THE EFFECTS OF MARKET INTEGRATION ON GLOBAL RISK SHARING: EXAMINING MARKET REACTIONS TO CATACLYSMIC EVENTS

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ABSTRACT

There are a number of cataclysmic events that stand out as markedly catastrophic enough to cause significant unrest in investors' outlook on the stability of the market. In today's increasingly integrated global market, the key concern for investors in adjusting for such situations is to spread their portfolio risk across different risk bases in order to reduce unwanted effects from the idiosyncrasy of a particular part of their portfolios. Using the event study method and ICAPM-derived measure of market integration, I find that there is evidence for market integration's global risk sharing effect on abnormal returns from cataclysmic events, specifically in regard to natural disasters and terrorist attacks. There is, however, no evidence of risk-diffusing effects beyond the event day, even for relatively short post-event windows of 6 and 11 days. This seems to suggest that market integration as motivated by global risk sharing is only effective to disperse the initial shock of a cataclysmic event.

BIOGRAPHICAL SKETCH

Jonathan Sheewon Park graduated from University of Pennsylvania in 2010 with magna cum laude and distinction in the Economics major. He holds two undergraduate degrees, Bachelor of Science in Finance from Wharton School and Bachelor of Arts in Economics from College of Arts of Sciences.

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I. INTRODUCTION

On March 11, 2011, East Japan was hit by a magnitude 9.0 earthquake followed by destructive tsunami waves over 100 feet in height that engulfed much of the coastal inland area. Dubbed the Great East Japan Earthquake, it was the most powerful earthquake to have ever occurred in Japan, causing over 15,000 deaths and enormous infrastructural damages. Even before the nation was able to mourn its dead, search for the missing, and take care of the huge numbers of homeless, the coastal nuclear plant in Fukushima began to show signs of nuclear leakage that many feared would lead to a nuclear meltdown.

Japan is third largest economy in the world, and the economic and financial implications of the aftermath of this catastrophe and the ongoing nuclear threat—many of which inevitably would involve other countries—were virtually limitless. Japan is a liberalized country with minimal capital controls and a market that is integrated with the markets of other countries to varying degrees: its economy was not the only economy to take the hit. Many countries whose markets are integrated with Japan's also suffered proportionally to their mutual stake. This is consistent with the global risk sharing hypothesis that proposes that firms or investors can spread risk across their shareholder bases, thereby lowering the individual risk load.

This international risk sharing phenomenon is not so different from the aftereffects of U.S.-originated financial crisis of 2008 when the meltdown of the U.S. subprime mortgage market instigated a rippling effect that spread to foreign markets. The financial globalization and widespread integration with foreign capital markets created a complex web of credit lines that rapidly spread the risk of the collapsing U.S. housing market throughout different countries. When the U.S. market burst, a global financial crisis ensued, a salient example of global risk sharing in action.

According to the theory of capital market integration, the market had priced the perennial threat of earthquake in Japan and rational investors had hedged their positions. However, an unfortunate turn of events changed what should have been a country-specific crisis that investors could address through diversification to a tragic case of a class-7 nuclear accident. The sheer enormity of this aftershock naturally had more significant consequences on investors worldwide.

The feeble attempts of the overly conservative media, the Japanese government, and the Tokyo Electric Power Company to pretend the catastrophe was "managed, and under control," clearly contradicting expert opinions from the rest of the world, raised serious concerns, rightful anger, and caustic criticisms from both within and outside Japan. With news constantly evolving over the month that followed, the international community developed a general skepticism about the Japanese government's public statements and risk-management abilities. The real threat of a nuclear meltdown, leading to uncertainties about the stability of Japanese consumer and credit markets, had many possible economic and financial implications, including rebound effects for competitors, spillover effects to neighboring or closely tied countries, and potentially persistent effects on the general economy of the region.

Motivation

Motivated by the occurrence and the development of such disasters, I have posed the following question for discussion in this essay: How did the integrated world market react to Japan's disaster? Did the reactions of markets depend on the degree of integration with the global financial market? In other words, are highly integrated markets affected more negatively than markets with less integration?

Every year, there are countless incidents of natural disasters and terrorist attacks around

the world. While all of them are disastrous in nature, causing local and regional damage, some stand out as markedly catastrophic enough to cause significant unrest in investors' outlook on the stability of the market—such as the recent earthquake and tsunami that hit Japan. The key concern for investors in adjusting for such situations is to spread their portfolio risk across different risk bases in order to reduce unwanted effects from the idiosyncrasy of a particular part of their portfolios. While some investors may want to take advantage of such effects by timing the market or hedging for risks, the unanticipated nature and the cataclysmic magnitude of these events often make this difficult.

In exploring this question, I have looked at other natural disasters, such as the 2004 Indian Ocean earthquake and selected terrorist attacks. I have not included events such as Hurricane Katrina, since such events are more seasonal and therefore predictable in some small degree. For Katrina, the trajectory and arrival were constantly announced, and the government took a number of anticipatory measures—even if, post-storm, they were deemed appallingly insufficient. The extent of damages—though much more disastrous than many had hoped—could have been anticipated by and priced in the market. One could argue that terrorist attacks are also anticipatable to a certain extent. While that would be true if proper intelligence allowed for it, these forms of intelligence are not likely to be readily available to rational financial markets and their investors to allow the market to preemptively quantify, model, and price the risk of an impending attack. As risk diversification is an important motivation for investors in this globalized economy, the potential concerns about the negative (or positive, for that matter) effects of unexpected catastrophic events are understandable, and there are significant issues to consider.

Market integration has its costs and benefits. One of the key motivations behind market

integration is global and regional risk sharing—which is the main focus of this study. According to Van Wincoop (2011), there is conflicting evidence as to the benefits, if any, of international risk sharing. However, the global market has become more and more integrated, beginning in the 1980s for developed markets and increasingly in emerging markets from the 1990s (Ayuso & Blanco, 2001; Bekaert, Harvey, Lundblad, & Siegel, 2011). At the same time, the world has experienced more frequent banking crises: around 67 since 1980, 52 of them in developing countries.[1] While the increasingly complex nature of financial systems due to technological advancements and sophisticated financial instruments could be partially responsible for this trend, increased market integration could well also be a cause. If so, the continuing trend of capital market integration despite increased vulnerability to banking crises could be suggestive of a definite benefit of market integration—global risk sharing, for instance—to the extent that policy-making authorities and private-sector market participants are willing to continue to open up and integrate.

By empirically exploring the above question, this study will effectively test global risk sharing *ex post* to see whether it is indeed the motivating factor for market integration. The null statement of the design is that there are no significant differences in market reaction for varying degrees of integration. According to the financial theory behind market integration (or liberalization), if market integration really does a good job in spreading the risks from the consequences of catastrophic events across investors in different markets as purported, markets that are more integrated should be affected more negatively than less integrated markets are. If this turned out to be the case, it would suggest that the target countries shared the risk effectively and were hit relatively less hard than if they had been less integrated with the global market. If

[1] See Jeffrey A. Frankel, Address to Conference on "Preventing Bank Crises: Lessons from Recent Global Bank Failures," sponsored by the Federal Reserve Bank of Chicago and the World Bank, Lake Bluff, Illinois, June 11, 1997.

more integrated global markets and less integrated markets were affected similarly, it would imply that global risk sharing does not deliver the intended benefits when countries decide to liberalize or de-segment. This can be evidence for other theoretical explanations for the motivation to integrate markets. For example, in the case of countries with poor investor rights, the bonding hypothesis could be a reasonable explanation for investments in foreign markets, but such discussions are outside the scope of this study.

