Executive Summary

Problem

The prevailing risk measure, when it comes to the optimization of equity portfolios, is the variance and the standard deviation, respectively. For quite some time, the Mean-Variance portfolio optimization method, developed by Harry Markowitz, has been unchallenged. However, the possibilities in the current world have expanded drastically. Not only the ever-increasing exchange of knowledge, but also all the enhanced computing power enables the application of far more complex approaches. There is the possibility that the implementation of a more sophisticated risk measure may reflect the real understanding of risk in a better way and therefore is superior in minimizing the overall portfolio risk. The downside risk measures would be a suitable risk measure in this regard.The risks that would be suitable for this are the lower partial moments and the value at risk in combination with the conditional value at risk.
The research examines the application of the risk measures lower partial moments and the value at risk in combination with the conditional value at risk in portfolio optimization. These two figures introduce a new interpretation of risk into the world of finance. Originally, risk was equated with volatility. However, positive volatility is a desired development and only negative volatility should be diversified. The distinction between positive and negative return developments seems, therefore, essential in order to also meet the expectations of hypothetical clients as portfolio managers.
This study aims to contribute to a knowledge foundation on the implementation of downside risks in the portfolio management. The research is also intended to provide Swiss investors with an indication of the performance opportunities by applying the more recent optimization process on the Swiss stock market.

Method

In a first step, the implementation of downside risk in portfolio management is examined. For this purpose, some parts of the methods were examined more closely in order to ensure an optimal information processing. The Endogeneity of the semi-covariance matrix and the Co-Lower Partial Moment calculation should be emphasized regarding the LPM. This was based on the work of Cumova (2004), Hogan and Warren (1972), Estrada (2007) and Ang (1975). When it comes to the CVaR, it was mainly the loss function and the conversion of the equation with the aim of an simplified optimum finding process which were looked at more closely. The work of Rockafellar and Uryasev (2000) and Uryasev (2000) was used as a basis for this purpose.
On the basis of the developed optimization approaches, the performance of created portfolios is subsequently examined. This is done by means of backtesting over the period 2000 to 2017. A rebalancing takes place at the beginning of each year, during which a portfolio optimization is carried out and the investments are executed according to the new asset allocation. Several portfolios were formed on the basis of the different downside risks and with some slight adjustments in the target return and potency for the LPM and in the significance level for the CVaR. In addition, the portfolios with the different risk measures were optimized in two ways. On the one hand, by simply minimizing the aggregated portfolio risks and, on the other hand, by max-

imizing the risk/return ratio. In addition, each of these variations were formed and tested with the different formation periods of 1y, 3y, 5y, 8y and 10y. The backtesting examined whether the portfolios created could achieve an excess return over the SPI representing the benchmark. For this reason, the asset universe was set equal to all equities within the benchmark.

Results

In a first step, the return distributions of the benchmarks and those of the formed portfolios were examined. It was assumed that by minimizing the negative returns, the entire yield distribution would have to transform from a left skewed to a right skewed distribution. The characteristics of the SPI return effectively show a negative skewness combined with a high kurtosis as expected, while the return distribution of the portfolios reveiled right-skewed characteristics, also combined with a high kurtosis. A transformation into a more advantageous distribution for the investor took place accordingly for all portfolios.
Afterwards, the interdependency of the annual portfolio excess return and the risk measures achieved in the same year is examined against the benchmark SPI. This way, it can be determined whether there is a link between the excess return and the downside risk values. Such a significant link could only be found for the risk measure LPM. In a further step, the predictive power of the risk indicators is examined with regard to future annual returns. In order to be able to draw conclusions about an overperformance based on the optimized risk measure, a correlation should ideally be found here. However, only the downside risk CVaR shows some significant predictive relations for portfolios optimized over a formation period of one to three years. With a longer formation period, the risk measures LPM shows significant predictive power. However, the predictive power remains rather low, albeit significant. Furthermore, the excess return is examined. It shows how often the portfolios perform better or worse and the average expected deviation value in the event of an over- or underperformance. Only two portfolios underperform more than they overperform over the 18-year period under consideration. In addition, the average return of overperformance clearly exceeds the average return of underperformances. Thereafter, the risk-adjusted return values of the different portfolios and the SPI are compared. None of the portfolios has performed worse than the SPI on average, regardless of the risk measure with which the risk adjustment is carried out. This demonstrates a good efficiency of portfolio optimization using downside risk measures. Finally, it is examined whether conclusions can be drawn as to which market situation, a bull market or a bear market, the excess returns were mainly achieved. However, no further information could be deducted from the results, which means that the excess returns are very likely to be found across all market trends.

Evaluation

The findings of the study show a clear outperformance of portfolios that have been optimized using downside risk measures against the benchmark SPI. An excess return is also available in a risk-adjusted form, which shows that the risk reduction process works with the proposed methods. Besides that, it remains an open question how the proposed optimization methods would perform compared to the classic mean varince approach.