

Long-Term Investing with Dynamic Hedging Using a Combination of Stocks and Options

FYT project proposed and completed by Mr Erik Tsang, supervised by Dr David Rossiter

Abstract

The **Dynamic Hedging** (DH) strategy proposed in this thesis is a strategy that can improve **return per unit risk**. DH strategy is a combination of three independent strategies that can profit in different market condition.

We backtested the system on the SPDR S&P 500 Trust ETF (SPY) from December 2013 to May 2020. Our test result shows that DH strategy outperformed SPY in **annual return**, **Sharpe ratio** and **Calmar ratio**. Our research also includes a practical approach to implement an **equity-options backtesting engine** in Python.

Background

Investors in the current market regime is facing more challenges than ever before due to the unprecedented market volatility caused by the ever-expanding quantitative easing (QE) intervention.

The importance of diversification in long-term investors' portfolios is more significant than ever before. However, research done by Bridgewater Associate revealed that most retail portfolios are neither balanced nor well-diversified.

This thesis proposed an alternative way to diversify investors' directional bias in the stock market using a combination of stocks and equity options. This can help investors mitigate risks in the upcoming market crashes without sacrificing returns.

Team Information

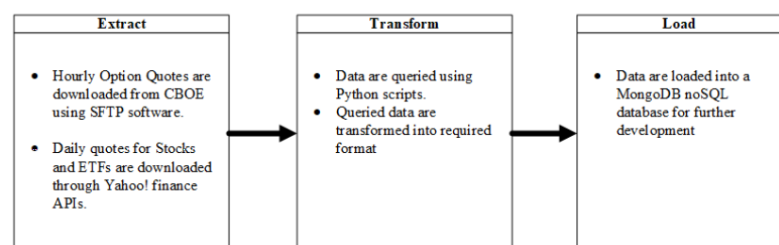
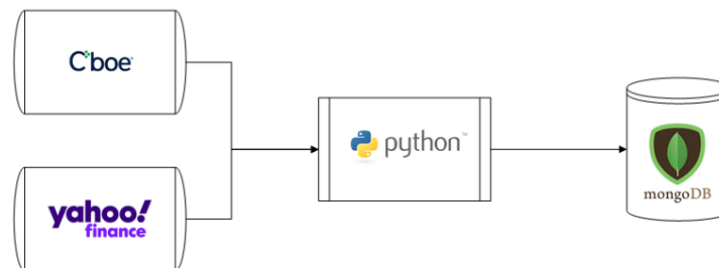
Mr. Erik Tsang is responsible for all the research tasks done in this project. Erik studied a degree of computer science and a degree of general business management in HKUST. Erik has a real passion for investment-related research and the determination to devise sustainable investment strategies for retail investors.

Mr. Erik Tsang co-founded a website www.billerikay.com for sharing his other investment related research with the public. Please scan the QR code to learn more.

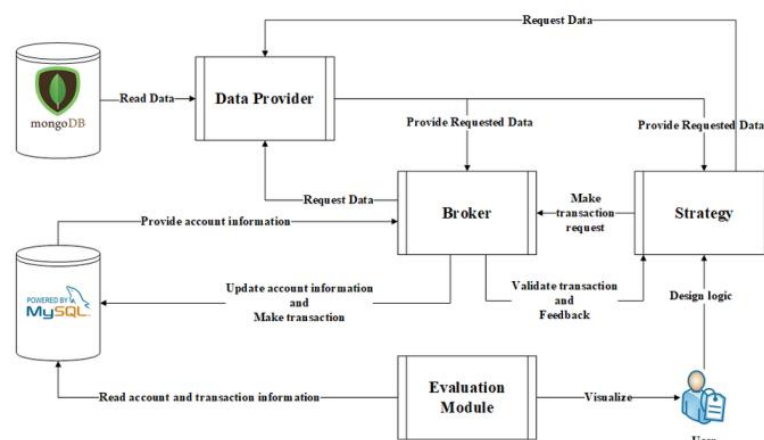


System Design

Data flow pipeline



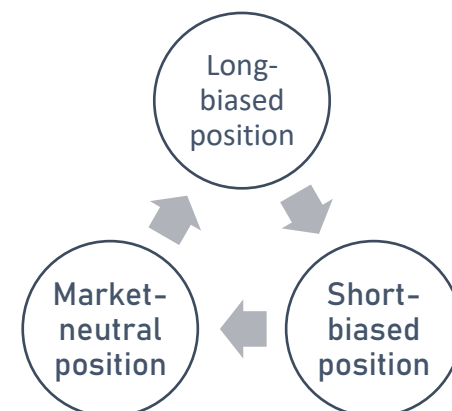
System architecture



DH Strategy Overview

DH strategy consist of 3 components designed to benefits from different market momentum. **Long-biased position** allows investors to gain in the capital when the asset goes up.

Short-biased position provides protection to the downside in bear markets. **Market-neutral position** provides a way for investors to profit when the market goes sideways.



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Methodology

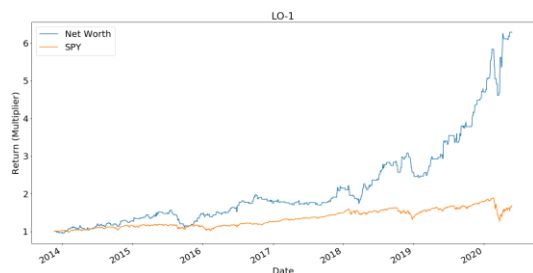
We have tested multiple strategies of different directional bias to find out the best strategies for the final DH strategy.

