Financial Firm Bankruptcies, International Stock Markets and Investor Sentiment

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Abstract

We consider bankruptcy announcements of large financial institutions in the US and examine their impact on an international sample of 66 stock market indices. Employing an event-study methodology, we find that stock markets exhibit strong adverse reaction in the aftermath of such announcements. Further, we develop a Surprise measure, based on the country-level investor sentiment, and find that stock markets in negatively surprised countries respond quickly, by sustaining significantly larger declines in the first three trading days following the announcements. Finally, we examine the reaction of stock markets, conditional on the economic classification of their home countries, and find that stock markets in developing (developed) economies are associated with substantially larger (smaller) economic losses.

JEL classification: G14, G15, G33

Keywords: bankruptcy announcements, financial firms, international stock markets, investor sentiment, economic classification

1. Introduction

It is widely accepted that large financial firm bankruptcies generate high uncertainty among investors and affect the wider economy (Aharony and Swary, 1983). The most pronounced recent example is the collapse of the Lehman Brothers Investment Bank, ten years ago. With an aggregate value of assets exceeding 600 billion USD at the time of the announcement, the Lehman Brothers bankruptcy was the largest in history and is associated with the onset of the Global Financial Crisis in 2008. That set aside, there are also other adverse effects related to financial firm bankruptcies such as contagion effects in the stock prices of competitors (Gay et al., 1991; Aharony and Swary, 1996; Yamori, 1999; Helwege and Zhang, 2016) and the stock prices of firms with exposure in the failing financial institutions (Chakrabarty and Zhang, 2012; Fernando et al., 2012). Overall, there is evidence to support the view that stock prices of corporations related to financial firms filing for bankruptcy decline following the announcement.

This paper explores an area of research which, to the best of our knowledge, is novel. In particular, we look to identify an "international" contagion effect, following bankruptcy announcements of large financial institutions in the US. There are several reasons to expect a negative reaction of the international stock markets after such announcements. First, the US is one of the strongest, most resilient and probably the most influential country in the world and thus plays an important role in affecting global stock markets (Bathia et al., 2016). Second, bankruptcies, and particularly those where the involved entity is a large financial institution, are events which can increase the systemic risk in the entire economy of a nation, group of countries, and the world. Hence, large shocks stemming from strong economies (such as the US) are a signal of an upcoming negative economic outlook. When this happens, investors engage in risk management (i.e. sell equity to buy safer securities), generating a negative reaction in stock market

prices. Thus, there is an "information contagion effect", where the disseminating of "bad" information leads investors to revise their future expectations downwards (Giesecke, 2004; Collin-Dufresne et al., 2010).[1] Finally, prior literature has documented that "shocks" generated from the US affect international markets. For instance, Tandon and Urich (1987) show that macroeconomic announcements from the US, related to money supply and inflation, affect the Eurocurrency interest rates, foreign exchange rates, and gold prices. Similar evidence has also been found by Cornell (1982) among others. In addition, Jones and Olson (2015) find that US uncertainty shocks induce significant declines in foreign exports and interest rates, and cause foreign currencies to appreciate relative to the dollar. Moreover, Becker et al. (1995) find that UK equities respond within half an hour following US macroeconomic releases, suggesting that investors react to public information originating from the United States.

The key contribution of this paper is that we investigate the post-US bankruptcy announcement reaction in an international sample of stock market indices. Our empirical evidence suggests that, following the announcements, stock markets exhibit strong negative reaction without signs of reversal for at least 10 trading days post-announcement.

Our second contribution is the consideration of the country-level investor sentiment to account for possible variations in the effects that bankruptcy announcements can impose on the feelings and mood of investors. In particular, we investigate the extent of stock markets' reactions, with respect to the fluctuations in investor sentiment, generated by bankruptcy announcements from

[1] Another mechanism through which a financial bankruptcy may cause stock prices to fall is the "counterparty risk effect". In this case, the bankruptcy of the financial institution causes distress to those firms linked with the failing institution (Davis and Lo, 2001). However, this is most likely to affect the stock index of the local market than the stock indices around the globe. Ultimately, we argue that the results of our paper are explained by the "information contagion effect".

large financial firms in the US. [2] We posit that international stock markets do not respond similarly in the aftermath of US bankruptcy announcements but, rather, the degree of reaction depends on how international investors perceive/evaluate the bankruptcy announcements or, equivalently, how investor sentiment changes after the announcements. We expect, for example, that economies maintaining strong trading and economic bonds with the US or economies with increased sensitivity to external shocks will exhibit larger declines in investor sentiment, following large financial firm bankruptcy announcements from the US.[3] Subsequently, we expect the stock markets in economies with large negative changes in the investor sentiment to exhibit a greater negative reaction to bankruptcy announcements. Thus, we seek to more accurately capture stock market reaction by taking investor sentiment into consideration. To this end, we employ the Marketpsych Indices from Thomson Reuters which measure the country-level investor sentiment and develop a measure for the post-announcement change in investor sentiment. Our findings suggest that stock markets in countries with higher decline in the post-announcement investor sentiment (i.e. countries exhibiting a Negative Surprise) respond quickly to the announcements and sustain significantly larger economic losses, in the first three trading days after the event.

Finally, we examine the effect of large US financial firm bankruptcy announcements on stock markets of developed and developing economies. Prior literature finds that developing markets are more vulnerable to external shocks. For instance, Soydemir (2000) finds that shocks generated in the US do affect emerging stock markets, and the effect lasts longer relative to the effect of such

[2] This is based on the argument that sentiment affects stock prices (see Baker and Wurgler, 2006; Tetlock, 2007; Schmeling, 2009 and Bathia et al., 2016, among others).

[3] By investigating this issue a little bit further, we find that the countries which experience a drop in the sentiment most of the times, are those where US is a major export partner. For instance, Colombia sends about 1/3 of its exports to US and thus, shocks generated from US possibly affects investor sentiment in Colombia negatively. However, there would possibly be other explanations which is beyond the scope of the present paper. It would be interesting for future research to shed light on the reasons why several countries experience a drop in the sentiment.

shocks in developed stock markets. Furthermore, Coudert et al. (2015) find that financial shocks generated in developed economies can affect stock markets in emerging economies. Consistent with prior studies, we find that stock markets in developing countries exhibit more negative reactions relative to the case of developed countries.

The remainder of the paper is organized as follows. In section 2, we describe the data, in section 3, we present the methodology. We discuss the results in section 4 and conclude in section 5.

