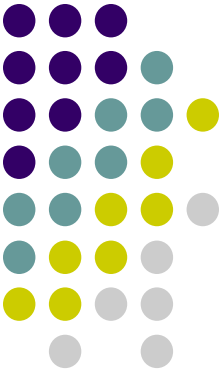


CHICAGO QUANTITATIVE ALLIANCE INVESTMENT CHALLENGE 2014-2015

Shailesh Kakkar
Lisa Alexandra Lee
Bingqing He
Changjiang Bi
Hang Gong
Lin Zeng

IIT Stuart School of Business

ILLINOIS INSTITUTE OF TECHNOLOGY

INTRODUCTION

The Chicago Quantitative Alliance (CQA) completion offered us the opportunity to bridge the gap between theory and practice. Given that the stocks had to be chosen from Russell 1000 universe, we opted for a strategy that relies on fundamental analysis and combines various metrics, thereby allowing for a robust performance of portfolio without over-relying over any specific factor and exposure to the whims of market.

INVESTMENT PHILOSOPHY

After thorough literature review and considering numerous metrics, we settled for an amalgamation of factors that have shown most promise empirically. This approach has an added advantage of refraining from data snooping, an ever present hazard in techniques such as machine learning etc.

$$Indicator = \frac{EBITDA * ROA}{EV}$$

This metric allows for the discovery of undervalued stocks in the market. The presence of ROA ensures that stocks that are undervalued because of bad performance are screened.

PORTFOLIO CONSTRUCTION & EXECUTION

Stocks were ranked using this indicator and we decided to go long in stocks on top and short in equal number of stocks at the bottom. We chose portfolio size of 30 stocks for a well-diversified portfolio, not opting for more since the portfolio might have ended up mirroring the stock universe due to over diversification.

The portfolio weights were assigned in accordance with the principal of equal Beta contribution to the portfolio. The reason being two pronged, equal beta contribution leads to a portfolio with net zero beta when the number of long stocks equals number of short stocks and stocks that have a large beta receive lower investment leading to a more stable portfolio.

$$\beta_1 \omega_1 = \beta_2 \omega_2$$

In cases of stocks with very small beta leading to higher than allowed allotment of capital to individual stock, we simply spill over the excess capital to the next stock higher in the ranked list for long stocks and lower in the list for short stocks.

We believe that the portfolio based on our investment strategy needs to be updated quarterly with the reporting of new data. This low frequency rebalancing leads to a low maintenance portfolio and saves on transaction costs as well.

PORTFOLIO PERFORMANCE

Till January 31, 2015 the return on the portfolio has been 16.08%. The Sharpe Ratio has been an impressive 4.42, Sortino Ratio being 9.04. The portfolio has a drawdown of 3.69% in-spite of a relatively long drawdown duration of 25 days out of 61 trading days being considered.

RISK MODEL

We decided to decompose the returns based on the extended Fama French four factor model

$$r = R_f + \beta_1(Rm - R_f) + \beta_2(SMB) + \beta_3(HML) + \beta_4(MOM) + \alpha$$

We ran the regression for estimation of parameters and got the following results:-

	Estimate	Standard Error	tStat	pValue
α	0.15847	0.09995	1.5855	0.11848
β_1	-0.11237	0.11483	-0.97865	0.33196
β_2	-0.17489	0.18771	-0.93171	0.35549
β_3	-0.40886	0.26704	-1.5311	0.13137
β_4	0.66932	0.1665	4.0198	0.00017579

R-squared: 0.4, Adjusted R-Squared 0.357

We see that the momentum factor is most significant in explaining the returns. This is in tune with the indicator that we are using since we use ROA as a metric to gauge the viability of addition of a stock in our portfolio.

