Adaptive Hybrid Regime-Switching Strategy with Dynamic Kill Switch: Balancing Performance and Risk in Crisis and Bull Markets.

Antonios Belias (17 years old)

(All backtests account for realistic trading costs and constraints. Each position assumes a **5% capital allocation per trade**, with total **transaction costs of 0.15%** (comprised of **0.05% in fees** and **0.10% slippage**) applied per round-trip trade. The trades are also done day-in day-out.)

It is common knowledge in the industry that no strategy can survive every single market, however **when we break the problem down there are really two main things stopping us. Signal staleness or full on irrelevance, and unchanging risk management. How does a strategy make profits no matter what the current regime is? How does it avoid crashing no matter what the current regime is?** That is the problem we have tried to tackle in this paper, using adaptive volatility/momentum/trend based risk management and signals from multiple different strategies, strategically filtered to only follow through when there is real profit to be made, while minimizing danger. **Because the goal is not always wealth and riches, often it is just...to not die stupidly.**

Chapter 1.1 : Core Buy/Sell logic

The heart of the algorithm we are presenting was, in its earlier states, explained in detail in my first paper [Hybrid Momentum-Reversion Strategy: A Quantitative Comparison with SMA and Mean Reversion] **, it combines mean reversion, momentum following and the usage of SMAs to filter out which signals hold truth behind them and which are caught in the noise of the market. Then through indicators like volatility and Z-scores it decides what strategy is most suited.** (a direct explanation of this logic will follow in chapters 1.2-1.3) Furthermore, for testing purposes, three versions of this strategy have been written, with each one keeping the same signal generation but relying on different methods of risk management.

- The first version **follows only what the signals are transcribing, buying when told to, selling when told to.**
- The second version **has a static kill-switch activated from the price's current drawdown in comparison to the portfolio's current value.**
- The third and most technically refined one **uses a kill-switch that only gets activated if volatility is high (in comparison to the rolling median), if momentum is negative and if the previous static drawdown limit is met. Only then will the kill switch activate.**

(Important note for the second and third version: If the algorithm leaves a trade because of the kill-switch, on the following day it will check for signals like normal. The kill-switch will only stay active if on every following day the conditions for it are still met.)

Chapter 1.2: Signal filtering between strategies and regimes

At any given time, our system receives signals from two core trading logics: **Simple Moving Averages (SMA)** and **Mean Reversion (MR)**. These signals don't exist in a vacuum—they're influenced by a broader context of momentum and volatility indicators. The decision engine uses the following filtering rules to determine which logic takes control on any given day:

- **If the volatility is lower than the rolling median, we go with SMAs** to keep things simple, they're proven and trustworthy in calm markets.

- **If the volatility is high but there's clear upwards momentum, we still opt for using SMAs**, as volatility isn't a concern when prices are going up no matter what.

- **If volatility is high and there's no clear trend then we go with mean reversion**, hoping to take advantage of a choppy sideways market.

- **Lastly, if the momentum is negative and volatility is low, we take a short position** on the stock as a default.

Once a strategy is chosen, **its own internal logic takes over**. For example, if SMA is selected and it's flashing a "sell" signal, that's what we act on. Same goes for MR logic: if it tells us to short, we short. This marks the **end of Version 1's logic.**

Chapter 1.3 : Risk management using the kill switch

The last step before the final signal is the potential to use a kill switch. **No matter what selections were made beforehand, if the conditions of the kill switches in versions 2 and 3 are met, the signal will get overwritten so that we stay out of trades until said conditions are met.** (The details of the conditions are in chapter 1.1)

Chapter 2.1 : Comparison between the three models

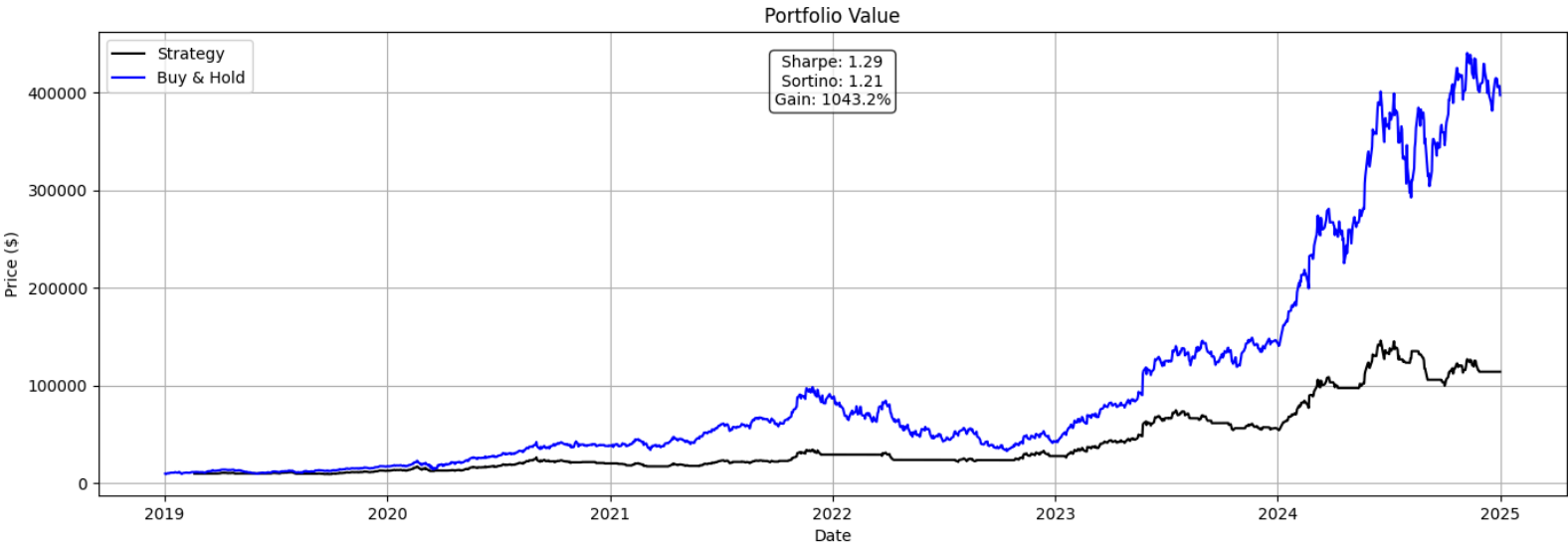
To evaluate performance, we tested all three versions of the strategy across multiple stocks. You'll find the full dataset at the end of the paper, but for clarity, the next few pages will focus on a handful of representative examples.