2. Data

2.1. Sample of Bankruptcies

We collect bankruptcy announcements from BankruptcyData, a comprehensive database containing corporate bankruptcy and distressed company information in the US dating back to the 1970s. The database, among others, reports a list with the 20 largest financial bankruptcies in the US, with aggregate assets above US$15 billion. We increase our sample by choosing bankruptcy announcements of financial institutions with aggregate assets exceeding US$10 billion at the time of the announcement. We search for financial bankruptcies that occurred up to April 2016 when our sample of TRMI (Sentiment) data ends. Overall, our sample comprises 27 bankruptcy announcements by US financial institutions over the period 1988-2012. Additional details are provided in Table 1.

[INSERT TABLE 1 HERE]

2.2. Equity Data

We collect equity data of local stock market indices from Thomson DataStream. In total, we use 67 equity return indices that belong to the DataStream World Stock Market Index “TOTMKWD”, of which 66 are local (country-level) indices and the last is the world market index. Note that we

report all indices in US dollars to eliminate noise that may come from foreign exchange rates (Pukthuanthong and Roll, 2009). The list of the 66 countries with equity data is provided in Table 2 and includes additional information, such as the economic classification of countries as developing or developed.[4]

[INSERT TABLE 2 HERE]

2.3. Thomson Reuters Sentiment Index and Surprise

For the purpose of this study, we consider the Thomson Reuters Marketpsych family of Indices (henceforth TRMI), available since the 1st of January 1998. The TRMI translate the volume, tone and specific word choices of articles, news stories and social media posts into practicable information which, among other uses, can measure the overall sentiment, optimism, joy, trust and fear with respect to companies, asset classes, and countries. In particular, the TRMI cover 12,000+ companies operating in more than 75 countries, 36 commodities and energy subjects, 45 currencies and 187 countries, among others. These indices are compiled based on proprietary algorithms developed by Thomson Reuters in collaboration with Marketpsych LLC and are available on a real-time basis and over a 24-hour rolling window.[5]

We adopt the TRMI because they come with several advantages. First, we argue that TRMI are more efficient in measuring the 'real' sentiment across the countries compared to other textual analysis-based sentiment metrics; the former use data from a larger number of international and social media news based on distinct dictionaries for traditional media and social media sources (Huang et al., 2018). Second, the same algorithms are used to generate TRMI across companies,

[4] To classify countries as developing and developed, we follow the MSCI market classification guide of 2018: https://www.msci.com/market-classification.
[5] For further information on the TRMI indices, see https://www.marketpsych.com

asset classes and countries, suggesting that the indices are homogeneous/comparable among those entities and do not need further processing or adjusting before use. Third, TRMI cover a broader range of countries compared to the traditional non-textual analysis-based sentiment measures (Baker and Wurgler, 2006; Baker and Wurgler, 2007; Yu and Yuan, 2011; Baker, Wurgler and Yuan, 2012; Huang et al., 2015). Finally, traditional sentiment measures use stock market trading data which are not readily available for the cross-section of the countries we use in this study.

We use the overall per-country sentiment which covers 61 (out of 66) countries for which we have equity data.[6] The TRMI Sentiment classifies and then maps news stories on a continuous scale between -1 and +1, from the most negative to the most positive. In the context of the present paper, we use TRMI Sentiment to proxy for investor sentiment at local country-level and, from this point onwards, we use the two terms interchangeably.

To account for the change in investor sentiment post-announcement, we construct a Negative Surprise Indicator (NSI) which takes the values 0 and 1, based on the direction of change in the TRMI Sentiment.[7] This is a 3-step procedure: First, we estimate the abnormal sentiments on days 0 and +1, by subtracting the average pre-announcement sentiment (over trading days -10 to -2) from the raw sentiment, to assess how the sentiment changes in the post-announcement period, relative to a normal day. Second, we calculate the Cumulative Abnormal Sentiment (CAS), by adding the abnormal sentiments on days 0 and +1. This is to measure the cumulative effect of the sentiment during the first two trading days post-announcement. Third, for countries with negative CAS, we assume a Negative Surprise (NSI=1) and when CAS is non-negative, we assume a Positive Surprise (NSI=0).

[6] With the exception of Cyprus, Croatia, Slovakia, Slovenia and Luxembourg.
[7] For countries without TRMI data and for events occurring before 1998, when TRMI data were introduced for the first time, NSI is not available.

3. Methodology

We generate our results using a short-horizon event-study analysis, a method regarded as straightforward and trouble-free (Kothari and Warner, 2007). In order to estimate robust results, we adapt the methodology in Michaelides et al. (2015) to the standards of this paper.

First, we estimate the Capital Asset Pricing Model (CAPM) using country stock market returns as the dependent variable and the world returns as the independent variable. We choose the estimation period to cover the interval of (-100, -11) trading days, relative to event day 0.[8] Specifically, we estimate the following equation.

$$\boldsymbol{R_{itj} = a_{ij} + \beta_{ij} R_{Wtj} + \varepsilon_{itj}} \quad s.t. \quad -100 \leq t \leq -11. \qquad (1)$$

R_{itj} is the stock market return of country "*i*", at day "*t*", relative to the event "*j*". R_{Wtj} is the return of the world index at day "*t*", relative to the event "*j*" ($i = 1,2, \ldots.,66 \; and \; j = 1,2, \ldots.,27$). Next, we use the estimated coefficients from Equation (1) to calculate abnormal returns (ARs) in the event window (-10, +10). We define abnormal returns (AR_{itj}) as the difference of actual (raw) and expected returns.

$$\boldsymbol{AR_{itj} = R_{itj} - \hat{a}_{ij} - \hat{\beta}_{ij} R_{Wtj}} \quad s.t. \quad -10 \leq t \leq +10. \qquad (2)$$

We obtain cumulative abnormal return (CAR_{ij}) over the interval (t_1, t_2), as follows.

$$\boldsymbol{CAR_{ij}[t_1, t_2] = AR_{i,t1,j} + \cdots + AR_{i,t2,j}} \quad s.t. \quad -10 \leq t_1 \leq t_2 \leq +10. \qquad (3)$$

[8] Event day 0 is the actual date of the bankruptcy incident, if a working day, or the first working day following the actual day of the incident, if not a working day.

