



# Machine Learning for Equities

## Focus on strategies that are investable, interpretable and interesting

Machine learning has become a part of everyday life, deciding which roads we take on our daily commute and which movies we watch when we are no longer commuting. Is investing next?

Academic papers churn out eye-popping returns in simulated backtests. Coding communities are striving to develop stock recommendation tools for those who want to use machine learning without needing to understand how it works. While we share in the excitement about these cutting-edge techniques, we believe that investability and interpretability are prerequisites for such strategies to be useful in practice.

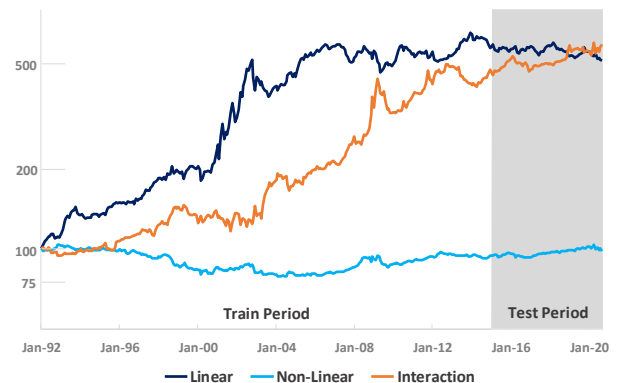
We structure our own tests to focus exclusively on stocks in the S&P 500 universe, which is large and liquid, and we ensure the amount of trading is reasonable. If there are predictive relationships that are too costly to be practical in the real world, we are happy for the machines to leave them behind.

So that we can interpret the models, we focus on a narrow set of well-established predictive variables. We apply a framework called the “Model Fingerprint” to see which variables explain the predictions. Each model finds linear, nonlinear and interaction effects, and we use the fingerprints to evaluate their efficacy. The chart above shows, for our neural network model, the attribution of portfolio performance to each of the three predictive components. Not only are interactions important, but they act as a hedge to offset risk events that hammered the buy-and-hold exposure of the model’s linear subcomponent.

We find that machine learning models can plausibly outperform simpler models in a range of applications, varying the prediction objective from total returns to returns in excess of a factor model and the time horizon from one month to 12 months. By observing the model fingerprints, we see intuitive shifts in the variables and relationships favored by the models in each setting. In sum, we believe complex models must be investable, interpretable and interesting for practitioners to gain value. Machine learning is a compliment to, and not a substitute for, good judgement.

*For more on this topic, see our 2022 journal article: “Investable and Interpretable Machine Learning for Equities” by Yimou Li, Zachary Simon, and David Turkington, The Journal of Financial Data Science, Vol. 4, No. 1, Winter 2022.*

Performance fingerprint (long-short)  
Neural network predicting 1-month stock total returns



*Based on monthly data from Jan 1992 through Sept 2020. Test period starts in Jan 2015. Neural network trained and evaluated on 1-month stock total returns. Long-short portfolios formed with stocks in the top and bottom quintiles each month according to model predicted returns. Portfolio returns decomposed into linear, nonlinear, and interaction subcomponents. For more details on the methodology, please refer to the paper cited below. Source: State Street Global Markets*

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