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Hurricane Matthew: Measuring the Stock Market Reaction on the Insurance Industry

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[“We are going to have a catastrophic storm,” said Florida Gov. Rick Scott. “We have not had a storm like this on the East Coast in a long time.” The storm already has left death and destruction in the Caribbean. At least 283 people were killed in Haiti, with six deaths in other countries linked to the storm, according to the Associated Press. Mr. Scott urged residents in areas under evacuation orders to leave immediately. “This storm will kill you,” he said, “time is running out.” A hurricane warning was in effect for much of Florida’s eastern coast, from Golden Beach—a town in northern Miami-Dade County—to the South Santee River in South Carolina, north of Charleston. The governors of Florida, Georgia and the Carolinas declared states of emergency.”][2]

Key Words: Hurricane Matthew, stock market reaction, insurance industry, event study

[1] The author would like to thank Dr. Laura Cole who served as Thesis Advisor, and the Masters Investment Learning Center for the use of Bloomberg terminals to obtain proprietary data.
[2] Campo- Lores, Arian and Bernstein, Elizabeth. (2017, October 6). *Matthew Weakens to Category 3 Hurricane as It Bears Down on Florida*, wsj.com. Retrieved from https://www.wsj.com/articles/hurricane-matthew-strengthens-as-it-heads-toward-florida-1475753588?mod=searchresults&page=1&pos=2

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I. Introduction

In October of 2016, the Caribbean was struck by Category 5 Hurricane, Matthew, which left catastrophic damage in its wake. Almost 500 people were killed, including 47 in the US, with approximately $10 billion in damages to the US, according to the National Centers for Environmental Information (NCEI). The hurricane broke multiple records including longest continuous Category 4+hurricane (5 days) as well as the largest natural disaster for 2016 in the US.

Although Hurricane Matthew will go down as a historically bad storm, it could have been much worse for the Southeastern United States. Early forecasts predicted the hurricane would directly hit Florida and the Carolinas with Category 3 or 4 intensity, which would have been the first Category 3+ hurricane to hit the US since Hurricane Wilma in 2005. State of emergencies were declared in Florida, South Carolina, and Georgia and mandatory evacuations of residents living within 100 miles of South Carolina's coastline were issued. Fortunately, the hurricane curved east and stayed just off the Florida coastline before weakening from a Category 3 to Category 1 hurricane and making landfall on October 8th in South Carolina. Large storm surges, however, caused widespread flooding with over 1 million homes in the Southeastern United States affected.

Hurricanes gain their energy from warm waters and with the world's oceans heating up from global warming, so has the frequency and strength of hurricanes around the world. With the destruction of hurricanes in loss of life and property damage, it's not surprising to know they adversely affect many industries, but it is questionable to what degree they affect the insurance industry and how the category of the hurricanes play into it as well.

This study seeks to understand the relationship between Hurricane Matthew and any abnormal returns produced on the insurance industry over the synoptic life of the hurricane. A stock insurer index will be utilized to mimic the insurance industry as a whole, and since hurricanes evolve and become stronger and weaker over time, we will seek how the stock insurance market will be affected before, during, and after landfall of the hurricane.

II. Literature Review

The event study methodology is extremely common in academia, but few researchers have looked at the effects of extreme weather occurrences on the stock market. Even fewer have looked at the effects of hurricanes on the stock market. My study will analyze the market impact of Hurricane Matthew on the insurance industry.