Then we estimate the equally weighted average (across all event-country observations) cumulative abnormal return (*ACAR*) over the same interval, as follows.

$$\boldsymbol{ACAR}[\boldsymbol{t_1}, \boldsymbol{t_2}] = \frac{\mathbf{1}}{\mathbf{1782}} \sum_{\boldsymbol{i=1}}^{\mathbf{66}} \sum_{\boldsymbol{j=1}}^{\mathbf{27}} \boldsymbol{CAR_{ij}}(\boldsymbol{t_1}, \boldsymbol{t_2}) \quad s.t. \quad -10 \leq t_1 \leq t_2 \leq +10. \qquad (4)$$

We further use test statistics that account for event-induced variance, standardizing abnormal returns in the event window. The method, proposed by Boehmer et al. (1991), takes ARs in the event window (Equation (2)) and divides them by the time series standard deviation of the residuals (abnormal returns) from the estimation period (-100, -11). The steps we follow to estimate the standardized abnormal returns (SARs hereafter) are provided in Equations (5) - (7).

$$\overline{\boldsymbol{AR_{ij}}} = \frac{\mathbf{1}}{\mathbf{90}} \sum_{\boldsymbol{t=-100}}^{\mathbf{-11}} \boldsymbol{AR_{ijt}} \qquad (5)$$

$$\overline{\boldsymbol{s_{ij}}} = \sqrt{\frac{\mathbf{1}}{\mathbf{89}} \sum_{\boldsymbol{t=-100}}^{\mathbf{-11}} (\boldsymbol{AR_{ijt}} - \overline{\boldsymbol{AR_{ij}}})^{\mathbf{2}}} \qquad (6)$$

$$\boldsymbol{SAR_{itj}} = \frac{\boldsymbol{AR_{itj}}}{\overline{\boldsymbol{s_{ij}}}} \quad s.t. \quad -10 \leq t \leq +10. \qquad (7)$$

Finally, the test statistic of Boehmer et al. (1991) is given in Equation (8).

$$\boldsymbol{T_{BMP}} = \sqrt{\mathbf{1782}} \frac{\boldsymbol{ASAR_t}}{\boldsymbol{s}} \quad s.t. \quad -10 \leq t \leq +10. \qquad (8)$$

The formula used to estimate Average Standardized Abnormal Returns (ASARs), the numerator of T_{BMP}, is provided below.

$$\boldsymbol{ASAR_t} = \frac{\mathbf{1}}{\mathbf{1782}} \sum_{\boldsymbol{i=1}}^{\mathbf{66}} \sum_{\boldsymbol{j=1}}^{\mathbf{27}} \boldsymbol{SAR_{itj}} \quad s.t. \quad -10 \leq t \leq +10. \qquad (9)$$

The denominator of T_{BMP} is estimated as follows.

$$\boldsymbol{s} = \sqrt{\frac{\mathbf{1}}{\mathbf{1781}}\sum_{\boldsymbol{i}=\mathbf{1}}^{\mathbf{66}}\sum_{\boldsymbol{j}=\mathbf{1}}^{\mathbf{27}}(\boldsymbol{SAR_{itj}} - \boldsymbol{ASAR_t})^{\mathbf{2}}} \quad s.t. \quad -10 \leq t \leq +10. \qquad (10)$$

Finally, we estimate the test statistic of Kolari and Pynnonen (2010), which is an expansion of the Boehmer et al. (1991) test statistic.[9] The difference is that the KP statistic also takes into account the cross-sectional correlation of the residuals in the estimation period. It is estimated as follows.

$$\boldsymbol{T_{KP}} = \boldsymbol{T_{BMP}}\sqrt{\frac{\mathbf{1}-\bar{\boldsymbol{r}}}{\mathbf{1}+(\mathbf{1781})\bar{\boldsymbol{r}}}}. \qquad (11)$$

The coefficient $\bar{\boldsymbol{r}}$ is the average sample cross-correlation of the estimation period residuals. Furthermore, the test statistics (Equations (8) and (11)) are estimated by assuming that the abnormal returns (Equation (2)) are independent and identically distributed random variables which follow the normal distribution with mean zero and variance σ^2. As such, the test statistics are assumed to asymptotically have the standard normal distribution, provided that the number of event-country observations on a given day t (relative to the event day 0) is sufficiently large.

4. Results

In this section, we discuss our results. First, we consider the collective effect of all 27 bankruptcy announcements on stock market indices (Overall case). Second, we consider the effect of the 20 post-1998 bankruptcy announcements, while differentiating stock market indices into two groups based on the direction of post-announcement change in investor sentiment (Surprise case). Third,

[9] In the tables of results, we only report the test statistics of Kolari and Pynnonen (2010). The test statistics of Boehmer et al. (1991) are not tabulated but can be provided upon request.

we consider the effect of all 27 bankruptcy announcements on stock market indices while taking into consideration the economic classification of the home country (Country classification case).

4.1. Overall and Surprise

Figure 1 presents the plots of Average Cumulative Abnormal Returns (ACARs) for the Overall and Surprise cases. It further shows a plot of ACARs around a set of randomly selected dates (matching the number and time span of the bankruptcy announcements in Table 1) for comparison purposes. The Overall case exhibits large adverse stock market reaction, with the decline being most pronounced during the first three trading days post-announcement but with a more gradual accumulation of the economic losses up to trading day 10, post-announcement. Stock markets in negatively surprised countries experience steeper and larger declines, which are particularly evident in the first three trading days following the announcement. Finally, positively surprised countries demonstrate a delayed reaction since, in the first four trading days post-announcement, stock market indices do not show a clear downward trend. Nevertheless, on trading day five post-announcement, the indices start exhibiting sharp declines and, by day 10, the losses are on a par with those of negatively surprised countries. We believe that positive concurrent good news, as documented by positive change in investor sentiment (i.e. Positive Surprise), temporarily cover the negative effect of bankruptcy news in the first four trading days following bankruptcy announcements. After that time (i.e. from trading day five onwards), stock markets start declining, adjusting the level of prices to reflect the content of the negative (from the bankruptcy announcement) news.

[INSERT FIGURE 1 HERE]

Table 3 presents the results for the Overall and Surprise cases. In the Overall case, several time windows, the [0,+1], [0,+2], [0,+3] and [0,+5], exhibit significant economic losses with their respective ACARs estimated at -0.331%, -0.285%, -0.549% and -0.445%. These results suggest that international stock markets react immediately to large US financial institutions' bankruptcy announcements. Several other time windows are also statistically significant, the [+1,+3], [+1,+5], [+2,+10], [+3,+10,] and [+5,+10], with ACARs estimated at -0.394%, -0.290%, -0.409%, -0.455% and -0.384%, respectively. These additional results indicate that significant economic losses occur not only in the first days following the announcements, but also later.

