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 diminishes 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.

A lot of research has been developed to model business survival. 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) study survival rates for plants in 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 firms across different manufacturing industries. 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. The authors estimate a hazard duration model for 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, 1995; Baldwin & Gorecki, 1991; Baldwin & Rafiquzzaman, 1995), Portugal (Mata & Portugal, 1994; Mata Portugal & Guimaraes, 1995), 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 market. The idea was first introduced by Gort and Klepper (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. Agarwal (1996) and Agarwal and Gort (1996) analyze firm survival in the product life cycle framework. Agarwal (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) 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 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 (1996), 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 are 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, Caporaso, Goldstein, Linebcrry, & McClearly, 1979; Rossi, Wright, Weber-Burdin, & Pereira, 1983; Wright, Rossi, Wright, & Weber-Burdin, 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 17 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. 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. The most closely related study to this one is LeSage, Pace, Lam, Campanella, and Liu (2011). This paper uses the same dataset of 673 establishments collected by Campanella (2007) in order to investigate business survival following hurricane Katrina. The authors employ a spatial probit model and argue the importance of the spatial component in business recovery. Other factors that influence survival are ownership type and flood levels.

Following LeSage et al. (2011), we employ a spatial probit model to explore the recovery of businesses in the wake of Hurricane Katrina. The primary difference between this study and LeSage et al. (2011) is the dataset. We use a dataset based on all employers filing unemployment reports (over 8,000 employers) rather than the Campanella database of 673 employers that he monitored in three corridors following the storm. Our dataset offers a more complete characterization of firms in the wake of the storm though with the limitation that we rely on the reports of firms concerning payrolls rather than eyewitness accounts at a particular geographic location.

We find that the spatial component is important in explaining business survival in the quarters immediately following the storm, but diminishes in importance in the long run. We also find that several firm characteristics influence firm survival. First, we find that larger firms are more likely to survive compared to smaller firms. Second, sole proprietorships are more likely to reopen compared to large chain stores. Finally, we find that establishments with less flooding are more likely to reopen.

The remainder of 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.

As previously stated, the key difference in this study and earlier work by LeSage et al. (2011) is the dataset employed. The dataset used in this study offers maximal breadth, covering the population of all firms filing unemployment insurance reports in Orleans Parish. The key advantage over other work is the use of this data for firms—a group estimated to cover 94−96% of all employees.

The primary disadvantage of the data used in this study is the reliance on reports by employers. Some employers chose to pay workers during the period immediately after the storm and others may have continued operations at a different location. In some sense, both issues implicitly involve defining open status of establishments in a manner other than a return to engaging in operations at the original location. Luckily, a close inspection of results and a comparison of our results reveals significant similarities to those of LeSage et al. (2011).

The dataset used for this study spans the period of 2004Q3−2007Q3. 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.[2] 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 LDOL in Orleans Parish in 2005Q2.[3] Following Terrell and Bilbo (2007), this study considers firms as open if they reported either employment or wages in any month of a quarter to the LDOL 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 three 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 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 (2007).[4] 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 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 will not be considered as 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.

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 dataset of Orleans Parish elevations was obtained from the Louisiana CADGIS Laboratory. This dataset consists of LIDAR Edited Points – a massive dataset 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, and manmade structures have been removed. The dataset is intended only to contain land elevations. The LIDAR and QCEW datasets were combined using a GIS software 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 2 feet above sea level. Therefore, the flood depth was calculated as two minus the elevation variable. A survey of establishments was used to evaluate the accuracy of these measures of flood depth based on elevation is in determining whether businesses were flooded or not. A phone survey of 1,833 Orleans Parish businesses asked whether they were flooded or not. The results based on the phone survey correspond to the results based on the elevation measure and 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 dependence between firm decisions by introducing a latent/unobservable vector of effects that are spatially structured. The structure is such that the unobserved factors influencing firm i's decision exert influences of similar magnitude on neighboring firms j. Intuitively, unobservable influences arising from location of firm i should be similar to those of influences impacting firms j located nearby.

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 four 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 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.

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 (2004). 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 remainder of this 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.[5] 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

Table 1. Firms by Industry and Quarter.

	04Q3	04Q4	05Q1	05Q2	05Q3	05Q4	06Q1	06Q2	06Q3	06Q4	07Q1	07Q2	07Q3
1. Agriculture, Forestry, Fishing and 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

Notes: The first column displays the industry. Columns 1–13 report the number of firms open for each quarter.

Table 2. Descriptive Statistics.