The first paper I read was "Insurer Stock Price Responses to Hurricane Floyd: An Event Study Analysis using Storm Characteristics" by Bradley T. Ewing, Scott E. Hein, and Jamie Brown Kruse (2004). They tested how the market value of insurer stocks (using the S&P Insurance Index) were affected by Hurricane Floyd. There have been similar studies on individual hurricanes, but they were the first to incorporate how changing news about a storm's characteristics affect the financial markets. Since hurricanes evolve and become weaker and stronger over time, they wanted to determine if these windstorm characteristics affected the way investors viewed stocks. They found that over the life cycle of the storm there is a negative effect on insurer stock prices, but the effect is not constant over the days of the storm. When the hurricane first reached Category 1 strength, there was a sharp decline in the insurer index as investors forecasted extreme damage. When the storm reached Category 4, however, there was actually a rise in insurer prices. The authors predicted this counter-intuitiveness due to the fact that the storm was so extreme that emergency services would help pay for the cleanup. This seems to signal that there are multiple variables in this analysis. Overall, though, the authors concluded that there was a negative stock market reaction over the synoptic life of the storm, but one that was neither constant or always negative.

One point to take away from their paper is the use of the insurer index instead of individual companies. Large insurance companies are well diversified and will most likely have operations in hurricane-prone areas, so an insurer index will be appropriate to use in my paper. A weighted index will then allow me to judge how the entire industry is affected compared to individual insurers. Additionally, the findings of a variable rise and decrease in stock performance over the life of the storm make necessary the use of a specified period of time to study the pricing habits instead of just at landfall when investors will have most likely already priced in the damages.

The second relevant paper studied was “Flight to Gold: Extreme Weather Events and Stock Returns” by Matthew G. Lanfear, Abraham Lioui, and Mark G. Siebert (2017). This paper details the effects of North Atlantic hurricanes on the U.S. stock market. The authors use the 34 hurricanes to make U.S. landfall from 1980-2014 to analyze the stock price effects on the 49 Industry Portfolios of Kenneth French. They use a period for the event study from the formation of the hurricane to 30 days post-landfall to study the price effects. Overall, the study found a total loss of 0.522% for the aggregate market 30 days post-landfall with many of the Industry Portfolios also consistently producing abnormal returns including many manufacturing and consumer focusing Industries. The paper then goes on to detail how gold reacts differently and actually produces positive abnormal results, acting as a safe asset during the extreme weather events.

This study contributes to my event study as it provides more evidence for the effect of storm characteristics and stock performance among different industries. I will only be looking at the insurer industry, but their conclusion that each industry was affected in different ways points to the validity of my hypothesis. My study will also closely mimic the use of the 34 North American hurricanes to make landfall from 1980-2014 and study the effects using a similar time window. Hurricanes don’t have long lifespans and are hard to determine strength and direction at the beginning of their lives, so investors are unlikely to place too much resolve at the beginning of the life of the storms. That's why they use a 10-day pre-landfall time window. Total hurricane damage after the fact is also fairly predictable soon after the storm hits and investors sentiments should be priced in quickly, which accounts for the 30-day post-landfall timeline.

The final paper reviewed was "Are Value Stocks More Exposed to Disaster Risk? Evidence from Extreme Weather Events" by Matthew G. Lanfear, Abraham Lioui, and Mark G. Siebert (2017). They similarly used the 34 hurricanes to make landfall from 1980-2014 to determine the effect of hurricanes on value stocks compared to growth stocks. Using an event methodology, they were able to show that value stocks are more perceptible to hurricane strikes compared to growth stocks, although the losses are concentrated in smaller stocks and not a pervasive phenomenon. With their study, they use an estimation period from December 1st-May 31st (180 days). This period is outside the North America hurricane season, which allowed them to avoid contaminating their model with abnormal hurricane returns.

This paper is relevant as we will be using a similar estimation period of Dec 1st-May 31st to determine normal returns for the insurer index. If we used the hurricane season within our estimation window to determine normal returns, our returns will be skewed as we'd be including the abnormal returns we're looking for. In their study, they looked at the different effect of hurricane strikes on value and growth stocks, but our study will be slightly different. Since we're using an insurer index, my study will include value and growth stocks together and will be unable to see the differences.

III. Data and Summary Statistics

III.A. Sample construction

The purpose of this sample was to create an index of companies that represent the overall stock insurance industry. Accomplishing this would allow us to see the stock market reaction for Hurricane Matthew on this specific industry. Previous research papers have used a similar methodology on other environmental phenomena.

