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THE EFFECTS OF DISASTER DAMAGE AND HOUSING AID ON HOUSEHOLD RECOVERY FOLLOWING THE 1976 GUATEMALAN EARTHQUAKE*,**

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This paper examines the effects of housing programs, disaster damage, community type, and other social determinants on household recovery following a major natural disaster--the 1976 Guatemalen earthquake. The domestic assets index, a measure of household living conditions, and a refined measure of household recovery are introduced and employed. The domestic assets scale is an index of the economic value of household equipment and is an adaptation of level of living scales. While reconstruction aid was the single most important determinant of recovery, it was the type and not the value of aid that was critical. Strong support exists for the conclusion that temporary housing as a form of aid retarded the recovery process while permanent housing programs actually produced net improvement in living conditions. There is also evidence that the

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unequal effects of different types of housing programs produced significant changes in the distribution of economic resources, thus effecting the stratification system in affected communities. In addition, while other factors associated with the social characteristics of household were found to be important, this analysis consistently suggests that households residing in small, rural, and politically removed communities experienced greater difficulty in overcoming the debilitating effects of a natural disaster.

INTRODUCTION

Recently researchers have begun to analyze the social processes determining household recovery after natural disasters. Bolin (1976, 1982) has examined family recovery following the Rapid City flood and the Wichita Falls and Vernon tornadoes. Bolin and Bolton (1983) added a cross-cultural dimension by comparing family recovery in both the United States and Nicaragua (cf. Bolin and Trainer 1978). This paper builds upon this research and on that conducted by Bates (1982) and his colleagues on household recovery following the Guatemalan earthquake. It uses an objective measure of the socioeconomic impact of disasters on household living conditions to develop a refined definition of household recovery. This definition takes into account disaster impact net of normally expected change in household living conditions had no disaster occurred. The focus of the analysis will be on the effects of reconstruction aid on household recovery taking into account the extent of disaster damage and other factors. In particular the long range effects of different types of housing programs on recovery are evaluated.

ASSESSING DISASTER IMPACT

Disaster can have a variety of impacts on households and their members including death, sociopsychological stress and economic loss (Bates et al. 1963; Kreps 1984). For this reason, a complete analysis of household recovery should be multi-dimensional. This need is illustrated by the work of Bolin and Bolton (1983) who attempted to measure and assess both a variety of objective and subjective or

perceptual measures of recovery (cf. Bolin 1976, 1982; Bolin and Trainer 1978). While it is important to consider various dimensions of household recovery to obtain a complete picture of the recovery process, this paper will focus more narrowly upon establishing and analyzing a single objective measure.

More to the point of this paper, Bolin and Bolton (1983) utilized several objective measures of household recovery such as income recovery, house-size recovery, and the recovery of household conveniences. A household was said to have recovered if its post-disaster income, house size and conveniences were equivalent to or higher than its pre-disaster levels. All of these indicators involve the assessment of a household's level of economic well-being or, more generally, the assessment of a household's living conditions. In this paper a single indicator of a household's socioeconomic standing will be employed that will overcome the limitations of using income and will combine into a single indicator various factors associated with a household's physical living conditions. Specifically, a measure of a household's domestic assets will be employed (Killian and Bates 1982; Bates et al. 1984).

The Domestic Assets Index. The domestic assets scale is an index of the economic value of household physical capital which includes the house and major household equipment and is an adaption of the level of living scales developed in rural sociology (Sewell 1940; Rural Sociological Society 1956; Ramsey and Collazo 1960; Sharp and Ramsey 1963; Ugalde 1970; Belcher 1972). Level of living scales were originally designed to measure the socioeconomic status of households, particularly rural farm households, using physical possessions as indicators. Early level of living scales centered around the determination of whether households possessed particular objects or facilities such as running water, indoor plumbing, electric lights, and radios. Such scales were particularly sensitive to cultural bias, levels of societal development and were especially difficult to employ in longitudinal studies because the items included at one time were of little discriminatory value at a later date (Sharp and Ramsey 1963; Sewell 1940; Drewnowski 1970; Knox 1974).

In light of these problems Belcher (1972) introduced a major modification in level of living scales to increase their

utility for longitudinal and cross-cultural analysis. He suggested that items should be selected on the basis of their utility in performing household functions. Belcher noted that every household, regardless of the society or culture, performs a common set of domestic or household functions. What differs across households, both within and between societies, is the types of physical items utilized to perform particular functions. Thus, he constructed a cross-cultural level of living scale "... by selecting items for inclusion in the scale because they are related to household goals or functions" (Belcher 1972, p. 212).