A more interesting result is documented in the Negative Surprise case. We find that stock markets in negatively surprised countries react more strongly to US bankruptcy announcements, generating large negative ACARs. Specifically, the ACARs in time windows [0,+1], [0,+2], [0,+3] and [0,+5], are statistically significant, amounting for -0.537%, -0.482%, -0.868% and -0.584%, respectively. Other time windows, for instance [+1,+2], [+1,+3], [+2,+10], [+3,+10] and [+5,+10], are also significant with the respective ACARS estimated at -0.224%, -0.611%, -0.491%, -0.547% and -0.451%.

In contrast, countries with Positive Surprise do not exhibit an immediate response in their stock market indices since the event windows [0,+1], [0,+2] and [0, +3], which immediately follow the announcement, have insignificant ACARs. Several other windows though, such as [+1,+5], [+2,+10], [+3,+10,] and [+5,+10], are significant, with the corresponding ACARs estimated at -0.222%, -0.675%, -0.731% and -0.779%, respectively, suggesting a delay in stock market reaction in Positive Surprise countries. Note that for the positively surprised countries, the negative reaction is more pronounced towards the end of the 10-trading-day post-announcement period.

[INSERT TABLE 3 HERE]

4.2. Country Classification

Figure 2 shows the plots of ACARs for the Country Classification case. It further shows the plots of ACARs for the Overall case around a set of randomly selected dates (i.e. Placebo: matching the number and time span of the bankruptcy announcements in Table 1) for comparison purposes. The graph suggests that most of the effect in the Overall case is caused by the adverse reaction in stock markets of developing countries, which decline substantially following the announcement date. Stock markets in developed countries are affected too but the effect is considerably milder and shorter-lived.

[INSERT FIGURE 2 HERE]

Table 4 presents results of ACARs for several event windows for the Overall and Country Classification cases. Starting with developing countries, we document strong adverse stock market reaction following the date of announcement. In particular, the windows [0, +1], [0, +2], [0, +3], [0, +5], [+1, +3], [+1, +5], [+2, +10], [+3, +10] and [+5, +10] are associated with statistically significant ACARs, estimated at -0.367%, -0.283%, -0.68%, -0.515%, -0.506%, -0.689%, -0.773% and -0.668%, respectively. Results suggest that, in developing countries, the bankruptcy news effect is long-lived, persisting for at least 10 trading days in the post-announcement period. Stock markets in developed countries are also affected, but to a much lesser degree. In this case, the windows [0,+1], [0,+2], [0,+3] and [0,+5] are associated with significant ACARs, estimated at -0.277%, -0.286%, -0.352% and -0.341%, respectively. These results are consistent with prior

studies which suggest that external shocks originating in developed economies adversely affect emerging (i.e. developing) economies (Soydemir, 2000; Coudert et al., 2015).[10]

[INSERT TABLE 4 HERE]

5. Robustness Tests

5.1. Testing the Sample and Methodology

We evaluate the robustness of our sample of events and methodology by conducting several additional tests. First, since all bankruptcy announcements were issued by US-based financial institutions, we remove the US from the sample of countries with equity data, in order to examine the effect of these announcements in non-US economies. The results remain qualitatively unaffected, albeit slightly stronger. Upon closer inspection of the results, we find that in the US alone, the stock market index exhibits negative (positive) abnormal returns before (after) the bankruptcy announcements (results untabulated). A possible interpretation of this result is that US investors anticipate bankruptcies of large US financial institutions, perceiving them as being systemic events that could possibly affect all stocks. Therefore, they sell off their equity holdings prior to the date of official announcement (thus the index drops) and reallocate to stock holdings several days later, following the announcement, thereby generating a reversion of the index.[11]

Next, from the sample of bankruptcy announcements, we exclude the collapse of Lehman Brothers Investment Bank, the largest bankruptcy in our sample, because the magnitude of this case can potentially skew the results. In this instance, the results remain qualitatively unaffected.

[10] We also document a pre-announcement event window (-10, -1) with an associated positive ACAR of 0.468% in the case of developed countries which we attribute to (other) positive news prior to the date of bankruptcy announcements.
[11] Other plausible interpretations of this result are also possible and although it would be interesting to investigate this matter further, it is beyond the scope of this paper. Hence, we leave this topic open for future research.

We further report results after excluding bankruptcy announcements cases of Very Large (VL) financial institutions, those of Lehman Brothers and Washington Mutual combined (the first and second largest bankruptcies in our sample).[12] Then, we repeat the test (i.e. we exclude VL bankruptcies) but this time, we also exclude equity data from the US. In all cases, the results remain statistically and economically significant, albeit slightly weaker than the Overall case.

Finally, we conduct a placebo test, by using 27 randomly selected dates (matching the number and time span of the sample of announcements in Table 1) and find that our methodology generates ACARs that are indistinguishable from zero (results untabulated).

We report the robustness test results in Table 5. Overall, our results are robust to the exclusion of the US from the sample of stock market indices and the exclusion of VL bankruptcies (i.e. Lehman Brothers and Washington Mutual) from the sample of events. Finally, our methodology is robust to the placebo test.

[INSERT TABLE 5 HERE]

5.2. Testing an Alternative Measure for Surprise

In order to test the robustness of the Negative Surprise Indicator (NSI), which we introduce in Section 2.3, we construct an alternative indicator based on the post-event Cumulative Difference in Sentiment (CDS). This is also based on a 3-step procedure: First, we estimate the difference in sentiments (DS) on days 0 and +1, defined as $DS_t = Sentiment_t - Sentiment_{t-1}$. Second we sum the DS of days 0 and +1 to get the CDS. Third, when the CDS of a country is negative we assume a Negative Surprise (NSI#2=1). If CDS is non-negative, we assume a Positive Surprise (NSI#2=0).

[12] The combined aggregate value of assets of Lehman Brothers and Washington Mutual at the time of the announcement exceeds USD1 trillion and accounts for more than 60% of the combined value of assets of all 27 bankruptcies that we consider in this paper.

Table 6 contains results from the event-study methodology for the Overall and Surprise cases, similar to Table 3, but using the alternative measure for Surprise (NSI#2). Overall, the results in Table 6 are comparable to those of Table 3, which we interpret as a validation of the robustness for our main Surprise measure.

