Taken by Storm: Business Survival in the Aftermath of Hurricane Katrina

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PRELIMINARY AND INCOMPLETE

Abstract

We use Hurricane Katrina's damage to the Mississippi coast in 2005 as a natural

1 Introduction

Hurricane Katrina's landfall in the fall of 2005 famously breached levees, flooding New Orleans. It also unleashed wind gusts and storm surge that destroyed hundreds of buildings along the Mississippi gulf coast. In this paper, we study the effect of direct storm-inflicted damage on establishments' ability to recover, focusing on the Mississippi coast. We use data from the Census Bureau's Longitudinal Business Database (LBD) on approximately 10,000 business establishments in Mississippi, including nearly 2,300 businesses in four counties with significant storm damage, combined with precise information on the location and extent of storm damage from the Federal Emergency Management Administration (FEMA). These data allow us to pinpoint which establishments were hit directly (e.g., damaged or destroyed by wind or storm surge) and which were left intact in the same area. We focus on establishments in the retail, restaurant, and hotel sectors, whose locations are non-fungible. Our identification comes from the randomness of actual damage within this fairly limited geographic area.

We document several characteristics of surviving businesses. First, establishments that survive are more likely to belong to large chains than establishments that do not survive. *Ceteris paribus*, a doubling of the size of the chain to which an establishment belongs reduces the impact of extensive or catastrophic damage on the probability of exit between 2004 and 2006 by about 2.5 percentage points, or about 10%.

Second, we use triple-difference regressions to show that the distance between an establishment's location and the nearest bank or bank branch is negatively correlated with the establishment's ability to survive storm damage, and that this is particularly true for establishments in small chains and stand-alone businesses. Of course, businesses in denser commercial areas may recover more easily from damage for reasons unrelated to access to credit, such as greater customer foot traffic. To test whether the differential recovery rates correlated with distance to the nearest bank are due to some omitted factor, we add a specification test using distance to the nearest dentist as an explanatory variable. Since we do not believe access to dentists has a causal effect on business survival, the difference in the explanatory power of distance to a bank and distance to a dentist provides us with a sense of the importance of banks relative to general commercial density. We find a weak relationship between distance to the nearest dentist and an establishment's ability to recover from storm damage, but, unlike in the case of distance to a bank, this effect does not vary with firm size.

Finally, we observe that most short-run predictors of survival are significantly weakened

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focus on in this paper, was in Louisiana (primarily due to flooding) and along the Mississippi coast (primarily due to high winds and storm surge).

Katrina's damage in Louisiana was widespread and caused large-scale population relocations and destruction of infrastructure. The population in many of the parishes has yet to recover. The population relocation created significant demand shocks; in the hospitality industry, which is a major focus of our paper, infrastructure damage also reduced tourism, exacerbating the extent of the demand shock. Because it is difficult if not impossible to compare the consumption patterns of the displaced and remaining populations, we cannot separately identify demand and cost shocks in Louisiana.

In contrast, infrastructure damage in Mississippi was for the most part limited, localized, and short-lived, and population loss was much more limited and short-lived. It is for this reason that the present study focuses on Mississippi. As one example, three weeks after Katrina, a bridge on Interstate 10 in Mississippi that was battered by a barge during the storm was open to traffic (Northway, 2005). A second bridge, Biloxi Bay Bridge, on U.S. 90 in Harrison and Jackson counties, took longer to reconstruct reopened in 2007 (Kunzelman, 2007). Because of the localization and short life of most infrastructure damage, we are able to identify the effects of damage to specific business establishments separately from widespread demand and cost shocks in Mississippi.

Figure 1 shows a map of Mississippi, highlighting the four counties that were most affected by hurricane Katrina. Table 1 lists the 2000 and 2010 population in the affected counties and the rest of the state. Population changes between 2000 and 2010 were generally modest in Mississippi. The exception is Stone County, which saw a population gain of nearly 27%. Stone County is very small, however, and accounts for less than 0.5% of our observations.

Given our concern with the impact demand shocks have on the relative activity of large and small firms it is important to gauge the extent of such shocks in Mississippi. One indicator of economic recovery is the local unemployment rate, which rose in Hancock, Harrison, and Jackson counties in 2005 and 2006, but by 2007 had returned to its pre-storm levels (Sayre and Butler, 2011). Another indicator of economic activity, especially relevant for the hospitality sectors including restaurants and hotels, is passenger air tra c. Figure 2 shows the dramatic decline and the recovery of the number of air passengers traveling to and third was disbursed to Mississippi businesses.

Despite this and sundry other programs, the General Accounting Office (GAO) concluded that some small businesses experienced credit- and funding-related difficulties recovering from the disasters. In some cases this was because their financial documents were lost in the disaster, limiting their ability to apply for SBA and other loans, and in other cases

Whereas a lawyer may continue to provide legal services and a janitorial firm may continue to provide cleaning services even if the main office is destroyed, stores, restaurants, and hotels provide their services at the business address and cannot survive otherwise.[4]

The LBD is an establishment-level dataset that includes firm characteristics. An establishment is the physical location where business is conducted and a firm is the legal entity with operational control. Establishments that belong to the same firm are linked in the data via a firm identifier. Firms in the LBD can and often do have very complex and dynamic structures. The LBD tracks the activity of these firms over time, i.e., establishments that open or close as well as any acquisitions and divestitures of pre-existing establishments. In the retail and hospitality context, a multi-establishment firm is usually a chain, although it can also be a firm operating, say, one retail outlet and one or more non-retail outlets (manufacturing facilities, warehouses, etc.). We use the firm identifier on each record to compute firm characteristics including the firm's age and its size.[5]

