy (%)
Buy & Hold	20151706.62	20051.70662	0.53	1.55	0.89	-83.48	-11.88	20051.70663
Bitcoin Price and Moving Averages	27199072.95	27099.07295	0.83	2.45	1.03	-77.70	-8.43	9.801900795
Realized Cap	13305859.44	13205.85944	0.79	2.08	1.09	-61.56	-7.00	391.8665058
Bitcoin Yardstick	8810269.917	8710.269917	0.62	1.56	0.89	-67.53	-8.49	118.3709183
MVRV	156363711.4	156263.7114	0.84	3.02	1.89	-61.56	-7.58	1065.999426
Reserve Risk	14974207.53	14874.20753	0.74	1.97	1.12	-61.56	-7.94	258.0641576
Pi Cycle Top	21568893.92	21468.89392	0.54	1.60	0.91	-83.55	-11.78	1340.557135
Realized Price	1305594.687	1205.594687	0.55	1.09	0.50	-61.56	-7.21	109.3710868
NUPL	2044840.275	1944.840275	0.67	1.46	0.85	-43.86	-7.21	55.84273813
Monthly HODL Net Position Change	437129.3405	337.1293405	0.31	0.52	0.21	-78.41	-13.48	38.6807968
Puell Multiple	23495245.08	23395.24508	0.59	1.71	1.01	-76.63	-10.70	610.2977579
Daily Address Activity	3617258.102	3517.258102	0.47	1.11	0.53	-86.81	-11.27	3.607809295
Miner Supply Spent	7010039.667	6910.039667	0.51	1.31	0.67	-83.48	-10.01	69.18234332
Miner Position Index	202602.1766	102.6021766	0.18	0.27	0.09	-88.99	-8.23	11.19226727
Percent of Supply in Profit	1992366.121	1892.366121	0.50	1.04	0.59	-62.04	-8.88	69.93921458
New Address Momentum	395942.5639	295.9425639	0.34	0.59	0.23	-68.61	-13.75	24.851879
Liquid vs Illiquid Supply	238536.38	138.53638	0.39	0.67	0.21	-45.21	-8.41	7.828329924
BTC HODL Waves	688336.2456	588.3362456	0.29	0.56	0.27	-83.48	-12.69	588.3362647
BTC Balance Buckets: # of Addresses	754711.9888	654.7119888	0.41	0.80	0.32	-73.65	-8.62	2.787235808
BTC Balance Buckets: Supply Held	245841.7085	145.8417085	0.42	0.83	0.26	-37.70	-11.26	3.24580075
Realized Cap + Pi Cycle Top	189257729.7	189157.7297	0.92	3.40	1.96	-61.56	-7.39	2453.559394

Backtesting strategies with a 10% stop-loss on all positions. Returns are decreased for some strategies. These strategies are more realistic in terms of real world performance.

Among the strategies that did not use stop-loss, the clear winner is the combined metric strategy of Realized Cap + Pi Cycle Top with a final equity of $189,257,729.72 and strong risk-adjusted ratios. A strong second best strategy is MVRV-Z with a slightly worse performance than Realized Cap + Pi Cycle Top but well surpassing Buy and Hold. Other strong performing strategies include the Puell Multiple which both beat out both baselines. Among the worst performing strategies include BTC balance buckets and liquid illiquid supply, which make sense given these metrics do not give inherent signal but rather gauge market sentiment. These strategies can be improved by engineering these features to better capture some trading signals.

For strategies that did include stop-loss, we have the same winners in Realized Cap + Pi Cycle Top and MVRV-Z, which had only a slight hit to its return. However, some strategies took big hits on their return such as NUPL and the Puell multiple, dropping more than 3000% in both cases. Other less performant strategies also took a hit to their return performance. Measuring performance with stop-loss is good, as it emulates real world conditions where most traders are unlikely to stomach more than a 10% loss on their positions.

Future Work

As mentioned in the case studies, there are a few enhancements we can make to our strategies to improve their return. The first is order sizing: by adjusting the entry position, we can take multiple positions in a bear market to increase our close options during a bull cycle. In the current strategy, we use all of our capital to buy out everything we can in one shot. This means that if the strategy predicts a peak too early, we lose out on potential gains later.
Another enhancement would be to add other market orders. In the current strategy, we only do simple buy and sell orders. If at the top of a market cycle, we can enter a short order, this will allow us to capitalize on our knowledge of the eventual market correction. Combined with order sizing, we can make smaller bets on price movement, and give us more control over which positions to open and close.

