

University of Delaware
Disaster Research Center

PRELIMINARY PAPER
#292

PREDICTING LONG-TERM BUSINESS RECOVERY
FROM DISASTER: A COMPARISON OF THE LOMA
PRIETA EARTHQUAKE AND HURRICANE ANDREW

Gary R. Webb
Kathleen J. Tierney
James M. Dahlhamer

1999

Predicting Long-Term Business Recovery from Disaster: A Comparison of the Loma Prieta Earthquake and Hurricane Andrew¹

Gary R. Webb
Kathleen J. Tierney
Disaster Research Center and
Department of Sociology and Criminal Justice
University of Delaware
Newark, DE 19716

James M. Dahlhamer
Office of Institutional Research
University of South Carolina-Spartanburg
Spartanburg, SC 29303

¹ Paper submitted for presentation at the 2000 Annual meeting of the American Sociological Association, Washington, D.C., August 12-16. Direct all correspondence to Gary R. Webb, Disaster Research Center, University of Delaware, Newark, DE 19716, tel. (302) 831-6618.

Predicting Long-Term Business Recovery from Disaster: A Comparison of the Loma Prieta Earthquake and Hurricane Andrew

Introduction

Although in recent years social scientists have paid increasing attention to the impacts of disasters on the private sector, little is currently known about how disasters affect the long-term economic viability of businesses. Most studies of disaster recovery have taken either households or entire communities as the unit of analysis (Bolin 1982; Bolin and Bolton 1986; Rubin 1981; Rubin, Saperstein, and Barbee 1985), and those that have looked at the economic impacts of disasters tend to focus on large levels of aggregation, such as regional economies, rather than on individual firms (Albala-Bertrand 1993; Cohen 1993; 1995; Friesema et al. 1979; Rossi et al. 1978; West and Lenze 1994). When researchers have studied how disasters affect individual businesses and economic activity, they have generally focused on short-term impacts, rather than the longer-term consequences of disaster victimization (Alesch et al. 1993; Gordon et al. 1995). Thus, it is not currently known whether disasters have any discernible longer-term consequences for individual businesses.

In this paper we address that issue by developing a model explaining *long-term* business recovery from disaster--that is, business well-being measured several years after disaster impact. Using data from two large-scale mail surveys, we compare long-term recovery outcomes among businesses that experienced the 1989 Loma Prieta earthquake and Hurricane Andrew, which struck South Florida in 1992. Our research builds on several recent studies conducted by the Disaster Research Center that focus on a variety of issues related to business disaster vulnerability, including direct and indirect impacts of disasters on businesses (Tierney 1997a;

1997b; Tierney, Nigg, and Dahlhamer 1996), levels of disaster preparedness among businesses (Dahlhamer and D'Souza 1997), and short-term recovery of businesses following the 1994 Northridge earthquake (Dahlhamer 1998; Dahlhamer and Tierney 1998; see Webb, Tierney, and Dahlhamer (2000) for a review of major findings from these studies). The present research departs from the earlier studies, however, in two important ways: first, its focus is on longer-term business recovery from disaster; and second, it compares recovery outcomes across two major disaster events.

In the first section of the paper, we present the model we used to explain long-term business recovery. Next, we describe the data and methods we used to test the model. In the third section we discuss the results of the analysis, highlighting important factors associated with long-term business recovery from disaster. The paper concludes with a discussion of the implications of this study for future research on the economic impacts of disasters.

A Model of Long-Term Business Recovery

To determine whether disasters have lasting consequences for businesses and to identify factors that influence the ability of individual businesses to recover in the longer-term, we developed a model that consists of five major components: business and owner characteristics, previous disaster experience, direct and indirect disaster impacts, loss containment measures, and owner perceptions of the business environment (see Table 1). This explanatory framework, which builds on the model Dahlhamer and Tierney (Dahlhamer 1998; Dahlhamer and Tierney 1998) used to predict short-term recovery (measured 18 months after the event) of businesses from the 1994 Northridge earthquake, draws on studies of disaster recovery processes and outcomes for households and on broader studies of organizational survival in nondisaster

contexts. The model is used to estimate the effects of its major components on the ability of businesses to recover eight years after the Loma Prieta earthquake and six years after Hurricane Andrew.

***** Table 1 about here*****

Business and Owner Characteristics

Research on the economic impacts of disasters and organizational survival in nondisaster settings suggests that both firm-level and owner characteristics affect business vulnerability. Economic sector (or type of business), for example, affects the amount of competition and growth businesses experience, the amount of earnings they generate (Loscocco and Robinson 1991), and ultimately their probability of failure (Bruderl, Preisendorfer, and Ziegler 1992; Halliday, Powell, and Granfors 1987). In the disaster context, there is some evidence to suggest that businesses in the trade and service sectors are more vulnerable to disaster impacts (Kroll et al. 1991). Although economic sector was not a statistically significant predictor of short-term business recovery in Dahlhamer and Tierney's (1998) earlier study, we have included it in our model of longer-term recovery.

As in the previous study, we have also included in our model measures of business age and size. There is a substantial amount of research suggesting that young or new organizations have a much stronger propensity to fail than established firms (Stinchcombe 1965; Singh and Lumsden 1990; Carroll 1983). Similarly, small businesses are more vulnerable because their larger counterparts generally have more resources on which to draw in both normal (Aldrich and Auster 1986) and disaster situations (Alesch et al. 1993; Kroll et al. 1991). In their study of short-term business recovery, for example, Dahlhamer and Tierney (1998) found that larger firms

were significantly more likely than their smaller counterparts to have recovered eighteen months after the Northridge earthquake.

