NOT FOR PUBLICATION

ONLINE APPENDICES

Household Financial Decision-Making After Natural Disasters: Evidence from Hurricane Harvey

A. Data Appendix

Timing

Hurricane Harvey's warning was issued on August 23, 2017. Harvey made landfall on August 25, with substantial rainfall continuing in the Houston area until August 29. Credit card spending and payment during the late-August period would appear in the September billing cycle. About 97 percent of borrowers' mortgage payments are due on the first of the month, so most households would already have made their August payments by the time the storm hit. For these reasons, we define September 2017 as the first post-storm month.

Data screening.

We exclude cards for which flooding data or the ZIP+4 is unavailable. Additionally, we exclude cards for which we have incomplete data (missing months), or for which the pattern of reported promotional APRs is inconsistent with typical card offers and may reflect borrower negotiations or reporting errors. (For example, if the card enters and exits promotional status several times over a short period of time.)

Because we found that the accounting identities allowing us to infer the borrower's revolving balance are occasionally inconsistent for the first two months of data (both for existing cards recently purchased by a bank and for new originations), we exclude the first two observations of data from our analysis of financial outcomes. The weighted sample includes about 85 million card-months and 3.3 million unique cards. Table A16 shows the role of each of these filters in our final sample of existing cards.

Promotional status

Banks are required to report the promotional status and promotional APR only for cards where the borrower has a balance on the card at the end of the billing cycle (the balance can be nonrevolving; carrying a balance indicates only that the card was used during the billing period). We infer that a card has been originated with a teaser rate if the card is observed to carry a promotional rate within the first 12 months of origination. About 95 percent of the cards we classify as promotional cards show an interest rate of 0 percent during the months they are under promotion.

B. Supplemental Figures and Tables

FIGURE A1
Evolution of credit card offers

Note: This figure shows the number of credit card offers per ZIP code (scaled by ZIP code population/10,000) in the Mintel survey. Mintel is a household survey of promotional mail. In the survey, the count of credit card offers in the Atlanta and Houston areas averaged about 20 per month from 2016 to 2019. The dashed line corresponds to August 2017, when Harvey was announced and made landfall.

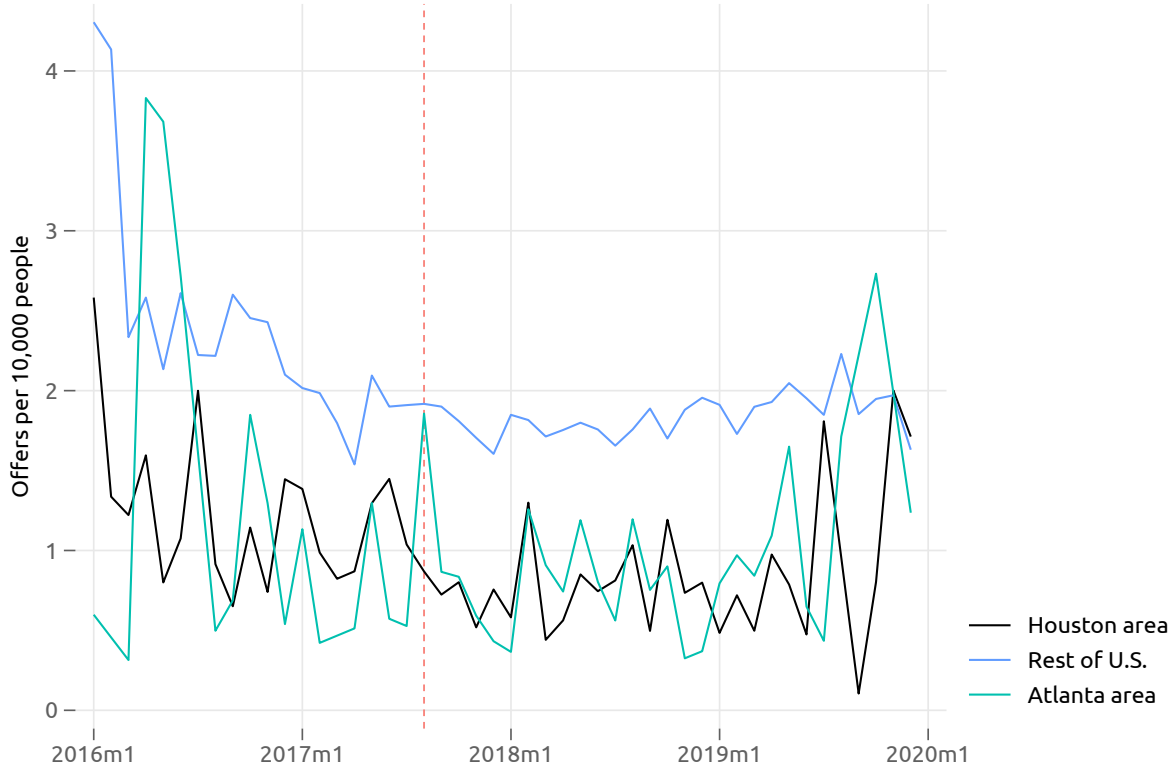
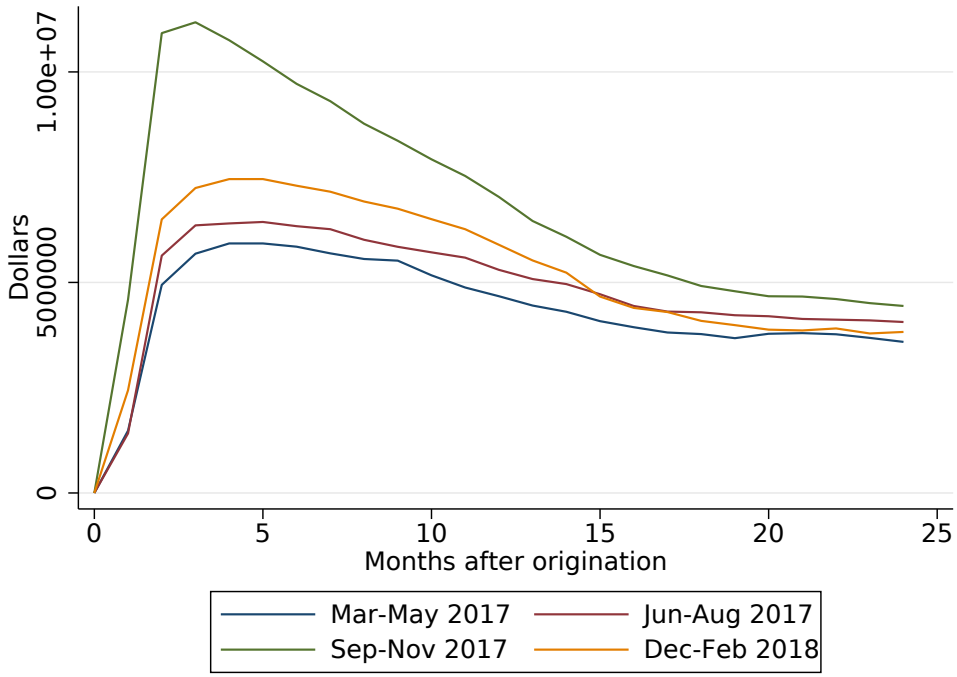