[INSERT TABLE 6 HERE]

5.3. Evaluating Sentiment and Surprise with Regression Analysis

For our final set of robustness tests we employ regression analysis. First, we regress the Cumulative Abnormal Returns on Cumulative Abnormal Sentiments (and the Cumulative Difference in Sentiments in a separate regression), reporting results in Table 7. We account for the heterogeneity of events and countries via indicator variables and for the heteroscedasticity of error terms by using White-Huber standard errors. We find that the estimated coefficient of Cumulative Abnormal Sentiment is positive and statistically significant at the 1% level, indicating that when investor sentiment drops following bankruptcy announcements, international stock markets experience lower returns. Similar inference can be drawn for the estimated coefficient of CDS.

[INSERT TABLE 7 HERE]

Second, we regress CAR (0, 1), CAR (0, 3) and CAR (0, 5) on our main and alternative Surprise measures (NSI and NSI#2) and report results in Table 8.[13] The estimated coefficients for NSI and NSI#2 are economically and statistically significant across all cases. Furthermore, the negative

[13] The steps followed to estimate CAR (0, X) are given by Equations (1) – (3). The steps followed to construct NSI and NSI#2 are described in Sections 2.3 and 5.2, respectively.

coefficients suggest that Negative Surprises (i.e. NSI=1 & NSI#2=1) are associated with larger economic losses in the post-announcement period, consistent with our event-study findings.

Overall, we provide robust evidence that the Sentiment (and our main Surprise measure) is important in determining the adverse effect of large US financial firm bankruptcy announcements on international stock market returns.

[INSERT TABLE 8 HERE]

6. Conclusions

This study considers 27 bankruptcy announcements by large financial institutions in the US and examines their impact on an international sample of 66 stock market indices. We employ an event-study methodology and find that stock markets exhibit strong adverse reaction, following the announcements. The adverse reaction is particularly evident in the first three trading days post-announcement but with losses accumulating for at least 10 trading days (two calendar weeks) in the aftermath, without signs of reversal.

Further, we classify countries by their level of Surprise, determined by the change in the country-level investor sentiment, in the aftermath of bankruptcy announcements, and find that negatively surprised countries are associated with more pronounced stock market declines in the first few days following the event. In cases of Positive Surprise, the economic losses of stock markets start materializing on trading day five post-announcement, suggesting that other concurrently running local good news (irrelevant to the bankruptcy) temporarily mask the negative effect of the bankruptcy news. These results lend support to the argument that, under certain circumstances, investor sentiment can explain the reaction of international stock markets to unexpected exogenous shocks.

Finally, we consider the economic classification of countries (Developing vs Developed) and show that stock markets in developing economies sustain significantly larger and more persistent losses. This result supports the view that stock markets in developing economies have increased sensitivity to "shocks" originating from the US, probably due to the larger degree of dependency of those economies on the US economy.

Our results and methodology are robust to several settings. For instance, results remain qualitatively unchanged after removing the US from the sample of countries with equity data and only slightly change (retaining their significance and direction) after removing the collapse of very large financial firms (i.e. the Lehman Brothers Investment Bank and Washington Mutual) from the sample of bankruptcy announcements. Finally, our methodology generates insignificant abnormal returns to the placebo (random dates) test.

For the future, it would be interesting to expand this study by considering additional country characteristics and how these characteristics can affect the reaction of international stock market indices after bankruptcy announcements. Further, the inclusion of bankruptcies from non-financial institutions and bankruptcy announcements from corporations not based in the US would be an interesting addition to the analysis.

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Tables and Figures

Table 1: Financial Firm Bankruptcies

This table lists the 27 largest bankruptcy announcements (Chapter 7 or Chapter 11) of financial institutions in the US, over the period 1988-2012. Assets are in billion USD and represent the estimated aggregate value of assets the institutions were holding when they filed for bankruptcy.

a/a	Company	Date of Announcement	Assets (in billion $)
1	Financial Corp of America	09/09/1988	33.9
2	Mcorp	31/03/1989	20.2
3	Gibraltar Financial Corp	08/02/1990	15
4	Imperial Corporation of America	28/02/1990	12.3
5	Bank of New England Corp	07/01/1991	29.8
6	Southeast Banking Corp	20/09/1991	13.4
7	HomeFed Corp	22/10/1992	13.9
8	FINOVA Group Inc, The	07/03/2001	12.1
9	Refco Inc	17/10/2005	33.3
10	New Century Financial Corporation	02/04/2007	26.1
11	American Home Mortgage Investment Corp	06/08/2007	18.8
12	Fremont General Corporation	18/06/2008	12.9
13	IndyMac Bancorp Inc	31/07/2008	32.7
14	Lehman Brothers Holdings Inc	15/09/2008	691
15	Washington Mutual Inc	26/09/2008	327.9
16	Downey Financial Corp	25/11/2008	13.4
17	CIT Group	01/11/2009	80.5
18	General Growth Properties Inc	16/04/2009	29.6
19	Thornburg Mortgage Inc	01/05/2009	36.5
20	Bank United Financial Corporation	21/05/2009	15
21	Colonial BancGroup	25/08/2009	25.8
22	Guaranty Financial Group Inc	27/08/2009	16.8
23	Capmark Financial Group Inc	25/10/2009	20.6
24	UCBH Holdings Inc	24/11/2009	13.5
25	AmTrustFinancial Corp	30/11/2009	11.7
26	MF Global Holdings	31/10/2011	40.5
27	Residential Capital LLC	14/05/2012	15.7

Table 2. List of Countries – Stock Market Indices

This table lists the 66 countries with equity data in our sample. We use the MSCI classification guide of 2018 to organize the 66 countries in developing (43) and developed (23) economies. Thomson Reuters Markepsych Indices (TRMI) are available for all listed countries, since the 1st of January 1998, with the exception of Cyprus, Croatia, Luxembourg, Slovakia and Slovenia.

