The impact of storms on firm survival: a bayesian spatial econometric model for firm survival

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Abstract

This paper investigates the impact of the storms Katrina and Rita on firm survival in the Orleans Parish. In particular, a Bayesian spatial probit model is used to assess the impact of a number of firm characteristics on firm survival. The results reveal that larger firms and those with less flooding are more likely to survive. Larger chain stores were less likely to return to the city than sole proprietorships. Spatial results also reveal a very strong spatial component to firm survival just after the storm which diminished as time passed.

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1 Introduction

In the form of Hurricanes Katrina and Rita, New Orleans and the gulf coast faced perhaps the most devastating natural disasters in the history of the United States. The disasters left policy makers with difficult questions not addressed in the academic literature. Fortunately, the disaster also left researchers with empirical data from a natural experiment of epic proportions.

This study addresses one key policy question, the determinant of business survival and recovery in the aftermath of a large scale natural disaster. According to the White House, [1] the Federal Government has provided over $ 114 billion in resources ($ 127 billion including tax relief) to the Gulf States to assist in rebuilding. State and Federal government officials faced the challenge of quickly implementing programs to minimize business failures and aide in the recovery process. Much of the academic literature focuses on business survival under normal operating conditions.

One body of literature is based on the theoretical model developed by Jovanovic (1982) which predicts a positive relationship between firm survival and firm age. The implications predicted by this model have been tested empirically by several authors. Dunne, Roberts, and Samuleson (1989) use The Census of Manufacturers dataset to study survival rates for 219,754 plants from the manufacturing industry and find that survival increases with age and size. Audretsch (1991) finds the same relationship between firm survival, firm size and age by analyzing survival rates for 11,000 firms across different manufacturing industries using the U.S. Small Business Data Base. The study also finds that differences in survival rates are due to differences in technological regimes and industry specific characteristics such as scale economies and capital intensity. The aggregation to the industry level is motivated by data limitations. Audretsch and Mahmood (1995) address this problem and extend the analysis by allowing firm specific characteristics to influence survival rates. Using a dataset compiled by the U.S. Small Business Administration, the authors estimate a hazard duration model for 12,251 firms in the manufacturing sector and find that survival rates depend not only on industry specific characteristics such as technological conditions and scale economies, but also on establishment specific characteristics. The establishment specific characteristics identified are ownership structure and size. The study also confirms the positive relationship between firm survival and firm size and age. Caves (1998), Sutton (1997), and Geroski (1995) present ample surveys of the relevant literature and offer a summary of the main stylized facts. For other countries similar findings are found for: Canada (Baldwin and Gorecki 1991, Baldwin 1995, Baldwin and Rafiquzzaman 1995), Portugal (Mata, Portugal, and Guimaraes 1995, Mata and Portugal 1994), and Germany (Wagner 1994).

The second body of literature has evolved in the direction of analyzing firm survival at the product market level. A novelty of these studies is that firm survival is analyzed in the context of an evolutionary product

[1] www.whitehouse.gov/infocus/katrina

market. The idea was first introduced by Gort and Kleppe (1982) who identify five stages of product life cycle based on net entry in the market. The authors conclude that firm survival is determined by technological changes as the market evolves over the life cycle of the products. Argawal (1996) and Agarwal and Gort (1996) use the Thomas Register of American Manufacturers database and analyze firm survival in the product life cycle framework. Argawal (1997) follows the same framework and considers the influence on firm survival of both firm specific characteristics and market product characteristics. The common finding across these studies is that the probability of survival changes across different stages of product life cycle development. Agarwal and Audretsch (2001) use the Thomas Register of American Manufacturers and analyze the relationship between firm survival and size in the context of the product life cycle framework. The study finds that while there is a positive relationship between size and survival in the early stages of development of the market, this relationship is no longer true for later stages of development. Agarwal and Gort (2002) conduct an analysis on firm survival by grouping the data according to the different stages of the product life cycle. The authors separate the different impacts on firm survival in industry specific life cycle factors and firm specific life cycle ones and take into account the effect of the two on each other. Their findings confirm the importance of both product and firm life cycle in determining firm survival.

Both of these strains of literature provide general guidance for our study, but do not specifically address the issue of business survival in a large scale disaster. One exception is Dahlhamer and Tierney (1997), who investigate the impact of the Northridge earthquake on 1,110 Los Angeles firms. Dahlhamer and Tierney find that the key factors predicting business performance were business size, disruption of operations, earthquake shaking intensity, and utilization of post-disaster aid. Much of the other literature on economic consequences of disasters focuses on community level effects (Friesma, et. al. 1979, Rossi, et. al. 1983, Wright et. al. 1979). Another approach is case study or qualitative analysis. For example, Runyan's (2006) qualitative analysis of Katrina is based on face-to-face interviews of seventeen small business owners affected by the storm. Another related study is the street survey of businesses after hurricane Katrina conducted by Campanella (2007). On a dataset containing 651 businesses established before the storm hit and 56 new businesses over a period of 15 months, the author conducts weekly street surveys to assess the status of New Orleans businesses recovery. Although the study is mainly based on summary statistics, since the geographical area under investigation is identical to ours, this study is of particular interest for our research. The author finds that locally owned businesses opened faster than large chain stores and businesses offering luxury items opened faster than businesses offering necessity goods. Finally, businesses located in less flooded areas opened faster when compared to ones located in more heavily flooded areas.

This paper is organized as follows. In the next section we describe the dataset used. Sections 3 and 4 describe the spatial probit model specification and the methodology used. The results are presented in Section 5. Section 6 concludes.

2 Data

This paper examines the impact of Hurricanes Katrina and Rita on firm survival in Orleans Parish, Louisiana. In particular, we focus on explaining firm survival for the whole parish and by industry. Hurricane Katrina was characterized as one of the deadliest hurricanes to make landfall in the United States. The most affected area was New Orleans, Louisiana, both in terms of loss of life and property destruction. The cause was the failure of the levee system resulting in flooding for most of the city and surrounding areas.

The data set used for this study spans the period of 2004Q3 to 2007Q3. The most basic unit of observation in our dataset is an establishment. An establishment is a particular firm situated at a single geographical location. Some establishments are independent, while other ones are linked to a parent firm in which case they are called reporting units. Because Hurricane Katrina hit on August 29, 2005, we estimate our model for each quarter following the 2005Q2 quarter when the hurricanes hit: 2005Q3, 2005Q4, 2006Q1, 2006Q2, 2006Q3, 2006Q4, 2007Q1, 2007Q2 and 2007Q3. For presentation purposes we present detailed results for 2005Q4, 2006Q2, and 2007Q2.

Just prior to the storm, a total of 9,592 firms reported employment or wages to the Louisiana Department of Labor in Orleans Parish in 2005Q2.[2] Following Terrell and Bilbo, this study considers firms as open if they reported either employment or wages in any month of a quarter to the Louisiana Department of Labor for unemployment insurance purposes. Out of the 9,592 employers open in 2005Q2, 8,171 had valid latitudes and longitudes that could be used to determine location and append elevation data. This results in a sample of 8,171 employers with detailed quarterly data from 2004 to 2007, including employment, wages, and location. Using GIS maps, we are able to append flood depths to this data. Table 1 reports the total number of firms open in our sample in each quarter by industry type in Orleans Parish. The loss in terms of employers for the 3 chosen quarters are: 3,208 employers (39.26%) for 2005Q4, 3,055 (37.39%) for 2006Q2, and 3,146 (38.50%) for 2007Q2.

The primary dependent variable for our study is a a binary variable assuming values of 1 or 0, depending on whether the firm is open or not in a particular quarter. In assigning this value for each firm we follow the methodology proposed in Terrell and Bilbo.[3] Louisiana firms are required by law to report employment and wage data to the Louisiana Department of Labor (LDOL). This data is reported on a quarterly basis and is the basis for the Quarterly Census of Employment and Wages (QCEW). Several issues must be addressed to assess whether businesses are open or closed. First, the LDOL removes a firm from the data only after that particular firm fails to file a report for seven consecutive quarters or requests removal from the database. The standard BLS measure of number of employers is based on a count of the number of employers in the

[2]Terrell and Bilbo, A Report on the Impact of Hurricanes Katrina and Rita on Louisiana Businesses: 2005Q2-2006Q4, found at www.bus.lsu.edu/ded

[3]www.bus.lsu.edu/ded

QCEW database. Typically, this provides a reasonable measure of the number of firms, and offers a potential advantage by not removing seasonal firms or those simply failing to report in a given quarter.

A second important issue is that some businesses report zero employment and wages, but are still considered open by the LDOL. For the purpose of our study these firms should be considered as not operating. Third, in some cases LDOL estimates the employment and wages for some firms that fail to report. These three issues might be unimportant for most purposes. However, in the wake of an event such as Hurricane Katrina, particularly when the goal is to determine the patterns of entry and exit, these issues are crucial. This study follows Terrell and Bilbo's method of using a very conservative measure to determine whether an employer is open. The methodology uses the fact that the QCEW data includes a variable describing the way in which the data was obtained (whether it was estimated or reported by the employer). Based on this variable, we define employers as open only if they report positive values for employment or wages in at least one month in a particular quarter.

Table 1: **Firms by Industry and Quarter.** The first column displays the industry. Columns 1-13 report the number of of firms open for each quarter.

