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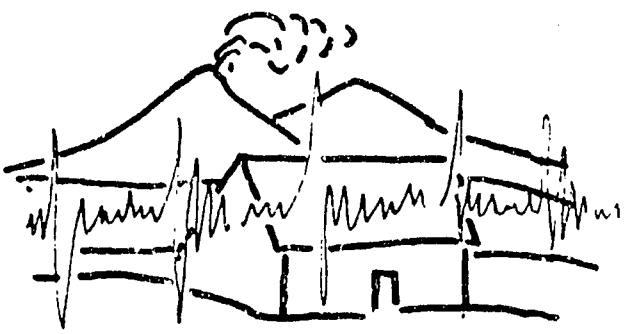
RECOVERY, CHANGE AND DEVELOPMENT:
A LONGITUDINAL STUDY OF THE 1976 GUATEMALAN EARTHQUAKE

FINAL REPORT
VOLUME 3



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RECOVERY, CHANGE AND DEVELOPMENT:
A LONGITUDINAL STUDY OF THE 1976 GUATEMALAN EARTHQUAKE

EDITED BY

FREDERICK L. BATES

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Chapter 14

An Assessment of Impact and Recovery at the Household Level

Charles D. Killian and Frederick L. Bates

Introduction

The purpose of this chapter is to describe a scale which may be used to measure the social and economic impact of the earthquake and to use this scale to measure the effects of the earthquake and the reconstruction process on households in Guatemala. There are a variety of ways to measure the impact of a natural disaster just as there is a variety in the types of losses and damages sustained. An individual may lose a job, a family member, his means of preserving food, a whole house, or faith in God and in mankind. A community may lose a factory, its public facilities, or its key leadership. Nations likewise may lose bridges, transportation and communications facilities, political leadership or even a political system. In addition, they may incur great debt, both foreign and domestic, and lose what foothold toward development and national autonomy they have attained at great costs in the past.

As reverberations of the disaster echo through the society and the social system begins to react, ethnic antagonisms, rural-urban differences and class conflicts may occur which can also be viewed as the "impact" of a complex interplay between natural and social environments. So we see that damage or impact takes a variety of forms and may operate at several levels of scale on human societies and their members.

Given this complexity, the task of measuring impact must be restricted to fit particular research or evaluation objectives. In the case of

natural disasters of the magnitude of the 1976 Guatemalan earthquake, even gross aggregate statistics such as the foreign debt incurred, or figures on changes in the balance of payments, inflation and gross national product, as well as estimates of destruction,will give some measure of impact. But, these gross national statistics fail to furnish a picture of where the impact occurred within the social system or on the differential impact of the disaster on various parts of the system.

A need exists for valid and reliable measuring scales through which the impact of disasters on human social systems can be measured with respect to various social units. Furthermore, there is a need for an instrument that measures not only the impact of a disaster on the social system but which also permits monitoring of the recovery process as it takes place over time.

Though physical science measures for assessing the impact of disaster agents are available, these instruments do not yield the kind of information necessary for social research. A Richter scale number, for example, does not furnish an indicator of the social and economic impact of an earthquake. What is needed is a scale that measures impact in terms of social indicators. Ideally, the scale created should be applicable to many different kinds of disaster situations involving various kinds of disaster agents. It should, in other words, be usable in measuring the impact of hurricanes, floods, tornadoes and earthquakes, and even man-caused catastrophes such as wars, violent explosions and fires. In addition to being applicable to various forms of disasters, to be maximally useful, a social impact measure should have cross-cultural relevance.

Researchers in the field of disasters have been accustomed to dealing with the magnitude of a disaster's social and economic impact by the use of crude indicators. For example, casualty figures in terms of the number of people killed and injured or the total population affected by the disaster are used as measures. Similarly, figures on the total value of property destroyed or damaged, or on the number of homes and businesses destroyed, often serve as crude measures of a disaster's size. It has long been known, however, that these figures are notoriously inaccurate and form a very weak basis for scientific inquiry. These sorts of figures are useful to disaster agencies in assessing the magnitude of a disaster's impact during the first few days after it occurs so that relief and reconstruction programs can be set in motion. They are not, however, very useful for research or evaluation purposes. Aside from their inaccuracy, the major fault in such measures is that they furnish aggregate level data that can not be easily broken down to the household level or to the level of small geographic areas such as neighborhoods or communities. In order to study such phenomena as reconstruction, it is necessary to know how a disaster affects specific households so that hypotheses concerning the effectiveness of relief and reconstruction programs can be tested. Because no such measuring techniques were available, it was necessary to create a methodology for measuring socioeconomic impact at household level for use in this research.

Background to Measuring Impact & Recovery

The measuring instrument utilized in this research is based on level of living scales which were originally developed to measure the socio-economic well-being of households using physical possessions as indicators

of the household's life style. By using physical possessions, level of living scales also measure indirectly the socioeconomic status of a household relative to others that are part of the same social system. Early scales such as that designed by Chapin and later modified and improved by Sewell and Belcher, measured level of living by determining the possession or non-possession of certain physical characteristics in the household (Chapin 1935; Sewell 1940 and Belcher 1951). For example, such scales give households points on the level of living scale if they possess such physical objects or facilities as (1) running water, (2) electric lights, (3) a radio or television, (4) a refrigerator or washing machine, etc.

One defect of such scales lies in the fact that as the economic situation of a society or community changes, the items which are used on the scale have to be changed in order to measure differences in a given population. If, for example, everyone in a society owns a radio, then radios can not be used as a means of differentiating the status of various household units and another item which is unequally distributed within the population has to be added in its place. This means that such scales can only be used in cross-sectional studies performed at one point in time but have inherent weaknesses with respect to longitudinal studies. Furthermore they have the more serious weakness of being highly specific to a given social and cultural context. A scale that will measure level of living in Mexico will be of little value in Western Europe or the United States. One that measures well in the U. S. in 1900 will be useless in 1980.

Still another weakness lies in the fact that the underlying dimension being measured can never be defined accurately enough to satisfy all critics. If level of living scales are intended to measure well-being, then the question arises as to what items should be included to represent such a relative state. For example, how does the possession or non-possession of a color television relate to the well-being of a household as opposed to having running water in the house? One can see a relationship between running water, health and sanitation and therefore can argue that one dimension of well-being is being tapped by such an item. Arguments concerning the beneficial effects of color television with respect to well-being are less straightforward.

In order to overcome some of these difficulties, especially those related to the use of such scales in longitudinal and cross-cultural studies, Belcher created what he refers to as a cross-cultural level of living scale (Belcher 1972). It is this scale which is used as the basis for the work being discussed in this research. It has many advantages in measuring disaster impact and recovery. Aside from its cross-cultural and longitudinal advantages, such a scale records in detail the types of physical possessions associated with a household. These include housing characteristics, urbanized services, and other household equipment. Since disasters destroy property, this offers a chance to measure impact in terms of property damage.

The reasoning behind Belcher's scale is that households in every society face certain common functional problems. For example, in every society there is a need for shelter in the form of housing. As a

consequence every society, no matter what its level of development or cultural preferences, provides some means of sheltering the household. Furthermore, households around the world utilize water in performing household functions, store and prepare food, dispose of human waste, utilize utensils for cooking and eating, face a problem of providing light during periods of darkness, and so forth. For any given function, however, there are alternative means by which the function is performed within a given society and between various different societies that range along the scale of economic and technological development. For example, taking the function of food preservation, there are various ways in which perishable food may be stored or preserved within the household. One way is to simply place it on the ground or on a shelf. Another is to use a clay jar, basket or wooden box as a storage device. Still another is to employ a spring house or cellar. Finally, one might employ an ice box or an electric or gas refrigerator. These various means of preserving food can be ranged along a scale representing what Belcher called technical efficiency. Starting at the top the most technically efficient method would be an electric or gas refrigerator. Next would come an ice box or ice chest; then a spring house or cellar, and towards the bottom, clay jars, baskets or wooden boxes. For each of fourteen separate functions, Belcher identified five alternative levels through which household functions could be performed and assigned scores in an arithmetic progression to these five alternatives. The alternative with the highest level of technical efficiency received a score of 5, the next 4 and so on, with the lowest receiving a score of

one. Thus an interviewer could obtain a level of living score for a household by determining how the fourteen different functions were performed within that household and giving appropriate scores to each item. The highest possible score would occur when the household performed all fourteen functions, using the highest or most technically advanced method of performing the function and the lowest score would be obtained at the opposite extreme (Belcher 1972).

In connection with the Guatemalan earthquake study, eleven of the fourteen items used in the Belcher scale were employed as a means of determining the level of living of households. A means was devised for using these same items to measure the impact of a disaster on the household. This was done as follows. Respondents were asked, for example, what the walls of their houses were made of at the time of the earthquake. This would yield a score on the Belcher scale, depending on the type of wall employed. For example, if the walls were made of brick, concrete block or masonry, they would receive a score of five. Respondents were then asked how much damage occurred to the walls during the earthquake. Damage was rated on a scale which ranged from destroyed through heavily damaged, to slightly damaged, and finally, to no damage. These damage ratings were then used as a means of depreciating the score for the walls of the house in terms of the amount of damage which had occurred. If the walls were destroyed, the score was multiplied by zero. If they were heavily damaged, it was multiplied by .33; if slightly damaged, by .67, and if no damage occurred, by one. This procedure was used for all household functional areas upon which damage could be computed. As a

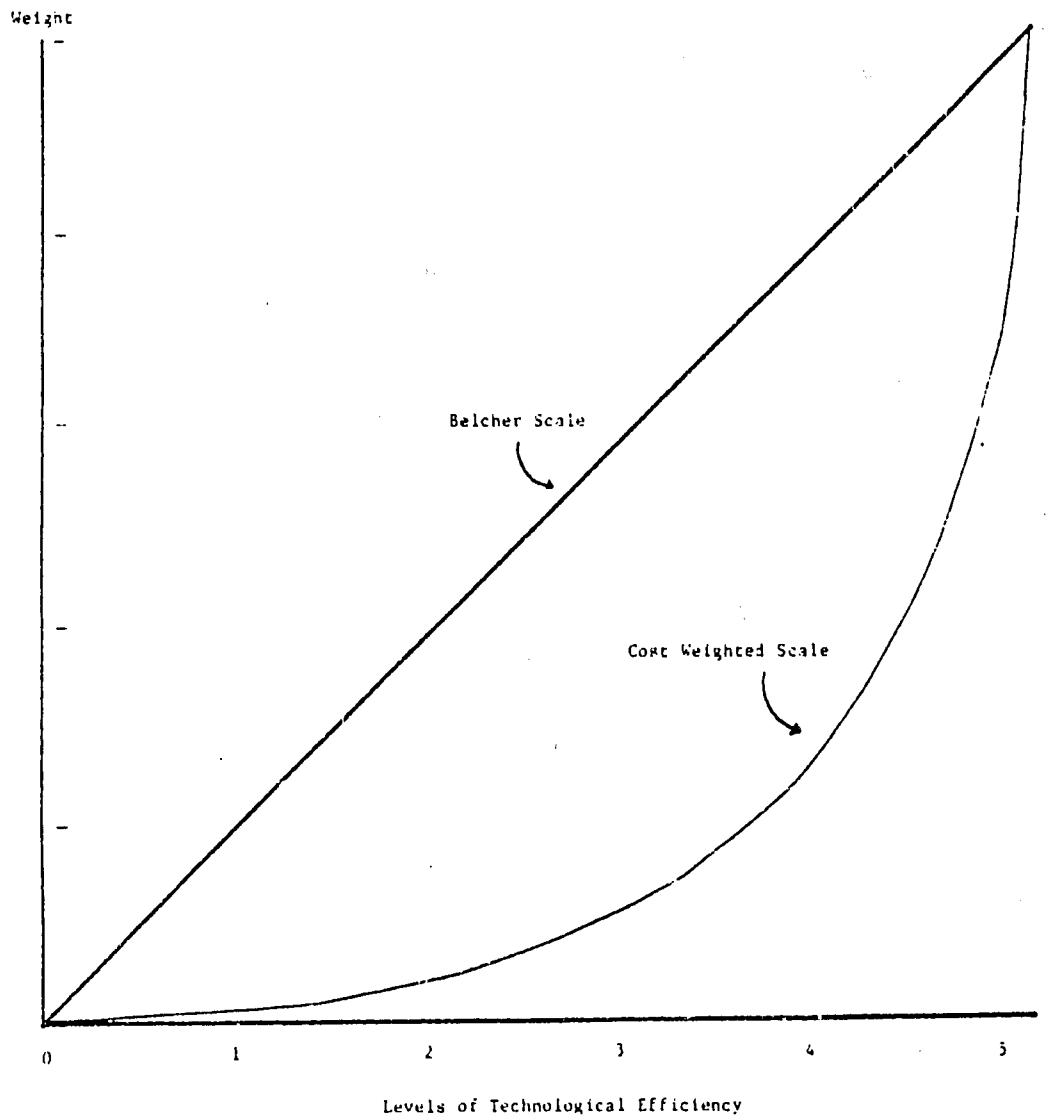
consequence, a post-impact level of living score reflecting the amount of loss or damage suffered in the earthquake was obtained. The reasoning upon which this procedure was based is apparent. The house and household equipment were depreciated in value, so to speak, according to the amount of damage that they suffered, thus yielding a lower level of living score which reflected the physical impact of the disaster on the individual household. The modified Belcher level of living scale employed in this research contains items particularly suited to the Guatemalan case. These items are given in the appendix of this chapter, along with the weights assigned.

During the course of analysis of materials obtained by using the Belcher method, certain questions arose concerning the underlying reasoning behind the Belcher scale, especially as it is reflected in the weighting of items in terms of "technological efficiency." The basic problem was that the Belcher scale weights different alternatives for performing a given function along a five point scale representing technological efficiency with each alternative being equally spaced with respect to those adjoining it. It was observed, however, that the household items represented by these scales varied considerably in money cost. For example, taking the food preservation item, a clay jar or basket in Guatmala used for food storage costs in the neighborhood of $1.00 to $3.00, while an electric or gas refrigerator costs $700 or more. If a person's clay jar were destroyed in the earthquake, one point would be lost on the Belcher type level of living scale. Similarly, if a refrigerator were destroyed, five points would be lost. This did not

seem to reflect the relative value of various types of loss although it did reflect some proportional amount. Furthermore, it was observed that all items on the Belcher scale seemed to share this common characteristic. It was more as if the items at the top of the scale for each function cost 500 to 1000 times what the ones at the bottom cost, while they were being weighted only 5 times as heavily. This relationship between the two scales can be diagrammed roughly as shown in Figure 14-1.

Since we were interested in measuring change it became important to weight the items according to some metric which would reflect change more accurately. Using the Belcher scale, a person could move up or down a point on the scale, at either the top or the bottom, and the amount of change would be equivalent. If, however, the items on the scale were weighted according to cost, changes at the top and bottom would be different. Furthermore, it was observed that the two ethnic groups in Guatemala, Indians and Ladinos differed substantially in how they scored on the Belcher level of living scale. Ladinos scored near or above the middle of the scale, while Indians scored closer to the bottom. As the recovery process progressed, it appeared that Indians were catching up with Ladinos at a fairly rapid rate. This, however, could be a function of the way in which the items on the scale were scored in arithmetic progression. If one goes from the bottom of the Belcher scale to the next highest level, he has moved an average of one point. Suppose we were dealing with a case at the top of the scale which moved from next to the top to the top, thus gaining one point. The two would appear to have moved the same distance in level of living but the cost of making such a move in terms of money

Figure 14-1


Weight
Belcher Scale
Cost Weighted Scale
0
1
2
3
4
5
Levels of Technological Efficiency

investment in household equipment would be quite different. Furthermore, the economic gain would be disproportionate. It could cost as much as 500 to 1000 times as much to make the same change at the top as compared to the bottom of the Belcher scale. The observation that Indians were improving faster than Ladinos could therefore be misinterpreted since their movement was from one very low level of living to one just slightly better, while the Ladinos at the top could be moving from a high level of living to one that is a good deal higher, economically speaking.

As a consequence of these problems, data were obtained from Guatemala on the cost of various items included in the Earthquake Study version of the Belcher level of living scale. These data were used as a means of weighting the items to create a new scale. This scale reflects the cost of obtaining the capital equipment to establish a given domestic life style. When damage scores are figured it reflects an estimate of the amount of dollar loss suffered as a result of impact. This method has the advantage of using a clearly defined underlying scaler dimension, cost, as the basis for measurement. It makes no assumptions about well-being or technological efficiency in so doing and therefore escapes some of the criticisms of other level of living scales. This new scale measures the relative cost of establishing a given household's life style. To distinguish this scale from other level of living scales, it will be called an "Index of Domestic Assets." In actuality, 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 necessary for such purposes. As an index, it does, however, measure relative differences between households in the same

society and also, potentially, differences between households in different societies.

Another problem which has plagued level of living scales concerns questions of relative weights of the various functional areas used to construct a particular version of the scale. These questions could be rephrased as "should the roof of a house be given equal weight with respect to water source, or food storage, or waste disposal, etc.." Although some attempts were made at weighting separate functional areas differentially, the most common approach has been simply to sum across the functional areas. The resulting score of course gave equal weight to each functional area and the selection of functional areas for inclusion in the scale became critical.

The Index of Domestic Assets is constructed in such a way that individual functional areas are unequally weighted since their weight is determined by actual dollar cost of the item used to satisfy a given function. Summing across functional areas then results in those areas having the highest potential economic value being weighted more heavily by the ratio of cost in item one to cost of item two, and so forth. All in all, the cost of housing weighs heaviest compared to other functional areas.

This seems to be a desirable property of the scale on several fronts. First of all, housing represents a major, if not <u>the</u> major, investment made by the household group. Secondly, earthquakes and other forms of disaster usually destroy property and it is this property in the form of housing from which the greatest financial loss stems for most people.

Furthermore, it is often housing which disaster mitigation agencies attempt to restore. Therefore, the domestic assets scale both reflects, or may be considered an indicator of, the relative assets, or physical capital, of the household and thus place that household in a larger distribution of well-being as well as being a useful indicator of both impact and recovery. Furthermore, a score on a level of living scale is not easily interpreted even when one is familiar with its inner workings. The domestic assets score in dollars is more intuitively understandable and should give some idea of the replacement costs of physical assets damaged or destroyed.

Another advantage claimed for the domestic assets measure relates to its cross-cultural interpretation. If an earthquake of similar magnitude strikes two different communities and does the same proportional amount of damage, but the two communities differ in household domestic assets, this will be reflected in the scores. For a very poor community where each household function is performed using the lowest cost (most primitive method),the value of the loss will be proportionately lower than in one where the opposite is the case. Furthermore, the cost of reconstructing the communities will be quite different. It may cost a thousand times more to reconstruct one community than the other, although both suffered loss of, say 50 percent, of their household level resources. Similarly, a small amount of financial aid to one community will have a greater impact on changing household level of living than in the other. These facts have far-reaching policy implications for the international disaster relief community.

Another implication is that the same amount of aid given to the lower socioeconomic and upper socioeconomic group will have quite different change implications for household as well as communities and regional economies. The way aid is distributed could partially close the economic gap among strata in the same community or society and thereby set in motion modifications in the stratification system. Since the domestic assets scale will measure relative economic status, successive measures using this scale will reflect these changes. This too has far-reaching policy implications for how disaster relief funds are utilized.

In the following pages the domestic assets scale will be utilized to show the impact of the earthquake and various aspects of the recovery process. The primary objective will be to examine experimental and control group differences at several points in time and to draw some tentative conclusions concerning changes in domestic assets attributable to the earthquake and the reconstruction process.

The question arises, "Why not use other indicators of economic well-being?" There are several replies to this question. First of all, incomes are extremely difficult to measure in underdeveloped agrarian societies such as Guatemala which are only partially commercialized. Estimates of a household's income are hampered by problems of attempting to combine income from farming with that from part-time labor engaged in frequently on only a periodic basis. Respondents do not keep accounts and tend not to remember payments in kind. Secondly, there is less resistence to multiple indicators of the domestic asset-level of living variety than there is to questions about income. Thirdly, this research was dependent upon retrospective questions to establish the pre-earthquake baseline

situation and retrospective questions about material possessions and housing are considerably more reliable than retrospective questions regarding income. And finally, most, if not all of the items used in the domestic assets scale are easily verified by a skilled interviewer. The same can not be said of income data. The drawbacks of other measures of well-being and the various advantages claimed by the domestic assets index make a good case for its validity and reliability as a measure. Aside from this, other measures do not offer the same advantage in measuring the actual impact of the disaster on infrastructure and do not measure directly the actual object towards which reconstruction is directed. Restoration of household as well as community infrastructure, rather than income, is usually the goal of reconstruction.

Domestic Assets as a Measure of Impact and Recovery at the Household Level

Utilizing the household interviews obtained in this research, domestic assets measures can be constructed at four points in time: T_1, pre-earthquake domestic assets, 1975; T_2, domestic assets the day after the earthquake, 1976; T_3, domestic assets two years after the earthquake, 1978; and T_4, domestic assets four years after the earthquake, 1980. From these various scores differences in domestic assets, or differences in amount of change may be examined for any sub-sample of households. However, before the data are examined, some problems in the measurement of change and the conceptualization and measurement of "recovery" should be addressed.

There are several criteria which could be used as a basis for defining recovery. The simplest would be to say that when a household

has reached its pre-earthquake level of domestic assets that it has recovered. This, however, assumes that things would have remained as they were had there not been an earthquake, an assumption which obviously is open to question. Instead of this, the definition of recovery should be made relative to some criteria which reflect on-going change. If this is done, a distinction can be made between "restoration" and "recovery." Restoration can be defined as a household achieving its pre-disaster level of domestic assets,while "recovery" is defined, instead, as achieving the relative position it would have attained through normal change processes, had the disaster not occurred.

The purpose of a control group is to provide estimates of what was happening at the time of the disaster. As has been pointed out before, the control communities used in this study are not strict, but loose controls. It is inconceivable that in a disaster of the magnitude of the earthquake and the resulting millions of dollars of reconstruction inputs, that there would not have been some spill-over effects on domestic assets into the area not directly experiencing the earthquake. Nevertheless, some idea of how households in the relatively unaffected areas of the country fared may be obtained and used as estimates of the "secular trend" in growth and development providing a standard against which to evaluate recovery. If this is done, recovery can be defined as the attainment of the same relative position vis-a-vis the control group as that which existed before the disaster. In this research, this will not be a pure statement of what any of the sample communities or households would have been like if no disaster at all had occurred, but conclusions concerning

the attainment of recovery will be impossible if the control communities are not used as a standard against which to make judgements.