Our model also includes a series of measures aimed at assessing the vulnerability of certain businesses to disaster impacts and estimating their effects on the ability of those businesses to recover. For example, we have included a self-report measure of pre-disaster business financial condition because there is some evidence to suggest that marginal businesses or firms in financial trouble have greater difficulty recovering from disasters (Durkin 1984). There is also some research that suggests that owning, as opposed to leasing, a business property may improve a firm's ability to recover from a disaster (Durkin 1984).

Additionally, we have included a measure of legal status to determine whether businesses that are owned by individuals or partners are more or less likely to recover in the longer-term than corporations. The model also employs variables measuring whether the business is an individual firm or part of a franchise or chain with multiple locations; whether the market for the firm's goods and/or services is mainly local or mainly regional, national, or international; and whether the business is female-owned or male-owned. Because corporations and businesses that are part of a franchise or chain generally have more resources upon which to draw (Aldrich and Auster 1986; Tigges and Green 1994), we expect that these types of firms will have less difficulty recovering from disasters. Moreover, businesses that are part of a chain or franchise and those that tap into broader regional, national, or international markets may be less vulnerable to disaster impacts and better able to recover because their risks are more dispersed than the concentrated risks associated with individual firms that rely primarily on local markets. Because researchers have only recently begun exploring the relationship between gender and disasters, it

is not clear whether female-owned businesses should be expected to have more or less difficulty recovering in the long-term than their male-owned counterparts. However, the literature on small businesses does suggest that female owners often face greater challenges than their male counterparts (Auster 1988; Loscocco and Robinson 1991).

Previous Disaster Experience

Also included in the model is a measure of whether the business has had prior experiences with disasters. There is some evidence to suggest that previous disaster experience leads to higher levels of preparedness among businesses (Dahlhamer and D'Souza 1997; Drabek 1994), and that may improve a firm's ability to recover in both the short- and long-term. For example, as a consequence of prior experience, owners may make plans to temporarily relocate the business, or they may be more familiar with various forms of recovery assistance and how to obtain them.

Direct and Indirect Disaster Impacts

The third component of the model contains measures of both direct and indirect disaster impacts. Previous research suggests that the ability of both businesses and households to recover from disasters is influenced by the amount of physical property damage sustained (Bolin 1994; Kroll et al. 1991), so our model includes a measure of owners' assessments of the disruptiveness of physical damage to the business property. In addition to these direct disaster impacts, however, there are other indirect impacts, such as loss of utilities, that may affect the ability of a business to operate and ultimately recover (Tierney 1994; 1997b; Tierney, Nigg, and Dahlhamer 1996). Thus, we have included in the model measures of how many lifelines the business lost as

a result of the disaster, how many days the business was forced to close, and how many operational problems the business encountered as a result of the earthquake.

Business closure immediately following a disaster can have longer-term consequences because customers may not return once the business reopens (Alesch et al. 1993; Nigg and Tierney 1990), and various operational problems, such as the inability of employees and customers to access the business, may limit a firm's ability to recover from a disaster (Durkin 1984; Kroll et al. 1991). To measure business operational problems, we asked owners to indicate whether they experienced the following problems after the disaster: difficulties with employees getting to work, employees missing time to attend to personal matters, damage to owners' own residences or other properties, decline in customer need for goods or services, customers unable to get to the business, inability to get supplies or materials needed to run the business, inability to deliver products or services, or inability to pay employees. In their study of short-term business recovery, Dahlhamer and Tierney (1998) found that businesses that experienced these kinds of problems were less likely than those who experienced fewer problems to have recovered eighteen months after the earthquake.

Loss Containment Measures

The model also contains two measures aimed at assessing the effects of loss containment measures (defined as activities undertaken by owners to reduce the costs associated with direct and indirect disaster impacts) on the ability of firms to recover from disasters. In this study, we have included two loss containment measures: use of post-disaster aid and disaster preparedness. Previous research on household recovery has documented the importance of post-disaster aid (Bolin 1989; 1994), so we assume that this will also be the case for businesses. Similarly, we

also assume that pre-disaster preparedness activities should improve a firm's ability to recover in the long-term.

Business Environment

The final component of the model of long-term business recovery from disaster is a measure of owners' perceptions of the broader economic climate. Because the viability of businesses in particular areas or economic sectors is largely contingent on broader environmental factors, it is important to consider how owners perceive the external business climate and how it influences their own businesses. We hypothesize that, other things being equal, more positive assessments of the overall economic climate will be associated with more positive recovery outcomes.

Data and Methods

To test the model, we employed ordinary least squares (OLS) regression techniques with questionnaire data collected from businesses in Santa Cruz County, California, which was hard-hit by the 1989 Loma Prieta earthquake, and Southern Dade County, Florida, which sustained heavy damage from Hurricane Andrew in 1992. In both study areas, we used systematic, large-scale mail surveys to assess long-term disaster consequences and to identify predictors of long-term disaster recovery. In Santa Cruz County, recovery outcomes were measured eight years after the earthquake, and in South Dade County they were measured six years after the hurricane.

To be considered for inclusion in the study, a business had to have been in existence at the time of the disaster event and still in existence at the time of survey administration (Santa Cruz County (Summer 1997) and South Dade County (Summer 1998)). Data from Dun & Bradstreet Information Services were used to establish the sampling frame for both study areas.