The remainder of this paper is organized as follows: Section II reviews the literature on on catastrophic events and quantifying market integration. Section III describes the model that is employed to empirically test the question of motivation for market integration. Section IV describes the data used in this study. Section V summarizes key results. Section VI is a conclusion that reviews the limitations of the study and offers suggestions for possible future research directions.

II. LITERATURE SURVEY

Event study of effects of catastrophes on stock markets

When a catastrophic event occurs, the stock market is one of the first places that shows an immediate reaction, reflecting investors' fear about heightened risks affecting their investments. With technological advancements in the financial industry, concerns about cataclysmic events and their potential direct and indirect effects on a company's future may affect stock prices very quickly. The panic from events that occur in one country can have far-reaching effects in different countries in the globally integrated equity market.

Terrorist attacks that shake the stability and security of a company, an industry, a country, or a region can have almost immediate and potentially lasting effects not only on local markets

but also on global financial markets. Chen and Siems (2004) employed event study to assess the effects of 14 terrorist attacks on the U.S. market, as well as the effects of two events—Iraq's invasion of Kuwait in 1990 and the September 11, 2001, attacks—on global capital markets. They found evidence that terrorist attacks do have significant short-term impacts on global capital markets, with higher resilience and quicker recovery for markets with a stronger banking and finance sector. Karolyi and Martell (2010) also found significant negative stock price reaction to terrorist attacks, the effect of which was larger for wealthier and more democratic countries.

Only a few studies have looked exclusively at the impact of natural disasters on the stock market. Worthington and Valadkhani (2004) studied this via intervention analysis with autoregressive-moving-average (ARMA) models, finding evidence of major effects on market returns from bushfires, cyclones, and earthquakes, but little effect from severe storms and floods. Chesney, Reshetar, and Karaman (2011) tested three different methods—an event-study approach, a nonparametric methodology, and a filtered GARCH-EVT approach—to analyze the impact of different types of catastrophes such as terrorist attacks, financial crashes, and natural disasters on financial markets. They found immediate negative abnormal returns after terrorist attacks and financial crashes and delayed effects after natural disasters. Brounrn and Derwall (2010) also found more pronounced price declines for terrorist attacks than for earthquakes, but both with swift recoveries within a week.

Berkman, Jacobsen, and Lee (2011) concluded that the time-varying probability of rare disaster risks—such as the ones under our interest—are actually priced, filling in the theoretical gaps of the equity premium puzzle and the volatility puzzle. Moreover, Garmaise and Moskowitz (2009) have shown that imperfections in the insurance market may lead to restrictions of credit

supply to such catastrophe-prone properties. The resulting implications for different markets tied to certain target countries—those with continual likelihood of earthquakes, for example—would be of interest.

Measuring market integration

While no consensus has been reached, there are numerous implications and applications to explore in regard to market-integration measures. Because of this, many studies have attempted to come up with different methods to measure market integration.

Bekaert and Harvey (1995) defined market integration as assets with the same level of risk having identical expected returns in different markets. A completely nonintegrated market, or segmented market, can be represented by classical models such as the capital asset-pricing model (CAPM). A perfectly integrated market can be represented by various modified versions of the CAPM, often with exchange risk, such as the world CAPM (Harvey, 1991), the world arbitrage pricing theory (Solnik, 1983), and so on. The middle ground between the two would be a mild segmentation model (Errunza, Losq, & Padmanabhan, 1992; Patro, 2005).

One common approach is to simply use the correlation of local market returns with the world market returns as one proxy. Bekaert and Harvey (1995) pointed out that this is problematic because a country's market could actually be integrated with the rest of the world but still have low correlation due to the differences among industries in the mix. Measures based on the asset-pricing model that are constant over time also raise questions because they ignore the possibility of changes in market liberalization through policy and regulation amendments that can fundamentally alter the degree to which a local market is integrated with the world. Many studies have found evidence of time-varying prices of risk, which in turn implies time-varying market-integration measures (Bekaert & Harvey, 1995; Carrieri, Errunza, & Hogan, 2009; De

Santis, Gerard, & Hillion, 2003; Dumas & Solnik, 1995; Gerard, Thanyalakpark, & Batten, 2003; Harvey, 1991).

As alternatives, a range of studies have attempted to suggest a time-varying measurement of market integration. Bekaert and Harvey (1995) used a conditional regime-switching model to find some evidence of time-varying integration, capturing the points at which country-specific information set tips the econometric likelihood of regime switch from integration to segmentation. Korajczyk (1996) suggested measuring the deviations of asset returns with an equilibrium asset-pricing model that assumes complete integration. He argued that the law of one price should hold for completely integrated markets so any pricing error can be a proxy for market segmentation. Yeoh, Arsad, and Hooy (2010) applied the kalman filter (KF) technique to change a static single-factor international CAPM (ICAPM) model into a time-varying model, recursively computing a dynamic measure of pricing errors of market returns in Malaysia and Singapore. Most studies found that market integration tends to be lower for emerging markets than for developed markets, and the measure tends to increase over time. This is consistent with what we know about the general trend of global market integration.

News-based measures could also provide a possible alternative measurement of integration. A line of studies implemented simple-shock-spillover models to measure the ratio of domestic equity volatility in individual countries explained by global risk factors (Bekaert & Harvey, 1997; Ng, 2000; Fratzscher, 2001).

Adam, Jappelli, Menichini, Padula, and Pagano (2002) and Baele, Ferrando, Hordahl, Krylova, and Monnet (2004) provided a broad overview of various market integration measurement methods.

III. METHODOLOGY

Event study

Considering each country's stock market index as a single portfolio, a widely used method to identify the effect of an unexpected event on a market index is the event-study approach as pioneered by Brown and Warner (1985). Most of the literature above employed this standard event-study test to single out abnormal returns caused by unexpected cataclysmic events such as natural disasters or terrorist attacks, analyzing the statistical significance of differences in return abnormality around a designated event window.

In order to determine whether the capital market experienced significant abnormal returns in response to the cataclysmic events, Brown and Warner's (1985) mean-adjusted-returns approach was employed. The return in excess of mean return was calculated as

$$A_{j,t} = R_{j,t} - \overline{R_j} \,,$$

where $A_{j,t}$ is the abnormal return of stock index j (AR0), R_{jt} is the actual observed return on index j at time t, and $\bar{R}_j$ is a mean of returns calculated as

$$\overline{R_j} = \frac{1}{20} \sum_{t=-30}^{t=-11} R_{j,t} \,.$$

The estimation window is t = [–30, –11], the event date is t = 0. The estimation window is also done at t = [–50, –11] for robustness, which yields no qualitative differences.