Assuming that both the experimental groups' pre-earthquake level and the control communities' trend line provide useful comparisons, there is an additional problem. The problem is whether absolute gain and loss scores in dollars are most revealing or whether percentage gain and loss scores tell more about loss and recovery. Also, there is the question of whether the mean or median loss and recovery should be utilized to measure recovery or whether some other way of depicting how individual households fared in terms of recovery and damage should be used. These different pieces of information provide different perspectives on the situation after the earthquake and will be examined as different populations and sub-populations are analyzed.

Evaluating Restoration and Recovery

Table 14-1 shows the means and medians for the domestic assets scale for the control and experimental groups at various points in time. It also gives the results of statistical tests for the significance of difference between the medians* of the two groups. This table reveals several important facts about the earthquake and the domestic assets scale. First is the observation that just before the earthquake in 1975 the control and experimental groups were somewhat different in average domestic assets. The domestic assets scale shows that the mean cost of household possessions contained in the scale was $1214 for the experimental group as compared to $982 for the control group. This is a statistically

*The median is the point above and below which fifty percent of the population falls.

Table 14-1

Mean Domestic Assets for the Control and Experimental Groups

	1975	1976	1978	1980	$\frac{1976}{1975}$X100	$\frac{1978}{1975}$X100	$\frac{1980}{1975}$X100
Experimental $\bar{X}$	1214*	451*	1064	1280	37.1	87.6	105.4
(s.d.)	(737)	(664)	(890)	(1059)			
Control $\bar{X}$	982	874	1060	1241	89.0	107.9	126.4
(s.d.)	(873)	(833)	(850)	(997)			
$\frac{\text{Exp'l}}{\text{Control}}$X100	123.6	51.6	100.4	103.1			

Median Domestic Assets for the Control and Experimental Groups

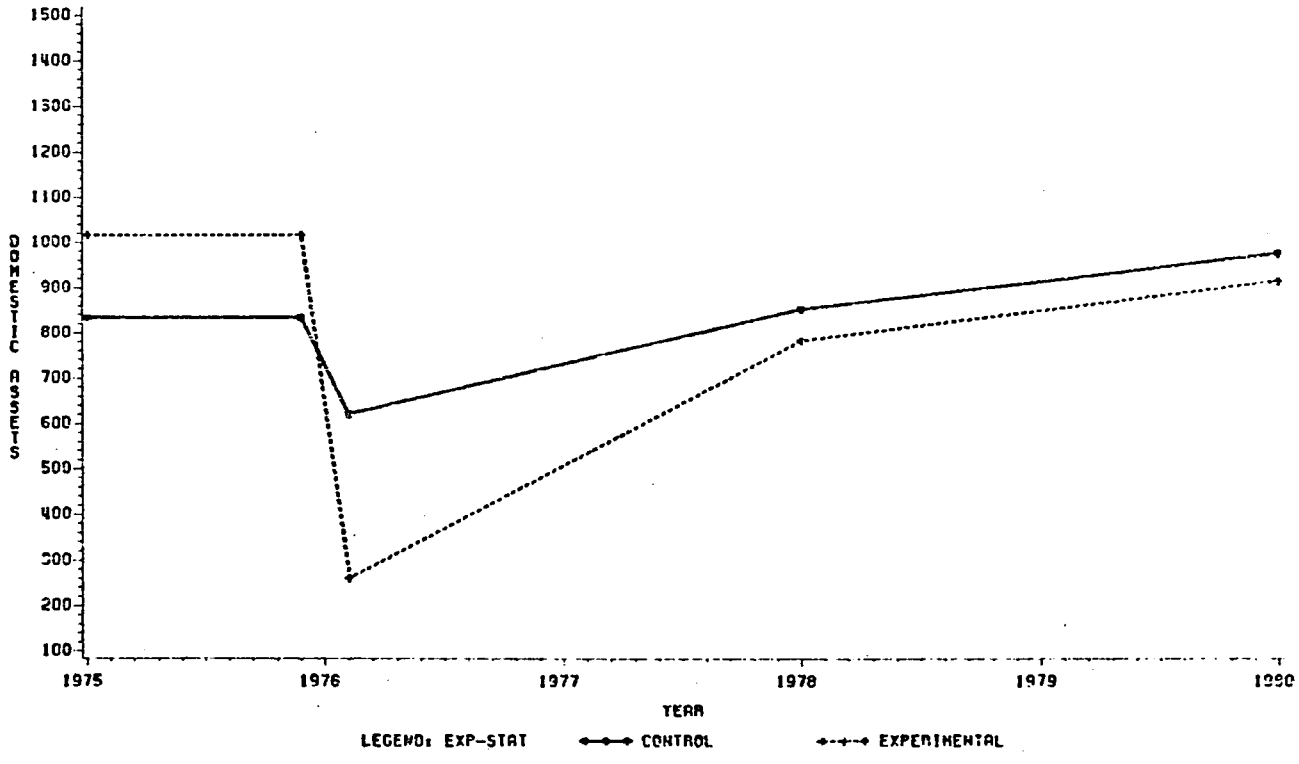
Experimental	1015	260	781	915	25.6	76.9	90.1
Control	832	620	851	975	74.5	102.3	117.2
$\frac{\text{Expl'l}}{\text{Control}}$ X100	122.0	41.9	91.8	93.8			

significant difference. Examination of the median cost of household equipment for the two groups shows $1015 for the experimental group and $832 for the control group; again the difference is statistically significant. It can be seen by comparing the mean and median, that the scores are skewed considerably, with most of the cases falling at the lower end of the distribution. This is the reason that the median test is employed for the scale. It is a better measure of the central tendency in these groups than is the mean. These median values are shown in graphic form in Figure 14-2.

The 1976 figures represent domestic assets the day after the earthquake. These figures were obtained by depreciating the 1975 domestic assets scale by the proportion of damage which occurred in the earthquake to each scale item as described earlier in this chapter. The first thing to note is that the scale shows a significant difference between the control and experimental groups but in the opposite direction from the pre-earthquake differences. This is not a particularly surprising result since the control group was selected deliberately to consist of communities with very light or no damage. It can be seen that some loss of domestic assets did occur in the control group, but not much, compared to the experimental group. If we were to "purify" the control communities so that any household suffering more than slight damage was eliminated, the control group would be one to four percent higher than it appears in the present table, but these households have been left in the control group sample so that estimates of "normal growth" are made slightly more conservative.

As a result of the earthquake, the experimental group dropped from a mean domestic assets score of $1214 to one of $451. As can be seen, both

FIGURE 14-2
DAMAGE & RECOVERY FOR EXPERIMENTAL STATUS
MEASURED BY MEDIAN DOMESTIC ASSETS



the mean and median reveal major losses in the experimental as compared to the control group. In median score, the drop is from $1015 to $260. In other words, the day after the earthquake one half of the households in the experimental group had domestic assets values of $260 or less although half were above $1015 the day before. At this point it is well to note that the difference in domestic assets scores reveals a loss of $763 out of $1214 for the mean household in the experimental group. This amounts to a 62.8 percent loss in mean domestic assets for the group. In terms of median values, the loss was $755,or 74.4 percent loss. Since the scale only measures losses on a selected group of household items, this figure should be viewed as an indicator of the disaster's magnitude rather than an actual total cost figure.

There are two ways of evaluating restoration and recovery: (1) at the individual household level and (2) at the group level taking all households together. By group level, is meant the difference or percentage of average domestic assets for the entire population in the sample group. Using this approach, the 1980 average domestic assets score for the experimental group can be compared with the average 1975 domestic assets score for the same group. If the 1980 figure is equal to or higher than the 1975 figure, then from one perspective, it could be concluded that restoration on the average has occurred for the group as a whole.

Table 14-1 shows that by 1978, two years after the earthquake, the domestic assets scores of the control and experimental groups were nearly equal ($1064 as compared to $1060). However, the meaning of these scores in terms of their starting points in 1975 was quite different for the two groups. Table 14-1 shows the percent the 1976, 1978 and 1980 scores

are of the 1975 scores for the control and experimental groups. It also shows for each year what percentage the experimental group score is of the control group score. For the experimental group the 1978 score is only 87.6 percent of the pre-earthquake value, while the control group has risen to 107.9 percent of its pre-disaster score. In other words, the experimental group is 12.4 percent behind its pre-earthquake level, while the control group is 7.9 percent ahead. By 1980 the domestic assets scores show the experimental group ahead of its initial value by $66, but this represents only 105.4 percent of its pre-earthquake score.

It is therefore apparent that while the experimental group on an average has achieved restoration, because it has risen back to its mean pre-earthquake level, it has not kept up relative to the control group. This is seen clearly in the last row in the top section of Table 14-1 which shows the percentage that experimental group values were of control group values at the four time periods. Before the earthquake, the experimental groups' domestic assets were 123.6 percent of those in the control group. By 1980 they measured only 103.1 percent. This means that the experimental group is 20.5 percent lower than needed to be fully recovered, assuming that recovery means reestablishing its relative pre-earthquake position with respect to the control group. In other words, domestic assets values must increase by $255, from $1280 to $1535, for the experimental group to be back to 123.6 percent of the control group.

On the basis of these data it appears that the experimental group has achieved restoration but that it has not recovered to its relative standing with respect to the control group. The reconstruction process

has, in other words, restored the group on an average to its pre-earthquake level of domestic assets but since a general trend towards improvement in domestic assets seems to have been occurring in unaffected areas, in effect the experimental group has failed to keep up with this trend and is relatively worse off than it would have presumably been if no disaster had occurred.

Table 14-1 also shows figures using the median value for the control and experimental groups for each year along with change and difference figures similar to those used with mean scores. There are several general points to be made from this table. The first is that the median is consistently lower than the mean in every time period for each group. This indicates that the households are not evenly distributed on either side of the mean and since the median is lower than the mean, that the majority of households have values less than the mean. The way this occurs is that some households have considerably larger domestic assets scores than the others and these extreme values influence the mean in an upward direction. The median is not susceptible to the influence of such extreme values. When values are distributed in this fashion, the median is often considered a better indication of the group than is the mean.

The second major point to be drawn from this table is that the percentages that the 1976, 1978 and 1980 scores are of the 1975 score are also lower. For example, in 1978 the experimental group is 87.6 percent of its <u>mean</u> pre-earthquake score but only 76.9 percent of its <u>median</u> pre-earthquake score. Furthermore, using median values, the experimental group in 1980 is still nearly ten percent below restoration to its 1975 value, measuring only 90.1 percent of restoration. The

control group meanwhile has risen to 117.2 percent of its 1975 value. This represents a strong trend towards improvement in domestic assets in the unaffected area even though this figure is less than the percentage improvement in the mean value. In order for the experimental group to reach recovery level as measured by the median, it will be necessary for it to reach 122 percent of the control group value. The last row of the table shows that by 1980 it had reached only 93.8 percent of that value. In other words, the experimental group must increase its median 1980 value by $275, or 30 percent, to achieve full recovery.

Both the mean and median group scores indicate that the experimental group has not recovered relative to the control group. In short, the mean and median scores yield different conclusions regarding restoration in the experimental group. The mean indicates that restoration to its pre-earthquake level has occurred by 1980. The median indicates that the experimental group is nearly ten percent below restoration. Relative to the control group, however, both the means and the medians indicate that full recovery has not yet taken place. The estimates are below recovery by twenty and thirty percent respectively. In the case of both restoration and recovery, the median values indicate lower levels of change following the disaster. This indicates that a few individuals may have over-recovered to such an extent that the means are drawn upward and mask the fact that many other individuals have remained below recovery level. In view of the fact that both means and medians can be misleading with respect to change, restoration and recovery will be examined at the individual level.

Individual Level Restoration and Recovery

Group level data can obscure individual variation and at times can be misleading with respect to how the majority of individual households making up the population fared. Since the individual level data are available and some measure of average restoration and recovery is sought, a more appropriate technique may be to define a recovery or restoration measure for each individual household and then to examine the average level of recovery for households.

Table 14-2 shows percent restoration and recovery in 1976, 1978 and 1980 for the experimental and control groups. Both means and medians are presented in this table. The mean restoration and recovery level for individual households in the experimental group is 95 percent in 1978 and 114.3 percent in 1980. The corresponding median values are 81.7 percent in 1978 and 100 percent in 1980. This says that by 1980 one half the households have reached or exceeded their pre-earthquake domestic assets value and that for individual households the mean restoration and recovery level is 14.3 percent above the 1975 score. It can be concluded that restoration has been achieved in the experimental area for at least half of the households. In order to evaluate recovery at the individual household level, households in the control group must be examined over this same period.

Table 14-2 shows that the mean change score in 1978 is 137.8 percent for the control group. In other words, when the 1978 and 1975 individual household domestic assets scores were compared using percentages, and then averaged, the 1978 score was 37.8 percent above the 1975 score.

Table 14-2

Individual Level Restoration and Recovery

	$\frac{1975}{1975}$X100	$\frac{1976}{1975}$X100	$\frac{1978}{1975}$X100	$\frac{1980}{1975}$X100
Experimental				
Mean	100.0	33.8	95.0	114.3
(s.d.)	(0.0)	(31.2)	(72.6)	(86.4)
Median	100.0	24.3	81.7	100.0
Control				
Mean	100.0	90.0	137.8	169.6
(s.d.)	(0.0)	(18.5)	(122.9)	(158.6)
Median	100.0	100.0	100.0	111.2

When this same procedure is used for 1980, the score is 69.6 percent higher than 1975. This seems to indicate a strong trend towards improvement in domestic assets scores, at least for some households. When, however, the median is considered using the same procedures, a less dramatic increase is observed. By 1978 one half of the households are above their respective 1975 levels and one half are at or below. Two years later one half the households have increased their scores by 11.2 percent or better. These figures suggest the possibility of considerable upward and downward movement.

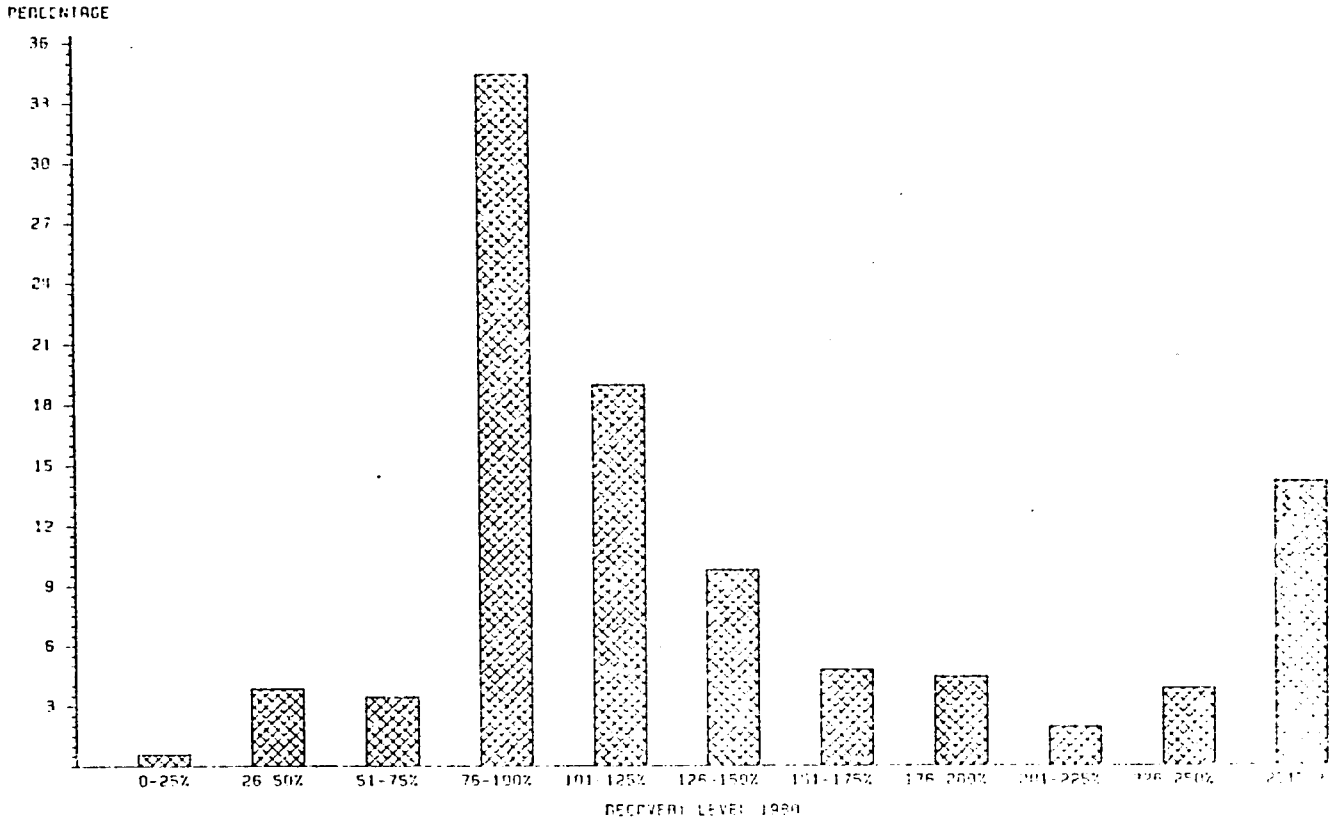
If the trend in the control group is assumed to represent what would have happened without a disaster, then the mean of the individual scores for the experimental and control groups can be used to define recovery at the individual level. The average household in the control group had achieved a level of domestic assets 69.9 percent above its pre-earthquake value by 1980. To have recovered, the average household in the experimental group should also have achieved this level. However, it had only improved by 14.3 percent, leaving it 55.3 percent below the expected level. Using means as criteria to judge recovery, it is apparent that the average household in the experimental group is a good deal away from this point. With respect to medians, a slightly more optimistic picture emerges. In the control group one half of the households had improved by 11.2 percent or more in the post earthquake period. But in the experimental group one half had achieved only 100 percent of their pre-earthquake domestic assets. Thus a gap of 11.2 percent exists between the control and experimental groups in their medians. In other words, the medians also

indicate that the experimental group has not achieved recovery but the gap is not as large as that indicated by the mean. The difference between the mean and median in both groups seems to indicate that while some households were improving far beyond their pre-earthquake domestic assets level, the majority were lagging behind. This can be seen by examining Figures 14-3 and 14-4.

These two figures show the percent of households reaching various levels of recovery in 1980 in the control and experimental groups. Recovery is computed by dividing the 1980 score by the 1975 score and multiplying by 100. The individual bars in the figures indicate the percentage of the total number of households who have reached the indicated levels of recovery. In the experimental group it can be seen that over half of the households fall below the 100 percent recovery level. Actually, about 22 percent fall below the the 50 percent recovery level. In contrast, the distribution is highly skewed towards the upper end, with nearly 12 percent reaching 200 per cent or more of recovery. In the control group the distribution is similarly skewed towards the upper end. However, the majority of households in the control group fall towards the upper and of the distribution, indicating that a general trend towards improvement was taking place for most people in the control group. These two figures lead to the conclusion that recovery in the experimental group was unequally distributed among households, with some benefitting from reconstruction programs and from other factors associated with recovery to a far greater extent than others.

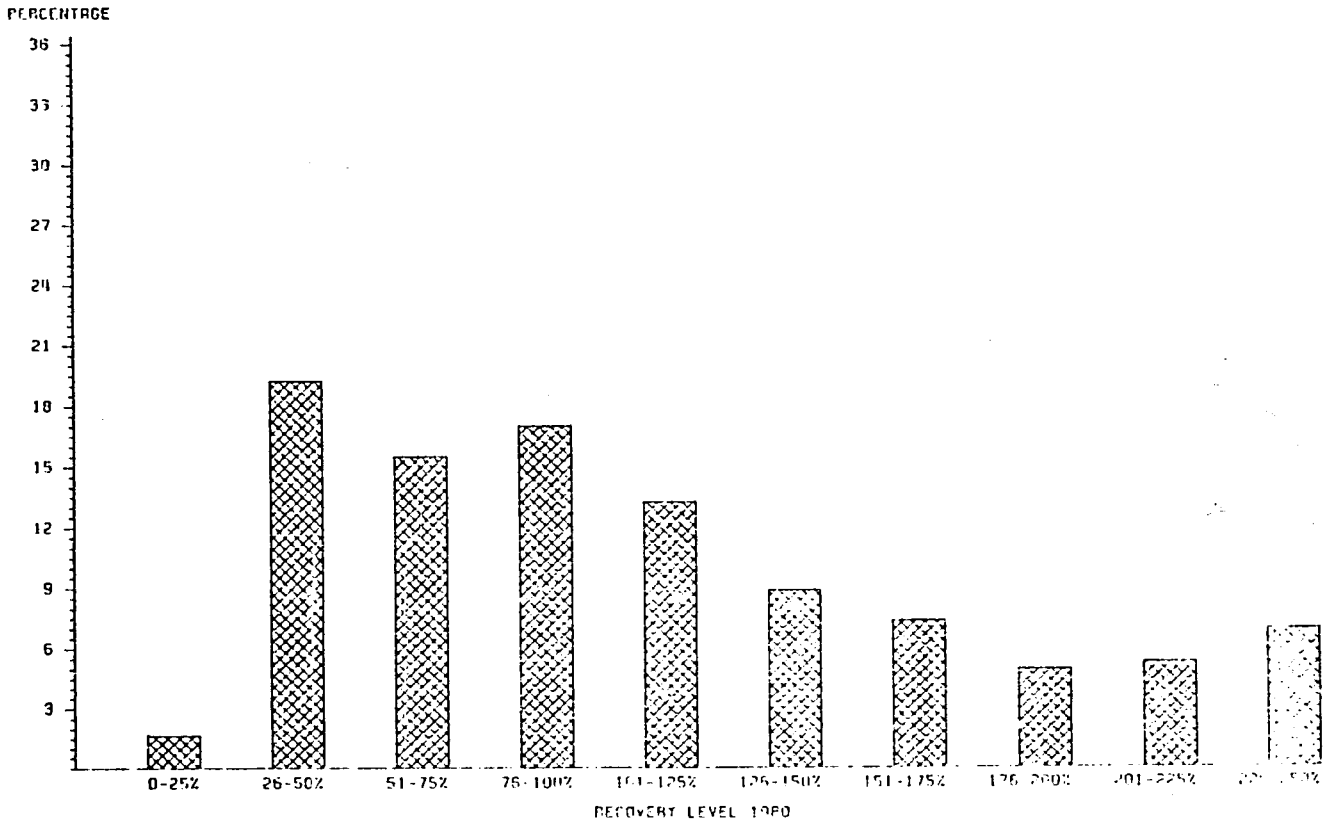
In the next section, recovery will be examined in terms of the type of place the household lived in and social class background in order

FIGURE 14-3
PER CENT REACHING VARIOUS RECOVERY LEVELS
IN THE CONTROL GROUP 1980



RECOVERY SCORE=1980/1975 X 100

FIGURE 14-4
PER CENT REACHING VARIOUS RECOVERY LEVELS
IN THE EXPERIMENTAL GROUP 1980



RECOVERY SCORE=1980/1975 X 100

to determine whether recovery was unequally distributed in different sub-populations of the sample.