Ref	Country	Developed	Ref	Country	Developed
1	Argentina	No	34	Malaysia	No
2	Australia	Yes	35	Malta	No
3	Austria	Yes	36	Mexico	No
4	Bahrain	No	37	Morocco	No
5	Belgium	Yes	38	Netherlands	Yes
6	Brazil	No	39	New Zealand	Yes
7	Bulgaria	No	40	Nigeria	No
8	Canada	Yes	41	Norway	Yes
9	Chile	No	42	Oman	No
10	China	No	43	Pakistan	No
11	Colombia	No	44	Peru	No
12	Croatia	No	45	Philippines	No
13	Cyprus	No	46	Poland	No
14	Czech Republic	No	47	Portugal	Yes
15	Denmark	Yes	48	Qatar	No
16	Egypt	No	49	Romania	No
17	Estonia	No	50	Russia	No
18	Finland	Yes	51	Singapore	Yes
19	France	Yes	52	Slovakia	No
20	Germany	Yes	53	Slovenia	No
21	Greece	No	54	South Africa	No
22	Hong Kong	Yes	55	South Korea	No
23	Hungary	No	56	Spain	Yes
24	India	No	57	Sri Lanka	No
25	Indonesia	No	58	Sweden	Yes
26	Ireland	Yes	59	Switzerland	Yes
27	Israel	Yes	60	Taiwan	No
28	Italy	Yes	61	Thailand	No
29	Japan	Yes	62	Turkey	No
30	Jordan	No	63	UAE	No
31	Kuwait	No	64	United Kingdom	Yes
32	Lithuania	No	65	United States	Yes
33	Luxembourg	No	66	Venezuela	No

Table 3: Average Cumulative Abnormal Returns

This table presents the Average Cumulative Abnormal Returns (ACARs) around the bankruptcy announcements listed in Table 1. In the Overall case, we use all 27 bankruptcy announcements and equity data from all the 66 countries in Table 2. In the cases of Negative and Positive Surprise we use the 20 post-1998 bankruptcy announcements and equity data from the 61 countries with TRMI data (all countries in Table 1, excluding Cyprus, Croatia, Luxembourg, Slovakia and Slovenia). Negative Surprise equals 1 if the Cumulative Abnormal Sentiment (CAS) on day one-post event is negative, set to 0 otherwise. Positive Surprise equals 1 when the CAS on day one-post event is non-negative, set to 0 otherwise. The CAS on day one-post event is the sum of the Abnormal Sentiment (AS) on days 0 and 1. AS is estimated by subtracting from the raw sentiment the average raw sentiment of trading days -10 to -2, relative to the event. T-stats and P-values are based on Kolari and Pynnonen (2010).

	Overall	**Negative Surprise**	**Positive Surprise**
Event window	**ACAR**	**ACAR**	**ACAR**
[-10, -1]	0.090%	0.163%	-0.112%
[-5, -1]	0.178%	0.339%	0.081%
[-3, -1]	-0.064%	-0.002%	-0.081%
[-2, -1]	0.017%	0.154%	-0.049%
[0, +1]	-0.331%***	-0.537%***	-0.103%
[0, +2]	-0.285%**	-0.482%***	-0.046%
[0, +3]	-0.549%***	-0.868%***	-0.140%
[0, +5]	-0.445%***	-0.584%***	-0.171%
[+1, +2]	-0.130%	-0.224%**	-0.097%
[+1, +3]	-0.394%**	-0.611%***	-0.190%
[+1, +5]	-0.290%*	-0.327%	-0.222%*
[+2, +5]	-0.114%	-0.048%	-0.069%
[+2, +10]	-0.409%**	-0.491%*	-0.675%**
[+3, +5]	-0.161%	-0.103%	-0.125%
[+3, +10]	-0.455%**	-0.547%*	-0.731%***
[+5, +10]	-0.384%**	-0.451%*	-0.779%***

* *p-value* < 0.1, ** *p-value* < 0.05, *** *p-value* < 0.01

Table 4: Average Cumulative Abnormal Returns

This table presents Average Cumulative Abnormal Returns (ACARs) around the 27 bankruptcies listed in Table 1. In the Overall case we use equity data from 66 countries and in the developed (developing) case data from 23 (43) countries, with developed (developing) economies. T-stats and P-values are based on Kolari and Pynnonen (2010).

	Overall	**Developing**	**Developed**
Event window	**ACAR**	**ACAR**	**ACAR**
[-10, -1]	0.090%	-0.161%	0.468%**
[-5, -1]	0.178%	0.069%	0.343%*
[-3, -1]	-0.064%	-0.141%	0.052%
[-2, -1]	0.017%	-0.040%	0.103%
[0, +1]	-0.331%***	-0.367%*	-0.277%**
[0, +2]	-0.285%**	-0.283%**	-0.286%**
[0, +3]	-0.549%***	-0.680%***	-0.352%*
[0, +5]	-0.445%***	-0.515%**	-0.341%*
[+1, +2]	-0.130%	-0.109%	-0.161%
[+1, +3]	-0.394%**	-0.506%***	-0.227%
[+1, +5]	-0.290%*	-0.340%*	-0.216%
[+2, +5]	-0.114%	-0.147%	-0.064%
[+2, +10]	-0.409%**	-0.689%***	0.013%
[+3, +5]	-0.161%	-0.231%	-0.055%
[+3, +10]	-0.455%**	-0.773%***	0.023%
[+5, +10]	-0.384%**	-0.668%***	0.043%

*** *p-value* < 0.1, ** *p-value* < 0.05, *** *p-value* < 0.01**

Table 5: Average Cumulative Abnormal Returns[+]

This table presents Average Cumulative Abnormal Returns (ACARs) around the bankruptcy announcements listed in Table 1, using equity data from countries in Table 2. In the Overall case, we consider all 27 bankruptcy announcements and use equity data from all 66 countries. In the Overall ex US case we consider all 27 bankruptcy announcements and use equity data from 65 countries (all except the US). In the Overall ex Lehman Brothers case we consider 26 bankruptcy announcements (all except Lehman Brothers) and use equity data from all 66 countries. In the Overall ex VL case we consider 25 bankruptcy announcements (all except Lehman Brothers & Washington Mutual bankruptcies) and use equity data from all 66 countries. Finally, in the Overall ex VL & US case we consider 25 bankruptcy announcements (all except Lehman Brothers & Washington Mutual bankruptcies) and use equity data from 65 countries (all except the US). T-stats and P-values are based on Kolari and Pynnonen (2010).