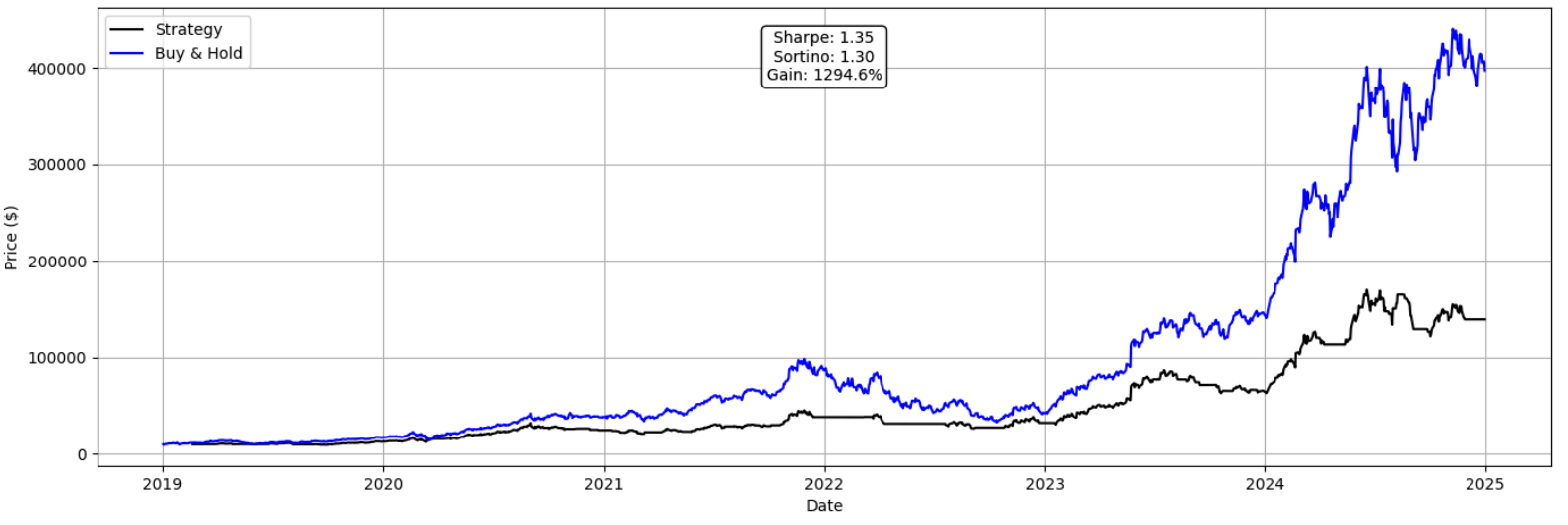
In each case, we start with **$10,000 in capital**. The **top chart** will always show the price of the stock. The **bottom two charts** will display the **two best-performing models** for that case. We'll walk

through why those two worked well, and what caused the third to underperform. Important risk and performance metrics will be displayed on top of each individual strategy’s graph.

NVIDIA stock (2019-2025)

Below is: Version 1 without a kill switch, and version 3 with an adaptive one, in that order. Buy-and-Hold is represented by the blue plot.





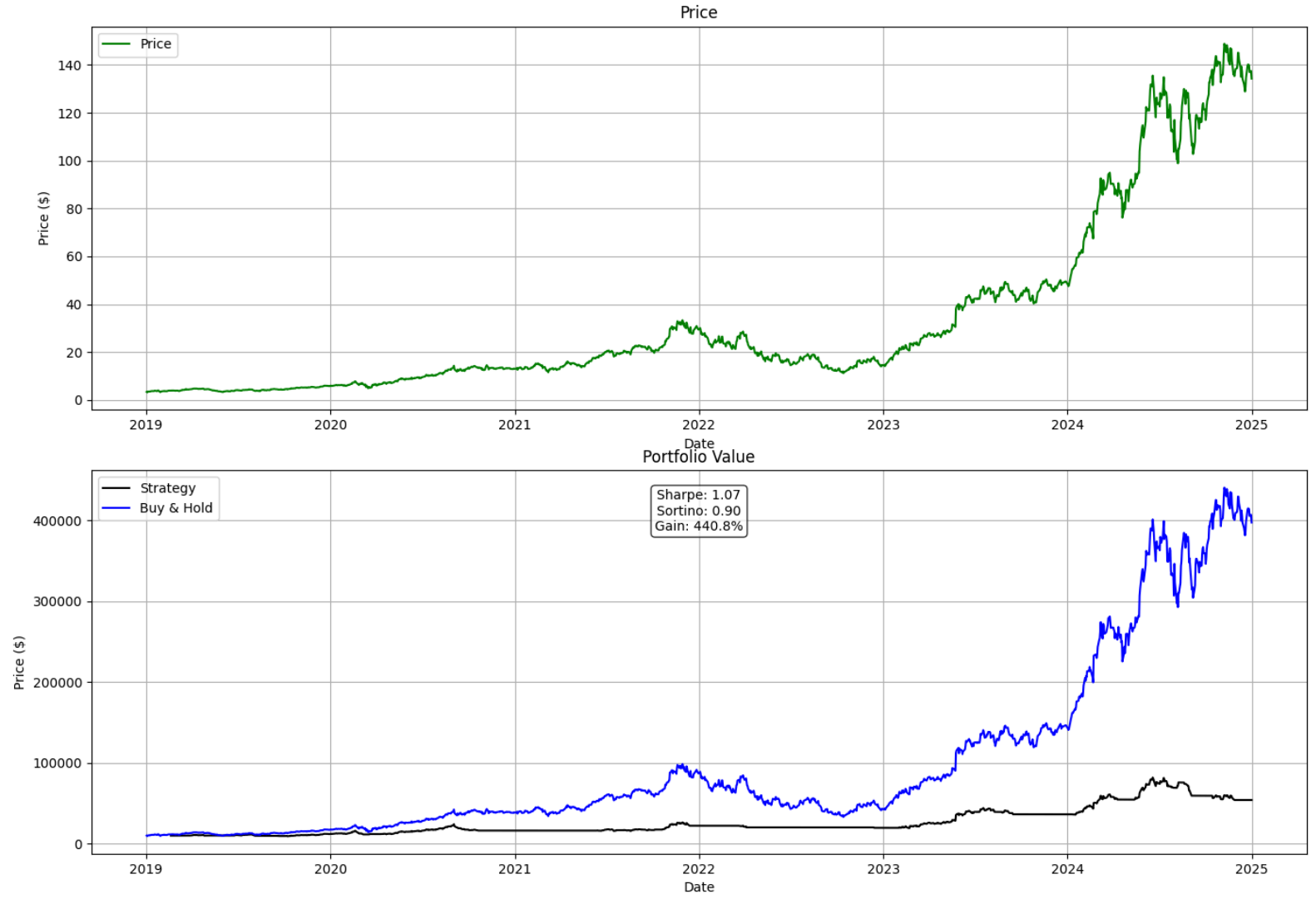
Final portfolio values:

- Buy-and-Hold = $397,532.32

- Hybrid strategy (V1) = $139,457.69
- Hybrid strategy (V3) = $114,322.69

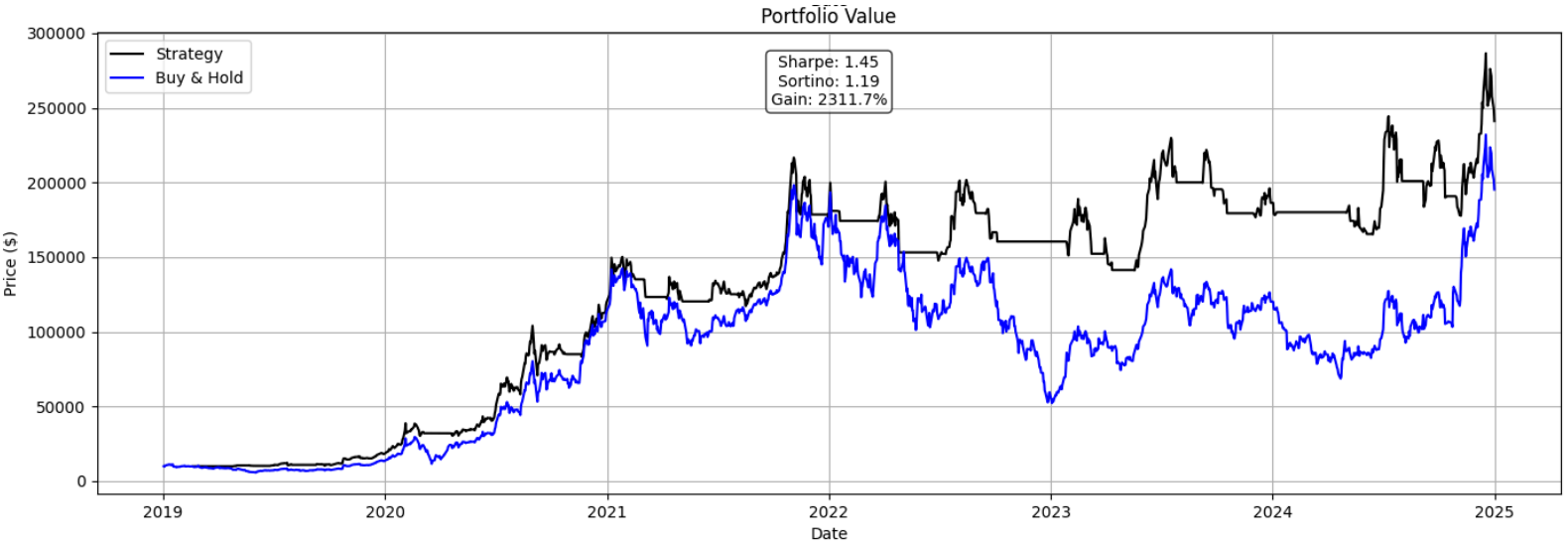
Summary of the 1st example(NVIDIA):

- NVIDIA had a massive bull trend, especially in 2024-2025, meaning that **strategies that follow the trend as closely as possible benefited. Ones that were too cautious like V2 got their profits massively cut down (As it only ended up with $54,082.57, around 12% of Buy-and-Hold's over $400,000.)**
- Out of all the models, **the one with the least amount of risk-management ended up being the most profitable.** Sounds counter intuitive, right? **Well, massive uphill trends like this usually work best when given the most possible freedom.** If there is risk management there's a chance a swing in volatility can cause the algorithm to sell, when in the long term riding the chaos out would've resulted in more profits. Still though, **Version 3 managed to keep risk management in place and only lose 18% of the profits.**
- The version with the strictest form of risk management failed to take advantage of the trend, as we can see below it left the trade too soon due to increased volatility, losing out on massive gains.



TESLA stock (2019-2025)

Once again the two plots below show V3 and V1, this time V3 outperformed even the unrestricted original, they look near identical but the numbers show that V3 was slightly ahead.