The null hypothesis is that the excess return is zero. The test statistic is calculated as a ratio of the excess return on the event day to its estimated standard deviation:

$$\theta_0 = A_{j,t} \,/\, \hat{S}(A_{j,t}) \,,$$

where

$$\hat{S}(A_{j,t}) = \sqrt{\left(\sum_{t=-30}^{t=-11}(A_{j,t} - \bar{\bar{A}})^2\right)\Big/ 19}\,,$$

$$\bar{\bar{A}} = \frac{1}{20}\sum_{t=-30}^{-11} A_{j,t}\,.$$

For cases in which a catastrophe has persistent effects and thus the market needs more time to evaluate the full extent of detriments, it would be meaningful to look at the post-event period. In order to look at the effects on a longer window, cumulative average abnormal returns (CARs) over t = [0, 5] and t = [0, 10] are also analyzed. The $CAR_{j,1}$ and $CAR_{j,2}$ are respectively calculated as a simple summation of abnormal returns A_{jt} over the respective periods

$$CAR_{j,1} = \sum_{t=0}^{5} A_{j,t}\,, \qquad CAR_{j,2} = \sum_{t=0}^{10} A_{j,t}\,,$$

and the two multi-interval test statistics are

$$\theta_1 = CAR_{j,1} \,/\, \left(\sum_{t=0}^{5}\hat{S}^2(A_{j,t})\right)^{\frac{1}{2}},\ \ \theta_2 = CAR_{j,2} \,/\, \left(\sum_{t=0}^{10}\hat{S}^2(A_{j,t})\right)^{\frac{1}{2}},$$

where the terms in the denominator are from above. The null hypothesis is that each CAR is equal to zero. Following from Brown and Warner (1985), $A_{j,t}$ is assumed to be independent, identically distributed, and normal; the test statistic θ is therefore distributed Student-t under the null hypothesis.

Market integration

Taking the Sharpe-Lintner CAPM as the correct asset-pricing model, the financial markets are integrated if the single-factor ICAPM holds for each country *j*'s market index portfolio and the benchmark world portfolio is mean-variance efficient:

$$R_{j,t} - R_{F,t} = \alpha_j + \beta_j\left(R_{W,t} - R_{F,t}\right) + \varepsilon_{j,t} \,,$$

where $R_{j,t}$ is the monthly return of country j's market portfolio, $R_{F,t}$ is the international risk-free rate, $R_{W,t}$ is the monthly return of world portfolio, and $\varepsilon_{j,t}$ is the residual. Using monthly returns mitigates problems arising from irregular market holidays. The 3-month U.S. treasury bill rate was used as the international risk-free rate. To make a time-varying measure of market integration in the simplest sense, I used a 36-month rolling basis, hence t = –1, –2 . . . –36. The R-squared values of each country were used as a continuous measure of market integration, 0 being completely segmented and 1 being perfectly integrated.

Linear regression

In order to analyze the relationship between abnormal returns and market integration, the following linear regression model was used:

$$AR_{j,t} = b_0 + b_1 MI_{j,t} + b_n\{CONTROL_{j,t}\} + b_k\{EVENT_t\} + u_j \,,$$

where j represents each country, t represents each event, b_n represents the vector of coefficients for each control variable from alternative hypotheses, b_k represents the vector of dummy variables identifying each event, and u_j is the residual.

The abnormal returns of event t in market j, $AR_{j,t}$, were from the event study conducted above. The simple magnitude of abnormal returns (and CARs) varying in statistical significance could be problematic for use as a meaningful relative comparison of significant abnormal returns after each event. On the other hand, the θ-statistics correct for standard error, maintain the signs, and are continuous measures, so the θ-statistics were used as $AR_{j,t}$. The market integration index of market j at the time of event t, $MI_{j,t}$, is the R-squared values computed from the market integration computed above.

There may be alternative explanations to differential market abnormal returns from

cataclysmic events. These should be controlled for in the regression model to single out the effect of market integration on abnormal returns. Among potential factors are market size, market volatility, economic growth, and national credit risk. The size of the domestic economy may have an effect, with large and more complex economies being more vulnerable to various events. Likewise, markets that are more volatile in the period right before the event (ex ante the event) may be naturally more sensitive to unforeseen cataclysmic events. Markets in countries with faster economic growth, as measured by GDP growth, may be more sensitive to such events. And countries with a lower sovereign credit rating, which is closely correlated with sovereign yield spreads representing a country's capital risk, may be viewed as more vulnerable to the detriments of a catastrophic event. I acknowledge that limiting the potential alternative hypotheses to these four factors for simplicity's sake may leave some room for misinterpretation of causal effects. Future research should include other country attributes that may also affect abnormal returns to catastrophes.

IV. DATA

In order to examine how each event affected different markets, I used DataStream to obtain return data on different countries' major stock exchanges at and around the time of disasters between 1998 and 2011. Using the aggregate country-level index as a portfolio helped avoid some survivorship bias problems, as I did not include or exclude a firm based on whether there is data throughout the estimation, event, and post-event windows. Following previous event-study papers, I chose daily returns as the most appropriate interval, as the daily development in the news would most likely have had immediate effects either within the first day or in the next few trading days to reflect the market reaction to the catastrophic event.

DataStream provides the longest and the most comprehensive list of daily returns on various country indices of my interest.

For many developed and emerging markets, DataStream has several major stock exchanges, each index covering a different base of firms. In order to maintain consistency in index base selection, I chose to use Morgan Stanley Capital International (MSCI) country indices (50 markets, 23 developed and 27 emerging markets) over each country's major indices. A benefit to using MSCI country indices is the way DataStream calculates total returns. DataStream has a total return index (RI) and a price index (PI) for each index, where total RI includes reinvested dividends while PI does not. Although DataStream has a PI for every country's major stock exchange, it does not have a total RI for all of them. Every MSCI country index has a total RI, making it preferable to use for the sake of consistency over major stock exchange indices. The appendix has a list of the 50 countries used in this study, the time period of DataStream availability, the DataStream mnemonic, and the respective major stock exchanges, if any, for each country. The selection of the major stock exchange for countries with multiple exchanges was followed from Pukthuanthong and Roll (2009). The analysis done on the major stock exchange indices yielded the same results and hence was omitted.

For every local currency index (RI) in DataStream, I chose an alternative conversion to U.S. dollars (USD). Having all the indices in a common currency, USD, I could mitigate the exchange-rate noise. This follows a technique employed by virtually all previous studies of international finance.

In case of a national or market holiday, DataStream records the identical value as the previous day, which yields a zero return. Different countries have different national or market holidays, and different cataclysmic events could result in irregular market closures. For example,

after the September 11, 2001 terrorist attack, the U.S. market closed and reopened on September 17, while most other countries did not close. For each country, I shifted the estimation, event, and post-event windows forward and backward in time to fill in the missing (market closed) days, ensuring that each country for each event had a guaranteed 20-day estimation window (20 trading days of nonzero returns before 10 trading days of non-zero returns), the event day (or the most immediate open trading day), and a 10-day post-event window (10 trading days of nonzero returns following a nonzero-return event day). There was a concern that when a market was intentionally closed down after an event such as the September 11, 2011, attacks, the market's processing of the catastrophe's effects on the market would be cushioned, which could lead to asynchronous treatment of each event's CAR. However, it is also important to note that, at least in this specific case, any cushion created by the closed days was not enough to completely insulate the market from largest one-week drop in the history of Dow Jones Industrial Average. Moreover, because the focus of this study was to analyze how the market processes the effects of a cataclysmic event on the day of the event (or the immediate subsequent trading day), relative to each market's integration with the global market, the main objective of the exercise was preserved. Also, it would be more problematic to consider AR or CAR of a day that the market did not open, which would incorrectly yield a 0% AR or a CAR biased toward zero.