According to Dun & Bradstreet, there were 3,075 businesses in Santa Cruz County and 4,286 firms in South Dade County that met this criteria. To ensure an adequate number of cases for the multivariate analyses that were planned, a decision was made to include the entire population of businesses in each community rather than drawing samples.

The data for both surveys were collected through a modified version of Dillman's (1978) "total design method."¹ In June 1997, surveys were mailed to the owners of the 3,075 businesses that met our study criteria in Santa Cruz County, and in June 1998 surveys were mailed to the 4,286 firms in South Dade County.

In the course of administering the surveys, 299 Santa Cruz County and 288 South Dade County firms were removed from their respective populations for several reasons, including: 1) that the business was not actually in existence at the time of the event; 2) that the business was not operating in Santa Cruz County/South Dade County at the time of the disaster; 3) that the business closed prior to data collection; 4) that the organization that received the survey was not a private, for-profit firm; and 5) that the firm could not be located after exhaustive searches. In addition, 430 Santa Cruz County and 243 South Dade County businesses were recorded as refusals. Of the 430 Santa Cruz County refusals, 344 were due to a respondent indicating by phone or mail that they did not wish to participate in the research and 86 were the result of

¹ This approach, which is widely used in mail survey research, consists of a series of mailings and phone calls. However, given the Disaster Research Center's previous experience with mail surveys, the initial mailing of questionnaires was followed by telephone calls to owners and managers after a reasonable amount of time had passed for questionnaire completion. Postcard reminder mailings were eliminated in both surveys, as was a second full mailing to Santa Cruz County firms. In all, several thousand phone calls were made to each study locale and approximately 1,400 and 1,200 surveys were remailed to Santa Cruz County and South Dade County businesses respectively.

personnel turnover, making survey completion impossible. Similarly, 183 of the 243 South Dade refusals were due to respondent non-participation, while the remaining 60 refusals were due to personnel turnover.

Because the initial mailing to South Dade County businesses generated only a 20 percent response rate (N=872)--14 percent lower than what was ultimately achieved in Santa Cruz County--a second mailing was sent to those businesses in South Dade County who had not returned a completed survey, had a valid address, had not refused to participate in the study, and had not been removed from the study population for reasons discussed above. An additional 214 surveys were obtained from this mailing. In all, 1,078 completed surveys from South Dade County firms were received and coded for analysis, reflecting a 27.0 percent response rate. In Santa Cruz County, 933 completed surveys were returned and coded for analysis for a response rate of 33.6 percent.²

Table 2 provides descriptive statistics for the variables included in the model for each sample. As shown in the first component of the model, comprising business and owner characteristics, economic sector is operationalized as a series of three dummy variables that compare recovery outcomes of wholesale/retail, manufacturing, and services firms to businesses in the finance, insurance, and real estate (f.i.r.e.) and "other" sectors. Business size and age are both measured on ordinal scales, as is the financial condition of the business at the time the disaster occurred. The remaining five variables in the first component of the model are measured

² The deletion of the 299 non-population cases in Santa Cruz County reduced the population figure from 3,075 to 2,776. Similarly, dropping the 288 cases in South Dade County reduced the population figure 4,286 to 3,998. These revised population figures were then used to compute the reported response rates.

dichotomously: whether the business property is owned or leased, whether the business is under sole/partner ownership or a corporation, whether the business is a single location or part of a chain or franchise, whether the market for goods and services provided by the business is mainly local or mainly regional, national, or international, and whether the business is female-owned.

*****Table 2 about here*****

The second component of the model, previous disaster experience, is also measured dichotomously, while each of the four variables in the third component (direct and indirect disaster impacts)--disruptiveness of physical damage, duration of closure, number of lifelines lost, and disruption of operations--is an ordinal scale. The fourth model component, loss containment measures, is measured by two variables--an ordinal measure of the number of post-disaster sources of aid used and a continuous measure of the number of preparedness actions taken by the business (out of 17 items in Santa Cruz and 19 items in South Dade). The fifth model component, business environment, is measured ordinally.

The dependent variable in the regression analysis, long-term business recovery, is measured as a semi-continuous variable that is an index of four ordinal-level variables measured on a three-point scale. Specifically, survey respondents were asked to indicate if the following three things had decreased, remained the same, or increased since the disaster: the number of employees at the business, the number of customers or clients served, and business profits. Additionally, respondents were asked to indicate whether the business was currently worse off, about the same, or better off than it was just prior to the disaster event. These four items were combined to create an overall index of long-term business recovery, measured eight years after the Loma Prieta earthquake and six years after Hurricane Andrew.

Results

Recovery Outcomes in the Two Disaster Communities. As shown in Table 3, the majority of businesses in both South Dade County and Santa Cruz County reported doing as well or better at the time the two surveys were conducted as they had been prior to disaster impact. That is, whether measured in terms of number of employees, clients, business profits, or overall financial condition, most businesses had at the very least not experienced long-term declines. However, it is important to note that advances over pre-disaster status outweighed declines only in Santa Cruz. In contrast, in Dade County, on all four indicators, the proportion of businesses that reported being worse off exceeded those that were better off. This may be because disaster impacts were proportionately much more severe in Dade County than in Santa Cruz. Although not reported here because of lack of space, Dade County businesses suffered greater losses and disruption than those in Santa Cruz County, measured in terms of dollar losses due to damage, the proportion of businesses that were forced to suspend operations due to the disaster, duration of business interruption, lifeline loss, and other indicators.

