

Federal Disaster Relief and Local Government Financial Condition*

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Federal relief for local governments following natural disasters is provided under the assumption that without aid disasters may overwhelm local resources thus slowing recovery. Using loss data for a sample of counties experiencing disasters in the mid-1980s, this paper provides evidence that changes in the financial condition of local governments was not improved by receiving federal aid. Additionally, the paper shows that the initial financial impacts of disasters may be negative, but that within two years the net effect is positive.

Each year natural disasters cause significant damage to local public infrastructure. During the 1980s in the United States, state and local governments were estimated to have lost \$1 billion per year to floods, earthquakes, hurricanes, and other natural hazards (Burby et al. 1991). Because these losses are sudden and relatively unexpected, the financial burden they impose on local governments can be substantial. The federal government supplies assistance for public losses primarily on the assumption that natural disaster losses may exceed local capacity to recover. This paper examines the financial condition of local governments that experienced disasters and shows that the provision of federal aid had little impact on their financial condition. Furthermore, the results demonstrate that the repercussions of disasters vary with time; they are strongly negative in the short term but become positive with time.

In the twenty year period up to 1985, records indicate that there were over 500 federally-declared disasters in the United States (Rubin et al. 1986). While most losses fall on the private sector, public losses are substantial. Federal disaster relief is predicated on the assumption that major disasters:

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...are catastrophes which warrant assistance...to supplement the efforts and available resources of states, local governments, and disaster relief organizations in alleviating the damage, loss, hardship or suffering caused thereby. (FEMA regulations [44 CFR Part 205]; Yezer and Rubin 1987)

By using damage thresholds and other criteria, the Federal Emergency Management Agency (FEMA) determines if federal help is needed to prevent local resources from being overwhelmed. Several authors have questioned whether relief is being targeted to those communities most in need (Settle 1990; Burby et al. 1991), but no research has explicitly addressed the assumption that aid is necessary for recovery.

Past research on recovery has produced mixed results, but the general conclusion is that disasters have little or no long-term impacts. Unfortunately, the reasons for this absence of negative effect are not completely known. The lack of long-term impacts could be a sign that government disaster relief works. Alternatively, local resources and widespread economic integration may provide sufficient forces to power local recovery regardless of outside aid. If federal aid is not needed to speed recovery, relief primarily becomes a transfer payment from one state to another. Determining what circumstances if any justify federal help has important implications for the management of federal assistance to local governments.

Past Research on Disaster Impacts and Recovery

The findings from research on recovery following natural disasters produce an uncertain picture. As a review of the literature done ten years ago made clear (Wright et al. 1979), a number of often contradictory hypotheses have received some empirical support. These include that disasters may have negative effects for at least part of the community, may have positive effects, may accelerate predisaster trends, or have no long-term effect. However, the general conclusion from the existing research taken as a whole appears to be that natural disasters have no long-term adverse impacts.

This research base is subject to several limitations. Most studies have been case studies and thus are subject to the restrictions of this form of research design (including the difficulty of generalizing, small Ns, lack of controls, nonstandardized evidence, and selection problems with choosing disasters that are large and possibly unique). There also has been inadequate measurement of several important concepts, most importantly severity of the disaster, but also including predisaster trends (or conditions), and differentiation between community and individual effects. Of critical con-

cern for this paper is that no article has explicitly tested whether the availability of federal aid made an important difference.

Wright et al. (1979) stands out as the first large cross-sectional analysis attempting to overcome the limitations of the case study approach. The authors did an analysis using all counties in the United States and a second analysis on a sample of census tracts. Using regression techniques, they tested whether the occurrence of a disaster (measured by a 0-1 dummy variable) between 1960 and 1970 resulted in changes in housing, population, and other housing stock indicators during the decade. Their conclusion was that disasters had no long-term discernible effects for counties or census tracts as a whole. Indeed, the coefficients were sometimes positive though not significant. The authors suggest that the lack of negative effect was partially due to the small size of most natural disasters.

A large cross-sectional study of government losses (Burby et al. 1991) also supports the assessment that most natural hazards losses are not disasters. While the study did not examine the issue of recovery, an analysis of losses to states and localities in Presidentially-declared disasters between 1980 and mid-1987 using FEMA records indicated that not all communities suffered disastrous losses. Of the more than 8,500 federal grants to states and localities, two thirds of the governmental units suffered eligible losses of less than \$50,000 and twenty-two percent had losses less than \$5,000. The authors questioned whether these damages constitute a catastrophic loss for most communities. An additional survey of local officials in communities that had Presidentially-declared disasters confirmed this assessment. The respondents were asked to assess the level of losses which would be disastrous. Two-thirds of the respondents had actual losses that were lower than what they rated as disastrous.

