Optimisation/Satisficing: Satisfactory is better than the best

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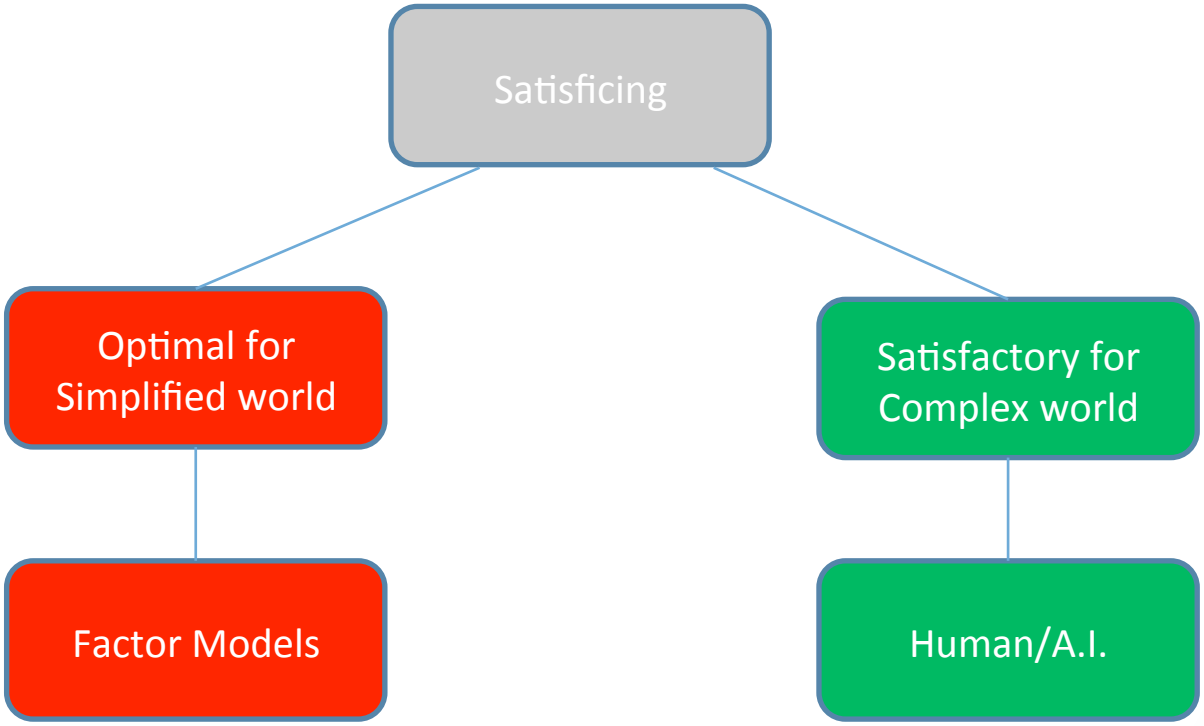
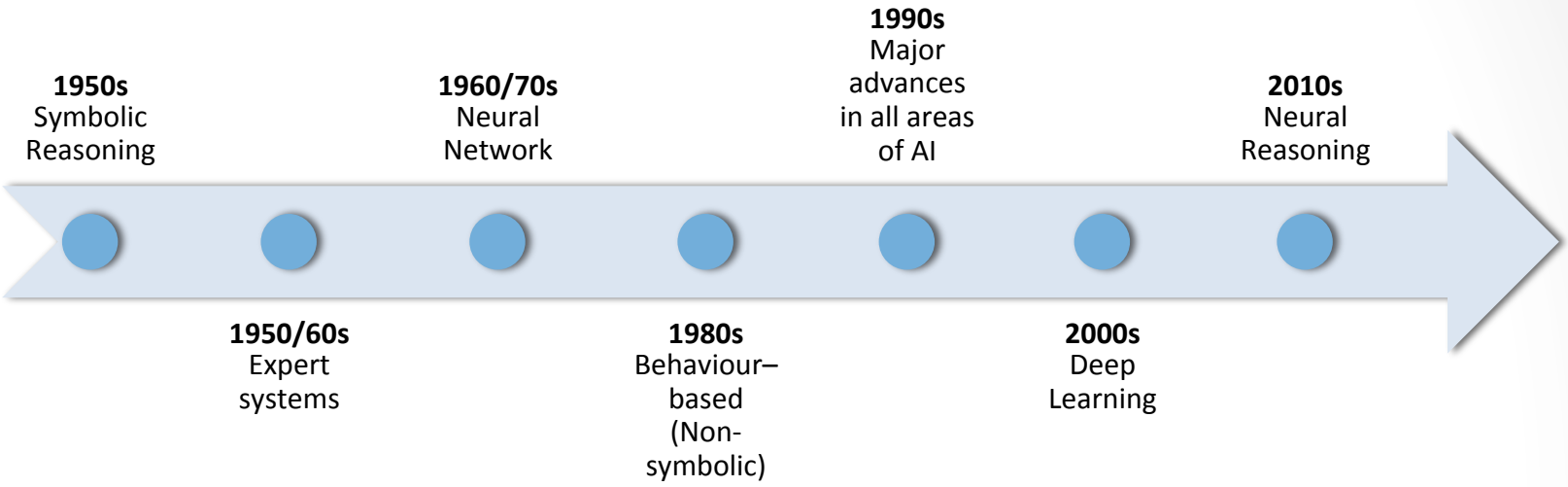
Motivation: "Finding satisfactory solutions for the complex world"

