



# How to outperform the stock market using artificial intelligence

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In this article, I would like to shed some light on how the quantitative stock selection approach at VT Wealth Management works and how it has performed so far.

## 1 How it all started

"What's our opinion on Fleury?", a Wealth Manager asked me one day last year. To my shame, I did not even know the Sao Paulo based company existed, let alone their fundamentals.

In order to be able to answer such requests more efficiently, I needed a solution that would let me rate a certain universe of stocks in literally no time. In addition, I wanted an answer to the ever-present question of which stock to buy today.

## 2 Do you really need to know them all?

In a recent paper, Bessembinder et al. analysed the return data of 61'100 global common stocks traded on public markets over the 1990 to 2018 period (Bessembinder, Chen, Choi, & Wei, 2019). They concluded that only 40.5% of global common stocks have full sample buy and hold return that exceed the accumulated return of one month US Treasury Bills! 23'905 firms created

positive wealth of 66.57 trillion dollars whereas the remaining 37'195 firms generated negative wealth of 21.83 trillion dollar resulting in a net wealth creation of 44.74 trillion dollars.

*"The majority of stocks underperform one-month US Treasury bills over the 1990 to 2018 period."*

- **Five firms** (Amazon, Apple, Microsoft, Alphabet and Exxon Mobile) accounted for 8.27% of global net wealth creation.
- The best **306 stocks** (0.5% of total) accounted for 73.03% of net wealth creation
- The best **811 stocks** (1.33% of total) accounted for 100% of net wealth creation

The paper shows, that by focusing on 1.33% of the overall universe, you would have achieved the same wealth creation as with investing in the market. This in turn means that the remaining 98.67% of companies netted themselves out, creating absolutely no value for investors. If one could only identify that 1.33%, it would prove that active management is still very much alive and low-tracking-error-strategies are a game of hide-and-seek resulting from the inability to select the right investments.

### **3 How to solve the puzzle?**

As an analyst by training, I believed that we would find the needle(s) in the haystack, if we carefully analysed the companies' key financial figures. Therefore, I followed the following steps.

Let us assume we consider buying shares of Vertical Food Corporation (VFC), an innovative, fictitious company operating in vertical farming (consumer staples) in Europe. After having analysed all the important metrics, how do we know if the company is cheap or expensive? After all, a

forward P/E of 15.1x can still be quite expensive if the sector trades at a forward P/E of 12.3x.

Therefore, to give those numbers a meaning, we need to analyse the peer group as well. There are many approaches to defining a peer group; an obvious one would be by sector and region (or accounting standard). After analysing the entire peer companies' set in the consumer staples sector in Europe (which would require some labour), let us assume that VFC is indeed relatively cheap.

However, Europe is not the only region in the world where companies like VFC operate. Therefore, we should draw a comparison against companies operating in the consumer staples sector in other regions as well. After having done so, and even if VFC is attractively valued against the global consumer staples sector, there is still a chance that the sector itself is expensive when compared to other sectors.

This means that if we want to carry out a proper analysis of one company, we have to perform a relative valuation against every other company on the planet. To complicate things further, such an analysis is only meaningful, if it is done simultaneously. In addition, the analysis would require a lot of labour and with banks constantly thinning out their teams of analysts, the puzzle seems almost impossible to solve.

Fortunately, enormous technical progress has been made over the last decades and computers now have enough computing power to solve even complicated tasks very quickly. So, you only have to be able to code (which I take for granted) to automate the classic financial analysis work. One of the big advantages is also, that artificial intelligence algorithms are now widely available (and therefore I will not touch on coding or specific algorithms in this article).

### **3.1 Artificial Intelligence**

For example, the use of machine learning algorithms allows us to loosely define our valuation models and let the algorithm decide which features are important in each sector. This really speeds up pre-processing of the available data sets and after all, leads to stronger and more robust models. As a side effect, those algorithms also pay attention to data points that might otherwise be considered irrelevant (often without having any statistical proof for such an assumption).