Most of the case study research has focussed on effects to the general economy, but several have addressed governmental impacts. Friesema et al. (1979) examined four communities struck by large disasters between 1955 and 1966 and found no long-term disruptions in the communities studied despite the severity of the disasters. In addition to a broad range of economic and social indicators, they examined governmental impacts but found no significant effects on property assessment or municipal expenditures. Chang (1983) presents monthly revenue data for Mobile, Alabama following Hurricane Frederic. He found that following the hurricane, monthly revenues for the city increased favorably over expectations (primarily due to increased sales tax collections) so much that the city's fiscal director quipped about the hurricane, "We need one every year." However, within one year, revenues had declined back to normal levels. LaPlante

(1983) argues, based on examination of riverine flooding in Pennsylvania, that recurrent events in disaster-prone communities may threaten local governments where the disasters are not severe but repeated.

If we accept the weight of the existing research that there are no long-term effects from disasters, the question remains why there is no effect. As one commentator on Wright's study noted, "Perhaps the most interesting question is how the noneffect is produced" (Bates in Wright and Rossi 1981, p. 39). As noted above, several authors have concluded that most so-called disasters are not really disasters at all and should not pose a significant burden (Burby et al. 1991; Wright et al. 1981). Even where the disasters are viewed as severe, the amount of life and property lost is usually only a small portion of the existing base. We may reasonably question whether there should be a lasting detectable impact from disasters if the severity is no greater than losses from auto accidents or fires for example. Another explanation for the observed noneffects may be the extensive integration of local communities into the national economy (Friesema et al. 1979). Private insurance, nondisaster governmental aid programs, and high population mobility may spread the effects of disasters over the larger society so that no locality is swamped. A third interpretation is that disasters act as a form of urban renewal that accelerates change and induces inflows of capital (Dacy and Kunreuther 1969). The inflow of federal disaster aid may fit this last category. However, empirical proof that federal aid plays this role or that aid is necessary is missing.

Recovering From Disaster

This paper will follow Friesema et al. (1979) in defining recovery as "the reacquisition of system capabilities on any variety of dimensions" (p. 44). However, as they note, "If 'recovery' entails a return to a disturbed behavioral path, then clearly the existence of a disturbance must be demonstrated" (p. 42). The simple occurrence of a physical event such as an earthquake is not enough. The physical event must have impacts on human systems that cause significant losses. The measurement of initial impacts therefore becomes critical to determine the disturbance. They go on to note that determining the point at which recovery is complete is also complicated by the need to consider whether the dependent variable is dynamic. Returning to an equilibrium state is recovery if the dependent variable is relatively stable over time. However, if the dependent variable displays a trend, then recovery may mean not only reaching the predisaster state but reaching the point where the community would have been without the disaster.

There are several dimensions for recovery that could be measured for a local government. Fiscal condition or health of the locality is the most obvious and arguably the most important in the long-run. Disasters can cause not only direct losses to public property, but also entail costs for emergency services and cleanup. Additionally, a local government may suffer indirectly from decreased revenues due to damage to the private sector. Thus, disasters may affect expenditures and revenues.

In the last twenty years increased attention has been focussed on assessing local government financial condition and trying to determine measures of fiscal stress (see for example, Ferguson and Ladd 1986; Ross and Greenfield 1980; Dearborn 1978). While the credit industry has benchmarks for local governments, standards of comparison across communities are somewhat suspect given differences in resource bases, demographics, service expectations, and political cultures. Therefore, no single accepted measure of financial stress now exists with which to compare localities on a single standard. A more reasonable approach may be to examine financial indicators within a community across time and compare governments on the changes rather than the actual measures (see Hughes and Laverdiere 1986; Groves and Valente 1986 for a discussion of indicators and comparisons). Indications of adverse impacts or stress would be disturbances in the changes over time.

Research Questions

The following two questions are the central focus of this research:

- (1) Does federal disaster aid lessen financial stress on local governments following disasters?
- (2) Does the severity of the disaster make a difference for local government recovery and the importance of federal aid?