Political Status of Communities and Recovery

Table 14-3 shows mean and median Domestic Assets scores for each type of community studied for each year that data exist. Only the median scores will be discussed in this section because they are considered a better measure of central tendency for these data. Change in median values is shown in graphic form in Figure 14-5. The higher median domestic assets were registered in departmental capitals before the earthquake ($1234), than municipios ($1030) and finally, aldeas or rural villages ($882). In other words, domestic assets in Guatemala before the earthquake seem to have varied with political status in the Guatemalan governmental administrative system. This contextual variable, political status of the community, roughly parallels what might be variously described as the size, complexity and remoteness of the village, though this is not strictly so in every case.

The 1976 figures show that the earthquake seems to have had its greatest absolute impact on the department capitals studied and a comparatively smaller absolute impact on the municipios and aldeas. But, proportionately speaking, this smaller absolute impact represents a greater percentage loss for municipios and aldeas. The day after the earthquake, the domestic assets in municipios were only 20.9 percent of their pre-earthquake value, while in department capitals they were 28.1 percent. Households in aldeas measured 23.6 percent of their pre-earthquake value. When the 1978 and 1980 figures are examined, the effects of the reconstruction process show up. By 1980 municipios reached 108 percent of their

Table 14-3

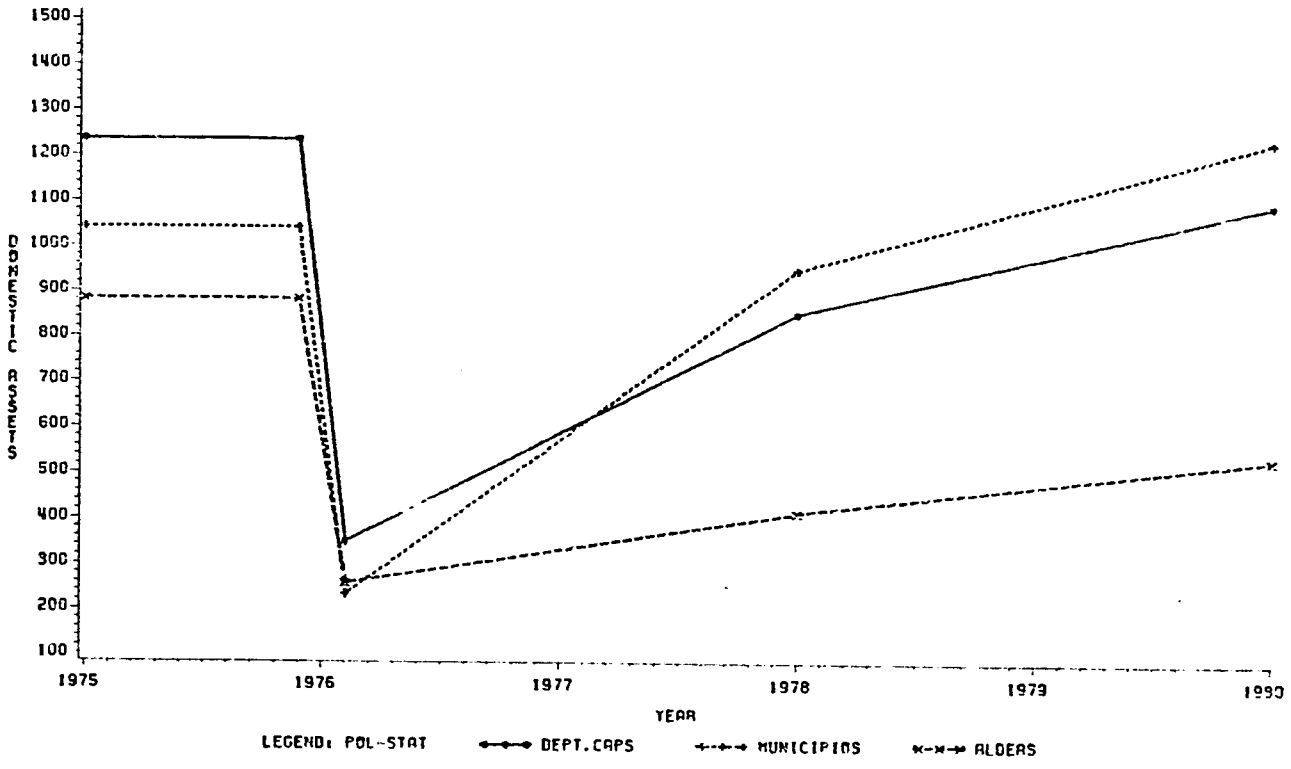
Mean Domestic Assets for Types of Communities

	1975	1976	1978	1980	$\frac{1976}{1975}$X100	$\frac{1978}{1975}$X100	$\frac{1980}{1975}$X100
Department Caps.							
Control $\bar{X}$	1574	1317	1530	1720	83.7	97.2	109.3
(s.d.)	(910)	(931)	(910)	(1096)			
Exp'l $\bar{X}$	1537	649	1281	1614	42.2	83.3	105.0
(s.d.)	(882)	(840)	(1117)	(1345)			
$\frac{\text{Exp'l}}{\text{Control}}$X100	97.6	49.3	83.7	93.8			
Municipios							
Control $\bar{X}$	992	933	1116	1287	94.1	112.5	129.7
(s.d.)	(923)	(905)	(885)	(1025)			
Exp'l $\bar{X}$	1178	392	1134	1359	33.3	98.6	115.4
(s.d.)	(631)	(575)	(794)	(920)			
$\frac{\text{Exp'l}}{\text{Control}}$X100	151.9	61.2	81.7	77.5			
Aldeas							
Control $\bar{X}$	574	518	690	861	90.2	120.2	150.0
(s.d.)	(485)	(448)	(558)	(702)			
Exp'l $\bar{X}$	872	317	564	667	36.4	64.7	76.5
$\frac{\text{Exp'l}}{\text{Control}}$X100	151.9	61.2	81.7	77.5			

Median Domestic Assets for Types of Communities

Department Caps.							
Control	1294	1056	1236	1405	81.6	95.5	108.6
Experimental	1234	347	851	1096	28.1	69.0	88.8
$\frac{\text{Exp'l}}{\text{Control}}$X100	95.4	32.9	68.9	78.0			
Municipios							
Control	632	591	832	1051	90.6	127.6	161.2
Experimental	1030	215	884	1112	20.9	85.8	108.0
$\frac{\text{Exp'l}}{\text{Control}}$X100	158.0	36.4	106.2	105.8			
Aldeas							
Control	359	308	481	805	85.8	134.0	224.0
Experimental	882	208	408	508	23.6	46.3	57.6
$\frac{\text{Exp'l}}{\text{Control}}$X100	245.7	67.5	84.8	63.1			

FIGURE 14-5
DAMAGE & RECOVERY FOR POLITICAL STATUS
MEASURED BY MEDIAN DOMESTIC ASSETS



pre-earthquake domestic assets. In contrast, households in aldeas were restored more slowly. By 1980, they had reached only 57.6 percent of their pre-earthquake domestic assets. Interestingly enough, department capitals seem to display this same pattern, but to a lesser degree. They measured 88.8 percent. These differences in restoration level are believed to be the consequence of differences in housing programs in the various types of communities, as discussed in Chapter 11. In both of the department capitals studied, and in all but one of the aldeas, temporary housing programs dominated. In the municipios permanent housing programs were the rule. Permanent housing programs, for the most part, furnish more costly houses to people and, along with them, such housing amenities as running water, electricity and sewage. Figure 14-5 may therefore present a picture of how temporary housing programs slow down recovery from a disaster, especially in department capitals.

When control and experimental group department capitals, municipios, and aldeas are compared through time, a clearer picture of relative recovery may be attained. For recovery to occur in a given type place, the experimental group must reach its relative position with respect to the control group in 1975. In the case of department capitals, the experimental group measured 95.4 percent of the control group in 1975. By 1980, it had only reached 78 percent of the control group value, indicating that they were 17.4 percent behind recovery. This would require raising the median value by $244 to achieve recovery.

Before the earthquake, experimental group municipios measured 58 percent higher than those in the control group. Two years after the earthquake they measured only 5.8 percent higher, leaving a gap of 52.2

percent between its pre and post earthquake ratio to the control group. To reach its relative pre-earthquake standing would require raising the median value by $549. In the aldeas, the experimental group measured 245.7 percent of the control aldeas in pre-earthquake domestic assets, indicating a huge difference in the two samples. The earthquake resulted in a very large reduction for aldeas in the experimental group which dropped to only 67.5 percent of the value of the control group. This represents a loss of 76.4 percent of their median pre-earthquake domestic assets. By 1980, the experimental group had reached 63.1 percent of the control group value although just two years before, it had measured 84.8 percent of that value. The data suggest that an exceptionally strong trend toward improvement in domestic assets was taking place during the post earthquake period in the particular control group aldeas selected for this study. This trend resulted in experimental group aldeas actually losing ground between 1978 and 1980, even when measured against their relative standing in 1976 when they were devastated by the earthquake. Two factors account for the lack of apparent recovery on the part of experimental aldeas. First, they were moving more slowly toward their pre-earthquake values than municipios and department capitals, having only achieved 57.6 percent of their pre-earthquake standing by 1980. In addition, the control group aldeas were changing very rapidly and by 1980 had achieved 224 percent of their 1975 domestic assets. This in effect means that experimental group aldeas, in order to attain their relative pre-earthquake standing with respect to the control group, would have to add $1470 to their median value. Clearly this represents an unreasonable estimate of what it would take to reach recovery. It

appears that the control group aldeas selected for this study represented particularly poor communities before the earthquake since their average domestic assets were only $359. Furthermore, they seem to have experienced an unusual economic boost from unknown sources which dramatically increased their domestic assets over the four year period.

The above discussion indicates that only experimental group municipios show evidence of restoration. All three types of places have yet to achieve recovery when evaluated in terms of aggregate level data. Table 14-4 supplies change figures computed at the individual level. In this table, the ratios times one hundred of each period to 1975 for each household are figured. Both means and medians of these percentages are presented. In 1980, fifty percent of the households in the department capitals stood at 85.9 percent of their 1975 levels or better, while an equal number in the control group stood at 102.6 percent. This indicates that the majority of households did not reach restoration levels and that while growth in domestic assets for the control group households was relatively retarded, recovery is still some distance away in 1980.

Municipios registered a median value of 111.7 percent in 1980, significant growth over their 1975 levels for the majority. The control group figure is 111.2 percent. The median level of change from 1975 to 1980 is nearly identical for the control and experimental groups, leading to the conclusion that at least one half of the households in the experimental municipios have reached recovery as defined by the median level of growth for individual households in the control. Households in the aldeas again both recovered at a slower rate and households in

Table 14-4

Individual Level Restoration and Recovery for Type of Community

	$\frac{1975}{1975}$X100	$\frac{1976}{1975}$X100	$\frac{1978}{1975}$X100	$\frac{1980}{1975}$X100
Control				
Dept. Caps. $\bar{X}$	100.0	82.0	103.2	114.4
(s.d.)	(0.0)	(22.7)	(43.5)	(57.4)
Median	100.0	87.7	100.0	102.6
Municipios $\bar{X}$	100.0	92.2	145.6	165.9
(s.d.)	(0.0)	(16.7)	(117.9)	(128.6)
Median	100.0	100.0	100.0	111.2
Aldeas $\bar{X}$	100.0	93.2	153.6	211.7
(s.d.)	(0.0)	(15.2)	(156.5)	(213.2)
Median	100.0	100.0	100.0	120.2
Experimental				
Dept. Caps. $\bar{X}$	100.0	35.0	84.9	110.4
(s.d.)	(0.0)	(28.0)	(56.9)	(81.6)
Median	100.0	28.2	66.8	85.9
Municipios $\bar{X}$	100.0	30.3	113.3	131.2
(s.d.)	(0.0)	(30.4)	(86.3)	(97.0)
Median	100.0	19.2	100.0	111.7
Aldeas $\bar{X}$	100.0	38.9	73.3	88.6
(s.d.)	(0.0)	(35.1)	(49.6)	(61.2)
Median	100.0	34.1	70.3	79.5

the control aldeas show higher median growth than households in the two other types of communities.

In conclusion, with respect to type of community, both aggregate and individual level data indicate that in median values, restoration occurred only in the municipios. Department capitals come next closest and aldeas lagged behind. Aggregate measures indicate substantial upward mobility in the control municipios, resulting in a lack of recovery for the experimental municipios. However, examination of the individual household data for these units shows that recovery was achieved in median 1975 to 1980 change scores. In the next section relative recovery will be examined in terms of social class to determine whether some socioeconomic groups recovered faster than others.

Class Differences in Restoration and Recovery

The domestic assets scale was employed to measure the pre-earthquake socioeconomic status of households in both the control and experimental groups. The distribution of scores from the scale was divided into four groups representing social status by means of standard deviation units. The lower socioeconomic group consists of households which were more than one standard deviation below the mean. The lower middle group is comprised of households who were between the mean and one standard deviation below. The upper groups were defined similarly in the opposite direction. Table 14-5 categorizes households according to these status groupings which are labeled "lower," "lower middle," "upper middle," and "upper" in the table. This does not mean that the "upper" category is upper class but merely represents households who fell more than one

Table 14-5

Mean Domestic Assets by Social Class

	1975	1976	1978	1980	$\frac{1976}{1975}$X100	$\frac{1978}{1975}$X100	$\frac{1980}{1975}$X100
Lower							
Control $\bar{X}$	208	199	379	505	95.7	182.2	242.5
(s.d.)	(76)	(85)	(353)	(450)			
Exp'l $\bar{X}$	183	125	440	500	68.3	240.4	273.2
(s.d.)	(68)	(87)	(349)	(477)			
$\frac{\text{Exp'l}}{\text{Control}}$X100	88.0	62.8	116.1	99.0			
Lower Middle							
Control $\bar{X}$	684	590	803	956	86.3	117.4	139.8
(s.d.)	(258)	(238)	(443)	(588)			
Exp'l $\bar{X}$	853	226	767	901	26.5	89.9	105.6
(s.d.)	(135)	(252)	(527)	(622)			
$\frac{\text{Exp'l}}{\text{Control}}$X100	124.7	38.3	95.5	94.2			
Upper Middle							
Control $\bar{X}$	1479	1302	1325	1758	88.0	103.1	118.9
(s.d.)	(241)	(350)	(543)	(775)			
Exp'l $\bar{X}$	1402	470	1171	1481	33.5	83.5	105.6
(s.d.)	(231)	(374)	(712)	(904)			
$\frac{\text{Exp'l}}{\text{Control}}$X100	94.8	36.1	76.8	84.2			
Upper							
Control $\bar{X}$	2932	2673	2692	3014	91.2	91.8	102.8
(s.d.)	(780)	(969)	(778)	(896)			
Exp'l $\bar{X}$	2780	1567	2397	2934	56.4	86.2	105.5
(s.d.)	(889)	(1245)	(1331)	(1424)			
$\frac{\text{Exp'l}}{\text{Control}}$X100	94.8	58.6	89.0	97.3			

Median Domestic Assets by Social Class

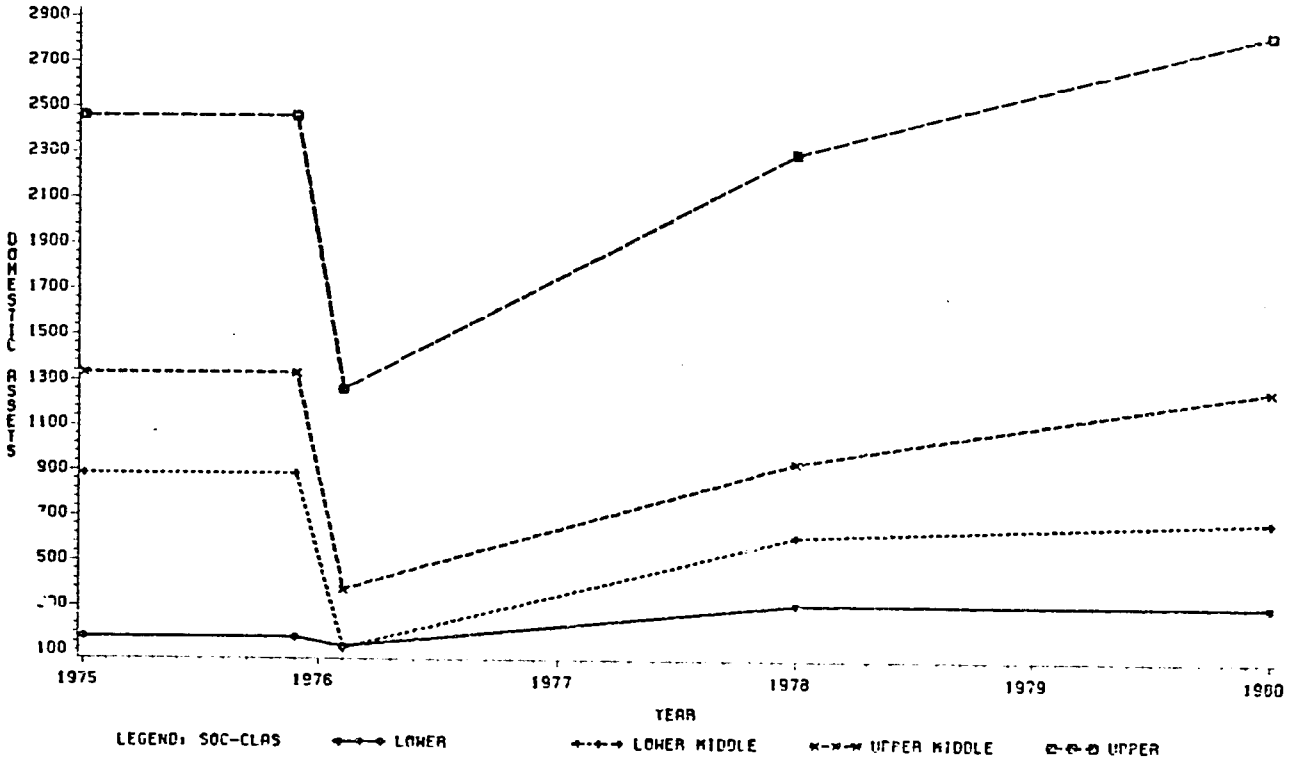
Lower							
Control	259	259	282	309	100.0	108.9	119.3
Exp'l	159	120	309	308	75.5	194.3	193.7
$\frac{\text{Exp'l}}{\text{Control}}$ X100	61.4	46.3	109.6	99.7			
Lower Middle							
Control	688	583	762	832	84.7	110.8	120.9
Exp'l	882	111	608	682	12.6	68.9	77.3
$\frac{\text{Exp'l}}{\text{Control}}$X100	128.2	19.0	79.8	82.0			
Upper Middle							
Control	1469	1339	1490	1636	91.2	101.4	111.4
Exp'l	1331	371	936	1266	27.9	70.3	95.1
$\frac{\text{Exp'l}}{\text{Control}}$X100	90.6	27.7	62.8	77.4			
Upper							
Control	2853	2555	2555	2853	97.3	97.3	100.0
Exp'l	2456	1257	2279	2838	51.2	92.8	115.6
$\frac{\text{Exp'l}}{\text{Control}}$	86.1	49.2	89.2	99.5			

standard deviation above the mean in domestic assets scores. This upper group is unbounded at the upper end. That is to say that there is no maximum limit to their scores,while the lower group is bounded at the lowest possible score on the domestic assets scale, which is near zero.

Table 14-5 shows mean and median domestic assets scores for the control and experimental groups for each of these status categories for the four time periods. It also shows the percentages that 1976, 1978 and 1980 scores are of the 1975 score. In addition, it gives the percentage that the experimental group is of the control group for each status or class category. Discussion in this section will focus on the median values which are depicted graphically in Figure 14-6. Table 14-5 shows that the lower class in the experimental group by 1980 had achieved 193.7 percent of their pre-earthquake median domestic assets, indicating a strong trend not only towards recovery, but towards economic improvement. When the control and experimental values are compared through time, it appears that the lower group has not only improved its own pre-earthquake level, but has also improved relative to the control group. In 1975 the experimental lower class households measured 61.4 percent of the control group. By 1980, they measured 99.7 percent, being only one dollar behind in median value. In other words, they improved their ratio to the control group by 38.3 percent.

This picture should be contrasted to that of the lower middle group which by 1980 had only achieved 77.7 percent of its pre-earthquake domestic assets,as contrasted to the lower group's 193.7 percent. Furthermore, it had begun in 1975 being 128.2 percent of the control group value

FIGURE 14-6
DAMAGE & RECOVERY FOR SOCIAL CLASS
MEASURED BY MEDIAN DOMESTIC ASSETS



but by 1980 had only reached 82 percent of that value. Thus the lower middle group was behind restoration level by 46.2 percent. In short, the lower group appears to have fared well in the recovery process, while the lower middle group has fared badly.

The two upper groups also present interesting contrasts. By 1980 the upper class in the experimental group had reached 115.6 percent of its pre-earthquake domestic assets, while the upper middle group had only reached 95.1 percent of its pre-earthquake standing. In the case of the upper class, the experimental group measured 86.1 percent of the control group before the earthquake but by 1980 it measured 99.5 percent, having improved by 13.4 percent in relative standing. The upper middle group started out 90.6 percent of the control group but ended up measuring only 77.4 percent. This is a difference of minus 13.2 percent. In other words, the upper middle group does not appear to have achieved recovery relative to the control group but to have approximately reached restoration level. On the other hand, the upper class has exceeded recovery as measured by its relative standing to the control group.

These data seem to show that the upper and lower status groups fared better than the two middle groups as far as the recovery process is concerned. They also point to the fact that the lower middle group lags far behind the others in this process. Figures for the lower group are based on relatively few cases and may be less reliable than other figures in this table. However, they seem to indicate that the lower group fared best in the recovery process.

Examination of domestic assets figures for all points in time for

both groups will show that the lower group was extremely poor especially as compared to the upper group. In 1975, the ratio of the upper group to the lower group in the experimental area was on the order of fifteen to one. If equal amounts of aid were passed out to the two groups, it is apparent that the lower group would improve at a much greater rate. As an example, if $100 in aid were given to the individual households in each of these two groups, the ratio between the groups would be lowered to ten to one because of the relatively greater impact of this amount of aid on the lower group. The lower group would improve by 62.9 percent in this case while the upper group would only improve by 4.1 percent. The implication of this example is that relatively small amounts of aid, when delivered to the lower economic groups, can result in significant improvements in the absolute and relative economic standing of these households. When these changes result in rapid improvement in domestic assets beyond the recovery level, they may be viewed as developmental in nature.