Fourteen household functions were identified and used as a basis for Belcher's cross-cultural level of living scale. The functions were shelter (walls, floors, and roofs), water storage, water transportation, lighting, preservation of perishable foods, eating (utensils), human waste disposal, transportation, cooking, cooking fuel, cleaning, dishwashing. Within each functional area, specific items of household equipment used to perform the function were ranked in a Guttman fashion into one of five ordinal sub-categories on the basis of their "technical efficiency." The most efficient item(s) received a rank of five while the least efficient received a rank of one. A total score for a household was obtained by summing ranks across functional categories. While greatly increasing the utility of the scale in cross-cultural and longitudinal research, there were problems with the Belcher revision.

The major problems stem from the failure to offer a clear definition of technological efficiency and to offer clear criteria for placing items into one of the five sub-categories. For example, in evaluation of cooking equipment such as gas or electric stoves as opposed to fireplaces or wood stoves, should efficiency be based upon the expenditure of energy or labor by household members, or in terms of societal expenditures of energy, labor or natural resources. Another problem stems from the use of a simple arithmetic progression (i.e., one to five) between the sub-categories within each functional area. One must question whether or not a simple ordinal progression reflects accurately the underlying dimension. For example, is a microwave oven simply four points more "efficient" than a fire built on the ground? A final problem concerns the weighting of the

individual functional areas. In Belcher's scale each category was given the same weight. The question is, should food storage or cooking equipment be given the same weight as housing?

In an attempt to overcome some of these problems a major revision was introduced in the domestic assets approach. Rather than assigning an arbitrary efficiency rating, items in each functional category (shelter, water source, lighting, food storage, dishwashing, and cooking) receive their average cost on the local market as a weight. Thus each item was weighted according to its replacement cost on the local market. A total score for the household, representing the value of selected physical assets utilized to perform household functions, is obtained by summing the weights across functional categories. By weighting items in terms of their dollar value on the local market, the measure avoids many of the criticisms of level of living scales. This simultaneously removes the inappropriate standardization of scales across functional areas and alters the underlying dimension. Replacing technological efficiency with a more clearly interpretable basis of measurement (i.e., cost or price) removes the need for questionable assumptions and judgments concerning technological efficiency and relative functional importance. In addition, the measure is self-weighting in that functional categories representing major capital investments such as housing are given greater weight than those requiring small expenditures. Furthermore, this measure is extremely useful in disaster research since it furnishes a measure of the relative cost of establishing or re-establishing a household's socioeconomic living condition. It should be noted however, that the domestic assets scale only furnishes an index rather than a complete measure of the cost of establishing a household since it does not include all of the capital equipment utilized by a household.

Recovery and Restoration. Recovery is usually said to have occurred if a household has reached or exceeded pre-disaster levels (cf. Bolin and Bolton 1983). Thus a household could be said to have recovered if its income levels, number of bedrooms, number of conveniences, or levels of satisfaction are equal to or greater than pre-disaster levels (Bolin and Bolton 1983). The implicit

assumption of these definitions of recovery is that households would not have undergone change during a given period had not disaster occurred. This is a questionable, though often necessary assumption, given data constraints. It is unreasonable, however, to assume that a household would not experience socioeconomic change, whether positive or negative, during an extended time period, even if no disaster occurred. Therefore, an alternative definition of recovery is needed.

In this paper, meeting pre-disaster levels of domestic assets will be defined as restoration. Recovery will be defined as meeting or exceeding the level of domestic assets that a household *would have attained* through normal processes had no disaster occurred. In light of this definition of recovery, the specific question to be addressed by this research is whether or not involvement in reconstruction aid programs had any effect on a household's ability to reach or exceed the levels of domestic assets it would have been expected to attain given no disaster.

Explicitly demanded by the research question and the definition of recovery is the ability to statistically model "normal" socioeconomic change at the household level. Ideally, one should have time series data for at least ten years on each side of the disaster event in order to estimate normal trends (cf. Friesema et al. 1979). This would permit greater confidence in modeling the normal processes of household socioeconomic change as a basis for measuring "true" recovery. Rarely do researchers have access to pre-disaster time series data of this nature; this is especially true when the unit of analysis is a household. However, in the Guatemalan case, pre-disaster data are available on individual households and more importantly, data from a set of control communities are also available. These data can be used to construct a statistical model of normal socioeconomic change.