The time difference around the globe when the particular event happened also called for appropriate adjustments. For each country, I coded in the time zone differences (adjusted for daylight savings time, depending on the country and the time of the year) to adjust the time of the event occurrence to the local time for each market. Once time differences were adjusted for, I also coded in the stock market opening and closing hours. If an event happened after market closing hour, the event day is coded as the next trading day to reflect the abnormal return as

processed by the market on the first possible trading day post-event. In the case of a prolonged event with stories developing over a period of time, the event time point is determined subjectively to appropriately reflect the majority of the event's effects on the stock market. Similarly, if an event happened on a weekend, the first trading day after the weekend was coded as the event day. Such adjustments made it possible to mitigate the incorrect treatment and analysis of normal returns as abnormal returns.

Monthly market returns for calculating the market integration measure were obtained the same way as the daily returns. Unlike daily returns, monthly returns do not particularly suffer from time differences or zero returns from holidays, so these were not of any notable concern for the purposes of this study.

Each country's year-end gross domestic product in USD and GDP growth data were obtained from the World Economic Outlook Database as published by the International Monetary Fund (IMF) in September 2011. The IMF calculates year-on-year GDP percentage change at constant prices with country-specific base years.

The sovereign credit ratings were obtained from Bloomberg. The credit ratings from Moody's, Standard & Poor's, and Fitch were linearly transformed into a numerical scale from 1 to 21, then averaged to make a balanced measure of the long-term credit risk of each country at the time of each event. The linear transformation of a 21-point scale has been commonly used in previous studies that attempt to perform ordinary least square (OLS) analysis on numerical representation of credit ratings (Afonso, 2003; Afonso, Gomes, & Rother, 2007; Butler & Fauver, 2006). See the Appendix for the conversion table of bond ratings.

The monthly volatility of each market was calculated using the standard method from the standard deviation of daily returns.

Brief recounting of each cataclysmic event

In addition to the Great East Japan Earthquake of 2011, the following catastrophes were also selected to be analyzed in conjunction. These events were particularly significant because they affected the biggest markets in the world that tended to be more deeply integrated with the rest of the world, which would bring out the effects of interest in this study more clearly. Although the list of catastrophic events was subjectively selected, the general criteria for inclusion were the relative size and importance of the target country's market in the global economy; the unexpectedness or shock factor; and the magnitude of the economic, infrastructural, or political damage done regionally. Potential concern about selection bias from this particular list is acknowledged and addressed in the final section. Information related to each event is from LexisNexis.

September 11, 2011—New York City and Washington, D.C., area, United States. Early on a Tuesday morning, four American commercial jets were hijacked by a then-unknown group of terrorists. The hijacked airplanes were each subsequently flown into different targets—two crashing into the twin towers of the World Trade Center in New York City, one crashing into the Pentagon in Washington, D.C., and one crash-landing in Pennsylvania. This was the first-ever major attack on the mainland United States by a foreign power since the last century, resulting in 2,996 deaths and more than 6,000 injured. The global financial market reacted significantly to the news of the event, and the U.S. stock exchanges remained closed until September 17. This attack eventually provided the cause for heightened security and sensitivity to terrorism around the world and set off the so-called War on Terror.

March 11, 2004—Madrid, Spain. A series of near-simultaneous bombings on four trains departing from the Alcalá de Henares Station devastated thousands of Thursday-morning

commuters in Madrid. With 191 fatalities and 1,800 injured, this was the biggest and deadliest terrorist attack to have occurred on European soil. It occurred exactly two and a half years after the 9/11 attack and just three days prior to national elections. Many countries around the world responded with a surge of political condemnation and civil demonstrations.

December 26, 2004—Coast off Indonesia, Indian Ocean. When the massive fault line off the coast of the northern island of Sumatra ruptured, one of the strongest earthquakes in recorded history hit under the sea, causing deadly tsunami waves that struck all along the coast of southeast Asia and even Africa. It was easily the biggest natural disaster in recent years, not only killing 230,000 people but also destroying the lives of millions, affecting over 10 countries. Currencies of affected countries fell sharply as the large-scale infrastructural damage, with added complications of possible sanitation problems and resulting endemic diseases, posed serious uncertainties in the economic recovery process for the poorer countries. The ironic fact that these poor nations around Indian Ocean had only recently decided to forego an expensive collective early tsunami warning system made this a virtually unanticipated catastrophe.

July 7, 2005—London, United Kingdom. The next major terrorist attack occurred in London when four suicide bombers set off a series of coordinated explosions on three underground trains and a double-decker bus, killing 56 people and injuring approximately 700. Although Europe's second-largest economy was shaken by these fatal attacks, other markets exhibited limited reaction despite rising uncertainty about new violence and a weakened British pound, possibly due to prior experience with similar attacks in September 2001 and March 2004.

May 12, 2008—Sichuan, China. Amid a booming Chinese economy, a deadly earthquake that killed 69,195 people and left 18,392 missing was one of the costliest natural disasters in the history of modern China. Although limited to only one region in the heart of

mainland China, the economic aftereffects of this catastrophe and strong aftershocks were constantly under wary watch.

V. RESULTS

Table 1 summarizes the event-day abnormal returns and the 6-day cumulative abnormal returns corrected for standard error. Abnormal returns were more significant for terrorist attacks than for natural disasters, which is consistent with previous studies done on both types of catastrophes. The September 11, 2001, attack exhibited the most significantly negative impact on global stock markets.

Table 1: Abnormal returns on global capital markets

The event-day abnormal returns and the 6-day cumulative abnormal returns corrected for standard error reported. The 11-day cumulative abnormal returns do not show any qualitative difference and are omitted.