"***Decision makers can satisfice either by finding optimum solutions for a simplified world, or by finding satisfactory solutions for a more realistic world*** (***Herbert Simon, 1979***) "



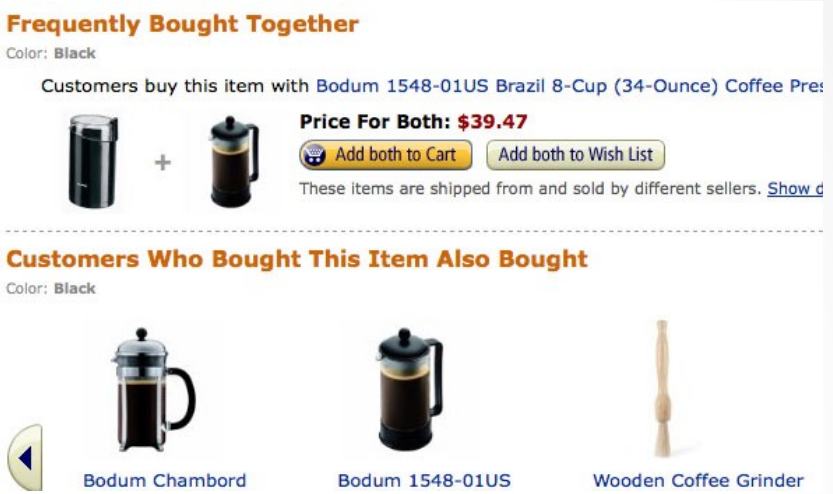
Classic AI vs. Modern AI



	Description	Pros	Cons
Classic AI (Symbolic)	Capture human knowledge using symbols	Interpretability, Robustness, transfer of concepts	Computation complexity, difficult to deal with sensor data
Modern AI (Non-Symbolic)	Originated from the attempt to Mimic a human brain	Flexible for different kind of applications/ data, handling uncertainty	Blackbox, Assumptions, adversarial examples problems