The LBD is constructed from several sources, of which the most important for our purposes are administrative business filings from the Internal Revenue Service (IRS).[6] These filings are processed by the Census Bureau on a flow basis as they are received. Establishments in the LBD are defined to be "active" if they have positive payroll at any point during the year. Following Katrina, the IRS several times postponed the tax filing deadlines, including waiving penalties and late fees, of individuals and businesses in affected areas. The

ArcGIS provides a normalized \score," out of 100, to indicate the quality of the geocoding; we keep only geocodes scored 60 or above. In a small number of cases the business address may represent the address of an accountant or other hired provider who assists the business with those forms. To minimize this problem, we removed 230 businesses whose addresses were identical to addresses provided by accounting or bookkeeping rms.

Not all addresses are of the necessary quality to be able to geocode down to the latitude and longitude successfully, either by the Geography Division or us. Incomplete addresses and non standard addresses (e.g. rural routes and PO Box) are main reasons for failures. Rural areas are known to be particularly problematic in this regard. For 2004, in each of the four

Damage information comes from FEMA and is described in detail in Jarmin and Miranda (2009). Using remote-sensing technology, FEMA classi ed damaged areas over the period August 30 to September 10 using a four-tier damage scale: limited, moderate, extensive, and catastrophic. We reduce this to a two-tier system, combining \extensive" and \catastrophic" into one category, and combining the \limited" and \moderate" into a second category. In practice, there was very little extensive damage, with almost all of the extensive/catastrophic damage being catastrophic. Critically, damage designations are not based on insurance

(All numbers are rounded to the nearest ten.)

We refer to all of these establishments as \damaged." The nal three columns in Table 2 provide the approximate percentage of establishments in each of the designated areas. Cells and an additional 4,591 establishments in accommodation and food services, a category that includes both restaurants and hotels. Of these 17,089, 403 were non-store retailers, 49 were caterers, and 11 were mobile food-service providers, leaving 16,626 establishments in the NAICS codes we include in our analysis.[10] The Business Dynamics Statistics (BDS) establishment-age by state table indicates that 17.5% of Mississippi establishments in 2004 were less than two years old, and are therefore excluded from our sample. Nationwide, 18.3% of retail establishments and 19.4% of service establishments were less than two years old in 2004.[11]

damaged by wind but also whether their residential address was damaged.

Table 5 provides summary statistics for the sole-proprietor sample in 2002 and 2004. As in the earlier tables, the first panel shows 2002 data for undamaged and damaged establishments and the second panel shows 2004 data. We omit firm-size measures because the 99th percentile sole proprietorship in our sample operated just one establishment. Compared to the full sample of establishments, which had 17 employees on average, sole proprietorships in our sample have only approximately 4 employees. They are also further from the nearest bank and dentist than the full sample. Perhaps surprisingly, they are only slightly younger on average than the full sample. As was the case with the full sample, sole proprietorships located in areas that were later damaged by storms are closer to banks and dentists than those in undamaged areas, but the difference is only statistically significant for dentists. No other establishment-level characteristics differ statistically by damage classification.

4 Stylized Facts

In this section we provide basic facts regarding the effect of the hurricanes on the economic activity of the region. We divide establishments in the sectors under analysis and for each state into three categories, based on their location: "damaged area" refers to establishments in areas that were extensively or catastrophically damaged by Katrina in the fall of 2005 as identified through FEMA's geo-spatial maps. "Undamaged area in damaged county" refers to establishments located in areas that were either undamaged or damaged to a limited or moderate extent, in Hancock, Harrison, Jackson, and Stone counties (the counties in which FEMA designated damaged areas). Finally, "rest of state" refers to counties that did not receive any such damage. Figure 4 shows the log change in the number of restaurants, stores, and hotels with positive payroll activity in each of these categories relative to 2002. The immediate effect of Katrina was an approximately 35% reduction in the number of payroll active establishments in the damaged areas of Mississippi. These areas remained depressed in 2008, while the number of establishments in undamaged areas continued the positive trend growth through 2008 with a small dip for establishments located in undamaged areas of damaged counties.

The nding that recovery of the hardest-hit areas was slow is consistent with other evidence. Burton, Mitchell, and Cutter (2011) use repeated photographic evidence to construct a recovery index for post-Katrina Mississippi. They nd that three years after the storm, i.e., by late 2008, approximately 65% of the Mississippi Gulf Coast was fully recovered in the sense that damaged buildings had been either repaired or razed and reconstructed. They also note some variation in this recovery, with some towns, such as Moss Point, MS, which storms.[12] This slump is due to a combination of three factors: demand and supply disruptions, temporary closures of businesses with less-than-extensive damage, and measurement

On the right-hand side, is a county xed e ect intended to capture di erent area-wide exit probabilities due to overall demand and infrastructure shocks. The six-digit NAICS xed e ect captures di erences in exit and reentry rates across 110 types of businesses, for example due to the fact that some types of businesses, such as building-material stores, may have fared better than others in the immediate aftermath of the storm (Pearson, Hickman, and Lawrence, 2011). All establishment- and rm-level control variables are evaluated in 2004. FirmSize is measured by the number of establishments operated by the rm that owns establishment *i*.[14] Damage is a vector of two damage indicators: limited or moderate damage and extensive or catastrophic damage, as described in Section 3.

