Web Appendix

For "Do Managers Overreact to Salient Risks? Evidence from Hurricane Strikes"

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In this appendix, we present some complementary results that are mentioned in the paper but, for brevity, are not reported there. We also provide further details about the methodology used to implement our matching approach in section 5.4 and to perform the event study presented in section 7.1.1. The structure of this appendix follows the structure of the paper.

A. Matching approach (Mentioned in Section 5.4)

We use a kernel matching approach similar to the one proposed by Heckmann, Ichimura and Todd (1998) where the matched outcome for each treated firm is a weighted average of the effects observed on several non-treated firms. In this approach, the weights are chosen so that the observations closer in terms of distance receive greater weight. In practice, we match each treated firm (neighborhood area) with all the control firms (rest of US mainland) from the same industry (SIC3) 6 months before the occurrence of the hurricane (i.e., time q-3). For each treated firm, we then compute the Mahalanobis distance to all matched firms along seven dimensions: size, age, market-to-book, financial leverage, working capital requirement, dividend and capital expenditures. The weight assigned to each matched firm is then given by

$$w_{i,j} = \frac{K\left(\frac{d_{i,j}}{h}\right)}{\sum_{k=1}^{k=n} K\left(\frac{d_{i,k}}{h}\right)}$$

where i indexes the treated firm, j indexes the matched firm, n_i is the number of firms matched to i, $d_{i,j}$ is the Mahalanobis distance between i and j, $K(.)$ is the Gaussian density function and h is a bandwidth parameter. For each treated firm i, we follow Todd (1999) and simply set the bandwidth equal to the distance to the nearest matched j. This methodology allows us to use a smaller bandwidth when the treated firm has more matched firms in its local neighborhood. The matched outcome is then the weighted average of the change in cash observed for all matched firms (i.e., control firms from the same SIC3 industry). The results of this analysis are reported in Table A.

B. Event Study Methodology (mentioned in section 7.1.1)

The event window is defined as [$BOH_{c,h}$-1 ; $EOH_{c,h}$+1], where c indexes county and h hurricane and where BOH (EOH) is the beginning (end) of the hazard date reported in the SHELDUS database. By definition, firms assigned to the Treatment or Control groups are not located in a county reported by SHELDUS. In this case, the event window is defined as [$Min(BOH_h)$-1 ; $Max(EOH_h)$+1], where $Min(BOH_h)$ ($Max(EOH_h)$) is the minimum (maximum) of the beginning (end) of hazard dates reported in the SHELDUS database for hurricane h. Because the events we are looking at overlap in time, we cannot assume the independence between the variances of security abnormal returns. To address this issue, we form an equally weighted portfolio whenever the event windows perfectly overlap. For firms assigned to the neighbor and control groups, we obtain 15 portfolios because there are 15 hurricanes (and thus 15 different event windows). We obtain 74 portfolios for firms assigned to the disaster zone category (instead of 15) because none of the affected counties are affected at the same time by the same hurricane. While some are affected on Monday, others can be affected on Tuesday and Wednesday as the hurricane moves across land.

For each portfolio p, the average abnormal return over the event window is then estimated as the parameter AR_p in the equally weighted market model (see Betton, Eckbo, Thorburn (2008))

$$r_{p,t} = \alpha_j + \beta_p rm_t + AR_p w_t + \epsilon_{p,t}, \quad \text{with } t = \text{day}\{BOH_p - 201; EOH_p + 1\}$$

where r_{jt} is the return to portfolio p over day t, rm_t is the crsp equally weighted market return, and w_t is a dummy variable that takes a value of one if day t is in the event window and zero otherwise. This

conditional event parameter approach allows us to easily incorporate variable-length event windows across portfolios, and it directly produces an estimate of the standard error of the Abnormal Return *AR*. To be included in the portfolio, a security must have at least 150 non-missing and non-zero returns over the estimation period (200 days) and no missing return over the event window. The cumulative abnormal return (CAR) to portfolio *p* over event window *w* is

$$\mathrm{CAR_p} = \mathrm{w_p AR_p}$$

where w_p is the number of trading days in the event window. For each group, the average CAR is