DATA AND ANALYSIS

The data for this research consist of observations on approximately 1200 household randomly selected from twenty-one Guatemalan communities (Bates 1982). Interviews were conducted in two waves between 1977 and 1980. Included

in the first interview were retrospective questions that obtained information about the pre-earthquake household living conditions. The second interview obtained data on the post-disaster household four years after impact. The communities were selected to reflect differences in population size, organizational complexity, geographic region and ethnic composition. The sample from these communities can be divided into two categories: (1) an experimental group, consisting of households from fourteen communities that suffered heavy to moderate earthquake damage; and (2) a control group, consisting of households from seven communities suffering light or no damage. The use of these communities as a control group is not without its problems.

The control communities must not be considered a true "control group." It is simply impossible, were it ethical, to randomly select from a population those individuals who will receive the treatment effects of earthquake damage and subsequent relief and reconstruction aid. Given this, an attempt was made to match a set of communities, using the above criteria, that suffered little or no damage with the set of selected experimental communities. Therefore, control household should be considered a comparison group or a loose control group at best, rather than a strict control.

There were some differences between experimental and control communities that may bias our results. First, there were undoubtedly spill-over effects of damage and indirectly, of aid. Secondly, economic inequality was higher in control communities during the pre-earthquake year (1975). The mean domestic assets score for control households, $984, is slightly lower than the mean for experimental households, $1196, a difference of $212, while its standard deviation is slightly higher. Third, the control communities appear to be slightly more Indian in their ethnic composition. While there are problems in utilizing these communities as controls, given that the control communities are matched to the experimental in most other respects and are located within the same political economy, their use as a comparison group is justified.

Net Recovery. The first step in this analysis the calculation of a net recovery variable. Net will be defined as the difference between an expe household's domestic assets in 1980, and the

domestic assets which that household was *expected* to have attained by 1980, given normal change processes. This measure can be positive, indicating over recovery or upward economic mobility; zero, indicating recovery; or negative, indicating a failure to reach recovery levels.

To determine the predicted value of 1980 domestic assets for experimental households, a statistical model of normal attainment processes was developed in which the 1980 domestic assets score of control households was regressed on a set of independent variables that the literature indicates should be important determinants of household socioeconomic attainment and disaster recovery. The following independent variables were included in this analysis: 1975 domestic assets, age of the head of household, head's educational attainment, household size, household ethnicity, the position of the community in the political organization of Guatemala, and the percent of Ladinos in a community. A household's 1975 domestic assets was included because one would anticipate that prior socioeconomic standing would have a strong positive effect on future assets because it is a proxy for prior income levels, and because it captures inherited wealth. Head's educational attainment (i.e., years of schooling) is a measure of the household's human capital and should have a positive effect on future living conditions even in a developing society.

The age of the household's head was included as a proxy for the family's life cycle stage and labor market experience of head. The literature is at best inconclusive as to the effect this measure should have on future domestic assets, especially in a developing society. Much of the literature suggests that with age, labor market experience increases thereby increasing earnings. As the family grows older, parents and older children can contribute greater amounts of time to economic activities resulting in greater household income (cf. Deseran et al. 1984; Oppenheimer 1982). Given these perspectives, the net effect of age on domestic assets should be positive. The work of Beck et al. (1978), however, suggests that this effect should be attenuated, if not reversed. They found that in peripheral sectors of an economy, characterized by low skill jobs with little chance for advancement, the positive effects of age were attenuated for male workers and nonexistent, bordering on negative,

for females. The implication of these findings suggest that when low-skilled, dead-end jobs are the rule, worker marketability declines with age. To the extent that peripheral sectors in developed societies are similar to the underdeveloped economies of developing societies, similar results could be expected.

Household size (i.e., number of members) is included as an indicator of the number of potential wage earners and for the size of the labor force available for household-based production. The total number of members is used because in Guatemala even young members, whether employed outside the home, are potential contributors to a household's socioeconomic standing. While the literature is clear in its expectation that all members of a household are potential earners, especially in rural areas (cf. Tienda 1979; Jaffe and Stewart 1951), and that household size will have an effect on socioeconomic standing, it is less clear on its directionality. Some researchers suggest that large households represent a new economic cost for parents in developing countries (cf. Mueller 1976) while others suggest that large households represent positive economic value (cf. Espenshade 1977).

The measure of household ethnicity is unique to this analysis. Typically, researchers interested in ethnicity simply obtain an individual's self-identification preclassified into discrete ethnic categories. In household analysis, information on the head's self-identification is utilized to classify the entire household. This approach to ethnicity suffers from a number of flaws: (1) it often depends exclusively upon self-identification, thereby ignoring culturally prescribed behavior characteristics or ethnic markers displayed by an individual which can be crucial in social interaction; (2) by opting for an all or nothing characterization, researchers fail to assess the dynamics of ethnicity, whereby an individual may be in the process of changing ethnic identity; and (3) such procedures fail to assess ethnic diversity in the household.