The variable Prod is the ratio of revenue to payroll in 2002, normalized by sector (retail, restaurants, hotels). To allow for the possibility that more productive establishments may be able to better withstand shocks, as well as have better reasons to return to operation after a negative shock, we also include the interaction between Prod and Damage. Productivity di erentials may be correlated with constraints of many types including credit constraints;

not in operation). In the aftermath of Katrina, we are interested not only in who exited but in who returned to operation. For this purpose we estimate a probability model with varying time horizons rather than a hazard model that imposes a single transition. We de ne an \exit" between 2004 and 2006 not as a permanent state change but as a (potentially) temporarily one; and we revisit the same establishments in 2008 to see which of them is, at that point, no longer in operation (whether or not it was in operation in 2006). The choice of a linear probability model over a nonlinear model such as a probit or logit is for computational convenience, partly due to the large number of xed e ects: there are 110 six-digit NAICS codes (

are, we discuss the differences in the text.

The identifying assumption in our analysis is that, within the counties affected by Katrina, the precise path of the storm and therefore the damage inflicted was random. While businesses were clearly not damaged *due to* any underlying characteristics such as size, productivity, profitability, etc. (the hypothesis of God's wrath notwithstanding), it could still be that damage was assigned non-randomly, that is, in a way that is correlated with un-

Estimates from this regression are presented in Table 6. We estimate three regressions, each of which defines \exits" over a different time period or horizon. The first uses 2002 as the baseline and uses a two-year horizon to define exits. This is our pre-storm baseline. The second uses 2004 data with a two-year horizon (post-storm short run), and the third uses

small number of employees | regardless of whether the store is operational. There could be multiple reasons for this; for instance, the business may retain good employees in expectation that the business will resume operations; reward long-term employees at a time of hardship, even if the business is not generating any revenue and possibly even if it does not expect to resume operation; keep the business operating at a skeletal level in order to gain an

5.2.2 Non-Employer Businesses

by Brevoort, Holmes, and Wolken (2010).[17]

We estimate a triple-di erence regression to allow the e ect of damage on an establishment's probability of exit to di er by rm size, as above, and also by its distance to the nearest bank, as well as by the interaction of the two. For completeness, we also allow an interaction of distance to the nearest bank with rm size; that is, not interacted with damage. The probability model is extended as follows:

$$\begin{aligned} \text{Exit}_i = \; & {}_{j(i)} + {}_{n(i)} + \ln(\text{FirmSize})_i + \ln(\text{Distance})_i + \text{Damage}_i \\ & + \ln(\text{FirmSize})_i \; \text{Damage}_i + \ln(\text{Distance})_i \; \text{Damage}_i + \ln(\text{FirmSize})_i \; \ln(\text{Distance})_i \\ & + \ln(\text{FirmSize})_i \; \ln(\text{Distance})_i \; \text{Damage}_i + {}_{s(i)} \; \text{Prod}_i + {}_{s(i)} \; \text{Prod}_i \; \text{Damage}_i \\ & + \text{Establishment controls}_i + {}''_i \qquad (2) \end{aligned}$$

where Distance is the distance between establishment *i* and the nearest bank lending institution included in the 2002 LBD. This regression includes, in addition to all the variables from Equation (1), our new sets of variables: log distance; log distance interacted with the vector of damage indicators; log distance interacted with log rm size; and the three-way interaction of log distance, log rm size, and the vector of damage indicators.

The results are reported in the rst with the-(i)]TJe-27(ortohe)f27(ortTnessog)-3050

The probability of exit declines with firm size and increases with distance from the nearest bank in the pre-storm period. The negative coefficient on the interaction of distance and firm size implies that the increase in exit rates correlated with distance from a bank diminishes for larger firms. Finally, the baseline estimates show a positive and statistically significant coefficient on the three-way interaction term: The mitigating effect of firm size on the relationship between distance and exit does not hold in the pre-storm period in the area later damaged by the storm.

The negative relationship between firm size and exit was already noted in Section 5.1. The new effect, the relationship between distance to the nearest bank and exit, is likely a combination of a causal effect noted in the finance literature whereby physical distance is a proxy for the existence or strength of a lending relationship; correlation with unobserved neighborhood-specific factors, such as neighborhood safety and customer traffic that tend to be higher in areas with banks and contribute to business success; and correlation with unobserved business-specific factors that also contribute to the business's success. We should note that we do not know whether a firm actually borrows from the nearest bank. Therefore, to the extent that this coefficient represents a causal relationship, it is necessarily attenuated. Omitted-variable bias, at the same time, exaggerates the size of the coefficient. Because these two effects operate in opposite directions, we cannot say whether the coefficient is biased towards or away from zero. That firm size mitigates the effect of distance to the nearest bank may mean that the relationship between distance and exit is causal, but that large firms have other borrowing options and are not as tied to the local bank.

The second column shows the effect of these variables on exits between 2004 and 2006. Establishments in the extensive-and-catastrophic-damage area were 31 percentage points more likely to exit than other establishments over this time period. The direct effect of firm size is slightly smaller than in the baseline regression, while the direct effect of distance disappears. As in Table 6, the coefficient on the interaction of firm size and extensive or catastrophic damage is negative and significant; in fact, it is larger both in absolute terms and

tudes of the coefficients. Consider a single-unit establishment, located 0.55 miles from the nearest bank, in a location about to be catastrophically damaged by Katrina's winds and storm surge. Suppose we have two policy interventions available to us just before the storm hits. The first intervention moves the nearest bank 0.45 miles closer to the establishment, so the establishment is now 0.1 miles from its nearest bank, with all the benefits this entails. The second intervention keeps the bank in its current location but incorporates the establishment into an existing firm with $(x - 1)$ additional establishments (and all the benefits this entails, including access to credit). Each of these interventions would have a direct effect on the establishment's probability of exit, which we ignore for the current experiment. Instead, we calculate the value of x that reduces the *increase* in the establishment's exit probability due to the catastrophic damage to the same extent as a move from the 75th to the 25th percentile of distance from a bank: $x = \exp$

etc. Locations near other retail and service establishments may benefit from externalities due to foot traffic, similar to the effect of locating in a mall with other retailers (see Gould, Pashigian, and Prendergast, 2005).