	04Q3	04Q4	05Q1	05Q2	05Q3	05Q4	06Q1	06Q2	06Q3	06Q4	07Q1	07Q2	07Q3
1. Agriculture, Forestry, Fishing & Hunting	9	10	10	10	10	9	9	8	9	9	8	9	9
2. Mining	36	35	39	40	33	33	31	32	28	29	29	27	26
3. Utilities	5	5	8	19	3	4	2	6	10	8	7	7	2
4. Construction	269	275	277	298	199	194	207	216	212	226	222	220	214
5. Manufacturing	172	173	188	196	146	126	131	132	134	140	135	134	135
6. Wholesale Trade	328	336	342	356	292	275	261	257	243	253	240	239	238
7. Retail Trade	1,186	1,201	1,275	1,336	932	609	630	680	682	694	711	716	687
8. Transportation & Warehousing	195	207	212	222	178	167	164	168	171	162	153	154	146
9. Information	107	111	115	128	97	82	80	74	77	71	68	68	58
10. Finance & Insurance	396	414	425	466	356	305	304	317	284	312	298	291	282
11. Real Estate, Rental & Leasing	360	362	379	402	295	249	237	231	232	232	229	226	211
12. Professional, Scientific & Technical Services	1,125	1,161	1,195	1,264	970	943	932	959	940	968	921	919	905
13. Management of Companies & Enterprises	29	30	32	37	23	25	21	21	19	20	19	21	16
14. Administrative, Support, Waste Management & Remediation	344	352	371	389	307	260	262	274	267	272	259	251	245
15. Educational Services	78	81	84	91	72	59	66	60	61	64	65	65	65
16. Health Care & Social Assistance	753	786	800	838	576	487	445	462	454	461	456	465	444
17. Arts, Entertainment & Recreation	134	139	138	149	113	100	99	96	95	96	93	97	92
18. Accommodation & Food Services	848	880	926	981	726	559	566	583	571	586	595	585	557
19. Other Services	708	732	748	784	526	392	426	450	437	452	443	453	440
20. Public Administration	139	141	155	165	108	85	86	90	83	83	81	78	79
Total	7,221	7,431	7,719	8,171	5,962	4,963	4,959	5,116	5,009	5,138	5,032	5,025	4,851

The next task consists of defining explanatory variables. One obvious factor that may affect the probability of being open is the flood depth. To focus on areas where flooding is relatively easy to measure, this study is limited to the city limits of New Orleans or equivalently Orleans Parish, Louisiana. Within the city, there are two distinct geographic areas, the East Bank and West Bank. The West Bank levees held and thus the area experienced minimal flooding. The levees failed in the East Bank where the majority of businesses existed. As a result this area filled with water much like a bowl. Elevation of these employers is thus a reasonable predictor of flood damage. Based on this logic, a flood value of zero is assigned to all West Bank employers, while latitude and longitude is used to assign flood elevations of East Bank employers.

More specifically, a second data set of Orleans Parish elevations was obtained from the Louisiana CADGIS Laboratory. This data set consists of something called LIDAR Edited Points – a massive data set of three dimensional points: latitude, longitude, and elevation. These points are considered to be "edited" points which means that ground obstructions such as vegetation foliage, man-made structures, etc. have been removed. The data set is intended only to contain land elevations. The LIDAR and QCEW data sets were combined using a GIS software package (ESRI's ArcView 9.2) and each employer was assigned the elevation of the point nearest to it from the LIDAR edited points data. This provides elevation to $8,171$ firms in Orleans Parish. The elevation is measured in feet relative to the sea level. The elevation variable was then used to calculate flood depth for all firms in our sample. As previously stated, West Bank employers were assigned a flooding variable of zero, while East Bank employer's flooding can be measured based on the elevation of the firm. The average flooding in New Orleans was roughly two feet above sea level. Therefore the flood depth was calculated as two minus the elevation variable. Terrell, Bilbo, and Lam (2007) conduct a study in order to determine how accurate the measure of flood depth based on elevation is in determining whether businesses were flooded or not. The results are based on a phone survey of 1,833 Orleans Parish businesses. Each business was asked if they were flooded or not. Then the authors compare the results based on the phone survey to the results based on the elevation measure. Their findings confirm that we have a good measure for flood depth.

We expect heavily flooded establishments to reopen more slowly than the less flooded ones. In order to test this hypothesis we construct a categorical variable capturing the feet of water as following: no flood, between 0 and 2 feet of water, between 2 and 4 feet of water, between 4 and 6 feet of water, between 6 and 8 feet of water, and finally above 8 feet of water.

One of the main contributions of this paper is the analysis of the spatial interactions between firms. We allow for a firm's decision to reopen to be influenced by the decision to reopen of nearby firms. Therefore we need information on neighboring firms. The latitude and longitude data was used to identify the nearest neighbors for each firm in our sample. Based on this we construct a 8,171$\times$ 8,171 spatial weight matrix (W) for every combination of firms in our dataset. We rely on a spatial contiguity relationship between firms in constructing the matrix W. Therefore the weight matrix reflects the spatial relationship between firms and is constructed such that each element w_{ij} of the matrix is assigned a value of 1 if firm j and firm i have a contiguity relationship and 0 in the absence of such a relationship. When we use the term contiguity relationship we follow the spatial literature and refer to the fact that firms i and j have a common border and therefore are considered neighbors. The diagonal elements were all set to zero. Next we row standardize the matrix by dividing each element w_{ij} in the matrix by the row sum such that all rows sum to one. The row standardization does not change the relative spatial dependency among observations. By dividing each element of the matrix by the row sum we implicitly assume that the decision of reopening for each firm is a weighted average of the same decision of nearby firms and that all nearby firms are assigned the same weight. Other more complicated weighting schemes are possible, depending on how one wishes to quantify the degree of contiguity between firms. For the purpose of this paper we simply want to account for spatial effects in the reopening decision, therefore any type of spatial dependency is acceptable.

Before proceeding any further we want to provide the reader with some intuition regarding the importance of the spatial weight matrix. A related concept in spatial econometrics is the spatial lag concept. While the first order contiguity matrix W provides information about each firm's neighbors, the spatial lag matrix provides information about the neighbors of neighbors. For the purpose of this study, this concept is very important since by using spatial lags the initial impact of neighbors on the decision to reopen propagates through space and has an impact on the decision of reopening of neighbors of neighbors.

The size of each establishment is another factor affecting the probability of reopening. We construct 4 categories based on the average employment across the three months of that quarter: size1 includes firms with average employment between 1 and 4 employees; size2 between 5 and 49 employees; size3 between 50 and 249 employees, and size4 includes firms with more than 250 employees.

The relative size of the establishment is also a factor that could affect the reopening decision. The variable relative size is calculated to make a distinction between locally owned businesses and chain stores. This hypothesis was also tested by Campanella (2007) who finds that locally owned businesses are reopening sooner than large chain stores. We calculate the variable relative size for each quarter by dividing the average employment across the three months of that quarter for each establishment by the the sum of average employment across all Louisiana establishments with the same reporting unit. Therefore a value close to one implies that we are looking at a locally owned business, while a value close to zero indicates a chain store. We also construct interactions between this variable and flooding variables (rel size&flood).

The type of industry is also expected to affect the firm reopening decision. We expect establishments in certain industries to open faster than in other ones. For this purpose we construct dummy variables for each of the 20 business categories presented in Table 1.

Summary statistics for all these variables are presented in Table 2.

Table 2: **Descriptive statistics.** The first column displays the variable symbol. Column 2 reports the number of observations. Column 3 and 4 report the mean and standard deviation. The last two columns present the min and max values.

	Obs	Mean	Std. Dev.	Min	Max
open 2005 Q4	8171	0.607	0.488	0	1
open 2006 Q2	8171	0.626	0.484	0	1
open 2007 Q2	8171	0.615	0.487	0	1
rel size	8171	0.890	0.298	0.0001	1
rel size&flood	8171	0.409	0.487	0.0000	1
size1	8171	0.486	0.500	0	1
size2	8171	0.435	0.496	0	1
size3	8171	0.065	0.247	0	1
size4	8171	0.011	0.106	0	1
Ind1	8171	0.001	0.035	0	1
Ind2	8171	0.005	0.070	0	1
Ind3	8171	0.002	0.048	0	1
Ind4	8171	0.036	0.187	0	1
Ind5	8171	0.024	0.153	0	1
Ind6	8171	0.044	0.204	0	1
Ind7	8171	0.164	0.370	0	1
Ind8	8171	0.027	0.163	0	1
Ind9	8171	0.016	0.124	0	1
Ind10	8171	0.057	0.232	0	1
Ind11	8171	0.049	0.216	0	1
Ind12	8171	0.155	0.362	0	1
Ind13	8171	0.005	0.067	0	1
Ind14	8171	0.048	0.213	0	1
Ind15	8171	0.011	0.105	0	1
Ind16	8171	0.103	0.303	0	1
Ind17	8171	0.018	0.134	0	1
Ind18	8171	0.120	0.325	0	1
Ind19	8171	0.096	0.295	0	1
Ind20	8171	0.020	0.140	0	1
flood 0-2	8171	0.152	0.359	0	1
flood 2-4	8171	0.109	0.311	0	1
flood 4-6	8171	0.101	0.302	0	1
flood 6-8	8171	0.044	0.204	0	1
flood 8	8171	0.067	0.251	0	1

3 Spatial Probit Model Specification

This section focuses on the statistical model for whether an establishment is open conditional on that establishment's characteristics. As previously stated, an "establishment" denotes a single location for an employer. We use a modified version of the spatial probit model introduced by Smith and LeSage (2002). We model the establishment's decision to stay in business or not as a function of temporally and spatially varying observable and unobservable factors. The goal is to characterize the probability that an establishment is open in a given time period.

