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

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

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

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## **Abstract**

This paper examines long-term recovery outcomes for businesses impacted by major natural disasters. Data were collected via two large-scale mail surveys—one administered to Santa Cruz County, California businesses eight years after the Loma Prieta earthquake and one administered to businesses in South Dade County, Florida, six years after Hurricane Andrew. Based on the results of OLS regression models, we argue that long-term recovery experiences of businesses are affected by various firm characteristics, including the economic sector in which a business operates, its age and financial condition, and the scope of its primary market; direct and indirect disaster impacts including physical damage, forced closure, and disruption of operations; and owner perceptions of the broader economic climate. Previous disaster experience, level of disaster preparedness, and use of external sources of aid were not found to significantly affect the long-term economic viability of businesses in the two study communities.

**Keywords:** natural disasters, private sector, economic impacts, disaster recovery

## Introduction

This paper focuses on the long-term consequences of major natural disasters for affected businesses. The literature on long-term disaster impacts contains contrary findings. Some scholars argue that disasters have few discernable effects beyond the disruption they cause during the immediate post-impact and short-term recovery periods (see Rossi, et al., 1983; Wright et al., Wright et al., 1979; Friesema et al., 1979). Consistent with this view, which sees disaster impacts as largely transitory, Drabek has observed that “[f]or most disasters studied...the overall picture is one of mixed, but relatively minor ripples in the long-term development cycle” (1986: 251). Other researchers (see, for example, Bates and Peacock, 1993) contend that, to the extent that disasters have long-term impacts, they do so primarily by accelerating trends that were already under way before they occurred. Still others (see Dacy and Kunreuther, 1969; Mussari, 1978) take the position that disasters do have long term impacts, but they are positive ones, because disasters create reconstruction booms and allow community improvements to be made rapidly, rather than gradually. Similarly, recent cross-societal research on the macroeconomic impacts of disasters also finds evidence that climate-related disasters (but interestingly, not geological ones) have long-term positive economic consequences along a number of dimensions related to physical capital, human capital, and productivity (Skidmore and Toya, 2002.)

Given the diverse impacts of disasters and the diversity of the social units affected, each of these positions is likely an oversimplification. Outcomes can be expected to vary according to which units of analysis and time frames are selected, what measures are used, and other factors.

The questions that need to be addressed are complex: What types of short- and longer-term impacts do disasters have for different social units—communities, local and regional economies, households, and businesses? Are there social units that experience these effects more strongly than others, and if so, why? What factors enable some social units to be resilient in the face of disasters while others have difficulty recovering? Do the same attributes that insulate communities, economies, households and businesses from other types of environmental stressors during non-disaster times function in the same way when disasters strike?

We take up these issues here, focusing specifically on how businesses fare several years after their communities have experienced major disasters. This is a new area of inquiry. Indeed, there has been very little research on the ways in which disasters affect businesses, either in the short term or in the long term. Most studies of disaster recovery have taken either households or entire communities, rather than business firms, as the unit of analysis (Bolin, 1982; Bolin and Bolton, 1986; Rubin, 1981; Rubin, Saperstein, and Barbee, 1985). Those studies that have looked at the economic impacts of disasters have tended to focus on large levels of aggregation, such as regional economies, rather than on businesses or business sectors (Albala-Bertrand, 1993; Cohen, 1993; 1995; Friesema et al., 1979; Rossi et al., 1978; West and Lenze, 1994; Rose, et al., 1997). Data from the small number of studies that have focused business vulnerability and business disaster impacts have been incorporated into loss-estimation models, but again the objective of that work has been to analyze the potential regional economic impacts of disasters, rather than impacts at the organizational level (see for example Chang et al., 2000).

Studies on disasters and the private sector have also been limited in other respects, such as their use of small or unrepresentative samples. Research has generally focused on short-term

impacts, rather than the longer-term consequences of disaster victimization (Alesch et al., 1993; Gordon et al., 1995). These shortcomings make it difficult to generalize about impacts disasters have on businesses—either in the short term or in the long term—and about which types of businesses are most affected and under what conditions.