We have tested three long-biased strategies, two short-biased strategies, and four market neutral strategies

Code	Strategy Nature	Strategy name	Descriptions
LS-1	Long-Biased	Buy and hold	Long stock throughout the test
LS-2	Long-Biased	Revert back to mean	Long stock when the stock is oversold
LO-1	Long-Biased	Long Call options + mean reversion	Long call options when the stock is oversold
SO-1	Short-biased	Long Put options + mean reversion	Short put options when the stock is overbought
SO-3	Short-biased	Tail Risk put	Long 5% OTM put
NO-2	Market-neutral	Short Straddle	Short Call + Short Put + 15% OTM put
NO-2b	Market-neutral	Short Straddle with volatility filter	Short Straddle when VIX < 15
NO-2c	Market-neutral	Short Straddle with shorter DTE	Short straddle weekly.
NO-3	Market-neutral	Short strangle	Short 5% OTM put and call
C-1	Combined	Combined strategy	LS-2 + SO-1 + NO-3
C-2	Combined	Combined strategy	LO-1 + SO-1 + NO-3

Best strategies from the backtest

LO-1 Long Call + mean reversion



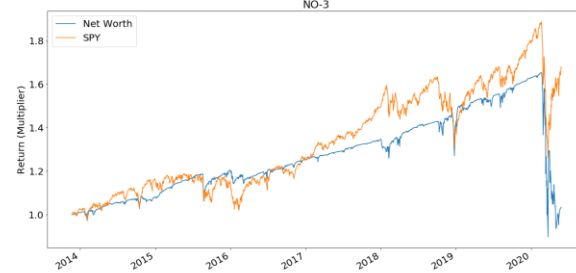
	gtsangtrading_20201115_0121	SPY
Annual Return	32.71%	8.32%
Max Drawdown	-29.56%	-33.00%
Annual Volatility	22.44%	15.16%
Sharpe Ratio	1.374	0.604
Calmar Ratio	1.107	0.252
Omega Ratio	1.517	1.123
Downside Risk	0.14	0.112
Tail Ratio	1.371	0.95
Alpha	0.302	0.0
Beta	0.481	1.0

SO-1 Long Put + mean reversion



	gtsangtrading_20201115_1447	SPY
Annual Return	13.66%	8.32%
Max Drawdown	-50.67%	-33.00%
Annual Volatility	25.60%	15.16%
Sharpe Ratio	0.626	0.604
Calmar Ratio	0.27	0.252
Omega Ratio	1.199	1.123
Downside Risk	0.143	0.112
Tail Ratio	1.136	0.95
Alpha	0.222	0.0
Beta	-0.439	1.0

NO-3 Short Strangle

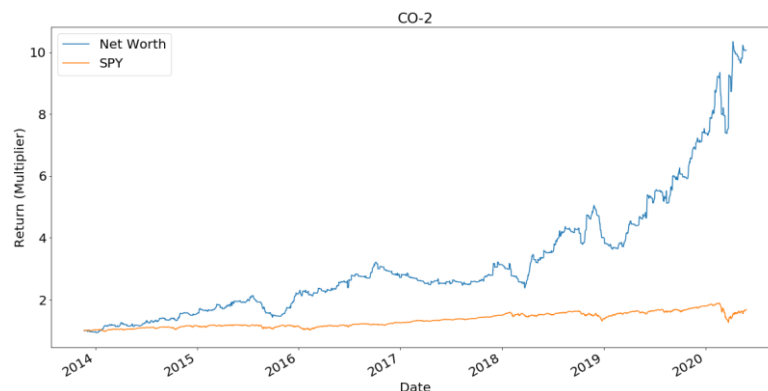


	gtsangtrading_20210103_1907	SPY
Annual Return	0.51%	8.32%
Max Drawdown	-45.75%	-33.00%
Annual Volatility	20.76%	15.16%
Sharpe Ratio	0.128	0.604
Calmar Ratio	0.011	0.252
Omega Ratio	1.054	1.123
Downside Risk	0.148	0.112
Tail Ratio	0.982	0.95
Alpha	-0.017	0.0
Beta	0.48	1.0

DH strategy results

Strategy CO-2 is a combined strategy with LO-1, SO-1, and NO-3. The combined strategy performed better in terms of annual return and return per unit risk than their component strategies. The following table shows the comparison of financial metrics between the combined DH strategy and the component strategies

	CO-2	LO-1	SO-1	NO-3	SPY
Annual return	42.67%	32.71%	13.67%	0.51%	8.32%
Max drawdown	-32.74%	-29.56%	-50.67%	-45.75%	-33.00%
Annual volatility	25.57%	22.440%	25.605%	20.76%	15.16%
Sharpe ratio	1.519	1.374	0.626	0.128	0.604
Calmar ratio	1.303	1.107	0.27	0.011	0.252



	gtsangtrading_20210107_1547	SPY
Annual Return	42.67%	8.32%
Max Drawdown	-32.74%	-33.00%
Annual Volatility	25.57%	15.16%
Sharpe Ratio	1.519	0.604
Calmar Ratio	1.303	0.252
Omega Ratio	1.447	1.123
Downside Risk	0.158	0.112
Tail Ratio	1.451	0.95
Alpha	0.419	0.0
Beta	0.419	1.0