In this analysis a relative ethnicity measure was employed (Peacock 1982, 1986; Peacock and Bates 1982). Guatemala is characterized as a bi-ethnic society composed of two cultural traditions, Mayan Indian and Ladino (Colby and van den Berghe 1979; Hinshaw 1975). Each cultural

tradition displays unique behavioral characteristics that serve as ethnic symbols or markers. Individual ethnicity scores were derived by factor analyzing salient ethnic behavioral characteristics exhibited by an individual such as language and clothing patterns (Peacock 1986). Household ethnicity scores were computed by obtaining an average score for all household members. The household scores range between pure Ladino, where all household members exhibit purely Ladino characteristics, to pure Indian, where all household members exhibit purely Mayan Indian behavioral characteristics. Given the extent of ethnic discrimination in Guatemala, the higher the ethnicity score, indicating that the household is more Ladino, the higher the expected domestic assets.

The final two measures included in the model predicting future socioeconomic assets are both community contextual effects. The political structure of Guatemala amounts to a dendritic chain of command with the national capital being the most important node of the structure from whence resources, directives, laws, etc., are dispersed. The location of a community within this dendritic structure is important for normal economic change but of critical importance in terms of system responsiveness to disaster needs and community access to relief and reconstruction resources. Therefore, the higher up the dendritic chain a community falls (i.e., the more politically integrated it is) the more likely a household will be to experience positive economic change. Political integration was operationalized in terms of the political designation of the household's community of residence. Political designation in Guatemala range from 'aldeas' which are tiny rural villages, through 'cabaceras,' which resemble small rural county seats, to department capitals,' which are roughly equivalent to, but much smaller than, state capitals in the United States. Political status is entered into the equation by using a pair of dummy variables for cabaceras and department capitals; aldeas are the excluded category.

In addition to designating political integration, these variables are proxies for community complexity, size, and rurality, variables that researchers have suggested are important to recovery (Wenger 1978; Dynes 1970). Dynes (1970), for example, suggested a community's organizational

complexity and size are important because households located in larger more complex communities have greater access to goods and services thereby facilitating recovery. In addition, Bolin's (1982) work suggests that rural households have more difficulty recovering from disasters. The implication of these findings is that households residing in larger, more complex, and urban departmental capitals should reach higher levels of recovery than households in smaller, less complex, and rural aldeas.

Because of the importance of ethnicity in Guatemalan social structure, an additional variable was included in this analysis. Guatemalan political and economic structure, both national and local, is controlled by the dominant ethnic group, Ladinos. As a consequence, these structures may be more responsive to communities dominated by Ladinos. This may especially hold true following a disaster. In order to assess this hypothesis, a single variable indicating the percent of community's population classified as Ladino was included in the model.

The regression analysis predicting 1980 domestic assets for control households utilizing the above variables is presented in Table 1. The F-ratio of 119.61 is highly significant and has a probability of less than .01, with 68 percent of the variance explained. As expected, domestic assets in 1975 is the most important predictor, accounting for most of the variance in 1980 domestic assets. This should be of no surprise since one's previous wealth is usually the best predictor of future wealth. Household ethnicity is the next most important predictor of 1980 domestic assets followed by the head's education. Interestingly, head's age has a significant negative effect on future domestic assets. This implies that the older households show a decline in domestic assets. While inconsistent with most conventional attainment research, this finding is not completely unanticipated given more recent research. Also of interest is the household size coefficient which approached significance at the .1 level (prob. of .11), indicating that larger household size is of economic value. The effects of the other variables are non-significant.

Predicted 1980 domestic asset values for each experimental household were computed by plugging appropriate information from each household into the above equation.

The final step in establishing the net recovery measure consisted of subtracting the predicted level of assets from actual 1980 assets attained by the household after four years of the recovery process and after participation or nonparticipation in reconstruction programs. The resulting net recovery score has a mean of -155 indicating that on average experimental households failed to reach recovery levels by $155. In other words, the total value of their domestic assets four years after the earthquake was on average $155 less than would be expected for the average household given an expected rate of change comparable to the control group. The maximum observed net recovery score was $3129, while the minimum was a minus $2110. This net recovery variable will be the dependent variable in subsequent analysis.

