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Terrorisk: The Impact of Terrorist Attacks on Sovereign Bond Yield Spreads of Targeted Countries

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Abstract

This study estimates the effects of terrorism incidents on a nation's borrowing costs. An event study approach is used to evaluate changes in sovereign-bond yield spreads after terrorist attacks occur. Prior research is not in consensus on whether the effect of terrorism on bond markets is significant, and no study shows why certain bond indices may rise while others may fall after a terrorist attack. This study does not find statistical significance, which suggests that the effect of an attack may depend on the targeted country. For terrorist researchers, this study is one step toward answering whether terrorists can manipulate financial markets to their advantage.

1. Introduction

An act of terrorism as defined by the Global Terrorism Database Codebook is an act that is intentional, violent (or threatens violence) and perpetrated by a sub-national actor. In addition, it must meet two more of the following three criteria: (a) It must be aimed at achieving a political, economic or social goal; (b) It must be intended to coerce, intimidate or convey a message to a larger audience; (c) It must be outside of humanitarian law (particularly against the prohibition of targeting civilians)[1]. Due to the sub-national nature of the terrorist groups considered, they will almost always face a better equipped and well-funded adversary against whom a "war of attrition" strategy will be employed. Hoffman (2011) and others argue that terrorists are very effective at achieving their stated objectives. The ability of small terrorist groups to wield outsized influence is not a phenomenon that we can observe with other types of political violence such as traditional wars. With hundreds of active terrorist groups functioning across the world, it becomes necessary to study the impact of terrorism on the financial markets in order to make well informed financial decisions. For example, investors may need to diversify their portfolio in cases when terrorist activity has a significant impact on a large number of their investment positions and may also need to find ways to hedge against this risk.

This study sets out to evaluate the argument that terrorism has a significant effect on sovereign bond yields[2]. It begins by outlining existing literature on the determinants of sovereign bond

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[1] National Consortium for the Study of Terrorism and Responses to Terrorism (START). (2011). Global Terrorism Database [Data file]. Retrieved from http://www.start.umd.edu/gtd

[2] This is the first study to consider yield spreads instead of the movement in composite bond indices.

yields and sovereign bond yield spreads and comments on the importance of the flight to safety effect. It then transitions to a complete review of the slim body of literature that specifically looks at how terrorism affects bond yields. This is followed by an explanation of the new approach proposed, an outline of the data, the empirical analysis, results and the conclusion.

2. Yield Spreads and Default Risk

Merton (1974) explains that the three items upon which the value of a sovereign bond would depend are: (a) the required rate of return on riskless bonds, (b) the terms of the indenture and (c) the risk of default. Since the yields of a bond measure the bond's return it follows that factors which can bring about changes in the risk of default will also change a bond's yields, with higher yields signaling the increased risk premium that investors demand on the bond. It is generally accepted that the risk of default is influenced by two sets of variables: economic and political.

For our purposes, it is useful to look at literature on bond rating agencies because they include both when assigning ratings. Bond rating agencies assign ratings to countries based on the risk that a country will default on their debt obligations. Although they publicize the variables that they include in their calculations and mention political variables as a factor, the specific weights of their inputs are not publicly available. However, several researchers have been able to create their own models with results that have a high correlation with the ratings that agencies assign to countries' sovereign debt. While some of the earlier successful attempts to model sovereign bond ratings such as Ederington and Yawitz (1987), Moon and Stotsky (1993) and Cantor and Packer (1996) claimed that political variables are unquantifiable, later models were able to achieve

greater predictive power by building on political science literature.

Hammer, Kogan and Lejeune (2004) used nine economic and three political variables (political stability, government effectiveness and corruption level) to construct a model that is highly correlated with the S&P 500 bond ratings with an R-squared of 91.2% (89.3% adjusted). Of these variables, only political stability was significant at the 5% level. They also found that that if the political variables are removed from the model than the R-squared drops to 88.6% (86.9% adjusted) the correlation between the model and the actual ratings also drops and the confidence intervals are increased. They conclude that although political variables are not critical to their model they do enhance it. Hammer, Kogan and Lejeune (2008) build on this study and conclude that political stability is in fact a “necessary” variable for the model. Other studies that recognized that the political environment is very important, but did not specifically look at political stability were Brewer and Rivoli (1990) Citron and Neckelburg (1987) Mauro (1993) and Afonso (2003).

What most studies agree on is that political data is more difficult to obtain than economic. A common source for this data after 1999 were three papers by Kaufmann, Kraay and Zoido-Lobaton (1999a,b and 2002). For our purposes, it is interesting to note that while the 1999 papers make no mention of terrorism the 2002 paper has several mentions of the term and includes it as part of an important variable in the study. More importantly, the studies are all based on surveys of population and polls of experts and are entirely “perception-based”. The ability of our data to overcome this weakness should not be understated.