	Obs	Mean	Std. Dev.	Min	Max
open 2005Q4	8,171	0.607	0.488	0	1
open 2006Q2	8,171	0.626	0.484	0	1
open 2007Q2	8,171	0.615	0.487	0	1
rel size	8,171	0.890	0.298	0.0001	1
rel size&flood	8,171	0.409	0.487	0.0000	1
size1	8,171	0.486	0.500	0	1
size2	8,171	0.435	0.496	0	1
size3	8,171	0.065	0.247	0	1
size4	8,171	0.011	0.106	0	1
Agriculture, Forestry, Fishing & Hunting	8,171	0.001	0.035	0	1
Mining	8,171	0.005	0.070	0	1
Utilities	8,171	0.002	0.048	0	1
Construction	8,171	0.036	0.187	0	1
Manufacturing	8,171	0.024	0.153	0	1
Wholesale Trade	8,171	0.044	0.204	0	1
Retail Trade	8,171	0.164	0.370	0	1
Transportation & Warehousing	8,171	0.027	0.163	0	1
Information	8,171	0.016	0.124	0	1
Finance & Insurance	8,171	0.057	0.232	0	1
Real Estate, Rental & Leasing	8,171	0.049	0.216	0	1
Professional, Scientific & Technical Services	8,171	0.155	0.362	0	1
Management of Companies & Enterprises	8,171	0.005	0.067	0	1
Administrative, Support, Waste Management & Remediation	8,171	0.048	0.213	0	1
Educational Services	8,171	0.011	0.105	0	1
Health Care & Social Assistance	8,171	0.103	0.303	0	1
Arts, Entertainment & Recreation	8,171	0.018	0.134	0	1
Accommodation & Food Services	8,171	0.120	0.325	0	1
Other Services	8,171	0.096	0.295	0	1
Public Administration	8,171	0.020	0.140	0	1

Table 2. (*Continued*)

	Obs	Mean	Std. Dev.	Min	Max
flood 0–2	8,171	0.152	0.359	0	1
flood 2–4	8,171	0.109	0.311	0	1
flood 4–6	8,171	0.101	0.302	0	1
flood 6–8	8,171	0.044	0.204	0	1
flood 8	8,171	0.067	0.251	0	1

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

difference in utility from alternatives 1 and 0. The difference in utility is modeled as:

$$z_i = x_i\beta + \theta_i + \varepsilon_i, \tag{1}$$

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 $\varepsilon_i \sim N(0,1)$. 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

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

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 spatial dependence across establishments. The spatial autocorrelation is thus determined by both ρ and W. We can write Eq. (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 Eq. (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 Eq. (6), we see that the distribution for θ is given by:

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

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

The full model in matrix notation is given by:

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

4. BAYESIAN INFERENCE IN THE SPATIAL PROBIT MODEL SPECIFICATION

Our statistical approach is a simplification of the Smith and LeSage (2004) 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

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

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

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

Given the statistical model summarized in Section 3, Smith and LeSage (2004) provide the full conditionals required to estimate the model by Markov Chain Monte Carlo (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 MCMC algorithm follows that of Smith and LeSage (2004) and primarily a Gibbs sampling approach. For clarity, the notation used in this paper is identical to that introduced by Smith and LeSage (2004). 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

$$z_i - \theta_i = x_i\beta + \varepsilon_i \tag{12}$$

is simply a linear regression model.

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

$$\beta|\left(\theta, \rho, \sigma^2, z, y\right) \sim N\left(A^{-1}b, A^{-1}\right), \tag{13}$$

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

The conditional distribution of θ also follows a normal distribution:

$$\theta|\left(\beta, \rho, \sigma^2, z, y\right) \sim N\left(A_0^{-1}b_0, A_0^{-1}\right), \tag{14}$$

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:

$$H_p = \frac{1}{\sigma^2}|(\beta, \theta, \rho, z, y) \sim \frac{\chi^2(m + 2\alpha)}{\theta' B'_\rho B_\rho \theta + 2v}. \tag{15}$$

The conditional posterior distribution of ρ is given by:

$$\rho|\left(\beta, \theta, \sigma^2, z, y\right) \propto |B_\rho| \exp\left(-\frac{1}{2\sigma^2}\theta' B'_\rho B_\rho \theta\right), \tag{16}$$

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

The distribution in Eq. (16) 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 (2004) 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 Eq. (16) can be written as:

$$\rho|(\beta, \theta, z, y) \propto |B_\rho| \left[m^{-1}\theta' B'_\rho B_\rho \theta\right]^{-m/2} \pi(\rho). \tag{17}$$

Before sampling from this posterior distribution for ρ, we need to calculate the normalizing constant that transforms Eq. (17) in a proper density function that integrates to one. The normalizing constant can be found by integrating Eq. (17) 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 (2004).