While we cannot entirely rule out these concerns, we attempt to address them by repeating the above regressions replacing distance to the nearest bank with distance to the nearest dental office. The number of bank outlets and dental offices in the U.S. is very similar; the 2007 Economic Census counted approximately 125,000 banks and 127,000 dental offices with employees. Unlike banks, however, the proximity of a dental office should not have any causal effect on the exit probability of a store, restaurant, or hotel.

Are dentists a good control group for banks? We attempt to answer this question with two empirical exercises. First, Figure 7 shows the distribution of distance to the nearest dentist and the nearest bank for establishments in single-unit firms, firms with 2-100 establishments, and firms with more than 100 establishments. The distributions are largely similar and overlapping, but, as Table 4 also showed, distance to the nearest bank is shorter than distance to the nearest dentist. This is particularly true for establishments in large multi-unit firms. Next, Figure 8 shows scatter plots of the distance to the nearest bank and the nearest dentist, again by the establishment's firm size. The mass is on and just above the 45-degree line, consistent with most establishments being further away from dentists than from banks. The correlation coefficients range from 0.39 for the establishments in the largest chains to 0.56 for single-unit firms. The figure also shows more clearly the much wider distribution of distances to both the nearest bank and the nearest dentist for single-unit firms.

A third check, in progress, is to map dentists and banks in Mississippi and check for different patterns of spatial agglomeration.

Because of this correlation we still expect to find some relationship between distance to a dentist and survival. Moreover, because distance to a dentist is more correlated with distance to a bank for establishments in small firms, we may even find a differential effect by firm size. However, we should expect this effect to be smaller than the effect of distance to a bank.

The last three columns of Table 7 show these results. None of the coefficients on distance to the nearest dental office or its interaction with size or damage are statistically significant with the exception of the interaction of distance and damage in the long-run regression (significant at the 5% level).

Broadly, these results support the findings of Brevoort and Hannan (2004) and Brevoort, Holmes, and Wolken (2010) who find that distance matters.

7 Sole Proprietorships

In this section, still under construction, we zoom in on the subset of establishments in our data that are organized as sole proprietorships. These sole proprietorships are uniformly small (more than 99% have a single establishment, and all operate in just one state), so they all fall into the set of financially vulnerable businesses based on our earlier results. The importance of liquidity for small businesses is well established; Holtz-Eakin, Joulfaian, and Rosen (1994), for example, show that individuals receiving an inheritance are much more likely to become entrepreneurs, and that this effect increases with the size of the inheritance received, a finding confirmed by many subsequent studies.

7.1 The Role of Establishment Location

First, we repeat the location analysis of Section 6 to test whether distance to a bank and/or dentist matters for sole proprietorships. These results are shown in Table 8. The on difference from our earlier regressions is that we no longer control for firm size since there is essentially no variation in this variable.

The coefficient on the interaction of distance to the nearest bank and extensive/catastrophic damage is large and very significant. Returning to our calculations in Section 6, it implies that, *ceteris paribus*, the difference between the 2004–06 exit rate of a sole proprietorship 0.55 miles from a bank and a sole proprietorship 0.1 miles from the nearest bank, if both were catastrophically damaged, is 30 percentage points. That difference shirks to 17 percentage points by 2008, but it remains statistically significant at the 1% level. We also find an effect of the interaction between distance to the nearest bank and limited or moderate damage in the long run, which increases in the long run.

Point estimates are much smaller (and standard errors much larger) in the regressions that substitute distance to the nearest dentist for distance to the nearest bank. Pre-storm estimates using dentists are very similar to those that used banks. In the short run, none of the effects are statistically significant, including the direct effect of damage. In the long run, the direct effect of damage returns, and there is also a statistically significant effect of the interaction of distance to the dentist and limited/moderate damage (significant at the 10% level), but not the interaction of distance to dentist and extensive/catastrophic damage.

These results are consistent with the notion that small businesses are most credit constrained and also most reliant on local banks for financing.

7.2 The Role of Owner Demographics

As a next step, we plan to test for an interaction between storm damage and owner demographics; specifically, whether female-owned sole proprietorships were more likely to exit following significant storm damage than sole proprietorships owned by males.

The motivation for the last point is existing evidence that businesses owned by women and minorities may be especially vulnerable to credit constraints. Historically, black entrepreneurs in the U.S. were more likely to use credit cards than other forms of finance. Chatterji and Seamans (2011) present evidence that black entrepreneurs are particularly vulnerable to limits on credit-card lending in the 1970s and 1980s, and Blanchflower, Levine, and Zimmerman (2003) show that in the 1990s, black-owned small businesses were twice as likely to be turned down for bank loans even after controlling for credit risk. More recently, Robb, Fairlie, and Robinson (2009) provide evidence from the Kau man Firm Survey that suggests that black-owned businesses' access to capital has not improved in the 2000s.

There is also evidence of gender-related credit constraints, although it is generally weaker (Blanch ower, Levine, and Zimmerman, 2003; Cole and Mehran, 2001).