Global stock market	WTC attack 2001-09-11		Madrid bombing 2004-03-11		London bombing 2005-07-07		Indian Ocean earthquake 2004-12-26		Sichuan earthquake 2008-05-12		Great Kanto earthquake 2011-03-11	
	Event-day AR	6-day CAR	Event-day AR	6-day CAR	Event-day AR	6-day CAR	Event-day AR	6-day CAR	Event-day AR	6-day CAR	Event-day AR	6-day CAR
Australia	-4.74 ***	-4.51 ***	-1.19 ***	0.83	-0.22	0.34	0.65	0.42	-0.65	0.05	-0.89	-1.39 *
Austria	-0.06	-0.99	-0.84	-0.14	-0.56	-0.12	0.53	-0.69	0.07	1.66 *	-0.30	0.80
Belgium	-8.19 ***	-5.13 ***	-2.89 ***	-1.64 *	-1.30	2.07 **	1.00	-0.16	0.18	-0.36	-0.26	-0.80
Canada	-5.17 ***	-3.86 ***	-0.54 ***	-0.19	0.06	-0.11	0.78	0.72	0.60	0.79	-0.15	-0.57
Denmark	-1.05	-1.72 *	-1.55	-0.51	-1.23	0.47	0.87	0.00	0.39	2.37 **	-0.70	0.51
Finland	-0.98	2.33 **	-1.73	-1.70 *	-1.73 **	1.61 *	0.09	-0.37	0.22	0.90	-0.61	0.64
France	-6.04 ***	-2.72 ***	-2.64 ***	-1.24	-1.45 *	1.75 **	0.59	0.08	0.68	1.29	-0.59	-0.46
Germany	-7.04 ***	-2.52 **	-2.53 ***	-1.01	-2.12 **	1.55 *	0.11	-0.28	0.77	1.18	-0.96	-1.32
Greece	0.64	-3.32 ***	-1.59	-0.40	-1.02	0.47	1.45 *	0.57	0.06	0.56	1.18	1.08
Hong Kong	-7.54 ***	-3.75 ***	-1.39 ***	-0.72	-1.57 *	1.56 *	0.51	-0.54	-0.25	0.05	-0.94	-1.23
Ireland	-0.90	-3.36 ***	-0.96	0.62	-0.97	0.97	0.55	-0.08	0.63	0.09	-0.31	0.42
Italy	-7.29 ***	-5.95 ***	-1.97 ***	-1.64 *	-2.28 **	2.04 **	0.43	-0.90	0.17	0.55	-0.42	-0.37
Japan	-4.61 ***	-0.56	-1.23 ***	2.64 ***	-0.84	-0.06	0.49	0.92	0.12	0.41	-0.33	-4.21 ***
Netherlands	-6.93 ***	-3.82 ***	-2.63 ***	-1.54 *	-2.17 **	0.40	0.56	-0.07	0.35	0.49	-0.91	-0.86
New Zealand	-8.40 ***	-6.89 ***	0.34 ***	0.50	-0.30	0.34	0.15	0.29	-0.08	-0.11	-1.18	-0.77
Norway	4.27 ***	-2.33 **	-0.99 ***	-0.47	-2.52 **	-0.28	0.60	-0.41	0.24	1.00	-0.53	-0.11
Portugal	-4.99 ***	-2.71 ***	-1.97 ***	-0.98	-0.59	1.10	0.98	-0.26	-0.69	-1.09	-0.13	0.30
Singapore	-6.38 ***	-8.06 ***	-1.23 ***	-0.32	-2.44 **	0.35	-0.31	0.61	0.23	0.08	-0.67	-1.15
Spain	-2.62 ***	-2.25 **	-1.57 ***	-1.51 *	-2.35 **	1.66 *	0.34	-0.64	0.94	0.70	0.00	0.57
Sweden	-4.71 ***	-1.94 **	-2.20 ***	-1.15	-2.08 **	1.86 **	0.45	-0.08	0.54	0.49	-1.07	0.30
Switzerland	-5.66 ***	-0.81	-2.73 ***	-1.05	-0.58	2.11 **	0.58	0.47	-0.21	0.94	-0.46	-1.31
United Kingdom	-5.39 ***	-1.55 *	-2.97 ***	-1.09	-4.70 ***	-0.05	0.45	-0.75	0.58	0.30	-0.55	-0.60
United States	-5.42 ***	-3.32 ***	-2.24 ***	-0.04	0.40	2.04 **	-0.83	-0.86	0.64	0.31	0.82	-0.69

*Statistically significant at the 0.10 level.
**Statistically significant at the 0.05 level.
***Statistically significant at the 0.01 level.

(Continued) Global stock market	WTC attack 2001-09-11		Madrid bombing 2004-03-11		London bombing 2005-07-07		Indian Ocean earthquake 2004-12-26		Sichuan earthquake 2008-05-12		Great Kanto earthquake 2011-03-11	
	Event-day AR	6-day CAR	Event-day AR	6-day CAR	Event-day AR	6-day CAR	Event-day AR	6-day CAR	Event-day AR	6-day CAR	Event-day AR	6-day CAR
Argentina	-1.50 *	-1.53 *	-0.54 *	-0.07	1.06	0.80	-0.36	-0.05	1.78 **	2.41 **	0.30	0.46
Brazil	-5.63 ***	-1.62 *	-1.33 ***	0.65	-0.49	0.54	-0.10	-0.11	1.15	1.58 *	0.64	0.20
Chile	-7.77 ***	-4.80 ***	-0.24 ***	-1.63 *	-1.21	0.27	-0.24	-0.55	-0.06	1.30	0.04	0.60
China	-2.86 ***	0.98	-1.83 ***	-0.85	-1.62 *	-0.17	0.01	-0.65	-0.29	0.07	-1.05	-0.98
Colombia	-4.30 ***	-4.57 ***	-0.18 ***	-0.30	0.30	-0.11	1.83 **	1.64 *	-0.81	-1.58 *	0.19	2.18 **
Czech Republic	-1.10	-1.81 **	-1.57	-0.85	-0.64	0.49	0.18	0.38	1.13	4.36 ***	1.23	1.48 *
Egypt	-1.90 **	-1.31	0.28 **	-0.32	-1.60 *	-1.46 *	0.04	2.93 ***	-3.76 ***	-3.16 ***	0.25	0.78
Hungary	-4.43 ***	-1.15	-1.75 ***	0.23	-1.31	-0.09	1.91 **	1.23	0.84	0.52	0.89	0.93
India	-5.26 ***	-7.72 ***	-1.15 ***	-1.31	-3.42 ***	-2.38 **	-0.20	0.71	-0.43	-0.07	-0.60	-0.29
Indonesia	-1.42 *	-1.74 **	-1.67 *	-0.43	-1.78 **	-0.46	0.58	0.31	0.19	1.29	-1.14	-1.10
Israel	-2.72 ***	-1.89 **	-2.29 ***	-0.62	-1.44 *	1.47 *	0.35	-0.47	-0.29	0.67	n/a	n/a
Jordan	-0.56	-1.86 **	-0.83	-0.43	-0.53	-3.21 ***	0.59	1.52 *	0.00	-1.57 *	0.54	1.42 *
Korea	-6.74 ***	-2.79 ***	-2.52 ***	1.15	-0.88	1.64 *	0.13	1.07	-0.60	-0.57	-0.87	0.40
Malaysia	-3.86 ***	-4.45 ***	0.10 ***	0.38	0.58	0.74	-0.24	-0.53	-0.11	-1.14	-1.25	0.10
Mexico	-5.37 ***	-2.98 ***	-1.88 ***	-0.49	-0.29	0.73	0.15	0.08	-0.01	1.06	0.71	-0.22
Morocco	-1.11	-1.25	0.33	-0.42	-0.14	1.56 *	0.19	-0.74	1.31	0.69	0.01	0.40
Pakistan	-4.55 ***	-4.78 ***	0.29 ***	0.36	0.04	-0.61	0.03	-0.29	-0.29	-3.01 ***	0.05	-0.77
Peru	-1.03	0.68	0.99	0.84	1.51 *	0.31	0.11	-0.07	-0.30	-0.03	1.71 *	0.61
Philippines	-2.78 ***	-1.94 **	-0.81 ***	0.54	0.85	0.54	-0.01	0.82	1.77 **	1.46 *	0.49	0.00
Poland	-1.82 **	-1.50 *	-1.26 **	-0.59	-1.96 **	-0.36	1.25	0.42	1.41 *	0.61	-0.18	0.97
Russia	-0.62	-2.29 **	-1.35	0.93	-0.91	0.61	1.18	1.53 *	0.58	2.12 **	-0.44	0.64
South Africa	-2.91 ***	-3.70 ***	-1.62 ***	-0.31	-0.43	2.14 **	0.33	0.25	0.45	0.56	1.10	-0.43
Sri Lanka	0.11	-0.91	-0.30	-0.28	0.91	-0.07	-0.26	-3.77 ***	-0.30	-1.81 **	-1.15	-2.00 **
Taiwan	0.31	-3.64 ***	-2.40	-0.75	-0.93	1.10	-0.27	0.81	1.67 *	0.96	0.14	0.28
Thailand	-0.04	-3.35 ***	-0.34	-0.42	0.07	1.00	-1.06	-0.42	-1.66 *	0.72	-1.14	-0.51
Turkey	-2.71 ***	-3.44 ***	-0.95 ***	-0.44	-1.00	0.10	0.68	0.65	-0.32	0.16	0.40	0.52
Venezuela	2.31 **	-1.32	-0.22 **	0.42	0.51	1.22	0.65	0.79	n/a	n/a	n/a	n/a