While the problem of recovery is not limited to local government alone, public losses may be more critical. Damages to public infrastructure can create not only inconveniences but economic disruptions in the private sector. Adverse impacts on local governments' finances could require cutbacks in services or the raising of taxes. With a growing shift of governmental responsibilities from the federal to state and local levels, unexpected financial obligations such as disasters could create local fiscal crises.

The focus on public losses as opposed to private losses also offers a methodological advantage for studying the question of recovery. Losses in life or private property are not borne equally in a community but are

generally concentrated on a small number of people or households. Thus, the reasonable unit of analysis may be the individual, household, or business when discussing private losses. Using community-wide measures as is common in many studies may mask the differences in effects on individuals by an average. However, for a local government, the loss is to the locality as a whole, and thus the government as the unit of analysis is appropriate.

Design of the Study

The basic design of this study was to compare changes in several measures of local government financial status before and after a natural disaster. The local governments selected all had suffered some losses from natural disasters during the study period, but only some received federal aid in response to those losses. Thus receipt of federal aid is the central treatment being studied.

Based on several case studies, Haas et al. (1977) constructed a conceptual framework for understanding recovery processes to which others have referred. Besides identifying four phases which emphasize the temporal nature of the recovery process, the authors suggest that four key factors shape the speed and degree of recovery. The four factors are magnitude of loss, resources for recovery, prevailing trends, and leadership. The authors suggest that the magnitude or severity of the disaster is the only factor linked to recovery by clear evidence, but that the other factors are reasonable based on scattered information and logic. These four factors provide a reasonable framework for constructing a model to test the impacts of disasters and recovery.

The list of the variables used and their measures can be found in Table 1. Except for 1985 Per Capita Income, all the measures are calculations from raw data. Where measures are expressed in per capita terms, the population used in the denominator was from Census estimates for 1975, 1980, or 1986, whichever year was closest. Additionally, all measures of financial condition and disaster impact were adjusted by the price deflator for local government services to a 1987 base year to eliminate differences due to inflation.

The dependent variables listed are those measures of financial condition for which data are reported. As mentioned above, no single measure of financial condition is adequate so multiple dependent variables need to be tested. If disasters have an impact, we should expect to see differences in these variables.

Table 1. Variables and Measures

Constructs	Measures*	Sources
Dependent Variables		
Change in local revenues per capita	Percent change in local revenues per capita, 1982-1987	1
Change in expenditures per capita	Percent change in general expenses per capita, 1982-1987	1
Change in operating position**	Difference in general operating position, 1982-1987	1
Disaster Character		
Disaster severity	Total losses as a percent of 1982 general expenses	1, 2
Capital Losses	Capital losses as a percent of total losses	2
Elapsed time	Time in months between disaster and fiscal year end, 1987	1, 2
Available Resources		
Federal aid	Percent of total losses paid by federal aid	2
Local income	Per capita income, 1985	3
Tax burden	1982 Local revenues per capita as a percent of 1985 per capita income	1, 3
Leadership		
	Number of county financial and administrative employees per 1000 population, 1982	1
Trends		
Population growth	Percent change in population, 1980-1986	1
Predisaster trends in local revenues	Percent change in local revenues per capita, 1977-1982	1
Predisaster trend in expenditures	Percent change in general expenditures per capita, 1977-1982	1
Predisaster trend in operating position**	Difference in general operating position, 1977-1982	1
Control Variables		
Age of capital stock	Percent of year-round housing built before 1939 as of 1980	4
Predisaster local revenues per capita	Local revenues per capita, 1982	1
Predisaster expenditures per capita	General expenditures per capita, 1982	1
Predisaster operating position**	Operating position, 1982	1

Sources: 1. U.S. Census, *Census of Governments*, 1977, 1982, and 1987; 2. Unpublished Federal Emergency Management Agency Records; 3. U.S. Census, *City-County Data Book*, 1988; 4. U.S. Census, *Census of Housing*, 1980.

*Measures are calculations from raw data except for per capita income

**Operating position = [(General revenues - General expenditures)/General revenues]*100

Operating Position is the difference between general revenues and general expenses divided by general revenues and converted to a percent. Positive values for operating position would indicate revenues exceeding expenses and generally a more favorable financial condition. Positive changes over time also would be a favorable sign.