Giant Retailers try to understand the shopping behaviour of customers

source: quora.com



source: medium.com

Transaction 1

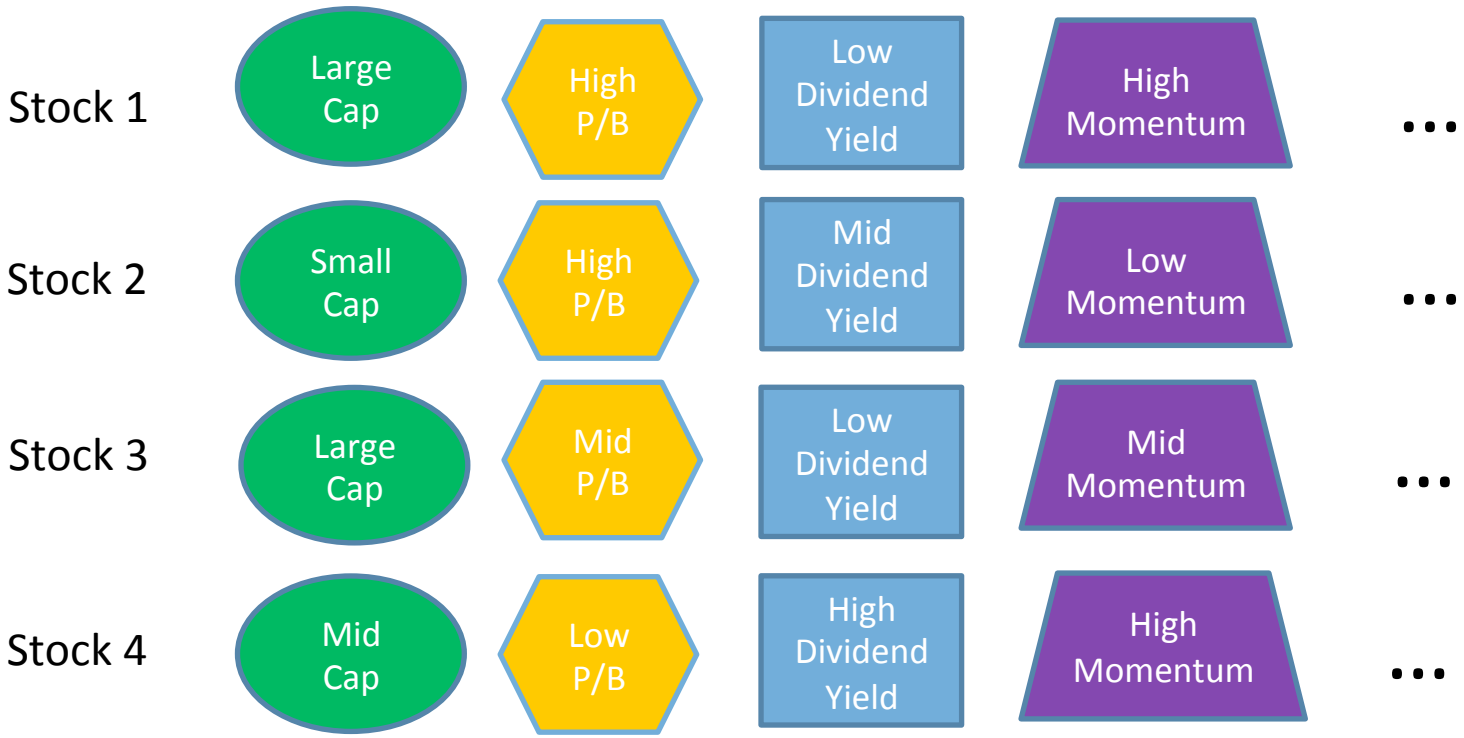
Transaction 2

Transaction 3

Transaction 4

source: medium.com

Shopping for 'basket' of stocks



- This emulates how human portfolio managers choose based on fundamental rules (Graham and Dodd, Buffett, etc.)
- With the benefit to gain insights from a large amount of data
- These thresholds are explainable.

Learning the "thresholds" that give **satisficing** results (open research problem)