	Overall	**Overall ex US**	**Overall ex Lehman Brothers**	**Overall ex VL**	**Overall ex VL & US**
Event window	**ACAR**	**ACAR**	**ACAR**	**ACAR**	**ACAR**
[-10, -1]	0.090%	0.095%	0.221%	0.176%	0.182%
[-5, -1]	0.178%	0.184%	0.242%	0.116%	0.118%
[-3, -1]	-0.064%	-0.067%	0.018%	0.056%	0.056%
[-2, -1]	0.017%	0.017%	0.054%	0.073%	0.074%
[0, +1]	-0.331%***	-0.342%***	-0.228%*	-0.257%**	-0.266%**
[0, +2]	-0.285%**	-0.295%**	-0.247%**	-0.190%*	-0.197%*
[0, +3]	-0.549%***	-0.569%***	-0.455%**	-0.420%**	-0.435%**
[0, +5]	-0.445%***	-0.461%***	-0.517%***	-0.493%***	-0.512%***
[+1, +2]	-0.130%	-0.136%	-0.128%	-0.076%	-0.079%
[+1, +3]	-0.394%**	-0.410%**	-0.335%*	-0.306%	-0.317%
[+1, +5]	-0.290%*	-0.301%*	-0.397%**	-0.379%**	-0.394%**
[+2, +5]	-0.114%	-0.118%	-0.288%**	-0.237%*	-0.245%*
[+2, +10]	-0.409%**	-0.423%**	-0.559%**	-0.349%**	-0.364%**
[+3, +5]	-0.161%	-0.166%	-0.269%*	-0.303%**	-0.315%**
[+3, +10]	-0.455%**	-0.470%**	-0.540%**	-0.416%**	-0.434%**
[+5, +10]	-0.384%**	-0.399%**	-0.440%**	-0.275%*	-0.290%*

*** *p-value* < 0.1, ** *p-value* < 0.05, *** *p-value* < 0.01**

[+] *Part of Robustness Analysis results*

Table 6: Average Cumulative Abnormal Returns[*]

This table presents the Average Cumulative Abnormal Returns (ACARs) around the bankruptcy announcements listed in Table 1. In the Overall case, we use all 27 bankruptcy announcements and equity data from all the 66 countries in Table 2. In the cases of Negative and Positive Surprise#2 we use the 20 post-1998 bankruptcy announcements and equity data from the 61 countries with TRMI data (all countries in Table 1, excluding Cyprus, Croatia, Luxembourg, Slovakia and Slovenia). Negative Surprise#2 equals 1 if the Cumulative Difference in Sentiment (CDS) on day one-post event is negative, set to 0 otherwise. Positive Surprise#2 equals 1 when CDS on day one-post event is non-negative, set to 0 otherwise. The CDS on day one-post event is the sum of the Difference in Sentiment (DS) on days 0 and 1. DS is the difference of the raw Sentiment (S) of two consecutive days (i.e. $DS_t = S_t - S_{t-1}$). T-stats and P-values are based on Kolari and Pynnonen (2010).

	Overall	**Negative Surprise#2**	**Positive Surprise#2**
Event window	**ACAR**	**ACAR**	**ACAR**
[-10, -1]	0.090%	-0.005%	0.080%
[-5, -1]	0.178%	0.199%	0.246%
[-3, -1]	-0.064%	0.019%	-0.110%
[-2, -1]	0.017%	0.138%	-0.039%
[0, +1]	-0.331%***	-0.495%***	-0.139%
[0, +2]	-0.285%**	-0.417%***	-0.108%
[0, +3]	-0.549%***	-0.726%***	-0.282%
[0, +5]	-0.445%***	-0.493%**	-0.266%
[+1, +2]	-0.130%	-0.217%*	-0.102%
[+1, +3]	-0.394%**	-0.526%***	-0.276%
[+1, +5]	-0.290%*	-0.293%*	-0.260%
[+2, +5]	-0.114%	0.002%	-0.127%
[+2, +10]	-0.409%**	-0.450%**	-0.727%**
[+3, +5]	-0.161%	-0.076%	-0.158%
[+3, +10]	-0.455%**	-0.528%**	-0.758%**
[+5, +10]	-0.384%**	-0.495%**	-0.739%**

[*] *p-value* < 0.1, [**] *p-value* < 0.05, [***] *p-value* < 0.01

[*] *Part of Robustness Analysis results*

Table 7: Regression Analysis[&]

This table presents results from OLS regression analysis estimations with the post-event Cumulative Abnormal Return (CAR) as the dependent variable and the post-event Cumulative Abnormal Sentiment (CAS) or Cumulative Difference in Sentiment (CDS) as the independent variables. CAR (0, x), with x spanning 0-10, is estimated by following the steps described in Equations (1) – (3). CAS (0, x) is estimated by summing up the post-event Abnormal Sentiment (AS) on days 0 to x, with x being the post-event day x, spanning 0-10. AS is estimated by subtracting from the raw sentiment the average raw sentiment of trading days -10 to -2, relative to the event. CDS (0, x) is estimated by summing up the post-event Difference in Sentiment (DS) on days 0 to x, with x being the post-event day x, spanning 0-10. DS is the difference of the raw Sentiment (S) in two consecutive days (i.e. $DS_t = S_t - S_{t-1}$). We control for Bankruptcy and Country-specific characteristics via indicator variables and for the heteroscedasticity of the error terms by using White-Huber (heteroscedasticity robust) standard errors.

Dependent Variable	$\boldsymbol{CAR(0,x): x \in [0,10]}$	
Constant	-0.0241***	-0.0243***
	(0.00366)	*(0.00385)*
$\boldsymbol{CAS(0,x): x \in [0,10]}$	0.00927***	
	(0.000952)	
$\boldsymbol{CDS(0,x): x \in [0,10]}$		0.0132***
		(0.00216)
Observations	**13177**	**13175**
Adj. R-Square	**0.118**	**0.11**

*** p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01**

[&] *Part of Robustness Analysis results*

Table 8: Regression Analysis¬

This table presents results from OLS regression analysis estimations with the post-event Cumulative Abnormal Return (CAR) as the dependent variable and the Negative Surprise or Negative Surprise#2 as the independent variables. CAR (0, x), with x spanning 0-10, is estimated by following the steps described in Equations (1) – (3). Negative Surprise Indicator (NSI) equals 1 if the Cumulative Abnormal Sentiment (CAS) on day one-post event is negative, set to 0 otherwise. The CAS on day one-post event is the sum of the Abnormal Sentiment (AS) on days 0 and 1. AS is estimated by subtracting from the raw sentiment the average raw sentiment of trading days -10 to -2, relative to the event. Negative Surprise Indicator 2 (NSI#2) equals 1 if the Cumulative Difference in Sentiment (CDS) on day one-post event is negative, set to 0 otherwise. The CDS on day one-post event is the sum of the Difference in Sentiment (DS) on days 0 and 1. DS is the difference of the raw Sentiment (S) in two consecutive days (i.e. $DS_t = S_t - S_{t-1}$). We control for Bankruptcy and Country-specific characteristics via indicator variables and for the heteroscedasticity of the error terms by using White-Huber (heteroscedasticity robust) standard errors.