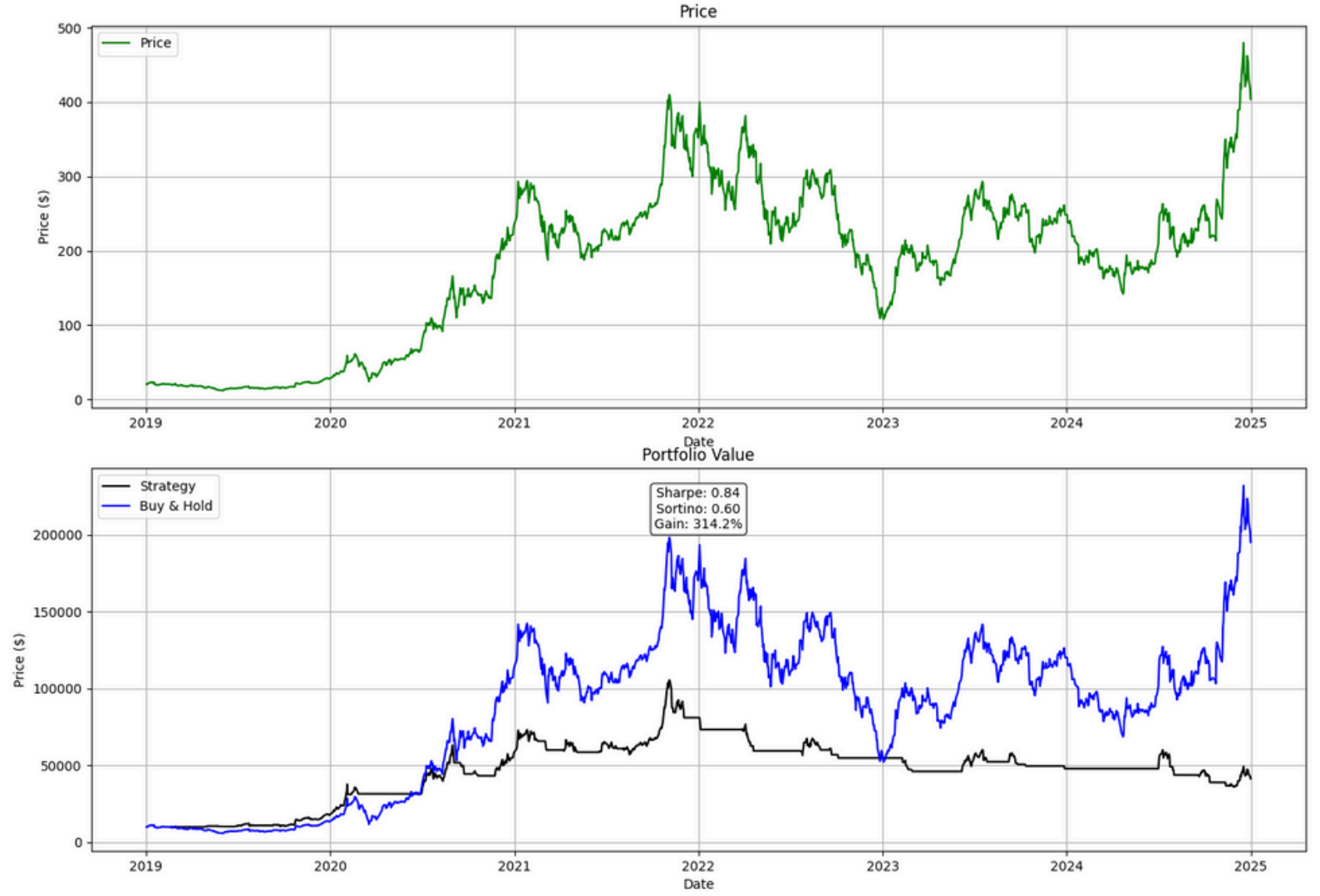
Final portfolio values:

- Buy-and-Hold = $195,330.83

- Hybrid strategy (V3) = $241,174.76
- Hybrid strategy (V1) = $236,329.34

Summary of the 2nd example(TESLA):

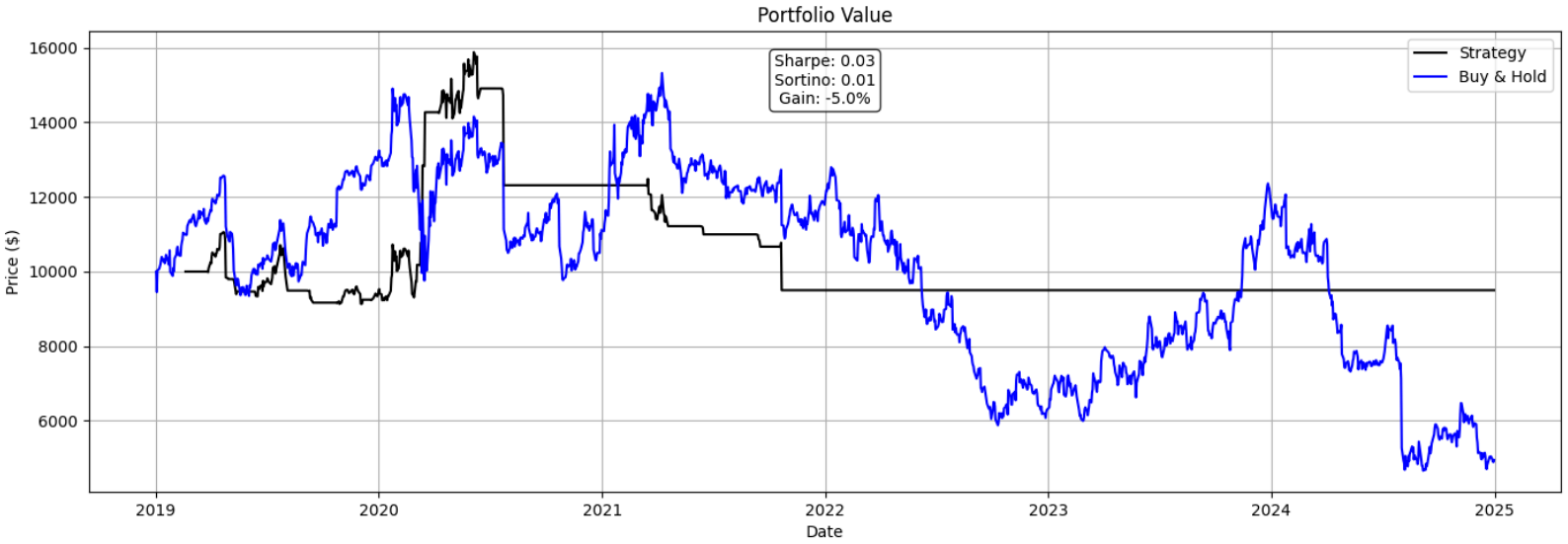
- TESLA prices were overall going upwards, as clearly shown, but they did so with such high volatility that systems that could a) profit from choppy markets through mean reversion and b) dynamically adapt to not leave trends due to said volatility would profit the most.
- This time, **smart trading based on indicators and signals even beat Buy-and-Hold by almost 25%.**
- Once again, the strict stop-loss version (V2) didn't have as good of a performance, as shown below.