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:

$$z_i | \left(\beta, \theta, \rho, \sigma^2, V, -z_i, y\right) \sim \begin{cases} TN_{(0,\infty)}\left(x_i'\beta + \theta_i, 1\right) & \text{if } y_i = 1; \\ TN_{(-\infty,0)}\left(x_i'\beta + \theta_i, 1\right) & \text{if } y_i = 0. \end{cases} \tag{18}$$

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 $\beta_1 | (\theta_0, \rho_0, \sigma_0^2, z_0)$ from the multinormal distribution given by Eq. (13).
3. Sample $\theta_1 | (\beta_1, \rho_0, \sigma_0^2, z_0)$ from the multinormal distribution given by Eq. (14).
4. Sample $\sigma_1^2 | (\beta_1, \theta_1, \rho_0, z_0)$ using Eq. (15).
5. Sample $\rho_1 | (\beta_1, \theta_1, \sigma_1^2, z_0)$ using numerical integration to obtain the conditional distribution for ρ using Eq. (17).
6. Sample $z_1 | (\beta_1, \theta_1, \rho_1, \sigma_1^2)$ from the truncated normal distribution given by Eq. (18).
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

This section discusses results from the spatial probit model specification developed in Section 3. Detailed results are presented for all three quarters of interest: 2005Q4, 2006Q2, and 2007Q2. Table 3 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 4. 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) and LeSage et al. (2011) report results from data gathered during bicycle tours over a 15-month period on three main commercial arteries in the city of New Orleans. One interesting result from these studies is that locally owned businesses are more likely to reopen than large chain businesses. The relative size variable used in our study has a positive sign in all three 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 2 locations it takes a value one-half, with 20 locations 0.05 and so forth. Thus, the change of 1 is roughly moving from a very large chain to sole proprietorship and implies an increase in probability by 8.6% in 2005Q4, 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.

Though an exact comparison of magnitudes is difficult due to differences in model specification, our results are broadly in line with the findings of Campanella (2007) and LeSage et al. (2011). It is interesting to note that the timing of the storm impact in our data differs substantially from LeSage et al. (2011). Our results show that the impact of flood depth on reopening rises over time from the initial period one quarter after the storm. This illustrates a fundamental difference in the pattern of reopening across the two studies.

The most likely explanation for this difference lies in the definition of "open." In our dataset, an employer is considered "open" if it continued to pay wages and thus taxes on those wages. Our results are consistent with the observation that many employers, particularly those with a single

Table 3. Estimation Results.

	2005Q4				2006Q2				2007Q2			
	p.mean	p.Std dev	2.5%	97.5%	p.mean	p.Std dev	2.5%	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
Agriculture, Forestry, Fishing & Hunting	2.073	0.846	0.561	3.866	0.886	0.684	−0.376	2.257	1.579	0.794	0.143	3.227
Mining	1.212	0.366	0.505	1.942	0.928	0.365	0.221	1.656	0.515	0.347	−0.151	1.181
Utilities	−1.289	0.515	−2.337	−0.312	−0.498	0.494	−1.478	0.428	0.138	0.455	−0.735	1.026
Construction	0.709	0.187	0.338	1.071	0.632	0.194	0.260	1.030	0.756	0.193	0.377	1.131
Manufacturing	0.467	0.202	0.058	0.864	0.174	0.200	−0.212	0.566	0.321	0.199	−0.062	0.720
Wholesale Trade	1.210	0.186	0.840	1.570	0.596	0.186	0.237	0.957	0.415	0.182	0.059	0.775
Retail Trade	−0.185	0.156	−0.488	0.121	−0.220	0.158	−0.533	0.094	−0.032	0.159	−0.341	0.276
Transportation & Warehousing	0.884	0.201	0.492	1.282	0.700	0.206	0.304	1.103	0.503	0.200	0.109	0.890
Information	0.523	0.219	0.101	0.955	0.114	0.221	−0.304	0.553	0.062	0.219	−0.374	0.478
Finance & Insurance	0.680	0.170	0.349	1.007	0.697	0.179	0.351	1.051	0.590	0.174	0.255	0.937
Real Estate, Rental & Leasing	0.554	0.177	0.207	0.910	0.175	0.181	−0.176	0.541	0.213	0.181	−0.132	0.580
Professional, Scientific & Technical Services	0.997	0.155	0.700	1.296	0.704	0.166	0.385	1.037	0.651	0.163	0.340	0.965

Management of Companies & Enterprises	0.395	0.343	−0.266	1.078	−0.092	0.338	−0.786	0.571	0.084	0.340	−0.619	0.717
Administrative, Support, Waste Management & Remediation	0.525	0.175	0.186	0.866	0.361	0.183	0.009	0.732	0.203	0.180	0.156	0.559
Educational Services	0.482	0.246	−0.002	0.961	0.242	0.263	−0.264	0.765	0.444	0.261	−0.054	0.961
Health Care & Social Assistance	0.434	0.163	0.118	0.754	0.038	0.166	−0.285	0.361	0.100	0.164	−0.223	0.420
Arts, Entertainment & Recreation	0.500	0.214	0.080	0.922	0.088	0.212	−0.327	0.493	0.268	0.214	−0.158	0.677
Accommodation & Food Services	−0.153	0.157	−0.459	0.154	−0.339	0.163	−0.650	−0.011	−0.183	0.162	−0.499	0.129
Other Services	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

Notes: 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.

