EDHEC Business School Master Project

Volatility Managed Portfolios

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Your firm, Volatility Management Strategies, is considering recent academic evidence suggesting that volatility-based strategies provide superior performance compared to other portfolio construction rules, including mean-variance optimization. Volatility-based strategies recognize that while expected returns are difficult to estimate, volatilities are predictable.

CTAs and hedge funds commonly use volatility targeting to manage the volatility of their positions. The popularity of volatility-targeting investment strategies increased after the 2008 financial crisis and includes strategies such as risk-parity funds, variable annuities, and CTA/Systematic trading strategies with assets under management exceeding $ 1 trillion.

Volatility targeting essentially leverages the exposure to the risky asset when predicted volatility is lower than the volatility target and scales down exposure when predicted volatility is high. The strategy is expected to boost portfolio returns and mitigate tail risk and drawdowns if successful.

Volatility Management Strategies consider the development of volatility-timing investment strategies applied to major equity markets, commodities, currencies, or equity factor portfolios.

The Advanced Master Project

For the Advanced Master Project, you are expected to critically assess the performance and practical implementation challenges of applying a volatility-targeting strategy <u>to at least five assets from one asset category</u> of your choice: equity index portfolios, commodities, currencies, or equity factor portfolios. Data for major equity indices, currencies, and commodities can be

found in Bloomberg or WRDS. Data for equity factor portfolios for various regions can be found in K. French's database[1].

Your report should cover the following areas:

1. **A description of volatility-targeting strategies**

   In this section of the report, you need to explain clearly the theory behind the idea of volatility-targeting and under what conditions is expected to work.

2. **The data used to develop the strategy**

   The data used in your study, including their frequency and data source.

3. **A detailed description of the calculation of volatility-targeting return and the choices made in implementing the strategy**.

   Volatility-targeting strategies scale the excess returns[2] of an asset by the inverse of its conditional volatility. In particular, the weight of the volatility managed asset at the beginning of month t, $w_{i,t}$, is equal to $\boldsymbol{w_{i,t}} = \frac{\boldsymbol{\sigma_{target}}}{\boldsymbol{\hat{\sigma}_{i,t}}}\ \boldsymbol{k}$ and the return of the volatility-managed asset, $\boldsymbol{r_t^{vm}} = \boldsymbol{w_{i,t} r_t}$, where σ_{target} is target volatility, $\hat{\sigma}_{i,t}$ is predicted volatility, and k a constant such that ex-post over the full sample period, the target volatility is realized. r_t is the return of the unmanaged asset.

   To implement the volatility-targeting strategy, you will need to provide values for target volatility (σ_{target}) and forecast volatility ($\hat{\sigma}_{i,t}$). Most papers in the literature set target volatility equal to the long-term realized volatility of the underlying asset. Note that using all available data (the full sample) to calculate target volatility introduces look-ahead bias because it is assumed that the volatility-targeting portfolio can be re-scaled ex-post. Under certain assumptions, *ex post* rescaling leaves Sharpe ratios unaffected and the performance of the strategy easy to compare with the original portfolio, but the strategies are impossible

[1] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[2] For long-only assets, like an equity index portfolio, the excess return is equal to the asset's return minus the risk-free rate. For long/short portfolios like a portfolio long value stocks and short growth stocks, the excess return is the return difference between the value and growth portfolios (i.e., the value premium)

to implement in practice.[3] *To avoid the look-ahead bias, you should calculate target volatility as the long-term realized volatility calculated using all daily returns up to and including month t-1 (rather than the full sample).*[4]

Models for future volatility include simple models based on historical volatility or more sophisticated time-series models, including models in the GARCH family or models using machine learning to develop volatility forecasts. For the project, you are expected to use forecasts of volatility based on (a) the previous month's realized volatility (as the equally weighted standard deviation of daily returns, (b) the last six-month standard deviation of daily returns, and (c) at least one more sophisticated model of volatility prediction of your choice. You should assess the robustness of the volatility-targeting you develop to the different choices of volatility prediction models.

4. Evaluation of performance

(a) Performance statistics should, at a minimum, include average return, volatility, alpha, return to risk (Sharpe, information and appraisal) ratios, max drawdown and turnover. Other statistics you might think are useful in this context, like skewness, kurtosis, expected shortfall, etc., could be used for further analysis. Depending on the chosen asset class, you need to consider carefully what is the appropriate risk model to be used in adjusting strategy performance for risk.

(b) You should also examine the performance of the volatility-managed strategy during the expansion and recession phases of the USA business cycle (using the NBER business cycle indicator to identify recessions/expansions).

5. Transaction costs and leverage

Two issues critical in the practical implementation of volatility-targeting strategies are transaction costs and leverage.

High turnover and transaction costs strategies could easily eliminate any return advantage. You should consider carefully the impact of transaction costs on the volatility-targeting

[3] The study by Moreira and Muir (2017) and Harvey et al. (2018) for example are both subject to look-ahead bias (for more on the issue of look-ahead bias see Liu et al., 2019).

[4] See the paper by Bongaerts et al. (2020), page 3.

strategies and propose mitigation strategies that reduce turnover and transaction costs but preserve some of the return advantage offered.

Significant time-varying leverage could also be challenging in practical implementation. You should consider the sensitivity of the strategy's performance to alternative constraints on leverage exposure.

6. **Summary/Recommendations**

   In the summary/recommendations section, you should summarize the evidence you found in your work and provide your recommendations to the Volatilities Management Board regarding the adoption or not of the volatility-targeting strategy studied, taking into account the advantages, possible shortcomings, and major challenges present in the implementation of volatility-targeting strategies in practice.

Your report should be succinct and to the point. You will be marked on content as well as presentation.

- Plan for a maximum 30-page long report (fond size 12 and interline 1.5, tables and figures included). Non-essential material should be put in an appendix.
- Put and submit in a separate excel file the data used.

References

DGJ (Dion) Bongaerts, Xiaowei Kang & Mathijs Dijk. 2020. "Conditional Volatility Targeting", Financial Analysts Journal, 76 (4), 54-71

Harvey, C. R., E. Hoyle, R. Korgaonkar, S. Rattray, M. Sargaison, and O. Van Hemert. 2018. "The Impact of Volatility Targeting." Journal of Portfolio Management 45 (1): 14–33.

Liu, F., Tang, X., & Zhou, G., 2019. Volatility-Managed Portfolio: Does It Really Work? The Journal of Portfolio Management, 46(1), 38–51.

Moreira, A., Muir, T., 2017. Volatility-Managed Portfolios. The Journal of Finance 72, 1611–1644.

The paper by Moreira and Muir (2017) provides an excellent description of volatility-managed strategies, the theoretical foundations, performance measurement and alternative stories that might explain the performance of risk-managed strategies.