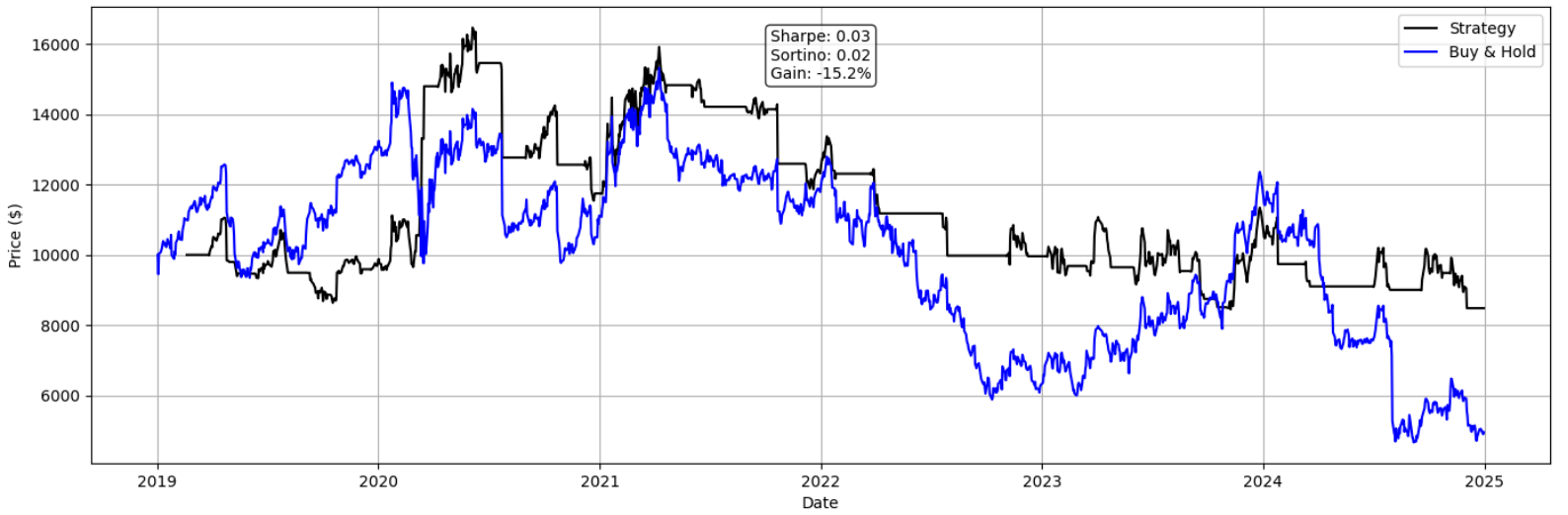


So a fair question to ask would be: Is there even a situation where a strategy such as V2 could be of use? These next examples answer this very question.

INTEL stock (2019-2025)

Now the benefits of a standardized kill-switch become apparent. As it doesn't trade unless specific conditions are met, it manages to avoid catastrophe. V2 had the best performance and is at the top, while V3 is once again following behind as a good middle ground between the strict rules or lack thereof of the two other versions.



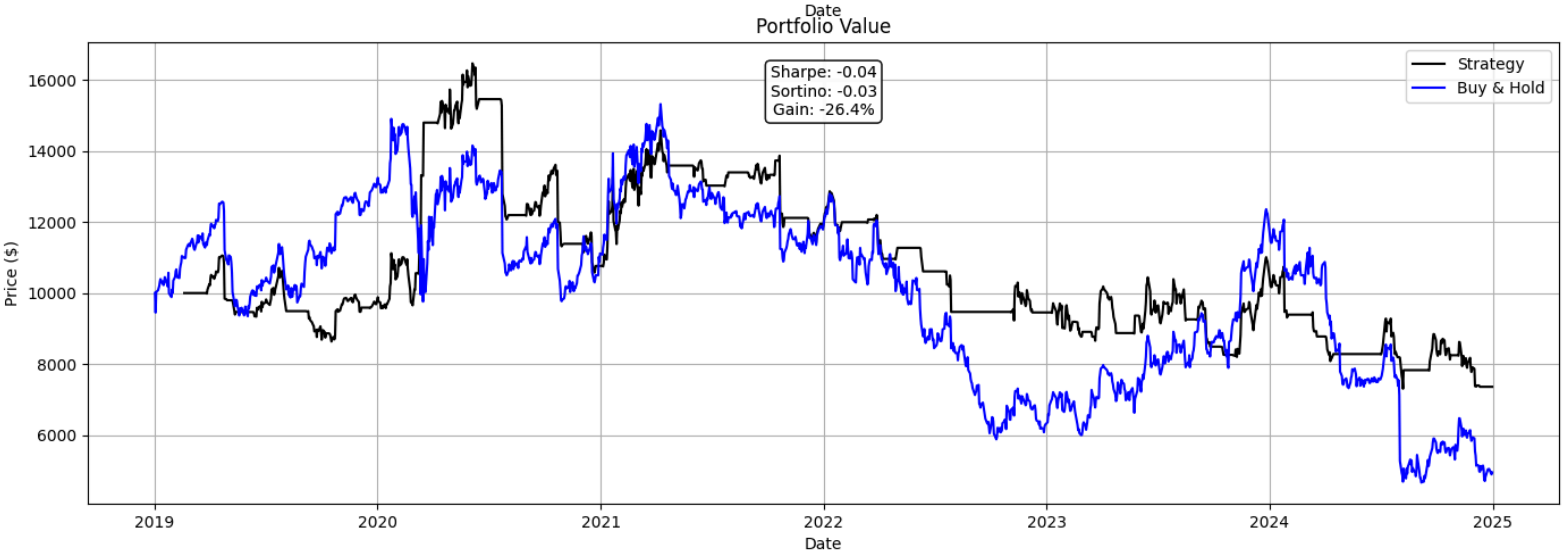


Final portfolio values:

- Buy-and-Hold = $4,948.41
- Hybrid strategy (V2) = $9,499.70
- Hybrid strategy (V3) = $8,482.58

Summary of the 3rd example(INTEL):

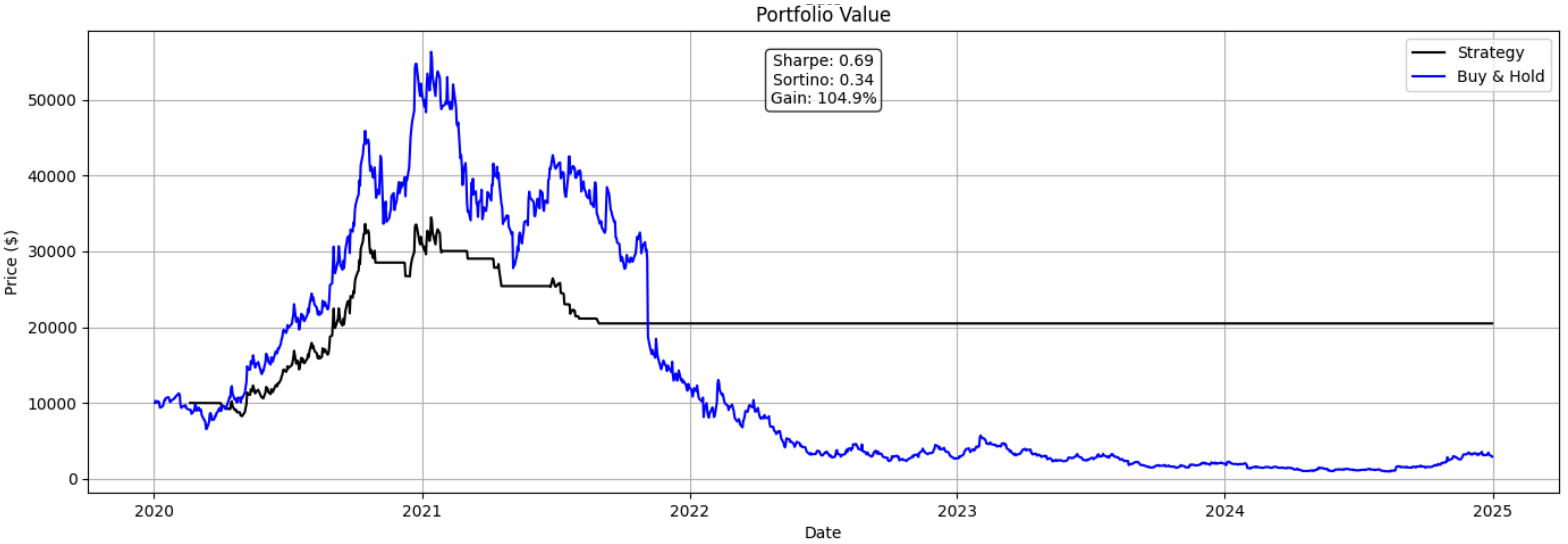
- Intel had massive and sudden drops, causing strategies with no proper risk management to lose most of their portfolio's value in a few big drops and then be unable to recover.
- In such cases, strict risk management like that of V2 helps minimize losses, while more dynamic approaches (like V3) can achieve close to that level of stability while still still being open to follow a potential uphill trend afterwards. (The pictures bellow are from V1's performance)

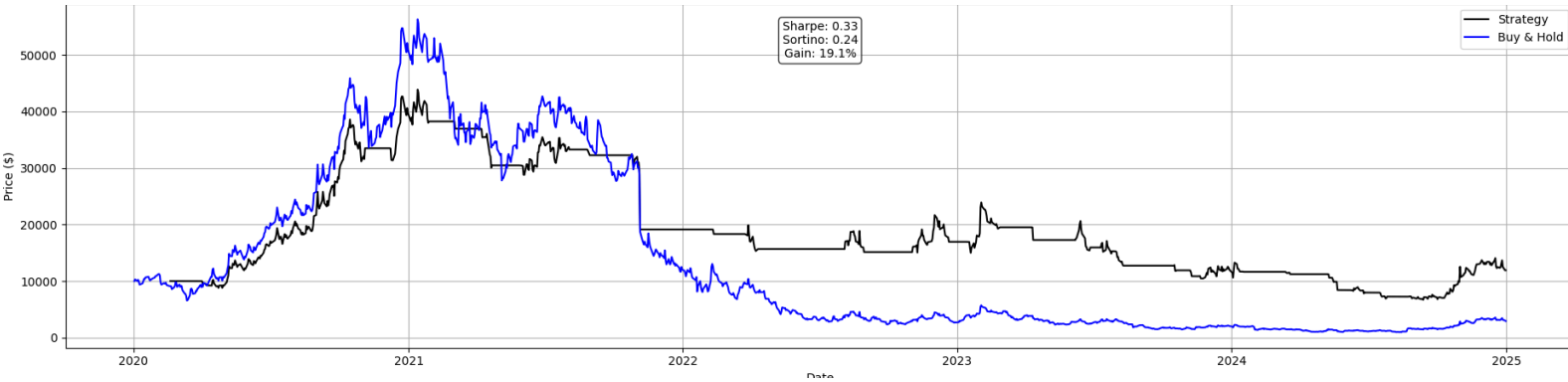


- **Hybrid strategy(V1) : $7,359.42**

Peloton Interactive stock (2020-2025)

Once again, V2 and V3 with their kill switches escape massive losses through their rigid risk management





Final portfolio values:

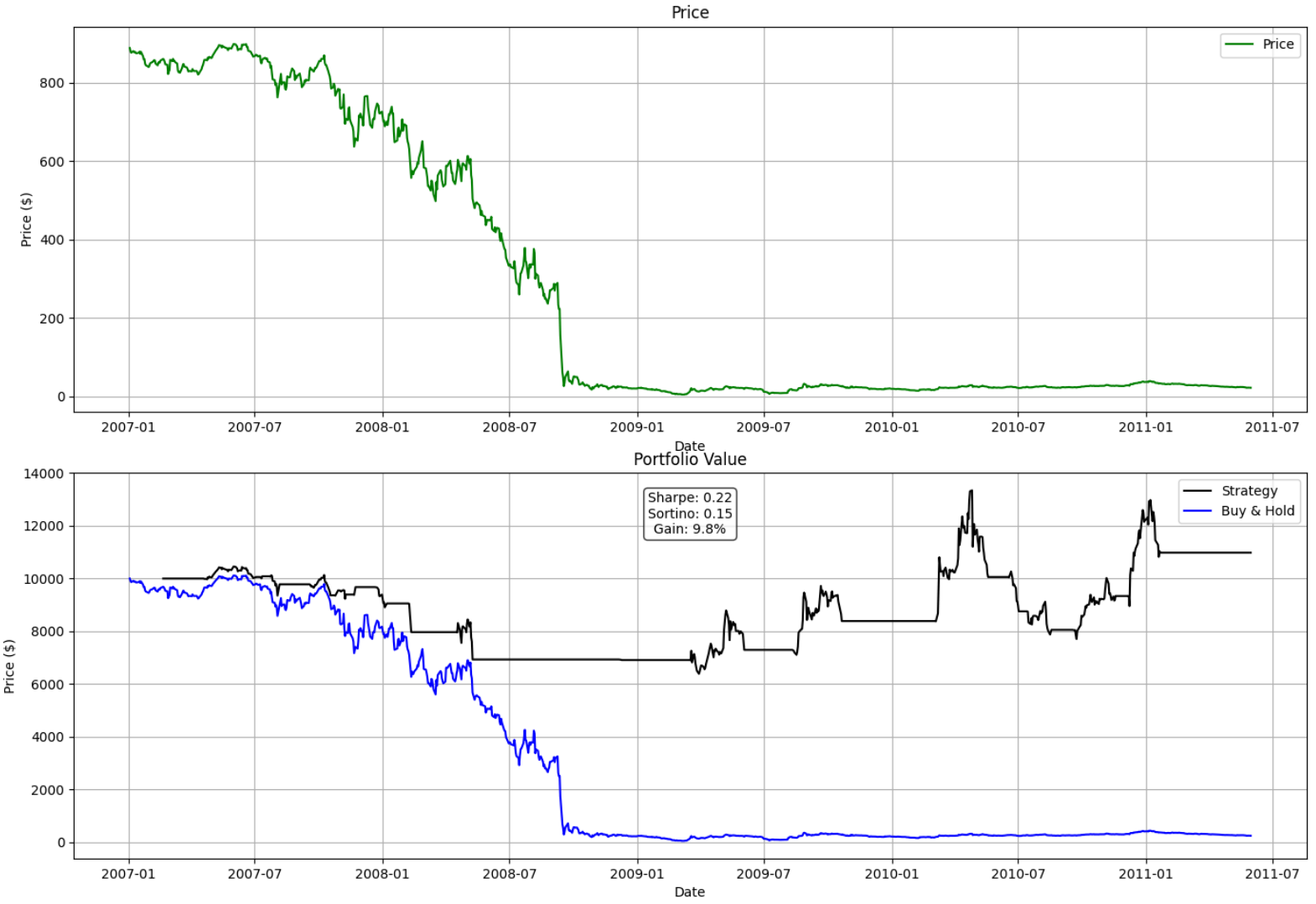
- Buy-and-Hold = 2,925.35
- Hybrid strategy (V2) = $20,486.17
- Hybrid strategy (V3) = $11,906.19

(There won’t be another page to explain this trend, the explanation is the same as the one for INTEL stock)

Chapter 3.1: Stress testing the final product (V3)

After being surprisingly happy with the results of the dynamic risk management model, I decided to stress test it by having it trade multiple stocks during big crashes. These following examples won't have a detailed explanation as the results speak for themselves and the logic behind this strategy has already been analyzed.

AIG (2007-2011)



Final Portfolio values:

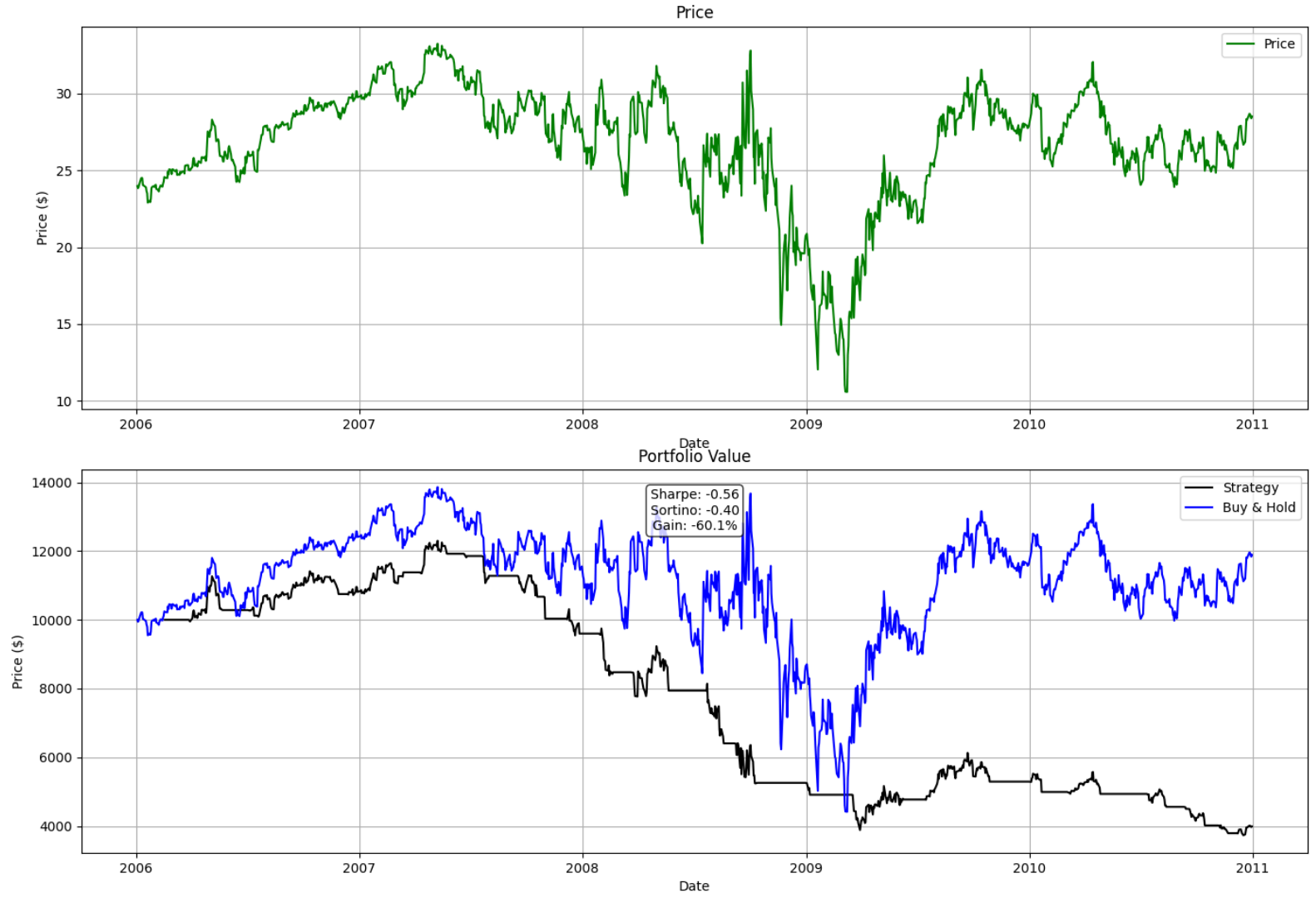
- Buy-and-Hold = $245.70
- Hybrid strategy (V3) = $10,981.36