After pre-processing the data and training your algorithms, you should be able to achieve decent estimates for your companies. We calibrated the model in a way that it finally comes up with either a Buy, Hold or Sell Rating. Due to the noise your dataset might contain (especially on price series), you probably should not expect accuracy scores as in «simpler» ML tasks like image classification. We achieved an accuracy (personally, I prefer the term «hit rate») of 70 to 80% which is decent given the task. If you achieve higher numbers, I would be keen to learn more about your approach.

If you are now somewhat disappointed that I did not publish the algorithm in detail, just get in touch with me. I will not reveal the code, but I will gladly take the time for a discussion among like-minded people.

## **4 Is it really working?**

### **4.1 Backtesting**

Before investing real money in a strategy, you always should test it throughout. We set up our test environment (after cross validation and so on) in a way, that the algorithm(s) were able to see the data up to a certain point in time. Then they needed to deliver an estimate, which was stored. After that, they get to know the next period, trained again, had to deliver the next estimate, store it and repeat until today. Insofar the algorithm has never experienced look-ahead-bias and the backtesting is fairly close to the

reality (as with all causal models). Those are the results for all stocks rated buy in the S&P 500 Index:

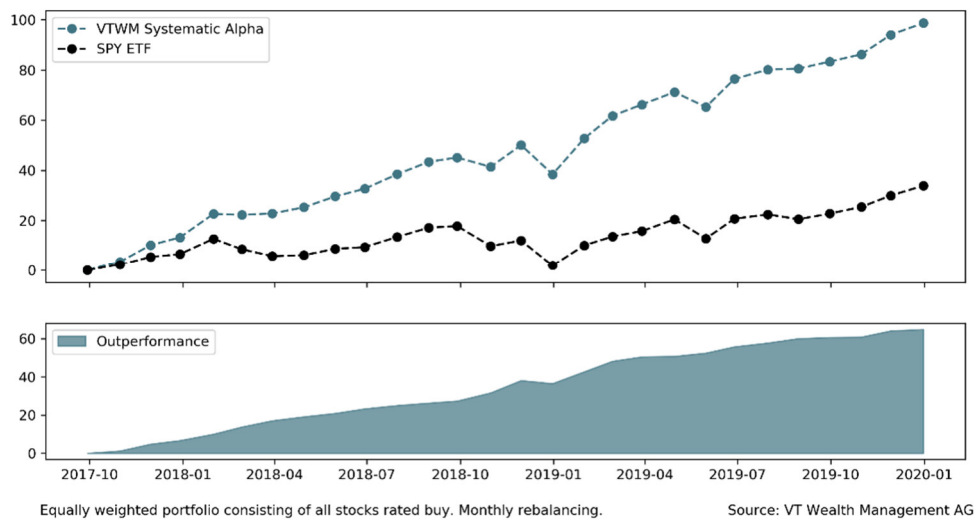


Figure 1: Backtested Performance of Long Only Strategy

The strategy achieves a sharpe ratio greater than 2, tracking error of about 4.65, an IR of 3.73, beta of 0.84 and correlation of 0.95 over the last two years. More detailed statistics will be available upon request.

## 5 Live Performance

As the backtest was very promising, we decided to launch an investable product on the strategy shown above for qualified investors (as well as a long/short version of the strategy as a managed account). Going-live-date of the product was January 6, 2020 and the MTD performance looks like this:

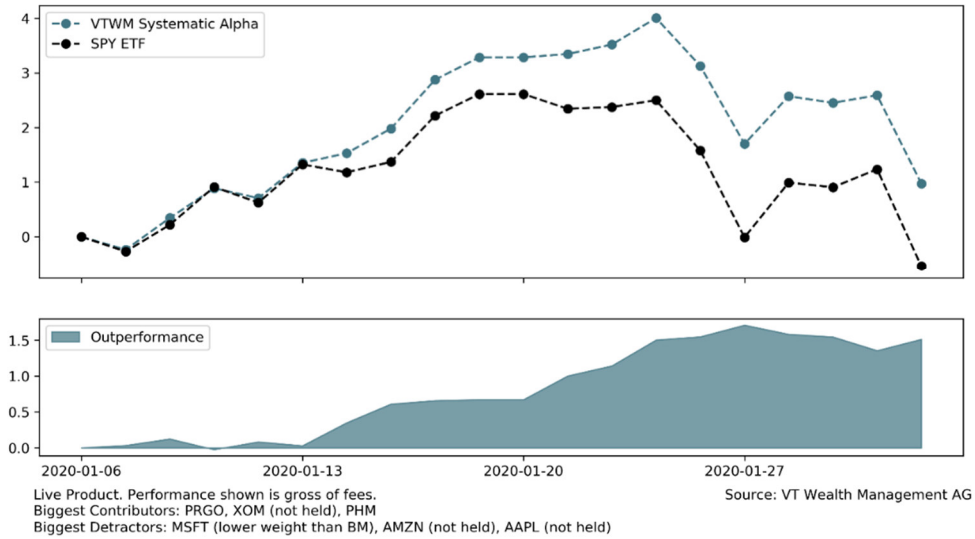


Figure 2: Live Performance of Long Only Strategy

The L/S strategy shows the following performance figures:

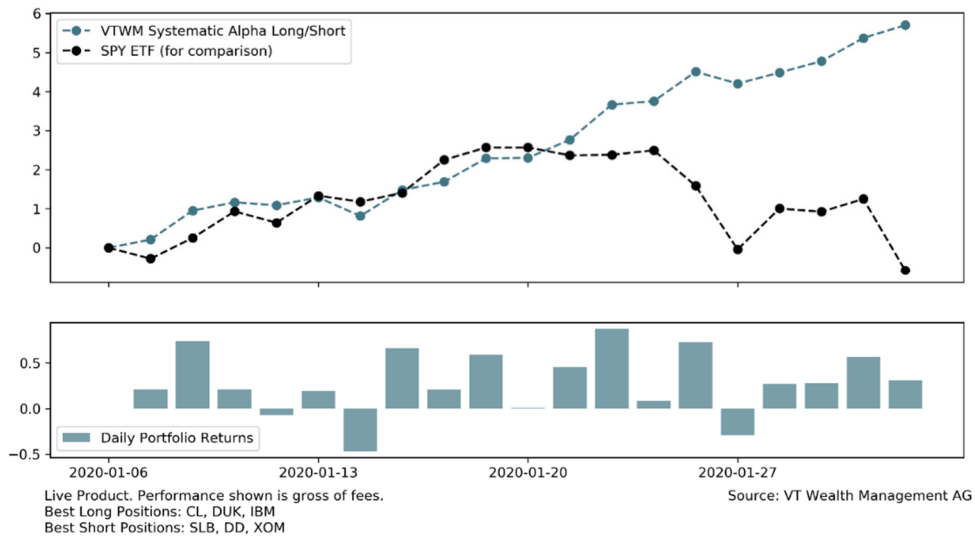


Figure 3: Live Performance of Long/Short Strategy

For sure, those are very short time frames and certainly no indication for future performance. Even more I would like to stress that the strategy will probably not be able to outperform the overall market in strong uptrends (like the one we have seen in Q4 last year, which was also especially challenging for integrated factor strategies).

I hope this gave you some insights on how we perform our quantitative stock selection. Let me know if you have specific questions or ideas on how to improve the approach or want to learn more about it.

## 6 Conclusion

- Active Management is very much alive
- To remain competitive as an asset manager, you will have to make use of the latest technologies
- The required skill set of financial analysts and portfolio managers will change significantly (i.e. traditional financial analysis skills paired with programming skills, big data, artificial intelligence, etc.)
- You don't have to fear the changes. In my opinion, it will play out like in chess after the defeat of Garri Kasparow by Deep Blue: human players now team up with computer algorithms to play even stronger games

## 7 References

Bessembinder, H., Chen, T.-F., Choi, G., & Wei, K.-C. (2019, July 5). *Do Global Stocks Outperform US Treasury Bills?* Retrieved from <https://ssrn.com/abstract=3415739>