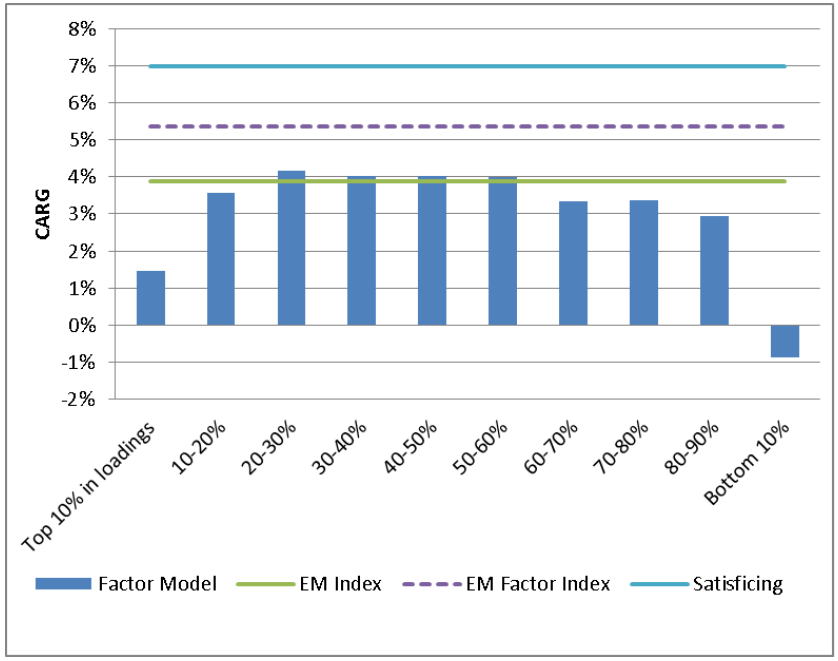
- One potential way to learn the **satisficing** thresholds is through Bayesian statistics.

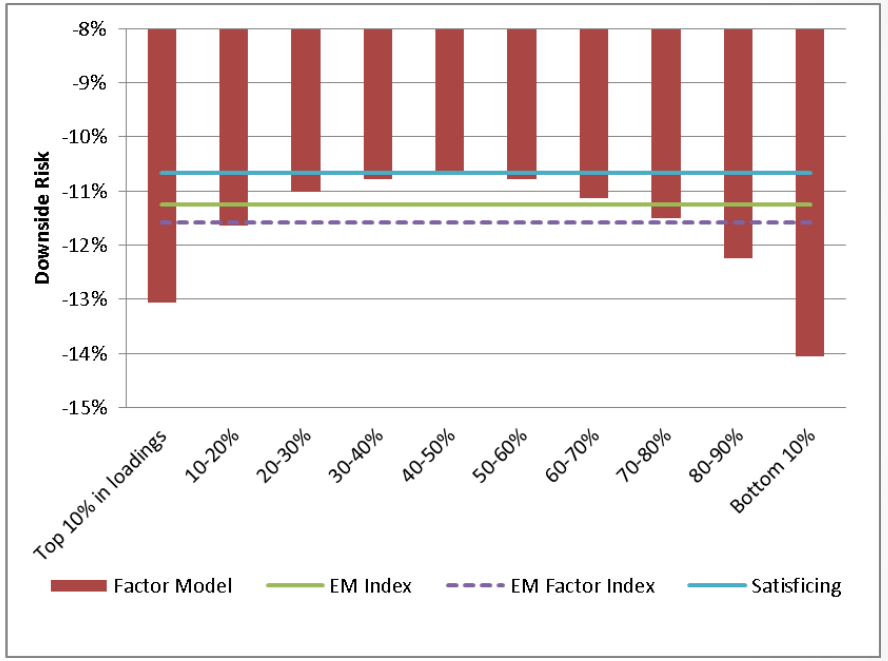
$$\underbrace{p(d|x,y,A,\alpha,\lambda,\eta)}_{posteriori} \propto \underbrace{p(y|x,d,\alpha)}_{likelihood} \cdot \underbrace{p(d|A,\lambda,\eta)}_{priori}$$

- A prior distribution may be assumed for the parameters (i.e. number of thresholds, the length of the fundamental rules, etc.)
- The posterior distribution may be estimated using empirical methods (i.e. MCMC).

The satisficing portfolio generates higher returns than the "best" factor portfolio with lower risk