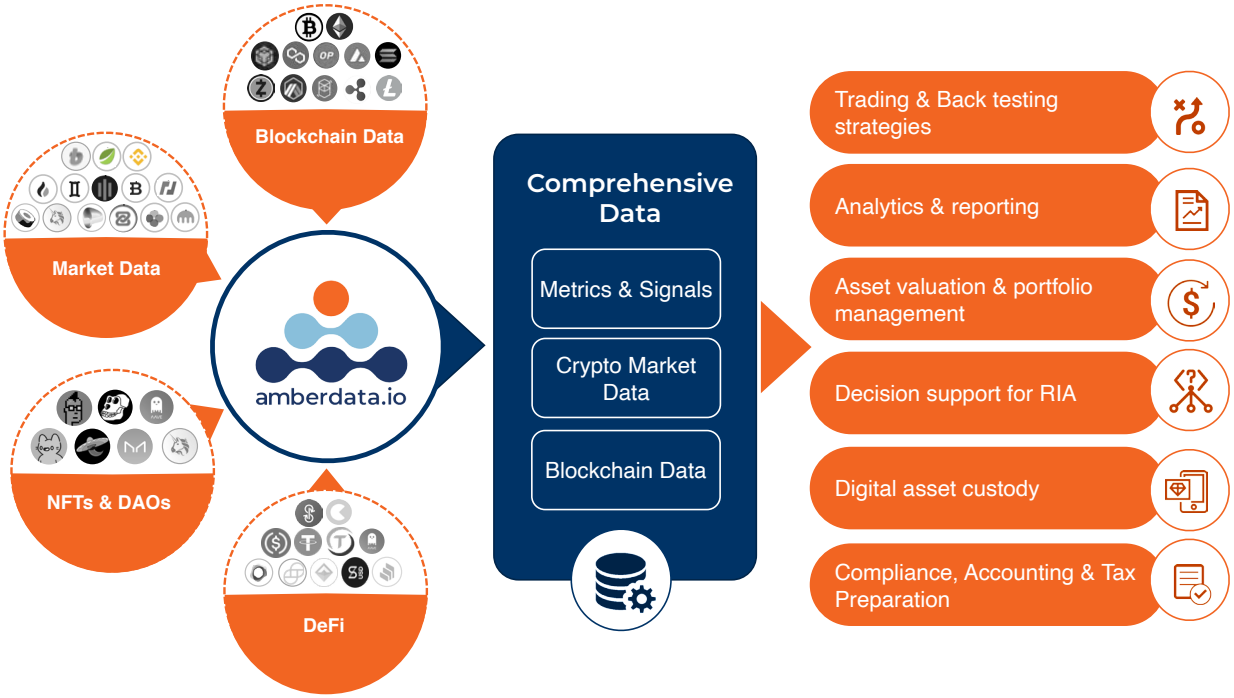
Finally, the last enhancement we can make to these strategies is tuning. Backtesting.py provides a comprehensive tuning library that allows us to optimize parameters for arbitrary metrics, such as the Sortino ratio or Calmar ratio. Many of these strategies can be greatly enhanced with simple tuning via grid search. Combining all three of these enhancements can easily lead to further gains in each of these backtests.

Conclusion

Out of the box, AmberLens is a powerful tool that can provide insights into current market cycles and sentiment. By using these metrics, researchers, traders, and analysts can make more informed decisions about their trades. This paper showcased how we can leverage these metrics for backtesting strategies, with clear room for improvement. We leave these improvements as an exercise to the reader. These strategies serve as a good baseline upon which investors can build more complex and inventive strategies.

Anyone can access AmberLens dashboards and metrics here for free. The complete historical datasets underlying AmberLens dashboards are available for purchase from Amberdata. If you're interested in obtaining these data sets, contact us to get a demo

LOOKING TO ENTER DIGITAL ASSETS?



If you're looking to enter the digital asset space, you need Amberdata.

Our platform connects to all the blockchains and markets that matter today, allowing a comprehensive view of crypto markets, blockchain networks, NFTs, DAOs, and DeFi. We provide real-time and historical transparency into markets and price discovery across spot, derivative and decentralized exchanges, as well as on-chain data from the most active cryptocurrency networks and protocols.

Our data solutions support all pre- and post-trade functions. We provide deep market data, down to Level 2 order books, facilitating backtesting of quant trading strategies. And our blockchain data provides transparency not seen with other asset classes, allowing you to track pending transactions and wallet balances over time across various blockchain networks, as well as market cap and total value locked. You can also create analytics dashboards with fundamental data to track network health and understand DeFi data like liquidity and lending rates. For fund accounting and administration, you'll know what was in a wallet at any time and what it was worth in any currency. For institutions that want to do custody themselves rather than outsource it, we provide the on-chain data needed.

With Amberdata, you get a single integration point for market and on-chain data, eliminating the need to integrate offerings from multiple vendors and allowing you to accelerate time to market for your digital asset products. We've built our data sets with institutional use cases in mind, providing the easy to consume formats and reliability you receive with traditional asset classes.

Request a demo to find out how the Amberdata platform solves digital asset data challenges and enables institutions to enter the digital asset space quickly, easily, and reliably. amberdata.io/demo

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