7.3 The Role of Home Damage

Another variable we hope to soon link in is the home address of sole proprietorships. Homes were destroyed in many Mississippi communities, including Biloxi and Gulfport.

We expect to nd that sole proprietors whose homes were damaged were less likely to return to operation. This could be for any of a number of reasons. First, sole proprietorships oftens driven by unobserved business and location quality as well as data issues. We plan to extend the current analysis using additional specifications, particularly for sole proprietorships, as well as additional data sets and time periods.

Since there has not been much entry into Katrina-damaged counties in the post-storm years, we can only speculate on the interaction of our exit observations with entry in other settings. If single-establishments firms, small chains, and other types of constrained businesses exit disproportionately in the aftermath of a shock and these types of businesses are also over-represented among entrants, the overall distribution of firm sizes may not change dramatically. However, if small operators exit in higher rates but do not enter in higher rates, the distribution of firm sizes may shift towards larger firms. This shift could contribute to existing concentration trends in the retail, restaurant, and hotel sectors.

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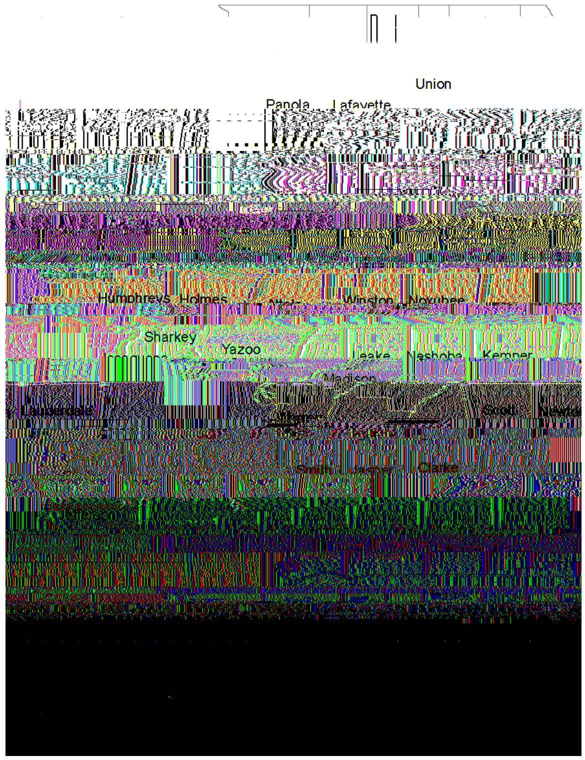

Figure 1. Mississippi (Shaded Counties Most A ected by Katrina)