We start by introducing the main assumptions in the model and the notation that will be used for the rest of the paper. Let m be the number of individual establishments. Each establishment is confronted in each period with choosing among two alternatives, labeled as 0 for closed and 1 for open. For each establishment we observe whether the firm is open or closed and model it as the realization of a random variable y_i. The decision to open after the storm ranges from consideration of profits of one store in a large chain by a manager of a fortune 500 company to a sole proprietorship's decision to reopen. Economic theory suggests that the decision to reopen is primarily made to maximize the discounted value of future profits.[4] However, the decision to open may be the same as the decision to return to the city for some proprietors who rely on business income as their primary source of funds. For ease of exposition, assume that the choice of whether to be open or closed is the result of an entrepreneur's decision to maximize their utility. An event will occur with a certain probability p if the utility derived from choosing that alternative is greater than the utility from the other alternative. Let z_i be the difference in utility from alternatives 1 and 0. The difference in utility is modeled as:

$$z_i = x_i\beta + \theta_i + \epsilon_i. \tag{1}$$

where $i = 1 \ldots m$, x_i is a vector of observed establishment specific attributes, β is a vector of unobserved parameters to be estimated, θ_i is an unobserved random effect component, and ϵ_i is the stochastic error term with $\epsilon_i \sim N(0,1)$. We do not observe z_i, but only observe the sign of z_i. We observe the establishment choice y_i being equal to 1 or 0, depending on whether z_i has a positive sign indicating the higher utility from this alternative or a negative sign associated with the lower utility associated with this alternative. Therefore we observe:

$$y_i = \begin{cases} 1 & \text{if } z_i > 0; \\ 0 & \text{if } z_i \leq 0. \end{cases} \tag{2}$$

[4]We address differences in behavior across the ownership class variable relative size (see discussion in the data section) measuring employment at this establishment as a ratio of total employment at this location to that of all establishments under the same ownership in Louisiana.

The probability of choosing alternative 1 is given by:

$$P_i = P(y_i = 1) = P(z_i > 0). \tag{3}$$

The distinction between this model and the standard probit model is the term θ_i. The unobserved component θ_i is constructed such that it allows for spatial correlation across establishments. In other words we assume that differences in utilities are similar for neighboring establishments. This is obtained by specifying θ_i according to a spatial autoregressive structure:

$$\theta_i = \rho \sum_{j=1}^{m} w_{ij}\theta_j + u_i. \tag{4}$$

with $u_i \sim N(0, \sigma^2)$, $W = (w_{ij} : i, j = 1 \ldots m)$ is a row standardized spatial weight matrix such that $\sum_{j=1}^{m} w_{ij} = 1$. ρ can be interpreted as the degree of spacial dependence across establishments. The spatial autocorrelation is thus determined by both ρ and W. We can write equation (4) in matrix notation:

$$\theta = \rho W \theta + u. \tag{5}$$

where $u \sim N(0, \sigma^2 I_m)$ and I_m is the identity matrix.

Let $B_\rho = I_m - \rho W$. We can obtain a solution for θ using (5):

$$\theta = B_\rho^{-1} u. \tag{6}$$

Note that the matrix B_ρ^{-1} plays a role similar to a lag polynomial in time series econometrics. This matrix captures the fact that spatial shocks (u) affect neighbors in space in much the same way that time series shocks affect observations close in time. Given our weight matrix, a shock to one firm has a first order impact of ρ on contiguous establishments, ρ^2 on establishments contiguous to those establishments, and so forth.

From (6) we see that the distribution for θ is given by:

$$\theta | (\rho, \sigma^2) \sim N(0, \sigma^2 (B_\rho^{'} B_\rho)^{-1}). \tag{7}$$

The error term ϵ is assumed to be conditionally independent of the spatial unobserved component such that $\epsilon | \theta \sim N(0, \sigma_\epsilon^2)$ and we assume $\sigma_\epsilon^2 = 1$.

The full model in matrix notation is given by:

$$Z = X\beta + \theta + \epsilon. \tag{8}$$

4 Bayesian Inference in the Spatial Probit Model Specification

Our statistical approach is a simplification of the LeSage and Smith (2002) model assuming a homoscedastic ϵ_i. Bayesian inference is preferred in this setting primarily because it is easier to implement than the EM algorithm suggested by McMillen (1992) for the analogous frequentist model. In addition, the Bayesian approach provides exact small sample inferences.

Prior distributions for the unknown parameters complete the statistical model. Following LeSage and Smith, we assume

$$\beta \sim N(c, T) \tag{9}$$

$$H_p = 1/\sigma^2 \sim \Gamma(\alpha, \upsilon) \tag{10}$$

$$\rho \sim U[(\lambda_{min}^{-1}, \lambda_{max}^{-1})] \tag{11}$$

Given the statistical model summarized in section 3, LeSage and Smith (2002) provide the full conditionals required to the model by Monte Carlo Markov Chain (MCMC) methods. The MCMC method arrives at the target distribution of the unknown parameters by sequentially sampling from a set of conditional distributions of the parameters. This is very useful since usually it is difficult to find an analytical result for the posterior densities. The MCMC method provides a sample from the posterior density and we can use this sample to draw inferences about the parameters of interest. Under mild regularity conditions satisfied in this application, these samples converge to sample from the posterior distribution.

The Bayesian framework uses the idea of a loss function. The loss function is a measure of the loss incurred when comparing the true value of the parameter with the estimated value. The Bayesian estimator is obtained by minimizing the loss function. Suppose that we are interested in estimating $g(\mu)$, where g is the function of interest. In order to obtain the estimate of g we minimize the expected value of the loss function. In the case of a quadratic loss function this is reduced to minimizing:

$$\int (g(\hat{\mu}) - g(\mu))^2 p(\mu|y) d\mu. \tag{12}$$

By differentiating (12) with respect to $g(\mu)$ and equating to zero we obtain:

$$g(\hat{\mu}) = \int g(\mu) p(\mu|y) d\mu. \tag{13}$$

Therefore the point estimator for $g(\mu)$ is the posterior mean $g(\hat{\mu}) = E[g(\mu)|y]$. Then for a sample of size N from the posterior distribution we can approximate the posterior mean by:

$$E(g(\mu)) = \frac{1}{N} \sum_{i=1}^{N} g(\mu_i) \overset{N \to \infty}{\rightarrow} \int g(\mu) p(\mu|y) d\mu. \tag{14}$$

Following the same approach we can approximate the posterior variance by:

$$Var(g(\mu)) = \frac{1}{N}\sum_{i=1}^{N}[g(\mu_i) - E(g(\mu))]^2. \tag{15}$$

The MCMC algorithm follows that of Smith and LeSage (2002) and primarily a Gibbs sampling approach. For clarity, the notation used in this paper is identical to that introduced by Smith and LeSage (2002). The problem consists of constructing a sampling algorithm for the set of unknown parameters given by (β, ρ, σ^2). Implementing the MCMC method also requires data augmentation to sample θ and z.

Intuitively, one can see that conditional on θ and the latent variable z, the equation

$$z_i - \theta_i = x_i\beta + \epsilon_i \tag{16}$$

is simply a linear regression model.

Thus, the conditional posterior distribution of β is proportional to the multinormal density:

$$\beta \mid (\theta, \rho, \sigma^2, z, y) \sim N(A^{-1}b, A^{-1}) \tag{17}$$

where $A = X^{'}X + T^{-1}$ and $b = X^{'}(z - \theta) + T^{-1}c$.

The conditional distribution of θ also follows a normal distribution:

$$\theta \mid (\beta, \rho, \sigma^2, z, y) \sim N(A_0^{-1}b_0, A_0^{-1}) \tag{18}$$

where $A_0 = \sigma^{-2}B_\rho^{'}B_\rho$ and $b_0 = z - X\beta$.

The conditional posterior distribution of σ^2 (or the related precision H_p) is related to a chi-squared distribution in the following way:

$$H_p = \frac{1}{\sigma^2} \mid (\beta, \theta, \rho, z, y) \sim \frac{\chi^2(m + 2\alpha)}{\theta^{'}B_\rho^{'}B_\rho\theta + 2v} \tag{19}$$

The conditional posterior distribution of ρ is given by:

$$\rho \mid (\beta, \theta, \sigma^2, z, y) \propto \mid B_\rho \mid \exp(-\frac{1}{2\sigma^2}\theta^{'}B_\rho^{'}B_\rho\theta) \tag{20}$$

where $\rho \in [\lambda_{min}^{-1}, \lambda_{max}^{-1}]$ and λ_{min} and λ_{max} are the minimum and maximum eigenvalues of W.

The distribution in (20) is non standard and therefore we cannot sample from it directly. One solution to this problem is to use a Metropolis-Hastings algorithm. Smith and LeSage (2002) suggest using univariate numerical integration rather than a Metropolis-Hastings algorithm in this setting. In particular, we use the properties of the inverted gamma distribution to integrate out the nuisance parameter σ^2. Then equation (20) can be written as:

$$\rho \mid (\beta, \theta, z, y) \propto \mid B_\rho \mid [m^{-1}\theta^{'}B_\rho^{'}B_\rho\theta]^{-m/2}\pi(\rho) \tag{21}$$

Before sampling from this posterior distribution for ρ we need to calculate the normalizing constant that transforms (21) in a proper density function that integrates to one. The normalizing constant can be found by integrating (21) over a grid of ρ values chosen from the interval $[\lambda_{min}^{-1}, \lambda_{max}^{-1}]$. The conditional posterior distribution for the grid of ρ values can be obtained by integrating the normalized density. The updated value for the unknown parameter ρ can be obtained by drawing from this distribution using the inversion method. In the estimation part of the paper we will use this method for updating the values of ρ. For a comparison between this method and the M-H method see Smith and LeSage (2002).