*****Table 3 about here*****

Model Results. Table 4 presents the regression results for both study communities. Both equations are statistically significant, and both explain a moderate amount of variance in long-term business recovery outcomes: 26 percent of the variance in South Dade, and 21 percent among Santa Cruz County firms. The model for South Dade County businesses produced seven statistically significant predictors of long-term recovery, while the model for Santa Cruz County produced four significant predictors.

*****Table 4 about here*****

In both communities, the strongest predictor of long-term recovery was business climate. In the South Dade model the standardized coefficient for this variable is .95, and for Santa Cruz it is .85. This strong relationship can be interpreted in at least two ways. On the one hand, it may be the case that more successful business owners are also more likely to see the overall economic picture as positive. In other words, they may make attributions about the broader economy based on their own experiences. On the other hand, the economic expansion of the past decade has not affected all economic sectors equally, and it may well be that owners were responding to these sectoral effects and connecting the viability of their own businesses to broader economic trends.

In South Dade, the second strongest predictor of long-term business recovery was the economic sector variable. Comparing wholesale/retail businesses to f.i.r.e. and “other” firms, ($B = -.68$), wholesale and retail firms were less likely to have recovered in the long-term. Because the wholesale/retail sector is highly competitive in nondisaster times, firms in that sector are routinely challenged to survive; as a result, the impacts of a disaster may place those firms at a further disadvantage during the recovery process. However, the absence of any significant economic sectoral effects in the Santa Cruz model suggest that it may be premature to draw firm conclusions about the relationship between economic sector and long-term business recovery.

The second strongest predictor of long-term recovery in Santa Cruz was the pre-disaster financial condition variable ($B = -.55$), which was also significantly related to long-term recovery in South Dade ($B = -.32$). In both cases, the relationship suggests that businesses that reported being in better financial condition just prior to the hurricane or earthquake were less likely to

have recovered in the long-term than those in worse financial condition just before the disaster. The direction of this relationship is unexpected and counterintuitive. It was expected that better off firms would have more resources to draw on, and, as a result, would have less difficulty recovering from a disaster than those who were in marginal or poor financial condition. It may be that better off firms simply have more to lose in a disaster, and it may take them longer to recoup those losses and reach what they consider to be a recovered state.

It is equally intriguing that the relationship between business age and long-term recovery, which was statistically significant in the South Dade model ($B = -.29$), is also in an unanticipated direction. It was expected that older businesses would be more likely to recover from disasters because they are more established and have more resources upon which to draw in responding to a major disaster. Instead, the regression results for South Dade suggest that older businesses in that area were less likely to have recovered six years after the hurricane than their younger counterparts. As with the findings on business financial condition, it may be that older businesses in that area had more to lose; and, as a result, it may take them longer to fully recover from the hurricane, or at least to reach their pre-disaster status. Because business age was not a significant predictor of long-term recovery in Santa Cruz, it seems that the relationship between age and recovery is not a simple and straightforward one. Indeed, the broader literature on organizations is also mixed in this regard. A large number of studies have found evidence of a “liability of newness” (Stinchcombe 1965; Aldrich and Auster 1986), but a few have found that older firms may also be at higher risk of failure due to organizational inertia and a reduced to alter their practices in a changing environment, a phenomenon that has been termed the “liability of obsolescence” (Barron, West, and Hannan 1994).

Another business characteristic that was significantly related to long-term recovery in the South Dade sample is the variable measuring primary market ($B=.58$). This relationship indicates that businesses whose primary markets are mainly regional, national, or international in scope are more likely to recover in the long-term than businesses who rely on mainly local markets in providing goods and services. By tapping into markets beyond the local economy, business owners are able to disperse their risks to a certain degree because they are not solely dependent on customers and other businesses in the disaster-stricken area. Again, however, because the relationship between primary market and long-term recovery did not achieve statistical significance in the Santa Cruz study, it would be premature to draw firm conclusions at this point.

Various direct and indirect disaster impacts were significantly related to long-term business recovery in both models. In both South Dade and Santa Cruz, businesses that were forced to close for longer periods of time following the hurricane or earthquake were less likely to recover in the long-term. Similarly, businesses in South Dade that experienced more operational problems after the hurricane were significantly less likely to recover in the long-term. And, in Santa Cruz, businesses that experienced disruptive physical damage were also less likely to recover in the long-term. In fact, the only disaster impact measure that did not achieve statistical significance in either equation was the variable measuring the number of lifelines lost as a result of the disaster. These findings suggest that to fully understand longer-term consequences of disaster victimization, it is important to consider immediate impacts that may have consequences for long-term recovery processes and outcomes.

It is interesting to note that two of the model components--previous disaster experience and loss containment measures--produced no statistically significant effects on long-term business recovery in either study community. We expected that business owners who had experienced a prior disaster would have a better understanding of the recovery process and fare better than their counterparts who lacked such experience, but our results suggest that this is not the case. Somewhat surprising, but consistent with our earlier research on short-term recovery, businesses that were better prepared were no more likely to have recovered in the long-term than their less-prepared counterparts. Contrary to what might be expected given findings from research on household recovery, businesses that utilized more sources of external disaster aid were no more likely to have recovered than those who used few or no sources of aid.