Given these studies, one mechanism by which terrorism can impact a country's sovereign yield spread becomes apparent. If terrorism impacts the stability of a government that, in turn, is a "necessary" factor when one measures the risk of a nation's default then, as demonstrated by Merton (1974), the risk of a nation's default will change the sovereign yield spread.

3. Flight to Quality/Safety

The clear picture illustrated up to this point is complicated by the "flight to safety" also known as "the flight to quality" phenomenon. Vayanos (2004) describes flight to safety phenomena as "sharp increases in market risk aversion during periods of turmoil." During such episodes investors begin to demand a higher risk premia for the volatility of an asset. Such a phenomenon could impact our data in two ways. First, investors fleeing from a country's sovereign bonds and purchasing U.S. treasury bonds would widen the observed yield spread beyond what they would be otherwise by decreasing the risk free yields of treasury bonds. Second, investors fleeing volatility in the stock market within a particular country may reinvest their money into the less volatile bond market of that same country. This latter case is most troublesome to our study as it would have the effect exactly opposite to the impact on the yield spread that the default risk would have. As explained in the next subsection, this study's use of 10 year sovereign bonds seeks to minimize it.

4. Terrorism and Bond Yields

Few researchers have explored the effects of terrorism on global capital markets and even fewer have specifically looked at its effect on bond markets. Schneider and Troeger (2006), Karolyi and Martell (2006) and Drakos (2009) all found a negative correlation between terrorism and stock market returns. Chen and Siems (2004) were the first to study the effect of terrorism on bonds. They looked at both domestic and foreign attacks, but did not distinguish between terrorist and military attacks by including attacks such as Pearl Harbor, the Iraq Kuwait War and attacks during the First and Second World Wars. Their small sample size of 14 attacks thus becomes even smaller when one wishes to study only terrorist attacks. Using an event study methodology, they found increased resilience to attacks in the U.S. and negative returns on the day of the attacks. Other than the September 11th attacks, just one attack results in returns that are significant at the .10 level: the Air India bombing. The study's attention to terrorism beyond the 9/11 attack coupled with a consideration of the bond market was essentially nonexistent.

Gulley and Sultan (2006) were the first to consider the bond market's response to terrorism. In addition, the U.S. stock market, foreign stock markets, and currency exchange markets were also studied using a GARCH model. While this study confirms that the negative associations between terrorism and stock/exchange markets are straightforward, they conclude that bond yield response is "tricky" and dependent on the type of bond index that is chosen. They propose that the flight to safety/quality effects may increase the yields of short-term bonds while the uncertainty associated with longer term bonds will cause their yields to depreciate. However, they find a significant effect on bond yields for only one country: Japan, where the negative

coefficient “may signal a flight to quality effect.”

Chesney, Reshetar and Karaman (2011) find that a non-parametric approach works better than GARCH and event-study methodologies when studying the effect of terrorism on financial markets. Though they incorrectly claim that their paper is “the first one that analyzes the impact [of terrorism] on bond and commodity markets,” their study is more exhaustive than Gulley and Sultan (2006). Using 77 terrorism events they find that terrorist attacks do have a significant impact on bond indices that can be positive or negative. Interestingly, they find that the Global Government Bond Index experienced the most positive movement. It is not altogether clear what accounts for the different results between their study and Gulley and Sultan (2006) in the case when both use the GARCH and GARCH-EVT methods.

This study uses a more comprehensive data set than either study and focuses exclusively on the bond markets. By using a much larger sample size, significant differences in bond yield not previously observed may be detected. The most significant departures from earlier methodologies is the use of benchmark bond indices that track the sovereign debt within the country where a terrorist attack occurs (targeted country) and the introduction of yield spreads as opposed to just yields. All previous studies have relied on bond indices that incorporate many countries. Thus, their findings would not be useful for investors and researchers who are attempting to discriminate between terrorist risk on a country by country basis.

5. Hypothesis

Two reasons have been proposed for why different bonds may behave differently after a terrorist attack. Gulley and Sultan (2006) propose that long term maturity bonds are more likely to ignore the flight to safety effect while Cheney, Reshetar and Karaman (2011) find that Government bond indices indicate greater yields following terrorist attacks. Building on these studies, the expected result for long term maturity sovereign bonds would be a positive abnormal yield following a terrorist attack. This expectancy is grounded in the assumption that 10-year maturity bonds will not be impacted as strongly by the flight to safety effect and that individual country yields will behave similarly to broader government indices that Cheney, Reshetar and Karaman have observed.