$$\mathrm{ACAR} = \left(\frac{1}{\mathrm{N}}\right)\sum_{\mathrm{p=1}}^{\mathrm{T}} \mathrm{n_p CAR_p}$$

where *N* is the total number of securities, n_p is the total number of securities in portfolio *p*, and *T* is the total number of equally weighted portfolios. Because the event windows do not overlap between portfolios, we can assume that the variances of the portfolio abnormal returns are independent. For each category, the variance of the average abnormal return is

$$\mathrm{V(ACAR)} = \left(\frac{1}{\mathrm{N^2}}\right)\sum_{\mathrm{p=1}}^{\mathrm{T}} \mathrm{n_p^2 w_p^{^2} \sigma_{AR_p}^2}$$

where σ_{ARp} is the estimated standard error of AR_p. The z-values are determined as

$$\mathrm{z} = \frac{\mathrm{ACAR}}{\sqrt{\mathrm{V(ACAR)}}}$$

C. Effects of hurricane proximity on Revenues (mentioned in section 7.1.1)

We study the difference in sales growth between treated and control firms at different points in time before and after the hurricane landfall using a specification similar to the one used in Table 4, where the dependent variable is *Sales growth*. The results are reported in Table B

D. Effects of hurricane proximity on Bank Loans (mentioned in section 7.1.3)

We examine the effect of hurricane proximity on Commercial and Industrial Loans (C&I Loans) at the bank level using the data from the FDIC database. This database provides "Reports of Income and Condition" (Call Reports) that include detailed quarterly financial and regulatory bank data for all commercial and domestic banks in the U.S. We include all banks in our sample provided that standard viability conditions of the bank are respected. [1] The outcome variable we are interested in is the amount of new commercial loans at the bank level. This variable corresponds to the change in commercial and industrial loans (RCON1766) relative to the previous quarter scaled by total assets (RCFD2170). We then use the same difference-in-differences methodology as that used to measure how the proximity of the hurricane affects cash holdings over time. The results are reported in Table C.

E. Hurricane proximity and Asset Insurability (mentioned in section 7.1.3)

We investigate how managers' response to hurricane proximity changes when the business operated by the company is less dependent on external insurance. We use the share of total assets, which are intangible assets, to identify when the business of the firm is more likely to be self-insured. Firms are identified as more likely to be self-insured if this share is in the top tercile of the distribution. We define a dummy variable *Self-Insurance* that is equal to one if the firm is more likely to be self-insured and zero if not. We then interact this variable with the *Neighbor* variable to study how the response to the salience of hurricane risk varies when firms are more likely to self-insure. The results of this analysis are reported in Table D.

F. Reaction to extreme earthquakes outside the US (mentioned in section 7.4)

We focus on the largest earthquakes of the past 30 years according to the magnitude, total deaths, and total damages descriptions. These selection criteria lead to the list of major non-US earthquakes described in Table E, Panel A. We then estimate the average change in cash holdings for the seismic zone group around the announcement of the earthquake outside the US using exactly the

[1] To be included in our sample, banks must have non-zero or negative equity, total assets above 25 million dollars, consumer loans representing less than 50% of total assets, more than two years of existence, and non-missing values on the commercial and industrial loans variable.

same matching methodology as that already used for the hurricanes. The results of this analysis are reported in Table E, Panel B.