Regarding why disaster preparedness is not significantly related to long-term business recovery, we offer three possible explanations (see Webb, Tierney, and Dahlhamer 2000). First, as shown in Table 2, businesses are doing relatively little to prepare for disasters. In Santa Cruz, for example, prior to the earthquake business owners on average had engaged in only 3.5 of the 17 preparedness activities they were asked about, while owners in South Dade had adopted 6.1 of 19 preparedness measures. Although South Dade businesses have been slightly more prepared than their counterparts in Santa Cruz, on the whole they had still carried out fewer than one-third of the activities asked about in the survey. Second, the types of preparedness actions taken by business owners were geared more toward life-safety than continuity of business operations. For example, business owners were much more likely to obtain first aid supplies and store batteries than to develop business recovery plans and make arrangements to temporarily move the business if necessary. While the former activities are certainly important, the latter are probably

more effective measures for improving the ability of a business to recover in both the short- and long-term. Finally, the types of preparedness actions business owners carried out to be site-specific, which means they were generally not preparing themselves for off-site disruptions, such as lifeline outages and various operational problems like the ones we included in our model, that may significantly hamper a firm's ability to recover from a major disaster.

The lack of a statistically significant relationship between the use of post-disaster assistance and recovery outcomes is also perplexing. Just as the use of post-disaster assistance has been shown to improve recovery outcomes for households (Bolin 1989; 1994), we would expect to observe the same relationship for businesses. However, our results suggest that there is no significant relationship between the use of post-disaster aid and long-term business recovery outcomes. There are at least two possible reasons for this (see Webb, Dahlhamer, and Tierney 2000). First, the type of aid available to businesses, as opposed to households, may largely explain why the use of outside aid does little to help businesses recover from disaster. While in many cases households can rely on outright grants from various sources, assistance to businesses more often comes in the form of loans that must be repaid. As a result, many business owners use their own personal savings to recover because external aid brings additional indebtedness and draws down savings.

The effectiveness of various forms of external assistance may also be limited due to the fact that the fate of individual businesses may be more dependent on broader economic trends than on disaster-related factors. For example, following the Northridge earthquake, businesses in industrial sectors that had been experiencing growth just before the earthquake were more likely to recover than businesses in declining industries (Dahlhamer 1998). As we discussed above, in

both the Loma Prieta and Hurricane Andrew studies, owners' assessments of the health of the overall business climate in their communities were strongly associated with their assessments of the extent to which their own businesses had recovered. This clearly suggests that economic trends exert a strong influence on business recovery, independent of how individual firms are impacted.

Discussion

This study has several obvious limitations. Critics are certain to point out that the businesses that were included in the two surveys had already achieved a measure of success, since they had managed to survive for a number of years after the two disasters occurred. The study did focus exclusively on surviving businesses and did not include firms that were no longer operating, due either to their disaster experiences or to normal attrition. As a practical matter, it is virtually impossible to locate businesses that have gone out of existence many years after a disaster event, but the study would clearly have benefitted from a more systematic effort to identify and follow up failed businesses over time. These analytic results are thus presented with one very important caveat: the findings are based on data from on disaster-stricken businesses that survived long enough to be included in our sample, rather than on all businesses that had been located in the two study communities at the time they experienced disasters. They may therefore paint an overly optimistic picture of the extent to which businesses are able to recover from disaster.

Another limitation of the current study is that the models used do not directly incorporate data on broader economic trends that may have affected businesses in the two communities. Instead, we used owners' own perceptions of the overall business climate in their communities as

a proxy measure of the well-being of the local economy. This use of self-report data is, of course, problematic, since owners' ideas about local economic trends may be colored by their own recovery experiences. Our earlier research on short-term business recovery outcomes following the Northridge earthquake (see, for example, Dahlhamer, 1998) suggested that objectively-measured trends within different economic sectors affect how businesses fare in the aftermath of disasters, and we hope to include such data in future analyses.

Our recovery measures focus on the extent to which businesses returned to their pre-disaster financial status and on changes that occurred at the business between the impact period and the time the data were collected. This approach did not attempt to take into account how well a business might have done had a major disaster never occurred. Additionally, although our survey did ask businesses owners to indicate whether the changes that took place at their businesses were disaster-related or not, we also recognize that many factors besides disaster experience affect business economic well-being--including, obviously, many factors not captured in our models.

Despite these limitations the study does represent the most systematic effort to date to track over the long term a large number of businesses that were affected by major community-wide disasters. Among the general conclusions that can be drawn from this study are that while most surviving businesses had returned at least to pre-disaster levels of economic well-being years after they experienced a major disaster, many still had not. Those effects were more pronounced in South Dade County. Perhaps that was because disaster impacts were so much more severe in South Dade than in Santa Cruz County, but the differences observed could also have been influenced by other factors, including methodological ones, since the study follow-up

period was longer for Santa Cruz than for South Dade. The fact that how businesses fared following these two disasters was closely tied to the community-level economic well-being suggests that business recovery processes need to be analyzed in the context of overall economic trends.

Business size clearly makes a difference for recovery outcomes, with large firms showing more long-term resiliency than smaller ones. Business type also makes a difference; businesses in crowded, highly competitive, and relatively undercapitalized economic niches appeared to have the most difficulty recovering. We also saw some indication that businesses that depend on primarily on local rather than supra-local markets may not fare as well as their more diversified counterparts in the aftermath of disasters, presumably because of the disruption those markets may experience following disasters.

Many owner-related and business characteristics that we thought would make a difference for long-term recovery, such as the gender of the business owner and whether the business was an individual firm or part of a larger chain, turned out to have little effect on business well-being. And, contrary to what many would expect, but consistent with what we have found in other studies, factors such as pre-disaster experience, levels of pre-disaster preparedness, and the use of various forms of post-disaster aid had virtually no discernable impact on business well-being years after disaster impact. However, the data do suggest that difficulties businesses experience at the time a disaster strikes, such as disaster-induced business interruption and problems with operating the businesses in the changed post-disaster environment, may well have lasting effects on business viability in the long term.