*Statistically significant at the 0.10 level.
**Statistically significant at the 0.05 level.
***Statistically significant at the 0.01 level.

Figure 1 shows the time series of the measure of market integration for developed countries and emerging markets. From 1995 to 2012, there is a clear upward trend, with a sudden

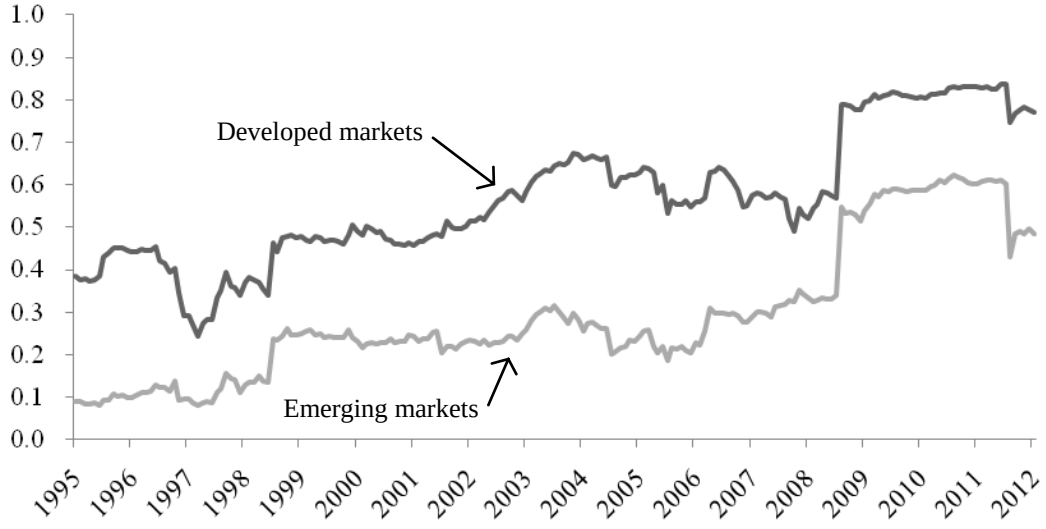

Figure 1: World market integration, 1995–2012
Time series of average of R-squared values for 23 developed markets and 27 emerging markets.

noticeable jump around October 2008, when the global financial crisis overtook the global markets. This increasing trend of global market integration is consistent with previous studies (Bekaert et al., 2011; Pukthuanthong & Roll, 2009).

Table 2 shows the correlations among the variables in the model. Market integration as proxied by the R-squared values from the single-factor ICAPM model is negatively correlated with stock market volatility and one-year lagged GDP growth and positively correlated with GDP and sovereign bond rating.

Table 2: Pearson correlation matrix

Pearson Correlation Coefficients, N = 297
Prob > |r| under H0: Rho=0

	R2	Vol	GDPg	GDP	Sov
R2	1.0000	-0.1022	-0.3024	0.6412	0.6470
		0.0788	<.0001	<.0001	<.0001
Vol	-0.1022	1.0000	0.1391	-0.1143	-0.5270
	0.0788		0.0165	0.0491	<.0001
GDPg	-0.3024	0.1391	1.0000	-0.1440	-0.3247
	<.0001	0.0165		0.0130	<.0001
GDP	0.6412	-0.1143	-0.1440	1.0000	0.4482
	<.0001	0.0491	0.0130		<.0001
Sov	0.6470	-0.5270	-0.3247	0.4482	1.0000
	<.0001	<.0001	<.0001	<.0001	

The regression results for the event-day abnormal returns are shown in Table 3. The coefficient for the market integration measure is consistently negative and significant. When sovereign bond rating is added to the model, however, the significance drops out completely, along with all the other control variables except for GDP. In the context of my model, this can be interpreted as follows: markets more integrated with the global market experience more negative abnormal returns on the day of a cataclysmic event. In other words, the sudden spike of uncertainty risk that should drive down market returns even further is distributed across different countries around the world—thus, global risk sharing is in effect.

Table 3: Regression results on event-day abnormal returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MI	-1.4661 ***	-0.9072 **	-1.3130 ***	-1.6354 ***	-0.8477 *	-0.8905 *	-0.4532
	(0.3357)	(0.4372)	(0.3530)	(0.3563)	(0.4679)	(0.4726)	(0.5554)
GDP		-0.1619 **				-0.1632 **	-0.1579 *
		(0.0817)				(0.0817)	(0.0816)
Vol			4.3604			5.1686	2.0428
			(3.1551)			(3.1493)	(3.7781)
GDPg				-4.2857		-4.2843	-4.9222
				(3.0640)		(3.0588)	(3.0822)
Sov					-0.0432 *		-0.0412
					(0.0229)		(0.0277)
Intercept	-0.3467	0.3445	-0.7094 **	-0.0560	0.0751	0.2108	0.8943
	(0.2410)	(0.4234)	(0.3561)	(0.3180)	(0.3279)	(0.5108)	(0.6856)
N	297	297	297	297	297	297	297
Adj.-R2	0.4645	0.4699	0.4662	0.4663	0.4692	0.4741	0.4763

Standard errors are in parentheses.
*Statistically significant at the 0.10 level.
**Statistically significant at the 0.05 level.
***Statistically significant at the 0.01 level.

The coefficient for the size of the economy as measured by GDP is negative and significant in all models, as hypothesized. Economic growth as measured by one-year lagged GDP growth is also negative as hypothesized, but not significant. The coefficients for market volatility and sovereign bond rating are both not significant.

The event dummy variables are not shown but were generally highly significant. The effects arising from the widely different nature, magnitude, conditions, and type of each individual event are captured by these dummies, which mitigate event-specific variances influencing the effects of market integration and other alternative hypothesis variables.