First, I needed to determine the date Hurricane Matthew originally made landfall in the United States. To do this, I employed the use of the National Hurricane Center's (NHC) archives, which is a division of the National Oceanic and Atmospheric Administration. The NHC is responsible for tracking and predicting weather systems within the tropics and the northern Atlantic Ocean. They keep detailed reports and statistics for every hurricane for the past 150 years. For us, however, we only needed the landfall date, which happened on Saturday, October 8th, 2016 in McClellanville, South Carolina.

Second, I needed to construct an index of companies that would mimic the wider insurance industry. To do this, I utilized the SPSIINS Index that included 47 insurance companies at the time of Hurricane Matthew. This index includes stocks in the S&P Total Market Index that are classified in the GICS insurance brokers, life & health insurance, multi-line insurance, property and casualty insurance and reinsurance sub-industries. I decided to use the entire insurance industry for this sample as the damage caused by powerful hurricanes like Matthew affect every sub-industry within the insurance category. Looking at multiple sub-industries also allowed for increased variation in potential returns. To gather the companies in my sample, I utilized the Bloomberg MEMB function to determine the constituents of the SPSIINS index on October 10th, the first trading date after landfall in the United States. This left me 47 companies to use for my sample.

III.B. Database collection

<u>EVENTUS</u>

To analyze the insurance industry market reaction to Hurricane Matthew, I utilized the Eventus software via Wharton Research Data Services (WRDS). Eventus is an event study program that utilizes stock data found within the Center for Research in Security Prices (CRSP) databases. CRSP is a provider of historical stock market data that includes the security price, return, and volume data for NYSE, AMEX, and NASDAQ listed firms. The Eventus software converts specific calendar dates from Excel to CRSP trading day numbers, converts CUSIP identifiers to CRSP permanent identification numbers (PERMNOs), and extracts event study cumulative and compounded abnormal returns for cross-sectional analysis. Once I had gathered my sample of companies, I used the company code lookup tool to determine the PERMNO for each of the companies within my sample. A PERMNO is a unique security identifier used by CRSP, which is required to run the analysis through Eventus. Then using SAS, I was able to pull the data from Eventus via WRDS. A portion of the SAS program that I wrote to access the Eventus software is in Appendix A.

IV. Event Study Methodology

An event study seeks to measure the stock price reaction around the announcement of an event. Analysis of these events allows investors and researchers to understand how the stock market reacts to certain events and could assist in arbitrage opportunities due to any market inefficiencies.

An event study is typically executed by using the announcement as date 0 with periods of time around the announcement date called event windows. These event windows are the periods of time you want to analyze. This study will use two different models, the **market model** and **market adjusted model**, to analyze the stock market reaction within our event window with both using **equal weighted** index and **value weighted** index returns. Using these models, I will study 10 short-term event windows for statistical significance.

Event Window	Estimation Window
[-10, -1]	(-311, -129)
[-5, -1]	(-311, -129)
[-3, -1]	(-311, -129)
[-1,0]	(-311, -129)
[-1, +1]	(-311, -129)
[0, +1]	(-311, -129)
[+1, +3]	(-311, -129)
[+1, +5]	(-311, -129)
[+1, +10]	(-311, -129)
[-10, +30]	(-311, -129)

Tables 2 through Tables 5 record the mean and median cumulative abnormal returns (CARs) and percentage of negative CARs over the event window with each Table representing one of our 4 statistical analysis.

V. Shareholder Response to Hurricane Matthew

Hypothesis 1: The announcement of Hurricane Mathew has an effect on the stock price of the insurance industry before and after landfall. This effect is negative before landfall and positive following landfall as damage estimates come in.

Hypothesis 2: The announcement of Hurricane Mathew has no effect on the stock price of the insurance industry before and after landfall. This no effect is due to the diverse holdings of major insurance companies with operations all over the United States.