Table 4. Marginal Effects.

	2005Q4				2006Q2				2007Q2			
	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
Agriculture, Forestry, Fishing & Hunting	0.351	0.099	0.159	0.546	0.232	0.163	−0.141	0.499	0.476	0.180	0.053	0.743
Mining	0.305	0.085	0.144	0.481	0.270	0.096	0.074	0.456	0.194	0.129	−0.053	0.435
Utilities	−0.425	0.137	−0.651	−0.119	−0.183	0.174	−0.500	0.156	0.057	0.161	−0.233	0.386
Construction	0.221	0.065	0.099	0.353	0.210	0.068	0.083	0.353	0.286	0.070	0.146	0.421
Manufacturing	0.156	0.069	0.020	0.295	0.064	0.074	−0.079	0.210	0.120	0.074	−0.023	0.267
Wholesale Trade	0.313	0.072	0.181	0.460	0.201	0.067	0.076	0.337	0.156	0.067	0.023	0.288
Retail Trade	−0.070	0.059	−0.186	0.046	−0.084	0.061	−0.202	0.037	−0.013	0.057	−0.125	0.094
Transportation & Warehousing	0.259	0.068	0.134	0.404	0.228	0.071	0.095	0.374	0.190	0.074	0.043	0.333
Information	0.171	0.072	0.036	0.316	0.042	0.082	−0.116	0.204	0.023	0.079	−0.132	0.175
Finance & Insurance	0.215	0.061	0.103	0.339	0.228	0.065	0.105	0.363	0.224	0.064	0.099	0.349
Real Estate, Rental & Leasing	0.182	0.062	0.066	0.309	0.065	0.067	−0.065	0.199	0.078	0.067	−0.051	0.212
Professional, Scientific & Technical Services	0.282	0.065	0.162	0.413	0.231	0.063	0.113	0.361	0.247	0.059	0.133	0.358
Management of Companies & Enterprises	0.127	0.110	−0.100	0.328	−0.037	0.126	−0.297	0.204	0.035	0.121	−0.197	0.269

Administrative, Support, Waste Management & Remediation	0.174	0.062	0.060	0.299	0.129	0.067	0.003	0.265	0.074	0.065	−0.058	0.199
Educational Services	0.159	0.081	−0.001	0.317	0.087	0.094	−0.098	0.275	0.167	0.098	−0.020	0.358
Health Care & Social Assistance	0.148	0.059	0.038	0.271	0.015	0.063	−0.106	0.139	0.035	0.059	−0.085	0.149
Arts, Entertainment & Recreation	0.165	0.071	0.027	0.305	0.033	0.079	−0.124	0.183	0.099	0.080	−0.060	0.252
Accommodation & Food Services	−0.058	0.060	−0.174	0.058	−0.131	0.062	−0.249	−0.004	−0.064	0.057	−0.180	0.042
Other Services	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

Notes: 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.

location, continued to pay wages for a few months after the storm. Terrell and Bilbo (2007) provide detailed analysis which shows that the maximum reduction in number of employers occurred in early 2006 before the recovery began in terms of total number of businesses.

It should be noted that the second increase in the size of the flood impact variables for 2007Q2 likely stems from a different source. This comes at a time at which the overall number of businesses in the parishes was rising. This likely captures the uneven pattern of recovery in the wake of Hurricane Katrina. Employers in the French Quarter or Central Business district were very likely to reopen. Other areas like the Lower Ninth or New Orleans East getting more floodwater experienced a much greater failure rate for employers.

This has important implications for an economies ability to weather a natural disaster or resiliency to any disruption. Our results suggest that employers are able to continue functioning in some respects (continue paying employees) for a period of a few months. However, the resiliency is not strong enough to get through a longer period of disruption like that experienced in New Orleans.

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 two 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 4 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 4 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 5–49 employees (size2 = 1). Firms with 50 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 three 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% in 2005Q4. The magnitude increases for the next two quarters considered, in 2007Q2 the probability of reopening decreases by a factor of 39%. 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 three 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.

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 allow for dependence between firm decisions by introducing a latent/unobservable vector of effects that are spatially structured. 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.

This paper also has important implications regarding an economy's resiliency in the wake of a large-scale disaster. Our results suggest that many employers will continue paying wages in the face of a disruption lasting a few months. Over longer periods, the sensitivity of employers rises, even when controlling for spatial impacts.