The severity of disaster is a critical measure. Given the contradictory findings in the literature, no expectation about the direction of effect is hypothesized. The construction of the measure follows the concept of "impact ratio" suggested by Wright et al. (1979). Public losses from the disaster are in the numerator while the denominator is the 1982 General Expenses for the county government. This measure of the disaster loss therefore is adjusted to account for differences in resources in each county. The measure reflects the obvious but important distinction that a \$100,000 loss would be more severe in a county with a \$1 million budget than the same sized loss in a county with a \$100 million budget. Losses in the numerator are from Federal Emergency Management Agency records. These are losses, as determined by FEMA field investigators, which are eligible for federal aid. Since federal eligibility standards do not cover all types of losses, this is a conservative estimate. However, it is a reasonably comparable measure across the two treatment groups. Depreciated property is the most notable type of loss not covered by federal guidelines. Thus, a bridge which was fully depreciated but still standing probably would not be covered. Localities not receiving aid had preliminary assessments done to determine the extent of their losses and possible eligibility for aid. Nonlinear representations of disaster severity as well as interactive effects with other variables, particularly time, are reasonable possibilities and were tested.

The measure of capital losses simply makes the distinction between losses to property and losses for cleanup and emergency services. The coefficient for this measure should be negative for the revenue and expense dependent variables since capital losses could be spread out over a longer time period through debt financing thus requiring less change in revenues and expenditures. However, for the operating position, the coefficient should be positive since being able to spread the losses over time means less need to raise expenses in any given year relative to revenues. Time since disaster is a control variable. With the passage of time, the impacts of disaster should be moderated.

The collection of variables for available resources includes the treatment variable, federal aid. For localities not receiving aid, this will be a 0. Federal guidelines now mandate cost sharing with a 75/25 split so that most localities will be near 75 percent though discretionary policy allows for

some adjustments by FEMA. The coefficients for federal aid may be either negative or positive depending on the local government's policy strategy. For example, a disaster could require new expenditures to replace losses, thus raising spending levels. Alternatively, the government might cut expenses to adjust to revenue shortfalls. The revenue and expenditure equations might produce equations with opposite signs. Per Capita Income is a measure for the potential resources available in a local community. The effect of this variable should be negative with respect to disaster impacts as more resources should moderate impacts. However, greater wealth in the community also may allow for government expansion. No direction is therefore hypothesized beforehand. The variable Tax Burden measures the size of local revenues relative to personal income. The coefficient for this measure is hypothesized to be negative as higher numbers suggest a higher tax burden which would promote political resistance to further increases. Conversely, lower values may allow more leeway for raising taxes to make up shortfalls.

Many researcher cite population change as a major factor driving local government expenses and revenues. While the dependent variables are already adjusted to reflect population changes, growth (or decline) can affect revenues and expenses depending on economies of scale and excess capacity in government services. A growing county with sufficient services already in place to serve the incoming population may incur only minor additions in expenses but substantial gains in revenues. The opposite result is also possible so the direction of the coefficient can not be predicted a priori.

To control for underlying financial trends that may have preceded the 1982-87 fiscal years, variables corresponding to the dependent variables but for the period 1977-82 are included. The variable Age of Capital Stock provides a relative measure of the age of public infrastructure. It is assumed that public infrastructure surrounding homes was built at roughly the same time as the homes. This measure controls for the need that localities with older infrastructure may have to spend more on capital improvements and repairs. It also controls for differences in eligible federal losses due to differences in remaining infrastructure life or the undepreciated amount. The coefficient should be negative for the revenue and expenditure dependent variables.

The sample frame from which this group was drawn was based on unpublished records from FEMA of counties that had requested federal aid for natural disasters. In order to assess the disturbance between the 1982 and 1987 financial statements, only counties that had disasters in 1983,

1984, or 1985 were included. Communities suffering losses in 1986 and 1987 were excluded as federal payments may be delayed for as long as a year after a disaster. Keeping counties which may not have received their aid in the sample frame would have biased the results. Counties with disasters before 1983 were also omitted since their disasters would have taken place before the first financial measure in the dependent variables. Additionally, localities that had more than one disaster during the 1980 to 1987 period were excluded to simplify the interpretation of the impacts of disaster to one readily identifiable event. The sample frame included more than six hundred counties. The sample population for this study was selected by drawing a simple random sample and produced a group of 112 county governments from across the United States. Fifty-three of the counties received aid and in fifty-nine counties FEMA denied aid since the overall disaster was judged insufficient to merit a Presidential Disaster Declaration.