Finally, we need a conditional posterior distribution for the latent variable z. This distribution is a truncated normal distribution where the truncation depends on the observed choice for each firm:

$$z_i \mid (\beta, \theta, \rho, \sigma^2, V, -z_i, y) \sim \begin{cases} TN_{(0,\infty)}(x_i'\beta + \theta_i, 1) & \text{if } y_i = 1; \\ TN_{(-\infty,0)}(x_i'\beta + \theta_i, 1) & \text{if } y_i = 0. \end{cases} \tag{22}$$

The Gibbs sampler is given by the following iterative process:

1. Set starting values for the parameters $\beta_0, \theta_0, \rho_0, \sigma_0^2$ and the latent variable z_0.
2. Sample $\beta_1 \mid (\theta_0, \rho_0, \sigma_0^2, z_0)$ from the multinormal distribution given by equation (17).
3. Sample $\theta_1 \mid (\beta_1, \rho_0, \sigma_0^2, z_0)$ from the multinormal distribution given by equation (18).
4. Sample $\sigma_1^2 \mid (\beta_1, \theta_1, \rho_0, z_0)$ using equation (19).
5. Sample $\rho_1 \mid (\beta_1, \theta_1, \sigma_1^2, z_0)$ using numerical integration to obtain the conditional distribution for ρ using equation (21).
6. Sample $z_1 \mid (\beta_1, \theta_1, \sigma_1^2)$ from the truncated normal distribution given by equation (22).
7. Return to the first step and iterate to generate the posterior sample. Discard the burn-in period of the sampler to avoid dependence on the starting values.

Before proceeding, it is useful to note that the full conditionals may differ substantially from the marginal densities for each of these parameters. For example, the fact that the conditional density of θ_i is mean zero does not imply that the posterior mean of θ_i is zero. In fact, we expect the posterior mean for parameter θ_i to differ substantially across firms to capture the impact of other open or closed businesses on the probability that firm i is open.

5 Results

In this section we present results from the estimation of the model discussed in the previous section. We start by comparing results from the spatial model presented and a non-spatial probit model specification. Therefore, we estimate both a non-spatial probit specification and a spatial probit specification using

Bayesian techniques. For comparison purposes we present results for 2005Q6. Next we proceed to estimate the spatial probit specification presented in Section 3. Detailed results are presented for all three quarters of interest: 2005Q4, 2006Q2, and 2007Q2.

5.1 Comparison between Non-Spatial and Spatial Model

In this section our objective is to compare the non-spatial probit and spatial probit Bayesian results. The only difference between the probit spatial model specification presented in Section 3 and a standard probit model is the unobserved spatial component θ_i. Abstracting away from the spatial interactions between neighboring firms simplifies the model so that each firm's decision is a just a function of firm specific attributes. The random utility model described in Section 3 continues to be of interest in explaining each firm's decision to reopen. The steps used in order to estimate the probit model from a Bayesian perspective are very similar to the ones described in Section 4 in the context of the spatial probit model. The results are presented in Table 5.1 for 2005Q4. The table reports the posterior means, posterior standard deviations, and highest posterior density intervals for both models.

When comparing the posterior means from the spatial model with the posterior means from the non-spatial specification we see that all posterior means from the spatial specification are larger in absolute value. This is rather unexpected since we would expect to see larger magnitudes in the non-spatial specification since this specification ignores any potential spatial affects (see LeSage and Smith 2002). The posterior mean for the autocorrelation parameter ρ is 0.454 indicating the existence of spatial correlation between establishments.

5.2 Spatial Bayesian Results

This section discusses results from the spatial probit model specification developed in Section 3. Table 5.2 contains results for all three quarters. While the coefficients are informative in indicating the direction of change in probabilities, their magnitudes are not very informative. Therefore we also report marginal effects in Table 5.2. Additional reports for particular firms can be found in the Appendix.

Perhaps the most surprising finding is the relationship between the relative size variable and the probability of reopening. Campanella (2007) reports results from data gathered during bicycle tours over a 15 month period. One interesting result from Campanella's study was that locally owned businesses were more likely to reopen than large chain businesses. The relative size variable has a positive sign in all 3 quarters. To interpret the relative size variable, it is useful to think of a simple example where a firm may have multiple locations with an identical number of employees. In this case, the relative size variable is simply 1 divided by the number of locations. For a sole proprietorship relative size is one, with two locations it takes a value one-half, with twenty locations 0.05 and so forth. Thus, the change of 1 is roughly moving from a very large

Table 3: **Estimation results for 2005Q4 using different models.** The first column displays the variable symbol. For each model, columns 1, 2, 3, and 4 report posterior means, posterior standard deviations, and highest posterior density intervals.

	Non-Spatial Model				Spatial Model			
	p.mean	p Std.Dev	2.5%	97.5%	p.mean	p Std.Dev	2.5%	97.5%
Intercept	0.603	0.174	0.259	0.94	0.826	0.238	0.353	1.286
rel size	0.138	0.078	-0.016	0.29	0.238	0.115	0.007	0.463
rel size&flood	-0.145	0.099	-0.34	0.052	-0.247	0.146	-0.526	0.048
Size1	-0.739	0.132	-0.999	-0.486	-1.04	0.187	-1.411	-0.693
Size2	-0.156	0.132	-0.415	0.099	-0.186	0.187	-0.553	0.166
Size3	0.366	0.147	0.075	0.655	0.551	0.203	0.145	0.938
Ind1	1.318	0.544	0.33	2.454	2.073	0.846	0.561	3.866
Ind2	0.865	0.268	0.345	1.404	1.212	0.366	0.505	1.942
Ind3	-0.903	0.349	-1.597	-0.222	-1.289	0.515	-2.337	-0.312
Ind4	0.466	0.127	0.216	0.715	0.709	0.187	0.338	1.071
Ind5	0.288	0.138	0.019	0.557	0.467	0.202	0.058	0.864
Ind6	0.827	0.125	0.58	1.07	1.21	0.186	0.84	1.57
Ind7	-0.164	0.106	-0.375	0.045	-0.185	0.156	-0.488	0.121
Ind8	0.608	0.138	0.335	0.879	0.884	0.201	0.492	1.282
Ind9	0.358	0.152	0.065	0.662	0.523	0.219	0.101	0.955
Ind10	0.463	0.119	0.228	0.693	0.68	0.17	0.349	1.007
Ind11	0.354	0.12	0.116	0.59	0.554	0.177	0.207	0.91
Ind12	0.703	0.108	0.492	0.915	0.997	0.155	0.7	1.296
Ind13	0.28	0.235	-0.184	0.751	0.395	0.343	-0.266	1.078
Ind14	0.352	0.122	0.111	0.597	0.525	0.175	0.186	0.866
Ind15	0.329	0.17	-0.008	0.664	0.482	0.246	-0.002	0.961
Ind16	0.274	0.111	0.056	0.494	0.434	0.163	0.118	0.754
Ind17	0.334	0.149	0.042	0.619	0.5	0.214	0.08	0.922
Ind18	-0.124	0.11	-0.34	0.091	-0.153	0.157	-0.459	0.154
Ind19	0.025	0.11	-0.194	0.241	0.047	0.159	-0.27	0.357
flood 0-2	-0.28	0.098	-0.474	-0.085	-0.325	0.146	-0.622	-0.038
flood 2-4	-0.513	0.101	-0.71	-0.314	-0.675	0.152	-0.968	-0.379
flood 4-6	-0.45	0.101	-0.649	-0.249	-0.58	0.153	-0.876	-0.28
flood 6-8	-0.446	0.113	-0.666	-0.219	-0.646	0.173	-0.997	-0.32
flood 8	-0.659	0.102	-0.857	-0.456	-0.965	0.158	-1.286	-0.658
σ^2					1.031	0.069	0.896	1.169
ρ					0.454	0.109	0.202	0.633

chain to sole proprietorship and implies an increase in probability by 8.6% for 2004Q4, by a factor of 26.5% in 2006Q2, and by a factor of 22.4% in 2007Q2 holding other things constant. Going from 2 locations to 1 location would imply an increase in probability by a factor of 4.3% for 2005Q4, while going from 20 locations to 1 implies an increase in probability of 8.2% for that same quarter. Campanella's (2007) study provides a good point of reference for our results. He finds that 75% of local businesses had reopened compared to 59% of national chains over a 15 month period ending November 2006. Though he is not using statistical analysis to hold other factors constant, the fact that the similarity between our 26.5% and the 26% difference in his study is reassuring.

The interaction term between the relative size of the firm and the flood variable has a negative sign in the first quarter. The sign flips for the following 2 quarters considered. Two years later after Katrina hit, locally owned businesses that were flooded are more likely to reopen.

With respect to the size of the firm, Tables 3 and 5.2 contain three dummy variables with over 250 employees as the omitted group. Recall that the literature predicts higher survival rates for larger firms. With regard to very small employers, our results conform to this prediction. Table 5.2 predicts that firms with less than five employees (Size1=1) were 38% less likely to be open in 2005Q4 or 2006Q2 and 15% less likely in 2007Q2. The pattern varies across time periods for firms with five to forty-nine employees (Size2=1). Firms with fifty to 249 were more likely to be open in all three quarters than the largest firms (18% more likely in 2005Q4 and 2007Q2 and 13% more likely in 2006Q2).