NOTES

1. www.whitehouse.gov/infocus/katrina
2. For example, each Walmart is considered as a separate establishment though there are multiple units in New Orleans.
3. 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
4. www.bus.lsu.edu/ded
5. We address differences in behavior across the ownership class variable relative size (see discussion in the section "Data") 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.

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APPENDIX

Table A1. Marginal effects for firm with probability of opening in the 25% percentile and no open neighbors.

	2005Q4				2006Q2				2007Q2			
	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%
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
Agriculture, Forestry, Fishing & Hunting	0.358	0.085	0.173	0.506	0.036	0.037	−0.049	0.093	0.211	0.075	0.038	0.344
Mining	0.311	0.076	0.157	0.459	0.046	0.020	0.012	0.093	0.121	0.079	−0.046	0.265
Utilities	−0.425	0.132	−0.637	−0.122	−0.099	0.110	−0.374	0.040	0.024	0.128	−0.269	0.232
Construction	0.227	0.063	0.105	0.353	0.041	0.019	0.013	0.086	0.170	0.052	0.076	0.279
Manufacturing	0.160	0.070	0.020	0.296	0.017	0.020	−0.019	0.060	0.088	0.056	−0.017	0.203
Wholesale Trade	0.320	0.062	0.203	0.446	0.040	0.019	0.011	0.084	0.110	0.052	0.014	0.217
Retail Trade	−0.071	0.059	−0.184	0.047	−0.026	0.019	−0.062	0.013	−0.008	0.050	−0.101	0.093
Transportation & Warehousing	0.265	0.064	0.145	0.393	0.043	0.019	0.015	0.088	0.128	0.054	0.027	0.236
Information	0.176	0.073	0.035	0.318	0.011	0.023	−0.031	0.058	0.018	0.067	−0.116	0.145
Finance & Insurance	0.220	0.060	0.106	0.340	0.043	0.019	0.014	0.088	0.145	0.051	0.055	0.250
Real Estate, Rental & Leasing	0.187	0.063	0.066	0.316	0.017	0.019	−0.014	0.062	0.063	0.054	−0.037	0.176
Professional, Scientific & Technical Services	0.288	0.059	0.178	0.406	0.044	0.019	0.015	0.089	0.156	0.050	0.069	0.258

Table A1. (*Continued*)

	2005Q4				2006Q2				2007Q2			
	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%
Management of Companies & Enterprises	0.131	0.112	−0.102	0.336	−0.017	0.045	−0.126	0.053	0.018	0.102	−0.208	0.190
Administrative, Support, Waste Management & Remediation	0.178	0.062	0.059	0.301	0.030	0.019	0.001	0.073	0.060	0.054	−0.042	0.169
Educational Services	0.162	0.081	−0.001	0.318	0.020	0.023	−0.026	0.069	0.113	0.065	−0.015	0.242
Health Care & Social Assistance	0.152	0.060	0.040	0.271	0.005	0.018	−0.025	0.046	0.032	0.050	−0.063	0.134
Arts, Entertainment & Recreation	0.169	0.072	0.027	0.313	0.009	0.022	−0.035	0.053	0.075	0.060	−0.046	0.194
Accommodation & Food Services	−0.058	0.060	−0.173	0.061	−0.045	0.022	−0.089	−0.002	−0.059	0.052	−0.159	0.044
Other Services	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

Notes: The first column displays the variable symbol. For each quarter, columns 2, 3, 4, and 5 report the estimates, posterior standard deviations, 2.5% and 97.5% percentile.

Table A2. Marginal effects for firm with probability of opening in the 25% percentile and all neighbors open.

	2005Q4				2006Q2				2007Q2			
	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%
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
Agriculture, Forestry, Fishing & Hunting	0.189	0.032	0.118	0.239	0.086	0.068	−0.098	0.154	0.047	0.014	0.013	0.067
Mining	0.174	0.029	0.110	0.224	0.107	0.027	0.041	0.150	0.031	0.019	−0.018	0.056
Utilities	−0.453	0.169	−0.732	−0.096	−0.158	0.156	−0.507	0.074	−0.002	0.050	−0.136	0.052
Construction	0.136	0.026	0.081	0.183	0.091	0.020	0.047	0.129	0.043	0.008	0.027	0.060
Manufacturing	0.100	0.036	0.016	0.162	0.030	0.036	−0.053	0.089	0.024	0.014	−0.007	0.046
Wholesale Trade	0.179	0.020	0.139	0.219	0.088	0.021	0.043	0.125	0.030	0.011	0.006	0.050
Retail Trade	−0.058	0.050	−0.163	0.032	−0.056	0.043	−0.150	0.019	−0.006	0.019	−0.048	0.024
Transportation & Warehousing	0.155	0.024	0.105	0.200	0.096	0.020	0.054	0.134	0.034	0.011	0.010	0.053
Information	0.109	0.037	0.027	0.172	0.018	0.043	−0.076	0.089	0.002	0.023	−0.053	0.036
Finance & Insurance	0.134	0.025	0.082	0.179	0.097	0.018	0.059	0.133	0.038	0.009	0.021	0.055
Real Estate, Rental & Leasing	0.115	0.029	0.052	0.168	0.031	0.033	−0.042	0.087	0.017	0.014	−0.016	0.040
Professional, Scientific & Technical Services	0.166	0.020	0.127	0.206	0.098	0.018	0.063	0.133	0.040	0.008	0.025	0.056
Management of Companies & Enterprises	0.079	0.068	−0.083	0.179	−0.034	0.083	−0.240	0.090	−0.001	0.039	−0.104	0.046
Administrative, Support, Waste Management & Remediation	0.111	0.030	0.047	0.164	0.060	0.026	0.002	0.106	0.016	0.015	−0.019	0.040