FIGURE A2

Revolving balances and fees on promotional cards by origination cohort

Note: These figures plot the aggregate revolving balance and aggregate cumulative fees by three-month cohort of origination for promotional cards in areas that experienced over 1 foot of flooding.

(A) **Revolving Balance**



(B) **Cumulative fees**

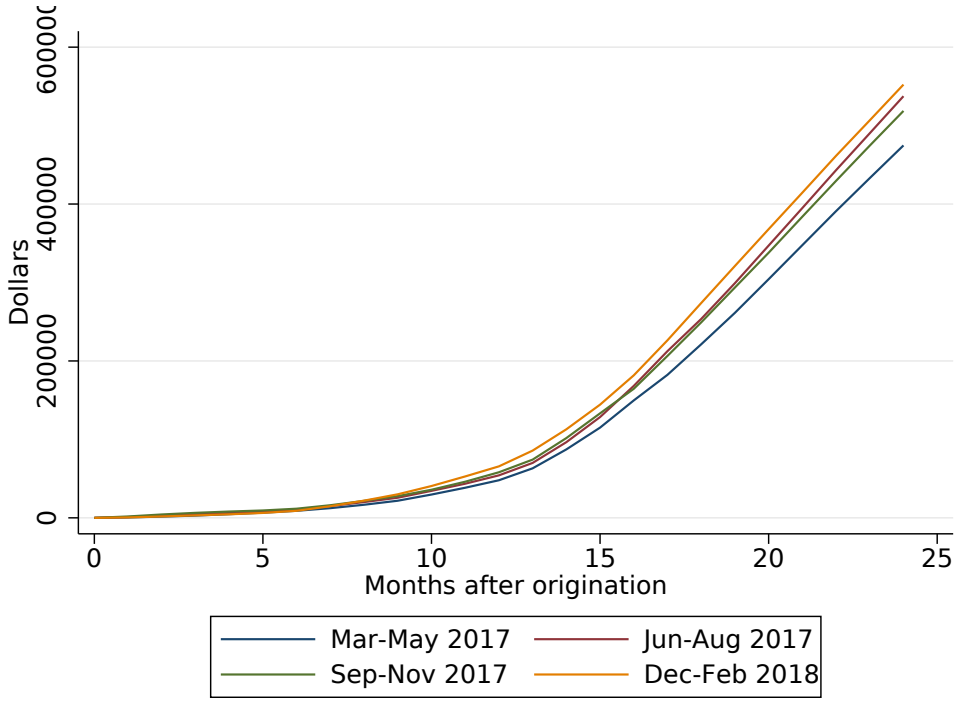


FIGURE A3

6-month change in credit score following new mortgage delinquency

Note: This figure shows the six-month change in the borrower's credit score following a new mortgage delinquency by level of flooding intensity. The dashed line corresponds to August 2017, when Harvey was announced and made landfall.