<u>Table 1</u>

Table 1 tests the market adjusted model equally weighted returns. Table 1 reports several event windows with statistical significance including the [-3, -1], [-1, 0], [-1, +1], [0, +1], [+1, +3], [+1, +5], and [-10, +30] windows with each having statistical significance at the 1% level. Interestingly, the mean cumulative abnormal returns are consistently positive throughout the windows, except for the [+1, +10] window with a -0.25% return, but is not statistically significant, however. The mean CAR from [-3, -1] is 1.52% and from [+1, +3] is 1.49% with only 3 of the 44 insurance companies with data having negative CARs for that window. Only 1 company in the [+1, +5] had a negative CAR. From [-10, +30] there is statistical significance at the 1% level and a CAR of 6.79%. These positive abnormal returns can be attributed due to early estimates (8 days prior to landfall) of Hurricane Matthew striking the Florida coast with Category 4 or 5 force. Soon after, however, new data forecasted the storm weakening greatly as it passed over the Caribbean islands and now striking the US with max Category 2 winds and even a probability of missing the US completely.

Table 2

Table 2 tests the market adjusted model value weighted returns. Table 2 reports all event windows with statistical significance except for the window [-10, -1]. Window [-5, -1] has a mean CAR of 1.0% and is statistically significant at the 5% level. For the window that includes the days before and after landfall [-1, +1], there was a CAR of 0.83% that is significant at the 1% level with only 16% of companies from the sample having negative CARs for the period. Once again, we see large positive mean CARs after the announcement date with a +1.73% CAR for the period [+1, +5] that is most likely due to more information being received by investor due to the actual damages caused by the storm. Forecasting the actual damage delivered by a large hurricane is difficult to determine with wind speeds, rainfall, and track of hurricane all being factors.

Table 3

Table 3 tests the market model equally weighted returns. Table 3 reports all event windows with statistical significance except for the window [-10, -1]. Similarly, to our other model's results, there are consistent positive CARs throughout our event windows, except for [+1, +10] with a -0.58% mean CAR with significance at the 10% level. The event window [-10, +30] saw a mean CAR of 6.29% with 73% of companies reporting positive mean CARs during the period.

Table 4

Table 4 tests the market model value weighted returns. Table 4 reports all event windows with statistical significance except for the windows [-10, -1] and [+1, +10]. The event window [+1, +3] saw a mean CAR of 1.27% with significance at the 1% level with only 9% of companies having a negative mean CAR for the period. Interestingly, the event window [+1, +10] saw a mean CAR of -0.92% that was not significant but did see a 10% significance on the number of negative mean CARs for the period, 64%.

VI. Conclusion

The purpose of this event study was to further progress the research on environmental disasters and their effects on the stock market. In doing this study, I was able to produce statistically significant results that showed a positive stock market reaction in the insurance industry from Hurricane Matthew. These results seem counterintuitive until you understand the history of Hurricane Matthew's development. At one point, Hurricane Matthew was a Category 5 hurricane that would have gone down as one of the strongest ever before fizzling out to a Category 1 when it hit South Carolina. The stock market rebounded strongly within our event windows with an average Cumulative abnormal return of 6.62% for the event window [-10, +30] that was statistically significant at the 1% level. Almost every insurer within our index showed positive returns within this period as well as 74% having positive CARs with significance at the 5% level. This shows that the effects of Hurricane Matthew were pervasive throughout the industry and that the diversification of the companies still do not protect against large swings in their share prices when powerful hurricanes threaten the US.

VI. Areas for Future Research

After finishing this study, there are multiple areas for expansion on this research. Extending the event window to include dates before, specifically [-20] and [-30], would show

how the stock market reacted initially and would put the positive abnormal returns in more context. The study could also expand to other hurricanes and analyze how the category and strength of the hurricane affect the CARs within different event windows. There is also the possibility of splitting up the insurance industry within its sub-industries and analyzing the differences within.