Using data from two large-scale mail surveys using randomly-selected samples of businesses, 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 employ survey techniques with large representative samples of businesses and 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). This analysis departs from the earlier work, however, in two important ways: first, it takes a longer-term focus than other recovery-related studies; and second, it compares recovery outcomes across two major disaster events using common survey instruments.

In the next section, we discuss findings from earlier research and present a model of long-term business recovery that draws on previous studies on disaster recovery and on the broader literature on organizations. We then describe the survey data and analytic techniques we used to identify significant predictors of long-term business recovery and move on to discuss the results of the analysis, highlighting important factors associated with long-term business recovery in

both study communities. The paper concludes with a discussion of the implications of this study for future research on the economic impacts of disasters.

### **Background**

Our approach to explaining long-term business outcomes following disasters is based on research that has been undertaken on household disaster recovery, on factors that influence business viability during normal, non-disaster times, and on prior research on pre-disaster preparedness and short-term recovery outcomes for businesses. The literature on households, for example, suggests that disaster experiences and recovery trajectories are influenced in significant ways by household characteristics, such as household income and home ownership, as well as by race and ethnicity (Bolin, 1982; Bolin and Bolton, 1986; Peacock et al., 1997; Bolin and Stanford, 1998). Such factors are important in that they are related to household vulnerability—for example, vulnerability to physical damage—as well as to the types and amount of post-disaster assistance that are available to households. This line of research suggests that businesses may also be differentially vulnerable to disasters, depending on their own resource levels, owner characteristics, and ability to access post-disaster aid.

Research on organizational survival in nondisaster settings suggests that a number of firm-level factors may also affect business vulnerability to disasters. The economic sector in which a business is located, 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). Similarly, in the disaster context, there is some evidence to suggest that some types of businesses—specifically firms in the trade and service sectors—are more

vulnerable to disaster impacts, at least in the short term (Kroll et al., 1991). The damage and disruption disasters cause may, in other words, make survival even more difficult for businesses that are already at high risk for failure due to competitiveness and niche crowding in particular economic sectors.

Business age and size may also play a role in long-term recovery. There is a substantial amount of research in the organizational field suggesting that young or new organizations have a much stronger propensity to fail than established firms during non-disaster times (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). Firms that have difficulty remaining viable on a daily basis may find their problems compounded when a disaster strikes. 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. Other research on disaster recovery patterns among small businesses also suggests that small size is a major source of vulnerability to negative disaster outcomes (Alesch, et al., 2001).

Paralleling what is known about household resources, disaster impacts, and household recovery, there is some evidence to suggest that marginal businesses or firms that are already in financial trouble when a disaster strikes have greater difficulty recovering (Durkin, 1984). This seems to be a reasonable assumption, since businesses that are already overextended may go even further into debt during the course of recovery and may ultimately find themselves even worse off. 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).

Along with financial condition and ownership of the business property, other business characteristics may also contribute to business resilience following disasters. Factors that may provide a degree of insulation from post-disaster problems include being structured as a corporation or being part of a franchise or chain with multiple locations. 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. Because disasters typically disrupt local business and residential ecologies, a firm may fare better in the aftermath of a disaster if its economic activities are tied more to regional, national, or international markets than to local ones. Owner characteristics, in particular the gender of the business owner, may also be important. In recent years, the disaster literature has increasingly focused on the ways in which gender is a factor in vulnerability to disasters (Fothergill, 1998; Enarson and Morrow, 1998). Research undertaken following Hurricane Andrew documents the manner in which women were adversely affected by that disaster (Morrow and Enarson, 1996). The literature on small businesses also suggests that female owners often face greater challenges than their male counterparts in establishing and maintaining businesses and that woman-owned businesses have higher failure rates and lower profitability than those owned by men (Auster, 1988; Loscocco and Robinson, 1991). For these reasons, it could be that, other things being equal, woman-owned businesses experience poorer recovery outcomes than those owned by men.

A number of studies involving individuals and households indicate that disaster experience has a positive impact on preparedness for future disasters (Russell, Goltz, and

Bourque, 1995; Lindell and Perry, 2000). Previous disaster experience also appears to be associated with higher levels of preparedness among businesses (Dahlhamer and D'Souza, 1997; Drabek, 1994), which in turn 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. In light of these findings, it seems reasonable to assume that businesses that have prior experience with disasters may be better prepared and thus may have an easier time recovering when subsequent disasters occur.