Table 1: Equation Predicting 1980 Domestic Assets Using Control Households

	b's	Beta's	S.E.
Constant	592.52***		138.87
1975 domestic assets	.92***	.78	.04
Head's education	26.65**	.08	12.43
Head's age	-4.87***	-.07	1.92
Household size	21.18	.04	13.33
Household ethnicity	103.31***	.11	49.11
Cabacera	23.13	.01	66.15
Dept. capital	-118.21	-.05	84.22
% Ladino	-2.05	.09	1.33

R-square = .68 F-ration = 119.61***
** = probability < .05 *** = probability < .01

THE ANALYSIS OF NET RECOVERY

Two sets of variables are employed to explain net recovery. The first set has been discussed previously: household

ethnicity, head's education, head's age, household size, 1975 domestic assets, political status of community, and the percent Ladino in the community. These variables were included in further analysis to determine if they played additional roles in determining household recovery. The focus of this analysis, however, was to determine the effects of earthquake damage and involvement in reconstruction aid programs on recovery.

Earthquake damage was measured by the absolute dollar loss incurred by each household. This was computed by depreciating the value of predisaster assets by the amount of damage suffered by each asset item. The mean damage for the experimental group was $780. This amount may not seem high by western standards, but the mean pre-earthquake domestic assets for this sample was $1196, thus the loss of $780 represents a 65 percent loss. While some households experienced no damage, the maximum observed loss figure was $3328.

The final group of variables included in this analysis indicate involvement in particular aid programs by a household. There were many types of aid distributed in Guatemala following the earthquake. The most substantial aid, in terms of dollar value, personnel, and time was housing reconstruction aid. Four types of housing reconstruction programs were evaluated. The most substantial aid in terms of dollar value was offered by programs that furnished victims with a complete reinforced concrete block house with sheet metal roof and concrete floor. Many of these houses were wired for electricity and some were fitted with plumbing. These houses were considered a permanent housing solution and represented a substantial improvement in housing quality for most recipients. Hereafter this type of program is known as "permanent." The value placed on such houses by participating agencies and by market surveys of building cost was around $1200.

A second type of housing aid was a one-room temporary house with wooden walls and sheet metal roof valued at approximately $500. These structures were intended to be used as dwellings for only a short time, the few months needed for the household to acquire more permanent housing or rebuild damaged dwellings. Many of these shelters were modified by disaster victims and became more than

temporary. They will, however, be referred to as "temporary."

The third type of housing assistance involved the distribution of free or discounted sheet metal roofing, known in Guatemala as "lamina." Sometimes lamina roofing was given in conjunction with education in aseismic construction techniques. In addition, many aid programs established local committees to assist in the program's administration and to organize infrastructural improvements with the money earned from sale of lamina. The value of this roofing was about $50. The fourth, residual category, includes those households which received no housing assistance at all. Such households will be collectively known as the "no-aid" group. These housing program types were included in the analysis through a series of three dummy coded variables. In the few cases that a household received two types of aid it was placed in the category representing the largest monetary input. In this analysis, those receiving no aid will be the excluded or comparison category.

In sum, two general sets of variables were used to predict net recovery following the Guatemalan earthquake. The first set of variables included a number of measures taken on the household and its community context. A second set was used to assess the consequences of disaster damage and involvement or non-involvement in one of three types of reconstruction programs. The first step in the analysis of net recovery was to assess the relative importance of earthquake damage and reconstruction aid as compared to other household variables in predicting recovery.

Table 2 presents unstandardized regression coefficients for four equations in which net recovery has been regressed on different sets of variables. Model One, the model including only household and community variables, is statistically significant, yet explains only 4 percent (adjusted R-square) of the variance in net recovery. Adding a damage variable to this model, as was done in Model Two, does not significantly enhance its explanatory power (F-ratio of .42), but adding program involvement variables to the basic model does (see Model Three). Indeed, Model Three explains 18 percent of the variance, four and a half

times that of the basic model (F-ratio of 47.75). While adding damage to the basic model did not enhance its explanatory power (see Model Two), adding it to the model with household characteristics and program variables (see Model Four) does increase the explanatory power significantly (F-ratio of 7.43). These findings suggest that factors associated with normal allocation mechanisms and damage, while important determinants of recovery, played a secondary role when compared to the overwhelming importance of program involvement.

