

# Commodity Markets: The Effect of Extreme Events and Possible Diversification Strategies

Bachelor Thesis in Banking & Finance

Swiss Banking Institute

University of Zurich

June 27, 2008

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## 1 Executive Summary

Commodities offer many interesting features, especially in terms of diversification. They provide risk-reduction benefits to portfolios which mainly consist of financial assets. Due to the small or even negative correlation between commodities and financial assets, the risk-adjusted return already improves even if only a small proportion of commodities is added to the portfolio. One of the reasons for the negative correlation originates from the fact that commodity prices generally react positively towards rising inflation while for financial assets it is the opposite case.

Still, in the area of commodity investments (including diversification strategies using commodities), little research has been done compared to other asset classes. A very recently published paper by Chesney and Reshetar (2007) analyzes the impact of terrorism, financial crashes and natural catastrophes on stock, bonds and commodity markets. In their paper, they focus mainly on terrorism and diversification strategies with stocks. In our paper, we focus on the characteristics of commodities in order to formulate diversification strategies with commodity categories and single commodity indices.

The aim of this empirical paper is to study the effect of different extreme events - terrorist attacks, financial crashes and natural disasters - on the behavior of commodity markets with further development of diversification strategies against catastrophic risk. To do so, we also involve the regionally and globally broadest equity and bonds indices. This allows us to compare the impact of different types of extreme events across several asset classes and enables us to make use of the interesting characteristics commodities have inherent.

The paper starts with an introduction to commodities as an asset class which covers the special characteristics of commodities and their implications on commodity investments. It continues with an empirical analysis which gives answer to the research questions we have defined upfront in order to be able to create portfolios with different risk and return profiles.

The paper considers ten extreme events (terrorist attacks, financial crashes and natural catastrophes) over a time period of 14 years. It examines the impact of these events on

21 indices of different asset classes with the event-study methodology in order to analyze the strength and direction of the impacts. To diversify the risk we use the results to rank the different indices according to their sensitivity to the extreme events considered. With the results from the event-study we are able to construct mean-variance optimized portfolios for rational investors which take into account the exposure to extreme events. We chose to build 3 portfolios which differ in terms of sensitivity. The first portfolio consists of the five least sensitive indices while the second portfolio includes the five most sensitive indices. The third portfolio contains the indices which exhibited the greatest number of positive reactions to these events.

We then choose the weights of the indices of the respective portfolios using mean-variance optimization. The analysis results in an efficient frontier which gives us the minimum-risk portfolio, the so-called global minimum variance portfolio. The paper ends with a comparison of the risk profiles of these portfolios using different risk measures.

The results are as follows. Especially terrorist attacks showed negative impacts on commodity prices. Commodity markets show the lowest number of reactions towards natural disasters and the highest towards terrorist attacks. The effect of the impact very often affects the event-day as well as the post-event window.

The myth of gold being the save-heaven diminishes partly in our study. The result of the event-study shows that the tougher lending conditions in the United States due to the arising subprime crisis had a negative effect on the gold price. Recent research from Chesney and Reshetar (2007) confirm this finding in terms of terrorist attacks. In their study, gold reacted more often negatively than positively on terrorist attacks.

In terms of sensitivity across asset classes, stocks were the most and bonds the least sensitive assets. The GSCI index as well as gold, energy and metals were the most sensitive commodity indices.

The sensitivity of the GSCI can be explained by its composition which in fact is heavily energy weighted. Of note is that at the same time, the most sensitive indices also exhibited the greatest number of upward jumps with gold as the only exception.

Investors can vary their exposure towards risk of extreme events by choosing one of

our three portfolios or a combination of them. Of note is that the portfolio with the lowest sensitivity towards the extreme events considered is not the portfolio with the best statistical risk measures (value-at-risk, expected shortfall and sharpe ratio).

Further research on this topic may involve calculations of the tangency portfolio so that the risk preferences of an investor can be varied in an even more flexible way by investing his wealth partly in risk-free assets and partly in the tangency portfolio on the efficient frontier. Also more recent risk preference models such as the prospect theory of Kahneman and Tversky from the field of behavioral finance could be employed.

Other research may include macro-economic aspects and assets such as currencies. Derivative instruments could also help to hedge or improve performance. The strategic asset allocation of the minimum variance portfolios can be used as underlying strategy to create 3<sup>rd</sup> generation structured products.