Severity of disaster impacts should also play a role in long-term recovery trajectories. The ability of both businesses and households to recover from disasters appears to be influenced by the amount of physical property damage sustained (Bolin, 1994; Kroll et al., 1991). In addition to direct disaster impacts to the business property, however, there are other indirect impacts, such as loss of utilities, that may affect the ability of a business to operate and ultimately to recover (Tierney, 1994; 1997b; Tierney, Nigg, and Dahlhamer, 1996).

Business closure immediately following a disaster can have longer-term consequences because customers may not return once the business reopens (Alesch et al., 1993; 2001; Nigg and Tierney, 1990). Additionally, 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). In their study of short-term business recovery following the 1994 Northridge earthquake, Dahlhamer and Tierney (1998) found that businesses that experienced disaster-induced problems with their operations, such as difficulties with employees getting to work, decline in customer demand for goods and services, and difficulties

with getting supplies and materials needed to run the business, were less likely than those who experienced fewer problems to have recovered eighteen months after the earthquake.

Loss-containment measures include both actions that can be taken prior to a disaster event to reduce losses and prepare social units to respond and actions that can be taken following disasters to compensate for losses suffered. As indicated above, there is considerable research suggesting that pre-disaster planning fosters adaptive behavior when disasters do occur (Kartez and Lindell, 1990; for a review of relevant literature, see Tierney, Lindell, and Perry, 2001). It thus seems reasonable to assume that pre-disaster preparedness activities should improve a firm's ability to recover in the long-term. Similarly, use of post-disaster aid has been shown to have a positive effect on household recovery following disasters (Bolin, 1989; 1994). It may be the case that post-disaster assistance works the same way for businesses—that is, that the more aid and the more sources of aid businesses are able to utilize, the better their chances of full recovery. In this research, we focus on two types of measures: pre-disaster planning and the utilization of post-disaster recovery assistance.

Besides being influenced by firm and owner characteristics, disaster impacts, and actions taken before and after disasters to contain losses, business recovery outcomes are also likely to be influenced by local and regional economic trends. Following the Northridge earthquake, for example, businesses in sectors that had been experiencing growth prior to the earthquake showed better short-term recovery outcomes than other firms (Dahlhamer, 1998). The Port of Kobe has still not recovered from the damage and disruption it sustained in the 1995 earthquake. Shippers had already been showing a tendency to prefer other ports in the region, especially in Korea and Taiwan, prior to the earthquake. The earthquake intensified this trend, particularly in the cargo

transshipment sector, and despite efforts on the part of Port management and the Japanese government to lure shippers back to Kobe, many did not return after the damage was repaired (Chang, 1999). On the positive side, as suggested earlier, the occurrence of a disaster may also help to economic trends for some businesses and business sectors, as disaster assistance and insurance payouts provide at least a temporary stimulus for firms involved in reconstruction.

Based on these literatures, we identify five types of factors that may influence longer-term post-disaster outcomes for businesses: (1) firm and owner characteristics, including such factors as business sector, age, and financial condition and whether the business is woman-owned; (2) experience with disasters in addition to those focused on in this study; (3) direct and indirect disaster impacts, including measures of both physical damage and operational disruption; (4) pre- and post-disaster loss containment measures employed by businesses, and (5) the extent to which owners assess the broader economic climate as positive or negative for the business, compared with the business environment prior to the occurrence of the disaster.

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

### **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 (summer of 1997 for Santa Cruz County and summer of 1998 for South Dade County). 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."<sup>1</sup> 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 one of several possible reasons, including: the business was not actually in existence at the time of the event; the business was not operating in Santa Cruz County/South Dade County at the time of the disaster; the business closed prior to data collection; the organization that received the survey was not a private, for-profit firm; or 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 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, yielding a response rate of 33.6 percent.<sup>2</sup>

Table 2 provides descriptive statistics for the variables included in the model for each sample. As shown in the first component of the model, 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 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 measured on 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, our data do show that 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 of disaster severity.