Acknowledgments

This research was supported by a grant from the National Science Foundation (Grant No. CMS 9632779, Kathleen J. Tierney, Principal Investigator and Joanne M. Nigg, Co-Principal Investigators). The findings, conclusions, and opinions expressed are those of the authors and do not necessarily reflect the views of the National Science Foundation. The authors would like to thank Marcia Cavanaugh and Nicole Mott for their assistance.

References

- Albala-Bertrand, J.M. 1993. *Political Economy of Large Natural Disasters*. Oxford, England: Clarendon Press.
- Aldrich, Howard and Ellen R. Auster. 1986. "Even Dwarfs Started Small: Liabilities of Age and Size and Their Strategic Implications." Pp. 165-198 in *Research in Organizational Behavior*, volume 8, edited by Barry M. Staw and L.L. Cummings. Greenwich, CT: JAI Press.
- Alesch, Daniel J., Craig Taylor, A. Sam Ghanty, and Robert A. Nagy. 1993. "Earthquake Risk Reduction and Small Business." Pp. 133-160 in *1993 National Earthquake Conference Monograph 5: Socioeconomic Impacts*, edited by Kathleen J. Tierney and Joanne M. Nigg, Memphis, TN: Central United States Earthquake Consortium.
- Auster, Ellen R. 1988. "Owner and Organizational Characteristics of Black- and White-Owned Businesses." *American Journal of Economics and Sociology* 47(3): 331-344.
- Barron, David N., Elizabeth West, and Michael T. Hannan. 1994. "A Time to Grow and a Time to Die: Growth and Mortality of Credit Unions in New York City, 1914-1990." *American Journal of Sociology* 100(2): 381-421.
- Bolin, Robert C. 1982. *Long-Term Family Recovery from Disaster*. Boulder, CO: Institute of Behavioral Science, University of Colorado.
- Bolin, Robert C. 1989. "Family in Disaster: Theoretical and Empirical Aspects." Pp. 194-208 in *Preparations for, Responses to, and Recovery from Major Community Disasters*, edited by E.L. Quarantelli and Carlo Pelanda. Newark, DE: Disaster Research Center, University of Delaware.
- Bolin, Robert C. 1994. *Household and Community Recovery after Earthquakes*. Boulder, CO: Institute of Behavioral Science, University of Colorado.
- Bolin, Robert C. and Patricia Bolton. 1986. *Race, Religion, and Ethnicity in Disaster Recovery*. Boulder, CO: Institute of Behavioral Science, University of Colorado.
- Bruderl, Josef, Peter Preisendorfer, and Rolf Ziegler. 1992. "Survival Chances of Newly Founded Business Organizations." *American Sociological Review* 57: 227-242.
- Carroll, Glenn R. 1983. "A Stochastic Model of Organizational Mortality: Review and Reanalysis." *Social Science Research* 12: 303-329.

- Cohen, Maurie J. 1993. "Economic Impact of an Environmental Accident: A Time-Series Analysis of the *Exxon Valdez* Oil Spill in Southcentral Alaska." *Sociological Spectrum* 13: 35-63.
- _____. 1995. "Technological Disasters and Natural Resource Damage Assessment: An Evaluation of the *Exxon Valdez* Oil Spill." *Land Economics* 71(1): 65-82.
- Dahlhamer, James M. 1998. "Rebounding from Environmental Jolts: Organizational and Ecological Factors Affecting Business Disaster Recovery." Ph.D. Dissertation No. 31, Disaster Research Center, University of Delaware, Newark, DE.
- Dahlhamer, James M. and Melvin J. D'Souza. 1997. "Determinants of Business-Disaster Preparedness in Two U.S. Metropolitan Areas." *International Journal of Mass Emergencies and Disasters* 15(2): 265-281.
- Dahlhamer, James M. and Kathleen J. Tierney. 1998. "Rebounding from Disruptive Events: Business Recovery Following the Northridge Earthquake." *Sociological Spectrum* 18: 121-141.
- Dillman, Don A. 1978. *Mail and Telephone Surveys: The Total Design Method*. New York: Wiley.
- Drabek, Thomas E. 1994. *Disaster Evacuation and the Tourist Industry*. Boulder, CO: Institute of Behavioral Science, University of Colorado.
- Durkin, Michael E. 1984. "The Economic Recovery of Small Businesses after Earthquakes: The Coalinga Experience." Paper presented at the International Conference on Natural Hazards Mitigation Research and Practice, New Delhi, India, October 6-8.
- Friesema, H. Paul, James Caparano, Gerald Goldstein, Robert Lineberry, and Richard McCleary. 1979. *Aftermath: Communities after Natural Disasters*. Beverly Hills, CA: Sage Publications.
- Gordon, Peter, and Harry W. Richardson, with Bill Davis, Chris Steins, and Ashwani Vasishth. 1995. *The Business interruption Effects of the Northridge Earthquake*. Final Report to the National Science Foundation. Los Angeles: Lusk Center Research Institute, School of Urban and Regional Planning, University of Southern California.
- Halliday, Terrence, Michael Powell, and Mark Granfors. 1987. "Minimalist Organizations: Vital Events in State Bar Associations, 1870-1930." *American Sociological Review* 52: 456-471.

