Appendix

Weathering an Unexpected Financial Shock: The Role of Cash Grants on Household Finance and Business Survival following a Natural Disaster

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1 Data Appendix

1.1 Tornado Sample

As discussed in Section 2.1 of the main text, the tornado sample includes 34 individual tornadoes. All tornadoes in the sample have a Fujita (F) or Enhanced Fujita (EF) rating of a 4 or 5, and a map demarcating heterogeneous intensities within the tornado path. We use the Tornado History Project database (www.tornadohistoryproject.com) to form this sample. We restrict to the years 2002-2013, so as to match the period covered by our individual and business financial data. The Tornado History Project obtains data from the Storm Prediction Center's (SPC) historical tornado data files (www.spc.noaa.gov/wcm/#data). These data are maintained by the SPC, the National Centers for Environmental Protection, and the National Weather Service (NWS). The Tornado History Project reports 15,247 individual tornadoes from 2002-2013. Restricting to tornadoes with a F/EF rating rating of a 4 or 5 results in 87 tornadoes.

We further restrict tornadoes in the sample to have a detailed map denoting heterogeneous intensities within the tornado path.[1] These maps are created using ground-level and aerial surveys (usually) conducted by the local NWS office. To our knowledge, there is no single database that contains damage maps for all tornadoes in the US. To locate the detailed maps we conducted an extensive search within local NWS office websites, and using more general web-based and archival searches. The search was conducted from from June 2013-August 2014.

For a map to be considered acceptable, it must contain exact locations of where the tornado hit at various F/EF intensities, and also have sufficient detail that it can be georeferenced using GIS software (ESRI ArcMap). We were able to obtain detailed damage maps for 35 of the 87 F/EF tornadoes. Many of the tornadoes for which we could not locate detailed maps occurred in very rural locations and directly hit few, if any, homes or built structures. It

[1]For example, the Joplin, MO tornado on May 22, 2011 : https://www.weather.gov/sgf/news_events_2011may22

is likely that detailed maps were not created for these tornadoes. Regardless, we would not be able to include most of these tornadoes in our sample because there would be insufficient credit bureau or business establishment data (in the Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP) and Infogroup's Historical Business Database, respectively).

Table 1 lists each of the 35 tornadoes. The table includes the date and location (closest city) of each tornado, and the following statistics provided by the Tornado History Project: fatalities, injuries, and estimated damage. The table also indicates whether each tornado was part of a Presidential Disaster Declaration, and whether Public Assistance or Individual Assistance (cash grants) was allocated.

Our main sample includes 34 tornadoes. We exclude one tornado from the sample (the Wayne, NE tornado in Table 1). The Wayne, NE tornado has differing pre-tornado trends for the hit and nearby businesses (see Figure 2). The differing pre-trends violate our key difference-in-differences and triple-difference modeling assumption. Moreover, the difference for this tornado is large enough to alter the pre-trends for the entire group of no-cash tornadoes (see Figure 3). We drop the Wayne, NE tornado from both the business and household finance samples, so as to conduct our main analysis on the same sample of tornadoes.

1.2 GIS Data Processing

1.2.1 Tornado Maps

The goal of the GIS data processing is to use the detailed tornado maps to determine the list of census blocks that are hit by the tornado and the list of census blocks that are just outside the tornado path and located in the 0.5-1.5 mile buffer region. Further, we calculate the percent of each block that incurs each level of F/EF damage in the tornado path. We use the percent of each block hit by the various F/EF damage levels to calculate a weighted damage intensity for every hit block. We also calculate the fraction of the block that is in the buffer region. We only include blocks in our nearby control sample if

more than 50% is located in the buffer region. This restriction, along with the half mile gap between the tornado path and our buffer region, helps to ensure that no portion of a nearby control block is also hit by the tornado.

The first step in the GIS process is to georeference the exact location of the tornado path. Occasionally, the tornado maps are available as GIS shapefiles which, after projecting the shapefiles, provide the exact tornado location. More often, we georeference the tornado path location ourselves by adding a US highway/major/minor roads layer within the GIS software (ESRI ArcMap) on top of the tornado damage heterogeneity map. Geographic points are identified on the heterogeneous damage map such as intersections of highways and major/minor roads. The damage maps are then georeferenced by lining up the identified points on the map image with the same points on the US highway/major/minor roads layer.

Next, we calculate the portion of each block (if any) that incurs each level of tornado damage, and the proportion of each block (if any) that falls inside the buffer region. We do this by intersecting the 2000 US Census block shapefile corresponding to the state (or states) hit by each tornado with the georeferenced tornado map. We calculate a block-level weighted intensity measure for each block. The block-level intensity measure is defined as the sum: (0 * %EF0) + (1*%EF1) + ... + (5 * %EF5).

Finally, the block-level tornado information is exported to a .csv datafile. The exported GIS-calculated tornado information is then matched on census block fips number to the household finance and business datasets.

1.2.2 Appendix Figure 1 and Table 2

Figure 1 and Table 2 both use zip code level FEMA Individual Assistance (cash grant) and SBA disaster loan data. We use the detailed geo-referenced tornado damage maps discussed in Section 1.2.1 to obtain the list of "hit" and "buffer" zip codes. To do this, we overlay state-specific 2000 US Census TIGER/Line zip code shapefiles onto each tornado map using Arc GIS. A hit zip code is defined as one which intersects with any portion of the tornado path. For example, in Figure 1, the following zip codes are hit: 64801, 84804,

64840, 64844. A buffer zip code is one that intersects with the 0.5 to 1.5 mile buffer zone outside of the tornado path and does not intersect with the tornado path. In Figure 1, zip codes 64841 and 64862 are buffer zip codes. If a zip code is within the buffer zone and the tornado path, we define it as hit.

Note that the zip code definition for hit is different than the one we use for the block-level analysis in the paper. Census blocks are geographically much smaller than zip codes. This allows us to have stricter definitions for hit and buffer areas in the empirical analysis. In the analysis, a hit block is one that is at least 50% in the tornado path, while a buffer (control) block is one that is at least 50% in the buffer zone.

1.3 Data Sources

This section lists information on all the data sources used in the paper. Further details provided in the paper. We list each source here for completeness.

1.3.1 Federal Emergency Management Agency (FEMA)

The Federal Emergency Management Agency (FEMA) is the source of the Presidential Disaster Declaration, Public Assistance, and Individual Assistance data. The FEMA website (https://www.fema.gov/disasters) provides information on whether there is a Presidential Disaster Declaration following the storm that includes each tornado, and whether Public Assistance and Individual Assistance (cash grants) disaster aid is distributed. The publicly available information on the website is typically provided at the disaster-level (and occasionally the county-level).

The Individual Assistance data we use are from a Freedom of Information Act Request (FOIA). We submitted a FOIA (No. 2015-FEFO-00159) in December 2014 for block-level Individual Assistance information. We received the FOIA information in January 2019. However, due to confidentiality considerations, FEMA provided 5-digit zip code level information (rather than block-level). The information includes: disaster declaration number, zip code, earliest application approval date, total number of housing grants, total

amount of housing assistance, total number of other needs (ONA) grants, and total amount of ONA. The information was provided for 23 of the 25 tornadoes in our full sample that are part of Presidential Disaster Declarations with Individual Assistance. We do not have zip code level cash grant information for the 2008 Waterloo, Iowa and 2008 Ridgeville, Georgia tornadoes. We are happy to share all of the FOIA Individual Assistance data.

1.3.2 Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP)

The credit and debt information is from the Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP). The consumer credit panel was first created via a collaboration between researchers at the NY Federal Reserve Bank and Equifax, a credit repository company. The panel is updated quarterly. Lee and van der Klaauw [2010] provide a comprehensive summary of the information included in the CCP. All data analysis using the CCP is conducted on a secure Federal Reserve Bank server. We are not able to post or share these data due to confidentiality concerns and a strict user agreement.

1.3.3 Infogroup's Historic Business Database

We use business establishment data from the Infogroup's Historic Business Database. An independent audit by the College of Information Science & Technology at the University of Nebraska at Omaha found the database similar to, and on many dimensions, of higher quality than other private establishment-level datasets such as the National Establishment Time-Series dataset (College of Information Science & Technology at the University of Nebraska [2017]). We are not able to post or share these data due to a strict user agreement.

1.3.4 National Weather Service (NWS)

The tornado maps are created by the National Weather Service. To our knowledge, there is no single location that includes all of the NWS maps with sub-tornado path F/EF ratings. We collected the tornado maps used in this study

over the time period June 2013-August 2014 via archival and internet searches. We are happy to share all of the NWS geocoded map data.

The US National Oceanic and Atmospheric Administration (NOAA) provides the following details to the questions "Who surveys tornado damage?" and "What's the criteria for the National Weather Service to do a survey?":

> *"This varies from place to place; and there are no rigid criteria. The responsibility for damage survey decisions at each NWS office usually falls on the Warning-Coordination Meteorologist (WCM) and/or the Meteorologist in Charge (MIC). Budget constraints keep every tornado path from having a direct ground survey by NWS personnel; so spotter, chaser and news accounts may be used to rate relatively weak, remote or brief tornadoes. Killer tornadoes, those striking densely populated areas, or those generating reports of exceptional damage are given highest priority for ground surveys. Most ground surveys involve the WCM and/or forecasters not having shift responsibility the day of the survey. For outbreaks and unusually destructive events–usually only a few times a year–the NWS may support involvement by highly experienced damage survey experts and wind engineers from elsewhere in the country. Aerial surveys are expensive and usually reserved for tornado events with multiple casualties and/or massive degrees of damage. Sometimes, local NWS offices may have a cooperative agreement with local media or police to use their helicopters during surveys."*

Source: https://www.spc.noaa.gov/faq/tornado/index.html#Damage

1.3.5 Small Business Administration (SBA)

Annual Small Business Administration disaster loan data are publicly available at the 5 digit zip code level separately for home and business loans. We downloaded the data directly from the SBA website https://www.sba.gov/offices/headquarters/oda/resources/1407821 (FY 2001-2013). The SBA

information includes dollar amounts for: real estate loss, content loss, real estate loans, content loans, and (for businesses) economic injury loans.

1.3.6 Tornado History Project

The Tornado History Project, http://www.tornadohistoryproject.com, is a searchable database that archives all reported US tornadoes from 1950-2017. The underlying source of the tornado information is the Storm Prediction Center's (SPC) historical tornado data file (https://www.spc.noaa.gov/wcm/#data). The Storm Prediction Center is part of the National Weather Service and the National Centers for Environmental Prediction. Tornado cost, casualty, and maximum intensity information are from the Tornado History Project.

1.3.7 US Census

We use two sources of data from the US Census. First, are the demographic and socioeconomic information from the 2000 decennial census. These data are used as part of a pre-tornado comparison between hit and nearby populations. Second, are 2000 decennial census block shapefiles. We use the shapefiles in the GIS data processing.

1.3.8 Voting Information

We collect county level vote share data from uselectionatlas.org. For each PDD county, we calculate the average share of the two party (Democratic and Republican) vote that the losing party receives across the 1996, 2000, and 2004 presidential elections.

2 Cost per Job Calculation

Manuscript Section 5 follows Brown and Earle [2017] and calculates a rough measure for the cost per created or retained job. We use the following equation to calculate the cost:

$$Cost\ Per\ Job\ =\ \frac{Total\ IA\ Costs}{Total\ Jobs\ Created} \tag{1}$$

2.1 Total Jobs Created

Total Jobs Created (denominator of Equation 1) is estimated from our log and level employment results for establishments that have three or fewer employees.[2] The estimated employment gains are then multiplied by the total number of employees in the year before a tornado to determine the number of jobs created by the cash grants. We use total employment at establishments with three or fewer employees located in blocks that are hit by a cash tornado the following year as the baseline level of employment. We estimate that 1,816 jobs were created using the log specification, and 3,165 jobs were created using the level specification.

2.2 Cost Per Job

2.2.1 Baseline Calculation

Our baseline cost per job calculation only considers direct IA program costs. We define direct IA program costs as the sum of the total IA grant dollars and the total FEMA administrative costs related to running the IA program.