Another bit of information indicated by Table 14-5 is relative loss by social class. The percentage that 1976 assets were of 1975 furnish a loss estimate. The figures also show that the lower middle class lost the most in the earthquake, being reduced to only 12.6 percent of its pre-earthquake assets, or losing 87.4 percent. This is the largest group in the sample and it shows the least movement towards recovery. Next comes the upper middle group which retained only about 28 percent of their pre-earthquake assets. The upper group suffered relatively less, having retained over half of its pre-earthquake score. Finally, the lower class

group suffered the least, measuring 75.5 percent of its assets right after the earthquake. It is apparent that progress toward recovery is directly related to the amount of relative loss suffered. The greater the relative loss, the less the progress toward recovery, as shown by the following tabulation.

Class	Relative Loss	Distance to Recovery
Lower Middle	87.4%	-46.2%
Upper Middle	72.1%	-13.2%
Upper	48.8%	+13.4%
Lower	24.5%	+38.3%

It is important to keep in mind in examining figures on recovery that the absolute amount of loss measured in dollar value is related to the level of domestic assets that the group had prior to the earthquake. Because of this, even though the upper group lost 48.8 percent of its domestic assets as compared to 87.4 percent for the lower middle group, its dollar loss was much higher. It went from $2456 to $1257, a loss of $1199 in median domestic assets. The lower middle group dropped from $882 to $111, losing $771. This same difference may be observed from the lower and upper middle groups. Absolute loss is directly related to social class. This means that in order to restore the upper group to its pre-earthquake standing, more must be invested even though relative losses were lower than with lower socioeconomic classes. The distribution of equal amounts of aid to all social groups would therefore have the effect of leveling the socioeconomic status system. Earlier data seemed to indicate that equal amounts of aid were not distributed to all socioeconomic

groups. The chapter on housing demonstrates that the lower middle group received less housing assistance than the others. This probably accounts for this group lagging behind the others in recovery as much as does their relative losses.

Table 14-6 shows individual level restoration and recovery for each social class in the control and experimental groups. The lower section of this table shows that in the experimental group the lower class achieved 193.9 percent recovery from their respective pre-earthquake scores. This figure is nearly identical to the group level figure. In fact, the lower, upper middle, and upper class group figures for individual level recovery are very similar to their comparable group level scores. However, the lower middle group recovery score in 1980, 91.2 percent, is nearly 15 points higher than the group level median score of 77.3 percent. Though the relative order of the four social classes is the same and the lower middle group is still shown to lag behind the others in recovery level, this gap is shown not to be nearly as great when the individual level data are examined. In the next section the relationship between reconstruction program type and recovery will be examined.

Program Type

From over 100 agency programs operating in Guatemala after the earthquake, four basic types have been selected for special study (see Chapter 11 for a description of these programs). These four types of programs are: permanent housing programs, temporary housing programs, lamina roofing programs, and finally, those households in the experimental

Table 14-6

Individual Level Restoration and Recovery by Social Class

	$\frac{1975}{1975}$X100	$\frac{1976}{1975}$X100	$\frac{1978}{1975}$X100	$\frac{1980}{1975}$X100
Control				
Lower Class $\bar{X}$	100.0	94.6	205.2	270.5
(s.d.)	(0.0)	(18.0)	(199.2)	(252.7)
Median	100.0	100.0	100.0	135.1
Lower Middle $\bar{X}$	100.0	88.4	127.3	149.8
(s.d.)	(0.0)	(18.9)	(89.5)	(103.0)
Median	100.0	100.0	100.0	109.4
Upper Middle $\bar{X}$	100.0	88.0	103.4	119.3
(s.d.)	(0.0)	(17.9)	(34.3)	(48.5)
Median	100.0	100.0	100.0	101.6
Upper $\bar{X}$	100.0	89.9	94.5	107.2
(s.d.)	(0.0)	(17.7)	(22.1)	(27.7)
Experimental				
Lower Class $\bar{X}$	100.0	70.9	240.3	278.1
(s.d.)	(0.0)	(38.1)	(177.6)	(213.7)
Median	100.0	92.6	194.3	193.9
Lower Middle $\bar{X}$	100.0	28.0	93.4	108.7
(s.d.)	(0.0)	(31.1)	(68.0)	(79.4)
Median	100.0	12.5	82.0	91.2
Upper Middle $\bar{X}$	100.0	33.2	84.1	108.5
(s.d.)	(0.0)	(25.2)	(49.4)	(66.0)
Median	100.0	25.5	69.8	94.1
Upper $\bar{X}$	100.0	52.7	87.3	108.9
(s.d.)	(0.0)	(28.3)	(42.8)	(48.1)
Median	100.0	50.6	83.2	112.6

area who received no benefits from housing programs. Though these programs have been previously examined with respect to the value of the houses occupied by recipients, this analysis is repeated utilizing the full complement of domestic assets items so that the effects of modernization in such things as electricity, food storage, cooking facilities, sewage and water may be taken into account. Table 14-7 presents mean and median values for each of these groups. Households were classified according to the type of aid they received after the earthquake.

In 1975 the only statistically significant differences between the groups' median domestic assets scores involve the group that was to receive lamina assistance. This category of households had a median value of $939 which is significantly lower than median household value in each of the other categories. This is looking back in time to the pre-earthquake situation, prior to any damage but does suggest that if there were social class biases in program types, then lamina programs were either directed at poor households, poorer households self selected into lamina programs, or that some combination of screening by agencies and self selection was operating. In interpreting these figures it must be remembered that households are classified by the type of aid they received after the earthquake and then their domestic assets scores are computed for various time periods. Thus,the 1975 domestic assets score for lamina program people represents their pre-earthquake situation and is an indicator of the relative economic standing of the group selected for that program type.

Looking ahead to the year of impact, 1976, the only significant differences in median values for this year are found between those who

Table 14-7

Mean and Median Domestic Assets for Types of Programs

Program Type		1975	1976	1978	1980
No Program	$\overline{X}$	1324	655	1183	1436
	(s.d.)	(914)	(839)	(1054)	(1224)
	Md.	1032	38[illegible]	882	981
Lamina	$\overline{X}$	1060	363	853	1035
	(s.d.)	(581)	(444)	(771)	(948)
	Md.	939	262	673	832
Temporary	$\overline{X}$	1233	328	743	985
	(s.d.)	(718)	(533)	(656)	(946)
	Md.	1084	208	554	626
Permanent	$\overline{X}$	1170	316	1638	1820
	(s.d.)	(425)	(331)	(606)	(703)
	Md.	1055	227	1732	1813

received no aid and the other three categories which did receive any form of housing assistance. In each case, the value of median domestic assets for those who received no aid ($383) is higher than the median scores for those who did receive aid. This suggests that the agency programs managed to successfully reach households suffering more damage. But some qualifications are in order. These are not figures on either absolute or relative loss, but on the 1976 score. Secondly, a substantial number who received no aid did suffer considerable damage both in absolute dollar value and relative to their pre-earthquake situation. Table 14-8 shows the median values, percentage each year is of the 1975 median domestic assets score, as well as the percent each group's median value is of the control group at the four time points.

The top row in Table 14-8 shows the control group's median value for each year and the percentage each year is of 1975. Each of the sets of two rows after this give the same figures for each program type and the percentage that each program type's median value is of the control. Examination of the rows for those receiving no program assistance shows that their pre-earthquake value of $1032 was reduced to $383 in 1976, representing only 37.1 percent of their 1975 assets. Despite this considerable damage and not receiving any housing assistance, this group is at 95.1 percent of their median pre-earthquake level by 1980. In other words, this group as a whole is only five percent from restoration. In terms of recovery, however, the control group has increased its median domestic assets by 17.2 percent,as has been previously noted. Thus, the "no aid" group which was 24 percent higher than the control group in median

Table 14-8

Group Level Restoration and Recovery for Types of Programs

Program Type	1975	1976	1978	1980	$\frac{1976}{1975}$X100	$\frac{1978}{1975}$X100	$\frac{1980}{1975}$X100
Control	832	620	851	975	74.5	102.3	117.2
No Program	1032	383	882	981	37.1	85.5	95.1
$\frac{\text{No Pgm}}{\text{Control}}$X100	124.0	61.8	103.6	100.6			
Lamina	939	262	673	832	27.9	71.7	88.6
$\frac{\text{Lamina}}{\text{Control}}$X100	112.9	42.3	79.1	85.3			
Temporary	1084	208	554	626	19.2	51.1	57.7
$\frac{\text{Temporary}}{\text{Control}}$X100	130.3	33.5	65.1	64.2			
Permanent	1055	227	1732	1813	21.5	164.2	171.8
$\frac{\text{Permanent}}{\text{Control}}$X100	126.8	36.6	203.5	185.9			

value before the earthquake is less than one percent above the control group in 1980. This leaves a gap of 23.4 percent between the relative recovery level of 124 percent and their 100.6 percentage of the control in 1980.

As a group, lamina recipients were reduced to 27.9 percent of their median domestic assets by the earthquake but show relatively strong improvements by 1978, 71.7 percent, and by 1980 were at 88.6 percent. This leaves them only 11.4 percent below restoration. Though they needed only a 12.9 percent higher score than the control to achieve recovery to their pre-earthquake relative position, the lowest distance of all four groups, by 1980 they were only at 85.3 percent of the control group. This gap between recovery and their 1980 position relative to the control is 27.6 percent, or $269.

The temporary housing group had a 1975 median assets value of $1084. The effect of the earthquake was to reduce this amount of $208, or 19.2 percent of the previous level. By 1978, the median assets of this group were raised from less than one fifth the pre-earthquake level to slightly over half, but the two years from 1978 to 1980 resulted in only a 6.6 percent increase in their restoration level. It follows that recovery for the temporary housing group stalled. With the pre-earthquake recovery level set at 130.3 percent of the control group, the 1980 relative recovery of 64.2 percent is less than one half the necessary level. This is in sharp contrast to those receiving permanent housing from agencies.

It should be remembered that the permanent housing group was indistinguishable from the temporary housing recipients in pre-earthquake score, 1976 domestic assets score and loss from 1975 to 1976. Two years after the earthquake their median domestic assets clearly surpassed restoration at 164.2 percent above their previous level. In 1980 the median for this group leveled off at $1813, or 171.8 percent of the pre-earthquake score of $1055. Since the control group did not come close to this level of growth, recovery was easily attained and surpassed. The last row of figures in Table 14-8 shows that the permanent housing recipients had a median domestic assets value 126.8 percent above the control group before the earthquake. This fell to 36.6 percent of the control due to the earthquake, then dramatically rose to over 200 percent of the control in 1978, before growth in the control group lowered the percentage to 185.9 percent two years later. In the face of this kind of rapid improvement in living conditions and domestic assets, development objectives, or at least results, are clearly evident. A graphic depiction of this can be seen in Figure 14-7.

Table 14-9 presents individual level restoration and recovery measures. The top portion of the table is mean recovery and restoration and the lower section is median recovery. These data follow the same trends observed in the group level restoration and recovery figures. Median values for 1980 are five to ten percent higher than were the comparable group level data. The same conclusions are derived.

What these tables show is that the temporary housing program group fell behind while the permanent housing recipients forged ahead, as compared to those receiving lamina roofs, no aid at all, and the control group.

FIGURE 14-7
DAMAGE & RECOVERY FOR PROGRAM TYPE
MEASURED BY MEDIAN DOMESTIC ASSETS

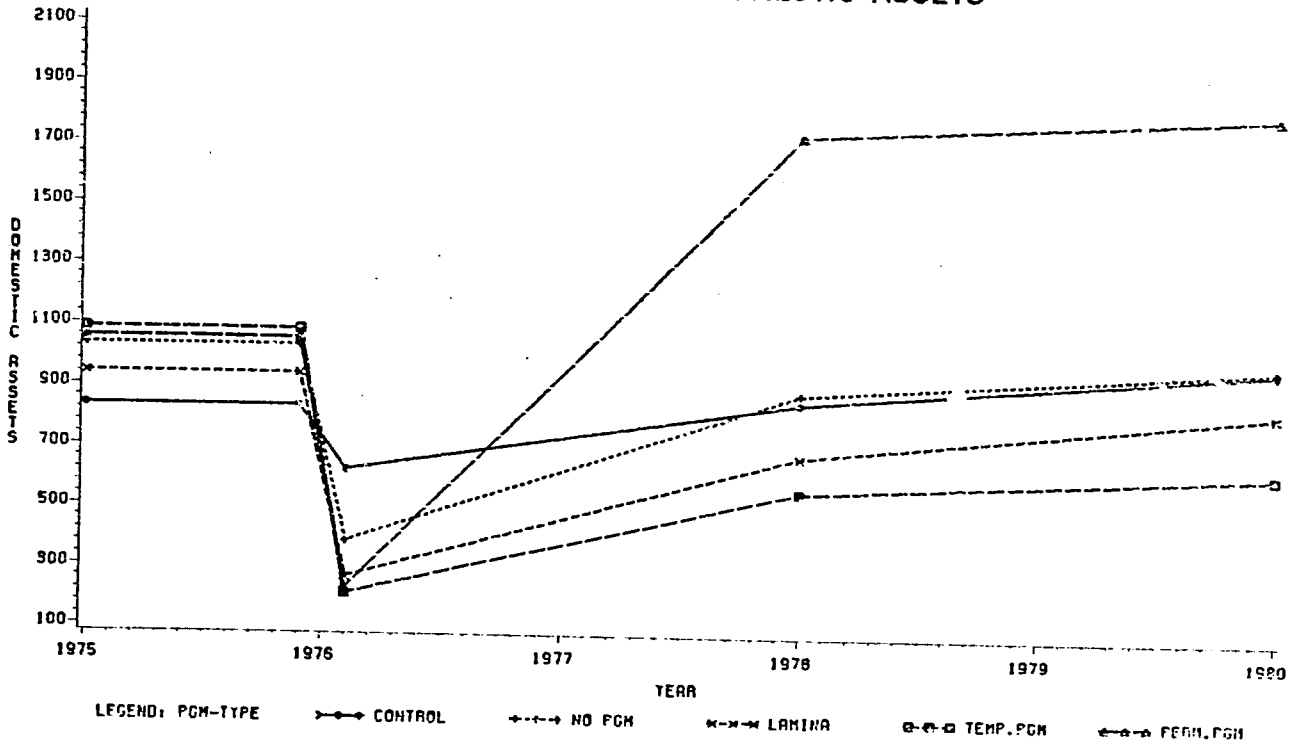


Table 14-9

Individual Level Restoration and Recovery

Program Type	$\frac{1975}{1975}$X100	$\frac{1976}{1975}$X100	$\frac{1978}{1975}$X100	$\frac{1980}{1975}$X100
Means				
Control	100.0	90.0	1[illegible].8	169.6
No Program	100.0	43.8	95.7	118.0
Lamina	100.0	34.2	84.7	102.8
Temporary	100.0	24.6	65.3	83.9
Permanent	100.0	25.1	157.4	173.4
Medians				
Control	100.0	100.0	100.0	111.2
No Program	100.0	42.3	91.7	100.1
Lamina	100.0	27.9	81.7	94.6
Temporary	100.0	17.4	55.2	64.6
Permanent	100.0	18.2	156.4	175.4

This seems to inevitably lead to the conclusion that temporary housing programs had the effect of retarding restoration and recovery and in the process, negating developmental trends. On the other hand, permanent housing programs appear to have definite developmental effects if the relative size of domestic assets is taken as a measure. There is, however, a possibility that permanent housing programs produced improvements in domestic assets while increasing the level of dependency in the areas where they were executed by providing more expensive and elaborate housing than local resources can sustain in the long run. At the same time, the apparent negative effects of temporary housing for recovery may be a consequence of this type of structure being supplied to a population who were accustomed to better quality housing. Because the temporary housing met the marginal requirements of this population, they may have been satisfied to suspend self-help efforts to improve their own situations, thus retarding their long range recovery.

This is strongly suggested by the no program and lamina recipients who began slightly below temporary housing recipients in 1975 and either received no aid, or aid worth no more than fifty dollars. These groups nevertheless moved closer to both restoration and recovery. If temporary housing had been supplied only to the very poor, thus representing an incremental improvement over their pre-earthquake situation, the picture would probably have been reversed since the temporary houses would have exceeded in value, and probably in quality, the houses they replaced. In actuality, temporary houses went to the group which had the highest domestic assets and as the chapter on housing shows, were worth considerably

less on the average than the pre-earthquake structures they replaced. Since, however, they functioned well as a "stop-gap," they reduced the sense of urgency people had with respect to the long range housing problem.

This was actually one of the aim of temporary housing programs. They were designed to provide an adequate shelter during the period in which the permanent housing programs would be organized and executed. However, the organization of the reconstruction process was such that particular agencies were assigned responsibility to particular communities. Once a community became the responsibility of an agency and its program, other sources of aid were directed elsewhere. This meant that communities with temporary housing programs,in effect,were not considered during the first four years as potential sites for agencies executing permanent ones. As a consequence, the permanent agency housing programs which were assumed by the temporary housing programs had not materialized by four years after the earthquake.

Furthermore, households in such communities apparently have not felt the need or the responsibility to construct permanent housing for themselves to the same extent that those who received no aid or only lamina did. There is a distinct possibility that the individuals in communities with temporary housing programs delayed permanent house construction on the assumption that if they built their own permanent houses, agency assistance would not be forthcoming. In short, it is possible that they felt that they needed to appear to need assistance in order to receive it. It is important to note, however, that this latter explanation is based on speculation rather than hard data.

Another point needs to be made. Temporary housing programs supplied whole houses very quickly and those persons who received them were re-housed well within a year after the earthquake. This effectively met emergency needs for temporary shelter but did not necessarily fit well with other agencies' reconstruction programs. This occurred while permanent housing programs were still getting organized. Had a measure of domestic assets been taken in 1977 in addition to 1978 and 1980, the temporary housing people would have undoubtedly measured higher in restoration than any of the other groups. What happened to them in effect was that they climbed back up from their low point to about fifty percent of recovery very rapidly and then remained at that level for the next two to three years.

Summary and Conclusions

The data presented in this chapter lead to a number of interesting conclusions concerning the reconstruction process following the 1976 earthquake. First, they show that relative to the control group, the various communities studied in this research who were heavily affected in the disaster have not yet recovered. This conclusion rests on the assumption that recovery amounts to achieving parity with respect to the control group. This assumption needs to be evaluated in terms of the possible spill-over of earthquake effects from the disaster area to the surrounding territory which was used as a control group. The data show a rather robust trend towards improvement in domestic assets in control group communities. This trend is probably in part a consequence of the disaster itself and the economic boost it gave the economy of the country in general. If this is so, then part of the improvement in the control

group should be discounted, at least from one perspective, in evaluating recovery. Unfortunately the research design employed does not permit the separation of spill-over effects from secular trends. This would require time series data on the control group prior to the earthquake which could be used to compute domestic assets scores. Such data are not available. This means that the description of recovery which has been presented rests on the assumption that the experimental group should have done relatively as well as the control group, even given the boost the disaster gave to the economy in the control area. This yields a conservative estimate of recovery if a definition of recovery based solely on the secular trend is preferred since the experimental group must register greater gains to register recovery as measured in this report.

This is the reason why restoration is also considered. Restoration is defined as achieving pre-earthquake levels of domestic assets. On a whole, the experimental group was very close to restoration level in 1980.

A second set of conclusions drawn from the above discussion is related to the unequal distribution of benefits of the restoration and recovery process for different sub-populations. Households located in municipios seem to have recovered more fully from the disaster in the four-year period covered by the data, while persons living in departmental capitals and aldeas have lagged behind. Earlier chapters point to differences in program type as the basis for this differential degree of recovery. The analysis of differences in socioeconomic status and recovery show that the upper and lower socioeconomic groups appear to have faired better after the earthquake than the two middle groups.

The lower middle group, in particular, has lagged behind in the recovery process. Again, earlier analysis seems to indicate that housing programs were differentially distributed among socioeconomic groups and the lower middle group received the least attention. There are also differentials in the amount of damage and loss suffered that are associated with progress towards recovery.

The final set of conclusions relates to program type and restoration and recovery. Data on this subject show clearly that those households associated with permanent housing programs not only recovered, but made substantial gains in socioeconomic status. These gains are so far beyond the recovery level that they appear to have had a developmental impact on households associated with these programs. There is, however, the troubling possibility that this rapid improvement in socioeconomic status may have been accomplished at the cost of increasing dependency. There is nothing in the data which can resolve this issue.

It is equally clear that the households who received temporary housing have lagged behind all other program types. This is especially interesting since both the control group and the "no program" are available for comparison. These groups appear better off, even though they received little or no aid to assist them in the recovery process. These facts raise the question as to whether temporary housing might retard progress towards recovery, rather than promote it. They also suggest that, while temporary housing appears to be a good emergency measure to furnish shelter quickly following a disaster, meeting the emergency need might interfere with long-range reconstruction. Data on refugee style housing

which are presented in Chapter 12 suggest a similar conclusion. Those households who were placed in temporary housing in refugee centers also lagged behind other groups in achieving recovery.

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Guatemalan Earthquake Project

Domestic Assets Scale
(Score equals the sum of the weights for the individual items)

Item	Answer Categories	Weight* Average Dollar Costs
1. Walls of House	1 Cardboard Shack	1
	2 Shack made from scraps of various materials (not a formal house)	15
	3 Cane, palm, bamboo, thatch, sticks	50
	4 Poured mud, rough lumber	100
	5 Corrugated sheet metal or asbestos siding	200
	6 Lower half adobe and upper half wood or other light material	450
	7 Adobe	600
	8 Lower half cement block, brick or stone, upper half wood or other material	750
	9 Cement block, brick or stone masonry	1100
2. Roof material	1 Scraps of various materials on an informal house	10
	2 Thatch or palm	50
	3 Wood	200
	4 Corrugated sheet metal	200
	5 Clay tile	250
	6 Clay tile over corrugated metal roofing	300
	7 Preformed asbestos and cement roofing (duralita)	400
	8 Cement slab	600

Note: Values for wall and roof were based on costs for a one or two room house of 3 x 4 meters. (note continued on next page)

Item	Answer Categories		Weight* Average Dollar Costs
	Note: (continued from previous page) For houses with three or more rooms, the wall and roof costs were multiplied by the following factors:		
	3 rooms	1.25	
	4 "	1.50	
	5 "	1.75	
	6 "	2.00	
	7 "	2.25	
	8 or more rms.	2.50	
3. Floor	1	Dirt	1
	2	Unglazed brick or tile	35
	3	Wood	75
	4	Poured cement	165
	5	Tile (Glazed)	200
4. Water Source	1	Public Sources (rivers, lakes, public tanks, pilas, or faucets or neighbors	1
	2	Own well	60
	3	Piped potable water on the house site, not in house	200
	4	Piped potable water inside house	250
5. Lighting	1	Candles, open fire, none	1
	2	Kerosine or oil lamps	5
	3	Gasoline or bottled gas lamps, Coleman lanterns	65
	4	Electricity	100
6. Food Storage Facility	1	None	1
	2	Baskets, clay pots, boxes, pouches or bags	3
	3	Ice box, including styrofoam	10
	4	Wooden cabinet, formal piece of furniture like a pie safe	60
	5	Refrigerator	700

Item	Answer Category	Weight* Average Dollar Costs
7. Dishwashing	1 River, lake, public washing area	1
	2 Dishpan used in house or own yard	2
	3 Sink in kitchen	93
	4 Dishwasher	930
8. Cooking	1 Tenemastes, rock or bricks placed on the ground or floor	1
	2 Converted oil drum or metal can	10
	3 Clay stove or kerosine stove	24
	4 Small propane stove or electric hot plate	53
	5 Clay or brick stove with built-in metal griddle or grill	175
	6 Stove with oven	395

Note: An extended version of the scale employs two other items measuring entertainment and transportation. However, with these items a house may receive credit for as many items as they own, while in the above items, they receive only one score per item.