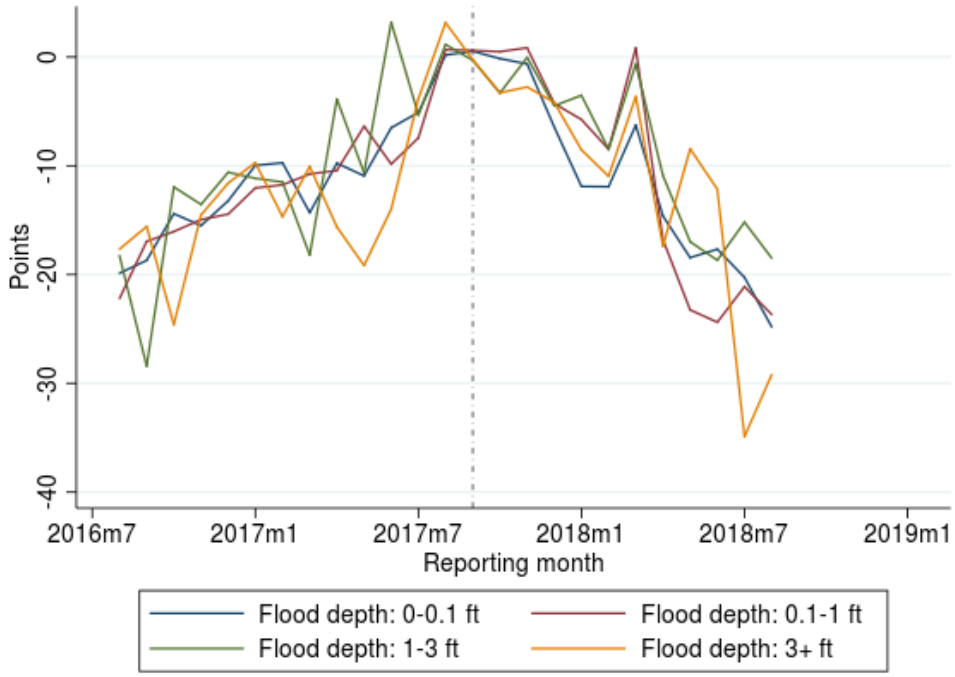


FIGURE A4
Average delinquency for storm-induced new delinquencies

Note: This figure shows by level of flooding intensity the average number of missed payments among borrowers who became delinquent in September through November 2017 *minus* the average number of missed payments among borrowers who became delinquent during the same calendar months in non-storm years (2016, 2018, and 2019).

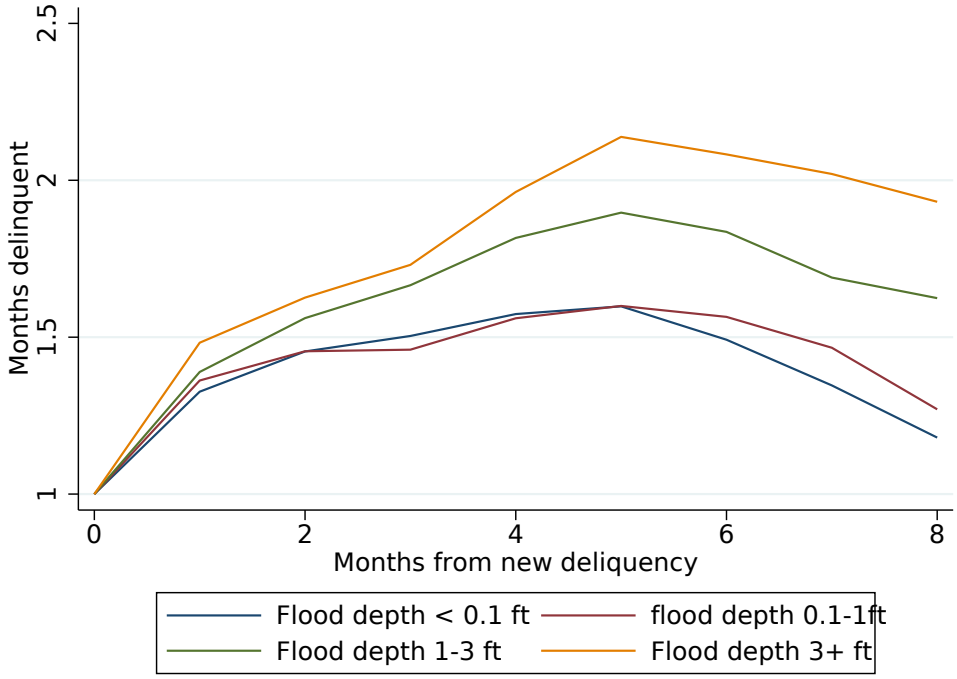


TABLE A1
Summary statistics: Active cards

Note: This table shows summary statistics for all card-months in the sample. All values are nominal dollars. Counts are unweighted and reflect unique card-months in the data. Means and distributions reflect our sampling framework. The description of the weights and the variable definitions can be found in subsection II.B.1 .

