PROBLEM STATEMENT

MScFE Capstone Project

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Stream:

Indicate which stream you will be following and which area of study you will be investigating.

Practical Track: Long-Term Trading Models – Handling Market Regime Shifts

Dynamic Regime Strategy for Stress Testing and Optimizing Institutional Investor Portfolios

Areas of study include:

- Deep Value
- Momentum
- Machine Learning
- Risk Factor Curves
- CVaR, VaR
- Stress Testing
- Risk Budgeting
- Volatility Targeting
- Multi-Asset Portfolios
- Levered Portfolios
- Drawdown Control Systems
- Measured Futures

Problem statement

The Ideal:

Large institutional investors such as pensions, endowments, and sovereign wealth funds invest large amounts of capital with long-run time horizons. In addition, these investors typically have liabilities with varying horizons tied to the duration or cash flows. In order to best meet the needs of shareholders, many institutional investors look to hedge funds to provide another source of diversifying returns for their portfolios. These relatively unconstrained and absolute return focused investment pools, generally pursue a variety of complex trading strategies, which involves hedging or reducing market risk through investments in both long and short positions. Thus, ensuring that institutional investors are successful in meeting their liabilities through reducing the vulnerability of their portfolios to regime shifts in the macroeconomic environment.

The Reality:

However, in reality, most institutional investors are extremely exposed to regime shifts in the macroeconomic environment. As a result, these long-horizon investors tend to focus excessively on equity-like asset classes that rely far too heavily on harvesting an illiquidity premium, as a source of return. Moreover, institutional investors typically use diversification as their only tool for risk management. All these features contribute to a heightened vulnerability to economic regime shifts. The lack of an absolute return approach makes it difficult for institutional investors have to meet the challenging goals of attaining a high return target with limited drawdown risk. In the face of macroeconomic and regulatory uncertainty, compounded by a world in a state of oscillation and a climate of financial repression.

The Consequences:

If the institutional investors continue to invest in equity and illiquidity risk premium centric-strategies, with minimal portfolio risk management tools. They are destined to experience losses during adverse shifts in the inflation and economic growth. During the 2008 global financial crisis, decisions to invest

in poorly diversified portfolios, that lacked proactive drawdown control systems, helped fuel the sharp drawdowns in institutional portfolios. Therefore, regime shifts in economic conditions presents critical challenges for many long-horizon investors with positive directional risk exposure to equity markets and economic growth.

Our Contribution:

Our commitment is to develop an absolute return-oriented trading system that would aid institutional investors in dynamically adapting their portfolio exposures to the prevailing market risk environment. Our program will also help in managing downside tail risk through a proactive drawdown control system, that will achieve higher risk-adjusted returns regardless of changing economic conditions. Most importantly, our program's complementary blending of deep value and momentum styles, along with a strong focus on balanced risk control, will help institutional investors in meeting their obligations through modest high returns and limited drawdown risk.

Aims and Objectives

Aim:

The aim of this project is to design standalone absolute return trading system with significant reduction in directional market risk and macroeconomic sensitivities to optimize institutional investor portfolios. Our program should have the additional benefit of not only exhibiting a more constant risk profile, but also reducing the probability of an outsized stress loss, fostered by significant external shock.

Objective(s):

- Portfolio A: Timing Portfolio
    - Idea
        - Create a directional market timing signal that aids in the decision to overweight or underweight an asset class
    - Signals
        - Diversified long-term (~12 months), medium-term (~6 months), short term (~3 months), and a counter trend signal
            - The counter trend signal would be basing on things moving too far, too fast and would use an outsized standard deviation that moves over some shorter time period (~1 month);
            - This signal would then tell us when to pair the trade back, making sure that we are not overexposed to trend, more likely than usual to reverse;
            - Additionally, the counter trend signal will be used to valuate metrics to tell us, when a market is extremely expensive or cheap. Thus, providing a proactive exposure control to markets with extreme valuations.
    - Academic Backing
        - Analyze the historical effectiveness of momentum, trend-following, and deep value under different market conditions.

        - Develop ways to dynamically adjust the portfolio's allocation based on the prevailing market risk environment to deliver the best risk/reward trade off.