\*\*\*\*\*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 is owner perception of the broader business climate. In the South Dade model the standardized coefficient for this variable is .36, and for Santa Cruz it is .35. The strength of this 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, because the economic expansion of the past decade has not affected all economic sectors equally, it may well be that owners, aware of these sectoral effects, connect the viability of their own businesses to broader economic trends.

In South Dade another significant predictor of long-term business recovery is the economic sector variable. Comparing wholesale/retail businesses to f.i.r.e. and “other” firms, ( $\beta=-.11$ ), wholesale and retail firms are 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 is the pre-disaster financial condition variable ( $\beta=-.15$ ), which is also significantly related to long-term recovery in South Dade ( $\beta=-.09$ ). In both cases, the relationship suggests that businesses that reported being in better financial condition just prior to the hurricane or earthquake are 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 is statistically significant in the South Dade model ( $\beta = -.13$ ), 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 found to be 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 reluctance 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 is significantly related to long-term recovery in the

South Dade sample is the variable measuring primary market ( $\beta=.10$ ). 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 are significantly related to long-term business recovery in both models. In both South Dade ( $\beta=-.10$ ) and Santa Cruz ( $\beta=-.10$ ), 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 ( $\beta=-.13$ ). And, in Santa Cruz, businesses that experienced disruptive physical damage were also less likely to recover in the long-term ( $\beta=-.09$ ). 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. Taken together, these findings clearly suggest that to fully understand longer-term consequences of disaster victimization, it is important to consider both immediate impacts and subsequent problems that business experience due to those 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.

In trying to understand 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 employee life-safety than toward 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 tend 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, Tierney, and Dahlhamer, 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 the impacts individual businesses sustain.

### **Discussion**

In interpreting the findings of this study and drawing out its implications for future research on the economic impacts of disasters, we should first acknowledge some of its limitations. Critics are certain to point out, for example, that the businesses included in the two surveys had already achieved some measure of success, since they had managed to survive for a number of years after the two disasters occurred. The study focused 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. Our results are thus presented with one very important caveat: the findings are based on data from 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.

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 performed financially had a major disaster never occurred. Although our survey asked businesses owners to indicate whether the changes that took place at their businesses were disaster-related, we recognize that many factors besides disaster experience affect business economic well-being--including, obviously, many factors not captured in our models.

The models used in this study did not directly incorporate data on broader economic trends that may have affected businesses in the two communities. Instead, we used owners' 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' assessments of 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 Dahlhamer, 1998) suggests that objectively-measured trends within different economic sectors are good predictors of how businesses fare in the aftermath of disasters, and we hope to include such data in future analyses.

The long-term fates of individual businesses affected by disasters are clearly linked to economic trends and decisions affecting communities--some of which may be linked to disasters and some of which may be completely unrelated. The importance of such factors is evident in both study communities. In Dade County, for example, plans had already been under way to close the Homestead Air Force Base prior to the hurricane. When Andrew struck, the base was closed due to extensive damage, and when it did not re-open, South Dade County lost one of its major economic engines, many jobs that depended on the base, and ultimately many of its better-

off residents. At around the same time but unrelated to the hurricane, the North American Free Trade Agreement (NAFTA) was instituted, dealing a severe blow to businesses in the South Dade agricultural sector, many of which had also suffered hurricane-related losses.

Recovery processes and outcomes for individual businesses are also linked in important ways to community-level recovery strategies. In Santa Cruz County, the city of Santa Cruz took active steps to help businesses get re-established after the Loma Prieta earthquake and to keep customers shopping in the downtown business district, which had been severely damaged. Because the community invested time and resources in long-term planning and chose what proved to be a successful vision to facilitate business recovery, Santa Cruz now has a central business district that has more businesses, generates more profits, and serves more patrons than before the earthquake. One study that focused on Santa Cruz ten years after the earthquake argues that the disaster provided the city an opportunity for “renewal on a scale that seemed inconceivable, and [that] enforced decision-making that would have taken years or even decades to accomplish” (Arnold, 1998:5). This may well be one reason why the businesses in our Santa Cruz sample reported more favorable recovery outcomes than their Dade County counterparts.