Web Appendix - Table A

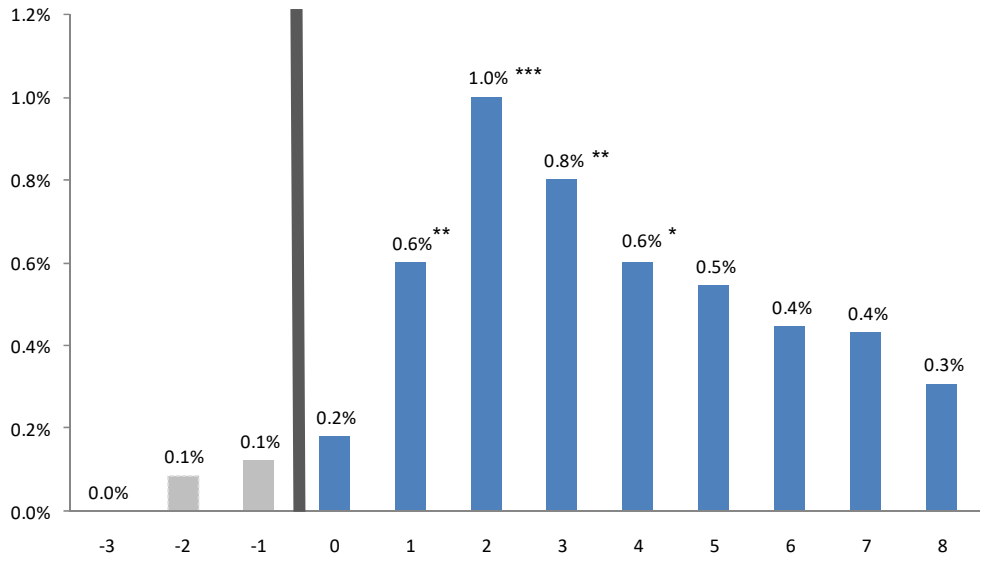
Effects of Hurricane Proximity on Corporate Cash holdings (Matching Approach)

Panel A presents changes in corporate cash holdings over time caused by the proximity of a hurricane occurring at quarter *q0*. The sample comprises 2,060 treated firm*s* whose headquarters are located in the neighborhood of an area hit by a hurricane during quarter *q0* ("Neighbor firms"). For each treated firm, the counterfactual outcome is the weighted average of the change in cash over all control firms with the same SIC 3 code ("Matched firm"). The weighting is achieved through a kernel function so that the control firms that are closer in terms of the Mahalanobis distance to the treated firm receive greater weight. The Mahalanobis distance is computed six months before the hurricane landfall at quarter q-3 along seven dimensions: size, age, market-to-book, financial leverage, capital expenditures and net working capital. *t*-statistics are reported in the last column. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively. Panel B plots the results in a graph.

Panel A

Average change in cash from q-3 to	**Neighbor firms**	**Matched firms**	**Diff-in-diffs**	***t*-statistic**
q-2	-0.5%	-0.6%	0.1%	0.51
q-1	-0.7%	-0.8%	0.1%	0.55
q0	-0.6%	-0.8%	0.2%	0.69
q+1	0.0%	-0.6%	0.6%**	1.96
q+2	0.4%	-0.6%	1.0%***	2.97
q+3	0.1%	-0.7%	0.8%**	2.38
q+4	-0.3%	-0.9%	0.6%*	1.71
q+5	-0.1%	-0.6%	0.5%	1.47
q+6	-0.5%	-0.9%	0.4%	1.18
q+7	-0.7%	-1.1%	0.4%	1.12
q+8	-0.9%	-1.2%	0.3%	0.79

