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The impact of terrorism on financial markets: An empirical study

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ABSTRACT

The main focus of this paper is to study empirically the impact of terrorism on the behavior of stock, bond and commodity markets. We consider terrorist events that took place in 25 countries over an 11-year time period and implement our analysis using different methods: an event-study approach, a non-parametric methodology, and a filtered GARCH–EVT approach. In addition, we compare the effect of terrorist attacks on financial markets with the impact of other extreme events such as financial crashes and natural catastrophes. The results of our analysis show that a non-parametric approach is the most appropriate method among the three for analyzing the impact of terrorism on financial markets. We demonstrate the robustness of this method when interest rates, equity market integration, spillover and contemporaneous effects are controlled. We show how the results of this approach can be used for investors' portfolio diversification strategies against terrorism risk.

1. Introduction

A lot of research on terrorism has been done in the fields of sociology, political science and history. With respect to economics and finance, terrorism has not received much attention from researchers until recently. The effect of the impact of the 9/11 terrorist attacks on stock markets as well as that of more recent attacks in Madrid in 2004 and in London in 2005 has revealed that terrorism risk is a new type of catastrophic risk that investors and financial institutions may be facing. In this paper we intend to provide a deeper understanding of the impact of this risk on the behavior of various financial markets. When studying the impact, we look at global, regional, national and industrial market levels. In addition, we compare the impact of terrorist events on financial markets with the impact of other extreme events such as financial crashes and natural catastrophes.

Among existing research, this empirical paper is one of the very few (see for example Arin et al., 2008; Chen and Siembs, 2004; Eldor and Melnick, 2004; Karolyi and Martell, 2006) that study the link between terrorism and the behavior of stock markets. It is also the first one that analyzes the impact on bond and commodity markets.

In contrast to impact studies which often employ only event-study methodology, in this work we investigate the impact of terrorism using other methods as well. We use a non-parametric methodology and a filtered generalized autoregressive conditionally heteroscedastic (GARCH) with the extreme value theory (EVT) approach. Both methods are standard econometric tools. However, our application of them in this work is original.

We show that a non-parametric approach is the most appropriate method among the three considered for analyzing the impact of terrorism on financial markets. In contrast to an event-study, it does not impose strong parametric restrictions. It is also less computationally intensive than a filtered GARCH–EVT method. Finally, a non-parametric approach allows us to analyze the impact of events in the post-event period which is not possible with the GARCH–EVT approach. We demonstrate the robustness of a non-parametric model when interest rates, equity market integration, spillover and contemporaneous effects are controlled.

The findings of our empirical investigation are useful for investors, insurance and reinsurance businesses, banks and government agencies. This study is the first one to give insights into possible portfolio diversification strategies with respect to the risk of terrorism. We demonstrate how Swiss and European investors can apply

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the results of our non-parametric model to the construction of their investment portfolios.

In order to study the impact of terrorism on financial markets empirically, we look at the effect of 77 terrorist attacks that occurred in 25 countries over an 11-year time period. We look at global, European, American, and Swiss stock markets as well as insurance, banking, travel, pharma/biotech, aero/defense and oil/gas industrial stock indices. In relation to other markets, we look at the US, European and World bond indices as well as at the global commodity and gold markets. When comparing the impact of terrorist events on these financial markets with the impact of other extreme events, we analyze the impact of 4 financial crashes and 19 natural catastrophes which occurred during the 11-year period under consideration.

The results of our work are as follows. Approximately two-thirds of the terrorist attacks considered lead to a significant negative impact on at least one stock market under consideration. The Swiss stock market is affected by the highest number of attacks while the American stock market by the lowest number. The insurance sector and the airline industry exhibit the highest susceptibility to terrorism, while the banking industry is the least sensitive.[1] This is in contrast to financial crashes which have a strong negative impact on the banking sector. The analysis of the impact on the aero/defense, pharma/biotech and oil/gas sectors shows both positive and negative reactions. These sectors behave similarly to natural disasters and financial crashes.

As with terrorist events, natural catastrophes cause both positive and negative return movements in the commodity/gold and bond markets. The gold index is affected by a lower number of events compared to the commodity index, implying less sensitivity of the former to natural disasters. Finally, among bond markets considered, the US government bond market shows the lowest impact from terrorist attacks, natural catastrophes and financial crashes.