Some types of businesses clearly have more difficulty recovering after disasters than others. Businesses in crowded, highly competitive, and relatively undercapitalized economic niches appear to have the most serious problems in the aftermath of disasters. We also saw some indication that businesses that depend primarily on local rather than supra-local markets may not fare as well as their more diversified counterparts, presumably because of the disruption those markets experience following disasters. Other studies also point to the ways in which local market disruption negatively affects businesses. In their research on small businesses in

communities that were particularly hard-hit by disasters, Alesch et al. (2001) recount the difficulties of business owners who continued to struggle to stay afloat, not recognizing that disaster-induced changes in community demographics and consumption patterns had severely eroded their customer base. Market diversity may thus contribute significantly to business resilience 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 on short-term business recovery, 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.

Despite its limitations, this study represents the most systematic effort to date to track a large number of businesses that were affected by major community-wide disasters over the long term. Among the general conclusions that can be drawn from this study are that while in the long term most businesses that manage to survive disasters do return to at least to pre-disaster levels of economic well-being, many do not. Our findings suggest the need for a multi-level conceptualization of long-term business vulnerability and resilience that takes into account not only firm-level characteristics, but also business sector characteristics and trends, both the

immediate damage and disruption and the continuing operational problems disasters cause, community context and recovery strategies, and the broader economic environment.

### **Footnotes**

<sup>1</sup> 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.

<sup>2</sup> 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.

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Table 1: Components of a Model Predicting 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	20.5% (n=221)	16.5% (n=154)
	1=wholesale/retail firm	28.6% (n=308)	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	48.7%	50.7%
	2=5-9 FTEs	23.4	21.7
	3=10-14 FTEs	10.5	9.5
	4=15-29 FTEs	8.7	8.5
	5=30 or more FTEs	8.7	9.6
		(N=1049)	(N=909)
Business age	1=1-4 years	14.8%	8.6%
	2=5-9 years	23.1	21.5
	3=10-14 years	22.6	22.6
	4=15-29 years	28.3	28.5
	5=30 or more years	11.2	18.8
		(N=1058)	(N=911)
Financial condition prior to disaster	1=in trouble	4.0%	3.3%
	2=not doing well	20.8	15.9
	3=good	51.3	57.4
	4=excellent	23.9	23.4
		(N=1054)	(N=899)
Own or lease	0=lease	62.1%	63.9%
	1=own	37.9	36.1
	(N=1056)	(N=915)	
Legal status	0=sole owner/partnership	25.1%	58.5%
	1=corporation	74.9	41.5
	(N=1072)	(N=926)	
Ownership and location	0=individual firm, single location	83.9%	82.9%
	1=franchise/chain/multiple location	16.1	17.1
	(N=1065)	(N=918)	
Primary market	0=local	65.9%	65.4%
	1=regional/national/international	34.1	34.6
	(N=1075)	(N=922)	
Woman-owned	0=no	82.9%	83.1%
	1=yes	17.1	16.9
	(N=1077)	(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%    <u>54.4</u>	1.9 10.1 24.6  (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.	2.65 <u>.95</u> (N=1039)	2.15 <u>1.00</u> (N=890)
Disruption of operations	0...8	mean std.dev.	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 std.dev.	1.74 <u>1.31</u> (N=1036)	.37 <u>.73</u> (N=850)
Preparedness	0...19 (South Dade) 0...17 (Santa Cruz)	mean std.dev.	6.07 <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.	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	<u>South Dade</u>			<u>Santa Cruz</u>		
	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	.20	-.06	-.10	.22	-.02
Legal status	.16	.22	.03	.19	.24	.04
Ownership and location	.13	.27	.02	-.08	.33	-.01
Primary market	.58**	.20	.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**	.08	-.10	-.26*	.12	-.10
Lifelines lost	.06	.10	.02	.13	.11	.05
Disruption of operations	-.17***	.05	-.13	-.01	.07	-.00
<u>Loss Containment Measures</u>						
Number of aid sources used	-.09	.08	-.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 <sup>2</sup>		.26		.21		
* $p < .05$ ** $p < .01$ *** $p < .001$						