	N (thousands)	Mean	Median	Std. Dev	1st percentile	99th percentile
	1	2	3	4	5	6
CHARGES ($)	17,521	383	23	1,633	0	5,361
PAYMENTS ($)	17,521	412	90	1,719	0	5,750
REVOLVING_BALANCE ($)	17,521	1,577	400	3,131	0	15,444
DELINQUENCY(30+ DAYS)	17,521	.045	0	.207	0	1
UPDATED_CREDIT_SCORE	16,883	696	700	92	464	862
CURRENT_CREDIT_LIMIT ($)	17,520	5,721	3,000	7,004	200	30,000
HOUSEHOLD_INCOME ($1,000)	17,392	75	68	38	22	213
SHARE_IN_FLOOD_PLAIN	16,601	.082	0	.274	0	1
FLOOD_DEPTH (FT)	16,968	.2	0	.7	0	3.6
SHARE_WITH_INSURANCE	17,521	.182	.142	.142	.015	.706

TABLE A2
Means by flooding intensity, 3 months before Hurricane Harvey (June-August 2017)

Note: This table shows summary statistics for all card-months in the sample during the 3 months before the storm, broken out by category of observed flooding intensity. All values are nominal dollars. Counts are unweighted and reflect unique card-months in the data. Means and distributions reflect our sampling framework. The description of the weights and the variable definitions can be found in subsection II.B.1 .

	Flood depth			
	Less than 0.1ft	0.1 to 1 ft	1 to 3 ft	More than 3 ft
	1	2	3	4
CHARGES ($)	370	408	420	462
PAYMENTS ($)	398	438	449	496
REVOLVING_BALANCE ($)	1,726	1,600	1,566	1,661
DELINQUENCY(30+ DAYS)	.069	.066	.066	.067
UPDATED_CREDIT_SCORE	690	696	697	699
CURRENT_CREDIT_LIMIT ($)	5,598	5,910	5,946	6,312
HOUSEHOLD_INCOME ($1,000)	66	64	66	71
FLOOD_PLAIN	.046	.305	.408	.435
FLOOD_DEPTH (FT)	0	.4	1.8	4.7
SHARE_WITH_INSURANCE	.169	.263	.271	.267
CARD-MONTHS_(THOUSANDS)	6,595	444	314	129
UNIQUE_9-DIGIT_ZIP_CODES	88,658	17,567	12,145	5,680

TABLE A3
Summary statistics: Mortgages

Note: This table shows summary statistics for mortgages. All values are nominal dollars. The definition of variables can be found in subsection II.B.2.

	N (thousands)	Mean	Median	Std. Dev	1st percentile	99th percentile
	1	2	3	4	5	6
MONTHLY_PAYMENT ($)	17,536	945	732	749	0	4,410
PRINCIPAL_BALANCE ($1,000)	17,536	141.1	102.0	145.7	0	848.7
PROPERTY_VALUE ($1,000)	17,316	289.5	205.0	272.6	72.7	1,648.9
DELINQUENCY (30+ DAYS)	17,853	.07	0	.255	0	1
UPDATED_CREDIT_SCORE	17,036	724	749	91	479	479
HOUSEHOLD_INCOME ($1,000)	17,708	87	77	43	25	250
FLOOD_PLAIN	16,284	.07	0	.255	0	1
FLOOD_DEPTH (FT)	17,446	.2	0	.7	0	3.5
SHARE_WITH_INSURANCE	17,863	.203	.157	.158	.023	.778
ELEVATED (BUILT_AFTER_1985)	17,111	.564	1	.496	0	1

Table A4
Means by flood depth, 3 months before storm (May-July 2017)

Note: This table shows summary statistics for mortgages in the sample during the 3 months before the storm, broken out by category of observed flooding intensity. All values are nominal dollars. Definition of variables can be found in subsection II.B.2.

	Flood depth			
	Less than 0.1ft	0.1 to 1 ft	1 to 3 ft	More than 3 ft
	1	2	3	4
MONTHLY_PAYMENT ($)	903	1,061	1,077	1,166
PRINCIPAL_BALANCE ($1,000)	134.6	159.5	162.9	175.8
PROPERTY_VALUE ($1,000)	274.9	336.3	348.3	384.6
DELINQUENCY (30+ DAYS)	.064	.057	.061	.058
UPDATED_CREDIT_SCORE	721	728	727	732
HOUSEHOLD_INCOME ($1,000)	86	94	95	94
FLOOD_PLAIN	.039	.269	.381	.408
FLOOD_DEPTH (FT)	0	.4	1.8	4.6
SHARE_WITH_INSURANCE	.189	.321	.312	.315
BUILT_AFTER_1985	.57	.489	.474	.416
MORTGAGES	306,748	19,433	13,482	5,382
UNIQUE_9-DIGIT_ZIP_CODES	128,440	8,403	5,999	2,589

Table A5
Revolving balances on promotional card originations

Note: This table presents estimates from three separate OLS regressions of specification (1) where the dependent variable is the balance on originations of promotional credit cards 2, 4, or 6 months after origination. The time period in the far-left column reflects the origination period of the credit card. So, for example, the coefficient in row 1 of column 1 indicates the difference in the average balance at 2 months for cards originated in the 3 months after the storm relative to the balance at 2 months for cards originated immediately before the storm. The depth variable measures the average ZIP+4 level of flooding created by Harvey in feet. All regressions include ZIP+4 and month-year fixed effects. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Definitions of dependent variables can be found in subsection II.B.1 .