9. Entertainment	1 Radio (small portable)	10
	2 Record player	68
	3 Tape deck	150
	4 Television	200
10. Transportation	1 Bicycle	150
	2 Motorcycle	1000
	3 Automobile or truck	4000

In the case of disasters where it is desirable to measure the amount of loss, respondents are asked to state the degree of damage to each item, such as the walls or roof of their house or their food storage facilities. Each degree of damage is then given a weight and this weight is multiplied by the weight of the item (its dollar cost) to calculate a depreciated value. The damage categories and weights are as follows:

	Percent Damage	Weight
No Damage	0.0	1.00
Light Damage (Easily repaired - still usable)	33.0	.66
Heavy Damage (Requiring extensive repairs before usable)	66.0	.33
Destroyed, unreparable	100.0	0.00

For example: If a house had adobe walls whose value is 600 and experienced heavy damage, the value given to the walls after a disaster would be 600 x .33 = 198.

Chapter 15

Ethnic Differences in Earthquake Impact and Recovery

Walter G. Peacock and Frederick L. Bates

Introduction

When a natural disaster such as an earthquake or hurricane strikes a region, both its force and geographical distribution are a function of a multitude of complex physical properties. However, the distribution of the effects of that same natural disaster for the social system residing in that region can not be completely explained by the same physical attributes. A more thorough understanding can be gained only from the study of the structure of the affected social system and its relationships to its physical environment.

Every social system is related to its physical environment in a particular fashion and at particular points. Central to an understanding of this complex set of relationships is an exploration of the technologies developed and utilized by members of the society. Technology consists of a system of behavior patterns, tools, and energy sources through which people produce and utilize artifacts as they attempt to meet their biological and social needs. Housing patterns, for example, represent a product of a technological system through which members of society meet the need for shelter. The complexity of this system and its products depend upon the level of modernization of the society.

Each technological system and its products, therefore, represent a particular relationship between a social system and its physical

environment. While there are several dimensions of this relationship, two are central to this discussion. Perhaps the most obvious is the fact that certain inputs or resources are required by each technology. Secondly, the products of technology are sensitive to certain environmental changes or alterations. Using housing patterns as an example, one can readily see that there will be different inputs or resources from the physical environment required to produce different housing patterns. These inputs will range from raw natural unprocessed resources to those which have been previously processed, but all technologies will require some form of input from the environment. Furthermore, housing patterns will also be sensitive to some degree to environmental changes or alternations. Some, for example, will be resistant to seismic activity while others will not.

Within any society there may exist different technologies for producing similar products. Consequently, there may co-exist several different housing patterns within the same society. Each of these technologies represents a different relationship between parts of the society and its physical environment. As a consequence, different inputs may be required by each housing pattern and some may require more processed inputs, thus increasing the interdependence among social units. Some of these housing patterns may be more susceptible to damage resulting from the effects of certain natural phenomenon than others. It is apparent therefore, not only that particular technological patterns are important determinants of the effects of a natural disaster, but that the differential distribution of these technologies within the social system is also important. In other words, the structure of the social system is a

determinant of how a society is affected by a disaster.

The particular manner in which a social system is structured and its units are related to one another determines the distribution of technologies and their products within the system. Some social systems are structured in such a manner that goods are distributed more or less equally throughout the system. Others are structured such that parts of the system are denied access to various goods and services.

Furthermore, its structure will, in turn, determine the system's ability to ameliorate the effects of a natural disaster. Some social systems, or sub-units of the system, may be structured in such a way that processes associated with mutual aid and self-help are facilitated, while other structures may encourage dependency, thereby blocking such relationships. In addition, some social systems will be so structured that the distribution of such external inputs as disaster aid throughout the system will be facilitated. Others, however, may, because of their structure, systematically target inputs to only certain parts or units of that system.

To fully understand the impact and consequences of a natural disaster for a social system it is therefore necessary to explore the technology employed by the impacted society and, more broadly, to examine its structural arrangement. To gain a more complete understanding of the 1976 Guatemalan earthquake, it is important to explore the consequences of certain aspects of Guatemala's social structure and their relationship to the physical environment. In this chapter the ethnic dimension of Guatemala's social structure and its consequences for earthquake damage and aid will be examined.

Guatemala: A Plural Society

Guatemala, not unlike many of the countries of Cental and South America, has been characterized by social scientists as a pluralistic society. Characteristic of a plural or multiple society is the existence of two or more cultural traditions (Smith 1960; Nash 1957 and 1966; Colby and van den Bergh 1969). Each of the cultural traditions is comprised of particular behavior patterns and traits. Often, these patterns are structured such that parallel institutional or organizational structures are present in the same social system. However, while these parallel institutions often exist - especially with respect to religious and leadership structures - both traditions are integrated into a single structural whole. This integration of the two cultural traditions is performed by national economic and political organization.

While the separate cultural traditions may be integrated into a structural whole, they need not be in equal positions. Indeed, Nash (1966) has noted that one often finds that the economy and government of a plural society are predominantly controlled by individuals from only one of the cultural traditions. Thus, members of one cultural group are in an economically and politically advantaged or dominant position with respect to the other.

In both the sociological and anthropological literature, Guatemala has been characterized as a pluralistic society composed of two cultural traditions or ethnic groups (Nash 1957 and 1966; Colby and van den Berghe 1969; van den Berghe 1970; and Hinshaw 1957). The two ethnic groups of Guatemala are termed "Indian" and Ladino," and each has its own cultural

tradition. The roots of Indian culture are principally found in the Mayan culture of the pre-Spanish conquest era. The roots of Ladino culture, on the other hand, are found principally in the Spanish and Western cultural tradition. The consequences of this plural structure for the distribution of the effects of the earthquake, and for the process through which its effects were ameliorated, could be substantial. This chapter will explore this possibility.

Some Characteristics of the Two Cultural Traditions

A few of the most often mentioned behavioral patterns included in the two Guatemalan cultural traditions are those associated with dress and language. Linguistically the Indian cultural tradition consists of four Mayan language groups -- Quiche, Mam, Cakchiquel and Kekchi. The Ladino language pattern is Spanish. The clothing for both male and female Indians is made of hand woven material and is usually extremely colorful. Traditional male dress consists of colorful hand made shirts and pants and a banda (a woven sash-belt). The traditional female garments consist mainly of wrap-around skirts or cortes and baggy blouses known as huipils. The clothing patterns of male and female Ladinos, on the other hand, are very similar to those found in the United States and Europe, consisting of machine manufactured clothing and Western shoes.

The above mentioned patterns are often discussed by anthropologists and sociologists as characteristics important in identifying ethnic group membership. While often discussed, it is rather difficult to conceive of such behavior patterns as playing an important part in the

determination of earthquake damage or aid. However, there are other cultural differences that these more obvious traits symbolize that may indeed play an important part in this determination. For example, Woods (1968), Hinshaw (1975), Tumin (1952), Tax (1963), and others have noted ethnic differences in housing. These differences range from wall and roof material to design and actual construction methods. As has been well documented in Chapters 9, 10 and 11, differences in housing material can play an important part in the determination of damage. Consequently, ethnic differences in housing to the extent that they existed at the time of the earthquake may also play an important part in explaining earthquake losses.

Hinshaw (1975) and Tax (1963) have also noted the characteristics of family and friendship relations among Indians. Within the household, the basic economic unit, sharing and mutual aid is the rule. However, interhousehold relations are quite different in that they tend to be more formal and rigid. When interhousehold exchanges or assistance occur, remuneration, often times financial, is expected even among relatives. These behavioral patterns may have important consequences in that they may effectively curtail a household's utilization of informal networks of aid and assistance during the reconstruction process following a disaster.

Many Indian households are also integrated into a highly developed political-religious structure: the Cofradia. A number of authors have noted the integrative and leveling functions accomplished by this organization for Indian households (Tax 1963; Tumin 1952; Reina 1966)

and, while the importance and influence of this organization has been waning in recent decades (see Hinshaw, Woods, and Brintnall), a potential source for information and assistance may well be provided through membership. However, the often discussed leveling of economic resourses in Indian households which results from financial burdens associated with assumption of leadership positions in the Cofradia may result in constraining the abilities of the household to rebuild, following the disaster. Further, Hinshaw (1975), Brintnall (1974) and Woods (1968) have all noted the rather rigid traditionalism of many of the Cofradia, which may constrain member households from seeking aid from other channels. Yet another consequence of ethnicity stems from the relative positions of the ethnic groups with respect to the economic and political structures of Guatemala.

Economic constraints on the relative recovery of the two ethnic groups may be present because of the economic structure of Guatemala as a total society. Individuals that adhere to the Ladino cultural tradition dominate the national economic structure and this domination, while not total, also exists at the local level. Indians tend to cluster in low income agriculturally oriented occupations. Ladinos, on the other hand, are disproportionately represented in commercial and professional occupations (Tax 1963; Woods 1968; Brintnall 1974). Indeed, Brintnall (1974) notes that Ladinos, in a sense, connect the local Indian population to the national economic system. This is accomplished because Ladinos own the majority of the local tiendas (retail stores), agricultural distribution and transportation systems, thus determining

the flow of goods and products that enter and leave local communities.

A major result of the almost complete control of economic and political structures by Ladinos can be seen in the distribution of wealth in Guatemala. While the relationship between ethnicity and wealth or social class is by no means perfect, it nevertheless is strong. Clearly Ladinos may be found at all levels of wealth and all levels of the class structure. Indians, however, tend to predominate at the lower levels of the class structure and the distribution of wealth.

The potential consequences of the domination of the economic and political structures of Guatemala by individuals adhering to the Ladino cultural tradition for the distribution of earthquake damage and aid are many. Perhaps the most obvious stems from the lower economic position held by Indians. A major result of this lower position may be an inability to afford substantial housing, resulting in turn in greater damage. This lower position may also result in an inability to recover as readily as Ladinos without substantial disaster aid.

Further, to the extent that aid is filtered through the economic and political structures of Guatemala, one ethnic group may fare better than the other. This potential for unequal distribution may result from active discrimination, or Ladinos, because of greater participation in the national political and economic structures may to a greater extent explore and exploit the opportunities for aid available to them. Yet another possibility is that international relief agencies, sensitive to the economic and political realities, may attempt to compensate by insuring that Indians receive a greater amount of aid.

Thus, one can see that ethnicity may indeed be an important factor in the determination of earthquake damage, aid, and consequently, recovery. This chapter will explore the importance of Guatemala's plural structure in this determination. Specifically, this chapter will explore: (1) pre-earthquake ethnic differences in the distribution of domestic assets and housing patterns and their consequences for earthquake damage; (2) ethnic differences in the need for, utilization of, and access to different sources and types of aid; (3) ethnic differences in attitudes toward aid; and (4) ethnic differences in recovery. Further, given the nature of the pre-earthquake situation with respect to ethnic groups, we shall also explore the impact of earthquake aid on the process of modernization. To accomplish this analysis, the concept of relative ethnicity will be introduced and operationalized.

Relative Ethnicity

Conventional approaches toward conceptualizing and operationalizing ethnicity suffer from two major shortcomings. First is the exclusion of culture as the key defining characteristic. Many researchers have rejected the importance of culture and opted instead for psychological feelings of identity or association (Barth 1969; Francis 1947; White 1978). While psychological feelings are an important dimension of ethnic phenomena, they do not negate the importance of one's cultural tradition as a determinant of behavior. For those researchers interested in the cultural dimension of ethnicity, the assumption is made that certain "identity" items such as race, religion, national origin, self identification, or identification by others are coterminous with culture.

Making this assumption may be valid in varying research situations. What is lacking, however, is a cultural measure of ethnicity through which the validity of this assumption can be assessed.

The second major shortcoming of conventional approaches stems from the propensity of researchers to classify individuals into all or nothing ethnic categories. In other words, an individual is classified either into Category "X" or "Y," the implication being that all of the individual's behaviors reflect adherence to one, and only one, cultural tradition. Clearly, simple observation shows that operations of this nature are questionable. Individual members of a society may well exhibit behavior patterns characteristic of several cultural traditions. These shortcomings of conventional approaches to ethnicity become critical when attempting to assess an individual's ethnicity in Guatmeala.

Ethnic distinctions within Guatemala are based, not on racial characteristics, but on cultural differences. While there are undoubtedly some phenotypical differences between some individuals in Guatemala, ethnic distinctions are based on the exhibition of behavior patterns that reflect adherence to one or the other of two cultural traditions. As a consequence, measures of ethnicity which are valid for Guatemala should reflect the culturally prescribed behavior patterns of individuals that constitute ethnic identity.

Further, because of the processes of acculturation, or more specifically, Ladinization, that are occurring in Guatemala at an ever accelerating rate, many individuals do not exhibit behaviors characteristic of only one cultural tradition. Indeed, relevant literature notes that one often finds individuals, especially males, that exhibit patterns

appropriate to both cultural traditions. Therefore, the operation of assigning an individual to a category denoting a single cultural group is, at the very least, questionable.

In this research, a measure of relative ethnicity will be introduced and developed. This measure will not be based upon which ethnic group the individual says he or she belongs to, or upon an individual's town or region of origin, or on phenotype differences. Rather, it will be based upon the degree to which particular behavior patterns exhibited by the individual reflect adherence to the two cultural traditions of Guatemala. This measure will not place individuals into one of two categories, Indian or Ladino. Rather, the individual will be placed relative to each tradition on the basis of the degree of adherence to each.

In a sense, one could conceptualize an ethnic continuum existing in Guatemala. This continuum would have as its end points the two cultural traditions of Guatemala and the different points along the continuum would represent different degrees of adherence to these cultural traditions. The closer one moves to a particular tradition, the more closely the behavior patterns exhibited would reflect adherence to that tradition.

The degree to which an individual adheres to an ethnic sub-culture can be important for the subsequent analysis of earthquake damage and aid. For example, more traditional Indians may utilize different housing patterns or respond differently than Indians in the process of Ladinization and these groups may, in turn, be different from pure Ladinos. International and domestic relief agencies may treat more traditional Indians differently than more Ladinized ones, or, more Ladinized Indians may have several

sources of aid, both formal and informal, while more traditional Indian sources may be attenuated.

The consequences of individuals attempting to change or "pass" into another ethnic group have been discussed in both the sociological and anthropological literature (van den Berghe 1970). Often, individuals attempting to change are ostracized by individuals adhering more closely to both of the other cultural traditions. Consequently, those individuals attempting to change may receive less aid from both informal and formal sources. Thus, the degree of adherence may indeed be important for our subsequent analysis.

The discussion thus far has been centered around the individual. However, the ultimate goal in the establishment of a measure of relative ethnicity will be the development of a household measure. The reason is that the household in Guatemala, as in other developing countries, is the basic economic unit since in Guatemala each member of the household, from a very early age, plays a role in the continued survival of that unit (Tax 1963). Furthermore, it is the unit affected by disasters through damage to infrastructure such as housing.

The first step in the development of a household level scale must take place at the individual level. The measure of an individual's relative ethnicity will depend upon the correspondence between the individual's culture as reflected by the behavior patterns he or she exhibits *vis-a-vis* the Indian and/or Ladino cultural traditions of Guatemala. The actual behavior patterns utilized to construct this measure will depend upon three criteria: (1) the prevalence or universality of the pattern (2) whether or not there are cultural

alternatives, and (3) its theoretical importance as an indicator of ethnicity.

Relevant literature on the cultural traditions of Guatemala provides direction as to which behavioral patterns should constitute an operationalization of relative ethnicity. As discussed above, there are many behavioral differences between individuals practicing the respective cultural traditions of Guatemala. Included are differences in languages, religion, dress, housing, cooking, political participation, occupations, and attitudes. However, the key indicators repeatedly mentioned are those cultural practices associated with language and dress (Tax 1973; Tumin 1952; Colby and van den Berghe 1969; van den Berghe 1970; Reina 1966; Hinshaw 1979; Woods 1968; Farrell 1977). There exist more or less clearly defined cultural alternatives for dress and language patterns and these practices are employed throughout the population of human actors. Therefore these patterns were selected for the construction of the relative ethnicity scale.

Data Analysis for the Measure of Relative Ethnicity

The data upon which this analysis is based comes from the first interviews conducted as part of the Guatemalan earthquake project. Interviews were obtained from a principal informant, usually the female head of household, in each of the 1,472 households of the original sample. Information was obtained about each member of the household for both the pre and post-earthquake periods. Consequently, the data on which this analysis was conducted consist of information gained on 6,841 pre-earthquake household members.

The development of the ethnicity scale represents a fairly straightforward process. As stated above, two behavioral patterns will be utilized in the construction of the ethnicity measure, language and dress. However, to adequately represent these patterns, the composite scale will actually include four items, one representing language and three representing dress. The language item consists of the language(s) used and the fluency level for each member of the household interviewed. There are four categories included in the language item: (1) Mayan predominantly -- the individual expresses himself in a Mayan dialect although he may know a few words of Spanish; (2) quasi-bilingual -- the individual uses Mayan primarily but speaks limited Spanish; (3) completely bilingual -- the individual speaks both a Mayan dialect and Spanish fluently; and (4) Spanish -- the individual speaks Spanish only.

The dress patterns of each respondent are represented by three items, each measuring different aspects of the dress practices. The first item concerns the type of footwear owned by individuals and was coded as follows: (1) barefoot; (2) caites -- a simple sandal constructed with thongs and leather or tire-tread soles; (3) sandalia -- a leather shoe which is open-toed and open-heeled; and (4) Western shoes -- any type of shoe which totally covers the foot with the possible exception of the toes.

Information for the final two items was collected differently for male and female household members in the original interview. The items concern the type of blouse or shirt and skirt or trousers worn by each individual. The female blouse item was coded as follows: (1) traditional huipil --

the typical Indian blouse that is worn loosely and is usually handmade; (2) altered huipil -- an Indian blouse made of any non-Indian machine made cloth; and (3) Western blouse. And, the skirt item's response categories are as follows: (1) corte or Indian skirt -- any skirt considered to be of typical Indian pattern or which is hand-woven; and (2) Western skirt or dress. The response categories for the male trouser item are: (1) native trousers -- including any of the wide variety of the typically Indian trousers, usually of hand-woven material; (2) Western trousers -- including any Western style pant made of machine made materials, whether mass-produced or tailor made. The response categories for the shirt item were coded in the same way as trousers, with the distinction being in style and type of material (hand-woven or machine made).

To facilitate the development of a single relative ethnicity score, two new variables were created from the above information. A shirt/blouse variable was created and coded in the following manner: (1) traditional huipil, altered huipil, or native shirt; and (2) Western blouse or shirt. A trouser/skirt variable was also created and was coded in the following manner: (1) corte or Indian skirt, or native trousers; and, (2) Western skirt,dress or trousers. As should be apparent, in all of the items utilized, the lower the response category, the more traditionally Indian the practice or trait.

Once the selection of the items upon which the ethnicity measure will be based has been completed, the problem becomes one involving the mechanics of scale construction. It was decided that, for the purposes of this discussion,the scale would be constructed using nominal (or unequal)

weighting. The basic reason unequal weighting was selected stems from the conceptualization of relative ethnicity. As noted, ethnicity has been conceptualized as a continuum between cultural extremes. Consequently, an individual's ethnicity is defined relative to these extremes. One must attempt to maximize a scale's ability to distinguish among individuals and this can be accentuated further through differential weighting. In other words, some items may be better able to differentiate among individuals than others. In order to insure the ability of these items to differentiate, unequal weights will be used.

There are many different techniques by which one could establish a weighting system, ranging from those of an *a priori* nature to those based on empirical evidence (Wang and Stanley 1970). An *a priori* method consists of ranking items in terms of their theoretical importance to the concept of interest, in this case, culture. It is likely that one could develop a theoretical argument for weighting language above the other items in this scale. While positing that the behavioral patterns associated with language and dress are key indicators of cultural distinction, no hypotheses have been presented that one or the other behavioral pattern takes theoretical precedence over the others. Each of these practices, though indicative of an individual's cultural tradition, are simply behaviors learned in the social context of the networks in which individuals act. Therefore, none of these behavioral patterns takes theoretical precedence over the other. The principal concern is to maximize the ability of the composite measure of ethnicity to differentiate among individuals along a continuum between two cultural traditions.

Consequently, the weighting system will be determined through empirical methods.

The exact procedure utilized to establish the weighting system depends upon the particular research design. Some of the more often utilized procedures are multiple regression and discriminant analysis. However, procedures of this type require the use of an external criterion on which to base weights. In other words, the research utilizes a criterion, a particular variable deemed to be especially salient to the particular concept of interest, for predictive purposes to establish weightings for the other items. While there are several external criterion variables which one could hypothesize to be related to an individual's ethnicity, some of which will be used as a validity check for the composite measure, there are none available in the data which can be used for such a technique. Consequently, a factor analytic procedure will be employed to determine the weighting system to be utilized.

Before a discussion of the results of the factor analysis, it will be useful to examine the correlations among the items to be included in the scale. Presented in Table 15-1 are the zero-order correlations between the clothing and language items. It is quite apparent that all of the items are highly correlated. The highest correlation, .94, occurs between the shirt/blouse and trousers/skirt items, with the lowest, .45, occurring between the shirt/blouse and shoes items.

The factor analytic solution utilized in establishing this measure was maximum likelihood factor analysis. The results of this analysis are presented in Table 15-2. One factor was retained by the factor analysis. All subsequent factors had Eigen values less than one. The

Table 15-1

Zero-order Correlation For Items Included in the Relative Ethnicity Scale

Variable	Language	Shoes	Shirt/Blouse
Shoes	.533		
Shirt/Blouse	.589	.454	
Trousers/Skirt	.598	.461	.937

Table 15-2

Results of Maximum Likelihood Factor Analysis

Item	Unrotated Factor	Coefficients for Standardized Variables	Communalities
Trousers/Skirt	.973	.574	.948
Shirt/Blouse	.962	.397	.925
Language	.619	.031	.383
Shoes	.481	.019	.231
Variance Explained	2.486		

results of this analysis have been arranged such that the items appear in decreasing order of the variance explained (note the communalities). An inspection of the loadings for the standardized variables indicates that the trouser-skirt item loaded highest, .574, followed by shirt-blouse, .397, language, .031, and lastly, shoes, .019. The total variance explained by the factor is .62. These standardized loadings are used as weights in the composite relative ethnicity score.