To estimate the Covariance matrix of our stocks, we use the time series regression for individual stocks to find out factor loadings and the Covariance of the stock returns is calculated as

$$\beta\, \Omega_{ff}\, \beta^T + \Omega_{ee}$$

where, β is (n x k) matrix, n being the number of stocks and k being number of factors

Ω_{ff} is the covariance matrix of factors

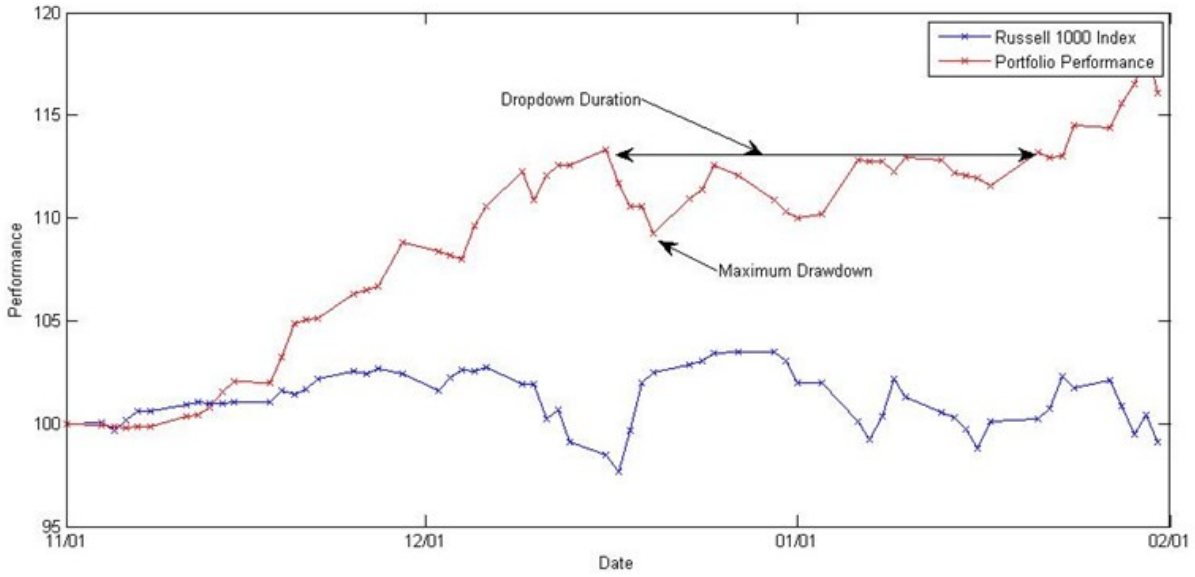
Ω_{ee} is the residual covariance matrix

In the estimation of Ω_{ee}, we made an assumption of it being a diagonal matrix. Had we not made this assumption, no dimensionality reduction is achieved in estimation which is the very purpose of this approach.

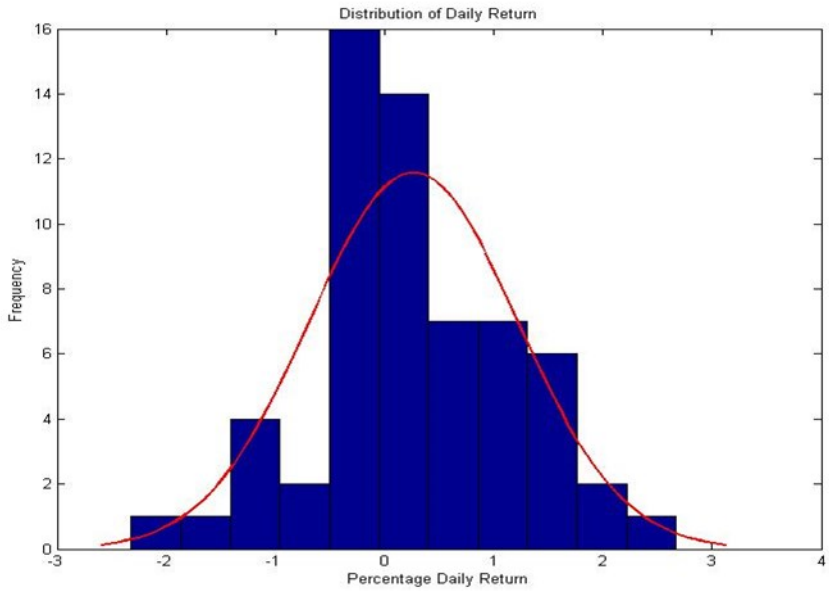
We got the portfolio Standard Deviation as 2.21%. This is quite low, again pointing to the fact that portfolio is quite stable due to equal Beta contribution approach.

