OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

WW FACULTY OF ECONOMICS AND MANAGEMENT

Management Summary

Computational Finance and Financial Management

Time frame: 06.01.2016-06.29.2021 (daily)

Group Asset:
MSCI EM Small Cap UCITS ETF
MSCI EM UCITS ETF
Gold

With the emerging interest in regards to the stock market, a lot of information has been put to the public and quite a high amount of research has been conducted with respect to this area. Product of this increased interest and extensive research, there have been a lot of investment research firms that provide stock indexes such as the MSCI (Morgan Stanley Capital International) EM one, which was the first comprehensive emerging markets index to be launched. This paper will be mainly focused on the analysis of the MSCI indexes, more specifically the "Emerging Markets" index, which will be studied and analyzed for small, mid and large cap securities for the past five years. Altogether with such indexes, gold will also be included and analyzed. The assets are analyzed for a period of over five years (from June 1st 2016 until June 29th 2021) through a time series and portfolio optimization analysis. Both of these analyses have been of great interests to researchers from areas of economics and finance which has led to a great number of research papers to be written in regards to them. Some of these papers include the one conducted by Naylor (1972) which included a comparison between Box-Jenkins approach and the Wharton econometric model for the time frame between 1963 and 1967. The research concluded that the accuracy of the ARIMA model (of the Box-Jenkins methodology) was more accurate than the Wharton econometric model. Another research that emphasizes the accuracy of ARIMA is the one conducted by Nelson (1972) whose research compared econometric regression to time series (ARIMA) by focusing the study on one quarter ahead predictions of 14 endogenous macroeconomic variables for which the results showed, again, that the ARIMA model was more accurate. As for the portfolio optimization, the one to lay the groundwork for modern portfolio construction was Markowitz (1952, 1959) whose work suggested that expected return and the variance return of a portfolio should be considered as criteria on portfolio selection. However, Chopra and Ziemba (1993) on the other side suggested that the estimation of errors in the predicted returns was actually more important while analyzing portfolio performance. As for the volatility part of a portfolio, the research conducted by Barndorff-Niesen and Shephard (2004) gives a proposition in calculating the realized covariance using the sum of cross products between the intraday returns for 2 assets over a given period of time. Therefore, it can be concluded that along with the expected return and volatility of the portfolio, estimated errors in the predicted returns as well as the realized covariance also vital elements in considering optimal portfolio.

The time series analysis on the given assets 'MSCI EM SC ETF', 'MSCI EM ETF' and 'Gold' starts off with some historical data in regards to the studied time frame. For the simplicity, we have considered 'IEMS' and 'IQQE' in case of two MSCI ETF. The graphs generated show a lot of similarities between the trends experienced between IQQE and IEMS. COVID crisis impacts all the considered stocks performance though Gold performs better compared with both MSCI index. According to the OLS regression, the two assets "IQQE" and "IEMS" are positively correlated that is confirmed through the correlation analysis as well, which shows that the correlation between the two is statistically significant and positive. In order to proceed with the ARIMA model, each of the assets has to be tested for stationary using the ADF test. The test results show that none of the assets are stationary. Therefore, the assets have to be turned to stationary using moving average before we can proceed with the ARIMA test. IEMS data predicts better price stability than IQQE and Gold in case of ARIMA model with the lag order of autoregressive is 3, degree of differencing is 1 and the lag order of moving average is 2 for all the assets. Moreover, the p-values in the ARIMA model are all below 0.05 so they are significant and the AIC as well as BIC show high negative values, which means that the models are quite accurate for all three assets. Further, the Ljung Box indicates that all errors are white noise. As for the heteroskedasticity test, the p-value represents that the residuals show variance. Furthermore, from the Jarque-Bera test, we can depict that data is not normally distributed.

In portfolio optimization, we have considered ACWI world index as market return because it is correlated with other assets in spite of lower correlation (0.04) with Gold. Therefore, it can be assumed that considering more weight on Gold ensures better diversification which can be noticeable in case of Minimum Variance Portfolio. However, Tangent Portfolio provides a bit different scenario by considering more weight on MSCI indexes which turns this portfolio more return centric (0.46) but more volatile (0.40) as well. In addition, Gold is considered less risky (ß =0.03) compared with MSCI ETFs though it presents less return as well. Last but not the least, for a risk preferred investor, invest according to tangent portfolio is the best decision in spite of its less diversified nature. On the contrary, risk-averse investor tends to choose diversified Minimum Variance Portfolio.

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