A frequency distribution of the individual relative ethnicity scores obtained from analysis above is presented in Table 15-3. The relative ethnicity score has been scaled between zero and one to aid in conceptualization. A score of zero represents total adherence on the part of the individual to the Indian cultural tradition, while a one represents total adherence to the Ladino cultural tradition. The distribution is negatively skewed with the vast majority of individuals falling at or toward the Ladino end of the continuum. However, there is a suggestion of bimodality in that there also is a large number of individuals falling toward the Indian end of the continuum.

In an attempt to assess the validity of the relative ethnicity score as a measure of ethnicity, its relationship to a number of other variables is examined. There are several external criteria discussed within the literature that should be significantly related to ethnicity. A number of social scientists have, for example, noted a strong relationship between an individual's gender and the adoption of Ladino cultural practices (Hindshaw 1975; Colby and van den Berghe 1969; Woods 1968). Consequently, one would expect a significant relationship between the sex of an

TABLE 15-3

Frequency Distribution of Individual
Relative Ethnicity Scores

Individual Relative Ethnicity	Frequency	Cum Freq	Percent	Cum Percent
0	72	72	1.052	1.052
0.008	8	80	0.117	1.169
0.015	67	147	0.979	2.149
0.016	40	187	0.585	2.734
0.024	37	224	0.541	3.274
0.031	112	336	1.637	4.912
0.032	77	413	1.126	6.037
0.039	39	452	0.570	6.607
0.04	36	488	0.526	7.133
0.046	6	494	0.088	7.221
0.047	343	837	5.014	12.235
0.054	7	844	0.102	12.337
0.055	175	1019	2.558	14.895
0.062	32	1051	0.468	15.363
0.07	66	1117	0.965	16.328
0.389	6	1123	0.088	16.416
0.397	7	1130	0.102	16.518
0.404	1	1131	0.015	16.533
0.405	3	1134	0.044	16.577
0.412	5	1139	0.073	16.650
0.42	2	1141	0.029	16.679
0.428	10	1151	0.146	16.825
0.429	1	1152	0.015	16.840
0.435	3	1155	0.044	16.883
0.436	13	1168	0.190	17.074
0.444	22	1190	0.322	17.395
0.451	12	1202	0.175	17.571
0.459	39	1241	0.570	18.141
0.579	1	1242	0.015	18.155
0.596	1	1243	0.015	18.170
0.611	1	1244	0.015	18.184
0.929	16	1260	0.234	18.418
0.938	9	1269	0.132	18.550
0.945	20	1289	0.292	18.842
0.946	1	1290	0.015	18.857
0.953	25	1315	0.365	19.222
0.954	18	1333	0.263	19.485
0.96	65	1398	0.950	20.436
0.961	2	1400	0.029	20.465
0.968	104	1504	1.520	21.985
0.969	33	1537	0.482	22.467
0.976	121	1658	1.769	24.236
0.984	645	2303	9.428	33.665
0.992	19	2322	0.278	33.942
1	4519	6841	66.058	100.000

Mean = .829 Variance = .127 Skewness = -1.711

individual and the realtive ethnicity score, with males having,in general,higher ethnicity scores.

Additional criteria upon which to base the validity of the relative ethnicity measure are schooling (years of completed education), literacy, and percent Ladino within the community. Again, many social scientists have noted that Ladinos tend to be more literate and educated than Indians. Further, the educational system is controlled by the government of Guatemala through the Ministry of Education. The classroom sessions are conducted in Spanish, the official language of Guatemala, by Ladino instructors. Thus, the more years of schooling a person has, the more exposure and contact he or she has had with a Ladino cultural tradition. The same should hold for literacy, not only because it is acquired for the most part through schooling, but also because it should be related to potential contact. If an individual is educated or at least literate, his or her potential for access and contact with traditionally Ladino networks (e.g. political, legal and economic structures, especially at the national level) increases. Increased contact may well lead to greater adoption of Ladino cultural patterns. Therefore, the relationship between the relative ethnicity score and education and literacy should be positive and significant.

Yet another criterion through which the validity of the ethnicity score can be assessed is the percent Ladino in the community. Again the hypothesis is made that the more contact with Ladinos, the more the adoption of Ladino cultural practices by non-Ladinos. Thus, the greater the percent Ladinos within the community, the higher the ethnicity score

(a strong positive relationship). Since complete and recent census data relative to the communities of interest are not available, it became necessary to compute this measure (percent Ladino) on the basis of the data collected on respondent's self-identification. It is worth noting that for the communities on which we have census information, our figures for percent Ladino and those computed based on census information are remarkably similar.

The zero-order correlations between the four criterion variables, sex, education (years schooling), literacy and percent Ladino in community, and the relative ethnicity score are presented in Table 15-4 (note last row on this table). Clearly, while not extremely high correlations, each coefficient is significant and in the direction anticipated. Thus, on the basis of these four criteria and given the support within the literature for language and clothing as key indicators of ethnicity, some confidence may be placed in the validity of the measure of relative ethnicity.

Table 15-4

Correlations for Criterion Variables and Relative Ethnicity Score

Variable	Sex**	Education	Literacy	% Ladino
Education	.113*			
Literacy	.200*	.776*		
% Ladino	.013	.125*	.166*	
Relative Ethnicity Score	.384*	.280*	.347*	.535*

* Significant at .0001 level
** Coded (0 - female, 1 - male)

The final criterion to be utilized to establish the validity of our relative ethnicity score will be self-identification. As noted above, researchers often implicitly assume that self-identification and culture are highly correlated. Reina (1966), van den Berghe (1970), and Colby and van den Berghe (1969) have reported that clothing and language are important factors in the process of determining an individual's ethnicity by Guatemalans themselves. Consequently, it is hypothesized that self-identification is positively correlated with the measure of relative ethnicity. The principal informant was asked to identify his or her ethnic group, thus it is possible to assess this relationship. The correlation, as hypothesized, between the two was strong and positive. The actual correlation was .81 with a significance of .0001.

Finally, the reliability of the relative ethnicity scale is assessed utilizing Cronbach's Alpha. This measure establishes the internal consistency of the measure. An Alpha of .857 was obtained for the relative ethnicity score. This value denotes a high order of internal consistency among the components of our measure.

The discussion thus far has been concerned with the development of a relative ethnicity measure at the individual level. Having established a degree of confidence in both the reliability and validity of this measure, attention can now turn to the establishment of the household relative ethnicity score.

Household Relative Ethnicity

There are a number of procedures through which one could, utilizing the individual ethnicity measures, establish a relative ethnicity measure

for the household. For example, one might simply utilize the male head's, or perhaps female head's, ethnicity score to reflect the ethnicity of the household. If information exists for both the male and female household heads, perhaps the mean of the two could represent the ethnicity of the household. These measures may well suffice in more or less culturally homogeneous societies in which the male or male and female heads are the principal determinants of the household's position in the social structure. However, given the nature of Guatemalan society and its households, perhaps information on all of the members of the households should be utilized.

Sol Tax (1963) notes that the household is the basic production and consumption unit, with each member playing an important part. Woods (1968:20), when discussing the Guatemalan household, states that:

> The family unit sharing in a hearth is the consumptive and productive unit with all members contributing. Young children free the mother for part-time weaving and vending in the market by running errands, tending infants, and doing part of the household chores...teenage males can earn the going daily wage and teenage girls can take domestic employment.

All members then, to a greater or lesser extent, play a role in the continued survival of the household unit. The members of the household, either by freeing older members of many domestic tasks, thereby allowing more productive tasks to be undertaken, or by actual production of goods or wages, play an important role within the household. Thus each household member is potentially important as a determinant of the household position within Guatemala's social structure.

Further, each member of the household may exhibit different levels of adherence to the cultural traditions of Guatemala. One member may

adhere more closely to the Indian cultural tradition, while others may exhibit more Ladino cultural traits. In other words, the household need not be culturally homogeneous with respect to adherence to the cultural traditions of Guatemala. Consequently, in an attempt to measure the degree of adherence to the cultural traditions of Guatemala at the household level, it is important to utilize information on all of the members of the household.

A final reason one might include information on all members of the household stems from Guatemala's plural structure. As discussed above, there are institutional structures - especially religious and leadership structure - associated with adherence to the respective cultural traditions, and, the differential association and participation on the part of individuals adhering to the Ladino cultural tradition in the economic and political structures of Guatemala has also been discussed. Consequently, because members in the same household may adhere in different degrees to the cultural traditions of Guatemala, to assess more completely the position of each household in this complex plural society, information on each member of the household will be utilized in the household measure of relative ethnicity.

In this research, the relative ethnicity score of each individual member of the household will be utilized to compute the household relative ethnicity score. Specifically, the household score will be computed by taking the mean of its members' scores. Prior to the earthquake, 1,414 of the 1,472 households in the first phase of interviews were in existence. The remaining 58 households formed after the earthquake. A cumulative

frequency distribution of these household scores for households that existed before the earthquake is presented graphically in Figure 15-1.

It is of interest to note the differences between the cumulative percentage distribution of the individual relative ethnicity scores which are shown graphically (Figure 15-2) as compared to the cumulative percentage distribution of the household relative ethnicity scores. The cumulative percentage of the individual scores show a rather quick rise to between 15-20 percent at the Indian end of the continuum. Following its initial rise, the cumulative percentage remains constant, except for a small increase at the mid-point of the ethnic continuum, until reaching the Ladino end where it rises precipitously to 100 percent. The cumulative percentage of the household score, on the other hand, rises gradually, not reaching above 15 percent until the mid-point of the ethnic continuum. From the mid-point, following a jump of around 10 percentage points, the cumulative percentage increases gradually to around 35 percent at the Ladino end where upon it,too,rises precipitously to 100 percent.

The differences in these distributions show the heterogeneity of Guatemalan households. While there are indeed a substantial number of individuals that adhere quite closely to an Indian cultural tradition, hence the sharp increase in cumulative percentage at the Indian end of the continuum, if we place these individuals within their household context a different picture emerges. One finds that these traditional Indians reside in households with other individuals that practice, to some extent, Ladino behavioral patterns. Consequently, there is not

FIGURE 15-1
CUMULATIVE PERCENTAGE OF
HOUSEHOLD RELATIVE ETHNICITY SCORE

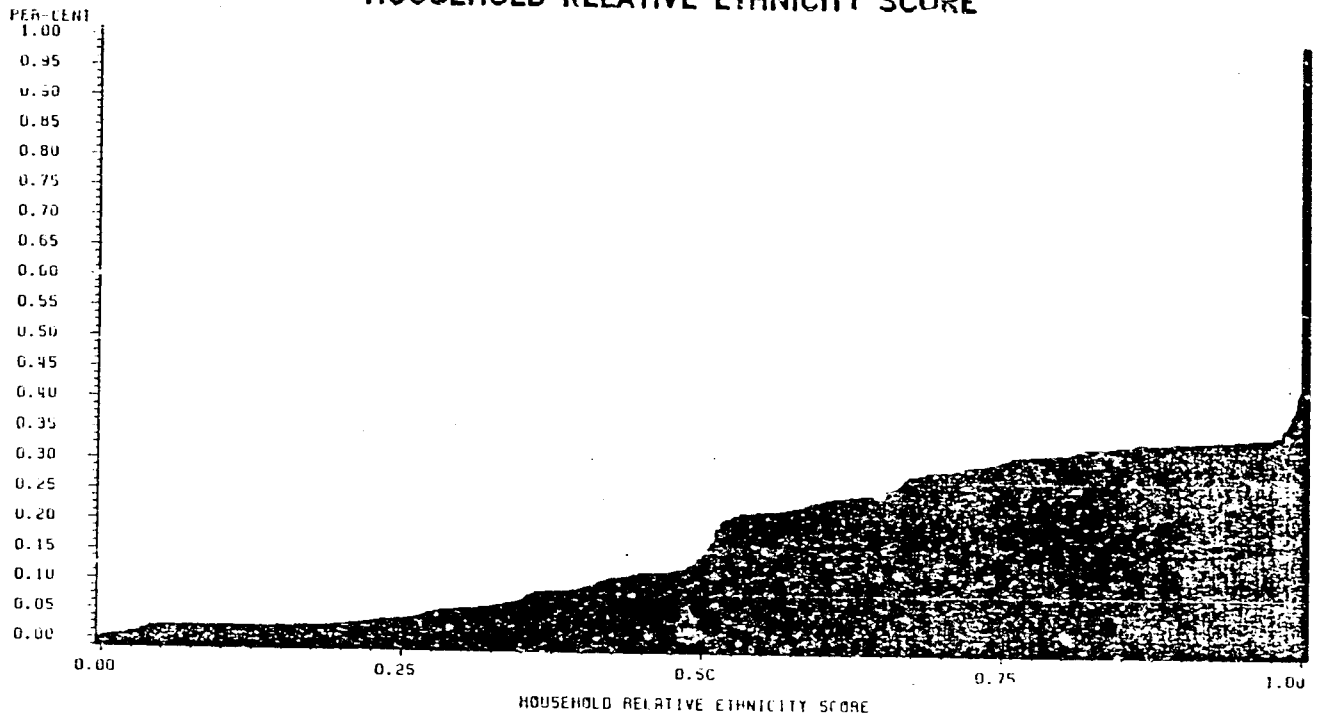
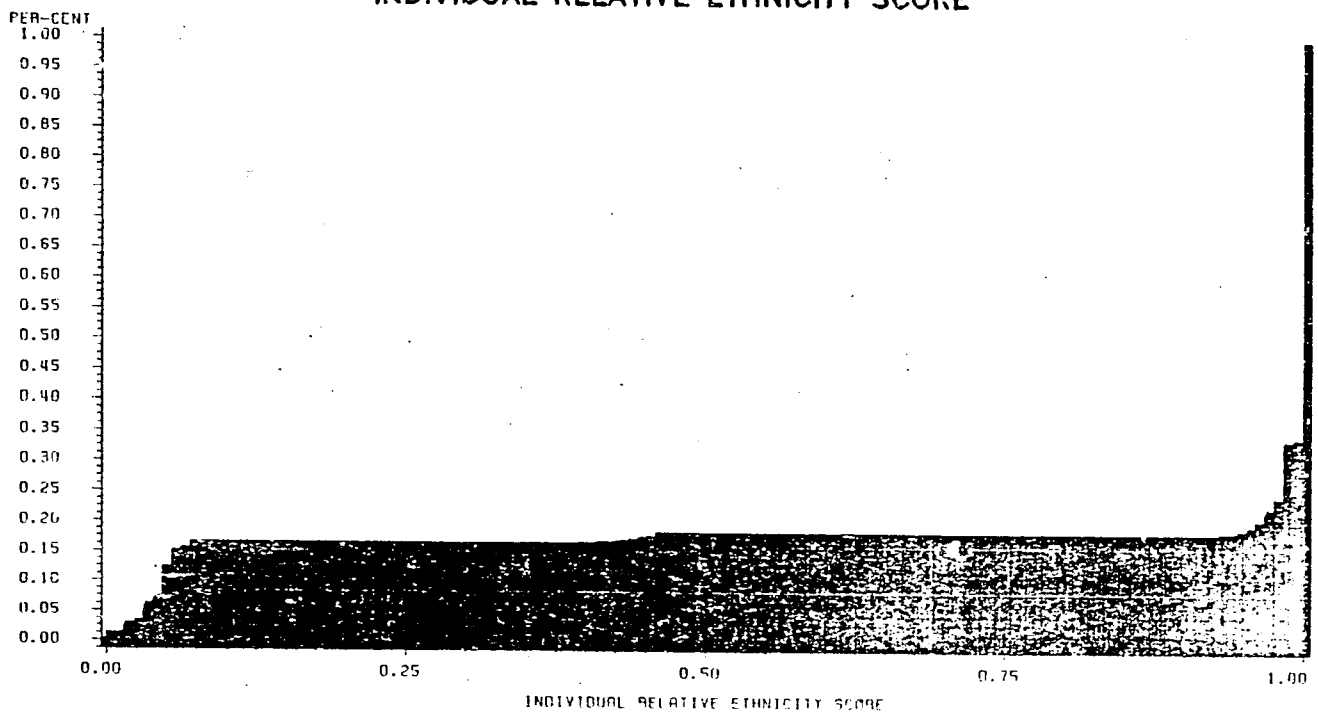


FIGURE 15-2
CUMULATIVE PERCENTAGE OF
INDIVIDUAL RELATIVE ETHNICITY SCORE



a large percentage of totally Indian households. Rather, one finds a gradual increase in the percentage, the closer one moves toward the Ladino end of the ethnic continuum. These differences also point out the large degree of ethnic transition that is occurring within Guatemalan households.

Throughout much of the remainder of this chapter a categorized version of the household realtive ethnicity score will also be utilized. Rather than a simple all or nothing categorization however, these categories will reflect degrees of adherence to the two traditions at the household level. In order to do this, the household realtive ethnicity score will be broken into three categories. The first category will reflect total adherence to the Ladino cultural tradition; in other words, households that score a one on the relative ethnicity measure. The remainder of the households then range between almost pure Ladino households and pure Indian households, an extremely small minority. The households are split into two categories at the median, the upper category consisting of households which display more Ladino characteristics, and the lower category being comprised of households more closely approximating traditional Indian behavior patterns.

Throughout the remainder of this chapter the consequences of ethnicity, as measured by the continuous and categorized relative ethnicity measures for disaster related phenomena, will be explored. However, subsequent analysis will not be based upon all of the households in the total sample because many are located in the almost totally Ladino eastern regions of Guatemala. Consequently, the subsequent analysis will be conducted on the weighted version of the control and experimental Indian communities of the highland region of Guatemala. Specifically the communities included

in the analysis are: (a) Experimental: Chimaltenango, San Martin Jilotepeque, Patzun, Pacoc, Santa Maria Cauque, Las Lomas, San Marcos P.R., (b) Control: Solola, San Lucas Toliman, San Marcos de Laguna, and Cerro de Oro.

Pre-Earthquake Ethnic Differences in Housing and Earthquake Vulnerability

This section will examine ethnic differences in pre-earthquake housing patterns and in the economic standing of households. The purpose of this analysis is to explore the extent to which ethnic differences exist in these characteristics and to discuss their potential implications for earthquake vulnerability. Because of the focus on ethnic differences, only households in highland, experimental group communities will be examined. These are the only communities included in the total sample that contain both Indians and Ladinos living in the same villages. Since one of the objectives of this chapter is to compare ethnic categories in terms of their recovery from the earthquake, especially as it depended upon the aid received, it is important to utilize only communities where both ethnic groups live side-by-side. Where this is true, each group had an opportunity to be exposed to the same program. With respect to the communities in the eastern region of the country, there are only Ladino residents. Consequently, these communities have been excluded from the sample employed in this chapter.

Ethnic Differences in Pre-earthquake Housing Patterns

In Chapter 9 it was shown that housing patterns, or more specifically, the materials used in house construction, can have important consequences

for the amount of earthquake damage experienced by a household. It was found that earthen structures suffered significantly higher levels of damage than structures utilizing light or masonry wall materials. Further, it was found that traditional houses and those with mixed modern and traditional materials suffered more damage than modern structures.

Tax (1963), Woods (1968), and Hinshaw (1975) have all noted ethnic differences in the materials utilized in house construction. Indian households tend toward more traditional materials such as adobe and tile, cane and thatch, or bajareque and thatch. More recently researchers have also noted the increasing prevalence of lamina (corrugated metal) as a roofing material used by Indians (Woods 1968; Hinshaw 1975). The degree to which these traditional housing patterns, especially earthen structures, are associated with particular ethnic categories may have consequences for differential earthquake damage between Indians and Ladinos.

Presented in Table 15-5 are ethnic differences in the roofing materials used on pre-earthquake principal houses in the highland region. Of particular importance to this discussion is the prevalence of tile, an extremely heavy and consequently dangerous traditional roofing material. All ethnic categories made extensive use of tile, nevertheless, there are ethnic differences exhibited in this table.

With respect to the traditional materials of tile and thatch, both Indian ethnic categories show a higher percentage of use than Ladino households. As a matter of fact, no Ladino households utilized thatch and only about 43 percent used tile as compared to about 57 percent for Ladinized Indians and 56 percent for traditional Indians.

TABLE 15-5

Roofing Material of Pre-earthquake House
by Household Ethnicity

Household Ethnicity	Thatch		Wood		Tile		Lamina		Duralita		Other	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ladino	0	0	0	0	38	42.7	49	55.1	1	1.1	1	1.1
Ladinized Indian	7	5.2	0	0	76	55.9	49	36.0	3	2.2	1	0.7
Traditional Indian	11	6.4	1	0.6	91	52.9	69	40.1	0	0	0	0
Totals	18	4.5	1	0.3	205	51.6	167	42.1	4	1.0	2	0.5

The degree to which lamina was utilized prior to the earthquake is also of interest. Agencies that distributed lamina were sometimes criticized for distributing a material that was culturally inappropriate and created dependency on foreign manufacturing. The latter criticism undoubtedly has some legitimacy. However, the trend toward lamina utilization was well underway prior to the earthquake when 42.1 percent of the households studied in this analysis utilized this material. As a matter of fact lamina represented the dominant pre-earthquake roofing material for Ladino households. Further, with respect to the categories that tend to be traditional in material usage, lamina represented the second most utilized material, (36.0 percent for ladinized households and 40.1 percent for traditional Indian households.)

Materials utilized in wall construction of the pre-earthquake house for each ethnic category are presented in Table 15-6. Overall, 87.9 percent of the households in this sample had adobe walls prior to the earthquake. The majority of Ladino households had adobe walls (88.8 percent) but a small percentage used cement block and tapia (7.9 and 3.4 percent respectively).

Even though among Indians adobe was the most common wall material used, Indians as a category employed a greater variety of wall materials in constructing houses . The three utilized most often by Ladinized Indian households were the traditional materials of adobe (86.8 percent) and bajareque (5.2 percent) and the modern material, cement block (2.9 percent). The three materials utilized most often by traditional Indian households were the traditional materials, adobe (88.4 percent), bajareque (5.2 percent), and cane (2.3 percent). The extent to which

TABLE 15-6

Principal House Walls by Household Ethnicity

Household Ethnicity	Adobe		Bajareque		Tapia-Mud		Cane Palm Thatch		Block		Half Adobe		Half Block		Wood		Other	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ladino	79	88.8	0	0	3	3.4	0	0	7	7.9	0	0	0	0	0	0	0	0
Ladinized Indian	118	86.8	7	5.2	0	0	1	0.8	4	2.9	0	0	2	1.5	3	2.2	1	0.7
Traditional Indian	152	88.4	9	5.2	1	0.6	4	2.3	1	0.6	1	0.6	0	0	2	1.2	2	1.2
Total	349	87.9	16	4.0	4	1.0	5	1.3	12	3.0	1	0.3	2	0.5	5	1.3	3	0.8

differences existed in utilization of earthen material can be better illustrated in Table 15-7.