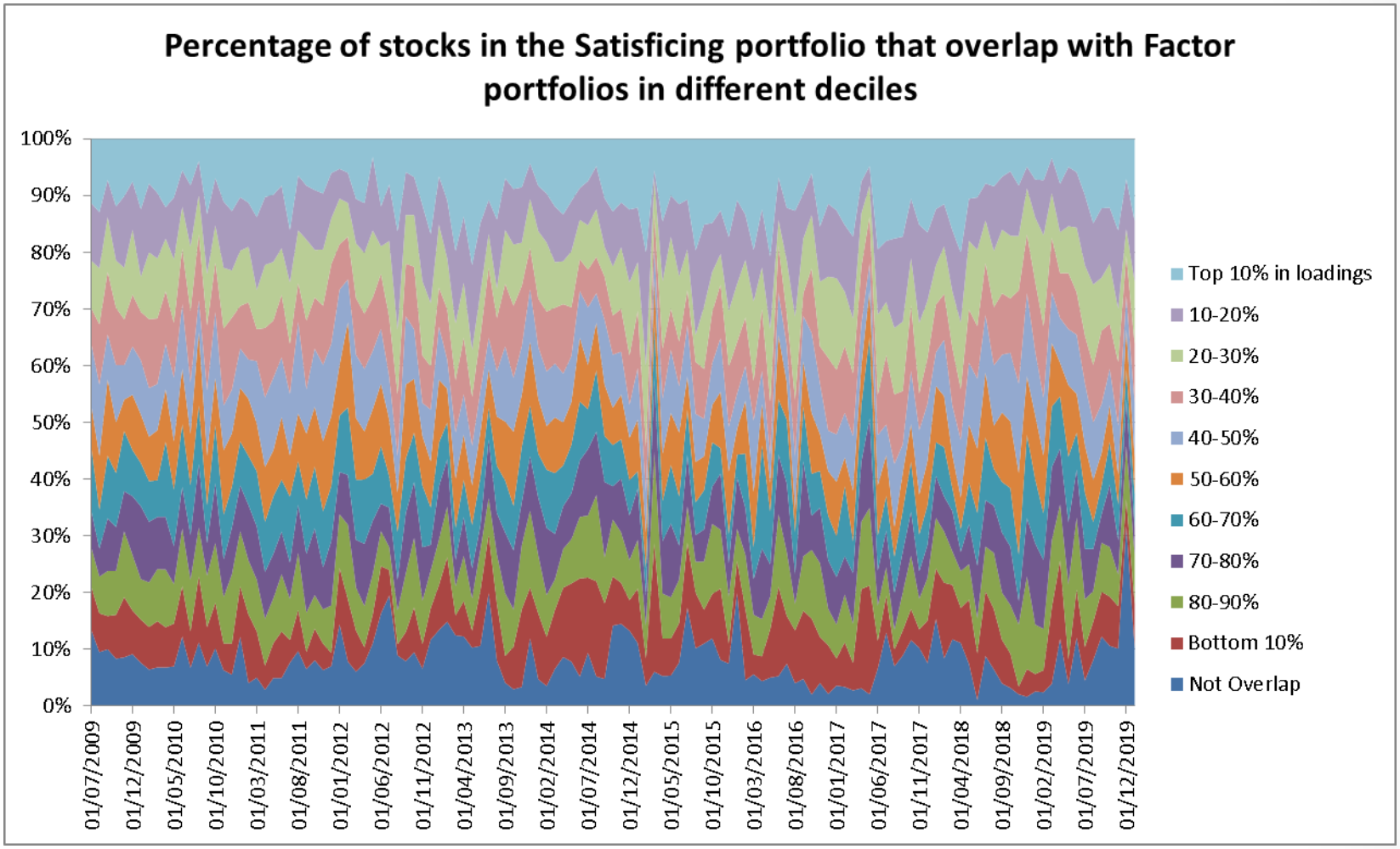
Annualized returns and downside risk of factor portfolio from different expected return decile