Panel B



Web Appendix - Table B

Hurricane Proximity and Sales Growth

This table presents difference-in-differences estimates of the effect of the proximity of a hurricane strike on the growth in revenues at different quarters around the occurrence of the hurricane. *Sales growth* is the growth in revenues relative to the same quarter of the previous year. *Neighbor_q+i* is a dummy equal to one if the county location of the bank headquarters at quarter *q+i* is in the neighborhood of an area hit by a hurricane during quarter *q0*. *Disaster_zone_q+i* is a dummy equal to one if the county location of the bank headquarters at quarter *q+i* is in the area hit by a hurricane during quarter *q0.* Standard errors are corrected for clustering of the observations at the county level. *t*-stat are reported between parentheses. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Dependent Variable : Sales Growth (in percentage points)		
	coef.	t-stat
Neighbor_q-4	0.25	(0.18)
Neighbor_q-3	-0.06	(-0.04)
Neighbor_q-2	2.09	(1.44)
Neighbor_q-1	0.64	(0.36)
Neighbor_q0	1.52	(0.99)
Neighbor_q+1	1.1	(0.59)
Neighbor_q+2	1.88	(0.97)
Neighbor_q+3	2.75	(1.52)
Neighbor_q+4	1.41	(0.88)
Neighbor_q+5	2.31	(1.26)
Neighbor_q+6	1.57	(1.25)
Neighbor_q+7	1.42	(0.79)
Neighbor_q+8	1.84	(1.11)
Disaster Zone_q-4	0.84	(0.51)
Disaster Zone_q-3	1.13	(0.59)
Disaster Zone_q-2	3.82	(1.54)
Disaster Zone_q-1	3.49	(1.34)
Disaster Zone_q0	1.39	(0.56)
Disaster Zone_q+1	-1.19	(-0.66)
Disaster Zone_q+2	-4.89***	(-2.57)
Disaster Zone_q+3	-4.49**	(-2.33)
Disaster Zone_q+4	-2.11	(-0.95)
Disaster Zone_q+5	-2.57	(-1.41)
Disaster Zone_q+6	-0.96	(-0.60)
Disaster Zone_q+7	-0.69	(-0.47)
Disaster Zone_q+8	0.26	(0.15)
Firm Fixed Effects	Yes	
Time Fixed Effects	Yes	
N	411,490	

Web Appendix - Table C

Hurricane Proximity and Bank Loans

This table presents difference-in-differences estimates of the effect of the proximity of a hurricane strike on the amount of new commercial and industrial loans of the bank at different quarters around the occurrence of the hurricane. *ΔC&I Loans* is the amount of new commercial and industrial loans granted during the quarter at the bank level expressed in percentage points of the total assets at the end of the quarter. *Neighbor_q+i* is a dummy equal to one if the county location of the bank headquarters at quarter *q+i* is in the neighborhood of an area hit by a hurricane during quarter *q0*. *Disaster_zone_q+i* is a dummy equal to one if the county location of the bank headquarters at quarter *q+i* is in the area hit by a hurricane during quarter *q0*. Standard errors are corrected for clustering of the observations at the county level. *t*-stat are reported between parentheses. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: ΔC&I Loans / Assets (in percentage points)		
	Coefficient	t-stat
Neighbor_q-4	-0.02	(-0.74)
Neighbor_q-3	0.00	(-0.07)
Neighbor_q-2	0.02	(0.90)
Neighbor_q-1	0.00	(-0.20)
Neighbor_q0	-0.01	(-0.68)
Neighbor_q+1	0.00	(0.05)
Neighbor_q+2	0.04*	(1.93)
Neighbor_q+3	0.00	(-0.20)
Neighbor_q+4	-0.01	(-0.53)
Neighbor_q+5	0.00	(-0.15)
Neighbor_q+6	0.00	(-0.01)
Neighbor_q+7	-0.01	(-0.48)
Neighbor_q+8	-0.04	(-1.60)
Disaster zone_q-4	0.00	(0.01)
Disaster zone_q-3	-0.01	(-0.19)
Disaster zone_q-2	0.02	(0.78)
Disaster zone_q-1	-0.01	(-0.51)
Disaster zone_q0	0.02	(0.68)
Disaster zone_q+1	0.03	(1.26)
Disaster zone_q+2	0.03	(0.88)
Disaster zone_q+3	0.06**	(2.30)
Disaster zone_q+4	0.09***	(3.11)
Disaster zone_q+5	0.05**	(2.07)
Disaster zone_q+6	0.01	(0.47)
Disaster zone_q+7	0.03	(1.24)
Disaster zone_q+8	0.00	(-0.16)
Bank Fixed Effects	Yes	
Time Fixed Effects	Yes	
N	787,595	