Table 1: Shareholder Response to Hurricane Matthew: Market Adjusted Model, Equal Weighted Returns, for the SPSIINS Index.

The table reports the average cumulative abnormal returns (CARs) for the landfall of Hurricane Matthew on the United States for the **market adjusted model** using **equally weighted** returns for all 47 firms in the sample that have data. The event date is identified from the National Oceanic and Atmospheric Administration. The estimation window is 180 days from (-311,-129), as observed in Lanfear, Lioui, and Siebert (2017). Average cumulative abnormal returns (CARs) are reported over the various announcement periods in the table. Median CARs are listed immediately below, followed by the percentage of CARs that are positive are in square brackets. ***, **, and * indicate the mean is significantly different from zero at the 1%, 5%, and 10% level, respectively, using the cross-sectional two-sided t-statistic of Boehmer, Musumeci, and Poulsen (1991).))),)), and) indicate the results of a Wilcoxon rank sum test for differences in the medians, significantly different at the 1%, 5%, and 10% level, respectively. >>>, >>, and > indicate the percentage of positive CARs is significantly different from zero at the 1%, 5%, and 10% level, respectively, using the generalized sign test in Cowan (1992), which controls for the normal asymmetry of positive and negative abnormal returns in the estimation period.

Table: 1

Market Adjusted Returns, Equally Weighted Index

Lanfear, Lioui, and Siebert (2017) using Estimation Window [-311, -129]

	Event Window [-10,-1]	Event Window [-5,-1]	Event Window [-3,-1]	Event Window [-1,0]	Event Window [-1,+1]	Event Window [0,+1]	Event Window [+1,+3]	Event Window [+1,+5]	Event Window [+1,+10]	Event Window [-10,+30]
Mean CAR	0.24%	0.96%*)	1.52%***)))	1.16%***)))	1.04%***)))	0.92%***)))	1.49%***)))	2.50%***)))	-0.25%	6.79%***)))
Median CAR	-0.06%	0.51%	1.04%	1.25%	0.83%	0.72%	1.63%	2.53%	-0.14%	6.51%
Negative CARs	52%	41%	27%>>	14%>>>	16%>>>	23%>>>	7%>>>	2%>>>	55%	25%>>

Table 2: Shareholder Response to Hurricane Matthew: Market Adjusted Model, Value Weighted Returns, for the SPSIINS Index.

The table reports the average cumulative abnormal returns (CARs) for the landfall of Hurricane Matthew on the United States for the **market adjusted model** using **value weighted** returns for all 47 firms in the sample that have data. The event date is identified from the National Oceanic and Atmospheric Administration. The estimation window is 180 days from (-311,-129), as observed in Lanfear, Lioui, and Siebert (2017). Average cumulative abnormal returns (CARs) are reported over the various announcement periods in the table. Median CARs are listed immediately below, followed by the percentage of CARs that are positive are in square brackets. ***, **, and * indicate the mean is significantly different from zero at the 1%, 5%, and 10% level, respectively, using the cross-sectional two-sided t-statistic of Boehmer, Musumeci, and Poulsen (1991).))),)), and) indicate the results of a Wilcoxon rank sum test for differences in the medians, significantly different at the 1%, 5%, and 10% level, respectively. >>>, >>, and > indicate the percentage of positive CARs is significantly different from zero at the 1%, 5%, and 10% level, respectively, using the generalized sign test in Cowan (1992), which controls for the normal asymmetry of positive and negative abnormal returns in the estimation period.