The R-square of each model shows that the model exhibits an explanatory power of around 50%. All the models are significant at 0.0001 levels as measured by F-tests.

For multiday cumulative abnormal returns, as shown in Table 4, any significance of market integration falls out, suggesting that there is no evidence that market integration has any effect on longer windows beyond the event day.

Table 4: Regression results on 6-day and 11-day CARs

Panel A: 6-day CAR

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MI	0.1465	0.1130	0.2520	-0.0595	0.4660	0.2354	-0.4532
	(0.3047)	(0.3995)	(0.3209)	(0.3226)	(0.4265)	(0.4314)	(0.5082)
GDP		0.00971				0.01384	0.01669
		(0.0747)				(0.0746)	(0.0747)
Vol			3.00529			3.45048	1.77645
			(2.8680)			(2.8745)	(3.4572)
GDPg				-5.21735 *		-5.53689 **	-5.87853 **
				(2.7738)		(2.7919)	(2.8204)
Sov					-0.02229		-0.02207
					(0.0208)		(0.0253)
Intercept	0.50884 **	0.46737	0.25887	0.86281 ***	0.72676 **	0.53837	0.90438
	(0.2188)	(0.3869)	(0.3237)	(0.2879)	(0.2989)	(0.4662)	(0.6273)
N	297	297	297	297	297	297	297
Adj.-R2	0.4274	0.4254	0.4276	0.4323	0.4277	0.4314	0.4309

Panel B: 11-day CAR

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MI	-0.2665	-0.2433	-0.1679	-0.4106	-0.0004	-0.2918	-0.1276
	(0.3343)	(0.4383)	(0.3522)	(0.3552)	(0.4683)	(0.4754)	(0.5606)
GDP		-0.0067				-0.0051	-0.0031
		(0.0819)				(0.0822)	(0.0824)
Vol			2.8063			3.1591	1.9859
			(3.1481)			(3.1679)	(3.8130)
GDPg				-3.6497		-3.8958	-4.1353
				(3.0541)		(3.0769)	(3.1107)
Sov					-0.0186		-0.0155
					(0.0229)		(0.0279)
Intercept	0.6833 ***	0.7120 *	0.4499	0.9310 ***	0.8648 ***	0.7067	0.9632
	(0.2400)	(0.4245)	(0.3553)	(0.3170)	(0.3281)	(0.5138)	(0.6919)
N	297	297	297	297	297	297	297
Adj.-R2	0.3981	0.3961	0.3977	0.3990	0.3974	0.3969	0.3955

Standard errors are in parentheses.
*Statistically significant at the 0.10 level.
**Statistically significant at the 0.05 level.
***Statistically significant at the 0.01 level.

The R-square of each model is lower in Table 4, which shows a decrease in explanatory power of the model for longer window cumulative abnormal returns as compared to that of the event-day abnormal returns.

VI. CONCLUSION

There is evidence for market integration's global risk sharing effect on abnormal returns from cataclysmic events, specifically in regard to natural disasters and terrorist attacks. There is, however, no evidence of risk-diffusing effects beyond the event day, even for relatively short post-event windows of 6 and 11 days. This seems to suggest that market integration as motivated by global risk sharing is only effective to disperse the initial shock of a cataclysmic event. This study was inconclusive in explaining any differential effects of market integration for events that either last for multiple days or develop post-event complications.

This study's aim was not only to give a snapshot of the integration conditions of the current global capital market but also to add to the understanding of the global risk sharing hypothesis. It was designed to be modified and replicated to examine a more extensive range of largely exogenous disasters, be they natural, political, or war-related. Every catastrophic event has a wide range of situational factors that may complicate analyses such as the ones conducted in this study. The potential concern about the selection criteria of catastrophic events for this study is acknowledged and should be tried and tested in future studies.

Possible future extensions

If access to data permits, the model-free, point-in-time measurement of market segmentation (integration) developed by Bekaert et al. (2011) would provide a great alternative measurement of market integration to the one used in this study. Moreover, while limited by the scope and availability of industry-level data for every country in this study, an added component of industry-level could greatly expand this study. Since each industry trades differently and may be integrated differently, an analysis of industry composition and structure within each domestic stock market could also prove to be revealing.

Future studies can test whether these effects are differentially persistent depending on market integration. Similar to Chen and Siems's (2004) work, the number of days that it took each stock market to rebound to normal could be used for this purpose. Similarly, looking at how different countries of differing global market integration react as the story of a cataclysmic event unfolds would also be interesting. Examining how news developments over time in different countries—optimistic versus pessimistic—affect the respective markets' reactions would provide a time-varying differential effect for markets with varying degrees of integration. Do closely integrated countries react optimistically to protect share values—reacting more positively to positive news, and less negatively to negative news? Or are they more skeptical so as to accurately price risk as quickly as possible—reacting more negatively to negative news and less positively to positive news? What about the reactions for less integrated countries?

Furthermore, on a slight tangent, another really interesting question to address would be price-discovery effect. Maloney and Mulherin (2003) documented the Challenger crash accident in 1986, when the domestic market essentially "discovered" the manufacturing firm at fault for the shuttle's explosion, before any official statement was even made. They claimed this as evidence for an efficient market. Here, a similar idea expanded over today's global market reaction to the current disaster could be tested. For instance, there could be an information asymmetry problem arising from the weak governance of the Tokyo Electric Power Company—the main culprit under question suspected of overlooking prior signs and warnings from the reactors' architects. Despite ineffective attempts by Tokyo Electric Power Company to cover up what was blatantly obvious to the rest of the world, examining how different stock markets around the world reacted could give evidence of a "price discovery" effect in an "efficient" global market. Similarly, in a perfectly efficient global market, given perfect transfer of such

intelligence, the global stock markets could provide hints about terrorist attacks from initially unknown sources of origin.

APPENDIX

S&P, Moody's, and Fitch rating systems and linear transformations

Characterization of debt and issuer (source: Moody's)		Rating			Linear transformations	
		S&P	Moody's	Fitch	Scale 21	Scale 17
Highest quality	Investment grade	AAA	Aaa	AAA	21	17
High quality		AA+	Aa1	AA+	20	16
		AA	Aa2	AA	19	15
		AA-	Aa3	AA-	18	14
Strong payment capacity		A+	A1	A+	17	13
		A	A2	A	16	12
		A-	A3	A-	15	11
Adequate payment capacity		BBB+	Baa1	BBB+	14	10
		BBB	Baa2	BBB	13	9
		BBB-	Baa3	BBB-	12	8
Likely to fulfil obligations, ongoing uncertainty	Speculative grade	BB+	Ba1	BB+	11	7
		BB	Ba2	BB	10	6
		BB-	Ba3	BB-	9	5
High credit risk		B+	B1	B+	8	4
		B	B2	B	7	3
		B-	B3	B-	6	2
Very high credit risk		CCC+	Caa1	CCC+	5	1
		CCC	Caa2	CCC	4	
		CCC-	Caa3	CCC-	3	
Near default with possibility of recovery		CC	Ca	CC	2	
				C		
Default		SD	C	DDD	1	
		D		DD		
				D		

REFERENCES

Adam, K., Jappelli, T., Menichini, A., Padula, M. & Pagano, M. (2002). Analyse, compare, and apply alternative indicators and monitoring methodologies to measure the evolution of capital market integration in the European Union. Report commissioned by the European Commission.