Web Appendix - Table D

Hurricane Proximity and Asset Insurability

This table presents difference-in-differences estimates of the effect of the proximity of a hurricane strike on the level of corporate cash holdings conditional on the dependence on external insurance. *Cash* is the total amount of cash and cash equivalents scaled by the total assets of the firm at the end of the quarter. We use the share of total assets, which are intangible assets, to identify when firms are more likely to self-insure and less likely to rely on external insurance companies. *Self-Insurance* is a dummy equal to one if the share of total assets, which are intangible assets, is in the top tercile of the distribution. *Neighbor* is a dummy equal to one if the county location of the firm headquarters is in the neighborhood of an area hit by a hurricane over the past 12 months. *Disaster_zone* is a dummy equal to one if the county location of the firm headquarters is in the area hit by a hurricane over the past 12 months. Note that the dummy *Self Insurance* is omitted from the regression because it is already fully interacted with the firm and time fixed effects. Standard errors are corrected for clustering of the observations at the county level. t-stat are reported between parentheses. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Dependent variable: Cash / Assets (in percentage points)	
	[1]
Neighbor x Self-Insurance	0.86*
	(1.67)
Neighbor	0.40**
	(1.97)
Disaster zone	-0.27
	(-1.37)
Firm-Season Fixed Effects (Interacted)	Yes
Time Fixed Effects (Interacted)	Yes
N	392,734

Web Appendix - Table E

Effects of Earthquakes outside the US on Corporate Cash holdings of US Firms

Panel A describes the 11 major earthquakes occurring outside the US since 1980. See the text for details on the selection criteria. *Magnitude* measures the energy contained in an earthquake according to the Richter scale, *Tsunami* is a dummy equal to one if the earthquake generated a Tsunami, *Fatalities* is the total number of deaths, and *Damages* is the estimated value of total damages expressed in billion dollars. *Damages (CPI adjusted)* is the estimated value of total damages expressed in billion dollars adjusted for the Consumption Price Index as of 2011. The primary source of information is the Significant Earthquake Database from the National Geophysical Data Center. Panel B presents changes in corporate cash holdings over time for US firms located in a seismic area after the occurrence of a major earthquake outside the US at quarter *q0*. The sample comprises 1,191 distinct treated firm*s* whose headquarters are located in an urban community where an earthquake is frequently felt according to U.S. Geological surveys ("Seismic zone firms"). For each treated firm, the counterfactual outcome is the weighted average of the change in cash over all control firms with the same SIC 3 code ("Matched firm"). The weighting is achieved through a kernel function so that the control firms that are closer in terms of the Mahalanobis distance to the treated firm receive greater weight. The Mahalanobis distance is computed at quarter *q-2* (i.e., three months before the earthquake occurrence) along four dimensions: size, age, market-to-book, and financial leverage. *t*-statistics are reported in the last column. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel A - Major Earthquakes outside the US since 1980

Country	Year	Date	Magnitude	Tsunami	Fatalities	Damages	Damages (CPI adjusted)
Mexico	1985	9/19/1985	7.5	Yes	9,500	4,000	8,362
Iran	1990	6/20/1990	7.1	No	40,000	8,000	13,768
Turkey	1999	8/17/1999	7.2	Yes	17,118	20,000	27,003
Taiwan	1999	9/20/1999	7.3	No	2,297	14,000	18,902
India	2001	1/26/2001	7.5	No	20,005	2,623	3,332
Indonesia	2004	12/26/2004	8.3	Yes	227,898	10,000	11,908
Pakistan	2005	10/8/2005	7.4	No	80,361	5,200	5,989
China	2008	5/12/2008	7.6	Yes	87,652	121,000	126,415
Indonesia	2009	9/30/2009	7.3	Yes	1,117	2,200	2,307
Haiti	2010	1/12/2010	7.0	Yes	222,570	8,000	8,253
Japan	2011	3/11/2011	8.2	Yes	15,854	210,000	210,000

Panel B - Effects of Earthquakes outside the US on Corporate Cash holdings of US Firms

Average change in cash from q-2 to	Seismic zone firms	Matched firms	Diff-in-diffs	*t* -statistic
q-1	-0.63%	-0.68%	0.05%	0.30
q0	-0.73%	-1.05%	0.32%	1.62
q+1	-0.74%	-1.20%	0.46%**	2.03
q+2	-0.49%	-1.09%	0.59%**	2.35
q+3	-0.70%	-1.24%	0.54%**	1.97
q+4	-0.77%	-1.25%	0.48%*	1.68
q+5	-0.83%	-1.22%	0.39%	1.36