Table A2. (*Continued*)

	2005Q4				2006Q2				2007Q2			
	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%
Educational Services	0.101	0.044	−0.001	0.170	0.038	0.044	−0.065	0.108	0.030	0.015	−0.006	0.054
Health Care & Social Assistance	0.096	0.030	0.030	0.151	0.005	0.035	−0.071	0.065	0.008	0.016	−0.027	0.033
Arts, Entertainment & Recreation	0.105	0.037	0.022	0.167	0.013	0.043	−0.083	0.080	0.020	0.016	−0.019	0.045
Accommodation & Food Services	−0.038	0.040	−0.111	0.044	−0.059	0.026	−0.106	−0.002	−0.016	0.014	−0.041	0.014
Other Services	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

Notes: 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.

Table A3. Marginal effects for firm with probability of opening in the 50% percentile and no open neighbors.

	2005Q4				2006Q2				2007Q2			
	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%
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
Agriculture, Forestry, Fishing & Hunting	0.015	0.008	0.004	0.036	0.081	0.070	−0.089	0.188	0.108	0.047	0.023	0.206
Mining	0.015	0.008	0.004	0.035	0.101	0.040	0.032	0.183	0.066	0.046	−0.033	0.152
Utilities	−0.198	0.146	−0.569	−0.014	−0.152	0.152	−0.496	0.070	0.004	0.086	−0.215	0.126
Construction	0.013	0.007	0.004	0.030	0.085	0.030	0.034	0.151	0.092	0.032	0.040	0.164
Manufacturing	0.011	0.006	0.002	0.026	0.028	0.036	−0.050	0.096	0.049	0.032	−0.012	0.116
Wholesale Trade	0.015	0.008	0.005	0.035	0.082	0.030	0.032	0.148	0.061	0.029	0.010	0.122
Retail Trade	−0.010	0.011	−0.036	0.004	−0.054	0.043	−0.152	0.017	−0.010	0.034	−0.089	0.049
Transportation & Warehousing	0.014	0.007	0.004	0.033	0.090	0.032	0.038	0.159	0.070	0.030	0.018	0.138
Information	0.011	0.007	0.002	0.027	0.016	0.042	−0.078	0.094	0.007	0.044	−0.094	0.084
Finance & Insurance	0.013	0.007	0.004	0.030	0.091	0.030	0.039	0.157	0.079	0.029	0.032	0.144
Real Estate, Rental & Leasing	0.012	0.006	0.003	0.028	0.028	0.032	−0.042	0.090	0.034	0.031	−0.030	0.094
Professional, Scientific & Technical Services	0.015	0.008	0.004	0.034	0.092	0.030	0.042	0.159	0.085	0.029	0.038	0.150
Management of Companies & Enterprises	0.008	0.010	−0.014	0.026	−0.033	0.080	−0.235	0.086	0.004	0.069	−0.166	0.107
Administrative, Support, Waste Management & Remediation	0.011	0.006	0.003	0.027	0.056	0.029	0.002	0.120	0.032	0.031	−0.034	0.092

Table A3. (*Continued*)

	2005Q4				2006Q2				2007Q2			
	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%
Educational Services	0.029	0.016	0.000	0.063	0.054	0.059	−0.065	0.168	0.109	0.062	−0.015	0.229
Health Care & Social Assistance	0.010	0.006	0.002	0.025	0.004	0.034	−0.073	0.065	0.015	0.031	−0.053	0.072
Arts, Entertainment & Recreation	0.011	0.007	0.002	0.026	0.012	0.042	−0.081	0.087	0.041	0.035	−0.036	0.107
Accommodation & Food Services	−0.008	0.010	−0.034	0.005	−0.086	0.050	−0.197	−0.002	−0.043	0.041	−0.136	0.025
Other Services	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

Notes: The first column displays the variable symbol. For each quarter, columns 2, 3, 4, and 5 report the estimates, posterior standard deviations, 2.5% and 97.5% percentile.