Table 2: Regression Equations Predicting Net Recovery (n = 607)

	model #1	model #2	model #3	model #4
Constant	-754.40***	-676.52***	-665.62***	-635.16***
1975 assets	-0.07	0.02	-0.08	-0.02
Head's educ.	28.87**	27.21**	24.33*	23.26*
Head's age	4.29**	4.37**	5.25***	5.26**
HH size	13.13	13.36	6.16	6.07
HH ethnicity	-44.44	-41.57	35.99	37.06
Cabacera	365.92***	397.21***	124.34	156.00**
Dept. capital	390.83***	413.53***	480.08***	490.18***
% Ladino	1.43	0.94	1.51	1.20
Damage		-0.22***		-0.16***
Lamina			-16.48	4.89
Temporary			-390.07***	-343.37***
Permanent			650.50***	672.9[illegible] *
R-squared	.0578	.0688	.1933	.1984
Adj. R-squared	.0452	.0548	.1784	.1822
F-ratio	4.59***	4.90***	12.96***	12.25***

* = < .1 ** = < .05 *** = < .01

Given the dramatic consequences of program involvement and that it implied much more than simply the receipt of materials or a house (i.e., educational programs, infrastructural improvements, leadership development, and access to community services) involvement in different programs can be thought of as qualitatively different treatment effects. Indeed, these treatment effects may have altered the process of recovery significantly. In other words, the effects of the other variables may be altered depending upon program involvement. To determine whether program involvement altered the process of recovery, a test for homogeneity in slopes across program groups was conducted (the interactive model is not presented in the interest of space). While the model containing household characteristics, program involvement and damage variables presented in Table 3, explains 20 percent of the variance in net recovery, reanalysis of this model allowing the slopes to vary across program types, thereby assessing for interaction effects, increases the explained variance to 28 percent. An F-test for increment to R-square yields a ratio of 2.23 which is statistically significant at the .01 level. These results indicate that the recovery process was significantly different across program types. In other words, very different recovery processes occurred dependent upon the type of housing reconstruction program in which each household was involved.

Reanalyzing the recovery model, this time for each program group, yields the results found in Table 3. Each of the regression models predicting net recovery for each aid group is significant, although the model for "no-aid" households is only significant at the .10 level. Examining the adjusted R-squared values, it can be seen that while the no-aid model accounts for 8 percent of the variance in net recovery, the model for lamina, temporary, and permanent household account for 21, 17, and 16 percent of the variance respectively. As anticipated, the process of recovery is substantially different for each aid group.

The constant in each of these models represents the mean net recovery score for households in aldeas. The non-significant constant for "no-aid" households indicates that the

Table 3: Separate Regression Equations for Aid Groups

	No Aid (N=199)	Lamina (N=152)	Temporary (N=155)	Permanent (N=101)
Constant	-149.49	-762.86***	-1732.57***	1038.66***
(standard error)	(345.06)	(244.58)	(286.23)	(462.28)
1975 assets	-0.04	0.07	0.13	-0.51**
(Beta's)	(-0.04)	(0.06)	(0.11)	(-0.25)
(standard error)	(0.09)	(0.16)	(0.17)	(0.29)
Head's level of education	13.52	101.38***	33.52	-74.56**
	(0.06)	(0.35)	(0.13)	(-0.23)
	(20.83)	(27.24)	(25.55)	(34.43)
Head's age	0.34	8.99***	11.82***	0.81
	(0.01)	(0.22)	(0.23)	(0.02)
	(4.01)	(3.31)	(4.05)	(5.22)
Household size	-1.96	0.13	63.99***	-55.86
	(-0.01)	(0.00)	(0.21)	(-0.16)
	(27.73)	(23.49)	(23.92)	(34.87)
Household ethnicity	240.54*	29.68	-188.50	60.33
	(0.22)	(0.03)	(-0.15)	
	(134.58)	(117.82)	(134.01)	
Damage	-0.04	-0.40**	-0.36	
	(-0.02)	(-0.28)	(-0.24)	
	(0.12)	(0.17)	(0.23)	(0.28)
Cabecera	85.54	346.93***	46.94	178.86
	(0.05)	(0.24)	(0.02)	(0.08)
	(0.12)	(0.17)	(0.23)	(0.28)
Department capital	381.49**	458.55**	288.86**	902.86**
	(0.22)	(0.25)	(0.20)	(0.29)
	(196.25)	(162.17)	(138.93)	(397.06)
Percent Ladino	-1.94	-0.52	6.00***	2.08
	(-0.09)	(-0.03)	(0.26)	(0.12)
	(2.72)	(2.31)	(2.66)	(3.25)
R-square	.0822	.2598	.2231	.2341
Adj. R-square	.0385	.2129	.1749	.1584
F-ratio	1.88*	5.54***	4.63***	3.09***

* = < .10 ** = < .05 *** = < .01

mean net recovery for these households was not significantly different from zero. In other words, these households on average reached recovery levels (i.e., the level of domestic assets they would have been expected to attain given no earthquake), even without receiving any organized housing assistance. The non-significant coefficient for cabaceras indicates that "no-aid" households located in cabaceras also reached recovery levels. "No-aid" households in department capitals fared better because they not only met, but exceeded recovery levels by $240. Thus, households that were not involved in an aid program and lived in aldeas or cabaceras reached levels of domestic assets they would have attained had no earthquake occurred. "No-aid" households that resided in department capitals however surpassed recovery levels and experienced net upward socioeconomic mobility.