Table: 2 Market Adjusted Returns, Value Weighted Index Lanfear, Lioui, and Siebert (2017) using Estimation Window [-311, -129]										
	Event Window [-10,-1]	Event Window [-5,-1]	Event Window [-3,-1]	Event Window [-1,0]	Event Window [-1,+1]	Event Window [0,+1]	Event Window [+1,+3]	Event Window [+1,+5]	Event Window [+1,+10]	Event Window [-10,+30]
Mean CAR	0.37%	1.0%**)	1.25%***)))	0.76%***)))	0.83%***)))	0.97%***)))	1.33%***)))	1.73%***)))	– 0.85%*	6.77%***)))
Median CAR	0.07%	0.55%	0.77%	0.85%	0.62%	0.77%	1.47%	1.76%	-0.74%	6.49%
Negative CARs	47%	39%	36%>>	25%>>>	16%>>>	23%>>>	11%>>>	9%>>>	59%	25%>>

Table 3: Shareholder Response to Hurricane Matthew: Market Model, Equal Weighted Returns, for the SPSIINS Index.

The table reports the average cumulative abnormal returns (CARs) for the landfall of Hurricane Matthew on the United States for the **market model** using **equally weighted** returns for all 47 firms in the sample that have data. The event date is identified from the National Oceanic and Atmospheric Administration. The estimation window is 180 days from (-311,-129), as observed in Lanfear, Lioui, and Siebert (2017). Average cumulative abnormal returns (CARs) are reported over the various announcement periods in the table. Median CARs are listed immediately below, followed by the percentage of CARs that are positive are in square brackets. ***, **, and * indicate the mean is significantly different from zero at the 1%, 5%, and 10% level, respectively, using the cross-sectional two-sided t-statistic of Boehmer, Musumeci, and Poulsen (1991).))),)), and) indicate the results of a Wilcoxon rank sum test for differences in the medians, significantly different at the 1%, 5%, and 10% level, respectively. >>>, >>, and > indicate the percentage of positive CARs is significantly different from zero at the 1%, 5%, and 10% level, respectively, using the generalized sign test in Cowan (1992), which controls for the normal asymmetry of positive and negative abnormal returns in the estimation period.

Table: 3
Market Model Abnormal Returns, Equally Weighted Index
Lanfear, Lioui, and Siebert (2017) using Estimation Window [-311, -129]

	Event Window [-10,-1]	Event Window [-5,-1]	Event Window [-3,-1]	Event Window [-1,0]	Event Window [-1,+1]	Event Window [0,+1]	Event Window [+1,+3]	Event Window [+1,+5]	Event Window [+1,+10]	Event Window [-10,+30]
Mean CAR	-0.02%	0.95%*	1.41%***)))	0.98%***)))	0.98%***)))	0.92%***)))	1.32%***)))	2.14%***)))	−0.58%*	6.29%***)))
Median CAR	-0.96%	0.40%	0.85%	0.94%	0.75%	0.70%	1.29%	2.29%	-0.56%	5.18%
Negative CARs	59%	43%	34%>>	16%>>>	14%>>>	20%>>>	9%>>>	7%>>>	57%	27%>>

Table 4: Shareholder Response to Hurricane Matthew: Market Model, Value Weighted Returns, for the SPSIINS Index.

The table reports the average cumulative abnormal returns (CARs) for the landfall of Hurricane Matthew on the United States for the **market model** using **value weighted** returns for all 47 firms in the sample that have data. The event date is identified from the National Oceanic and Atmospheric Administration. The estimation window is 180 days from (-311,-129), as observed in Lanfear, Lioui, and Siebert (2017). Average cumulative abnormal returns (CARs) are reported over the various announcement periods in the table. Median CARs are listed immediately below, followed by the percentage of CARs that are positive are in square brackets. ***, **, and * indicate the mean is significantly different from zero at the 1%, 5%, and 10% level, respectively, using the cross-sectional two-sided t-statistic of Boehmer, Musumeci, and Poulsen (1991).))),)), and) indicate the results of a Wilcoxon rank sum test for differences in the medians, significantly different at the 1%, 5%, and 10% level, respectively. >>>, >>, and > indicate the percentage of positive CARs is significantly different from zero at the 1%, 5%, and 10% level, respectively, using the generalized sign test in Cowan (1992), which controls for the normal asymmetry of positive and negative abnormal returns in the estimation period.