The wall categories shown in Table 15-6 have been collapsed in Table 15-7 into three categories: (1) earthen (adobe, bajareque, tapia and half adobe); (2) light (cane, palm, and wood); and (3) masonry (cement block and half cement block). This table demonstrates that almost all pre-earthquake walls across ethnic categories were earthen (93.9 percent). While there were slightly more traditional Indians with earthen walls than either Ladinized Indians or Ladinos (95.9 percent to 92.6 and 92.1 percent respectively), these differences are small. Indian households, both Ladinized and traditional, dominated in the light wall construction category and Ladinos and Ladinized Indians had greater percentages of masonry walls.

In Chapter 9 which was concerned with pre-earthquake housing, it was established that earthen structures suffered significantly more damage than either light or masonry structures. While there are differences in the utilization of earthen versus either of the other two types of wall materials between ethnic categories, these differences are not statistically significant (see Chi Square test on Table 15-8). As a consequence, it is difficult to anticipate differences in level of earthquake damage between the respective ethnic categories based upon this information. However, if projected damage scores are computed for each ethnic category, differences do emerge.

Projected damage scores can be computed for each ethnic category based on the mean damage actually experienced in the earthquake for each wall type. The mean damage for each wall type for this sample is: 2.50 for earthen walls; 1.35 for light walls; and 0.50 for masonry walls

TABLE 15-7

Wall Material Classified as Earthen, Light, and Masonry
By Household Ethnicity

Household Ethnicity	Earthen		Light		Masonry	
	No.	%	No.	%	No.	%
Ladino	82	92.1	0	0	7	7.9
Ladinized Indian	125	92.6	4	3.0	6	4.4
Traditional Indian	163	95.9	6	3.5	1	0.6
TOTALS	370	93.9	10	2.5	14	3.6

TABLE 15-8

Wall Material by Household Ethnicity

Household Ethnicity	Earthen No.	Earthen %	Light or Masonry No.	Light or Masonry %
Ladino	82	92.1	7	7.9
Ladinized Indian	125	92.6	10	7.4
Traditional Indian	163	95.9	7	4.1
TOTALS	370	93.9	24	6.1

CHISQ = 2.056 DF = 2 PROB = .358

where 3.00 means "destroyed" and 0.00 means "no damage". By computing the projected means for each ethnic category on the basis of their pre-earthquake walls, the following results are obtained: 2.34 for Ladino households, 2.37 for Ladinized Indians and 2.45 for traditional Indian households. Thus, on the basis of these projections, it appears that traditional Indians would be expected to suffer slightly more damage than the other two ethnic categories.

The wall and roof material used in the pre-earthquake house have been combined into housing types in Table 15-9. The traditional housing pattern which uses adobe walls and a tile roof is the most prevalent, followed by adobe and lamina (49.8 and 36.5 percent respectively). Both Indian categories show the highest percentage in the adobe-tile house type (55.9 percent for Ladinized Indians and 50.0 percent for the traditional Indians). However, a rather large percentage of Ladino households (40.5 percent) also have adobe tile houses. The largest percentage of Ladino houses (47.2 percent) is in the adobe and lamina category where houses employ a traditional wall material and a modern roofing material. The second highest percentages of traditional and Ladinized Indian households are also in this category, with 36.1 and 30.2 percent respectively.

The third and fourth most prevalent categories respectively, ignoring "miscellaneous," are bajareque and thatch, a traditional housing pattern, and block and lamina, a modern housing type. No Ladino households are in bajareque and thatch structures. However, 4.4 percent of the Ladinized Indian and 3.5 percent of the traditional Indian house structures fall in this category. Finally it is apparent that a larger

TABLE 15-9

Principal House Type by Household Ethnicity

Household Ethnicity	Adobe-Tile		Adobe-Lamina		Wood-Lamina		Block-Lamina		Bajareque-Thatch		Cane-Lamina		Other	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ladino	36	40.5	42	47.1	0	0	7	7.9	0	0	0	0	4	4.5
Ladinized Indian	76	55.9	41	30.2	3	2.2	3	2.2	6	4.4	1	0.7	6	4.4
Traditional Indian	86	50.0	62	36.1	0	0	1	0.6	6	3.5	1	0.6	16	9.3
Totals	198	49.9	145	36.5	3	0.8	11	2.8	12	3.0	2	0.5	26	6.5

percentage of Ladino households fall in the modern block and lamina category relative to the percentages of Indian households.

Utilizing the same classification scheme introduced in Chapter 9, the above housing types have been collapsed into modern, mixed and traditional categories in Table 15-10 in order to illustrate the relationship between ethnicity and housing type. There is a clear, but moderate relationship between household ethnicity and house type. Higher percentages of Ladinized and traditional Indian houses are traditional, while a somewhat higher percentage of Ladino houses are both mixed and modern.

While ethnic differences have been found in the utilization of modern materials, it is difficult to make meaningful statements with respect to potential earthquake damage due to the substantial damage suffered by both traditional and mixed house types (see Chapter 9). Calculating projected mean damage for each ethnic category however, will aid in the determination of whether these differences may lead to ethnic differences in damage.

The projected damage for each ethnic category based on pre-earthquake house type, can be computed using the mean damage for each house type. The mean damage of each house type for this sample is: 2.52 for traditional houses; 2.42 for mixed houses; and 0.47 for modern houses. The projected means for each ethnic category are: 2.31 for Ladino households; 2.35 for Ladinized Indian households; and 2.46 for traditional Indian households. The difference in the projected mean damage for Ladino and Ladinized Indian households is slightly larger than the difference in the projections based solely on wall material. However, the greatest differences in projected damage occur between

TABLE 15-10

Modernity of Housing by Ethnicity

Household Ethnicity	Housing Category: Traditional No.	Traditional %	Mixed No.	Mixed %	Modern No.	Modern %
Ladino	38	42.7	44	49.4	7	7.9
Ladinized Indian	83	61.0	44	32.4	9	6.6
Traditional Indian	101	58.7	69	40.1	2	1.2
TOTALS	222	55.9	157	39.6	18	4.5

Chi Sq = 15.45 DF = 4 Probability .004

Phi = .197

traditional Indian households and the other two ethnic categories. Thus, it appears that traditional Indian households, on the bases of pre-earthquake housing materials, may have been slightly more vulnerable to earthquake damage at the time of the earthquake. On an average traditional Indians were about 6.5 percent higher on the damage scale than Ladinos and 4.7 percent higher than Ladinized Indians.

Summary of Ethnic Differences in Housing

Significant ethnic differences in the modernity of materials utilized in pre-earthquake housing have been noted. Also, some minor ethnic differences were found in the utilization of certain wall and roofing materials. On the basis of these differences in pre-earthquake housing materials, it appears that traditional Indian households may have been slightly more vulnerable to earthquake damage than the other two ethnic categories because of their housing patterns.

The above conclusion has been based exclusively on ethnic differences in housing materials however, and not on the type or quality of house construction and design. These design and construction factors have important consequences for earthquake damage. It is possible that the quality of construction may also be related to ethnicity, especially because of the relationship between ethnicity and economic standing. It is this relationship toward which attention is now turned.

Ethnicity and Economic Standing

Researchers have noted a relationship between ethnicity and relative economic standing in plural societies. The extent to which this relationship exists in Guatemala can be of importance to this study

of reconstruction because disaster research has shown that lower socioeconomic groups are most vulnerable in disasters (Bates et al. 1963 and Cochrane 1975). The domestic assets measure, introduced in Chapter 14, will be utilized to assess this relationship.

The zero order correlation between the continuous household relative ethnicity score and the pre-earthquake Domestic Assets score is .45 and is significant at the .0001 level. This correlation indicates a moderately strong positive relationship between household ethnicity and household domestic assets. Thus, the more Ladinized the household, the greater the household's domestic assets. This relationship can also be illustrated using the categorized relative ethnicity measure.

Table 15-11 presents the means, medians, and standard deviations of the Domestic Assets Scores for each ethnic category. The mean Domestic Assets for Ladino households is $664.89 higher than the mean for Ladinized Indian households and almost double the mean assets for traditional Indian households (a $912.85 difference). The mean assets for Ladinized Indian households is $247.96 higher than the mean assets for traditional Indian households.

Given the highly skewed nature of the domestic assets distribution, the median is a better indicator of central tendency. Even so, the results obtained using medians are not appreciably different from those using means. Ladinos have the highest median ($1636.00), which is $592.25 higher than Ladinized Indian household and $747.00 higher than traditional Indian households. Also the Ladinized household median is $154.75 higher than the traditional Indian household median.

The results of significance tests for differences between for means and medians for the respective ethnic categories are presented in Tables

TABLE 15-11

Means, Standard Deviations, and Medians of Domestic Assets By Each Ethnic Category in Dollars

	Household Relative Ethnicity		
Domestic Assets	Ladino	Ladinized Indian	Traditional Indian
Mean	1885.40	1220.51	972.55
Std Dev	999.29	598.85	368.55
Median	1636.00	1043.75	889.00

15-12 and 15-13 respectively. In Table 15-12, all means were found to be significantly different from each other. When Domestic Assets scores were logged to normalize their distribution, the means of the logged Domestic Assets scores for each group were also found to be significantly different from each other. Finally, in Table 15-13, differences in medians for the respective ethnic categories were tested using Chi-Square approximations and all medians were found to be significantly different.

With respect to relative economic standing in pre-earthquake Guatemala as measured by household Domestic Assets, Ladino households are highest followed by Ladinized Indian households. Traditional Indian households, on the other hand, are lowest.

Clearly then, there are ethnic differences in relative economic standing. The more traditionally Indian the household, the lower its domestic assets. Previous disaster research indicates that the poor tend to be more vulnerable to disaster. Thus, combining these findings and those concerning differences in housing material, one might expect that non-Ladino households, especially traditional Indian households, would suffer greater levels of loss and damage.

Earthquake Damage and Loss

This section will examine actual earthquake damage and loss with respect to ethnicity. Three measures of damage and loss will be employed. The first measure, damage, is the average of the wall and roof damage experienced by the pre-earthquake house. The damage measure, discussed more completely in Chapter 9, ranges between 0.00,

TABLE 15-12

Statistical Test for
Difference in Means of Domestic Assets
Score for Respective Ethnic Categories

Categories Compared	Mean Domestic Assets (Dollars)	Std. Dev. (Dollars)	t	Prob. of t
Ladino	1885.40	999.29	-5.65	.0001
Ladinized Indian	1220.51	598.85		
Ladino	1885.40	999.29	-8.33	.0001
Traditional Indian	972.55	368.55		
Ladinized Indian	1220.51	598.85	-4.24	.0001
Traditional Indian	972.55	368.55		
Ladino	7.42*	.48	-6.56	.0001
Ladinized Indian	7.00*	.47		
Ladino	7.42*	.48	-10.81	.0001
Traditional Indian	6.81*	.42		
Ladinized Indian	7.00*	.47	-3.87	.0001
Traditional Indian	6.81*	.42		

*Means of Logged Domestic Assets Score

TABLE 15-13

Statistical Test for Difference in Median of Domestic Assets for Respective Ethnic Categories

Ethnic Categories Compared	Median Domestic Assets Dollars	ChiSq	Prob. ChiSq.
Ladino	1636.00	22.161	.0001
Ladinized Indian	1043.75		
Ladino	1636.00	49.814	.0001
Traditional Indian	889.00		
Ladinized Indian	1043.75	14.654	.0001
Traditional Indian	889.00		

indicating no damage to the wall or roof of the structure, and 3.0, indicating that the structure was completely destroyed.

The second and third measures to be employed are indicators of the amount of economic loss incurred by the household as a result of earthquake impact. The first, absolute loss, equals the amount of reduction in household domestic assets produced by the earthquake. This measure was computed by subtracting the household domestic assets measure for 1976, immediately following the earthquake, from the 1975 Domestic Assets scores. The absolute loss in domestic assets is not only a function of how much damage was substained but it is also a function of the household's economic standing in 1975. Consequently, a household with a large Domestic Assets score may score above a poorer household in absolute loss while suffering less relative damage.

The final measure employed is the relative loss in domestic assets incurred by the household. The relative loss measure is computed by dividing the absolute loss measure by the household's 1975 Domestic Assets score. This measure indicates the percentage loss in domestic assets incurred by the household because of the earthquake.

Thus, two of the measures to be employed, damage and relative loss, are measures of the relative impact of the earthquake on households. The absolute loss measure, on the other hand, is a consequence of the household's pre-earthquake economic standing as well as earthquake impact. Given ethnic differences in the use of housing materials and domestic assets, one would expect that while Ladinos would suffer more in economic loss, the Indian categories, because of their vulnerable position, would suffer more in terms of the relative measures of earthquake impact.

Presented in Table 15-14 are the means for the damage measure for each ethnic category. The results of test for differences in mean damage between the respective categories are also presented. All of the means are above 2.0, indicating all categories suffered greater than heavy damage. Ladinos had the lowest level of damage (2.15), traditional Indians had the highest level of damage (2.54), and the mean damage for the Ladinized Indian category (2.34) fell between the other categories.

In terms of statistically significant differences in mean damage however, only two ethnic categories have different scores. There is no significant difference between the mean damage for Ladino and Ladinized Indian households or between Ladinized and traditional Indian households, although the latter difference does approach significance. The mean scores for Ladino households and traditional Indian households is statistically significant. On this basis it appears that traditional Indian households suffered on an average more damage than Ladino households.

The means and test for significant differences on absolute loss for the respective ethnic categories are presented in Table 15-15. The mean absolute loss for the respective groups is: Ladino, $957.; Ladinized Indian, 885.; and traditional Indian, $772. In terms of significant differences it appears that the means for Ladino and Ladinized households are not different. However, the mean absolute loss for traditional Indian households is significantly different from both the other categories.

In Table 15-16 means and significance tests for relative loss by ethnic categories are presented. The mean percentage loss of 1975

TABLE 15-14

Means and Difference
In Mean Damage for Respective
Ethnic Categories

Ethnic Categories Compared	Mean Damage	Standard Deviation	t	Probability t
Ladino	2.15	1.01	1.43	.1535
Ladinized Indian	2.35	1.03		
Ladino	2.15	1.01	3.24	.0015
Traditional Indian	2.54	.79		
Ladinized Indian	2.35	1.03	1.85	.0656
Traditional Indian	2.54	.79		

TABLE 15-15

Means and Differences in Absolute Loss for Respective Ethnic Categories

Ethnic Categories Compared	Mean Absolute Loss	Standard Deviation	t	Probability t
Ladino	957.36	534.32	-1.08	.2823
Ladinized Indian	884.51	469.11		
Ladino	957.36	534.32	-2.97	.0036
Traditional Indian	772.22	343.04		
Ladinized Indian	884.51	469.11	-2.34	.0201
Traditional Indian	772.22	343.04		

Table 15-16

Means and
Difference in Mean Relative Loss
For Respective Ethnic Categories

Ethnic Categories Compared	Mean Relative Loss	Standard Deviation	t	Probability t
Ladino	.59	.29	3.61	.0004
Ladinized Indian	.74	.30		
Ladino	.59	.29	5.89	.0001
Traditional Indian	.80	.25		
Ladinized Indian	.74	.30	1.73	.0856
Traditional Indian	.80	.25		

assets was 59 percent for Ladino households while it was 74 percent for Ladinized Indians was 80 percent for Traditional Indians. The means for the two Indian categories are not significantly different from each other. However, both Indian means are significantly different from the mean Ladino relative loss. Thus, the two Indian categories, traditional and Ladinized, lost a significantly greater percentage of their 1975 domestic assets than did Ladinos.

While it appears that Ladino and Ladinized Indian households, in part because of their higher economic standing, suffered on an average, greater absolute economic loss, a different picture emerges with respect to relative loss. Both traditional and Ladinized Indian households had a greater mean level of relative (percentage) loss than Ladino households. Further, traditional Indian households suffered greater mean damage than Ladino households.

The Effect of Ethnicity on Damage and Loss

The analysis in this chapter began, having established the relative ethnicity measure, by examining the relationship between ethnicity and two factors, economic standing and housing materials, that have been associated with earthquake damage. The purpose of examining these relationships was to note their potential implication for the relationship between ethnicity and earthquake damage and loss. In the last section significant differences were found between ethnicity and the amounts of damage and loss incurred by a household. Given the bivariate nature of this analysis however, these differences may be due exclusively to ethnic differences in housing material or economic standing. This section will assess the effect of ethnicity on

earthquake damage and loss more directly through a multivariate analysis.

A series of regression equations will be estimated in which the type of housing materials employed in the principal house, the household's economic standing, and the household's relative ethnicity are regressed on earthquake damage and loss. The purpose of this analysis is of course the estimation of the effect of ethnicity. The inclusion of the other variables is necessary to remove their effects, thus allowing a more accurate assessment of the effect of ethnicity on damage.

Two measures of earthquake damage and loss will be employed in this analysis. The first series of regression equations will utilize damage as the dependent variable and the last series will employ relative or percent loss as the dependent variable. These measures of earthquake impact will be employed because they provide a sound and readily interpretable estimation of relative earthquake impact across households.

The modernity measure which classifies house types will also be employed. It will be used because it provides information on both wall and roofing material in the pre-earthquake house. The categories of this measure are: (1) traditional--both the wall and roof materials are traditional; (2) mixed--one material, wall or roof, is traditional and the other modern; and (3) modern--both the wall and roof materials are modern. Given the qualitative nature of this measure, a dummy coding scheme will be employed in both series of regression equations. Two dummy coded variables will be created, one for the mixed house type and

the other for the modern house type. The traditional house type will be the excluded category.

The last two variables (both continuous) included in this analysis are domestic assets and relative ethnicity. The domestic assets measure is included as an index of the economic standing of the household. Finally, relative ethnicity is employed as a measure of household ethnicity.

The first step in this analysis is to determine whether the continuous variables, domestic assets and relative ethnicity, have equal effects on damage or relative loss across the different house type categories. This amounts to testing for significant differences in the regression coefficients for domestic assets and relative ethnicity for each category. To make this assessment, two regression equations are estimated, one which constrains the house types categories to common coefficients while the other, employing interaction terms, allows them to vary. Focusing on these estimations, a test for incremental change in the variance explained will be conducted. If the second equation does indeed explain a greater percent of the variance, then the coefficients for domestic assets and relative ethnicity are different across house type categories.

Presented in Table 15-17 are the results of the analysis discussed above for damage to the pre-earthquake house. Equation one, the constrained equation, explains 20.97 percent of the variance in damage. On the other hand, equation two, the equation that allows the coefficients to vary, explains 23.13 percent of the variance. An F-test for incremental change in R^2 between the two equations was significant at the .05 level. The coefficients for domestic assets and relative

TABLE 15-17

Regression Coefficients for Equations of Effects of House Type, Domestic Assets, And Relative Ethnicity on Damage*

Independent Variables	Coefficients for Equation 1	Coefficients for Equation 2	Means	Std Dev
Constant	2.926	2.694		
Mixed**	-0.100	0.544	.396	.490
Modern***	-1.918	-4.610	.045	.208
Domestic Assets	-0.160×10^{-4}	0.923×10^{-5}	1262.14	726.05
Relative Ethnicity	-0.155	-0.074	2.536	.703
(Mixed) (Domestic Assets)		-0.570×10^{-4}	467.11	682.80
(Mixed) (Relative Ethnicity)		-0.227	1.012	1.336
(Modern) (Domestic Assets)		-0.200×10^{-3}	108.25	593.23
(Modern) (Relative Ethnicity)		1.020	.138	.641
R^2	.2097	.2312		
F-Ratio	26.01	14.59		
Prob F	.0001	.0001		

* F-Test for increment in R^2 Between Equation 1 and 2 was 2.71: significant at .05 level with 4 and 388 degrees of freedom

** Dummy coded variable for mixed houses: 1 if mixed, 0 otherwise.

*** Dummy coded variable for modern houses: 1 if modern, 0 otherwise.

ethnicity are not equal across house type categories. Thus, separate equations are calculated for each house type category.

Presented in Table 15-18 are the separate regression equations estimating damage for traditional, mixed and modern house types. Of particular interest in these equations are the coefficients for the relative ethnicity variable. These regression coefficients represent the change in damage due to a unit change in relative ethnicity.

Noting the regression coefficients for relative ethnicity, one can see that ethnicity does not have equal effects across house type categories. For the traditional and mixed house types, ethnicity has a negative effect, -.074 and -.301 respectively. These coefficients indicate that for the majority of households in this sample, the more Indian the household the greater the amount of damage. This is especially true for mixed housing in which the effect of ethnicity is more than four times its effect in traditional housing. Finally, for the modern house types, ethnicity has a positive effect; the more Ladino the household the greater the damage. However, here it must be noted we are dealing with a small percentage of houses that sustained slight damage.

Presented in Table 15-19 are the results of the same analysis performed with relative loss as the dependent variable. The explained variance for equation one, the constrained equation, is 23.85 percent, while the explained variance for equation two is 26.26 percent. The F-ratio for incremental change in R^2 was significant at the .05 level. This indicates that the coefficients for the effects of domestic assets and relative ethnicity on damage for each category are not equal. Thus,

Table 15-18

Separate Regression Equations For the Different House Types Predicting Damage

Traditional Houses:

$$\text{Damage} = 2.694 + .923 \times 10^{-5} \text{ (Domestic Assets)} - .074 \text{ (Relative Ethnicity)}$$

Mixed Houses:

$$\text{Damage} = 3.238 - .478 \times 10^{-4} \text{ (Domestic Assets)} - .301 \text{ (Relative Ethnicity)}$$

Modern Houses:

$$\text{Damage} = -1.916 - .191 \times 10^{-3} \text{ (Domestic Assets)} + .946 \text{ (Relative Ethnicity)}$$

Table 15-19

Regression Coefficients for Equation of Effects of Housing Type, Domestic Assets, and Relative Ethnicity on Relative Loss*

Independent Variables	Equation 1	Equation 2	Means	Standard Deviation
Constant	.985	.935		
Mixed**	-.029	.138	.396	.490
Modern***	-.494	-1.455	.045	.208
Domestic Assets	$-.628 \times 10^{-4}$	$-.780 \times 10^{-4}$	1262.14	726.05
Relative Ethnicity	-.056	-.028	2.536	.703
(Mixed) (Domestic Assets)		$-.750 \times 10^{-5}$	467.11	682.80
(Mixed) (Relative Ethnicity)		-.063	1.012	1.336
(Modern) (Domestic Assets)		$.207 \times 10^{-4}$	108.25	593.23
(Modern) (Relative Ethnicity)		.301	0.138	0.641
R^2	.2385	.2626		
F-Ratio	30.70	17.27		
Prob. F	.0001	.0001		

* F-Test for increment in R^2 between Equation 1 and 2 was = 3.17: Significant at .05 level with 4 and 388 degrees of freedom.