- Kroll, Cynthia A., John D. Landis, Qing Shen, and Sean Stryker. 1991. "Economic Impacts of the Loma Prieta Earthquake: A Focus on Small Business." Working Paper No. 91-187. Berkeley, CA: University of California Transportation Center and the Center for Real Estate and Economics, University of California.
- Loscocco, Karyn A. and Joyce Robinson. 1991. "Barriers to Small Business Success Among Women." *Gender and Society* 5(4): 511-532.
- Nigg, Joanne M. and Kathleen J. Tierney. 1990. "Explaining Differential Outcomes in the Small Business Disaster Loan Application Process." Paper presented at the 12th World Congress of Sociology, Madrid, Spain, July 9-13.
- Rossi, Peter H., James D. Wright, Sonia R. Wright, and Eleanor Weber-Burdin. 1978. "Are There Long-Term Effects of American Natural Disasters?" *Mass Emergencies* 3: 117-132.
- Rubin, Claire B. 1981. *Long-Term Recovery from Natural Disasters: A Comparative Analysis of Six Local Experiences*. Columbus, OH: Academy for Contemporary Problems.
- Rubin, Claire B., Martin D. Saperstein, and Daniel G. Barbee. 1985. *Community Recovery from a Major Natural Disaster*. Boulder, CO: Institute of Behavioral Science, University of Colorado.
- Singh, Jitendra V. and Charles J. Lumsden. 1990. "Theory and Research in Organizational Ecology." *Annual Review of Sociology* 16: 161-195.
- Stinchcombe, Arthur L. 1965. "Social Structure and Organizations." Pp. 142-193 in *Handbook of Organizations*, edited by James G. March. Chicago: Rand McNally.
- Tierney, Kathleen J. 1994. "Business Vulnerability and Disruption: Data from the 1993 Midwest Floods." Paper presented at the 41st North American Meetings of the Regional Science Association International, Niagara Falls, Ontario, November 16-20.
- Tierney, Kathleen J. 1997a. "Business Impacts of the Northridge Earthquake." *Journal of Contingencies and Crisis Management* 5(2): 87-97.
- Tierney, Kathleen J. 1997b. "Impacts of Recent Disasters on Businesses: The 1993 Midwest Floods and the 1994 Northridge Earthquake." Pp. 189-222 in *Economic Consequences of Earthquakes: Preparing for the Unexpected*, edited by Barclay G. Jones. Buffalo, NY: National Center for Earthquake Engineering Research.

- Tierney, Kathleen J., Joanne M. Nigg, and James M. Dahlhamer. 1996. "The Impact of the 1993 Midwest Floods: Business Vulnerability and Disruption in Des Moines." Pp. 214-233 in *Disaster Management in the U.S. and Canada*, 2nd edition, edited by Richard T. Sylves and William L. Waugh, Jr. Springfield, IL: Charles C. Thomas.
- Tigges, Leann M. and Gary P. Green. 1994. "Small Business Success Among Men- and Women-Owned Firms in Rural Areas." *Rural Sociology* 59(2): 289-310.
- Webb, Gary R., Kathleen J. Tierney, and James M. Dahlhamer. 2000. "Businesses and Disasters: Empirical Patterns and Unanswered Questions." *Natural Hazards Review* (in press).
- West, Carol T. and David G. Lenze. 1994. "Modeling the Regional Impact of Natural Disaster and Recovery: A General Framework and an Application to Hurricane Andrew." *International Regional Science Review* 17(2): 121-150.

Table 1: A Model of Long-Term Business Recovery from Disaster

Business and Owner

Characteristics

Economic Sector

Full-time employees

Business age

Financial condition

Own or lease

Legal status

Ownership and location

Primary market

Woman-owned

Previous Disaster Experience

Disaster experience

Direct and Indirect

Disaster Impacts

Disruptiveness of

physical damage

Duration of closure

Lifelines lost

Disruption of operations

Loss Containment Measures

Number of aid sources used

Preparedness

Business Environment

Business climate

Table 2: Descriptive Statistics of Model Variables

	Coding Scheme	South Dade	Santa Cruz
<u>Business and Owner Characteristics</u>			
Wholesale/retail	0=f.i.r.e. and "other" firms 1=wholesale/retail firm	20.5% (n=221) 28.6% (n=308)	16.5% (n=154) 31.0% (n=289)
Manufacturing	0=f.i.r.e. and "other" firms 1=manufacturing firm	19.9% (n=215)	17.7% (n=165)
Services	0=f.i.r.e. and "other" firms 1=services firm	31.0% (n=334)	34.8% (n=325)
Full-time employees	1=1-4 FTEs 2=5-9 FTEs 3=10-14 FTEs 4=15-29 FTEs 5=30 or more FTEs	48.7% 23.4 10.5 8.7 8.7 (N=1049)	50.7% 21.7 9.5 8.5 9.6 (N=909)
Business age	1=1-4 years 2=5-9 years 3=10-14 years 4=15-29 years 5=30 or more years	14.8% 23.1 22.6 28.3 11.2 (N=1058)	8.6% 21.5 22.6 28.5 18.8 (N=911)
Financial condition	1=in trouble 2=not doing well 3=good 4=excellent	4.0% 20.8 51.3 23.9 (N=1054)	3.3% 15.9 57.4 23.4 (N=899)
Own or lease	0=lease 1=own	62.1% 37.1 (N=1056)	63.9% 36.1 (N=915)
Legal status	0=sole owner/partnership 1=corporation	25.1% 74.9 (N=1072)	58.5% 41.5 (N=926)
Ownership and location	0=individual firm, single location 1=franchise/chain/multiple location	83.9% 16.1 (N=1065)	82.9% 17.1 (N=918)
Primary market	0=local 1=regional/national/international	65.9% 34.1 (N=1075)	65.4% 34.6 (N=922)
Woman-owned	0=no 1=yes	82.9% 17.1 (N=1077)	83.1% 16.9 (N=919)