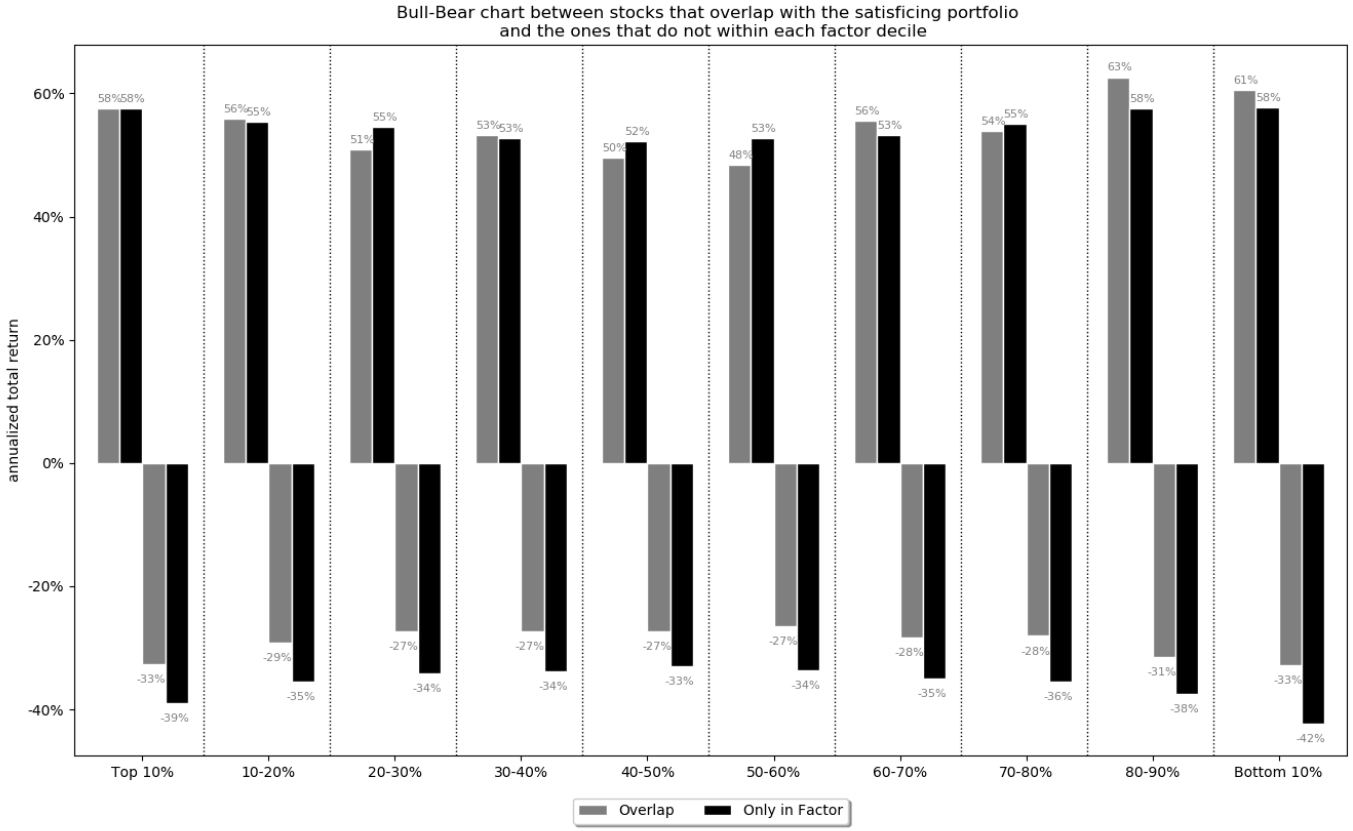
- Stocks selected from the top decile (optimal) gives the worst performance.
- The satisficing portfolio gives higher returns with lower risk in compare to indices or factor portfolio in any decile.