We calculate total IA grant dollars by summing the amount of Individual Assistance allocated for the entire Presidential Disaster Declaration area. We do not restrict the calculation to the smaller geographic area most affected by the tornado. Refer to Appendix Section 1.3.1 and Appendix Table 2 for more information on the Individual Assistance data.

We calculate total FEMA administrative costs using a Government Accountability Office (GAO) report on FEMA's state-level obligations for major disasters declared during fiscal years 2004 through 2013 (GAO [2014], Table 8). We first estimate the amount of FEMA administrative overhead for

[2]Manuscript Table 7 panel C, column 2, estimates the block-level cash grant employment effect for small establishments using our preferred log model (16.3%). The level model results, while not reported in the table, estimate a larger 28.4% increase in employment.

every IA dollar. The numerator in Equation 2 is an estimate of the total FEMA administrative expense to run the IA program for each state. The total expenditure categories include Public Assistance, Individual Assistance, Mission Assignment, and Hazard Mitigation. We divide these IA-related administrative costs by the total IA dollars in the state to obtain a state-by-state administrative cost per IA grant dollar.

$$Admin\ Dollar\ Per\ IA\ Dollar = \frac{Admin\ Costs * (\frac{IA}{TotalExpenditures})}{IA} \quad (2)$$

Each state's administrative cost per IA grant dollar is then multiplied by the state's total amount of IA grant dollars. For example, if a state allocated $10 million in IA grants and we estimate that it costs $0.2 dollars in administrative overhead for every $1 IA dollar spent, then we would estimate a total administrative cost of $2 million for that state.

The baseline total Individual Assistance program costs for our sample is $233.28 million. We divide the baseline IA cost by our jobs estimate to obtain our baseline cost per job (Manuscript Table 8, Column 1) .

2.2.2 More Comprehensive Calculations

Manuscript Table 8 columns 2-5 provide rough estimates of the net job cost inclusive of other program costs and fiscal externalities (e.g. Bastian and Jones [2019]; Hendren [2016]).

Manuscript Table 8 column 2 considers administrative cost savings from issuing fewer SBA disaster loans. FEMA is prohibited from duplicating benefits between the Individual Assistance and SBA programs (SBA [2011]). We assume that in the absence of the cash grants that an equal dollar amount of SBA disaster loans would have been distributed to disaster victims. Using Brown and Earle [2017] (pages 1074-1075) we calculate that recipients default on roughly 8% of SBA loan dollars (18.9 billion out of 230 billion). Therefore, for each IA grant dollar distributed, we estimate a cost savings of $0.08 due to foregone defaults under the SBA program. These administrative cost savings

are subtracted from our baseline total costs when calculating the cost per job.

Manuscript Table 8 column 3 considers federal tax revenue raised from the additional jobs. We use two primary data sources to estimate the additional tax revenue. First are state level salary estimates for each state and year in our sample from the Bureau of Labor Statistics Quarterly Census of Employment and Wages (of Labor Statistics [2019]). Specifically, we use the "average annual pay" for the "Total, all industries" group. Second, we use the National Bureau of Economic Research (NBER) income tax calculator for "US Federal Marginal Income Tax Rates: Tax Rate on Wage Income" (of Economic Research [2019]). We use these two data sources to calculate the average federal tax an employee would pay (i.e. federal taxes per employee per year). We sum the estimated federal tax revenue across states and years. We use the number of employees at small establishments in cash-tornado hit blocks for each state in the year before the tornado as the state-by-year specific level of employment, and the (common) regression jobs created point estimate for this calculation. The total federal tax revenue is subtracted from our baseline total costs when calculating the cost per job.

Manuscript Table 8 column 4 considers federal cost savings from lower unemployment benefits due to fewer unemployed workers. Evidence in the manuscript suggests that the difference between cash and no-cash disaster blocks is largely due to "retained" jobs rather than "new" jobs. Thus, the cash grants mostly aid in preventing job loss. Unemployment insurance is paid by states. The federal government typically pays only for the administrative costs of running the unemployment insurance programs up to 26 weeks (Stone and Chen [2014]). The federal government can extend unemployment benefits beyond 26 weeks. We do not factor any extended federal unemployment benefits into our calculation. The total estimated federal costs to administer the unemployment insurance program is subtracted from our baseline total costs when calculating the cost per job. Here are the steps we use to calculate the cost savings from reduced unemployment benefits:

(1) We calculate the average length of unemployment from 2002-2013 as 25.54 weeks using data from the Federal Reserve (FED [2019]).

(2) We use an estimate for the cost in administration overhead per-person, per-week for the federal government to run the unemployment program (Whittaker et al. [2019], page 1). Using the FY2020 proposed budget, the document states that for every 100,000 person increase in average weekly claims above the baseline amount, $28.6 million in funding would be available. We use this statistic to calculate an administrative cost of $286 allocated per person per week (i.e. $28,600,000 / 100,000 more weekly claims).

(3) Our estimate for the total unemployment savings to the federal government is: Total Jobs Created * 25.54 weeks * $286

Manuscript Table 8 column 5 includes cost savings from columns 2-4 are added together and then subtracted from our baseline total costs when calculating the cost per job.

3 Supporting Analysis

3.1 Main Samples

This section provides supporting analysis for the main household finance and business establishment samples that include 34 tornadoes. The tables and figures in this section are all directly referenced in the manuscript.

Figure 1 shows the total amount of Individual Assistance cash grants received for each zip code in the vicinity of the May 22, 2011 Joplin, MO tornado. The figure illustrates the data limitations of using the zip code-level cash grant data. The per capita zip code-level summary statistics (Table 2) dramatically understate the average grant amount for individuals hit by the tornado. The majority of the tornado path and nearly all of the most highly damaged areas occur in a single zip code (64804). More than $12 million is provided to residents in this zip code. Nevertheless, the tornado only hits approximately 9.95% of the land area of the zip code. Some residents in portions of the zip code farther away from the tornado path likely experienced minor storm-

related damage. These residents are eligible for cash assistance. As evidence for this, all of the zip codes surrounding the tornado path have non-zero levels of cash assistance. The majority of these zip codes (colored light blue in the figure) receive much smaller levels of total cash grants, ranging from $408 to $301,382.

Figure 2 plots the trends in the number of establishments and employment in blocks hit by and nearby to a tornado. The difference between this figure and manuscript Figure 5 is that the no-cash tornado trends are plotted only for the Wayne, NE tornado. The Wayne, NE tornado is omitted from the main 34 tornado sample due to divergent pre-tornado business trends.

Figure 3 shows the trends in the number of establishments and employees for establishments located in hit Census blocks at the time of a tornado, and for establishments near to, but outside the tornado path. The difference between this figure and manuscript Figure 5 is that the no-cash tornado trends include hit and control blocks from the Wayne, NE tornado.

Figure 4 shows the distribution of establishments by employment size for the 34 tornado sample analyzed in manuscript Table 7.

Table 1 shows summary information for all 35 tornadoes in our full sample. The 35 tornadoes are the subset of the 87 Fujuti or Enhanced Fujita 4 and 5 tornadoes that struck the US between 2002-2013 which have detailed damage path maps. Manuscript Section 2.1 and Appendix Section 1.1 provide more details.

Table 2 shows summary statistics for the level of SBA disaster loans awarded to the hit and nearby zip codes following a tornado. SBA disaster loans are available to both individuals (households) and businesses. Individuals can apply for up to $240 thousand, while businesses can apply for up to $2 million. Loan amounts are based on verified losses (i.e. building damage, personal property, business property). Small businesses can also receive loans based on "economic injury" (e.g. documented income loss). Loan applicants do not need collateral, but must demonstrate credit worthiness. Not all applications are approved.

Tables 3-5 show difference-in-differences estimates for individual debt, fi-

nancial distress, and migration using the CCP. We separately estimate the model for cash and no-cash tornadoes for each dependent variable.

Table 6 shows difference-in-difference model results for home debt conditional on whether an individual affected by a tornado (either hit or nearby) moved or stayed in the same census block following the tornado, and by type of home debt. Columns 1-2 only include individuals who move (for at least one quarter) at any point during the three years following the tornado. Columns 3-4 only include individuals who do not move. Our main measure of home debt includes both mortgage debt and home equity debt. Columns 5-6 only consider mortgage debt, while columns 7-8 only consider home equity debt.

Table 7 shows triple difference estimates for establishments in each of the "1 digit" industries that we pool together in the non-manufacturing category (manuscript Table 7).

3.2 Robustness

Tables 8-17 show robustness analysis for the household finance and migration outcomes (manuscript Tables 3 - 5), and for the business outcomes (manuscript Tables 6 and 7). We estimate two alternative specifications for each outcome. First, we use our main 34 tornado sample, except that we weight by the inverse of the propensity score. Second, we estimate the same model as in the paper, except we use all 35 tornadoes.

Figures 5-8 show event study household finance and migration outcomes for the two alternative specifications.

4 References

Federal emergency management agency, opportunities exist to strengthen oversight of administrative costs for major disasters. Technical Report GAO-15-65, Government Accountability Office (GAO), December 2014. URL https://www.gao.gov/assets/670/667606.pdf.

Fred economic data. Technical report, Federal Reserve Bank of St. Louis, 2019. URL https://fred.stlouisfed.org/series/UEMPMEAN.

Jacob E. Bastian and Maggie R. Jones. Do eitc expansions pay for themselves? effects on tax revenue and public assistance spending. *Working Paper*, 2019.

J. David Brown and John S. Earle. Finance and growth at the firm level: Evidence from sba loans. *The Journal of Finance*, 72(3), 2017.

Omaha College of Information Science & Technology at the University of Nebraska. Business database competitive audit report. 2017. URL http://marketing.infogrouptargeting.com/acton/attachment/4454/f-0b5e/1/-/-/-/-/Infogroup_Business%20Audit_2017.pdf.

Nathaniel Hendren. The policy elasticity. *Tax Policy and the Economy*, 30(1), 2016.

Donghoon Lee and Wilbert van der Klaauw. An introduction to the frbny consumer credit panel. Technical Report 479, Federal Reserve Bank of New York, November 2010.

National Bureau of Economic Research. Taxsim, July 2019. URL https://users.nber.org/~taxsim/conrate/.

Bureau of Labor Statistics. Quarterly census of employment and wages, July 2019. URL https://www.bls.gov/cew/downloadable-data-files.htm.

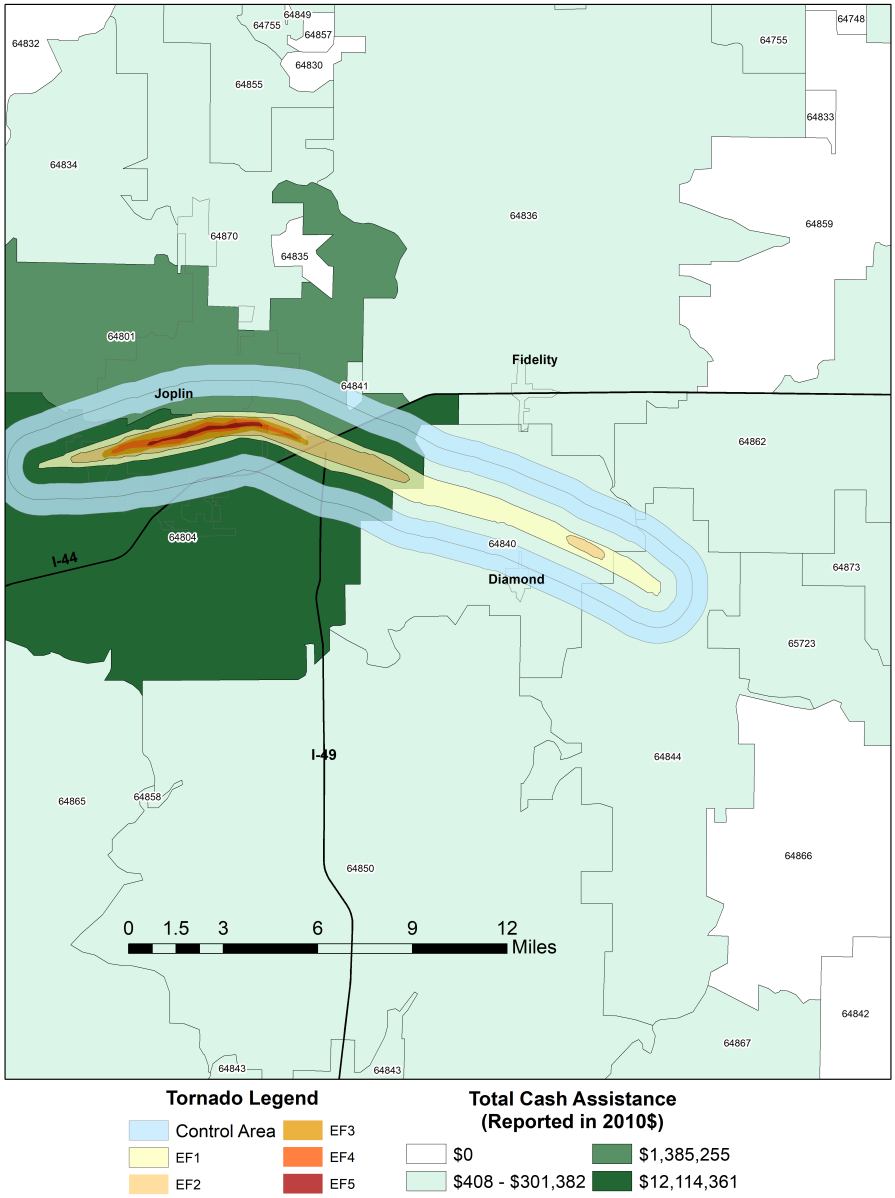
Small Business Association SBA. Small business administration standard operating procedure. Technical Report SOP 50-30-7, May 2011.