(Made 9.8% profit when the stock price had a 98% drop in price)

Chapter 3.2: Stress testing the final product (V3)

JPM (2006-2011)

(An unfortunate underperfomer, but you can't win 'em all)

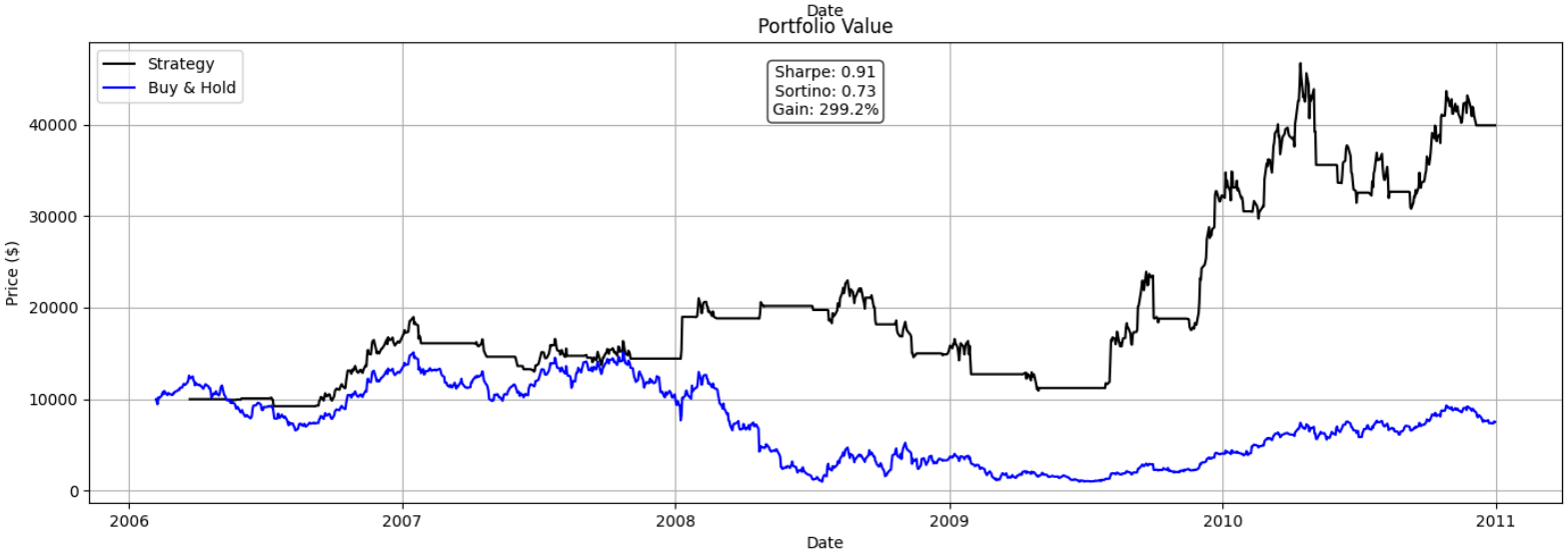


Final Portfolio values:

- Buy-and-Hold = $11,890.35
- Hybrid strategy (V3) = $3,989.07

Chapter 3.3: Stress testing the final product (V3)

United Airlines (2006-2011)



Final Portfolio values:

- Buy-and-Hold = $7,513.87
- Hybrid strategy (V3) = $39,916.22

Conclusion

This project isn’t perfect. If backtested more thoroughly I’m certain more and more weaknesses will come to light, but my goal wasn’t to make the perfect trading algorithm. That is something much smarter and more experienced people than me are tackling,

What I wanted to show was that, even without Machine Learning techniques and tricks which I cannot test due to hardware limitations, the deep need for adaptability in this field can be achieved with simplicity if the right market intuition is present.

The risk metrics also show the fragility of the strategy, the improvements of which will be what I focus on in the future.

It doesn’t always work, as clearly presented, in extreme, calm and steady Bull markets it gets beaten by BnH, in some extreme crashes it fails to recover, but the rate of success as far as I am aware still remains extremely high. This paper goes to show that simple ideas executed properly can yield results incomparably larger than their individual strengths would demand.