Lamina and temporary households did not fare as well. Aldea households receiving lamina and temporary housing failed to meet recovery levels by a minus $763 and $1733 respectively. Since pre-earthquake mean domestic assets was only $1196, these amounts are staggering. Lamina households in both cabaceras and department capitals fared significantly better than aldea households, although their means were still below recovery levels at a minus $416 and $304 respectively. Temporary households in department capitals fared significantly better than aldea households; however, these households also failed to meet recovery levels by a very substantial $1448.

While only "no-aid" households in department capitals experienced over recovery or upward mobility, every household involved in permanent housing programs experienced remarkably high levels of upward mobility, holding other factors constant. Households receiving permanent housing in small rural aldeas surpassed recovery levels by $1039 and households in cabaceras experienced essentially the same levels of overrecovery. In department capitals those receiving permanent housing surpassed this level by another $903 for a mean of $1942 in domestic assets above the levels of domestic assets they would have been expected to attain, given normal change processes. Hence, households involved in permanent housing projects experienced remarkably high levels of upward socioeconomic mobility.

Overall there were wildly divergent recovery levels among experimental households depending upon program involvement and place of residence, holding other factors constant. Involvement in lamina and temporary housing programs appears to have had a retarding effect on subsequent domestic assets levels, resulting in net downward mobility. These effects were mitigated somewhat by residence in more urban and complex communities but not enough to result in recovery. On the whole, "no-aid" households fared much better than lamina and temporary groups, all households reaching recovery levels and those located in more urban department capitals exceeded recovery levels by $381. This finding is probably due in part to a self-selection process. In other words, "no-aid" households may have been better able to meet reconstruction needs and thus choose other means than standardized reconstruction programs, to rebuild their houses. In contrast to all other subgroups, households that were involved in permanent housing programs, especially those in more urban communities, not only met but substantially surpassed recovery levels.

At first appearance some of these results may seem anomalous. How could the receipt of aid have a retarding effect? It must be remembered that Guatemala is a developing society in which there is rarely sufficient capital for a household to completely build a new house in one short period. Therefore, building the family house is usually a protracted process. In such a situation, what are considered temporary housing solutions in the developed world become relatively long-term housing solutions in developing countries. Thus, households receiving "temporary solutions" to housing need were saddled with low quality semi-permanent housing, while those receiving "permanent solution" had high quality permanent housing.

Another seeming paradox involves the relationship between net recovery and pre-earthquake assets. While not significant when all households are taken as a whole (see Table 2), pre-earthquake assets had a significant and *negative* effect on net recovery for the permanent households (see Table 3). Although the average permanent household experienced upward socioeconomic mobility, this coefficient indicates that the greater the levels of pre-earthquake assets the lower the levels of upward mobility.

Thus, permanent housing programs had a leveling effect on participating households by pulling those households at lower levels of the wealth distribution up and lowering those at the top. Given the model of normal wealth attainment (see Table 1), this program represents a radical departure from normal socioeconomic attainment processes.

Education had significant effects on net recovery for lamina and permanent households. In permanent households, education affected net recovery in a fashion analogous to pre-earthquake assets. That is households with higher levels of education experienced lower levels of upward socioeconomic mobility. Among lamina households, however, education has a significant positive effect on recovery, indicating that households with higher investments in human capital were better able to make use of lamina program involvement to improve their living conditions. Here one sees the economically conservative elements of lamina programs in Guatemala, which determined who would receive such aid by a household's ability to pay the subsidized price for the product. This meant that the same factors that normally determined the distribution of economic benefits in terms of market relations operated in the lamina program. Therefore, this program favored the "haves" over the "have nots." Permanent housing programs on the other hand, tended to reverse this process.

For all experimental households, head's age had a significant and positive effect (see Table 2); however, examination by aid groups presents a much clearer picture of this effect. Age of household head, a proxy for household's life cycle stage and labor force experience, is only significant for lamina and temporary households. The positive coefficients indicate that older households were relatively better off than younger households. Given the retarding effects of involvement in these programs and the negative effect that age usually has on attainment (see Table 1), these coefficients indicate that older households experienced less downward economic mobility than younger ones as a result of association with temporary housing.