When we examine the relationship between the industry category and the reopening decision we find the following. All industry types except utilities and accommodation and food services were more likely to reopen immediately after the storm when compared to public administration businesses. Firms in construction had a higher probability of reopening by a factor of 0.2 in all three quarters considered when compared to public administration businesses.

Not surprisingly the coefficients attached to all flood variables have a negative sign and are generally quite large for all 3 quarters considered. For example, having been flooded with less than 2 feet of water compared with no flooding decreases the reopening probability by 9.9% for 2005Q4. The magnitude increases for the next 2 quarters considered, in 2007Q2 the probability of reopening decreases by a factor of 3.9%. All the flood variables increase in magnitude over time. The largest magnitudes occur for employers with eight or more feet of flooding. Holding other things constant, this level of flooding reduces the probability of opening by 34% in 2005Q4, 51% in 2006Q4, and 66% in 2007Q2 relative to firms with no flooding. The growing impact of flooding on firm survival is somewhat surprising and may indicate that some firms tried to reopen in areas with heavy damage, only to fail after a short period.

The error term attached to the spatial component θ is just over one in all 3 quarters. The spatial autocorrelation term ρ diminishes in magnitude as time passes. This finding suggests that spatial interactions between establishments were very important in the quarters immediately after the storm, but that the spatial component loses importance as time passes.

Table 4: **Estimation results.** The first column displays the variable symbol. For each quarter, columns 1, 2, 3, and 4 report posterior means, posterior standard deviations, 2.5% and 97.5% percentile

	Quarter 6				Quarter 8				Quarter 12			
	p.mean	p.Std dev	2.5%	97.5%	p.mean	p.Std dev	2.5% p	97.5%	p.mean	p.Std dev	2.5%	97.5%
Intercept	0.826	0.238	0.353	1.286	0.592	0.254	0.090	1.095	0.023	0.248	-0.440	0.507
rel size	0.238	0.115	0.007	0.463	0.762	0.115	0.538	0.990	0.626	0.114	0.409	0.853
rel size&flood	-0.247	0.146	-0.526	0.048	0.363	0.147	0.076	0.644	0.778	0.150	0.489	1.078
Size1	-1.040	0.187	-1.411	-0.693	-1.037	0.197	-1.438	-0.664	-0.464	0.185	-0.847	-0.110
Size2	-0.186	0.187	-0.553	0.166	-0.142	0.191	-0.529	0.227	0.383	0.186	0.006	0.732
Size3	0.551	0.203	0.145	0.938	0.348	0.211	-0.064	0.752	0.470	0.203	0.075	0.880
Ind1	2.073	0.846	0.561	3.866	0.886	0.684	-0.376	2.257	1.579	0.794	0.143	3.227
Ind2	1.212	0.366	0.505	1.942	0.928	0.365	0.221	1.656	0.515	0.347	-0.151	1.181
Ind3	-1.289	0.515	-2.337	-0.312	-0.498	0.494	-1.478	0.428	0.138	0.455	-0.735	1.026
Ind4	0.709	0.187	0.338	1.071	0.632	0.194	0.260	1.030	0.756	0.193	0.377	1.131
Ind5	0.467	0.202	0.058	0.864	0.174	0.200	-0.212	0.566	0.321	0.199	-0.062	0.720
Ind6	1.210	0.186	0.840	1.570	0.596	0.186	0.237	0.957	0.415	0.182	0.059	0.775
Ind7	-0.185	0.156	-0.488	0.121	-0.220	0.158	-0.533	0.094	-0.032	0.159	-0.341	0.276
Ind8	0.884	0.201	0.492	1.282	0.700	0.206	0.304	1.103	0.503	0.200	0.109	0.890
Ind9	0.523	0.219	0.101	0.955	0.114	0.221	-0.304	0.553	0.062	0.219	-0.374	0.478
Ind10	0.680	0.170	0.349	1.007	0.697	0.179	0.351	1.051	0.590	0.174	0.255	0.937
Ind11	0.554	0.177	0.207	0.910	0.175	0.181	-0.176	0.541	0.213	0.181	-0.132	0.580
Ind12	0.997	0.155	0.700	1.296	0.704	0.166	0.385	1.037	0.651	0.163	0.340	0.965
Ind13	0.395	0.343	-0.266	1.078	-0.092	0.338	-0.786	0.571	0.084	0.340	-0.619	0.717
Ind14	0.525	0.175	0.186	0.866	0.361	0.183	0.009	0.732	0.203	0.180	-0.156	0.559
Ind15	0.482	0.246	-0.002	0.961	0.242	0.263	-0.264	0.765	0.444	0.261	-0.054	0.961
Ind16	0.434	0.163	0.118	0.754	0.038	0.166	-0.285	0.361	0.100	0.164	-0.223	0.420
Ind17	0.500	0.214	0.080	0.922	0.088	0.212	-0.327	0.493	0.268	0.214	-0.158	0.677
Ind18	-0.153	0.157	-0.459	0.154	-0.339	0.163	-0.650	-0.011	-0.183	0.162	-0.499	0.129
Ind19	0.047	0.159	-0.270	0.357	-0.024	0.165	-0.350	0.297	0.077	0.163	-0.243	0.398
flood 0-2	-0.325	0.146	-0.622	-0.038	-0.747	0.144	-1.028	-0.458	-1.109	0.149	-1.407	-0.817
flood 2-4	-0.675	0.152	-0.968	-0.379	-1.079	0.151	-1.374	-0.785	-1.210	0.150	-1.513	-0.925
flood 4-6	-0.580	0.153	-0.876	-0.280	-1.174	0.156	-1.482	-0.866	-1.325	0.160	-1.630	-1.011
flood 6-8	-0.646	0.173	-0.997	-0.320	-1.359	0.180	-1.725	-1.009	-1.589	0.191	-1.970	-1.224
flood 8	-0.965	0.158	-1.286	-0.658	-1.645	0.167	-1.962	-1.316	-1.956	0.178	-2.310	-1.619
σ^2	1.031	0.069	0.896	1.169	1.033	0.133	0.750	1.245	1.090	0.140	0.757	1.302
ρ	0.454	0.109	0.202	0.633	0.318	0.185	0.001	0.616	0.288	0.176	-0.025	0.566

Table 5: **Marginal effects.** The first column displays the variable symbol. For each quarter, columns 1, 2, 3, and 4 report the posterior means, posterior standard deviations, 2.5% and 97.5% percentile.

	Quarter 6				Quarter 8				Quarter 12			
	Marg.eff	p.Std dev	2.5%	97.5%	Marg.eff	p.Std dev	2.5%	97.5%	Marg.eff	p.Std dev	2.5%	97.5%
rel size	0.086	0.041	0.003	0.166	0.265	0.039	0.189	0.342	0.224	0.040	0.147	0.303
rel size&flood	-0.089	0.053	-0.190	0.017	0.126	0.051	0.027	0.223	0.279	0.053	0.176	0.384
Size1	-0.382	0.070	-0.514	-0.246	-0.375	0.074	-0.517	-0.233	-0.149	0.067	-0.292	-0.032
Size2	-0.070	0.070	-0.204	0.065	-0.054	0.073	-0.197	0.089	0.143	0.067	0.003	0.267
Size3	0.183	0.073	0.045	0.330	0.126	0.078	-0.021	0.279	0.178	0.074	0.029	0.323
Ind1	0.351	0.099	0.159	0.546	0.232	0.163	-0.141	0.499	0.476	0.180	0.053	0.743
Ind2	0.305	0.085	0.144	0.481	0.270	0.096	0.074	0.456	0.194	0.129	-0.053	0.435
Ind3	-0.425	0.137	-0.651	-0.119	-0.183	0.174	-0.500	0.156	0.057	0.161	-0.233	0.386
Ind4	0.221	0.065	0.099	0.353	0.210	0.068	0.083	0.353	0.286	0.070	0.146	0.421
Ind5	0.156	0.069	0.020	0.295	0.064	0.074	-0.079	0.210	0.120	0.074	-0.023	0.267
Ind6	0.313	0.072	0.181	0.460	0.201	0.067	0.076	0.337	0.156	0.067	0.023	0.288
Ind7	-0.070	0.059	-0.186	0.046	-0.084	0.061	-0.202	0.037	-0.013	0.057	-0.125	0.094
Ind8	0.259	0.068	0.134	0.404	0.228	0.071	0.095	0.374	0.190	0.074	0.043	0.333
Ind9	0.171	0.072	0.036	0.316	0.042	0.082	-0.116	0.204	0.023	0.079	-0.132	0.175
Ind10	0.215	0.061	0.103	0.339	0.228	0.065	0.105	0.363	0.224	0.064	0.099	0.349
Ind11	0.182	0.062	0.066	0.309	0.065	0.067	-0.065	0.199	0.078	0.067	-0.051	0.212
Ind12	0.282	0.065	0.162	0.413	0.231	0.063	0.113	0.361	0.247	0.059	0.133	0.358
Ind13	0.127	0.110	-0.100	0.328	-0.037	0.126	-0.297	0.204	0.035	0.121	-0.197	0.269
Ind14	0.174	0.062	0.060	0.299	0.129	0.067	0.003	0.265	0.074	0.065	-0.058	0.199
Ind15	0.159	0.081	-0.001	0.317	0.087	0.094	-0.098	0.275	0.167	0.098	-0.020	0.358
Ind16	0.148	0.059	0.038	0.271	0.015	0.063	-0.106	0.139	0.035	0.059	-0.085	0.149
Ind17	0.165	0.071	0.027	0.305	0.033	0.079	-0.124	0.183	0.099	0.080	-0.060	0.252
Ind18	-0.058	0.060	-0.174	0.058	-0.131	0.062	-0.249	-0.004	-0.064	0.057	-0.180	0.042
Ind19	0.018	0.059	-0.099	0.134	-0.009	0.063	-0.132	0.114	0.027	0.059	-0.092	0.138
flood 0-2	-0.099	0.048	-0.198	-0.012	-0.175	0.051	-0.281	-0.086	-0.390	0.056	-0.496	-0.281
flood 2-4	-0.225	0.057	-0.340	-0.118	-0.289	0.066	-0.417	-0.168	-0.428	0.055	-0.533	-0.319
flood 4-6	-0.189	0.056	-0.301	-0.084	-0.325	0.068	-0.456	-0.198	-0.470	0.056	-0.572	-0.358
flood 6-8	-0.214	0.065	-0.350	-0.098	-0.396	0.077	-0.545	-0.244	-0.557	0.059	-0.665	-0.435
flood 8	-0.337	0.062	-0.458	-0.216	-0.506	0.071	-0.633	-0.359	-0.656	0.046	-0.740	-0.558