	2 months after origination	4 months after origination	6 months after origination
	1	2	3
1-3 MTHS_POST X DEPTH	221.0***	131.2***	87.21***
	(21.69)	(19.94)	(18.47)
4-6 MTHS_POST X DEPTH	117.4***	111.0***	83.37***
	(20.68)	(21.77)	(21.06)
7-9 MTHS_POST X DEPTH	36.05*	11.00	-12.54
	(18.15)	(19.06)	(16.73)
10-12 MTHS_POST X DEPTH	12.80	4.472	3.704
	(16.47)	(17.30)	(17.13)
N	934039	934123	931948

Table A6
Revolving balances on standard card originations

Note: This table presents estimates from three separate OLS regressions of specification (1) where the dependent variable is the balance on originations of promotional credit cards 2, 4, or 6 months after origination. The time period in the far-left column reflects the origination period of the credit card. So, for example, the coefficient in row 1 of column 1 indicates the difference in the average balance at 2 months for cards originated in the 3 months after the storm relative to the balance at 2 months for cards originated immediately before the storm. The depth variable measures the average ZIP+4 level of flooding created by Harvey in feet. All regressions include ZIP+4 and month-year fixed effects. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Definitions of dependent variables can be found in subsection II.B.1 .

	2 months after origination	4 months after origination	6 months after origination
	1	2	3
1-3 MTHS_POST X DEPTH	4.719	-7.499*	-10.99
	(3.174)	(3.729)	(5.723)
4-6 MTHS_POST X DEPTH	4.381	2.971	-2.595
	(3.623)	(5.359)	(5.285)
7-9 MTHS_POST X DEPTH	11.96*	14.25*	8.070
	(5.776)	(6.641)	(7.129)
10-12 MTHS_POST X DEPTH	1.375	8.026	6.691
	(3.170)	(5.883)	(6.505)
N	1275000	1272457	1270900

TABLE A7

Storm-induced response on active cards by floodplain status

Note: This table presents estimates from four separate OLS regressions (for charges, payments, revolving balances, and delinquency, respectively) that interact the specification described in equation (1) with the indicator variable equal to one if the borrower had a revolving balance in July 2017. The depth variable measures the average ZIP+4 level of flooding created by Harvey in feet. This specification also includes an interaction with a floodplain indicator, equal to 1 if the mailing address ZIP+4 is located in a floodplain (variable FP). Because floodplain designation is highly colinear with income, this specification also includes interactions of household income with flood depth and flood depth x post period. All regressions include credit line and month-year fixed effects. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Subsection II.B.1 provides definitions of all variables and describes the weights used.

	Charges	Payments	Revolving balance	New 30+ day delinquency (ppt)
	1	2	3	4
1-3 MTHS_POST X DEPTH X FLOODPLAIN	-36.407***	-29.086**	5.126	0.001
	(9.864)	(9.174)	(3.916)	(0.010)
4-6 MTHS_POST X DEPTH X FLOODPLAIN	-19.869	-25.043	9.898	0.006
	(23.475)	(24.402)	(5.421)	(0.012)
7-9 MTHS_POST X DEPTH X FLOODPLAIN	-21.444	-23.718	16.432*	0.018
	(14.507)	(14.692)	(6.463)	(0.011)
10-12 MTHS_POST X DEPTH X FLOODPLAIN	-9.189	-15.232	13.929	0.019
	(14.522)	(15.257)	(7.727)	(0.016)
1-3 MTHS_POST X DEPTH X FP X REVOLVES	27.450**	23.953*	-3.384	-0.005
	(9.887)	(9.320)	(5.987)	(0.034)
4-6 MTHS_POST X DEPTH X FP X REVOLVES	11.894	14.447	1.163	-0.040
	(22.798)	(23.687)	(8.730)	(0.035)
7-9 MTHS_POST X DEPTH X FP X REVOLVES	15.666	17.596	-7.370	-0.056
	(14.340)	(14.602)	(10.581)	(0.033)
10-12 MTHS_POST X DEPTH X FP X REVOLVES	7.455	14.009	-3.349	-0.056
	(14.459)	(15.269)	(12.030)	(0.039)
N	14579252	14579252	14579252	13489068
R^2	0.634	0.565	0.810	0.119

Table A8
Storm-induced response on active cards by initial insurance penetration

Note: This table presents the results from four separate regressions of augmented versions of specification (1) where we include an interaction with an indicator for high insurance (HIGH INS). This indicator variable is equal to 1 if the mailing address ZIP+4 is located in a census tract with above-median insurance coverage. Because insurance is highly colinear with income, this specification also includes interactions of household income with flood depth and flood depth x post period. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The sample for credit card originations and revolving balances after origination includes all originations between January 2016 and August 2018 for borrowers with mailing addresses in Harris, Aransas, Nueces, and San Patricio counties in Texas at the time of Hurricane Harvey. Definitions of dependent variables can be found in subsections II.B.1 and II.B.2.

