Executive Summary

This study investigates the relation between implied volatility and future market return. Hsiao and Li (2010) found strong predictive power of IV on future market returns and were able to develop an investment strategy which generated abnormal returns over the S&P 500. However, they back tested their strategies over an in-sample time period.

In order to answer the research questions, I started by studying Hsiao and Li's paper on implied volatility and its predictive power on future market returns. They collected option price information on S&P 100 index options and calculated the implied volatilities of each option. Then, they sub-sampled the options in call and put options and in the different types of moneyness. They evaluated the current market returns for each option and sub-sampled their observations further into the six different states of market and calculated the open interest weighted implied volatility for each trading day of each sub-sample.

I replicated their calculations in order to find out whether I am following the correct procedure or not. After my results were verified, I proceeded with the same calculations for the years 2008 to 2015. The results I calculated differ from Hsiao and Li's results in many ways.

First of all, the pattern of average IV over all sub-samples were similar. IV was highest when the market dropped more than -2%. The average IVs then declined with increasing current market returns and w lowest when the market performed between 0% and 1%. IVs went up again with more extreme positive returns. This pattern could be found for all types of options. The main difference between the average IVs for the two periods was, that the range from highest to lowest IV was slightly wider for the years 2008 to 2015. This could be because the time period covered the last days of the 2008 financial crises and the following recovering years.

Another difference between descriptive statistics of the two periods could be found in the average future return after a certain state of market. Hsiao and Li found an average market reversal for extreme current market movements of $+/-2\%$ and a continuing upward (downward) trend when the current market has risen (dropped) between 1% and 2%. For movements between -1% and 1%, the market seemed to reverse its direction on average for the future. For the years 2008 to 2015, the market reacted always positive on average after a any current state, except for when the market

dropped between -1% and 0%. This might be a sign for rising markets and that Hsioa and Li's strategies might not hold in this environment.

Further, the signs of the regression coefficients I calculated for the years 2008 to 2015 were very different from the values Hsiao and Li reported for the years 1996 to 2008. Hsiao and Li based their strategies on the results of the 36 regressions they ran. They found common patterns over all types of options for most of the six different states of market. The coefficients for a current drop of -2% or more were all positive. This means they predict a market reversal and, therefore, a contrarian trading strategy, where you take a long position, would be best. The coefficient for a current state of -2% to -1%, on the other hand, were all negative. Therefore, a momentum can be expected, and going short would be the best strategy. All the coefficients for both states of market are statistically significant on the 10% significance level or higher. All the other coefficients were not statistically significant. In comparison to that, I found statistical significance on the current market state of 0% to 1% only. All the signs of the regression coefficients are negative for this bracket. This implies that the strategy of Hsiao and Li cannot be based on regression coefficients outside their sample period. It is also remarkable, that Hsiao and Li stated, that their trading strategy would perform best in times of high IV. This goes with their results, both, statistical significance and IV being at its highest, when markets drop between -1% and -2%. My results, on the other hand, show that the statistical significance is highest in the bracket with the lowest average IV over the whole sample. Further, I tested the relation including risk factors as control variables. The results are congruent for statistically significant results.

Following their strategy, Hsiao and Li were able to achieve remarkable abnormal returns. However, since they covered the same time period they derived their strategy from, I expect a different outcome by applying the strategy on a out-of-sample time period. In order to get out-of-sample performance results of Hsiao and Li's trading strategy, I applied the strategy on the S&P 500 index over the period 2008-2015. I took a short position when the current return was between -1% and -2% and the IV above its 75% quantile, and took a long position when the market dropped more than -2% and IV was above the before-mentioned level. For the cases the market did not meet the requirements for the strategies, I invested at the risk-free rate. In order to calculate the trading signals, I relied on a rolling estimation method, where I calculated the average current return

and IV over the last three weeks for every trading day. I than placed the investments according to the trading signals. The strategy was able to outperform the index over the first few months but performed rather poorly shortly after. The reason is, that the markets began to rise after the 2008 financial crisis and the average IVs rarely exceeded the 75% quantile. Therefore, I was invested at the risk-free rate for the most of the time, while the S&P 500 index experienced a good growth. After all, the strategy was able to provide a steady growth and outperformed the index in times of uncertainty, but missed on a lot of chances to profit from rising markets.

For the last part, I examined whether the abnormal (negative) returns, generated by using Hsiao and Li's trading strategy, could be explained by the Fama-French three risk factor model. I did run a regression of monthly risk factors for market-risk, size and value on the cumulated monthly returns, following the trading strategy. I did not find any statistically significant relation for any of the above mentioned risk factors. This implies, that the abnormal returns can not be explained by the risk factors and the strategy might generate alpha.