Table A4. Marginal effects for firm with probability of opening in the 50% percentile and all neighbors open.

	2005Q4				2006Q2				2007Q2			
	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%
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
Agriculture, Forestry, Fishing & Hunting	0.620	0.177	0.173	0.845	0.176	0.128	−0.132	0.375	0.202	0.079	0.038	0.349
Mining	0.426	0.129	0.162	0.655	0.210	0.073	0.066	0.348	0.113	0.075	−0.049	0.249
Utilities	−0.167	0.058	−0.292	−0.064	−0.186	0.174	−0.516	0.126	0.018	0.124	−0.265	0.213
Construction	0.241	0.075	0.097	0.389	0.167	0.051	0.074	0.271	0.160	0.046	0.080	0.255
Manufacturing	0.152	0.075	0.015	0.306	0.052	0.061	−0.077	0.169	0.081	0.050	−0.018	0.181
Wholesale Trade	0.430	0.072	0.279	0.558	0.160	0.050	0.067	0.263	0.102	0.045	0.017	0.192
Retail Trade	−0.044	0.038	−0.117	0.034	−0.080	0.059	−0.200	0.030	−0.012	0.049	−0.118	0.076
Transportation & Warehousing	0.307	0.081	0.152	0.464	0.180	0.053	0.085	0.288	0.119	0.047	0.029	0.216
Information	0.172	0.082	0.028	0.344	0.032	0.070	−0.114	0.165	0.013	0.065	−0.128	0.131
Finance & Insurance	0.230	0.069	0.100	0.364	0.181	0.048	0.091	0.280	0.135	0.042	0.058	0.223
Real Estate, Rental & Leasing	0.183	0.069	0.057	0.326	0.052	0.056	−0.064	0.157	0.055	0.048	−0.043	0.148
Professional, Scientific & Technical Services	0.351	0.065	0.223	0.468	0.182	0.047	0.097	0.278	0.146	0.042	0.073	0.233

Table A4. (*Continued*)

	2005Q4				2006Q2				2007Q2			
	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%
Management of Companies & Enterprises	0.132	0.117	−0.063	0.387	−0.040	0.115	−0.300	0.158	0.012	0.098	−0.215	0.171
Administrative, Support, Waste Management & Remediation	0.172	0.067	0.050	0.308	0.105	0.051	0.003	0.209	0.053	0.048	−0.050	0.144
Educational Services	0.106	0.060	0.000	0.237	0.085	0.092	−0.099	0.263	0.150	0.086	−0.019	0.316
Health Care & Social Assistance	0.139	0.060	0.032	0.267	0.010	0.055	−0.105	0.112	0.026	0.047	−0.074	0.113
Arts, Entertainment & Recreation	0.164	0.079	0.021	0.330	0.025	0.068	−0.121	0.148	0.067	0.055	−0.050	0.169
Accommodation & Food Services	−0.036	0.039	−0.109	0.046	−0.124	0.062	−0.248	0.004	−0.061	0.055	−0.178	0.038
Other Services	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

Notes: The first column displays the variable symbol. For each quarter, columns 2, 3, 4, and 5 report the estimates, posterior standard deviations, 2.5% and 97.5% percentile.

Table A5. Marginal effects for firm with probability of opening in the 75% percentile and no open neighbors.

	2005Q4				2006Q2				2007Q2			
	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%
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
Agriculture, Forestry, Fishing & Hunting	0.516	0.105	0.220	0.625	0.301	0.202	−0.133	0.595	0.487	0.245	0.026	0.871
Mining	0.414	0.093	0.198	0.558	0.339	0.116	0.087	0.527	0.134	0.102	−0.024	0.362
Utilities	−0.317	0.079	−0.422	−0.112	−0.145	0.140	−0.352	0.169	0.049	0.101	−0.079	0.305
Construction	0.272	0.066	0.134	0.393	0.245	0.071	0.101	0.383	0.203	0.068	0.079	0.348
Manufacturing	0.182	0.077	0.023	0.326	0.068	0.077	−0.078	0.223	0.073	0.051	−0.010	0.188
Wholesale Trade	0.424	0.048	0.321	0.508	0.232	0.070	0.091	0.361	0.097	0.051	0.011	0.207
Retail Trade	−0.068	0.056	−0.172	0.047	−0.078	0.055	−0.179	0.036	−0.003	0.027	−0.049	0.057
Transportation & Warehousing	0.330	0.065	0.194	0.446	0.269	0.074	0.119	0.406	0.123	0.060	0.020	0.253
Information	0.203	0.082	0.040	0.357	0.046	0.085	−0.109	0.218	0.017	0.043	−0.051	0.113
Finance & Insurance	0.262	0.061	0.138	0.375	0.269	0.065	0.137	0.388	0.148	0.056	0.050	0.268
Real Estate, Rental & Leasing	0.216	0.066	0.081	0.343	0.069	0.070	−0.064	0.213	0.047	0.042	−0.021	0.141
Professional, Scientific & Technical Services	0.294	0.036	0.222	0.362	0.222	0.045	0.130	0.307	0.072	0.015	0.043	0.101

