Thesis idea fall 2021

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The main inspiration for our thesis is the seminar paper that we did in the spring of 2021. However, we now want a greater focus on theoretical arguments and more realistic markets to simulate.

# Topic

We want to investigate portfolio optimization in a market modelled by a multi-asset GARCH process similar to [(Herzog, 2005)](https://www.researchgate.net/profile/Hans-Geering/publication/259440003_Strategic_Asset_Allocation_with_Factor_Models_for_Returns_and_GARCH_Models_for_Volatilities/links/0deec52b8ba0fc1f31000000/Strategic-Asset-Allocation-with-Factor-Models-for-Returns-and-GARCH-Models-for-Volatilities.pdf). In other words, we want to merge GARCH models from econometrics that best match empirical stylized facts of non-normality and non-IID distributed markets, with optimal portfolio theory.

# Methods

**Theoretical**

First, we want to solve the one-period optimization problem for a risk averse investor with mean-variance preferences (maybe even preferences for higher moments) where returns of the N assets are GARCH with some non-normal error distribution (student’s t or GED) rather than standard IID Normal.

Here, we think it would be interesting to ex-ante incorporate transactions costs and/or preferences for higher moments.

Next, we want to expand this model into a multi-period problem. We want to find a theoretical result for both an institutional investor, that likely has transaction costs, and a retail investor who can utilize leverage (so we relax the constraint of weights summing to 100%).

**Empirical**

Here, we test the result for both an institutional investor, and a case study of a Danish retail investor that follows our strategy. We will use backtesting and simulated markets using the MGARCH (likely a DDC MGARCH) model to test the strategies. This DCC MGARCH will be fitted to several ETFs representing different sections, industries, and geographical regions. Ideally, we would like to include the housing market for the retail investor given that this is the most common asset in Denmark, but this might be too difficult to fit into our theoretical model.

We would like to test the optimal strategy found in the theoretical section along with more trivial investment strategies like 1/N, vanilla Markowitz and so on.

If possible, we would like to model the risk-free rate rather than a constant estimate for 40-60 years. This might not be viable as we are likely limited by space and time.

For the retail investor we will test a leveraged and non-leveraged version of each strategy for different parametrizations of the model (different margin rate [cost of borrowing], risk aversion, savings profil etc) to see if leveraged when young is only viable for certain strategies and to more generally investigate the potential benefit benefits and drawbacks of using leverage.