Chad Stone and William Chen. Introduction to unemployment insurance. Technical report, July 2014.

Julie M. Whittaker, Katelin P. Isaacs, and Abigail R. Overbay. Funding the state administration of unemployment compensation (uc) benefits. *Conressional Research Service*, June 2019.

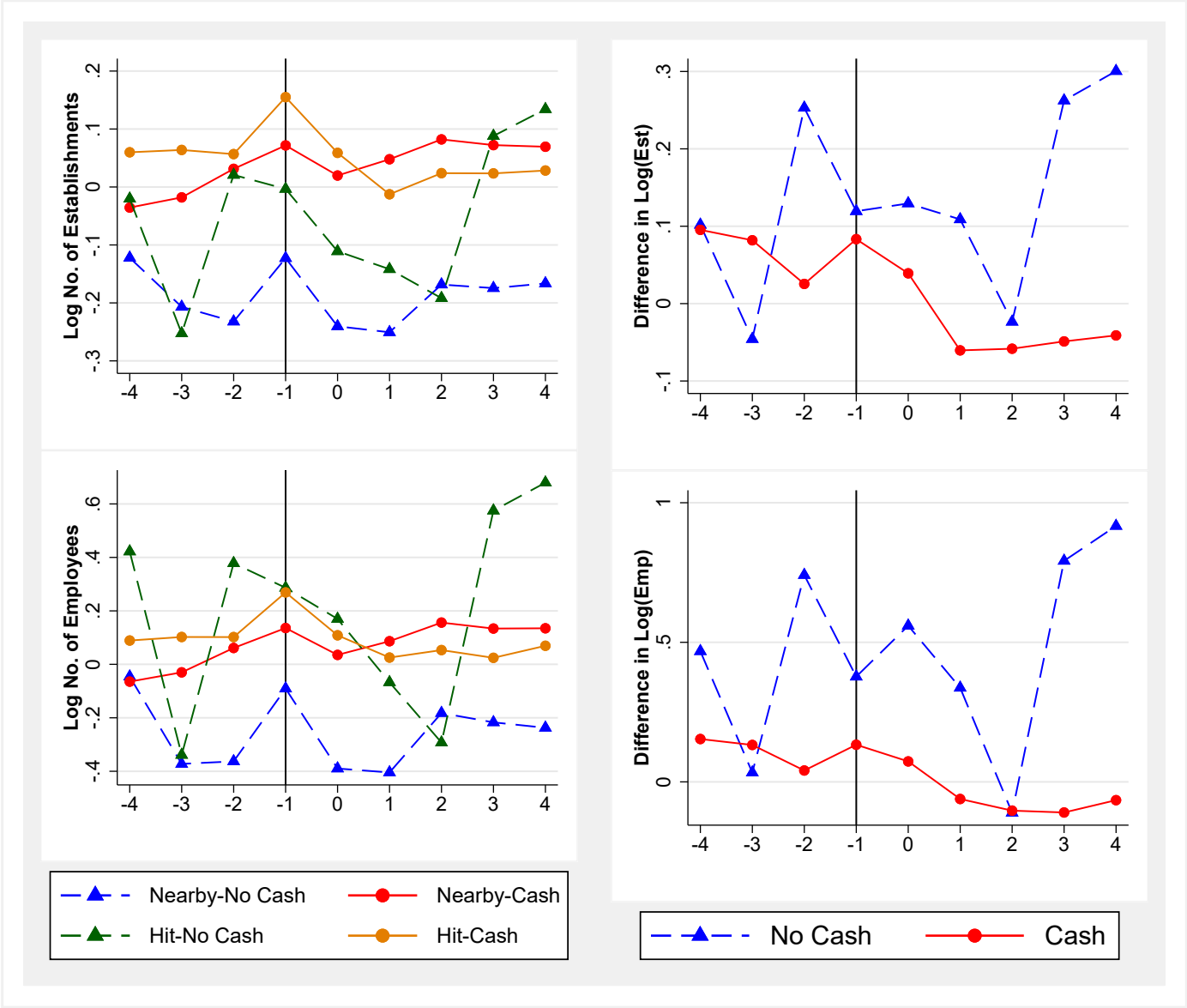
5 Figures and Tables

Figure 1: **Individual Assistance Cash Grants for the Presidential Disaster Declaration that includes the Joplin, MO 2011 Tornado**



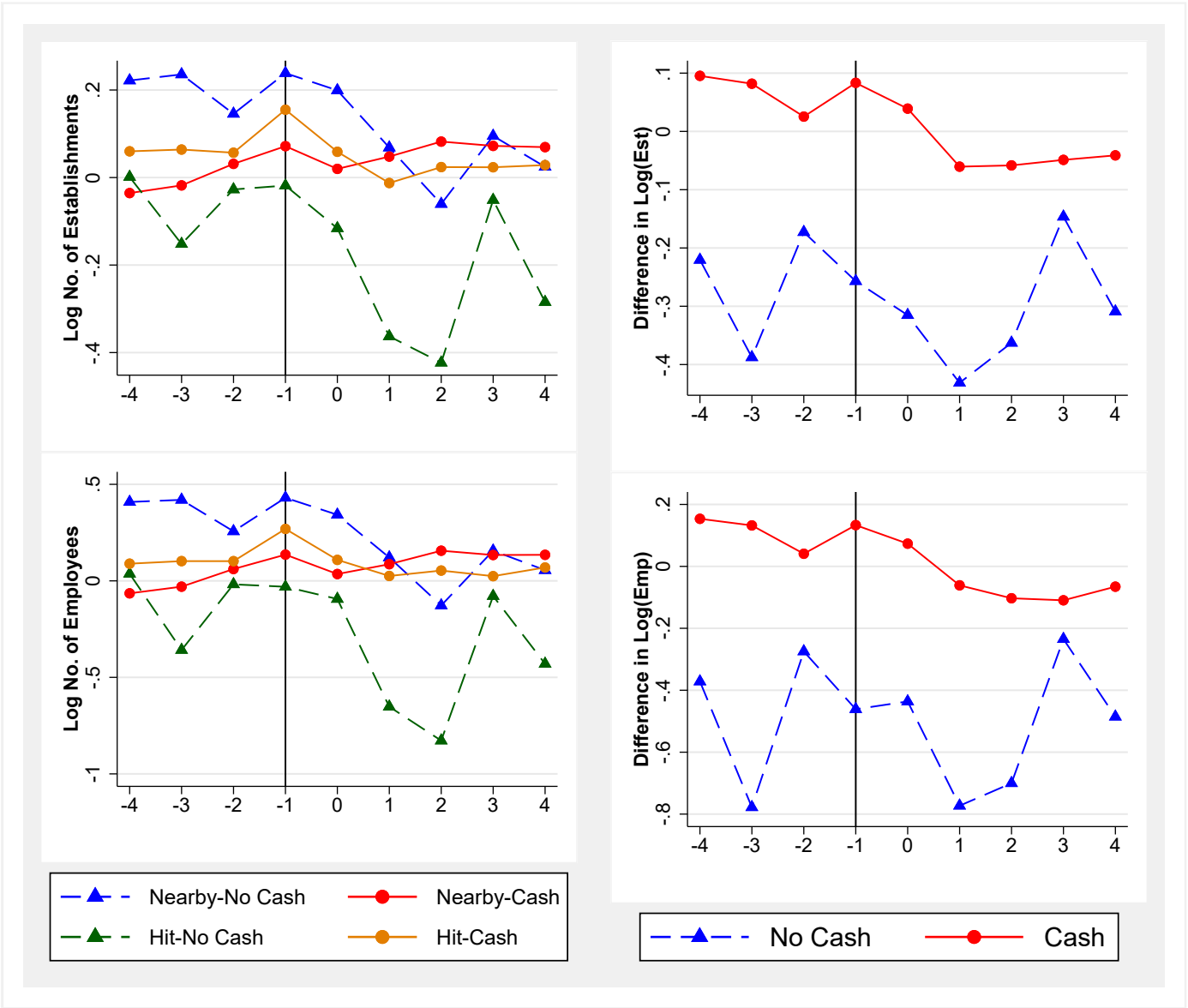
The figure plots the tornado path and 0.5-1.5 tornado buffer region for the EF5 tornado that struck near Joplin, MO on May 22, 2011. The figure also displays the total amount of Individual Assistance cash grants received for each zip code. The Individual Assistance data are from a Freedom of Information Act Request (No. 2015-FEFO-00159) submitted in December 2014 and received in January 2019. Due to confidentiality considerations, FEMA provided 5-digit zip code level information (rather than block-level). See Section 2.2 of the manuscript for more details. Sources: Federal Emergency Management Agency, National Weather Service, US Census.

Figure 2: **Trends in Business Outcomes for the Sample of Cash Tornadoes and the No-cash Wayne, NE Tornado Excluded from the Main Sample**