“Hand”-picking the better stocks



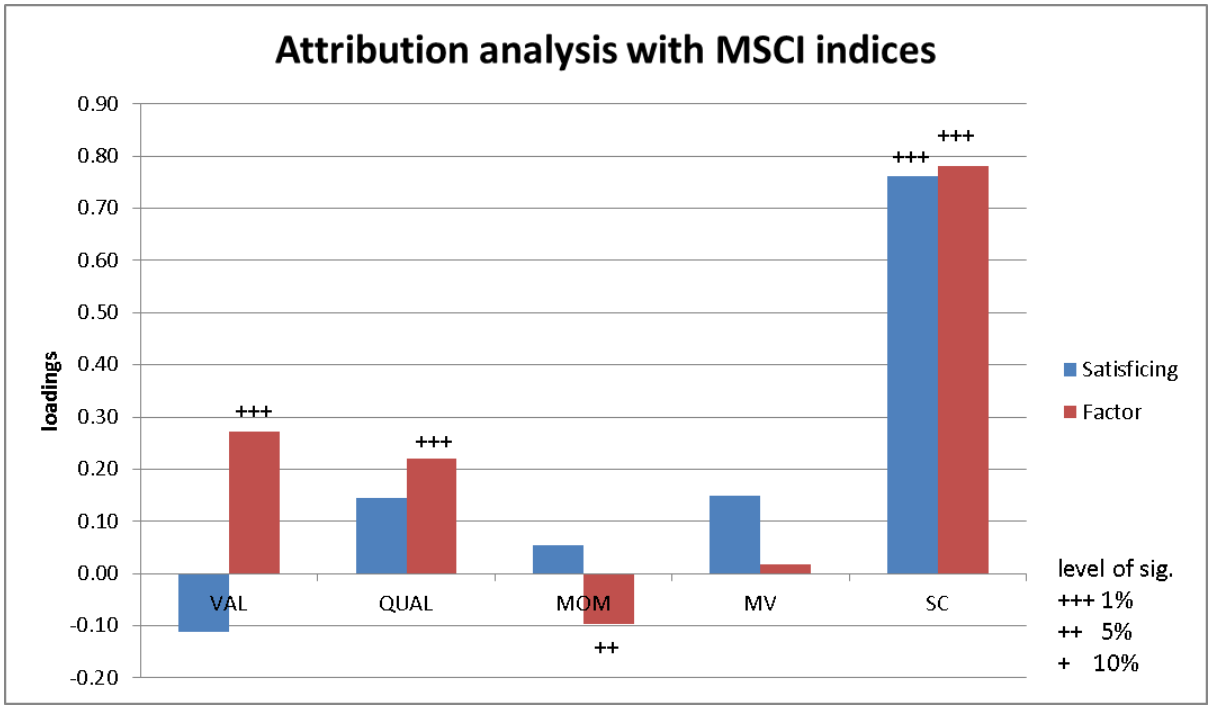
- The stocks selected do not come from one particular decile but distributed from all deciles.

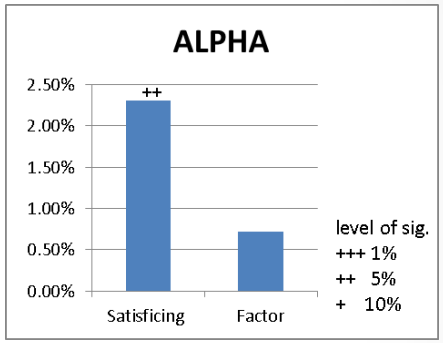
Satisficing: Better bull and bear characteristics vs Factor model in all deciles



- The satisficing methodology selects lower risk stocks in bear market and for some deciles better returns in bull market.