6 Conclusion

In this paper a Bayesian framework is used in order to investigate the post storm survival of firms in the Orleans Parish. A novelty of our approach is the spatial component in the model specification. In particular, we model each firm's decision of reopening as a function of firm characteristic variables and as a function of neighboring firms' decision to reopen. We estimate a spatial probit model on a dataset containing quarterly data on 8,171 firms from the Orleans Parish and find evidence indicating the presence of spatial components, especially in the quarters immediately following the storms. Other findings are: larger firms are more likely to survive; also, less flooded firms are more likely to survive; finally, sole proprietorships are more likely to reopen than large chain stores.

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APPENDIX

Table 6: **Marginal effects.** Marginal effects for firm with probability of opening in the 25% percentile and no open neighbors. The first column displays the variable symbol. For each quarter, column 2, 3, 4, and 5 report the estimates, posterior standard deviations, 2.5% and 97.5% percentile.

	Quarter 6				Quarter 8				Quarter 12			
	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p
type	0.070	0.045	0.001	0.162	0.233	0.082	0.046	0.366	0.191	0.071	0.039	0.312
typeflood	-0.073	0.053	-0.188	0.011	0.111	0.058	0.012	0.230	0.237	0.089	0.049	0.391
Size1	-0.291	0.052	-0.399	-0.197	-0.049	0.018	-0.092	-0.021	-0.116	0.044	-0.206	-0.033
Size2	-0.072	0.072	-0.215	0.061	-0.021	0.029	-0.092	0.021	0.098	0.046	0.002	0.185
Size3	0.180	0.060	0.054	0.289	0.026	0.017	-0.007	0.061	0.117	0.047	0.023	0.210
Ind1	0.358	0.085	0.173	0.506	0.036	0.037	-0.049	0.093	0.211	0.075	0.038	0.344
Ind2	0.311	0.076	0.157	0.459	0.046	0.020	0.012	0.093	0.121	0.079	-0.046	0.265
Ind3	-0.425	0.132	-0.637	-0.122	-0.099	0.110	-0.374	0.040	0.024	0.128	-0.269	0.232
Ind4	0.227	0.063	0.105	0.353	0.041	0.019	0.013	0.086	0.170	0.052	0.076	0.279
Ind5	0.160	0.070	0.020	0.296	0.017	0.020	-0.019	0.060	0.088	0.056	-0.017	0.203
Ind6	0.320	0.062	0.203	0.446	0.040	0.019	0.011	0.084	0.110	0.052	0.014	0.217
Ind7	-0.071	0.059	-0.184	0.047	-0.026	0.019	-0.062	0.013	-0.008	0.050	-0.101	0.093
Ind8	0.265	0.064	0.145	0.393	0.043	0.019	0.015	0.088	0.128	0.054	0.027	0.236
Ind9	0.176	0.073	0.035	0.318	0.011	0.023	-0.031	0.058	0.018	0.067	-0.116	0.145
Ind10	0.220	0.060	0.106	0.340	0.043	0.019	0.014	0.088	0.145	0.051	0.055	0.250
Ind11	0.187	0.063	0.066	0.316	0.017	0.019	-0.014	0.062	0.063	0.054	-0.037	0.176
Ind12	0.288	0.059	0.178	0.406	0.044	0.019	0.015	0.089	0.156	0.050	0.069	0.258
Ind13	0.131	0.112	-0.102	0.336	-0.017	0.045	-0.126	0.053	0.018	0.102	-0.208	0.190
Ind14	0.178	0.062	0.059	0.301	0.030	0.019	0.001	0.073	0.060	0.054	-0.042	0.169
Ind15	0.162	0.081	-0.001	0.318	0.020	0.023	-0.026	0.069	0.113	0.065	-0.015	0.242
Ind16	0.152	0.060	0.040	0.271	0.005	0.018	-0.025	0.046	0.032	0.050	-0.063	0.134
Ind17	0.169	0.072	0.027	0.313	0.009	0.022	-0.035	0.053	0.075	0.060	-0.046	0.194
Ind18	-0.058	0.060	-0.173	0.061	-0.045	0.022	-0.089	-0.002	-0.059	0.052	-0.159	0.044
Ind19	0.019	0.060	-0.098	0.137	-0.001	0.018	-0.034	0.039	0.025	0.050	-0.071	0.129
flood 0-2	-0.126	0.056	-0.241	-0.015	-0.136	0.038	-0.218	-0.072	-0.411	0.052	-0.510	-0.307
flood 2-4	-0.260	0.057	-0.368	-0.148	-0.238	0.054	-0.353	-0.142	-0.446	0.051	-0.544	-0.347
flood 4-6	-0.225	0.058	-0.335	-0.111	-0.271	0.059	-0.392	-0.165	-0.485	0.052	-0.580	-0.381
flood 6-8	-0.249	0.064	-0.377	-0.125	-0.339	0.073	-0.486	-0.206	-0.561	0.054	-0.666	-0.451
flood 8	-0.358	0.055	-0.467	-0.250	-0.449	0.073	-0.589	-0.313	-0.644	0.045	-0.727	-0.552

Table 7: **Marginal effects.** Marginal effects for firm with probability of opening in the 25% percentile and all neighbors open. The first column displays the variable symbol. For each quarter, column 2, 3, 4, and 5 report the estimates, posterior standard deviations, 2.5% and 97.5% percentile.

	Quarter 6				Quarter 8				Quarter 12			
	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p
type	0.062	0.043	0.000	0.155	0.204	0.096	0.016	0.362	0.180	0.076	0.021	0.312
typeflood	-0.065	0.051	-0.176	0.010	0.097	0.060	0.004	0.223	0.223	0.096	0.025	0.391
Size1	-0.168	0.022	-0.210	-0.126	-0.117	0.017	-0.152	-0.087	-0.032	0.010	-0.052	-0.010
Size2	-0.060	0.060	-0.188	0.042	-0.038	0.049	-0.150	0.043	0.028	0.012	0.001	0.048
Size3	0.114	0.034	0.038	0.172	0.057	0.032	-0.014	0.110	0.032	0.011	0.007	0.053
Ind1	0.189	0.032	0.118	0.239	0.086	0.068	-0.098	0.154	0.047	0.014	0.013	0.067
Ind2	0.174	0.029	0.110	0.224	0.107	0.027	0.041	0.150	0.031	0.019	-0.018	0.056
Ind3	-0.453	0.169	-0.732	-0.096	-0.158	0.156	-0.507	0.074	-0.002	0.050	-0.136	0.052
Ind4	0.136	0.026	0.081	0.183	0.091	0.020	0.047	0.129	0.043	0.008	0.027	0.060
Ind5	0.100	0.036	0.016	0.162	0.030	0.036	-0.053	0.089	0.024	0.014	-0.007	0.046
Ind6	0.179	0.020	0.139	0.219	0.088	0.021	0.043	0.125	0.030	0.011	0.006	0.050
Ind7	-0.058	0.050	-0.163	0.032	-0.056	0.043	-0.150	0.019	-0.006	0.019	-0.048	0.024
Ind8	0.155	0.024	0.105	0.200	0.096	0.020	0.054	0.134	0.034	0.011	0.010	0.053
Ind9	0.109	0.037	0.027	0.172	0.018	0.043	-0.076	0.089	0.002	0.023	-0.053	0.036
Ind10	0.134	0.025	0.082	0.179	0.097	0.018	0.059	0.133	0.038	0.009	0.021	0.055
Ind11	0.115	0.029	0.052	0.168	0.031	0.033	-0.042	0.087	0.017	0.014	-0.016	0.040
Ind12	0.166	0.020	0.127	0.206	0.098	0.018	0.063	0.133	0.040	0.008	0.025	0.056
Ind13	0.079	0.068	-0.083	0.179	-0.034	0.083	-0.240	0.090	-0.001	0.039	-0.104	0.046
Ind14	0.111	0.030	0.047	0.164	0.060	0.026	0.002	0.106	0.016	0.015	-0.019	0.040
Ind15	0.101	0.044	-0.001	0.170	0.038	0.044	-0.065	0.108	0.030	0.015	-0.006	0.054
Ind16	0.096	0.030	0.030	0.151	0.005	0.035	-0.071	0.065	0.008	0.016	-0.027	0.033
Ind17	0.105	0.037	0.022	0.167	0.013	0.043	-0.083	0.080	0.020	0.016	-0.019	0.045
Ind18	-0.038	0.040	-0.111	0.044	-0.059	0.026	-0.106	-0.002	-0.016	0.014	-0.041	0.014
Ind19	0.010	0.043	-0.082	0.085	-0.008	0.037	-0.091	0.055	0.006	0.016	-0.032	0.032
flood 0-2	-0.104	0.051	-0.214	-0.011	-0.227	0.055	-0.339	-0.123	-0.253	0.056	-0.367	-0.151
flood 2-4	-0.234	0.060	-0.355	-0.120	-0.354	0.062	-0.475	-0.233	-0.288	0.059	-0.411	-0.181
flood 4-6	-0.198	0.059	-0.318	-0.086	-0.392	0.063	-0.514	-0.264	-0.331	0.065	-0.459	-0.209
flood 6-8	-0.223	0.067	-0.361	-0.101	-0.463	0.070	-0.599	-0.324	-0.433	0.079	-0.591	-0.282
flood 8	-0.348	0.062	-0.471	-0.226	-0.567	0.059	-0.670	-0.444	-0.574	0.071	-0.704	-0.428