	Promotional card originations (logit)	Revolving balance 2 months	Revolving balance 4 months	Mortgage nonpayment
	1	2	3	4
1-3 MTHS_POST X DEPTH	0.071***	76.3	93.1	0.022***
	(0.014)	(54.4)	(51.6)	(0.0018)
4-6 MTHS_POST X DEPTH	0.039**	210.5***	184.1***	0.012***
	(0.015)	(52.8)	(54.3)	(0.0016)
7-9 MTHS_POST X DEPTH	-0.0023	8.00	4.49	0.0086***
	(0.015)	(45.4)	(46.3)	(0.0015)
10-12 MTHS_POST X DEPTH	-0.022	94.9*	99.7*	0.0040**
	(0.016)	(45.2)	(47.5)	(0.0013)
1-3 MTHS_POST X DEPTH X HIGH_INS	0.018	61.4	25.1	-0.00073
	(0.018)	(53.9)	(54.3)	(0.0023)
4-6 MTHS_POST X DEPTH X HIGH_INS	-0.041*	-7.21	-19.1	0.0019
	(0.020)	(56.1)	(58.2)	(0.0020)
7-9 MTHS_POST X DEPTH X HIGH_INS	-0.0054	51.9	22.6	0.00059
	(0.020)	(49.3)	(50.7)	(0.0019)
10-12 MTHS_POST X DEPTH X HIGH_INS	0.0026	-21.7	-25.4	0.00018
	(0.020)	(48.6)	(51.4)	(0.0016)
N	9999036	924892	924979	17292853
R^2		0.018	0.017	0.515
pseudo R^2	0.003			

TABLE A9

Storm induced response on active cards by initial insurance penetration and revolving balance status

Note: This table presents estimates from four separate OLS regressions (for charges, payments, revolving balances, and delinquency, respectively) that interact the specification described in equation (1) with the indicator variable revolves and the indicator variable high insurance. The indicator variable revolves is equal to 1 if the borrower had a revolving balance in July 2017. The indicator variable high insurance is equal to 1 if the mailing address ZIP+4 is located in a census tract with above-median insurance coverage. Because insurance is highly colinear with income, this specification also includes interactions of household income with flood depth and flood depth x post period. All regressions include credit line and month-year fixed effects. The depth variable measures the average ZIP+4 level of flooding created by Harvey in feet. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Subsection II.B.1 provides definitions of all variables and describes the weights used.

	Charges	Payments	Revolving balance	New 30+ day delinquency (ppt)
	1	2	3	4
1-3 MTHS_POST X DEPTH X HIGH_INSURANCE	38.659***	21.236*	-2.521	0.001
	(9.727)	(8.940)	(4.639)	(0.012)
4-6 MTHS_POST X DEPTH X HIGH_INSURANCE	50.640**	62.546***	-5.576	0.008
	(15.866)	(16.357)	(6.280)	(0.012)
7-9 MTHS_POST X DEPTH X HIGH_INSURANCE	20.616	22.444	-5.832	0.003
	(13.200)	(12.778)	(7.616)	(0.015)
10-12 MTHS_POST X DEPTH X HIGH_INSURANCE	20.614	15.070	-6.423	-0.013
	(12.652)	(12.891)	(8.574)	(0.018)
1-3 MTHS_POST X DEPTH X HIGH_INS X REVOLVES	-32.919***	-11.894	-6.893	-0.037
	(9.929)	(9.310)	(6.366)	(0.034)
4-6 MTHS_POST X DEPTH X HIGH_INS X REVOLVES	-43.506**	-52.543**	-17.742	-0.072*
	(16.056)	(16.536)	(9.377)	(0.035)
7-9 MTHS_POST X DEPTH X HIGH_INS X REVOLVES	-15.061	-13.626	-27.897*	-0.062
	(13.405)	(12.968)	(11.707)	(0.036)
10-12 MTHS_POST X DEPTH X HIGH_INS X REVOLVES	-17.313	-14.088	-27.038*	-0.040
	(13.055)	(13.481)	(13.184)	(0.039)
N	15392057	15392057	15392057	14248734
R^2	0.638	0.570	0.811	0.119

TABLE A10

Storm-induced response on active cards controlling for neighbor flooding (250 to 500m)

Note: This table presents estimates from four separate OLS regressions (to predict charges, payments, revolving balances, and delinquency, respectively) that interact the specification described in equation (1) with the indicator variable revolves. This variable takes the value of 1 for credit lines that carry a revolving balance before Harvey. The depth variable measures the average ZIP+4 level of flooding created by Harvey in feet. This specification also includes the average flood depth experienced by neighbors within 250m to 500m of the cardholder, and the interaction terms neighbor flood depth x post period. All regressions include credit line and month-year fixed effects. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Definitions of all dependent variables can be found in subsection II.B.1 . Regression results are weighted according to the sampling framework described in subsection II.B.1 .

	Charges	Payments	Revolving balance	New 30+ day delinquency
	1	2	3	4
1-3 MTHS_POST X DEPTH	43.281***	26.863***	2.406	0.004
	(5.873)	(5.043)	(2.693)	(0.007)
4-6 MTHS_POST X DEPTH	49.474***	48.164***	0.426	0.009
	(12.952)	(12.883)	(3.555)	(0.004)
7-9 MTHS_POST X DEPTH	29.636***	26.754***	2.207	0.007
	(8.397)	(8.037)	(4.323)	(0.005)
10-12 MTHS_POST X DEPTH	17.317*	21.578*	-1.745	-0.009
	(8.390)	(8.835)	(5.487)	(0.008)
1-3 MTHS_POST X DEPTH X REVOLVES	-35.035***	-17.434***	-13.962**	0.010
	(5.992)	(5.269)	(4.785)	(0.023)
4-6 MTHS_POST X DEPTH X REVOLVES	-40.045**	-38.244**	-18.747**	-0.044
	(13.011)	(12.923)	(6.837)	(0.024)
7-9 MTHS_POST X DEPTH X REVOLVES	-22.349**	-18.031*	-24.216**	-0.015
	(8.498)	(8.192)	(8.450)	(0.022)
10-12 MTHS_POST X DEPTH X REVOLVES	-13.155	-17.922*	-18.338	0.012
	(8.484)	(9.032)	(9.443)	(0.025)
N	15450002	15450002	15450002	14305211
R^2	0.638	0.569	0.811	0.119