Characteristics of the treatment and control groups (aid and no aid) are listed in Table 2. While there are some differences between the two groups, both encompass a wide range of counties and the median values are relatively close across most measures. The aided counties were generally somewhat larger, wealthier, and in better financial condition. The counties in the sample come from 30 different states.

Results

Analysis of the model was done using OLS regression. Table 3 provides the results for the regressions on revenues and expenses. The coefficient for federal aid is positive in both regressions as expected but is not statistically significant in either equation. Additionally the size of the coefficients is small suggesting there is no strong effect.

While federal aid had no discernible impact, the severity of disasters was significant at the .001 level in both equations. Both coefficients are positive and of similar magnitudes though the coefficient for the revenue's equation is slightly higher, 1.11 versus 0.81. The size of these coefficients show that for each percentage increase in the severity of the disaster, there would be roughly equal percentage increases in revenues and expenses per capita over the five year period. Based on these two equations, though, these results do not suggest whether this is a negative or positive impact. Higher revenues and expenses could be a sign of positive stimulation to the local economic base through the "urban renewal" effect. However, the higher revenues and expenses could suggest that more effort was necessary on the local governments' part to replace the losses. The slightly higher coefficient

Table 2. Comparison of Aided and Nonaided County Governments

Measures	Aided Counties	Nonaided Counties
Number of cases	53	59
1986 Population		
Average	106,764	47,234
Median	26,901	21,860
Minimum	1,352	5,732
Maximum	1,367,045	406,034
Population Growth, 1980-86		
Average	5.6%	4.9%
Median	3.0%	3.1%
Minimum	-25.0%	-11.9%
Maximum	40.5%	42.4%
1985 Per Capita Income		
Average	\$ 8,730	\$ 7,887
Median	8,118	7,683
Minimum	3,692	5,130
Maximum	17,304	13,487
1987 Local Revenues Per Capita		
Average	\$ 322	\$ 246
Median	219	168
Minimum	27	41
Maximum	1,487	1,026
1987 Operating Position		
Average	3.9%	3.4%
Median	3.9%	1.8%
Minimum	-65.3%	-22.8%
Maximum	27.9%	25.1%
Disaster Severity (Losses as a percent of 1982 expenditures)		
Average	8.9%	4.0%
Median	1.9%	1.4%
Minimum	0.01%	0.03%
Maximum	156.1%	75.8%
Age of Capital Stock (Housing stock built before 1939)		
Average	27.7%	23.4%
Median	20.3%	20.2%
Minimum	5.5%	7.3%
Maximum	65.9%	65.9%

Table 3. Regression Results for Revenues and Expenses

		Percentage Change Local Revenue Per Capita 1982-1987	Percentage Change General Expenses Per Capita 1982-1987
Constant	beta	122.6	48.6
	t	3.13***	2.19**
Disaster Character			
Disaster severity	beta	1.11	0.81
	t	4.37***	4.62***
Capital losses	beta	-0.16	-0.11
	t	-0.98	-1.01
Elapsed time	beta	-0.47	-0.29
	t	-1.18	-1.05
Available Resources			
Federal aid	beta	0.005	0.02
	t	0.04	0.23
Local income	beta	-0.007	0.001
	t	-1.88*	0.31
Tax burden	beta	-16.8	0.41
	t	-2.34**	0.16
Leadership			
Leadership	beta	-3.23	-1.76
	t	-0.76	-0.59
Trends			
Population growth	beta	0.55	-0.11
	t	1.08	-0.32
Predisaster trend in local revenues	beta	-0.10	
	t	-1.59	
Predisaster trend in expenditures	beta		-0.01
	t		-0.29
Control Variables			
Age of capital stock	beta	-0.10	-0.57
	t	-0.27	-2.36**
Predisaster local revenues per capita	beta	0.15	
	t	1.88*	
Predisaster expenditures per capita	beta		-0.016
	t		-0.87
Significant at			
0.01 ***	R ²	0.30	0.25
0.05 **	Adj. R ²	0.22	0.17
0.10 *	F	3.89***	3.10***

in the revenue equation suggests that the stimulatory effect may be a more reasonable interpretation over time.

The regression results in Table 4 represent two different models using changes in operating position as the dependent variable. The results for the first column use the same basic model as the regressions in Table 3. The coefficient for federal aid is again not significant (though negative this time). The negative coefficient suggests that federal aid actually had an adverse impact. However, given the low statistical significance, no effect should be attached to federal aid for these equations as well.