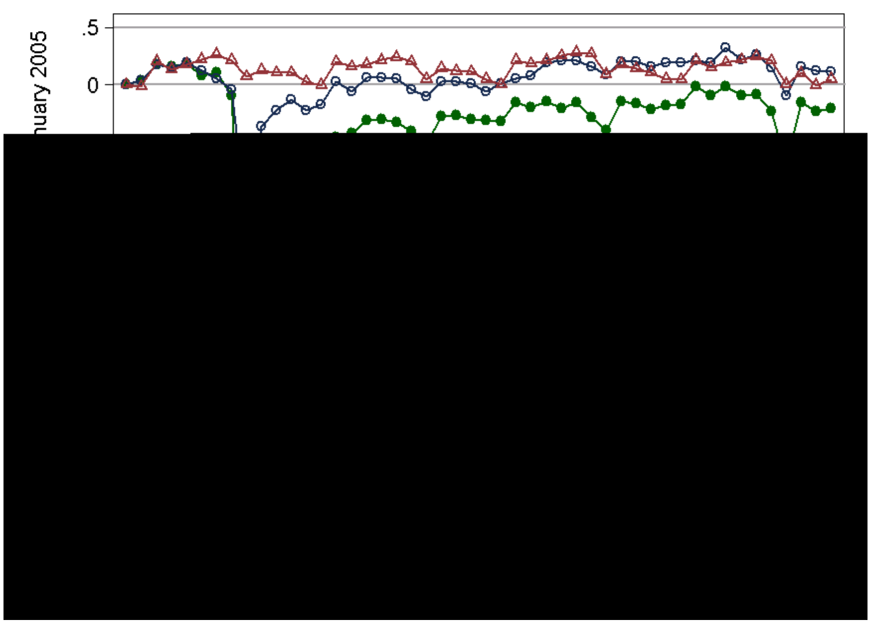

Figure 2. Air Passenger Travel to and from New Orleans and Biloxi, 2005{2008

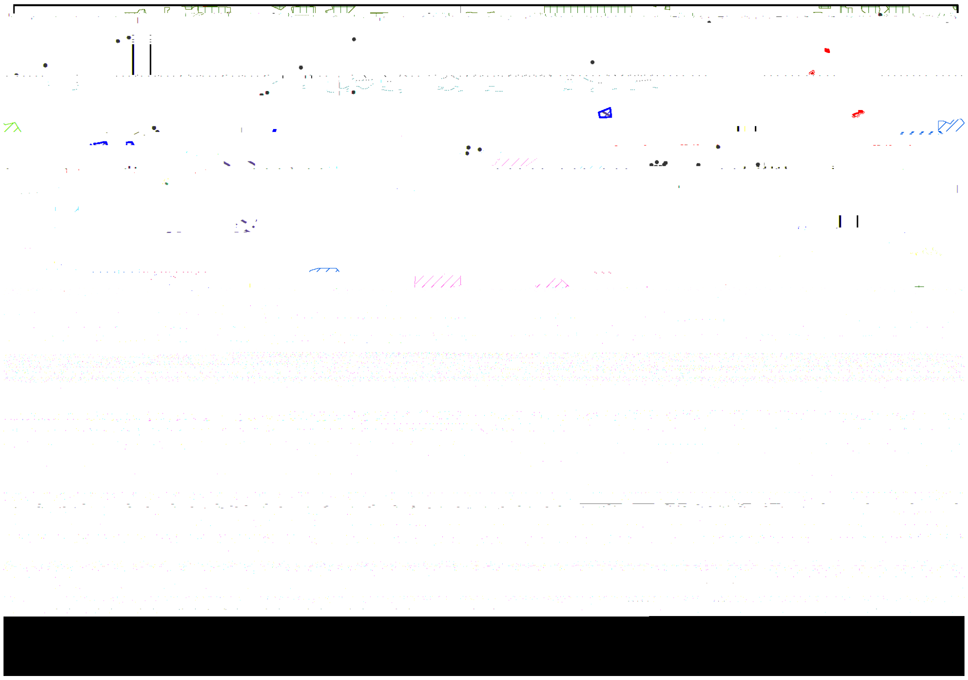

Figure 3. Damage Area Closeup: Harrison and Hancock Counties, MS

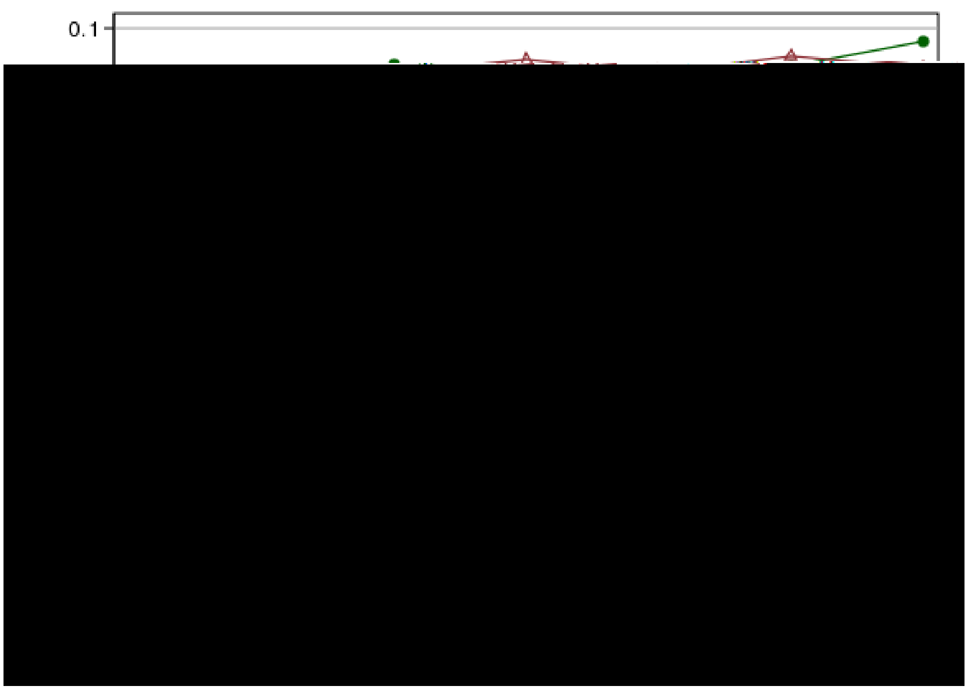

Figure 4. Log Change, since 2002, in Stores, Restaurants and Hotels

Figure 5. Log Change, since 2002q1, in Single-Unit Stores, Restaurants and Hotels

Figure 7. Distribution of Distance to Nearest Bank and Nearest Dentist, by Firm Size

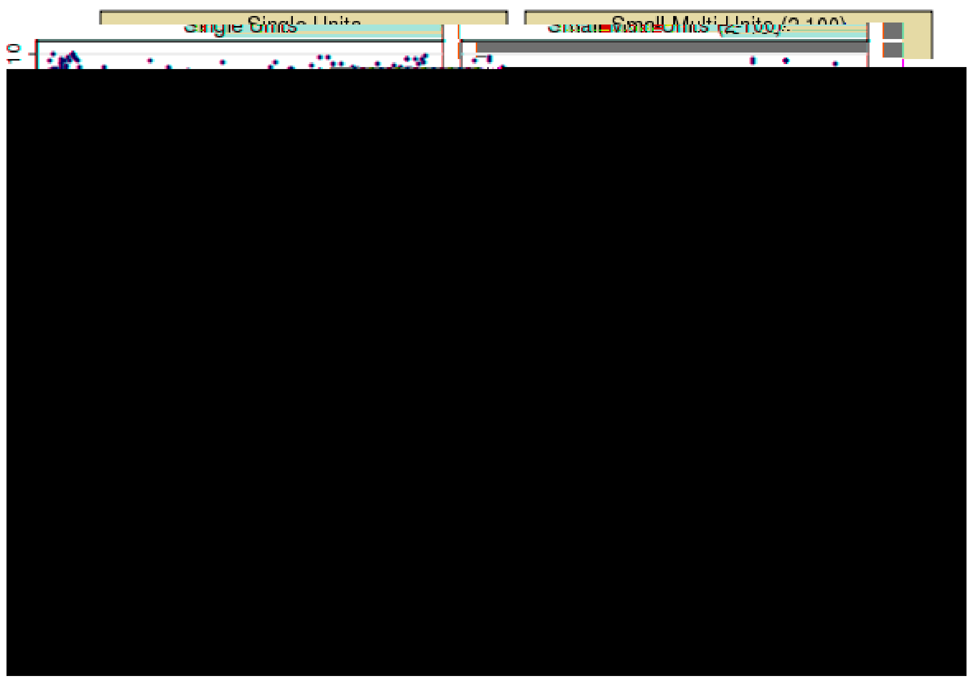

Figure 8. Correlation between Distance to Nearest Bank and Nearest Dentist, by Firm Size