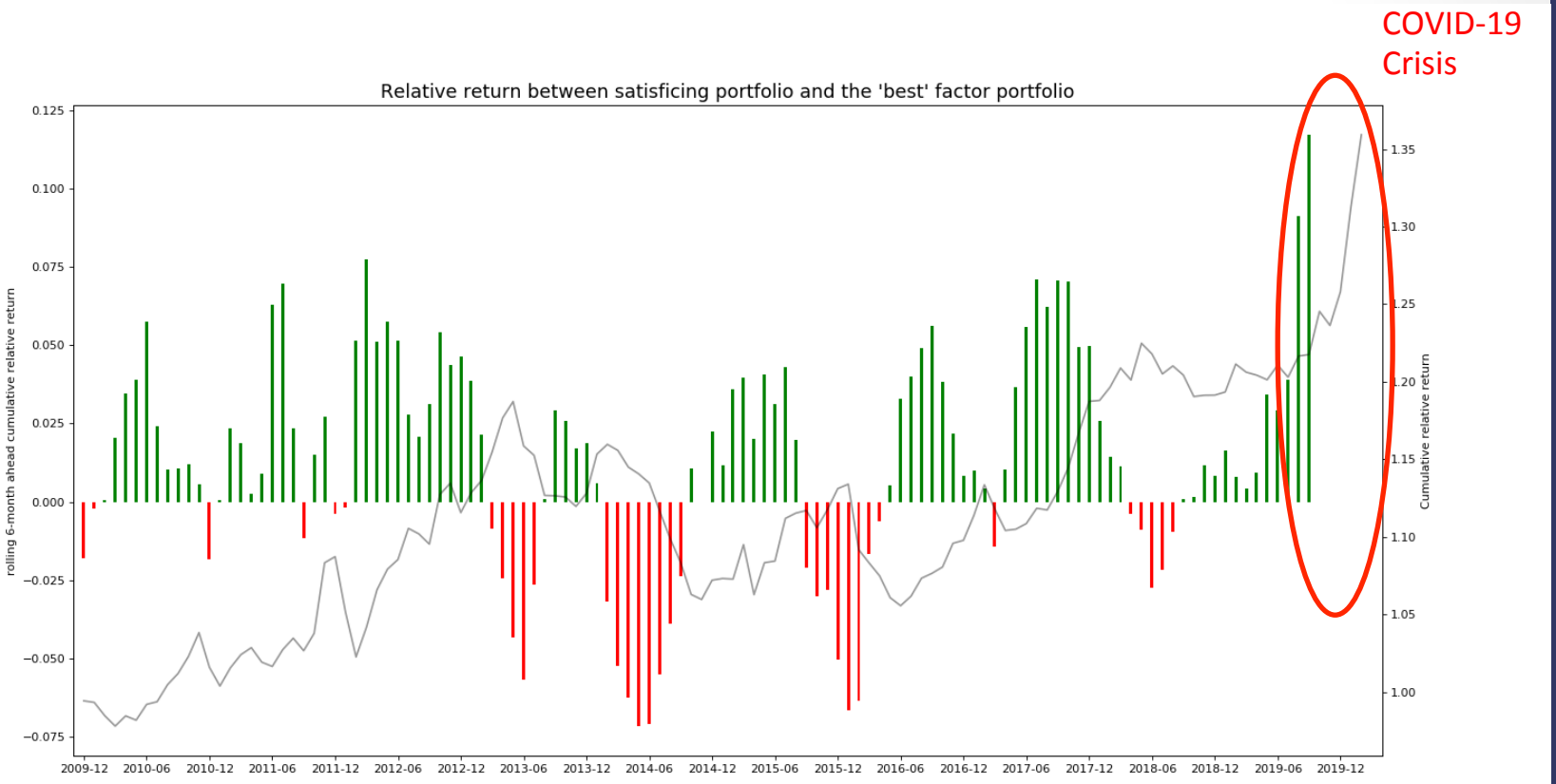
Satisficing portfolio captures a different decision boundary





- It shows that the satisficing portfolio generates higher alpha.
- Most MSCI indices have low contribution to the returns of the satisficing portfolio (i.e. satisficing methodology is capturing another dimension!)

Satisficing portfolio generates better returns for most periods



- The satisficing portfolio generates better returns in most period and it recovers faster for the ones that it underperforms.
- Great outperformance is observed when the COVID-19 crisis begins due to the defensiveness of the satisficing portfolio.

Conclusions

- A linear model (Factors) may not be sufficient to model the complex world.
- Satisficing approach emulates human stock selection but avoid the handicap of cognitive bottle neck and behavioural bias.
- Satisficing portfolio selects the better stocks and define a different decision boundary than the one provided by the factor methodology.
- Satisficing stock selection is interpretable as human decisions.
- Satisficing methodology may be further improved using Bayesian statistics.

Rothko working paper:
Law, T., Philps, D.G., Tilles, D.G., Optimisation/Satisficing: Satisfactory is better than the best (To be submitted).

Appendix

Factor Models

The Three-Factor Model (Fama and French, 1992) is an asset pricing model that expands on the capital asset pricing model (CAPM) by adding other factors to the market risk factor in CAPM. It was later extended to include more factors (Carhart, 1997, Fama and French, 2013).

$$R_{it} - R_{ft} = \alpha_{it} + \beta_1(R_{Mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \epsilon_{it}$$

where:

R_{it} = total return of a stock or portfolio i at time t

R_{ft} = risk free rate of return at time t

R_{Mt} = total market portfolio return at time t

$R_{it} - R_{ft}$ = expected excess return

$R_{Mt} - R_{ft}$ = excess return on the market portfolio (index)

SMB_t = size premium (small minus big)

HML_t = value premium (high minus low)

$\beta_{1,2,3}$ = factor coefficients