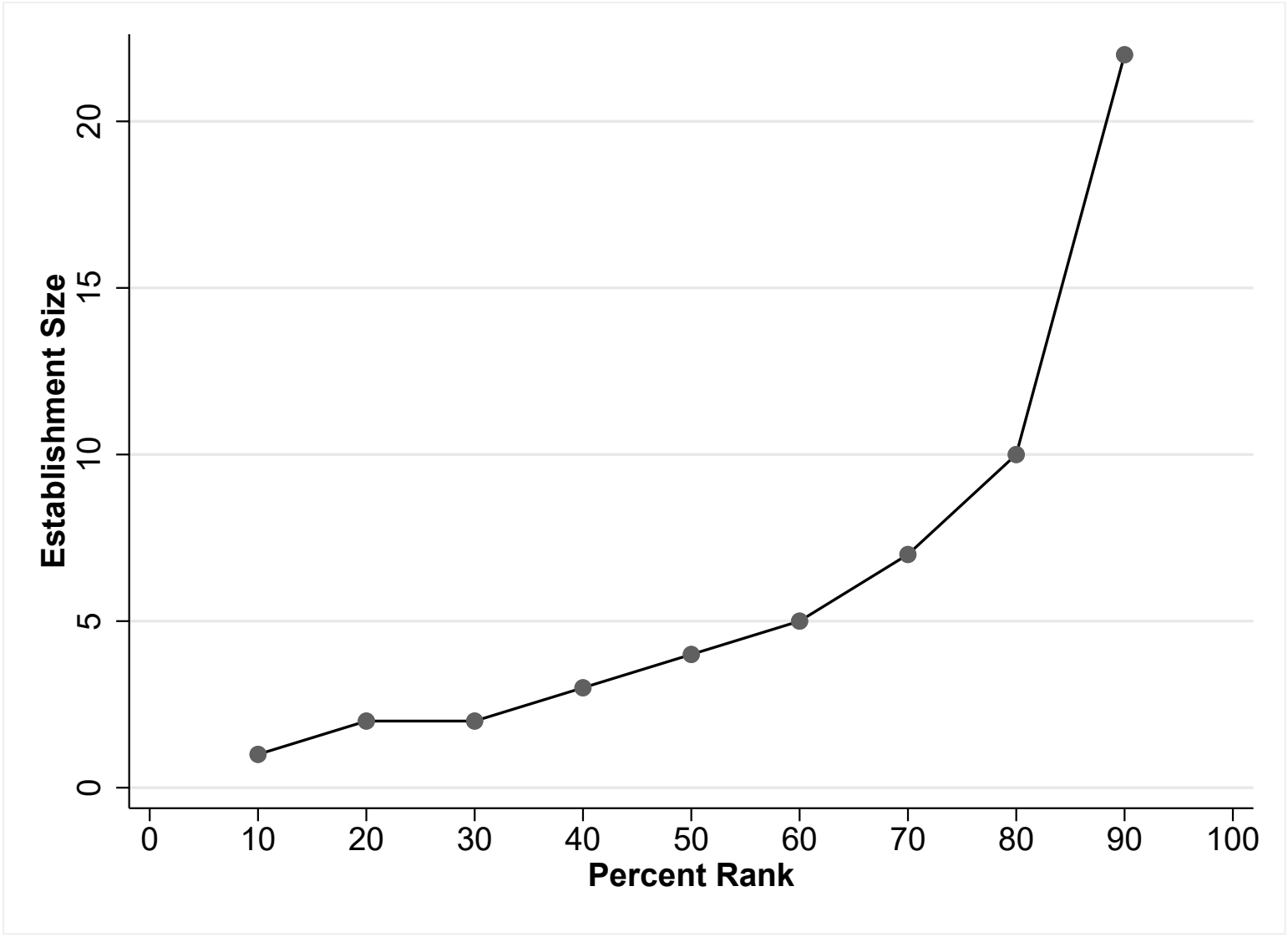
The figure shows the trends in the number of establishments and employees for establishments located in hit Census blocks at the time of a tornado, and for establishments near to, but outside the tornado path. The difference between this figure and manuscript Figure 5 is that the no-cash tornado trends are plotted only for the Wayne, NE tornado. The Wayne, NE tornado is omitted from the main sample. The cash tornado observations are identical to those plotted in manuscript Figure 5. Manuscript Section 4.2 provides more details. Sources: Infogroup Historic Business Database, National Weather Service, US Census.

Figure 3: **Trends in Business Outcomes, 35 Tornado Sample Including the Wayne, NE Tornado**



The figure shows the trends in the number of establishments and employees for establishments located in hit Census blocks at the time of a tornado, and for establishments near to, but outside the tornado path. The difference between this figure and manuscript Figure 5 is that the no-cash tornado trends include hit and control blocks from the Wayne, NE tornado. Manuscript Section 4.2 provides more details. Sources: Infogroup Historic Business Database, National Weather Service, US Census.

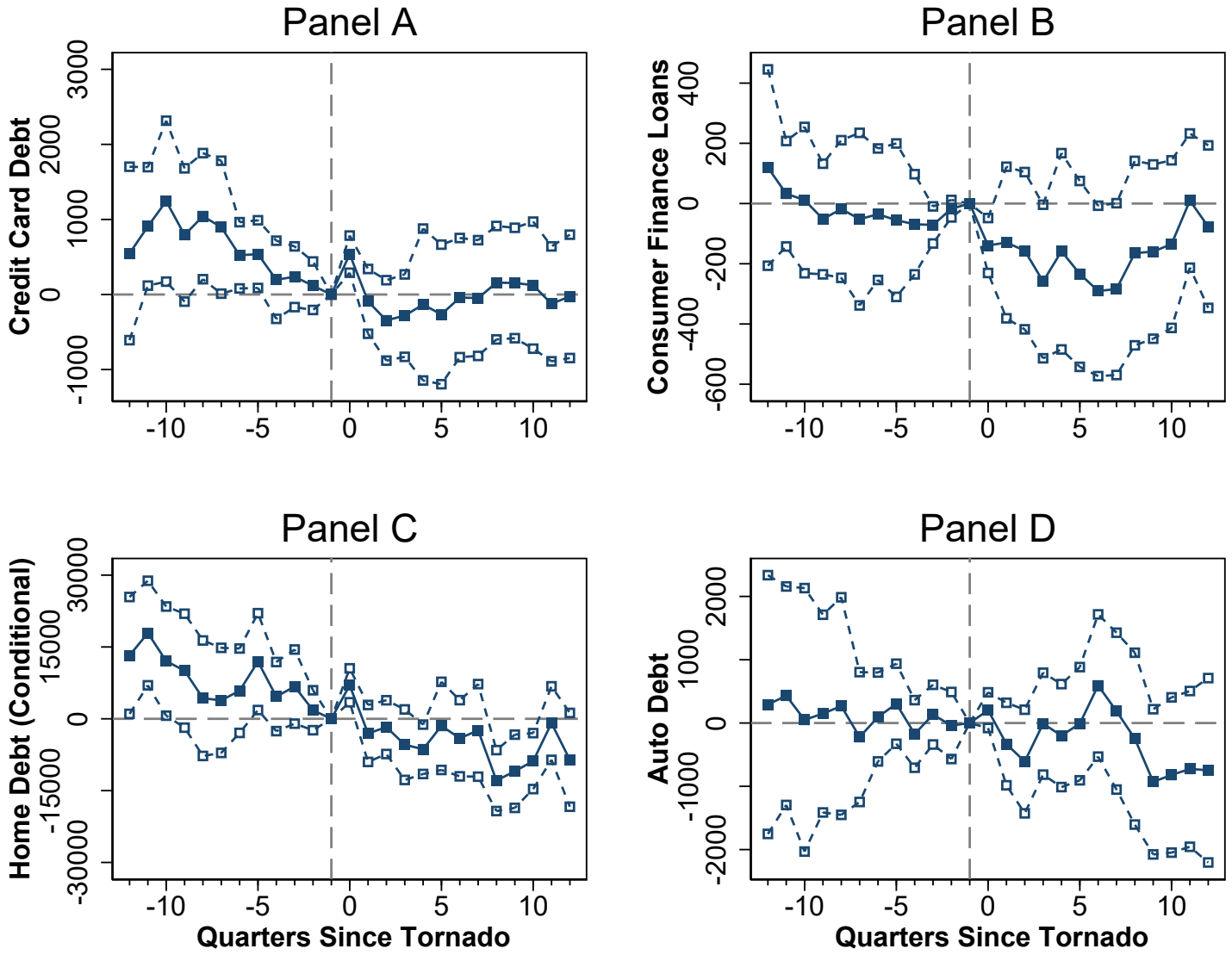
Figure 4: **Distribution of Establishment Size by Number of Employees**



This figure shows the distribution of establishments by employment size for the 34 tornado sample analyzed in manuscript Table 7.
Sources: Infogroup Historical Database, National Weather Service

Figure 5: **Quarterly Analysis of Debt**

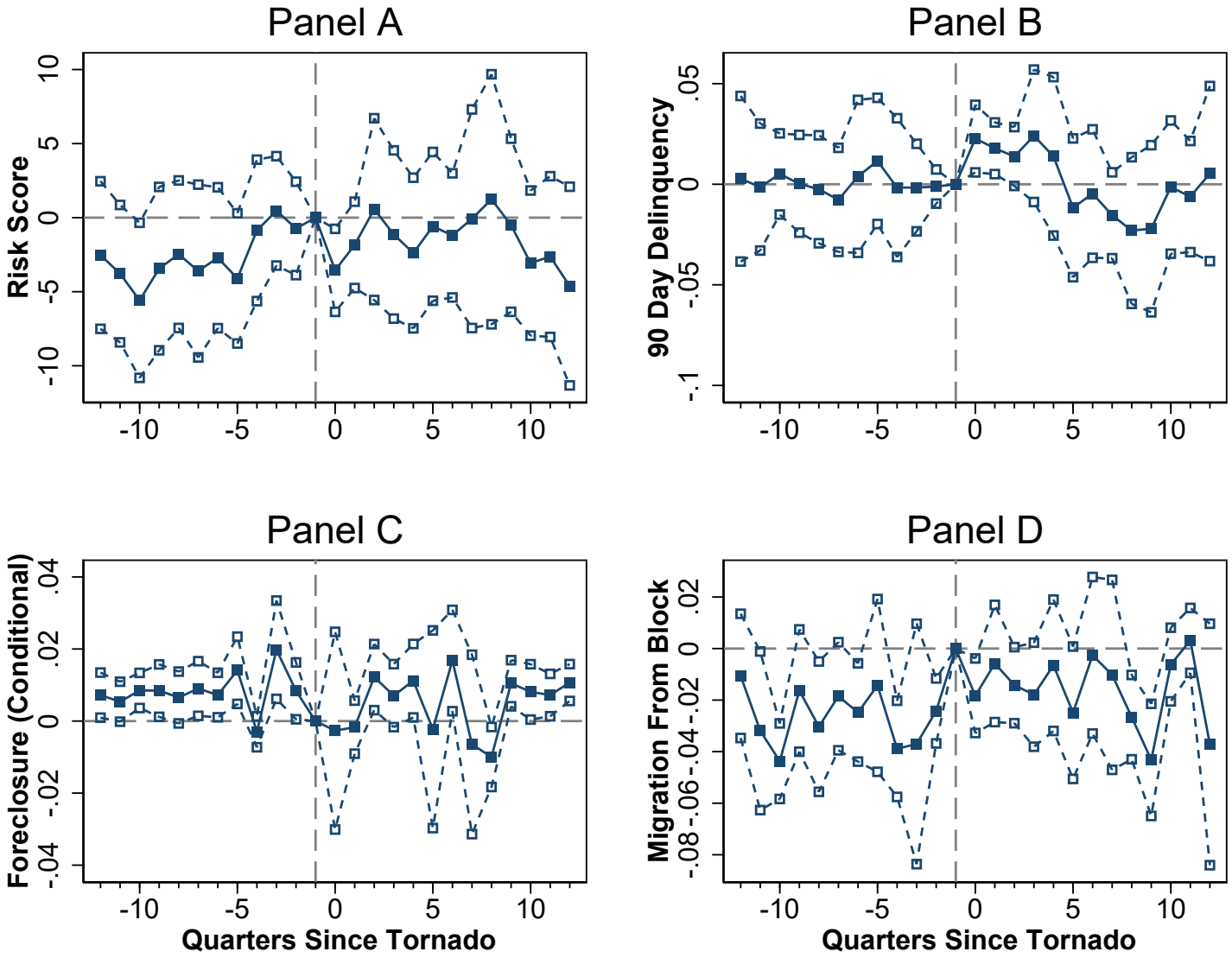
34 Tornado Sample, Inverse Propensity Weighted



The figure shows quarterly event study estimates and 95% confidence intervals for the same four debt outcomes as in manuscript Figure 3. The difference is that this figure shows results from an event study model that weights using the inverse of the propensity score. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Figure 6: **Quarterly Analysis of Financial Outcomes**