As to the strength of the impact, terrorist attacks and financial crashes cause event-day return movements that are mostly extreme, with the strength of the impact declining in the post-event period. This implies that although markets perceive these events as unusual, they do not see their effects as long-lasting. Regarding natural catastrophes, the negative impact is more often observed in the post-event period. This can be attributed to the fact that markets need more time to evaluate the long-term impact of such events. Furthermore, as natural disasters can last for several days, the impact is more likely to be evaluated during the period following the event.

The results of this paper suggest several diversification strategies for minimizing the terrorism risk. Investors concerned about this risk should consider holding two groups of assets: those which are likely to react positively to terrorist attacks, or those which have little or no negative sensitivity to this risk. In the first case, a US Government Bond Index is the safest choice followed by such industry stocks as aero/defense and pharma/biotech. However, given that these stock markets may also exhibit a negative response, investing in these industries as a diversification strategy against terrorist attacks may not always work. In the second case, a banking stock index may be good for investment. It is important to note, however, that although a banking stock index is least sensitive to terrorist attacks, it exhibits significant negative return movements associated with financial crashes.

Regarding the other financial markets, investing in a composite commodity index is preferable to investing in gold only. This is because the gold market often reacts more negatively than positively to terrorist events. In addition, when compared to the commodity market in general, the negative impact on the gold market is more long-lasting. At the same time, the commodity market also shows a short-term negative reaction to some terrorist events. This implies that investing in gold and commodity markets may not always provide a good hedge.

Another possible way to reduce negative exposure to terrorist events would be to avoid investing in insurance, travel and airline stocks or to short these indices. Note that insurance and airline industries show high negative sensitivity not only to terrorist attacks but also to financial crashes and natural disasters. This implies that by taking long positions in these stocks, investors may end up increasing their risk of loss if further terrorist attacks occur.

Finally, our analysis of the possible investment diversification strategies for Swiss and European investors shows that an investor who uses the results of our paper and constructs an investment portfolio in such a way that she imposes a negative correlation on the industries that react inversely to the terrorist attacks and a positive average correlation on the rest of the covariance matrix, would outperform other investors.

2. Related research

Analysis of existing literature on the impact of terrorism on financial markets shows that most of the research has a descriptive character and focuses on the impact of very few terrorist events (often only those which occurred on September 11, 2001). A recent article by Karolyi (2006) discusses what is known and unknown about the effects of terrorist events on financial markets. It also provides a summary of the research done in this area. According to the author, there is still little known about the economic and financial consequences of terrorism.

A very recent paper by Arin et al. (2008) shows interesting results regarding the effect of terrorist events on the markets' behavior based on evidence from six different financial markets (Indonesia, Israel, Spain, Thailand, Turkey and UK). In their work, the authors investigate the effects of terrorism not only on the stock markets, but also on stock market volatility. They find that the magnitude of terrorist effects is larger in emerging markets.

Johnston and Nedelescu (2005) examine cases in which financial markets are directly or indirectly affected by terrorist acts. They review the reaction of the markets to the 9/11 attacks in the US and the attacks in Madrid in March, 2004. The main conclusion of their study is that financial markets are not only confronted with major disruptions caused by the massive damage to property and communication systems, but also with high levels of uncertainty and market volatility, especially in the case of the 9/11 attacks in New York. However, there are some differences in the stock market reaction to these two terrorist events. While the attacks in Madrid were perceived as mostly having a regional effect, those in New York were seen as having repercussions on the global financial system.[2] The authors view the timing of the attacks as a possible explanation for the different impacts. Whereas the attacks in New York occurred during a period of economic downturn, the attacks in Spain happened when the world economy was experiencing growth. We believe that the difference in the impact can also be explained by examining the targets of the attacks. The 9/11

[1] Note that the banking sector was affected negatively by the 9/11 attacks. However, this event was exceptional in terms of its magnitude and place of occurrence (Manhattan, the financial center).

[2] The major worldwide equity markets experienced sharp and rapid declines, demonstrating that market participants perceived the 9/11 event as a global shock. In contrast, the 2004 terrorist bombings in Madrid had much less effect on the financial markets. The Dow Jones EURO STOXX fell by about 3% on March 11, and continued to drop during the following days but had recovered almost completely by the end of the month. Similarly, after a small decline, the S&P 500 returned to pre-March 11 levels in less than a month (Johnston and Nedelescu, 2005).