6. Data Parameters and Applied Screens

The approach used by every study that looks at this problem to date has been an event study methodology. While Cheney, Reshetar and Karaman concluded that a non-parametric approach is more robust it is also much more difficult to apply given that there is only one example of its use to model terrorism's effect on the bond market. The better tested event study methodology is thus applied in our study.

Drawing data from the Datastream database, 12 countries are identified for which daily 10-year sovereign bond yields are available for years 1997-2010. For each day of each of the thirteen years, a yield spread is calculated for each country by subtracting the 10 year United States

benchmark “risk free” yield corresponding to the same date. These dates are paired with dates of terrorist attacks obtained from the Global Terrorism Database. Several screens are then applied.

First, because it is necessary to make sure that the observed effect of each attack is not the result of another attack’s lingering effect, all attacks occurring in the same country within twenty days of each other are eliminated from our calculations. Because terrorist attacks tend to occur together, this parameter eliminates a very large number of incidents. Another screen makes sure that there are no missing values on the day of an attack, thus attacks occurring on weekends and other days for which yield spreads are not available are eliminated. Nevertheless, in order to obtain the best possible results as much data as possible is retained and so 16,821 data points are included in the calculation of the eventual averages.

7. Calculations

Based on Cheney, Reshetar and Karaman (2011) three sovereign yield spread values for each attack are calculated. An average yield spread for the twenty days prior to each attack is calculated first (CY20). Then the average yield spread for the five days after an attack is calculated (CY5). Lastly, the yield spread on the day of the attack is identified (CY0).

We run a series of “paired two-sample t-tests for mean” that are two-tailed and assume a normal distribution. The H_0 hypothesis is that the means for each value are equal for all countries and for

each individual country for which a sufficient number of data points are available. In other words, CY20=CY5=CY0 will hold for a t-test that includes all attacks for all countries as well as for all attacks within any given country.

8. Results

The following table summarizes our results. It is important to note that for the United States, instead of yield spreads, the entire magnitude of the change in the 10 year maturity benchmark yield is used. Using a yield spread would have been impossible for the United States since it would involve subtracting the yield from itself and the results would all equal to zero. Also of note, is that the yields are all calculated in basis points "bp" with one basis point equal to 1/100th of a percent. A "-" sign indicates that the yield spread has declined while a "+" sign indicates an increase in the yield spread.

Mean Change in Yield Spread Following Terrorist Attacks[3]

	All Countries[4]	**Spain**	**France**	**Germany**	**Italy**	**United States**
Change in Spreads on Day of Attack (CY0-CY20)	.2bp	1bp	.4bp	1bp	3bp*	-2bp*
Change in Spreads Five Days After Attack (CY5-CY20)	.2bp	-.1bp	0bp	2bp	1bp	4bp**

9. Conclusion and Interpretation

Although the majority of the results are not statistically significant, in ten out of twelve t-tests

[3] ** denotes significance at the 5% level and * denotes significance at the 10% level.

[4] All countries excludes the United States because a yield spread for the U.S. is unavailable.

that were run the sign is consistent with our hypothesis. Overall, the yield spreads rise after a terrorist attack indicating an increase in default risk. In the United States, where the real yields (as opposed to yield spread) were considered we find a negative change in yields on the day of the terrorist attack. This is an interesting finding that is actually highly consistent with the flight-to-safety effect. It would make sense that the flight-to-safety effect is strongest in the United States where a very efficient and large stock market can send loosing investors fleeing into the bond market very rapidly. Furthermore, the reputation of treasury bonds as the safest in the world makes them the ideal investment after a terrorist attack. However, in the five days after an attack this effect appears to abate and the yields rise. In fact, the magnitude of their subsequent rise may be heightened by their decline on the day of the attack. Perhaps the most intriguing finding is that the impact of terrorist attacks may depend on the country where an attack takes place. For example, while Spain had many more incidents it was Italy that experienced the strongest and most statistically significant change in yield spreads.

10. Further Research

This study lends itself to continued research. I plan to further this study by including lethality parameters and other indicators of the magnitude of an attack to see if they correlate with greater movements in the yield spread. Just as important, is a need to improve the methodology of this study. First, a non-parametric regression could yield stronger results as demonstrated by Chesney, Reshetar and Karaman (2011) and should be applied to this study. Second, an even trickier problem is the need to eliminate the counteracting effects of the default risk increases and the flight-to-safety phenomenon following an attack. The latter is something that this study was

originally intended to accomplish (unsuccessfully) and later tried to minimize by looking at 10 year maturity bonds. Yet, it seems that this attempt has also failed as shown by the results for the United States on the day of the attack. The limited amount of literature on the flight-to-safety effect presents a powerful obstacle to its elimination from any empirical study of sovereign bonds.

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