- Portfolio B: Construction Portfolio
    - Idea
        - Risk targeted, and risk balanced portfolio humbly accepting the market risk premium for whatever market we are trading, could be an extremely difficult portfolio to outperform.
    - Signals
        - Markets chosen would be diversified by risk instead of capital:
            - Each market would be equally weighted according to its risk contribution to the broader portfolio, by utilizing machine learning to better optimize its correlation and level of volatility;
            - Floor correlations at a -0.3, account for volatility using (~12 month) EMA, and use machine learning tools to build the long-only portfolio.

        - Aggregate long-only market exposure would be volatility targeted:
            - This would prevent the portfolio from becoming significantly riskier than otherwise intended, just because markets are currently demonstrating risk levels higher or lower than their long-term averages;
            - The portfolio would be utilizing leverage to achieve this constant level of portfolio risk.

        - Drawdown control system:
            - This would reduce the volatility target of the portfolio in a systematic fashion during a time of adverse returns and would then increase the volatility level back to the baseline volatility target, when market conditions become more favourable;
            - Build systematic and proactive CVaR on VaR risk management overlay.

    - Academic Backing
        - Provide economic intuition on why targeting a constant level of risk within portfolios and reducing exposure within a portfolio under adverse scenarios are fundamental to garnering a more predictable investment outcome.

- Proposition: Integrated Timing & Construction:

    - Creating both portfolios would require only market data outside of the counter-trend deep value signals
        - We would start utilizing only two broad-based equity indices to build everything, then add in world equity markets as the model becomes robust enough to handle more markets;
        - The majority of our Timing Portfolio and our Construction Portfolios would only require the change in prices of the underlying assets, we would then be able to test each of the two portfolios using out of sample data from commodity and fixed income markets.
            - If we utilized significant amounts of data more specific than price levels similar to a market timing strategy, we would not be able to test the strategy in a true out of sample, and multi-asset fashion.

- Comparing the two portfolios
  - Demonstrate two contrasting approaches:
    the Timing Portfolio would be one that speaks of a more absolute strategy, while, the Construction Portfolio would be one that speaks of a more directional strategy;
  - Build the Construction portfolio as the humblest way to generate market-based returns, relying on correlation, a balanced amount of risk contribution across markets, and a constant amount of risk to be taken across the portfolio.
  - Our drawdown control system, in conjunction with risk balancing and risk targeting, would be our humble way to attack the long-term market directional signal problem, where increasing volatility levels in markets are generally associated with declining returns in those markets;
  - Build the Timing Portfolio, as a possible way to avoid having to always be long: This will garner the returns by leveraging on the volatility of markets
    - Use momentum, trend following, and the associated investor behavioural biases which create these phenomena, we might be able to garner the same market premiums as our Construction Portfolio, but without the drawdown associated with always being long-only
  - Stress testing the combination of both the Timing Portfolio and the Construction Portfolio, to see what balance between the two strategies that would lead to the most robust experience for investors.
- Further thoughts
  - Propose implementing the risk and drawdown features of the Construction Portfolio into the Timing Portfolio
  - Propose incorporating as multi-asset class approach into our Timing Portfolio, also with a balanced risk approach across asset classes
    - These enhancements would make the portfolio even more robust and further enhance the Sharpe Ratio of our now, humbler, and significantly more diversified, Timing Portfolio
  - Reverse stress testing the combination of the two portfolios now that the Timing Portfolio has been improved
  - Propose a proactive drawdown control system based on the fluid dynamics, principle of no-slip condition for viscous fluids. Where we assume that at a floor boundary, the portfolio will have zero volatility relative to the boundary.

- Testing Economic Regime Shifts
  - Stress test integrated portfolios across a wide array of extreme economic changes
    - Record vital risk metric such as rolling VaR, and expected shortfall
  - Test the portfolio using non-equity market such as commodities and fixed income
  - Document how sensitive the integrated portfolio's risk metrics are to changes is asset returns as well as changes to the macroeconomic climate
    - Also monitor and test for stress losses such as the failure of Lehman Brothers and the bailout of Long-term Capital Management
  - Summarize and draw conclusions
  - Develop and present fund fact sheet for the absolute return trading system.