Household size, ethnicity and damage are each significant in only one of the four equations. Household size has a significant positive effect on net recovery among temporary households. This may have been because larger households

required investment of labor or capital to build other structures or additions to the temporary house due to the small size of one-room temporary shelters, thus improving household assets. Interestingly, household ethnicity is significant and positive in the self-help group indicating the more Ladino the household the higher the levels of recovery or over-recovery. Unlike the pooled regression (Model Four, Table 1), damage is only significant in the lamina equation. So, for lamina households, damage still had negative consequences a full four years after the earthquake. This effect may have shown up for temporary households but for the considerable negative consequences of program involvement. Finally, location in communities with greater percentages of Ladinos had a positive effect for temporary households. Thus, there is weak support for the proposition that ethnic composition of a community played a part in resource allocation.

SUMMARY AND CONCLUSIONS

The most important single determinant of household recovery or failure to recover following the Guatemalan earthquake was aid program involvement. Housing programs that were designed by agency personnel and planners to provide temporary housing proved to have long-term negative effects on recovery, measured in terms of living conditions. In the four years covered by this study, holding other factors constant, households involved in temporary housing programs failed to reach recovery levels by a staggering amount compared even to those that received no form of aid. Temporary houses simply became semi-permanent dwellings, perhaps due to economic and social factors associated with the "normal" conditions of underdevelopment in Guatemala. Permanent housing programs, on the other hand, had exactly the opposite effect in that they not only produced recovery on an average, but resulted in positive increases in the value of domestic assets well above recovery levels because they provided participants with long-term housing that was superior to pre-disaster housing in most cases.

These findings suggest that consideration of the technological appropriateness of external interventions is

mandatory in disaster aid situations, especially relative to the stratification systems of the country and its conditions of development or underdevelopment. Temporary housing has long been used to meet emergency needs in developed societies while governmental and private agencies plan and execute programs to provide permanent housing. In lesser developed societies, however, resources to provide both temporary and permanent housing are often not available. Therefore, solutions utilized in disaster situations in developed societies are not directly applicable to the less developed world. In particular, housing for most people in such societies is usually minimal and acquired through a many-staged process in which households ordinarily participate in the actual construction of their own shelters. Also it is rare that governments have the knowledge, experience or resources to execute large public housing programs. Under such conditions the expenditure used to provide temporary housing which may approach half the cost of pre-disaster permanent housing would be used better to start the permanent housing process using autoconstruction techniques.

As a matter of fact, most of the permanent housing programs in Guatemala did exactly that. The result was that earthquake victims lived in self-constructed temporary shelters made of salvaged materials and occasionally from lamina bought from subsidized lamina programs while they participated in agency coordinated permanent housing programs. After four years those who followed this procedure ended up considerably better off in terms of living conditions than those who received agency-constructed temporary housing.

Caution must especially be used in providing temporary housing in disaster situations where other programs are providing permanent housing. Knowing that permanent housing programs are underway elsewhere, victims who receive temporary housing may assume they too will be provided permanent housing if they simply wait and do not solve their housing problems on their own. Some temporary housing recipients in Guatemala appear to have done just this. In contrast, those receiving no aid went about rebuilding their own houses. This is not an argument for no aid, but one for planned autoconstruction programs which

utilize victim labor and ingenuity in solving the housing problem.

While a number of household characteristics--prior wealth, head's education, life cycle stage, size, ethnicity, earthquake damage--also had significant effects on disaster recovery, these effects varied by the type of aid received by the household. Some forms of aid are essentially conservative in nature in that factors normally determining allocations of scarce resources are still important determinants of recovery and operate in a similar or even exaggerated fashion after disasters. Other forms of aid are essentially radical in that they directly counter normal allocation mechanisms and resulted in stratification changes.

While the net effect of permanent housing programs was upward socioeconomic mobility and a leveling of its clientele, the net effect of the combination of these different programs, given their divergent recovery trajectories, was an increase in socioeconomic inequality. Households in permanent housing programs experienced dramatic increases in socioeconomic status while lamina and particularly temporary households experienced equally dramatic negative socioeconomic mobility. These findings suggest that not only were there alterations in the allocation of scarce resource among households following the earthquake, but that there were also significant alterations in the structure of socioeconomic inequality in disaster-damaged communities.

The above analysis also lends support to the proposition that structural features of a household's social environment are important for a household's recovery following a natural disaster. Specifically, it suggests that households residing in less complex and more rural communities experienced greater difficulty in recovering from the disaster than those in larger more urban communities. Since results were consistent across program types, they attest to the salience and robustness of community structural effects.

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