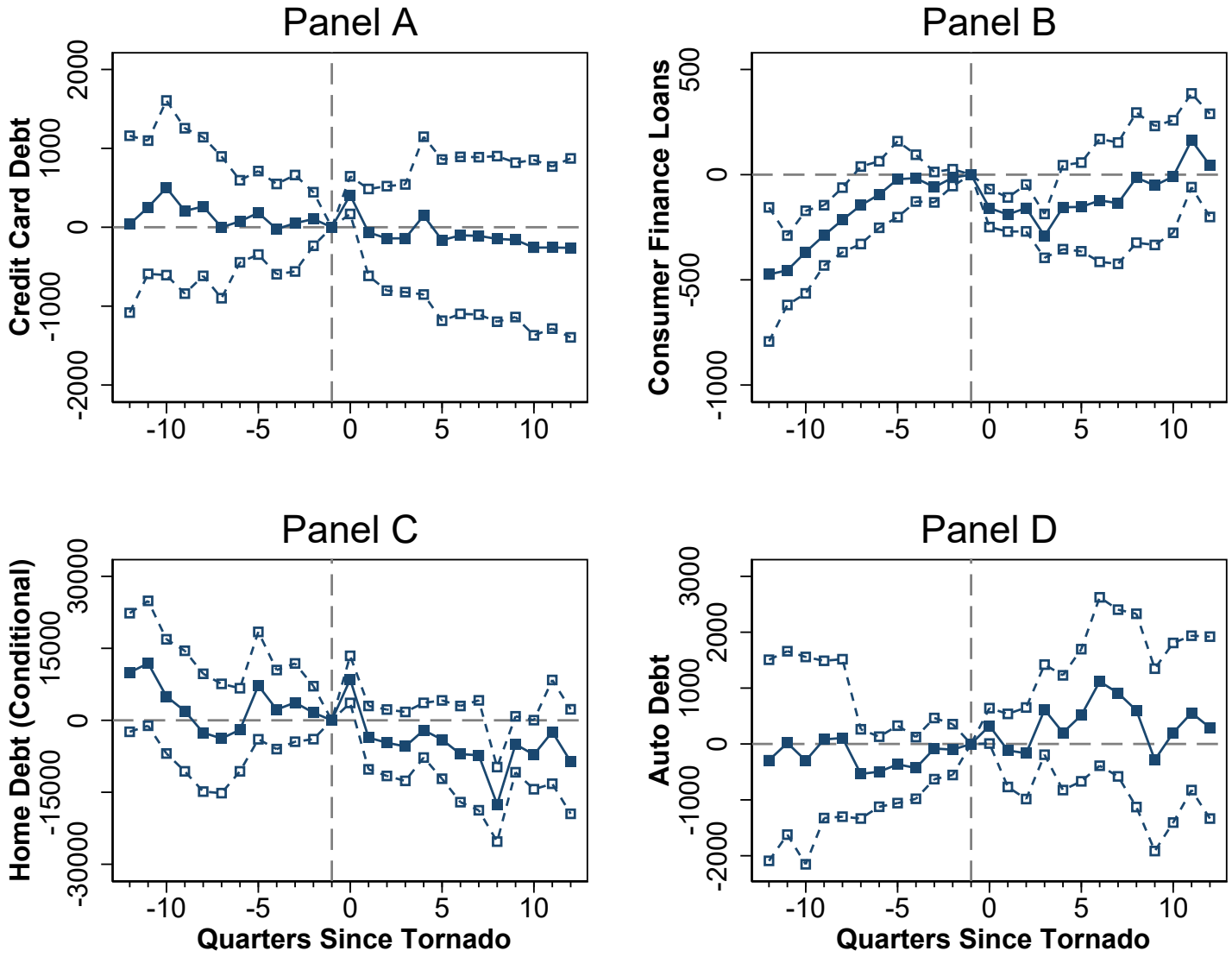
34 Tornado Sample, Inverse Propensity Weighted



The figure shows quarterly event study estimates and 95% confidence intervals for the same four financial and migration outcomes as in manuscript Figure 4. The difference is that this figure shows results from an event study model that weights using the inverse of the propensity score. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Figure 7: **Quarterly Analysis of Debt**

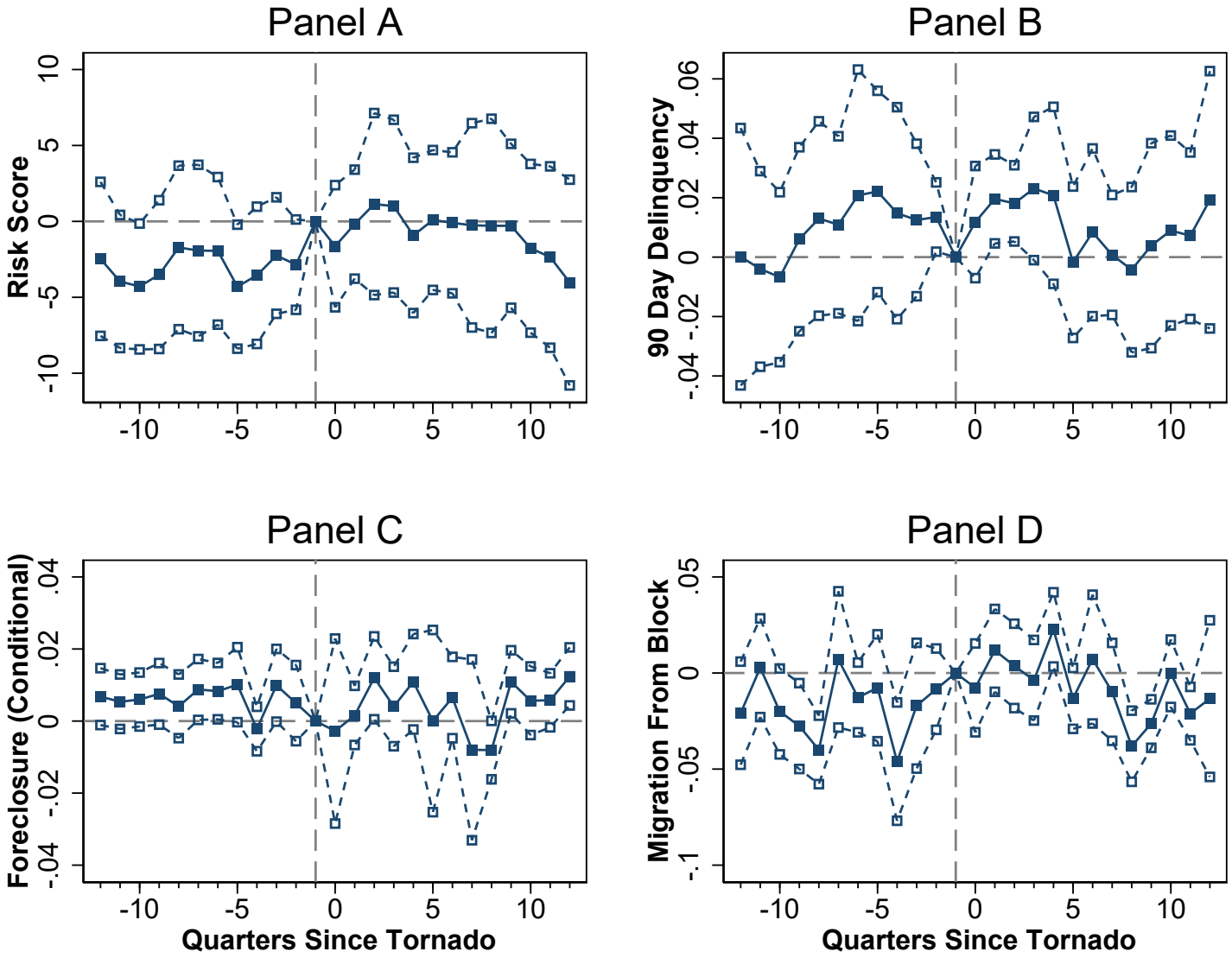
35 Tornado Sample, No Inverse Propensity Score Weighting



The figure shows quarterly event study estimates and 95% confidence intervals for the same four debt outcomes as in manuscript Figure 3. The difference is that this figure shows results from estimating the event study model on the sample of 35 tornadoes that includes the Wayne, NE tornado. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Figure 8: **Quarterly Analysis of Financial Outcomes**

35 Tornado Sample, No Inverse Propensity Score Weighting



The figure shows quarterly event study estimates and 95% confidence intervals for the same four financial and migration outcomes as in manuscript Figure 4. The difference is that this figure shows results from an event study model on the sample of 35 tornadoes that includes the Wayne, NE tornado. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 1: **Location, Damage, and Federal Assistance Information for All 35 Tornadoes**

Date of Tornado	Nearby City	Tornado F/EF	Fatalities	Injuries	Casualties	Estimated Damage (Millions)	Presidential Disaster Declaration	Public Assistance	Individual Assistance
4/28/2002	La Plata, MD	4	3	122	125	$124.00	1	1	0
11/10/2002	Van Wert, OH	4	4	17	21	$30.00	1	0	1
5/4/2003	Jackson, TN	4	11	86	97	$40.00	1	1	1
5/8/2003	Moore, OK	4	0	134	134	$370.00	1	1	1
5/22/2004	Lincoln, NE	4	1	38	39	$160.22	1	1	1
3/1/2007	Enterprise, AL	4	9	50	59	$250.00	1	1	1
5/4/2007	Greensburg, KS	5	11	63	74	$250.00	1	1	1
2/6/2008	Moulton, AL	4	4	23	27	---	0	0	0
2/6/2008	Flat Rock, AL	4	1	12	13	$2.00	0	0	0
5/11/2008	Ridgeville, GA	4	0	9	9	$12.50	1	1	1
5/25/2008	Waterloo, IA	5	9	70	79	$100.30	1	1	1
6/11/2008	Manhattan, KS	4	0	0	0	$66.00	1	1	0
2/10/2009	Ardmore, OK	4	8	0	8	$3.00	1	1	1
4/10/2009	Murfreesboro, TN	4	2	58	60	$100.00	1	1	0
6/5/2010	Millbury, OH	4	7	28	35	$102.40	0	0	0
11/29/2010	Winnfield, LA	4	0	0	0	$0.75	0	0	0
4/22/2011	Ferguson, MO	4	0	5	5	$30.00	1	1	1
4/27/2011	Chattanooga, TN	4	20	335	355	$68.25	1	1	1
4/27/2011	Tuscalousa, AL	4	64	1,500	1,564	$2,450.00	1	1	1
4/27/2011	Huntsville, TN	5	72	145	217	$1,290.00	1	1	1
4/27/2011	Birmingham, AL	4	22	85	107	$366.76	1	1	1
4/27/2011	Chattanooga, TN	4	1	0	1	$0.03	1	1	1
4/27/2011	Fort Payne, AL	5	25	0	25	$0.15	1	1	1
4/27/2011	Hamilton, AL	5	23	137	160	$14.40	1	1	1
4/27/2011	Cullman, AL	4	6	48	54	---	1	1	1
5/22/2011	Joplin, MO	5	158	1,150	1,308	$2,800.10	1	1	1
5/24/2011	Booneville, AR	4	4	27	31	$9.08	1	1	1
3/2/2012	Crittenden, KY	4	4	8	12	$20.50	1	1	1
5/15/2013	Decordoya, TX	4	6	54	60	$143.00	0	0	0
5/19/2013	Norman, OK	4	2	10	12	---	1	1	1
5/20/2013	Moore, OK	5	24	212	236	$2,000.00	1	1	1
10/4/2013	Sergeant Bluff, IA	4	0	0	0	$2.01	0	0	0
10/4/2013	Wayne, NE	4	0	15	15	$0.50	1	1	0
11/17/2013	Peoria, IL	4	3	125	128	$935.23	1	0	1
11/17/2013	New Minden, IL	4	2	2	4	---	1	0	1

The table shows summary information for all 35 tornadoes in our full sample. The 35 tornadoes are the subset of the 87 Fujuti or Enhanced Fujita 4 and 5 tornadoes that struck the US between 2002-2013 which have detailed damage path maps. Manuscript Section 2.1 and Appendix Section 1.1 provide more details. Sources: Tornado History Project, National Weather Service, Small Business Administration, US Census.