The coefficient for disaster capital losses is positive and significant at the .10 level. The results support the hypothesis of a positive relationship. The negative coefficient for the control variable 1982 operating position may reflect that operating position is probably an equilibrium measure. Therefore higher values in one period are apt to be followed by lower values later as the locality seeks to adjust to the equilibrium target.

A major difference between the results shown in Table 4 and those in Table 3 is that the coefficients of determination are much higher for the equations in Table 4. This difference shows that estimating changes in operating position is subject to greater reliability. The higher reliability of the equations in Table 4 may be an indication that the effects of disaster (as well as the other independent variables) are not constant across localities with regard to affecting revenues or expenses. In some communities, the independent variables may put pressure on the revenue generating capacity, while in others the variables impinge on expenditures. However, they clearly affect the combined measure of operating position. The difference may also be due to political choices at the local level. Certain communities may be more inclined to adjust revenues, while others modify expenses because of political preferences. Because local governments generally must maintain balanced budgets, some adjustments are likely. The differences between Tables 3 and 4 suggest that estimating which side of the revenue-expense equation will be affected is more difficult, but clearly some readjustment of the balance is made.

The second regression equation in Table 4 uses the same dependent variable but includes an interactive effect between time and severity. As noted earlier, the possibility of nonlinear functional forms to certain variables and interaction effects between variables was recognized in the research design. Testing supported an interactive effect of time and severity on the operating position dependent variable. The variable Elapsed Time was dropped in the second model as its statistical significance indicated it was not a factor. The interesting difference between the two columns in

Table 4. Regression Results for Operating Position

		Difference in Operating Position 1982-1987	Difference in Operating Position 1982-1987
Constant	beta	-21.06	-16.85
	t	-2.35**	-1.88*
Disaster Character			
Disaster severity	beta	0.03	-0.30
	t	0.51	-1.84*
Capital losses	beta	0.08	0.07
	t	1.77*	1.64*
Elapsed time	beta	0.06	
	t	0.58	
Interaction of severity and elapsed time	beta		0.014
	t		2.25**
Available Resources			
Federal aid	beta	-0.02	-0.006
	t	-0.55	-0.18
Local income	beta	0.001	0.001
	t	1.81*	1.69*
Tax burden	beta	-0.21	-0.29
	t	-0.35	-0.49
Leadership	beta	1.50	1.08
	t	1.27	0.92
Trends			
Population growth	beta	0.12	0.155
	t	0.88	1.14
Predisaster trend in operating position	beta	0.10	0.14
	t	1.17	1.65*
Control Variables			
Age of capital stock	beta	0.21	0.19
	t	2.15**	1.97**
Predisaster operating position	beta	-1.00	-1.05
	t	-9.91***	-10.4***
Significant at			
0.01 ***	R ²	0.70	0.71
0.05 **	Adj. R ²	0.66	0.68
0.10 *	F	20.87***	20.33***

Table 4 is the change in sign and in the level of statistical significance for the variable Disaster Severity once the interaction term is introduced. The other coefficients change only slightly except for the predisaster difference in operating positions which becomes statistically significant in the second regression. The coefficient of determination also improves slightly.

The interpretation of the interaction term along with the normal severity measure also produces a substantively interesting result. The severity of the disaster has a negative effect on operating position by itself, but a positive effect when combined with elapsed time. The net effect of these terms suggests that for periods up to 21 months, the impact of a disaster is negative. However, when the time since disaster passes 21 months the net effect is positive. Therefore, disasters initially cause stress but within two years stimulate the localities to improved financial conditions. Interestingly, the net positive effect at 22 months and beyond is experienced irregardless of the severity of the disaster. The combined effect would suggest that as a disaster becomes more severe, the initial negative impact is greater but the rebound is also greater with time. This may reflect forces pushing toward equilibrium, particularly the need for most localities to maintain balanced budgets.

A large proportion of the observations had very low severity disaster events. As noted in Table 2, the median severity percents were 1.9 and 1.4 for aided and non-aided communities. In order to test whether the low severity disasters were biasing the estimators, a regression was done on a subset of the observations with severity measures greater than five percent. This included 22 of the original 112 observations. As would be expected, the lower sample size inflated the standard errors so that only one variable in this regression was significant. The sign of federal aid changed to a positive value, but the coefficient was still small and not near being significant. Thus, even focussing on the high end of the severity scale, no effect of federal aid could be found.