Table 2: Continued

	Coding Scheme	South Dade	Santa Cruz
<u>Previous Disaster Experience</u>			
Disaster experience	0=no 1=yes	86.9% <u>13.1</u> (N=1066)	64.8% <u>35.2</u> (N=917)
<u>Direct and Indirect Disaster Impacts</u>			
Disruptiveness of physical damage	0=no damage 1=not disruptive at all 2=not very disruptive 3=disruptive 4=very disruptive	9.0% 1.9 10.1 24.6 <u>54.4</u> (N=1075)	48.1% 6.5 17.1 14.5 <u>13.8</u> (N=925)
Duration of closure	0=did not close 1=one hour to 3 days 2=4-7 days 3=8-21 days 4=22 or more days	9.9% 11.6 18.3 25.3 <u>34.9</u> (N=1061)	24.5% 44.6 19.5 7.4 <u>4.0</u> (N=910)
Lifelines lost	0...4 mean std.dev. (N=1039)	2.65 <u>.95</u> (N=1039)	2.15 <u>1.00</u> (N=890)
Disruption of operations	0...8 mean std.dev. (N=1064)	3.24 <u>2.13</u> (N=1064)	1.53 <u>1.68</u> (N=893)
<u>Loss Containment Measures</u>			
Number of aid sources used	0...6 or more (South Dade) 0...3 or more (Santa Cruz)	mean 1.74 std.dev. <u>1.31</u> (N=1036)	.37 <u>.73</u> (N=850)
Preparedness	0...19 (South Dade) 0...17 (Santa Cruz)	mean 6.07 std.dev. <u>4.28</u> (N=1073)	3.50 <u>3.44</u> (N=896)
<u>Business Environment</u>			
Business climate	1=gotten much worse 2=gotten worse 3=remained about the same 4=improved 5=improved a great deal	17.8% 31.0 30.9 17.1 <u>3.2</u> (N=961)	6.5% 19.7 32.3 32.6 <u>8.9</u> (N=820)
<u>Dependent Variable</u>			
Long-term recovery	4...12 mean std.dev. (N=961)	7.92 <u>2.78</u> (N=961)	8.45 <u>2.62</u> (N=798)

Table 3: Descriptive Statistics for Individual Long-Term Recovery Items

Item	South Dade	Santa Cruz
Present state of business (compared to just before the disaster)		
Worse off	34.2%	21.5%
About the same	34.4	41.5
Better off	<u>31.4</u> (N=1055)	<u>37.0</u> (N=898)
Number of employees		
Decreased	33.6%	27.0%
Remained the same	35.0	42.0
Increased	<u>31.4</u> (N=1010)	<u>31.0</u> (N=846)
Number of customers or clients		
Decreased	38.4%	25.6%
Remained the same	24.0	32.1
Increased	<u>37.6</u> (N=1006)	<u>42.3</u> (N=848)
Business profits		
Decreased	37.6%	29.2%
Remained the same	30.5	35.4
Increased	<u>31.9</u> (N=1018)	<u>35.4</u> (N=855)

Table 4: OLS Regression Coefficients and Standard Errors for Model Predicting Long-term Recovery Among Santa Cruz and South Dade County Firms

Variable	South Dade			Santa Cruz		
	Unstd. Coeff.	S.E.	Std. Coeff.	Unstd. Coeff.	S.E.	Std. Coeff.
<u>Business and Owner Characteristics</u>						
Wholesale/retail	-.68*	.27	-.11	.05	.32	.01
Manufacturing	.00	.29	.00	-.27	.36	-.04
Services	.08	.27	.01	-.11	.31	-.02
Full-time employees	.05	.08	.03	-.04	.09	-.02
Business age	-.29***	.08	-.13	-.16	.09	-.07
Financial condition	-.32**	.12	-.09	-.55***	.15	-.15
Own or lease	-.33	.19	-.06	-.10	.22	-.02
Legal status	.16	.22	.03	.19	.24	.04
Ownership and location	.13	.27	.02	-.08	.33	-.01
Primary market	.58**	.19	.10	.26	.23	.05
Woman-owned	-.06	.25	-.01	.14	.28	.02
<u>Previous Disaster Experience</u>						
Disaster experience	-.11	.28	-.01	-.30	.22	-.06
<u>Direct and Indirect Disaster Impacts</u>						
Disruptiveness of physical damage	.09	.08	.04	-.15*	.08	-.09
Duration of closure	-.20**	.07	-.10	-.26*	.12	-.10
Lifelines lost	.06	.10	.02	.13	.11	.05
Disruption of operations	-.17***	.05	-.13	-.01	.06	-.00
<u>Loss Containment Measures</u>						
Number of aid sources used	-.10	.07	-.04	.03	.16	.01
Preparedness	.00	.02	.00	-.03	.03	-.04
<u>Business Environment</u>						
Business climate	.95***	.09	.36	.85***	.10	.35
N		743			546	
F-value		13.58***			7.13***	
R ²		.26			.21	
*p<.05 **p<.01 ***p<.001						