Table 2: **Individual Assistance Cash Grants and Small Business Administration Loans**
Zip Code Level Summary Statistics

Tornado:	Cash Assistance		No Cash Assistance	
Zip Code:	Hit	Buffer	Hit	Buffer
Panel A: Individual Assistance Cash Grants				
	Mean (Median)	Mean (Median)		
Days between PDD and Approval	12 (6)	25 (12)		
Total Assistance (1,000 $)	522 (133)	69 (15)		
Total Assistance Per-Grant	5,863 (5,140)	4,569 (2,531)		
Total Assistance Per-Capita	62 (20)	19 (2)		
Number of Zip Codes	160	55		
Panel B: Small Business Administration (SBA) Loans				
	Mean (Median)	Mean (Median)	Mean (Median)	Mean (Median)
Home Loans				
Total Verified Loss (1,000 $)	4,211 (701)	268 (24)	3,051 (170)	2 (0)
Total Approved Loans (1,000 $)	1,321 (266)	101 (0)	1,414 (132)	2 (0)
Per-Capita Approved Loans	297 (37)	38 (0)	344 (12)	0 (0)
Business Loans				
Total Verified Loss (1,000 $)	1,886 (68)	152 (0)	1,567 (0)	0 (0)
Total Approved Loans (1,000 $)	490 (0)	30 (0)	436 (0)	0 (0)
Per-Establishment Approved Loans ($)	3,138 (0)	112 (0)	2,394 (0)	0 (0)
Number of Zip Codes	154	54	19	6

The Individual Assistance data are from a Freedom of Information Act Request (No. 2015-FEFO-00159) submitted in December 2014 and received in January 2019. Due to confidentiality considerations, FEMA provided 5-digit zip code level information (rather than block-level). The cash grant and SBA loan data are discussed in Section 2.2 of the manuscript. Sources: Federal Emergency Management Agency, National Weather Service, Small Business Administration, US Census.

Table 3: **Household Finance Difference-in-Differences Estimates, Consumer Debt**

Dependent Variable:	Credit Card		Consumer Finance Loans		Home Conditional		Auto	
Tornado Type:	Cash	No-Cash	Cash	No-Cash	Cash	No-Cash	Cash	No-Cash
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Pooled								
After Tornado x Hit	-20	244	4	-71	-2,911	8,331	363*	-403
	(100)	(228)	(33)	(112)	(1,943)	(6,637)	(198)	(621)
Dependent Variable Mean	$3,622	$4,978	$884	$797	$149,584	$163,904	$6,996	$7,984
R-Squared	0.757	0.738	0.621	0.634	0.811	0.782	0.620	0.649
Observations	416,198	80,466	416,198	80,466	104,053	19,524	416,198	80,466
Panel B: Binned Damage Levels								
After Tornado x Low	116	641	8	121	889	10,663	188	-933
	(123)	(434)	(42)	(146)	(2,288)	(8,177)	(265)	(836)
Dependent Variable Mean	$3,472	$4,874	$887	$610	$154,202	$170,276	$7,018	$6,929
After Tornado x Medium	-94	-342	-32	-423***	-7,961**	-5,392	550*	17
	(149)	(262)	(59)	(151)	(3,664)	(8,217)	(302)	(943)
Dependent Variable Mean	$3,846	$5,417	$898	$1,314	$148,588	$174,400	$7,690	$9,159
After Tornado x High	-359**	134	63	117	-6,225**	37,798*	603*	1,011
	(173)	(383)	(61)	(296)	(2,850)	(19,996)	(356)	(754)
Dependent Variable Mean	$3,700	$4,033	$845	$16	$134,135	$113,552	$5,471	$9,494
R-Squared	0.757	0.738	0.621	0.634	0.811	0.782	0.620	0.649
Observations	416,198	80,466	416,198	80,466	104,053	19,524	416,198	80,466

This table presents difference-in-difference (DD) estimates for the four consumer debt outcomes we analyze using a triple difference model in the manuscript (Table 3, columns 1-4). The DD estimates represent the pre- to post-tornado difference in debt outcomes for hit individuals as compared to non-hit individuals in the 1-mile tornado buffer region. The table displays DD estimates separately for cash and no-cash tornadoes. See manuscript Section 3 for details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by census tract, * < 0.10, ** < 0.05, *** < 0.01. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 4: **Household Finance Difference-in-Differences Estimates, Financial Health**

Dependent Variable:	Risk Score		90 Day Delinquency		Foreclosure (Conditional)	
Tornado Type:	Cash	No-Cash	Cash	No-Cash	Cash	No-Cash
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Pooled						
After Tornado x Hit	-0.1	-1.2	-0.002	-0.007	-0.0003	0.0021
	(0.8)	(2.5)	(0.004)	(0.021)	(0.0007)	(0.0021)
Dependent Variable Mean	671.7	704.7	0.207	0.149	0.0049	0.0093
R-Squared	0.881	0.880	0.606	0.594	0.056	0.056
Observations	412,413	79,981	416,198	80,466	104,053	19,524
Panel B: Binned Damage Levels						
After Tornado x Low	-0.1	2.9	0.001	-0.040	-0.0011	0.0046
	(0.9)	(2.9)	(0.006)	(0.026)	(0.0009)	(0.0031)
Dependent Variable Mean	672.6	703.9	0.209	0.147	0.0059	0.0000
After Tornado x Medium	0.7	-7.0*	-0.009	0.041	0.0000	0.0001
	(1.1)	(3.7)	(0.006)	(0.032)	(0.0009)	(0.0034)
Dependent Variable Mean	672.7	698.8	0.206	0.180	0.0052	0.0244
After Tornado x High	-1.7	-2.3	0.006	0.004	0.0019	-0.0015*
	(1.7)	(6.4)	(0.008)	(0.011)	(0.0012)	(0.0009)
Dependent Variable Mean	666.4	729.0	0.206	0.051	0.0000	0.0000
R-Squared	0.881	0.880	0.606	0.595	0.056	0.057
Observations	412,413	79,981	416,198	80,466	104,053	19,524

This table presents difference-in-difference (DD) estimates for the three financial health outcomes we analyze using a triple difference model in the manuscript (Table 3, columns 5-7). The DD estimates represent the pre- to post-tornado difference in debt outcomes for hit individuals as compared to non-hit individuals in the 1-mile tornado buffer region. The table displays DD estimates separately for cash and no-cash tornadoes. See manuscript Section 3 for details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by census tract, * < 0.10, ** < 0.05, *** < 0.01. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 5: **Migration Difference-in-Differences Estimates**

Dependent Variable:	Move From Block		Move From County		Move From Block		Move From County	
Duration:	1 Quarter				3 Years			
Tornado Type:	Cash	No-Cash	Cash	No-Cash	Cash	No-Cash	Cash	No-Cash
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Pooled								
After Tornado x Hit	0.0019	-0.0054	0.0004	-0.0037	0.0003	0.0006	0.0001	0.0008
	(0.0020)	(0.0052)	(0.0011)	(0.0040)	(0.0002)	(0.0008)	(0.0002)	(0.0008)
Dependent Variable Mean	0.054	0.037	0.025	0.027	0.001	0.000	0.001	0.002
R-Squared	0.102	0.113	0.097	0.103	0.039	0.040	0.039	0.040
Observations	638,339	125,218	638,339	125,218	638,339	125,218	638,339	125,218
Panel B: Binned Damage Levels								
After Tornado x Low	0.0016	-0.0058	0.0010	-0.0067	-0.0000	0.0010	0.0002	0.0009
	(0.0021)	(0.0057)	(0.0014)	(0.0052)	(0.0003)	(0.0011)	(0.0002)	(0.0012)
Dependent Variable Mean	0.048	0.045	0.022	0.030	0.000	0.000	0.000	0.004
After Tornado x Medium	0.0006	-0.0072	-0.0009	-0.0007	0.0004	-0.0008	0.0002	0.0005
	(0.0032)	(0.0080)	(0.0021)	(0.0060)	(0.0004)	(0.0016)	(0.0003)	(0.0016)
Dependent Variable Mean	0.059	0.036	0.026	0.030	0.003	0.000	0.002	0.000
After Tornado x High	0.0053	0.0038	0.0008	0.0033	0.0009	0.0024	-0.0001	0.0010
	(0.0043)	(0.0144)	(0.0025)	(0.0115)	(0.0006)	(0.0017)	(0.0005)	(0.0023)
Dependent Variable Mean	0.067	0.000	0.033	0.000	0.001	0.000	0.001	0.000
R-Squared	0.102	0.113	0.097	0.103	0.039	0.040	0.039	0.040
Observations	638,339	125,218	638,339	125,218	638,339	125,218	638,339	125,218

This table presents difference-in-difference (DD) estimates for the migration outcomes we analyze using a triple difference model in the manuscript (Table 4). The DD estimates represent the pre- to post-tornado difference in migration rates for hit individuals as compared to non-hit individuals in the 1-mile tornado buffer region. The table displays DD estimates separately for cash and no-cash tornadoes. Please refer to manuscript Sections 3 and 4.1 for more details on the model. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by census tract, * < 0.10, ** < 0.05, *** < 0.01. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 6: **Difference-in-differences Estimates for Home Debt by Whether an Individual Moved Following a Tornado and by Type of Home Debt**

	Moved		Stayed		1st Mortgage Debt		Home Equity Debt	
Tornado Type:	Cash	No-Cash	Cash	No-Cash	Cash	No-Cash	Cash	No-Cash
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Pooled								
After Tornado x Hit	-2,031	14,536	-3,172	6,655	-2,818	8,825	-427	-1,520*
	(4,217)	(20,866)	(2,138)	(5,749)	(2,002)	(7,792)	(308)	(819)
Dependent Variable Mean	$151,191	$206,887	$148,838	$149,397	$139,657	$150,650	$8,560	$12,577
R-Squared	0.723	0.650	0.854	0.846	0.811	0.777	0.784	0.744
Observations	26,661	4,850	77,392	14,674	104,053	19,524	104,053	19,524
Panel B: Binned Damage Levels								
After Tornado x Low	2,444	14,634	531	10,416	986	5,862	-244	1,504
	(6,105)	(27,006)	(2,006)	(10,738)	(2,459)	(9,542)	(440)	(1,564)
Dependent Variable Mean	$170,533	$260,647	$148,961	$150,910	$143,353	$153,567	$9,216	$14,786
After Tornado x Medium	-4,708	-15,063	-10,213***	-1,270	-8,351**	-2,957	-435	-1,415
	(7,030)	(23,503)	(3,788)	(5,285)	(3,612)	(8,348)	(476)	(1,502)
Dependent Variable Mean	$141,382	$210,825	$152,942	$159,328	$139,643	$168,230	$8,118	$6,794
After Tornado x High	-6,035	73,971	-5,248	14,134*	-5,114*	51,608***	-1,090*	-12,461***
	(6,201)	(52,495)	(4,748)	(7,904)	(2,809)	(17,385)	(651)	(4,733)
Dependent Variable Mean	$130,109	$118,371	$137,690	$110,339	$125,588	$92,679	$7,023	$20,873
R-Squared	0.723	0.652	0.854	0.846	0.811	0.778	0.784	0.746
Observations	26,661	4,850	77,392	14,674	104,053	19,524	104,053	19,524

The table shows difference-in-difference model results for home debt conditional on whether an individual affected by a tornado (either hit or nearby) moved or stayed in the same census block following the tornado, and by type of home debt. Columns 1-2 only include individuals who move (for at least one quarter) at any point during the three years following the tornado. Columns 3-4 only include individuals who do not move. Our main measure of home debt includes both mortgage debt and home equity debt. Columns 5-6 only consider mortgage debt, while columns 7-8 only consider home equity debt. Please refer to manuscript Sections 3 and 4.1 for more details on the model. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by census tract, * $<$ 0.10, ** $<$ 0.05, *** $<$ 0.01. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 7: **Triple Difference Estimates for Highly Damaged Blocks "1 Digit" SIC Non-manufacturing Industries**

Dependent Variable:	Log(Establishments)	Log(Employment)
	(1)	(2)
Panel A: Agriculture, Forestry/Fishing		
Cash Tornado x Post x Hit	0.010	0.021
	(0.009)	(0.018)
R-squared	0.457	0.472
Observations	141,977	141,977
Panel B: Mining		
Cash Tornado x Post x High	-0.001	-0.009
	(0.002)	(0.008)
R-Squared	0.471	0.436
Observations	141,977	141,977
Panel C: Construction		
Cash Tornado x Post x High	0.063*	0.104*
	(0.036)	(0.057)
R-Squared	0.489	0.496
Observations	141,977	141,977
Panel D: Transportation		
Cash Tornado x Post x High	0.014	0.046*
	(0.015)	(0.025)
R-Squared	0.486	0.496
Observations	141,977	141,977
Panel E: Wholesale/Distributors		
Cash Tornado x Post x Hit	0.008	0.021
	(0.010)	(0.026)
R-squared	0.461	0.462
Observations	141,977	141,977
Panel F: Retail		
Cash Tornado x Post x High	0.041*	0.071
	(0.023)	(0.052)
R-Squared	0.571	0.564
Observations	141,977	141,977
Panel G: Finance, Insurance, Real Estate		
Cash Tornado x Post x High	0.034*	0.033
	(0.019)	(0.028)
R-Squared	0.553	0.541
Observations	141,977	141,977
Panel H: Service		
Cash Tornado x Post x High	0.082*	0.128*
	(0.042)	(0.073)
R-Squared	0.560	0.554
Observations	141,977	141,977

The table shows triple difference estimates for establishments in each of the "1 digit" industries that we pool together in the non-manufacturing business category (see manuscript 4.2.2 and Table 7). Excluded from the pooled non-manufacturing category and from this table are public administration businesses (SIC 91-97) and non-classified businesses (SIC 99). Standard errors (in parentheses) are robust to heteroskedasticity and clustered by tornado, * < 0.10, ** < 0.05, *** < 0.01. Sources: Infogroup Historical Database, National Weather Service, US Census.