Table 1. Population of Selected Mississippi Counties 2000{2010

County	2000 Population	2010 Population	Log Change
Hancock	42,967	43,929	+ 2.2%
Harrison	189,601	187,105	1.3%
Jackson	131,420	139,668	+ 6.1%
Stone	13,622	17,786	+26.7%
Rest of State	2,467,048	2,578,809	+ 4.4%

Source: Authors' Calculations from Population Census, 2000 and 2010

Table 2. County Summary Statistics, 2004

County	Estabs[a]	Geo-Coded[a]	Extensive or Catastrophic	Limited or Moderate
Hancock	180	170	11.4%	63.9%
Harrison	1,050	920	35.6%	17.6%
Jackson	540	470	6.6%	17.3%
Stone	60	50		
Rest of State	11,620	9,260		
Total[b]	13,460	10,870	3.5%	3.2%

[a] Counts rounded to nearest 10 observations.
[b] Total rounded separately, may di er from sum due to rounding.
Damage counts are percentages of geo-coded establishments.
Blank cells indicate fewer than ten establishments in damage zone.

Table 3. Establishment Summary Statistics: All Establishments, 2002 and 2004

Variable	Obs[a]	2002 Mean for: All	Non-Geocoded	Geocoded	T-test[b]
Establishments in rm	13,200	404.2	426.2	397.9	0.24
States with operations by rm	13,200	7.7	8.8	7.4	0.00
Firm employment	13,200	10,836.4	9,265.0	11,292.3	0.16
Establishment employment	13,200	16.1	14.2	16.7	0.89
Establishment age	13,200	11.8	11.5	11.9	0.13
Productivity[c]	13,110	0.0	0.1	0.0	0.65

Variable	Obs[a]	2004 Mean for: All	Non-Geocoded	Geocoded	T-test[b]
Establishments in rm	13,350	447.8	461.5	444.5	0.56
States with operations by rm	13,350	8.0	8.7	7.8	0.60
Firm employment	13,350	11,669.1	10,443.0	11,964.0	0.39
Establishment employment	13,350	16.7	15.4	17.0	0.27
Establishment age	13,350	12.1	11.9	12.2	0.10
Productivity[c]	13,290	0.0	0.1	0.0	0.37

[a] Counts rounded to nearest 10 observations
[b] p-value from t-test for equality of the distributions
[c] Normalized ratio of revenue to payroll in 2002

Table 4. Establishment Summary Statistics: Geocoded Establishments, 2002 and 2004

Variable	Obs[a]	2002 Mean for: All	Undamaged	Damaged	T-test[b]
Single-unit rms	10,190	0.6	0.6	0.6	0.758
Establishments in rm	10,190	399.0	392.7	486.0	0.430
States with operations by rm	10,190	7.4	7.3	9.3	0.000
Firm employment	10,190	11,334.9	11,347.4	11,159.7	0.948
Establishment employment	10,190	16.8	16.7	18.1	0.608
Establishment age	10,190	11.9	11.9	11.9	0.954
Distance to nearest bank (miles)[c]	9,740	0.9	1.0	0.4	0.000
Distance to nearest dentist (miles)[c]	9,740	1.7	1.8	0.8	0.000
Productivity[d]	10,190	0.0	0.0	0.0	0.489

Variable	Obs[a]	2004 Mean for: All	Undamaged	Damaged	T-test[b]
Single-unit rms	10,740	0.6	0.6	0.6	0.908
Establishments in rm	10,740	444.3	439.7	508.9	0.173
States with operations by rm	10,740	7.8	7.7	9.6	0.000
Firm employment	10,740	11,973.8	12,098.9	10,229.8	0.559
Establishment employment	10,740	17.5	17.5	18.0	0.824
Establishment age	10,740	12.3	12.3	12.3	0.919
Distance to nearest bank (miles)[c]	10,350	0.9	1.0	0.4	0.000
Distance to nearest dentist (miles)[c]	10,350	1.7	1.7	0.8	0.000
Productivity[d]	10,740	0.0	0.0	0.0	0.920

[a] Counts rounded to nearest 10 observations; sample omits estabs aged < 2
[b] p-value from t-test for equality of the means
[c] Distance computed using banks and dentists in operation in 2002
[d] Normalized ratio of revenue to payroll in 2002

Table 5. Establishment Summary Statistics: Sole Proprietorships, 2002 and 2004

Variable	Obs[a]	2002 Mean for: All	Undamaged	Damaged	T-test[b]
Establishment employment	1,840	4.3	4.3	4.1	0.755
Establishment age	1,840	11.2	11.2	11.0	0.821
Distance to nearest bank (miles)[c]	1,750	1.6	1.6	0.6	0.000
Distance to nearest dentist (miles)[c]	1,750	2.4	2.5	0.8	0.000
Productivity[d]	1,840	0.0	0.0	0.0	0.310