We also explore the nature of daily returns of the portfolio and find the distribution to be leptokurtic in nature which points towards the shortcoming of the model being used since regression analysis assumes normal distribution.

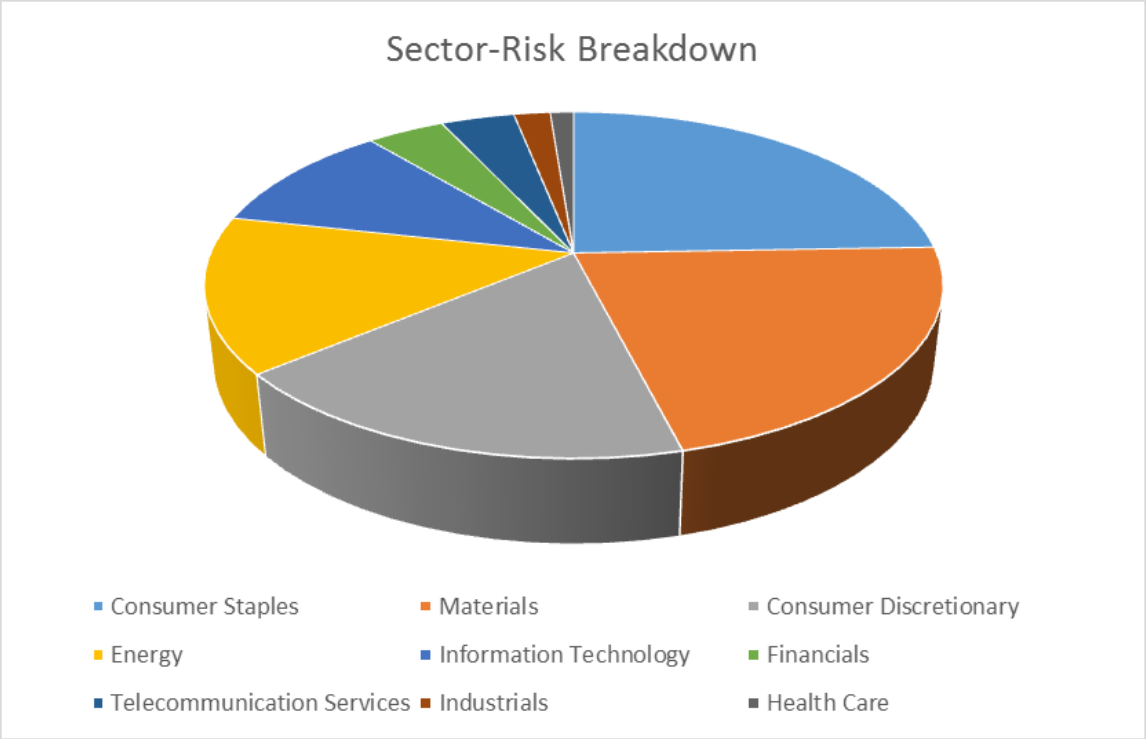
Further, we explore the breakdown of the portfolio risk into different sectors as well and we observe no specific sector loading.



Portfolio Performance and Drawdown



Daily Return Distribution


Sector-Risk Breakdown
Consumer Staples
Materials
Consumer Discretionary
Energy
Information Technology
Financials
Telecommunication Services
Industrials
Health Care


Industry-Risk Breakdown
Metals & Mining
Personal Products
Internet & Catalog Retail
Oil, Gas & Consumable Fuels
Energy Equipment & Services
IT Services
Wireless Telecommunication Services
Tobacco
Software
Airlines
Diversified Financial Services
Textiles, Apparel & Luxury Goods
Computers & Peripherals
Insurance