Dependent Variable	$\boldsymbol{CAR(0,1)}$	$\boldsymbol{CAR(0,1)}$	$\boldsymbol{CAR(0,3)}$	$\boldsymbol{CAR(0,3)}$	$\boldsymbol{CAR(0,5)}$	$\boldsymbol{CAR(0,5)}$
Constant	-0.00118	-0.000097	-0.00223	-0.00163	-0.0171*	-0.017
	(0.00806	*(0.00841)*	*(0.00932)*	*(0.00974)*	*(0.0101)*	*(0.0105)*
NSI	-0.00312**		-0.00497***		-0.00510***	
	(0.00121)		*(0.00167)*		*(0.00187)*	
NSI#2		-0.00351***		-0.00387**		-0.00331*
		(0.0013)		*(0.00176)*		*(0.0019)*
Observations	**1198**	**1197**	**1198**	**1197**	**1198**	**1197**
Adj. R-Square	**0.127**	**0.128**	**0.0861**	**0.0833**	**0.0982**	**0.0948**

* ***p-value*** **< 0.1,** ** ***p-value*** **< 0.05,** *** ***p-value*** **< 0.01**

¬ *Part of Robustness Analysis results*

Figure 1: Average CAR (ACAR) vs Relative Date

This figure plots Average Cumulative Abnormal Returns (ACARs) around bankruptcy announcements in Table 1 using equity data from countries in Table 2. For the Overall case, we consider all the 27 bankruptcies in Table 1 across 66 stock market indices from countries in Table 2. For the Surprise cases (Negative and Positive), we consider the 20 post-1998 bankruptcy announcements across the 61 countries with TRMI data (excluding Cyprus, Croatia, Luxembourg, Slovakia and Slovenia). A plot of 27 randomly selected dates (to match the number and time span of the bankruptcies in Table 1) across all 66 countries (in Table 2) is included for comparison purposes.

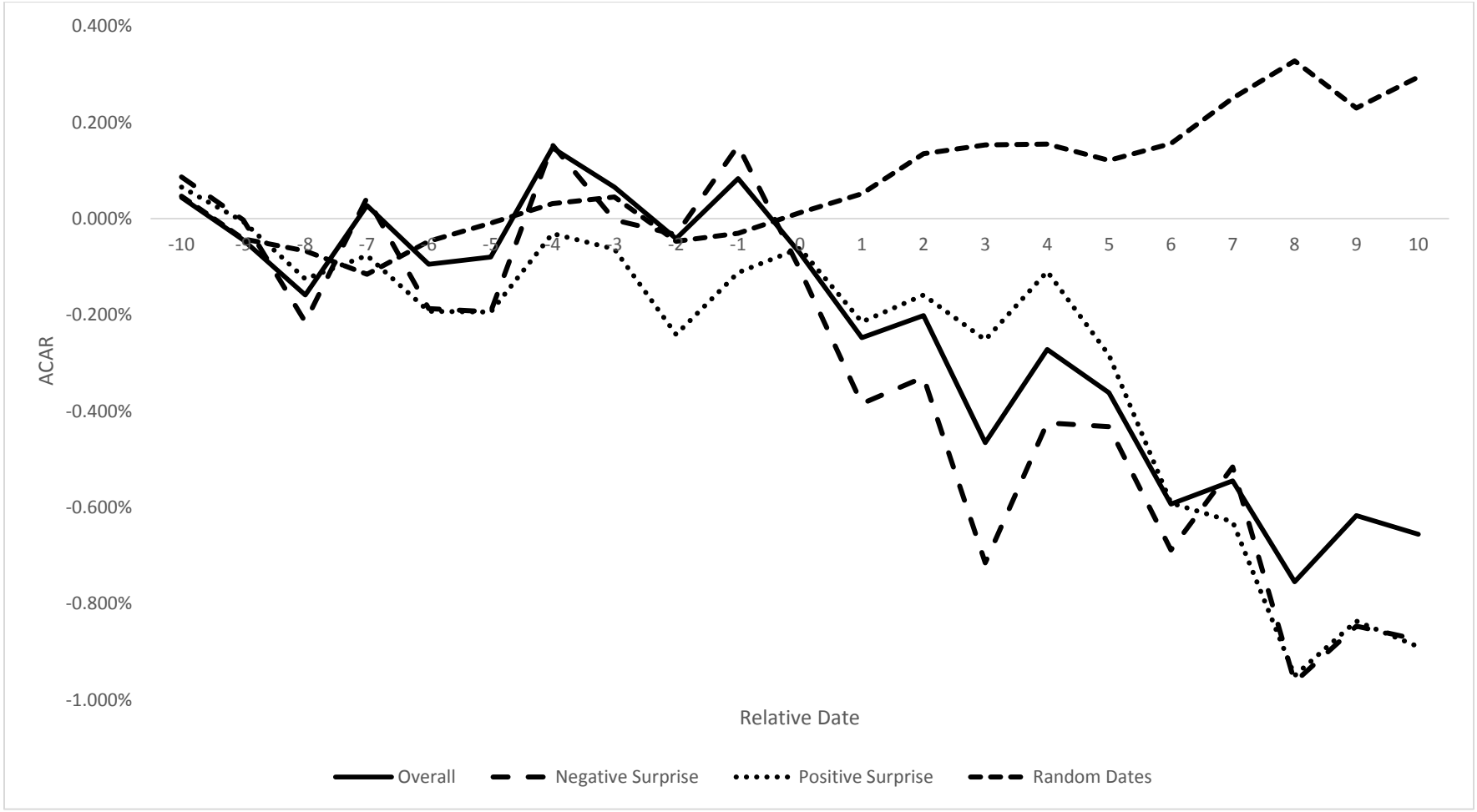

Figure 2: Average CAR (ACAR) vs Relative Date

This figure plots Average Cumulative Abnormal Returns (ACARs) around bankruptcy announcements in Table 1 using equity data from countries in Table 2. For the Overall case, we consider all the 27 bankruptcies in Table 1 across 66 stock market indices from the countries in Table 2. For the developed case, we consider the 27 bankruptcies across 23 countries with developed economies. Finally, for the Developing case, we consider the 27 bankruptcies across 43 countries with developing economies. A plot of 27 randomly selected dates (to match the number and time span of the bankruptcies in Table 1) across all 66 countries (in Table 2) is included for comparison purposes.