Discussion

The most important finding of this article is the lack of effect of federal aid when comparing changes in financial condition of local governments over time. Several explanations for the lack of observed effect suggest themselves. The severity of most of the disasters in this sample was low. Four-fifths of the localities had disaster losses that were less than 5 percent of one year's general expenses, a loss within most communities' probable reserve funds. With losses so low, no effect may be likely. Therefore federal aid may not make a difference as the disturbance is too small to register over

time. The distribution of losses observed in this sample follows the pattern of losses noted for all public losses in federally declared disasters during the 1980s (Burby et al. 1991). Thus, many local governments may not require aid.

The selection of the sample for this study excluded counties with multiple disasters. Burby et al. (1991) found that although governments experiencing more than one loss event were less than one-fourth of the total cases, they accounted for more than half the losses. Thus, the need for federal aid may be very different for local governments with multiple disasters. Whether this is true even for relatively low severity events if repeated over time is an open question.

Nevertheless, if there is indeed no difference for low severity events for governments with single disasters over time, a large proportion of federal grants are being distributed needlessly. These results suggest that federal aid may need to be reformed so as not to distribute relief to low severity losses. Additionally, some localities which now have relatively severe losses are not eligible for aid because the disasters are more concentrated and do not meet the guidelines for federal help. Adjusting federal policy so that eligibility for aid is not dependent on the overall size of the disaster but instead goes to the most severely hit local governments would target resources in a more efficient manner. Aiding communities with low severity losses may simply reduce their willingness to fund these losses themselves even though they have the capacity to do so without negative consequences.

The lack of effect of federal aid alternatively may be because localities that did not receive federal aid got state assistance. Local officials cite federal aid as being the most desirable form of assistance for disaster relief (Burby et al. 1991). However, in an effort to transfer the costs elsewhere, it is reasonable to wonder if local governments that received no federal aid then turned to their respective state governments. Unfortunately, the data to test this hypothesis are not readily available. Except for California, no states have formalized disaster relief programs for which records are accessible. Determination of which governments received state aid would be difficult due to the lack of a central source of information. Additionally, states may not earmark assistance as disaster relief. Trying to decide whether state grants for roads in a given year were disaster relief or normal intergovernmental transfers could prove impossible. For unmeasured state grants to have this washing out effect, however, it is probable that the amount of aid would have had to have been similar in size to federal aid. The financial pressures on state governments during this time period and the lack of

formal programs make it unlikely that state aid could be accounting for all the differences.

Unmeasured financial changes at the local level also may account for the lack of observed effect. While the measures used here as dependent variables are reasonable, local financial condition is obviously much more complicated. Localities which did not receive aid may have absorbed the losses through reserve funds or by taking on debt not captured by these data. A more thorough examination of individual governments' financial statements might reveal that unaided disasters did have impacts but in a manner not captured by the measures used here. However, the fact that severity of disasters did come through as a significant measure suggests that the dependent variables are reasonable and measuring disaster impact.

The significant coefficients for disaster severity observed in this study suggest that the assessment of impacts following disasters may need to consider a more complex set of relationships that are not simply positive or negative but changing over time. Further studies to evaluate the dynamic relationship between time and severity are needed to understand better the appropriate time periods for policy intervention. The best approach in the first two years following a disaster may be unwise when pursued later. The results presented here strongly indicate that for aid to do the most good, it needs to be received as early as possible.

Further research is needed to evaluate the importance of federal aid for speeding recovery. Evaluating local governments with multiple disasters may be one promising avenue. Case studies or more detailed financial analysis of localities that had high severity events but received no aid may help to explain what these communities do to avoid adverse impacts or if those impacts are being felt in changes not measured by this research.

Conclusion

Disasters were found to have a changing impact over time on local government financial condition. While the results suggested that there may be some negative effects that last for more than a year, no long-term adverse impacts were found. Indeed, the results suggest that within two years, a disaster may have a net positive effect on local government financial condition. This supports the results from many previous studies but provides a more sophisticated analysis by isolating the dynamic nature of the impacts. The study also found no significant difference in recovery between local governments which received federal aid and those which did not. Further study of the role which federal aid plays in recovery is warranted. Reforms to federal aid also may be needed to target assistance only on those

communities truly suffering severe local losses rather than simply any hazard losses in a widespread disaster.

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