Afonso, A. (2003). Understanding the determinants of sovereign debt ratings: evidence for the two leading agencies. *Journal of Economics and Finance*, 27(1), p56-74.

Afonso, A., Gomes, P. & Rother, P. (2007). What 'hides' behind sovereign debt ratings? European Central Bank Working Paper Series, 711.

Auzairy, N. & Ahmad, R. (2009). The impact of subsequent stock market liberalization on the integration of stock markets in ASEAN-4 + South Korea. *World Academy of Science, Engineering and Technology*, 58, p348-359.

Ayuso, J. & Blanco, R. (2001). Has financial market integration increased during the nineties? *Journal of International Financial Markets Institutions and Money*, 11, p265-287.

Baele, L., Ferrando, A., Hordahl, P., Krylova, E. & Monnet, C. (2004). Measuring financial integration in the Euro area. European Central Bank Occasional Paper, 14.

Bekaert, G. & Harvey, C. (1995). Time-varying world market integration. *Journal of Finance*, 50(2), p403-444.

Bekaert, G. & Harvey, C. (1997). Emerging equity market volatility. *Journal of Financial Economics*, 43, p29-77.

Bekaert, G. & Harvey, C. (2003). Emerging markets finance. *Journal of Empirical Finance*, 10, p3-55.

Bekaert, G., Harvey, C., Lundblad, C. & Siegel, S. (2007). Global growth opportunities and market integration. *Journal of Finance*, 62(3), p1081-1137.

Bekaert, G., Harvey, C., Lundblad, C. & Siegel, S. (2011). What segments equity markets? *Review of Financial Studies*, 24(12), p3841-3890.

Berkman, H., Jacobsen, B. & Lee, J. (2011). Time-varying rare disaster risk and stock returns. *Journal of Financial Economics*, 101(2), p313-332.

Brounrn, D. & Derwall, J. (2010). The impact of terrorist attacks on international stock markets. *European Financial Management*, 16(4), p585-598.

Brown, S. & Warner, J. (1985). Using daily stock returns: the case of event studies. *Journal of Financial Economics*, 14, p3-31.

Bruner, R., Li, W., Kritzman, M., Myrgren, S. & Page, S. (2008). Market integration in developed and emerging markets: evidence from the CAPM. *Emerging Markets Review*, 9(2), p89-103.

Butler, A. & Fauver. L. (2006). Institutional environment and sovereign credit ratings. *Financial Management*, 35(3), p53-79.

Carrieri, F., Errunza, V. & Hogan, K. (2009). Characterizing world market integration through time. *Journal of Financial and Quantitative Analysis*, 42, p915-940.

Chen, A. & Siems, T. (2004). The effects of terrorism on global capital markets. *European Journal of Political Economy*, 20, p349-366.

Chesney, M., Reshetar, G. & Karaman, M. (2011). The impact of terrorism on financial markets: an empirical study. *Journal of Banking & Finance*, 35(2), p253-267.

Corrado, C. (1989). A non parametric test for abnormal security price performance in event studies. *Journal of Financial Economics*, 23, p385-395.

De Santis, G., Gerard, B. & Hillion, P. (2003). The relevance of currency risk in the EMU. *Journal of Economics and Business*, 55, p427-462.

Dumas, B. & Solnik, B. (1995). The world price of exchange rate risk. *Journal of Finance*, 50, p445-479.

Eldor, R. & Melnick, R. (2004). Financial markets and terrorism. *European Journal of Political Economy*, 20, p367-386.

Errunza, V., Losq, E. & Padmanabhan, P. (1992). Tests of integration, mild segmentation and segmentation hypotheses. *Journal of Banking Finance*, 16, p949-972.

Fratzscher, M. (2002). Financial market integration in Europe: on the effects of EMU on stock markets. *International Journal of Finance and Economics*, 7, p165-193.

Frijns, B., Tourani-Rad, A. & Indriawan, I. (2012). Political crises and the stock market integration of emerging markets. *Journal of Banking & Finance*, 36(3), p644-653.

Garmaise, M. & Moskowitz, T. (2009). Catastrophic risk and credit markets. *Journal of Finance*, 64(2), p657-707.

Gerard, B., Thanyalakpark, K. & Batten, J. (2003). Are the East Asian markets integrated? Evidence from the ICAPM. *Journal of Economics and Business*, 55, p585-607.

Gultekin, M., Gultekin, B. & Penati, A. (1989). Capital controls and international capital market segmentation: the evidence from the Japanese and American stock markets. *Journal of Finance*, 44(4), p849-869.

Harvey, C. (1991). The world price of covariance risk. *Journal of Finance*, 46(1), p111-157.

Karolyi, G. (2006). Shock markets: What do we know about terrorism and the financial markets? *Canadian Investment Review*, 19(2), p9-15.

Karolyi, A. & Martell, R. (2010). Terrorism and the stock market. *International Review of Applied Finance Issues and Economics*, 2(2), p285-314.

Korajczyk, R. (1996). A measure of stock market integration for developed and emerging markets. *World Bank Economic Review*, 10(2), p267-289.

Levine, R. & Zervos, S. (1998). Stock markets, banks, and economic growth. *American Economic Review*, 88, p537-558.

Makinen, G. (2002). The economic effects of 9/11: a retrospective assessment. Congressional Research Service. Library of Congress.

Maloney, M. & Mulherin, H. (2003). The complexity of price discovery in an efficient market: the stock market reaction to the Challenger crash. *Journal of Corporate Finance*, 9, p453-479.

McWilliams, A. & Siegel, D. (1997). Event studies in management research: theoretical and empirical issues. *Academy of Management Journal*, 40(3), p626-657.

Ng, A. (2000). Volatility spillover effects from Japan and the U.S. to the Pacific-Basin. *Journal of International Money and Finance*, 19, p207-233.

Patro, D. (2005). Stock market liberalization and emerging market country fund premiums. *Journal of Business*, 78(1), p135-168.

Pukthuanthong, K. & Roll, R. (2009). Global market integration: an alternative measure and its application. *Journal of Financial Economics*, 94(2), p214-232.

Ragunathan, V. (1999). Financial deregulation and integration: an Australian perspective. *Journal of Economics & Business*, 51(6), p505-514.

Solnik, B. (1983). International arbitrage pricing theory. *Journal of Finance*, 38, p449-457.

Van Wincoop, E. (1999). How big are potential welfare gains from international risk sharing? *Journal of International Economics*, 47, p109-235.

Worthington, A. & Valadkhani, A. (2004). Measuring the impact of natural disasters on capital markets: an empirical application using intervention analysis. *Applied Economics*, 36(19), p2177-2186.

Yeoh, B., Arsad, Z., & Hooy, C. (2010). Stock market integration measurement: investigation of Malaysia and Singapore stock markets. *World Academy of Science, Engineering and Technology*, 66, p1585-1590.