Table A5. *(Continued)*

	2005Q4				2006Q2				2007Q2			
	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%
Management of Companies & Enterprises	0.153	0.128	−0.100	0.392	−0.027	0.120	−0.246	0.224	0.028	0.068	−0.073	0.188
Administrative, Support, Waste Management & Remediation	0.205	0.066	0.073	0.329	0.142	0.071	0.003	0.285	0.044	0.041	−0.024	0.138
Educational Services	0.187	0.093	−0.001	0.359	0.095	0.101	−0.096	0.295	0.109	0.075	−0.008	0.276
Health Care & Social Assistance	0.170	0.063	0.045	0.291	0.016	0.063	−0.102	0.142	0.022	0.033	−0.034	0.095
Arts, Entertainment & Recreation	0.195	0.081	0.031	0.346	0.036	0.081	−0.116	0.195	0.061	0.052	−0.025	0.176
Accommodation & Food Services	−0.056	0.058	−0.164	0.061	−0.118	0.053	−0.212	−0.004	−0.026	0.023	−0.064	0.024
Other Services	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

Notes: The first column displays the variable symbol. For each quarter, columns 2, 3, 4, and 5 report the estimates, posterior standard deviations, 2.5% and 97.5% percentile.

Table A6. Marginal effects for firm with probability of opening in the 75% percentile and all neighbors open.

	2005Q4				2006Q2				2007Q2			
	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%
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
Agriculture, Forestry, Fishing & Hunting	0.119	0.020	0.078	0.151	0.091	0.071	−0.100	0.162	0.201	0.057	0.040	0.266
Mining	0.112	0.018	0.073	0.143	0.113	0.028	0.043	0.155	0.113	0.069	−0.048	0.210
Utilities	−0.422	0.182	−0.756	−0.077	−0.162	0.158	−0.512	0.077	0.018	0.124	−0.271	0.197
Construction	0.091	0.017	0.055	0.122	0.095	0.020	0.050	0.133	0.161	0.028	0.099	0.211
Manufacturing	0.068	0.024	0.011	0.108	0.031	0.038	−0.054	0.092	0.082	0.046	−0.019	0.162
Wholesale Trade	0.115	0.013	0.090	0.142	0.092	0.021	0.047	0.129	0.103	0.039	0.018	0.171
Retail Trade	−0.045	0.039	−0.127	0.023	−0.059	0.044	−0.154	0.020	−0.013	0.050	−0.117	0.076
Transportation & Warehousing	0.102	0.015	0.070	0.131	0.101	0.020	0.057	0.138	0.120	0.039	0.032	0.185
Information	0.074	0.024	0.020	0.114	0.018	0.045	−0.080	0.091	0.013	0.064	−0.129	0.121
Finance & Insurance	0.089	0.016	0.056	0.120	0.102	0.018	0.064	0.134	0.136	0.030	0.070	0.190
Real Estate, Rental & Leasing	0.078	0.019	0.037	0.112	0.032	0.034	−0.044	0.090	0.056	0.047	−0.042	0.139
Professional, Scientific & Technical Services	0.314	0.058	0.205	0.426	0.217	0.059	0.110	0.335	0.236	0.062	0.118	0.356

Table A6. (*Continued*)

	2005Q4				2006Q2				2007Q2			
	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%
Management of Companies & Enterprises	0.053	0.047	−0.063	0.116	−0.035	0.086	−0.244	0.092	0.013	0.099	−0.222	0.162
Administrative, Support, Waste Management & Remediation	0.076	0.019	0.033	0.110	0.063	0.027	0.002	0.110	0.053	0.047	−0.050	0.135
Educational Services	0.069	0.029	0.000	0.114	0.040	0.046	−0.068	0.110	0.105	0.054	−0.017	0.190
Health Care & Social Assistance	0.066	0.020	0.022	0.102	0.005	0.036	−0.075	0.066	0.026	0.047	−0.073	0.108
Arts, Entertainment & Recreation	0.072	0.025	0.015	0.113	0.014	0.045	−0.089	0.084	0.068	0.053	−0.052	0.153
Accommodation & Food Services	−0.037	0.039	−0.119	0.029	−0.093	0.050	−0.200	−0.003	−0.062	0.055	−0.176	0.037
Other Services	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

Notes: 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.