Variable	Obs[a]	2004 Mean for: All	Undamaged	Damaged	T-test[b]
Establishment employment	1,730	4.4	4.4	4.6	0.727
Establishment age	1,730	11.6	11.6	11.8	0.781
Distance to nearest bank (miles)[c]	1,650	1.5	1.6	0.6	0.100
Distance to nearest dentist (miles)[c]	1,650	2.4	2.5	0.8	0.000
Productivity[d]	1,730	0.0	0.0	0.0	0.284

[a] Counts rounded to nearest 10 observations
[b] p-value from t-test for equality of the distributions
[c] Distance computed using banks and dentists in operation in 2002
[d] Ratio of revenue to payroll in 2002

Table 6. Di erence-in-Di erence Exit Regressions: Firm Size and Damage

	2002{04	2004{06	2004{08
Extensive/Catastrophic Damage	-0.0191 (0.0129)	0.2275*** (0.0272)	0.2378*** (0.0370)
Limited/Moderate Damage	0.0054 (0.0134)	0.0320*** (0.0063)	0.0418 (0.0361)
ln(Establishments)	-0.0049** (0.0021)	-0.0054*** (0.0013)	-0.0079*** (0.0023)
Extensive/Catastrophic ln(Estabs)	-0.0008 (0.0028)	-0.0234*** (0.0022)	-0.0129*** (0.0049)
Limited/Moderate ln(Estabs)	-0.0016 (0.0023)	-0.0108** (0.0054)	-0.0048 (0.0101)
Productivity Sector	X	X	X
Productivity Sector Damage	X	X	X
County FE	X	X	X
NAICS FE (6 digit)	X	X	X
Establishment controls[a]	X	X	X
Observations	10,186	10,744	10,744
Percent predicted outside [0; 1]	2%	4%	1%

Robust standard errors in parentheses, clustered by county.

Table 7. Triple-Di erence Exit Regressions: Chain Size, Establishment Location, and Damage

	Distance to Nearest Bank			Distance to Nearest Dentist		
	2002{04	2004{06	2004{08	2002{04	2004{06	2004{08
Extensive/Catastrophic Damage[a]	-0.0315*	0.3098***	0.3398***	-0.0241*	0.2524***	0.2776***
	(0.0170)	(0.0220)	(0.0422)	(0.0143)	(0.0109)	(0.0182)
ln(Establishments)	-0.0087***	-0.0053***	-0.0066***	-0.0057***	-0.0060***	-0.0084***
	(0.0023)	(0.0017)	(0.0022)	(0.0020)	(0.0015)	(0.0022)
ln(Distance)[b]	0.0095***	-0.0007	0.0027	0.0061	-0.0040	0.0013
	(0.0029)	(0.0040)	(0.0045)	(0.0039)	(0.0042)	(0.0047)
Extensive/Catastrophic ln(Establishments)	0.0055*	-0.0261***	0.0036	0.0012	-0.0240***	-0.0075*
	(0.0031)	(0.0053)	(0.0058)	(0.0022)	(0.0037)	(0.0043)
Extensive/Catastrophic ln(Distance)	-0.0087	0.0632***	0.0744***	-0.0077	0.0330	0.0415**
	(0.0065)	(0.0091)	(0.0117)	(0.0112)	(0.0245)	(0.0167)
ln(Establishments) ln(Distance)	-0.0024***	0.0004	0.0009	-0.0010	-0.0001	-0.0003
	(0.0007)	(0.0008)	(0.0009)	(0.0006)	(0.0008)	(0.0010)
Extensive/Catastrophic ln(Estabs)	0.0034***	-0.0046**	0.0034*	0.0018	-0.0021	0.0020

Table 8. Di erence-in-Di erence Exit Regressions: Establishment Location for Sole Proprietorships

	Distance to Nearest Bank			Distance to Nearest Dentist		
	2002{04	2004{06	2004{08	2002{04	2004{06	2004{08
Extensive/Catastrophic Damage	-0.0066	0.3345***	0.3131***	0.0174	0.0575	0.1935**
	(0.0728)	(0.0992)	(0.0602)	(0.0649)	(0.1031)	(0.0747)
Limited/Moderate Damage	-0.0006	0.0905**	0.1379***	0.0596	0.0039	0.0747**
	(0.0604)	(0.0380)	(0.0494)	(0.0659)	(0.0269)	(0.0303)
ln(Distance)[a]	0.0162**	-0.0081	-0.0007	0.0145**	-0.0028	-0.0083
	(0.0078)	(0.0063)	(0.0075)	(0.0069)	(0.0081)	(0.0091)
Extensive/Catastrophic ln(Distance)	-0.0200	0.1787***	0.0973***	-0.0060	-0.0366	0.0081
	(0.0478)	(0.0339)	(0.0150)	(0.0589)	(0.0825)	(0.0529)
Limited/Moderate ln(Distance)	-0.0383	0.0674**	0.0931***	0.0193	0.0089	0.0746*
	(0.0409)	(0.0270)	(0.0185)	(0.0552)	(0.0428)	(0.0418)
County FE	X	X	X	X	X	X
NAICS FE (6 digit)	X	X	X	X	X	X
Establishment controls[b]	X	X	X	X	X	X
Productivity Sector	X	X	X	X	X	X
Productivity Sector Damage	X	X	X	X	X	X
Observations	1,749	1,653	1,653	1,749	1,653	1,653
Percent predicted outside [0; 1]	1%	2%	1%	1%	2%	1%

Robust standard errors in parentheses, clustered by county

* signi cant at 10%; ** signi cant at 5%; *** signi cant at 1%

[a] Distance is measured to the nearest bank or dental o ce in operation in 2002

[b] Log establishment age, log establishment employment, and zero employment indicator