Table: 4
Market Model Abnormal Returns, Value Weighted Index
Lanfear, Lioui, and Siebert (2017) using Estimation Window [-311, -129]

	Event Window [-10,-1]	Event Window [-5,-1]	Event Window [-3,-1]	Event Window [-1,0]	Event Window [-1,+1]	Event Window [0,+1]	Event Window [+1,+3]	Event Window [+1,+5]	Event Window [+1,+10]	Event Window [-10,+30]
Mean CAR	0.27%	1.01%*)	1.23%***)))	0.72%***)))	0.83%***)))	0.97%***)))	1.27%***)))	1.64%***)))	-0.92%	6.67%***)))
Median CAR	1.01%	0.45%	0.69%	0.75%	0.56%	0.75%	1.30%	1.61%	-0.80%	5.51%
Negative CARs	52%	43%	36%>	20%>>>	16%>>>	20%>>>	9%>>>	9%>>>	64%<	27%>>

Appendix A
SAS Code for Eventus

```
/****************************************************************************
****************************
  EVENTUS 9.0
   USING PC SAS CONNECT
   ENVIRONMENTAL EVENT STUDY, DAILY RETURNS
****************************************************************************
****************************
   AUTHOR: Dr. Laura Cole, University of Tennessee
   This information was compiled by the author and is provided as a public
service. The author is not
   responsible for any errors or omissions, or for any consequential problems
that might result.
   USE AT YOUR OWN RISK.
****************************************************************************
****************************
   GLS THESIS FOR GREG GILBERT
****************************************************************************
***************************/

/****************************************************************************
****************************
 STEP 1:
   You will need to use PROC IMPORT to transfer your Excel spreadsheet into a
SAS Dataset.
    Set LIBNAME to your local windows directory.
      If working from APPS@UT then you need to assign your H: drive to READ &
WRITE, and then the libname is:
      '\\Client\H$\Documents\ .... '
****************************************************************************
****************************/
libname edata '\\Client\C$\Users\Admin\Documents\Classes\Thesis';

proc import
  datafile = '\\Client\C$\Users\Admin\Documents\Classes\Thesis\Thesis Data'
  dbms = xls
  out = eventus replace;
  *The SAS dataset created is now in your temporary WORK directory.
  *Also, issues with SAS 9.4 and Windows 64, need to use XLS filetype instead
of XLSX.
   You could change this to a local directory.;
run;

/****************************************************************************
****************************
 STEP 2:
   You need to subset and "clean" your SAS dataset and format it for Eventus.
   The general variable order should be:

    PERMNO (or 8-digit CUSIP) EVENTDAT EVENTDAT2 ID GROUP GRPWEIGHT

   In the following datastep, you need to complete the following:
     (1) EVENTDAT & EVENTDAT2 will need to be in the format YYMMDD6.
     (2) DELETE variables other than those above.
     (3) Variables should be in the order above.
```

```
     (4) If either PERMNO (or CUSIP) or EVENTDAT is missing, the observation
needs to be DELETED.

   However, when uploading a SAS dataset the variable names do matter, but
the EVENTDAT format can be
   relaxed.  As of Eventus 9.0, we CAN upload a SAS dataset using PC SAS
Connect.
*****************************************************************************
*****************************/
* This will reorder the variables (not necessary, but makes it easier to
analyze);
data eventus (RENAME= (event2=event));
  retain permno event2;  /*  CHANGE BETWEEN EVENT1 (Hermine) to EVENT 2
(Matthew) */
  set eventus;  *the SAS dataset of the original Excel spreadsheet;
  run;

proc contents data=eventus;
run;

/*  MATTHEW CATEGORY 5 10/07/2016 */
data edata.eventus0 (KEEP = newpermno event RENAME= (newpermno=permno
event=eventdat));
set eventus;
  format event YYMMDD6.;
  newpermno = permno*1;  *Or you can add 0;
run;

proc contents data=edata.eventus0;
run;

/* Let's make sure everything is formatted correctly */

/****************************************************************************
*****************************
*****************************************************************************
*****************************
 STEP 3:
   Run the EVENTUS program through PCSASConnect which allows us to avoid UNIX
programming.  You will be
   prompted for your WRDS username and password.

*****************************************************************************
*****************************
Please consult the EVENTUS manual for specific options.

REQUEST Statement:
  AUTODATE Specifies that a calendar date in the request file that is not a
trading day thus be converted
           to the following trading day.

  EST The absolute value of the argument of EST determines how many trading
periods (days, months, etc.)
      the estimation period is offset from the event date.  The sign of the
argument determines whether the
      estimation period is pre-event or post-event.
```