TABLE A11

Storm-induced response on active cards controlling for neighbor flooding (500 to 1000m)

Note: This table presents estimates from four separate OLS regressions (to predict charges, payments, revolving balances, and delinquency, respectively) that interact the specification described in equation (1) with the indicator variable revolves. This variable takes the value of 1 for credit lines that carry a revolving balance before Harvey. The depth variable measures the average ZIP+4 level of flooding created by Harvey in feet. This specification also includes the average flood depth experienced by neighbors within 500m to 1000m of the cardholder and the interaction terms neighbor flood depth x post period. All regressions include credit line and month-year fixed effects. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Definitions of all dependent variables can be found in subsection II.B.1 . Regression results are weighted according to the sampling framework described in section II.B.1 .

	Charges	Payments	Revolving balance	New 30+ day delinquency
	1	2	3	4
1-3 MTHS_POST X DEPTH	50.454***	34.481***	0.114	0.008
	(5.280)	(5.142)	(3.176)	(0.005)
4-6 MTHS_POST X DEPTH	53.004***	52.273***	2.204	0.003
	(12.251)	(13.495)	(3.358)	(0.004)
7-9 MTHS_POST X DEPTH	31.918***	29.129***	5.725	-0.002
	(7.614)	(7.787)	(3.698)	(0.007)
10-12 MTHS_POST X DEPTH	12.457	22.231**	4.786	0.003
	(8.338)	(8.421)	(4.153)	(0.005)
1-3 MTHS_POST X DEPTH X REVOLVES	-41.861***	-25.655***	-8.341	-0.009
	(5.377)	(5.306)	(4.727)	(0.024)
4-6 MTHS_POST X DEPTH X REVOLVES	-43.747***	-40.465**	-21.544***	-0.080**
	(12.294)	(13.539)	(5.998)	(0.024)
7-9 MTHS_POST X DEPTH X REVOLVES	-24.365**	-20.171*	-29.613***	-0.013
	(7.692)	(7.915)	(7.010)	(0.026)
10-12 MTHS_POST X DEPTH X REVOLVES	-7.056	-19.361*	-23.152**	-0.033
	(8.418)	(8.583)	(7.845)	(0.026)
N	15448812	15448812	15448812	14303746
R^2	0.638	0.569	0.811	0.119

Table A12
Storm-induced card originations controlling for neighbor flooding (250 to 500m)

Note: This table presents three separate logit estimates from specification (1). The depth variable measures the average ZIP+4 level of flooding created by Harvey in feet. This specification also includes the average flood depth experienced by neighbors within 250m to 500m of the cardholder and the interaction terms neighbor flood depth x post period. All regressions include month-year fixed effects. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The sample includes all originations between January 2016 and August 2018 for borrowers with mailing addresses in Harris, Aransas, Nueces, and San Patricio counties in Texas at the time of Hurricane Harvey. Definitions of all dependent variables can be found in subsection II.B.1 .

	All cards	Promotional cards	Standard cards
	1	2	3
1-3 MTHS_POST X DEPTH	0.0386***	0.0516***	0.0348***
	(0.00697)	(0.00974)	(0.00876)
4-6 MTHS_POST X DEPTH	0.00637	0.00554	0.00571
	(0.00812)	(0.0120)	(0.0104)
7-9 MTHS_POST X DEPTH	-0.00786	-0.0169	0.00123
	(0.00782)	(0.0112)	(0.0102)
10-12 MTHS_POST X DEPTH	-0.0171*	-0.0261*	-0.00683
	(0.00782)	(0.0119)	(0.00952)
N	10078056	10078056	10078056
pseudo R^2	0.003	0.003	0.003

Table A13
Storm-induced card originations controlling for neighbor flooding (500 to 1000m)

Note: This table presents three separate logit estimates from specification (1). The depth variable measures the average ZIP+4 level of flooding created by Harvey in feet. This specification also includes the average flood depth experienced by neighbors within 500m to 1000m of the cardholder and the interaction terms neighbor flood depth x post period. All regressions include month-year fixed effects. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.The sample includes all originations between January 2016 and August 2018 for borrowers with mailing addresses in Harris, Aransas, Nueces, and San Patricio counties in Texas at the time of Hurricane Harvey. Definitions of all dependent variables can be found in subsection II.B.1 .