Table 8: **Household Finance Triple Difference Estimates**

34 Tornado Sample, Inverse Propensity Weighted

Dependent Variable:	Debt Level				Financial Health		
	Credit Card	Consumer Finance Loans	Home (Conditional)	Auto	Risk Score	90 Day Delinquency	Foreclosure (Conditional)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Pooled							
Cash Tornado x Post x Hit	-616*	-152	-11,914***	-386	0.9	0.001	-0.0028
	(352)	(139)	(4,307)	(734)	(3.7)	(0.016)	(0.0275)
Dependent Variable Mean	$3,847	$924	$149,841	$7,413	675.1	0.214	0.0049
R-squared	0.740	0.642	0.814	0.628	0.883	0.612	0.056
Observations	456,777	456,777	122,827	456,777	458,031	456,777	122,827
Panel B: Binned							
Cash Tornado x Post x Low	-888	-335**	-11,746**	5	-3.2	0.035*	-0.0063*
	(605)	(130)	(5,010)	(1,097)	(3.2)	(0.020)	(0.0034)
Dependent Variable Mean	$3,675	$911	$154,347	$7,387	676.0	0.215	0.0059
Cash Tornado x Post x Medium	-95	160	-1,814	-683	7.1*	-0.051**	-0.0003
	(296)	(126)	(4,945)	(967)	(3.8)	(0.019)	(0.0479)
Dependent Variable Mean	$4,047	$948	$148,588	$8,054	674.9	0.211	0.0052
Cash Tornado x Post x High	-888**	-279**	-45,802***	-1,422**	2.1	-0.008	0.0031
	(350)	(120)	(5,004)	(692)	(2.8)	(0.011)	(0.0020)
Dependent Variable Mean	$4,071	$918	$135,265	$6,084	672.4	0.216	0.0000
R-squared	0.740	0.642	0.814	0.628	0.883	0.612	0.056
Observations	456,777	456,777	122,827	456,777	458,031	456,777	122,827

The table shows triple difference estimates for the same seven outcomes as in manuscript Table 3. The sample and econometric models underlying the estimates in this table are the same as those for manuscript Table 3, except that the sample in this table is trimmed and the estimates are weighted by the propensity score. Please refer to manuscript Sections 3 and 4.1 for more details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by tornado, except for those standard errors marked with a 1 which are clustered by census tract, and those marked with a 2 which are not clustered, * < 0.10, ** < 0.05, *** < 0.01. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 9: **Block and County Migration Estimates**

34 Tornado Sample, Inverse Propensity Weighted

Dependent Variable:	Move From Block	Move From County	Move From Block	Move From County
Duration:	1 Quarter		3 Years	
	(1)	(2)	(3)	(4)
Panel A: Pooled				
Cash Tornado x Post x Hit	0.008**	0.011**	0.000	-0.000
	(0.003)	(0.004)	(0.001)	(0.001)
Dependent Variable Mean	0.054	0.025	0.001	0.001
R-squared	0.107	0.099	0.040	0.040
Observations	496,289	496,289	496,289	496,289
Panel B: Binned Damage Levels				
Cash Tornado x Post x Low	0.008	0.014	-0.001	-0.000
	(0.005)	(0.009)	(0.002)	(0.000)
Dependent Variable Mean	0.048	0.022	0.000	0.000
Cash Tornado x Post x Medium	0.009	0.007*	0.002*	0.000
	(0.005)	(0.004)	(0.001)	(0.001)
Dependent Variable Mean	0.059	0.026	0.003	0.002
Cash Tornado x Post x High	0.004	0.005	-0.001**	-0.001
	(0.010)	(0.005)	(0.000)	(0.001)
Dependent Variable Mean	0.067	0.033	0.001	0.001
R-Squared	0.107	0.099	0.040	0.040
Observations	496,289	496,289	496,289	496,289

The table shows inverse propensity score weighted triple difference estimates for whether an individual hit by a tornado moves from their census block or county. Columns (1) and (2) define a move as being for (at least) one quarter, while columns (3) and (4) define a move as being for (at least) three years. The sample and econometric models underlying the estimates in this table are the same as those for manuscript Table 4, except that the sample in this table is trimmed and the estimates are weighted by the propensity score. Please refer to manuscript Sections 3 and 4.1 for more details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by census tract, * < 0.10, ** < 0.05, *** < 0.01. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 10: **Household Finance Triple Difference Estimates - Heterogeneity**

34 Tornado Sample, Inverse Propensity Weighted

Dependent Variable:	Debt Level				Financial Health		Migration	
	Credit Card	Consumer Finance Loans	Home (Conditional)	Auto	90 Day Delinquency	Foreclosure (Conditional)	Move from Block	Move from County
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Available Credit								
Low Available Credit								
Cash Tornado x Post x Hit	220	-123	-10,155	-100	-0.024	-0.0030	-0.018***	-0.003
	(151)	(144)	(7,098)	(694)	(0.057)	(0.0169)	(0.006)	(0.007)
Dependent Variable Mean	$432	$686	$126,903	$3,840	0.356	0.0000	0.052	0.022
Observations	123,729	123,729	13,389	123,729	123,729	13,389	149,895	149,895
High Available Credit								
Cash Tornado x Post x Hit	-1,348**	-265	-17,848***	-183	0.006	-0.0010	0.022**	0.023***
	(563)	(230)	(5,532)	(1,203)	(0.011)	(0.0023)	(0.009)	(0.004)
Dependent Variable Mean	$7,177	$558	$153,459	$8,542	0.039	0.0031	0.045	0.018
Observations	165,817	165,817	68,076	165,817	165,817	68,076	182,746	182,746
Panel B: Credit Score								
Low Credit Score								
Cash Tornado x Post x Hit	-452	-155	12,120**	-365	-0.034	-0.0028	-0.008	0.001
	(345)	(181)	(5,573)	(745)	(0.054)	(0.0186)	(0.006)	(0.007)
Dependent Variable Mean	$2,057	$1,398	$127,882	$5,951	0.561	0.0179	0.071	0.032
Observations	142,295	142,295	21,230	142,295	142,295	21,230	146,825	146,825
High Credit Score								
Cash Tornado x Post x Hit	-990*	-130*	-16,540**	-470	0.001	0.0002	0.018**	0.019***
	(533)	(67)	(6,497)	(883)	(0.000)	(0.0002)	(0.007)	(0.004)
Dependent Variable Mean	$3,251	$325	$162,587	$6,316	0.000	0.0000	0.031	0.013
Observations	160,666	160,666	55,020	160,666	160,666	55,020	185,414	185,414
Panel C: Age								
Young								
Cash Tornado x Post x Hit	-598	-30	16,001	1,342	-0.033**	-0.0069	0.004	0.017
	(511)	(123)	(9,757)	(1,382)	(0.013)	(0.0056)	(0.009)	(0.011)
Dependent Variable Mean	$2,921	$893	$167,934	$7,978	0.310	0.0108	0.072	0.038
Observations	149,652	149,652	26,887	149,652	149,652	26,887	140,723	140,723
Old								
Cash Tornado x Post x Hit	110	-93	-20,476***	-1,345	0.017	-0.0021	0.001	0.004
	(376)	(210)	(5,633)	(1,020)	(0.018)	(0.0013)	(0.005)	(0.005)
Dependent Variable Mean	$3,701	$625	$119,737	$5,483	0.107	0.0054	0.034	0.013
Observations	154,223	154,223	38,908	154,223	154,223	38,908	193,335	193,335

The table shows triple difference estimates for the same outcomes as in manuscript Table 5. The sample and econometric models underlying the estimates in this table are the same as those for manuscript Table 5, except that the sample in this table is trimmed and the estimates are weighted by the propensity score. Please refer to manuscript Sections 3 and 4.1 for more details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by tornado, except for those standard errors marked with a 1 which are clustered by census tract, and those marked with a 2 which are not clustered, * < 0.10, ** < 0.05, *** < 0.01. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 11: **Household Finance Triple Difference Estimates**

35 Tornado Sample, No Inverse Propensity Score Weighting

Dependent Variable:	Debt Level				Financial Health		
	Credit Card	Consumer Finance Loans	Home (Conditional)	Auto	Risk Score	90 Day Delinquency	Foreclosure (Conditional)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Pooled							
Cash Tornado x Post x Hit	-241	83	-7,564	599	2.1	0.002	-0.0017
	(405)	(98)	(4,946)	(603)	(3.3)	(0.016)	(0.0022)
Dependent Variable Mean	$3,622	$884	$149,584	$6,996	671.7	0.207	0.0049
R-squared	0.753	0.624	0.806	0.626	0.882	0.605	0.055
Observations	498,687	498,687	123,843	498,687	494,391	498,687	123,843
Panel B: Binned							
Cash Tornado x Post x Low	-439	-75	-6,440	888	-1.2	0.034	-0.0049*
	(612)	(113)	(5,036)	(900)	(3.0)	(0.020)	(0.0029)
Dependent Variable Mean	$3,472	$887	$154,202	$7,018	672.6	0.209	0.0059
Cash Tornado x Post x Medium	262	376***	1,476	378	8.0*	-0.051***	0.0008
	(368)	(103)	(6,002)	(1,027)	(4.1)	(0.017)	(0.0045)
Dependent Variable Mean	$3,846	$898	$148,588	$7,690	672.7	0.206	0.0052
Cash Tornado x Post x High	-665*	-65	-39,585***	-429	1.4	-0.000	0.0042***
	(364)	(78)	(4,453)	(642)	(2.4)	(0.011)	(0.0015)
Dependent Variable Mean	$3,700	$845	$134,135	$5,471	666.4	0.206	0.0000
R-squared	0.753	0.624	0.807	0.626	0.882	0.605	0.055
Observations	498,687	498,687	123,843	498,687	494,391	498,687	123,843

The table shows triple difference estimates for the same seven outcomes as in manuscript Table 3. The only difference between the sample and econometric model underlying the estimates in each table is that this table shows results from the 35 tornado sample that includes the Wayne, NE tornado. Please refer to manuscript Sections 3 and 4.1 for more details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by tornado, except for those standard errors marked with a 1 which are clustered by census tract, and those marked with a 2 which are not clustered, * < 0.10, ** < 0.05, *** < 0.01. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 12: **Block and County Migration Estimates**

35 Tornado Sample, No Inverse Propensity Score Weighting

Dependent Variable:	Move From Block	Move From County	Move From Block	Move From County
Duration:	1 Quarter		3 Years	
	(1)	(2)	(3)	(4)
Panel A: Pooled				
Cash Tornado x Post x Hit	0.008**	0.005	-0.001	-0.001
	(0.004)	(0.003)	(0.001)	(0.001)
Dependent Variable Mean	0.054	0.025	0.001	0.001
R-squared	0.104	0.099	0.039	0.039
Observations	766,282	766,282	766,282	766,282
Panel B: Binned Damage Levels				
Cash Tornado x Post x Low	0.009	0.009	-0.001	-0.001
	(0.005)	(0.007)	(0.002)	(0.000)
Dependent Variable Mean	0.048	0.022	0.000	0.000
Cash Tornado x Post x Medium	0.008*	0.001	0.001	-0.000
	(0.005)	(0.004)	(0.001)	(0.001)
Dependent Variable Mean	0.059	0.026	0.003	0.002
Cash Tornado x Post x High	0.004	-0.001	-0.002***	-0.001**
	(0.009)	(0.004)	(0.000)	(0.001)
Dependent Variable Mean	0.067	0.033	0.001	0.001
R-Squared	0.104	0.099	0.039	0.039
Observations	766,282	766,282	766,282	766,282