Table 8: **Marginal effects.** Marginal effects for firm with probability of opening in the 50% percentile and no open neighbors. The first column displays the variable symbol. For each quarter, column 2, 3, 4, and 5 report the estimates, posterior standard deviations, 2.5% and 97.5% percentile.

	Quarter 6				Quarter 8				Quarter 12			
	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p
type	0.057	0.043	0.000	0.153	0.171	0.102	0.005	0.350	0.141	0.086	0.003	0.301
typeflood	-0.060	0.051	-0.175	0.008	0.083	0.061	0.001	0.218	0.176	0.108	0.004	0.376
Size1	-0.015	0.008	-0.034	-0.004	-0.111	0.037	-0.190	-0.049	-0.067	0.029	-0.132	-0.018
Size2	-0.011	0.013	-0.046	0.005	-0.036	0.048	-0.151	0.041	0.057	0.029	0.001	0.116
Size3	0.012	0.006	0.003	0.027	0.053	0.032	-0.014	0.117	0.067	0.030	0.012	0.130
Ind1	0.015	0.008	0.004	0.036	0.081	0.070	-0.089	0.188	0.108	0.047	0.023	0.206
Ind2	0.015	0.008	0.004	0.035	0.101	0.040	0.032	0.183	0.066	0.046	-0.033	0.152
Ind3	-0.198	0.146	-0.569	-0.014	-0.152	0.152	-0.496	0.070	0.004	0.086	-0.215	0.126
Ind4	0.013	0.007	0.004	0.030	0.085	0.030	0.034	0.151	0.092	0.032	0.040	0.164
Ind5	0.011	0.006	0.002	0.026	0.028	0.036	-0.050	0.096	0.049	0.032	-0.012	0.116
Ind6	0.015	0.008	0.005	0.035	0.082	0.030	0.032	0.148	0.061	0.029	0.010	0.122
Ind7	-0.010	0.011	-0.036	0.004	-0.054	0.043	-0.152	0.017	-0.010	0.034	-0.089	0.049
Ind8	0.014	0.007	0.004	0.033	0.090	0.032	0.038	0.159	0.070	0.030	0.018	0.138
Ind9	0.011	0.007	0.002	0.027	0.016	0.042	-0.078	0.094	0.007	0.044	-0.094	0.084
Ind10	0.013	0.007	0.004	0.030	0.091	0.030	0.039	0.157	0.079	0.029	0.032	0.144
Ind11	0.012	0.006	0.003	0.028	0.028	0.032	-0.042	0.090	0.034	0.031	-0.030	0.094
Ind12	0.015	0.008	0.004	0.034	0.092	0.030	0.042	0.159	0.085	0.029	0.038	0.150
Ind13	0.008	0.010	-0.014	0.026	-0.033	0.080	-0.235	0.086	0.004	0.069	-0.166	0.107
Ind14	0.011	0.006	0.003	0.027	0.056	0.029	0.002	0.120	0.032	0.031	-0.034	0.092
Ind15	0.029	0.016	0.000	0.063	0.054	0.059	-0.065	0.168	0.109	0.062	-0.015	0.229
Ind16	0.010	0.006	0.002	0.025	0.004	0.034	-0.073	0.065	0.015	0.031	-0.053	0.072
Ind17	0.011	0.007	0.002	0.026	0.012	0.042	-0.081	0.087	0.041	0.035	-0.036	0.107
Ind18	-0.008	0.010	-0.034	0.005	-0.086	0.050	-0.197	-0.002	-0.043	0.041	-0.136	0.025
Ind19	0.001	0.007	-0.015	0.013	-0.008	0.036	-0.091	0.054	0.012	0.031	-0.058	0.070
flood 0-2	-0.019	0.014	-0.056	-0.001	-0.216	0.061	-0.340	-0.103	-0.347	0.069	-0.478	-0.214
flood 2-4	-0.055	0.029	-0.124	-0.015	-0.340	0.071	-0.473	-0.201	-0.386	0.071	-0.519	-0.244
flood 4-6	-0.043	0.024	-0.101	-0.010	-0.376	0.071	-0.512	-0.234	-0.430	0.071	-0.561	-0.284
flood 6-8	-0.052	0.030	-0.128	-0.012	-0.447	0.076	-0.586	-0.293	-0.528	0.074	-0.661	-0.375
flood 8	-0.101	0.044	-0.203	-0.036	-0.552	0.065	-0.661	-0.410	-0.648	0.056	-0.743	-0.524

Table 9: **Marginal effects.** Marginal effects for firm with probability of opening in the 50% percentile and all neighbors open. The first column displays the variable symbol. For each quarter, column 2, 3, 4, and 5 report the estimates, posterior standard deviations, 2.5% and 97.5% percentile.

	Quarter 6				Quarter 8				Quarter 12			
	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p
type	0.072	0.043	0.002	0.163	0.222	0.088	0.028	0.363	0.187	0.072	0.027	0.311
typeflood	-0.075	0.052	-0.187	0.012	0.106	0.059	0.006	0.229	0.233	0.091	0.033	0.393
Size1	-0.163	0.045	-0.262	-0.086	-0.383	0.068	-0.513	-0.246	-0.161	0.071	-0.312	-0.034
Size2	-0.057	0.059	-0.182	0.044	-0.043	0.061	-0.163	0.081	0.131	0.068	0.002	0.266
Size3	0.182	0.078	0.039	0.343	0.100	0.058	-0.022	0.210	0.112	0.047	0.021	0.207
Ind1	0.620	0.177	0.173	0.845	0.176	0.128	-0.132	0.375	0.202	0.079	0.038	0.349
Ind2	0.426	0.129	0.162	0.655	0.210	0.073	0.066	0.348	0.113	0.075	-0.049	0.249
Ind3	-0.167	0.058	-0.292	-0.064	-0.186	0.174	-0.516	0.126	0.018	0.124	-0.265	0.213
Ind4	0.241	0.075	0.097	0.389	0.167	0.051	0.074	0.271	0.160	0.046	0.080	0.255
Ind5	0.152	0.075	0.015	0.306	0.052	0.061	-0.077	0.169	0.081	0.050	-0.018	0.181
Ind6	0.430	0.072	0.279	0.558	0.160	0.050	0.067	0.263	0.102	0.045	0.017	0.192
Ind7	-0.044	0.038	-0.117	0.034	-0.080	0.059	-0.200	0.030	-0.012	0.049	-0.118	0.076
Ind8	0.307	0.081	0.152	0.464	0.180	0.053	0.085	0.288	0.119	0.047	0.029	0.216
Ind9	0.172	0.082	0.028	0.344	0.032	0.070	-0.114	0.165	0.013	0.065	-0.128	0.131
Ind10	0.230	0.069	0.100	0.364	0.181	0.048	0.091	0.280	0.135	0.042	0.058	0.223
Ind11	0.183	0.069	0.057	0.326	0.052	0.056	-0.064	0.157	0.055	0.048	-0.043	0.148
Ind12	0.351	0.065	0.223	0.468	0.182	0.047	0.097	0.278	0.146	0.042	0.073	0.233
Ind13	0.132	0.117	-0.063	0.387	-0.040	0.115	-0.300	0.158	0.012	0.098	-0.215	0.171
Ind14	0.172	0.067	0.050	0.308	0.105	0.051	0.003	0.209	0.053	0.048	-0.050	0.144
Ind15	0.106	0.060	0.000	0.237	0.085	0.092	-0.099	0.263	0.150	0.086	-0.019	0.316
Ind16	0.139	0.060	0.032	0.267	0.010	0.055	-0.105	0.112	0.026	0.047	-0.074	0.113
Ind17	0.164	0.079	0.021	0.330	0.025	0.068	-0.121	0.148	0.067	0.055	-0.050	0.169
Ind18	-0.036	0.039	-0.109	0.046	-0.124	0.062	-0.248	-0.004	-0.061	0.055	-0.178	0.038
Ind19	0.016	0.045	-0.064	0.111	-0.010	0.057	-0.130	0.092	0.020	0.047	-0.080	0.108
flood 0-2	-0.073	0.034	-0.145	-0.009	-0.279	0.056	-0.384	-0.164	-0.405	0.056	-0.509	-0.292
flood 2-4	-0.129	0.037	-0.211	-0.068	-0.399	0.053	-0.497	-0.290	-0.440	0.054	-0.541	-0.330
flood 4-6	-0.191	0.058	-0.309	-0.081	-0.249	0.059	-0.361	-0.135	-0.213	0.057	-0.328	-0.109
flood 6-8	-0.125	0.039	-0.213	-0.062	-0.486	0.055	-0.594	-0.374	-0.558	0.055	-0.663	-0.445
flood 8	-0.159	0.044	-0.258	-0.085	-0.558	0.050	-0.653	-0.458	-0.644	0.047	-0.730	-0.547

Table 10: **Marginal effects.** Marginal effects for firm with probability of opening in the 75% percentile and no open neighbors. The first column displays the variable symbol. For each quarter, column 2, 3, 4, and 5 report the estimates, posterior standard deviations, 2.5% and 97.5% percentile.