EST=SPECIFIC selects an estimation period ending on the calendar or trading date specified in the estimation date column of the request file (immediately after the event date in an ASCII request file, e.g. EVENTDAT2), of length ESTLEN.

ESTLEN Specifies the length of the estimation period in trading days, weeks, months, quarters, or years, depending on the return interval being used for estimation in the current run. Default=255.

MINESTN Specifies the minimum number of usable trading days in the estimation period (default=3). Will remove firm if fewer than n days of return data.

WINDOWS Statement:
For a single event date event study, use WINDOWS to list up to 200 event windows for which cumulative/ compounded abnormal returns and test statistics are to be reported on the output. The earliest and latest possible dates are determined by the value of the PRE and POST options respectively.

If WINDOWS statement is omitted, Eventus reports 3 windows: (-PRE, -2), (-1,0), (+1, +POST)

EVTSTUDY Statement:
PRE Specifies the number of trading days or months immediately preceding the event date for which to compute abnormal returns.

POST Specifies the number of trading days or months immediately following the event date for which to compute abnormal returns.

MAR Market-adjusted returns benchmark method. The default is not to compute MAR.

MM Market-model benchmark method. This is the default (because it's the most popular method used in the literature).

STACK Selects an alternative event study report format in which medians are printed below means and numeric p-values are printed below test statistics.

VALUE|BOTH By default, Eventus uses only equally weighted market index returns in MM and MAR. Specify VALUE to change to value weighted index or BOTH to produce separate event studies using both indexes.

Statistical Tests (PATELL and GENSIGN are default):

PATELL Specifies the Patell (1976) test. The Patell Z test is an example of a standardized abnormal

```
          return approach, which estimates a separate standard error for each
security-event and assumes
          cross-sectional independence.

  GENSIGN  The generalized sign test is a nonparametric test that adjusts the
fraction of positive
           abnormal returns in the estimation period instead of assuming 0.5.
The null hypothesis
           for this test is that the fraction of positive returns is the same
as in the estimation
           period.

  STDCSECT  Specifies the standardized cross-sectional test (Boehmer,
Musumeci, and Poulsen 1991).

  WSR  The Wilcoxon signed-rank test for medians.

  TAIL=1|2  Specifies the significance levels of the reported test statistics
is based on 1 or 2-tailed
            tests.  The default is TAIL=1.
*****************************************************************************
*****************************/
%let wrds=wrds.wharton.upenn.edu 4016;
options comamid=TCP remote=WRDS;
signon username="lscole" password="UTKwrds13";

libname edata '\\Client\C$\Users\Admin\Documents\Classes\Thesis';

rsubmit;
options fullstimer ps=60;
libname mywrds '/home/utk/lscole';

proc upload data=edata.eventus0 out=mywrds.eventus0;

eventus;
  title  'MATTTHEW CATEGORY 5 10/07/2016';
request insas=mywrds.eventus0 autodate est=-129 estlen=180 minestn=3 ;
windows (-10,-1) (-5,-1) (-3,-1) (-1,0) (-1,1) (0,1) (1,3) (1,5) (1,10) (-
10,30);
evtstudy noplist pre=10 post=30 mm mar both stack stdcsect patell wsr gensign
tail=2 outwin=mywrds.results0;
run;

proc download data=mywrds.results0 out=edata.results0;
run;
```

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