	All cards	Promotional cards	Standard cards
	1	2	3
1-3 MTHS_POST X DEPTH	0.0466***	0.0654***	0.0367***
	(0.00587)	(0.00840)	(0.00741)
4-6 MTHS_POST X DEPTH	0.00200	0.00818	-0.000280
	(0.00672)	(0.0101)	(0.00851)
7-9 MTHS_POST X DEPTH	-0.00746	-0.0105	-0.00146
	(0.00656)	(0.00957)	(0.00834)
10-12 MTHS_POST X DEPTH	-0.0148*	-0.0189	-0.00814
	(0.00650)	(0.00985)	(0.00806)
N	10080144	10080144	10080144
pseudo R^2	0.003	0.003	0.003

TABLE A14

Storm-induced mortgage nonpayment controlling for neighbor flooding

Note: This table presents estimates from three separate OLS regressions where the dependent variable is an indicator for mortgage nonpayment. This variable takes the value of 1 if a borrower has missed more than 1 payment. The depth variable measures the average ZIP+4 level of flooding created by Harvey in feet. The specifications in column 2 (3) also include the average flood depth experienced by neighbors within 250m to 500m (500m to 1000m) of the cardholder and the interaction terms neighbor flood depth x post period. All regressions include mortgage and month-year fixed effects. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

	Mortgage nonpayment 1	Mortgage nonpayment 2	Mortgage nonpayment 3
1-3 MTHS_POST X DEPTH	0.020***	0.015***	0.021***
	(0.00094)	(0.0014)	(0.0020)
4-6 MTHS_POST X DEPTH	0.012***	0.0088***	0.014***
	(0.00081)	(0.0011)	(0.0019)
7-9 MTHS_POST X DEPTH	0.0091***	0.0062***	0.0096***
	(0.00075)	(0.0011)	(0.0017)
10-12 MTHS_POST X DEPTH	0.0046***	0.0033***	0.0046**
	(0.00061)	(0.00083)	(0.0014)
N	17440607	17425665	15714971
R^2	0.51	0.51	0.52
Neighbor flooding control	None	250-500m	500-1000m

Table A15
Storm-induced mortgage nonpayment by floodplain and elevated structure status controlling for neighbor flooding

Note: This table presents estimates from three separate OLS regressions that interact the specification described in equation (1) with the floodplain indicator variable (FP) and the elevated structure indicator variable. In all cases the dependent variable is an indicator for mortgage nonpayment. The depth variable measures the average ZIP+4 level of flooding created by Harvey in feet. The specifications in columns 2 (3) also include the average flood depth experienced by neighbors within 250m to 500m (500m to 1000m) of the cardholder and the interaction terms neighbor flood depth x post period. All regressions include mortgage and month-year fixed effects. Robust standard errors clustered at the ZIP+4 are presented in parentheses. Significance levels are indicated by * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

	Mortgage nonpayment 1	Mortgage nonpayment 2	Mortgage nonpayment 3
1-3 MTHS_POST X DEPTH	0.027***	0.021***	0.024***
	(0.0017)	(0.0020)	(0.0018)
4-6 MTHS_POST X DEPTH	0.018***	0.014***	0.016***
	(0.0017)	(0.0019)	(0.0017)
7-9 MTHS_POST X DEPTH	0.012***	0.0096***	0.011***
	(0.0015)	(0.0017)	(0.0016)
10-12 MTHS_POST X DEPTH	0.0059***	0.0046**	0.0055***
	(0.0012)	(0.0014)	(0.0013)
1-3 MTHS_POST X DEPTH X FP	-0.0083**	-0.0075**	-0.0074**
	(0.0027)	(0.0025)	(0.0026)
4-6 MTHS_POST X DEPTH X FP	-0.0061*	-0.0057*	-0.0056*
	(0.0024)	(0.0024)	(0.0024)
7-9 MTHS_POST X DEPTH X FP	-0.0048*	-0.0046*	-0.0044
	(0.0023)	(0.0023)	(0.0023)
10-12 MTHS_POST X DEPTH X FP	-0.0021	-0.0020	-0.0020
	(0.0019)	(0.0019)	(0.0019)
1-3 MTHS_POST X DEPTH X FP X ELEVATED	-0.014***	-0.012***	-0.013***
	(0.0037)	(0.0036)	(0.0037)
4-6 MTHS_POST X DEPTH X FP X ELEVATED	-0.011**	-0.010**	-0.011**
	(0.0035)	(0.0035)	(0.0035)
7-9 MTHS_POST X DEPTH X FP X ELEVATED	-0.0098**	-0.0091**	-0.0094**
	(0.0032)	(0.0032)	(0.0032)
10-12 MTHS_POST X DEPTH X FP X ELEVATED	-0.0056*	-0.0052*	-0.0055*
	(0.0026)	(0.0026)	(0.0026)
N	15723040	15714971	15717564
R^2	0.52	0.52	0.52
Neighbor flooding control	None	250-500m	500-1000m

TABLE A16
Sample waterfall for existing credit cards

Note: This table shows the effect of each of the sample restrictions on the size of our credit card sample. More detailed descriptions of the sample restrictions can be found in subsection II.B.1 .

	Thousands of loan-months
RAW PULL	211,286
MATCHED WITH PITNEY BOWLES LOCATION DATA	199,627
SAMPLED	40,329
FLOODING DATA AVAILABLE	39,925
SCREENED FOR DATA QUALITY	39,449
CARD ORIGINATED BEFORE JAN 2017	37,088
ACTIVE OR REVOLVING IN JULY 2017	17,402