The table shows triple difference estimates for whether an individual hit by a tornado moves from their census block or county. Columns (1) and (2) define a move as being for (at least) one quarter, while columns (3) and (4) define a move as being for (at least) three years. The only difference between the sample and econometric model underlying the estimates in manuscript Table 4 is that this table shows results from the 35 tornado sample that includes the Wayne, NE tornado. Please refer to manuscript Sections 3 and 4.1 for more details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by census tract, * < 0.10, ** < 0.05, *** < 0.01. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 13: **Household Finance Triple Difference Estimates - Heterogeneity**

35 Tornado Sample, No Inverse Propensity Score Weighting

Dependent Variable:	Debt Level				Financial Health		Migration	
	Credit Card	Consumer Finance Loans	Home (Conditional)	Auto	90 Day Delinquency	Foreclosure (Conditional)	Move from Block	Move from County
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Available Credit								
Low Available Credit								
Cash Tornado x Post x Hit	330*	102	-10,432	732	-0.004	-0.0088	-0.002	-0.000
	(174)	(122)	(10,085)	(588)	(0.052)	(0.0133)	(0.011)	(0.006)
Dependent Variable Mean	$392	$598	$126,903	$3,435	0.316	0.0000	0.052	0.022
Observations	152,669	152,669	13,505	152,669	152,669	13,505	247,617	247,617
High Available Credit								
Cash Tornado x Post x Hit	-557	-142	-11,691*	1,068	0.009	-0.0001	0.023***	0.018***
	(685)	(149)	(5,785)	(896)	(0.012)	(0.0014)	(0.007)	(0.003)
Dependent Variable Mean	$7,101	$558	$153,092	$8,447	0.039	0.0031	0.045	0.018
Observations	171,567	171,567	68,751	171,567	171,567	68,751	264,086	264,086
Panel B: Credit Score								
Low Credit Score								
Cash Tornado x Post x Hit	113	502**	10,661	672	-0.035	0.0016	-0.001	-0.005
	(265)	(232)	(9,153)	(1,050)	(0.051)	(0.0131)	(0.008)	(0.007)
Dependent Variable Mean	$1,900	$1,307	$127,929	$5,466	0.525	0.0179	0.071	0.032
Observations	161,767	161,767	21,446	161,767	161,767	21,446	246,789	246,789
High Credit Score								
Cash Tornado x Post x Hit	-448	-25	-12,176	277	0.001	0.0003	0.021***	0.016***
	(704)	(64)	(7,837)	(696)	(0.000)	(0.0002)	(0.006)	(0.003)
Dependent Variable Mean	$3,204	$319	$162,278	$6,193	0.000	0.0000	0.031	0.013
Observations	166,859	166,859	55,570	166,859	166,859	55,570	246,713	246,713
Panel C: Age								
Young								
Cash Tornado x Post x Hit	-697	292**	16,200	2,041*	0.004	-0.0046	-0.002	0.003
	(458)	(123)	(9,972)	(1,155)	(0.036)	(0.0048)	(0.008)	(0.009)
Dependent Variable Mean	$2,684	$850	$167,478	$7,315	0.289	0.0108	0.072	0.038
Observations	168,802	168,802	27,162	168,802	168,802	27,162	255,680	255,680
Old								
Cash Tornado x Post x Hit	420	5	-13,875**	-211	0.011	-0.0010	0.009	0.005
	(530)	(153)	(6,500)	(858)	(0.018)	(0.0014)	(0.006)	(0.004)
Dependent Variable Mean	$3,571	$618	$119,737	$5,336	0.107	0.0054	0.034	0.013
Observations	163,858	163,858	39,299	163,858	163,858	39,299	263,168	263,168

The table shows triple difference estimates for the same outcomes as in manuscript Table 5. The only difference between the sample and econometric model underlying the estimates in each table is that this table shows results from the 35 tornado sample that includes the Wayne, NE tornado. Please refer to manuscript Sections 3 and 4.1 for more details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by tornado, except for those standard errors marked with a 1 which are clustered by census tract, and those marked with a 2 which are not clustered, * < 0.10, ** < 0.05, *** < 0.01. Sources: Federal Reserve Bank of New York Consumer Credit Panel / Equifax (CCP), National Weather Service, US Census.

Table 14: **Estimates for the Number of Businesses Establishments and Employees**

34 Tornado Sample, Inverse Propensity Weighted

Model:	Triple Difference		Difference-In-Difference			
Dependent Variable:	Log (Establishments)	Log (Employment)	Log(Establishments)		Log(Employment)	
Tornado Type:			Cash	No-Cash	Cash	No-Cash
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Pooled						
Cash Tornado x Post x Hit	0.225**	0.344**	-0.006	-0.218***	-0.024	-0.328**
	(0.097)	(0.156)	(0.014)	(0.079)	(0.026)	(0.132)
R-squared	0.562	0.555	0.557	0.544	0.549	0.518
Observations	141,745	141,745	124,888	16,857	124,888	16,857
Panel B: Binned Damage Levels						
Cash Tornado x Post x Low	0.276**	0.420**	0.043***	-0.223**	0.054*	-0.336**
	(0.115)	(0.187)	(0.015)	(0.094)	(0.030)	(0.156)
Cash Tornado x Post x Medium	0.136**	0.166	-0.063**	-0.186**	-0.122***	-0.237
	(0.064)	(0.124)	(0.025)	(0.076)	(0.046)	(0.146)
Cash Tornado x Post x High	0.122	0.336	-0.131***	-0.220**	-0.219***	-0.445*
	(0.100)	(0.347)	(0.027)	(0.087)	(0.053)	(0.227)
R-Squared	0.563	0.556	0.557	0.544	0.549	0.518
Observations	141,745	141,745	124,888	16,857	124,888	16,857

Columns (1) and (2) show triple difference estimates of the effect of cash grants on the number of establishments and employment. Columns (3)-(6) show difference-in-differences model estimates separately for cash and no-cash tornadoes. The sample and econometric models underlying the estimates in this table are the same as those for manuscript Table 6, except that the sample in this table is trimmed and the estimates are weighted by the propensity score. Please refer to manuscript Sections 3 and 4.2 for more details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by tornado for the triple difference model and by census tract for the difference-in-differences model, * < 0.10, ** < 0.05, *** < 0.01. Sources: Infogroup Historic Business Database, National Weather Service, US Census.

Table 15: **Heterogeneity in Business Establishment Triple Difference Estimates by Industry, Age, and Size**

34 Tornado Sample, Inverse Propensity Weighted

	(1)	(2)
Dependent Variable:	**Log(Establishments)**	**Log(Employment)**
Panel A: Establishment Industry		
Non-Manufacturing		
Cash Tornado x Post x Hit	0.225**	0.344**
	(0.098)	(0.157)
R-squared	0.562	0.553
Manufacturing		
Cash Tornado x Post x Hit	-0.003	-0.017
	(0.008)	(0.034)
R-squared	0.513	0.515
Panel B: Establishment Age		
New (1 year or less)		
Cash Tornado x Post x Hit	0.051	0.056
	(0.033)	(0.049)
R-squared	0.395	0.329
Existing (4 years or more)		
Cash Tornado x Post x Hit	0.147*	0.247*
	(0.079)	(0.132)
R-squared	0.543	0.536
Panel C: Establishment Size		
Small (≤ 3 Employees)		
Cash Tornado x Post x Hit	0.172**	0.216**
	(0.069)	(0.089)
R-squared	0.544	0.528
Large (≥ 7 Employees)		
Cash Tornado x Post x Hit	0.123*	0.208
	(0.070)	(0.123)
R-squared	0.576	0.572

The samples and econometric models underlying the estimates in this table are the same as those for manuscript Table **??**, except that the sample in this table is trimmed and the estimates are weighted by the propensity score. Please refer to manuscript Sections 3 and 4.2 for more details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by tornado, * < 0.10, ** < 0.05, *** < 0.01. Sources: Infogroup Historic Business Database, National Weather Service, US Census.

Table 16: **Estimates for the Number of Businesses Establishments and Employees**

35 Tornado Sample, No Inverse Propensity Score Weighting

Model:	Triple Difference		Difference-In-Difference			
Dependent Variable:	Log (Establishments)	Log (Employment)	Log(Establishments)		Log(Employment)	
Tornado Type:			Cash	No-Cash	Cash	No-Cash
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Pooled						
Cash Tornado x Post x Hit	0.141	0.231	-0.002	-0.122***	-0.014	-0.203**
	(0.095)	(0.155)	(0.014)	(0.047)	(0.026)	(0.087)
R-squared	0.560	0.555	0.559	0.518	0.549	0.513
Observations	143,337	143,337	125,016	18,321	125,016	18,321
Panel B: Binned Damage Levels						
Cash Tornado x Post x Low	0.192*	0.319*	0.047***	-0.128**	0.066**	-0.220**
	(0.104)	(0.174)	(0.015)	(0.053)	(0.030)	(0.100)
Cash Tornado x Post x Medium	0.069	0.027	-0.060**	-0.111	-0.116**	-0.098
	(0.090)	(0.177)	(0.025)	(0.074)	(0.046)	(0.137)
Cash Tornado x Post x High	-0.011	0.099	-0.127***	-0.069	-0.209***	-0.210
	(0.115)	(0.278)	(0.027)	(0.088)	(0.052)	(0.190)
R-Squared	0.561	0.555	0.559	0.518	0.549	0.513
Observations	143,337	143,337	125,016	18,321	125,016	18,321

Columns (1) and (2) show triple difference estimates of the effect of cash grants on the number of establishments and employment. Columns (3)-(6) show difference-in-differences model estimates separately for cash and no-cash tornadoes. The sample and econometric models underlying the estimates in this table are the same as those for manuscript Table 6, except that this table shows results from the 35 tornado sample that includes the Wayne, NE tornado. Please refer to manuscript Table 6 and manuscript Sections 3 and 4.2 for more details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by tornado for the triple difference model and by census tract for the difference-in-differences model, * < 0.10, ** < 0.05, *** < 0.01. Sources: Infogroup Historic Business Database, National Weather Service, US Census.

Table 17: **Heterogeneity in Business Establishment Triple Difference Estimates by Industry, Age, and Size**

35 Tornado Sample, No Inverse Propensity Score Weighting

	(1)	(2)
Dependent Variable:	**Log(Establishments)**	**Log(Employment)**
Panel A: Establishment Industry		
Non-Manufacturing		
Cash Tornado x Post x Hit	0.143	0.230
	(0.093)	(0.154)
R-squared	0.560	0.552
Manufacturing		
Cash Tornado x Post x Hit	-0.008	-0.032
	(0.008)	(0.033)
R-squared	0.513	0.519
Panel B: Establishment Age		
New (1 year or less)		
Cash Tornado x Post x Hit	-0.001	-0.018
	(0.018)	(0.024)
R-squared	0.379	0.317
Existing (4 years or more)		
Cash Tornado x Post x Hit	0.080	0.181
	(0.067)	(0.117)
R-squared	0.538	0.534
Panel C: Establishment Size		
Small (≤ 3 Employees)		
Cash Tornado x Post x Hit	0.107	0.130
	(0.066)	(0.085)
R-squared	0.543	0.529
Large (≥ 7 Employees)		
Cash Tornado x Post x Hit	0.063	0.116
	(0.040)	(0.086)
R-squared	0.570	0.571

Note: Shawn has not sent these results yet The samples and econometric models underlying the estimates in this table are the same as those for manuscript Table **??**, except that this table shows results from the 35 tornado sample that includes the Wayne, NE tornado. Please refer to manuscript Sections 3 and 4.2 for more details. Standard errors (in parentheses) are robust to heteroskedasticity and clustered by tornado, * < 0.10, ** < 0.05, *** < 0.01. Sources: Infogroup Historic Business Database, National Weather Service, US Census.