	Quarter 6				Quarter 8				Quarter 12			
	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p
type	0.044	0.041	0.000	0.142	0.144	0.103	0.003	0.339	0.194	0.070	0.040	0.316
typeflood	-0.046	0.046	-0.162	0.006	0.069	0.059	0.001	0.205	0.240	0.087	0.051	0.396
Size1	-0.378	0.054	-0.476	-0.269	-0.382	0.059	-0.489	-0.260	-0.111	0.054	-0.235	-0.020
Size2	-0.067	0.067	-0.192	0.066	-0.050	0.068	-0.179	0.089	0.088	0.050	0.001	0.195
Size3	0.214	0.076	0.056	0.353	0.136	0.082	-0.025	0.290	0.113	0.059	0.015	0.247
Ind1	0.516	0.105	0.220	0.625	0.301	0.202	-0.133	0.595	0.487	0.245	0.026	0.871
Ind2	0.414	0.093	0.198	0.558	0.339	0.116	0.087	0.527	0.134	0.102	-0.024	0.362
Ind3	-0.317	0.079	-0.422	-0.112	-0.145	0.140	-0.352	0.169	0.049	0.101	-0.079	0.305
Ind4	0.272	0.066	0.134	0.393	0.245	0.071	0.101	0.383	0.203	0.068	0.079	0.348
Ind5	0.182	0.077	0.023	0.326	0.068	0.077	-0.078	0.223	0.073	0.051	-0.010	0.188
Ind6	0.424	0.048	0.321	0.508	0.232	0.070	0.091	0.361	0.097	0.051	0.011	0.207
Ind7	-0.068	0.056	-0.172	0.047	-0.078	0.055	-0.179	0.036	-0.003	0.027	-0.049	0.057
Ind8	0.330	0.065	0.194	0.446	0.269	0.074	0.119	0.406	0.123	0.060	0.020	0.253
Ind9	0.203	0.082	0.040	0.357	0.046	0.085	-0.109	0.218	0.017	0.043	-0.051	0.113
Ind10	0.262	0.061	0.138	0.375	0.269	0.065	0.137	0.388	0.148	0.056	0.050	0.268
Ind11	0.216	0.066	0.081	0.343	0.069	0.070	-0.064	0.213	0.047	0.042	-0.021	0.141
Ind12	0.294	0.036	0.222	0.362	0.222	0.045	0.130	0.307	0.072	0.015	0.043	0.101
Ind13	0.153	0.128	-0.100	0.392	-0.027	0.120	-0.246	0.224	0.028	0.068	-0.073	0.188
Ind14	0.205	0.066	0.073	0.329	0.142	0.071	0.003	0.285	0.044	0.041	-0.024	0.138
Ind15	0.187	0.093	-0.001	0.359	0.095	0.101	-0.096	0.295	0.109	0.075	-0.008	0.276
Ind16	0.170	0.063	0.045	0.291	0.016	0.063	-0.102	0.142	0.022	0.033	-0.034	0.095
Ind17	0.195	0.081	0.031	0.346	0.036	0.081	-0.116	0.195	0.061	0.052	-0.025	0.176
Ind18	-0.056	0.058	-0.164	0.061	-0.118	0.053	-0.212	-0.004	-0.026	0.023	-0.064	0.024
Ind19	0.019	0.061	-0.100	0.141	-0.007	0.062	-0.125	0.116	0.017	0.032	-0.036	0.089
flood 0-2	-0.116	0.049	-0.208	-0.015	-0.232	0.035	-0.297	-0.157	-0.091	0.011	-0.114	-0.071
flood 2-4	-0.222	0.041	-0.294	-0.137	-0.296	0.029	-0.350	-0.238	-0.093	0.011	-0.116	-0.073
flood 4-6	-0.196	0.044	-0.275	-0.103	-0.310	0.028	-0.364	-0.253	-0.095	0.012	-0.119	-0.074
flood 6-8	-0.213	0.047	-0.299	-0.117	-0.332	0.029	-0.388	-0.274	-0.098	0.012	-0.122	-0.076
flood 8	-0.287	0.034	-0.351	-0.219	-0.356	0.026	-0.404	-0.305	-0.100	0.012	-0.124	-0.078

Table 11: **Marginal effects.** Marginal effects for firm with probability of opening in the 75% percentile and all neighbors open. The first column displays the variable symbol. For each quarter, column 2, 3, 4, and 5 report the estimates, posterior standard deviations, 2.5% and 97.5% percentile.

	Quarter 6				Quarter 8				Quarter 12			
	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p	Marginal eff	Std dev	2.5% p	97.5% p
type	0.035	0.037	0.000	0.133	0.121	0.100	0.001	0.329	0.119	0.087	0.001	0.292
typeflood	-0.036	0.042	-0.148	0.004	0.058	0.056	0.000	0.195	0.148	0.108	0.002	0.359
Size1	-0.109	0.014	-0.138	-0.083	-0.124	0.015	-0.155	-0.096	-0.113	0.037	-0.178	-0.032
Size2	-0.047	0.048	-0.152	0.031	-0.039	0.050	-0.151	0.045	0.096	0.042	0.002	0.165
Size3	0.077	0.022	0.028	0.115	0.060	0.033	-0.014	0.113	0.113	0.041	0.022	0.183
Ind1	0.119	0.020	0.078	0.151	0.091	0.071	-0.100	0.162	0.201	0.057	0.040	0.266
Ind2	0.112	0.018	0.073	0.143	0.113	0.028	0.043	0.155	0.113	0.069	-0.048	0.210
Ind3	-0.422	0.182	-0.756	-0.077	-0.162	0.158	-0.512	0.077	0.018	0.124	-0.271	0.197
Ind4	0.091	0.017	0.055	0.122	0.095	0.020	0.050	0.133	0.161	0.028	0.099	0.211
Ind5	0.068	0.024	0.011	0.108	0.031	0.038	-0.054	0.092	0.082	0.046	-0.019	0.162
Ind6	0.115	0.013	0.090	0.142	0.092	0.021	0.047	0.129	0.103	0.039	0.018	0.171
Ind7	-0.045	0.039	-0.127	0.023	-0.059	0.044	-0.154	0.020	-0.013	0.050	-0.117	0.076
Ind8	0.102	0.015	0.070	0.131	0.101	0.020	0.057	0.138	0.120	0.039	0.032	0.185
Ind9	0.074	0.024	0.020	0.114	0.018	0.045	-0.080	0.091	0.013	0.064	-0.129	0.121
Ind10	0.089	0.016	0.056	0.120	0.102	0.018	0.064	0.134	0.136	0.030	0.070	0.190
Ind11	0.078	0.019	0.037	0.112	0.032	0.034	-0.044	0.090	0.056	0.047	-0.042	0.139
Ind12	0.314	0.058	0.205	0.426	0.217	0.059	0.110	0.335	0.236	0.062	0.118	0.356
Ind13	0.053	0.047	-0.063	0.116	-0.035	0.086	-0.244	0.092	0.013	0.099	-0.222	0.162
Ind14	0.076	0.019	0.033	0.110	0.063	0.027	0.002	0.110	0.053	0.047	-0.050	0.135
Ind15	0.069	0.029	0.000	0.114	0.040	0.046	-0.068	0.110	0.105	0.054	-0.017	0.190
Ind16	0.066	0.020	0.022	0.102	0.005	0.036	-0.075	0.066	0.026	0.047	-0.073	0.108
Ind17	0.072	0.025	0.015	0.113	0.014	0.045	-0.089	0.084	0.068	0.053	-0.052	0.153
Ind18	-0.037	0.039	-0.119	0.029	-0.093	0.050	-0.200	-0.003	-0.062	0.055	-0.176	0.037
Ind19	0.007	0.031	-0.064	0.059	-0.009	0.039	-0.096	0.057	0.020	0.047	-0.081	0.103
flood 0-2	-0.082	0.042	-0.175	-0.008	-0.232	0.055	-0.342	-0.127	-0.413	0.054	-0.517	-0.301
flood 2-4	-0.194	0.055	-0.306	-0.093	-0.361	0.060	-0.478	-0.245	-0.449	0.053	-0.550	-0.345
flood 4-6	-0.161	0.052	-0.269	-0.066	-0.399	0.061	-0.519	-0.276	-0.488	0.053	-0.582	-0.380
flood 6-8	-0.184	0.061	-0.316	-0.076	-0.469	0.067	-0.599	-0.336	-0.567	0.052	-0.662	-0.456
flood 8	-0.302	0.062	-0.431	-0.183	-0.572	0.055	-0.671	-0.457	-0.653	0.036	-0.715	-0.577