Executive Summary

This thesis provides novel empirical results on the relationship between physical climate risks and stock markets. Using the risk scores of Kölbel et al. (2020) and Sautner et al. (2020), the risk-return relationships of low physical climate risk portfolios are evaluated. This portfolio analysis is not limited to the US market, but extends previous research to a global approach. It is similar in structure to the portfolio analysis of In et al. (2019) but focuses on physical instead of transitional climate risks. The key questions of this thesis are:

1. Do investors achieve positive returns on low-physical climate risk investment strategies with long positions on low physical climate risk firms and short positions on high physical climate risk firms?
2. If so, are these returns abnormal or compensation for bearing additional risk?
3. Are there differences in results for different markets?
4. Is there divergence between the physical risk scores and how does this affect the results of the portfolios formed?

The methodologies and findings to these four questions are summarized as follows: First, the question is addressed whether investors can generate positive returns with low-physical long-minus-short investment strategies. For this purpose, zero-cost LMH (low-minus-high) portfolios are formed, which take long positions in low-physical climate risk stocks and short positions in high-physical climate risk stocks. The stocks are market-capitalization-weighted within the long and short positions and rebalanced monthly. LMH portfolios are formed using the Sautner-based approach and/or the BERT-based approach[1], with the two methods differing in the source of risk scores. The two risk scores cover different markets; the BERT-based risk score builds on US 10-K reports, while the Climate Risk Score of Sautner et al. (2020) is quantified using earnings calls of US and non-US firms. For this reason, LMH portfolios can be formed using both approaches on the US-merged index, while on the EU-merged, FTSE 100, SMI-merged, and Nikkei 225 indexes, only the Sautner-based approach

[1] The Sautner-based approach uses physical climate risk scores from Sautner et al. (2020) to form portfolios, while the BERT-based approach uses the data from Kölbel et al. (2020) created with BERT.

is used for portfolio formation. The results reveal that in the period 2009-2018, four of the six LMH portfolios achieve positive average monthly returns, while the negative average returns of the two last-placed portfolios are not significant.

To address the second and third questions, 4 well-known asset pricing models are used to determine whether bearing additional risks can explain these returns or whether they are abnormal. According to the Fama French 5-factor model by Fama and French (2015), all LMH portfolios with positive average returns also achieve positive alphas, whereby only the one generated from the EU-merged subsample shows significance with an annual abnormal return of 7.44%. The two LMH portfolios from the Swiss and British stock markets are among those that hold (too) few stocks in the low portfolio. Despite their negative absolute returns, they also generate positive abnormal returns according to the FF-5 factor model.

To provide an answer for the fourth question, the Sautner-based and BERT-based approaches are compared in terms of formation and returns of portfolios in the common US-merged market. We find that the right skewness property of the physical climate risk scores is more prominent in the Sautner-based approach, which causes fewer firms to be included in the high physical climate risk portfolio. In addition, the differences in the returns of the LMH portfolio are mainly driven by the high physical risk position.

Overall, the results seem to point in one direction: all LMH portfolios generate positive abnormal returns. Nevertheless, only one of these alphas is significant, and other limitations of the work need to be considered. First, some high sorted portfolios carry a risk of poor diversification, which could have an impact on the results. Second, this portfolio analysis does not control for survivorship bias, and in addition, large portions of stocks are excluded from the sorting. Excluding stocks can affect the results if these stocks have systematically higher or lower climate risks. Another confounding factor is that the companies are not sorted within the industries. As a result, companies from sectors exposed to higher (lower) physical climate risks may be assigned to the high (low) portfolio. Consequently, the returns of the LMH portfolio may be driven by the returns of individual industries.

Bibliography

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