** Dummy coded variable for mixed houses: 1 if mixed, 0 otherwise.

*** Dummy coded variable for modern houses: 1 if modern, 0 otherwise.

separate regression equations for each house type category must again be calculated.

The separate regression equations predicting damage for each house type are presented in Table 15-20. With respect to ethnicity, the same pattern of effects occurs in predicting relative loss as occurred in predicting damage. Again, for most house types in this sample, the the traditional and mixed categories, ethnicity has a negative effect (-.028 and -.091 respectively). In other words, the more Indian the household the greater the relative loss. The effect of ethnicity on damage for mixed houses is more than three times its effect for traditional houses. Finally, ethnicity has a positive effect in the equation predicting damage to modern houses. However, the modern house type represents a small percentage of the houses in this sample and damage to them was slight.

Thus, for the most of the house types in this sample, ethnicity has a negative effect on both earthquake damage and relative loss. In other words, the more Indian the household, for both traditional and mixed house types, the greater the damage and percentage loss incurred.

Ethnicity and Earthquake Aid

The last section examined the effect of ethnicity on earthquake damage and loss. For almost all of the households in the highland experimental sample, ethnicity has a negative effect; the more Indian the household the greater the earthquake damage and loss experienced. With this finding in mind, attention is now turned to ethnic differences in disaster aid. The following section will examine the relationship between ethnicity and the distribution of different types of aid

Table 15-20

Separate Regression Equations For The Different House Types Predicting Relative Loss

Traditional Houses:

$$\text{Relative Loss} = .935 - .780 \times 10^{-4} \text{ (Domestic Assets)} - .028 \text{ (Relative Ethnicity}$$

Mixed Houses:

$$\text{Relative Loss} = 1.074 - .855 \times 10^{-4} \text{ (Domestic Assets)} - .091 \text{ (Relative Ethnicity)}$$

Modern Houses:

$$\text{Relative Loss} = -.519 - .573 \times 10^{-4} \text{ (Domestic Assets)} + .273 \text{ (Relative Ethnicity)}$$

followed by an examination of ethnic differences in opinions of aid programs and distribution.

Ethnicity and Emergency Aid

Following the earthquake, several forms of emergency aid were distributed to meet the immediate needs of those affected by the natural disaster. Paramount among these forms of aid is medical care for the many injured.

Presented in Table 15-21 are the ethnic differences in the receipt of some form of medical aid. Almost 32 percent of the households in this sample received medical assistance. There is a clear, yet weak, relationship between ethnicity of the household and receiving medical care (Chi Square = 9.095; Probability = .01). A higher percentage of traditional Indian households (39 percent) than Ladinized Indian households (28.9 percent) received medical care. Ladino households had the smallest percentage (21 percent). This finding may represent an indicator of the relative number of injuries in the various ethnic groups as much as it does the availability of medical care. This possibility is made plausible by the differential damage and loss associated with ethnic groups.

Blankets and clothing were also distributed following the earthquake. Presented in Table 15-22 is the distribution of clothing by household ethnicity. A stronger relationship exists between ethnicity and receiving clothing. Almost 40 percent of the traditional Indian households received some form of clothing as compared to only 22.1 and 19.1 percent of the Ladinized Indian and Ladino households.

Table 15-21

Received Medical Care by Household Ethnicity

Household Ethnicity	Receive Medical Care: No No.	No %	Yes No.	Yes %
Ladino	70	78.7	19	21.4
Ladinized Indian	96	71.1	39	28.9
Traditional Indian	105	61.1	67	39.0
Totals	271	68.4	125	31.6

ChiSq = 9.095 DF = 2 Prob. = .01

Phi = .15

Table 15-22

Received Clothes by Household Ethnicity

Household Ethnicity	Received Clothes: No No.	No %	Yes No.	Yes %
Ladino	72	80.9	17	19.1
Ladinized Indian	106	77.9	30	22.1
Traditional Indian	104	60.5	68	39.5
Totals	282	71.0	115	29.0

Chisq = 16.7 DF = 2 Prob. = .0002

Phi = .21

Lastly, in Table 15-23 ethnic differences in the receipt of blankets are presented. Again, there exists a clear relationship between household ethnicity and the receiving of a blanket or blankets (Chi Square = 21.275; Probability =.0001). Larger percentages of traditional (58.1 percent) and Ladinized (49.3 percent) Indian households than Ladino households (28.1 percent) received blankets.

Overall, in terms of all three forms of emergency aid examined, there exists a clear relationship between household ethnicity and emergency aid. The more traditionally Indian the household, the more likely the receipt of medical care, clothing, and blankets. It is quite possible that these differences could be explained by ethnic differences in damage and loss. However, such conclusions are based upon conjecture not data presented in this analysis.

Ethnicity and Reconstruction Aid

Following the emergency period, the major emphasis becomes the reconstruction process. The following sections will examine the relationship between ethnicity and reconstruction aid. For the purposes of this analysis reconstruction aid will be divided into two general types: (1) reconstruction aid in the form of assistance in reconstruction from informal networks; and (2) reconstruction aid in the form of lamina, whole houses or loans through which to purchase material.

Ethnicity and Reconstruction Assistance From Informal Networks

The data upon which this analysis is based were obtained during the second phase of interviews. During this phase a subsample of the

Table 15-23

Received Blankets by Household Ethnicity

Household Ethnicity	Received Blankets: No No.	No %	Yes No.	Yes %
Ladino	64	71.9	25	28.1
Ladinized Indian	69	50.7	67	49.3
Traditional Indian	72	41.9	100	58.1
Totals	205	51.6	192	48.4

ChiSq = 21.275 DF = 2 Prob. = .0001

Phi = .23

original 1472 households was interviewed. Consequently, the sample for this analysis consists of only 106 households. Respondents were asked if household members, relatives not members of the household, and friends assisted in the reconstruction processes. The actual activities carried out by these individuals range from simple clearing away of rubble to carpentry and other construction work. Before the examination of ethnic differences in receiving aid from friends and relatives, ethnic differences in household members participating in reconstruction will be examined because one would not expect to find assistance from friends and relatives rendered unless household members themselves took part in the reconstruction process.

Presented in Table 15-24 are ethnic differences in household members participating in the reconstruction process. A strong relationship exists between household ethnicity and household members taking part in reconstruction (Chi Square = 20.64, Probability = .0001, and Phi = .45). An extremely large percentage of Ladinized (86.5 percent) and traditional (87.2 percent) Indian households took active part in reconstructing their houses. On the other hand, a relatively small percentage of Ladino household members (40.0 percent) took an active part in the reconstruction of their houses. Given these findings one would also expect to find ethnic differences in participation of friends and relatives in reconstruction.

Presented in Table 15-25 are ethnic differences in participation by relatives in reconstruction. A relationship also exists between household ethnicity and receiving aid from relatives (Chi Square = 7.172, Probability = .03, and Phi = .26). However, this relationship is not as strong as the relationship discussed above. Greater percentages

Table 15-24

Family Members Work on Reconstruction by
Household Ethnicity

Household Ethnicity	No No.	No %	Yes No.	Yes %
Ladino	12	60.0	8	40.0
Ladinized Indian	5	13.5	32	86.5
Traditional Indian	6	12.8	41	87.2
Totals	23	22.1	81	77.9

ChiSq =20.64 DF = 2 Prob. = .0001

Phi = .45

Table 15-25

Did Other Relatives Aid in Reconstruction by
Household Ethnicity

Household Ethnicity	Did Other Relatives Aid in Reconstruction: No No.	No %	Yes No.	Yes %
Ladino	19	95.0	1	5.0
Ladinized Indian	28	75.7	9	24.3
Traditional Indian	30	63.8	17	36.2
Totals:	77	74.0	27	26.0

ChiSq = 7.172 DF = 2 Prob. = .03

Phi = .26

of traditional (36.2 percent) and Ladinized (24.3 percent) households than Ladino households (5.0 per cent) received aid from relatives. Of the two Indian categories, a higher percentage of traditional Indian households received aid from relatives.

Somewhat different results are obtained when examining ethnic differences in receiving aid from friends (Table 15-26). A rather large percentage (46.0 percent) of Ladinized Indian households, received assistance from friends, followed by Ladino (25.0 percent) and then traditional Indian households (21.3 per cent). These findings also represent a significant relationship (Chi Square = 6.301, Probability = .04, And Phi = .25).

Clear relationships exist between ethnicity and the receiving of aid from informal networks. First of all, Indian households, both Ladinized and traditional, were more likely to be involved in some aspect of the reconstruction of their homes. The more traditionally Indian the household, the more likely they were to receive reconstruction assistance from relatives. Lastly, while 25 percent or less of the Ladino and traditional Indian households received reconstruction assistance from friends, almost 50 percent of Ladinized Indian households did. Thus, it appears that Indian households received greater amounts of assistance from informal network. However, due to the low number of individual households, especially Ladino, in this sample these findings are extremely susceptible to substantive changes, given small fluctuations in responses.

Table 15-26

Friends Aid in Reconstruction by Household Ethnicity

Household Ethnicity	Friends Aid in Reconstruction			
	No		Yes	
	No.	%	No.	%
Ladino	15	75.0	5	25.0
Ladinized Indian	20	54.1	17	46.0
Traditional Indian	37	78.7	10	21.3
Totals	72	69.2	32	30.8

Chi Square = 6.301 DF = 2 Prob. = .04

Phi = .25

Ethnicity and Reconstruction Aid: Loans, Lamina, and Agency Housing

Following the earthquake, over a hundred foreign and domestic agencies established reconstruction programs in Guatemala. These programs ranged from those that built and distributed whole houses to those that distributed building materials or loans. This section will examine the relationship between household ethnicity and the distribution of lamina, temporary houses, permanent houses and loans.

There are of course, many factors that will influence which households receive particular types of aid. Two of these factors will be controlled for in this analysis. The damage sustained by a household will undoubtedly be related to receiving reconstruction aid and, as shown above, it is also related to ethnicity. In an attempt to control for the influence of damage in this analysis, households will be divided into one of two categories on the basis of the damage suffered by their pre-earthquake house: (1) high damage (house was heavily damaged or destroyed), or (2) low damage (pre-earthquake house suffered slight or no damage.)

The community in which the household resides will also have consequences for the particular types of aid received. Disaster relief agencies, as discussed in Chapter 8, were assigned particular communities in which to carry out their programs. For this reason, at particular points in this analysis comparisons will be made utilizing data from a selected number of communities, i.e. those communities associated with particular programs of interest. Before comparing specific program types separately, the relationship between household ethnicity and program type will be examined.

The program type measure utilized in this analysis was introduced in Chapter 11. It will be recalled, that a household is placed in the appropriate category on the basis of the type of housing program it was associated with. In other words, if a household received a temporary house, then it was associated with and consequently placed in the temporary house program category. In those rare occasions when a household received aid from two types of programs, it was placed in the category for the program distributing the aid of highest value.

Presented in Table 15-27 is the relationship between household ethnicity and program type for the total and for each damage category. Noting the total sample, a clear relationship exists between ethnicity and program type (Chi Square = 17.431, Probability = .008, and Phi = .21). There are basically no differences in lamina distribution and slight differences in the distribution of temporary houses with higher percentages of Ladino and Ladinized Indian households receiving temporary houses. The major differences occur in the no aid and permanent house categories. A greater percentage of Ladinos (43.8 per cent) received no aid when compared to both Indian categories. Further, a substantially smaller percentage of Ladinos (4.5 percent) received permanent houses than either Ladinized (22.1 percent) or traditional (21.5 percent) Indian households. The same pattern occurs among those households that suffered high damage.

A significant relationship also exists between household ethnicity and program type among households suffering high damage, that is, among households needing reconstruction aid. Higher percentages of Ladino (35.8 percent) and Ladinized Indian (31.2 percent) households than traditional Indian households (25.0 percent) received temporary houses.

Table 15-27

Relationship Between Household Ethnicity and Program Type Classified by Damage

Household Ethnicity	Program Type: None		Lamina		Temporary House		Permanent House		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
High Damage										
Ladino	23	34.3	16	23.9	24	35.8	4	6.0	67	20.4
Ladinized Indian	23	21.1	26	23.9	34	31.2	26	23.9	109	33.2
Traditional Indian	42	27.6	37	24.3	38	25.0	35	23.0	152	46.3
Total	88	26.8	79	24.1	96	29.3	65	19.8	328	100.0
Chi Square = 13.017 Probability = .04 Phi = .20										
Low Damage										
Ladino	16	72.7	5	22.7	1	4.6	0	0.0	22	31.9
Ladinized Indian	13	48.2	7	25.9	3	11.1	4	14.8	27	39.1
Traditional Indian	9	45.0	5	25.0	4	20.0	2	10.0	20	29.0
Total	38	55.1	17	24.6	8	11.6	6	8.7	69	100.0
Total Sample										
Ladino	39	43.8	21	23.6	25	28.1	4	4.5	89	22.4
Ladinized Indian	36	26.5	33	24.3	37	27.2	30	22.1	136	34.3
Traditional Indian	51	29.7	42	24.4	42	24.4	37	21.5	172	43.3
Total	126	31.7	96	24.2	104	26.2	71	17.9	397	100.0
Chi Square = 17.431 Probability = .008 Phi = .21										

Another difference in this table occurs in the permanent house category where only 6 percent of the Ladino households, as compared to 23.9 and 23.0 percent of the Ladinized and traditional Indian households respectively, received permanent houses. Also, 34.3 percent of the Ladino and 27.6 percent of the traditional Indian households versus 21.1 percent of the Ladinized Indian households did not receive any aid, although they all experienced high levels of earthquake damage.

With respect to those households experiencing low levels of damage, it appears, although tests of significance can not be computed due to sparseness of cell frequences, that Indian households received more aid, especially in the temporary and permanent house categories. Of the Ladino households experiencing low levels of damage, 27.3 percent received some type of reconstruction aid. On the other hand, 51.8 percent of the Ladinized, and 55 percent of the traditional Indian households, all experiencing low levels of damage, received reconstruction aid, with greater than 24 percent of both categories receiving permanent or temporary houses.

Overall, it appears that, when considering the total sample, greater percentages of both Ladinized and traditional Indian households received reconstruction aid, even when holding damage constant. Further, of the two Indian categories experiencing high levels of damage, Ladinized Indian households faired better than traditional Indian households. The one exception appears to be with temporary house programs in which greater percentages or Ladino households, for both the total and high damage samples, received this aid.

The above analysis was conducted on the highland sample. Thus, it provides insight into the relationship between ethnicity and aid

programs across communities containing both Indians and Ladinos. A more detailed examination can be provided by examining the relationship between household ethnicity and specific programs in selected communities. However, as a caveat it must be noted that for some of the following analysis, the sample, due to selection of particular communities, becomes extremely small. Small sample size will make significance tests impossible in some cases and, where tests can be performed, minor alterations in cell frequencies can substantially change the results.

Presented in Table 15-28 is the relationship between ethnicity and receiving a permanent house in communities with large permanent house programs by damage (no significance tests are reported due to low cell frequencies). Noting the total sample in these communities, Ladinized Indian households had the highest percentage (62.2 percent) receiving permanent housing, followed by traditional Indian households (46.8 percent) who in turn were followed by Ladino households (37.5 percent). However, performing this analysis on high damage households, a somewhat different picture emerges. While 66.7 percent of the Ladinized Indian households experiencing high levels of damage received a permanent house, only 50 percent of the traditional Indian households did. The percentage of Ladino household receiving a permanent house (60 percent) falls between the other two categories. In other words, when examining households that needed reconstruction aid in permanent housing program communities, 66.7 percent of the Ladinized Indian, 60 percent of the Ladino and only 50 percent of the traditional Indian households received permanent housing.

Table 15-28

Relationship Between Household Ethnicity and Receiving a Permanent House in Communities With a Permanent Housing Program Classified by Damage

Household Ethnicity	High Damage						Low Damage						Total Sample in Select Communities					
	Received Permanent House						Received Permanent House						Received Permanent House					
	No		Yes		Totals		No		Yes		Totals		No		Yes		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ladino	2	40.0	3	60.0	5	4.6	3	100.0	0	0.0	3	14.3	5	62.5	3	37.5	8	6.2
Ladinized Indian	12	33.3	24	66.7	36	33.0	5	55.6	4	44.4	9	42.9	17	37.8	28	62.2	45	34.6
Traditional Indian	34	50.0	34	50.0	68	62.4	7	77.8	2	22.2	9	42.9	41	53.3	36	46.8	77	59.2
Total	48	44.0	61	56.0	109	100.0	15	71.4	6	28.6	21	100.0	63	48.5	67	51.5	130	100.0

It appears then, that with respect to permanent housing programs among households that suffered high levels of damage. Ladinized Indian and Ladino households faired better than traditional Indian households, with a larger percentage of Ladinized Indians receiving permanent houses. Among households suffering low levels of damage no Ladino households, 22 percent of the traditional Indian households, and 44.4 percent of the Ladinized households received permanent houses. Thus, among households suffering low levels of damage, Indian, especially Ladinized Indian, households faired better. It must be remembered that these differences have not been tested for significance and they need not be indicative of discrimination on the part of agencies administering these programs. Indeed, many other factors such as self selection or overlapping aid programs may account for these differences.

The relationship between household ethnicity and receiving a temporary house in communities with a temporary housing program by damage is presented in Table 15-29. A significant relationship between ethnicity and receiving a temporary house exists in the total sample and among those households which suffered high levels of damage. A similar pattern is evident among households suffering low levels of damage. In general, the more traditionally Indian the households, the greater the percentage receiving a temporary house. Substantially greater percentages of Indians received temporary houses as compared to Ladinos.

Lamina Programs and Ethnicity

Presented in Table 15-30 are the different sources of lamina by ethnicity for the total sample and for households of varying degrees of damage. A significant relationship exists between ethnicity and the

TABLE 15-29

RELATIONSHIP BETWEEN HOUSEHOLD ETHNICITY AND RECEIVING A TEMPORARY HOUSE IN COMMUNITIES WITH A TEMPORARY HOUSING PROGRAM CLASSIFIED BY DAMAGE.

	HIGH DAMAGE						LOW DAMAGE						TOTALS FOR SELECTED COMMUNITIES					
	RECEIVED TEMPORARY HOUSE						RECEIVE TEMPORARY HOUSE						RECEIVE TEMPORARY HOUSE					
Household Ethnicity	NO		YES		TOTALS		NO		YES		TOTALS		NO		YES		TOTALS	
	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
Ladino	38	73.1	14	26.9	52	31.1	18	94.7	1	5.3	19	51.4	56	78.9	15	21.1	71	34.8
Ladinized Indian	35	55.6	28	44.4	63	37.7	12	92.3	1	7.7	13	35.1	47	61.8	29	38.2	76	37.3
Traditional Indian	27	51.9	25	48.1	52	31.1	2	40.0	3	60.0	5	13.5	29	50.9	28	49.1	57	27.9
TOTALS	100	59.9	67	40.1	167	100.0	32	86.5	5	13.5	37	100.0	132	64.7	72	35.3	204	100.0

CHI SQUARE = 5.631

PROBABILITY = .06

PHI = .18

CHI SQUARE = 11.286

PROBABILITY = .004

PHI = .24

Table 15-30

Relationship Between Household Ethnicity and Sources of Lamina Classified by Damage

Household Ethnicity	Source of Lamina: Given		Given or Subsidized		Subsidized		Other		None		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
High Damage												
Ladino	3	4.5	4	6.0	30	44.8	18	26.9	12	17.9	67	20.4
Ladinized Indian	16	14.7	6	5.5	41	37.6	41	37.6	5	4.6	109	33.2
Traditional Indian	16	10.5	10	6.6	46	30.3	71	46.7	9	5.9	152	46.3
Total	35	10.7	20	6.1	117	35.7	130	39.6	26	7.9	328	100.0
	Chi Square = 22.612 Probability = .004 Phi = .26											
Low Damage												
Ladino	2	9.1	0	0.0	4	18.2	7	31.8	9	40.9	22	31.9
Ladinized Indian	4	14.8	1	3.7	6	22.2	12	44.4	4	14.8	27	39.1
Traditional Indian	1	5.0	0	0.0	8	40.0	5	25.0	6	30.0	20	[illegible]
Total	7	10.1	1	1.5	18	26.1	24	34.8	19	27.5	69	100.0
Total Sample												
Ladino	5	5.6	4	4.5	34	38.2	25	28.1	21	23.6	89	22.4
Ladinized Indian	20	14.7	7	5.2	47	34.6	53	39.0	9	6.6	136	34.2
Traditional Indian	17	9.9	10	5.8	54	31.4	76	44.2	15	8.7	172	43.2
Total	42	10.6	21	5.3	135	34.0	154	38.8	45	11.3	397	100.0
	Chi Square = 24.786 Probability = .002 Phi = .25											

receipt of lamina for the total and high damage sample. The significance for the low damage sample cannot be assessed. For each sample, the "other" source of lamina was indicated most often. The "other" category indicates that lamina was purchased at market value, owned or salvaged.

The three most often indicated sources, in decreasing order, for each ethnic category in the total sample are: (1) Ladino-subsidized, other, and none; (2) Ladinized Indian - other, subsidized, and given; and (3) traditional Indian - other, subsidized, and given. The same order exists in the high damage except that the second and third sources of the Ladinized Indian households are equal. The highest percentage of Ladino households procured lamina at a subsidized price while the highest percentage of Indian households procured lamina from "other" sources. However, while the third largest percentage of Ladino households fell in the "no source" category, the third largest percentage of Indian households was given lamina free.

Of central importance, of course, is the relationship between household ethnicity and the receipt of lamina aid (receiving lamina free or at a subsidized price). Noting Table 15-31, one can clearly see that there is no relationship between household ethnicity and receiving lamina free or at a subsidized price for the total sample, whether controlling for damage or not.

Ethnicity and Loans

Lastly, ethnic differences in receiving a reconstruction loan by damage are presented in Table 15-32. For the total sample there is a clear relationship between household ethnicity and receiving a reconstruction loan (Chi Square = 7.203, Probability = .03, and Phi =

TABLE 15-31

RELATIONSHIP BETWEEN HOUSEHOLD ETHNICITY AND RECEIVING LAMINA FREE OR AT A SUBSIDIZED PRICE CLASSIFIED BY DAMAGE

	HIGH DAMAGE						LOW DAMAGE						TOTAL SAMPLE					
	RECEIVED LAMINA FREE OR SUBSIDIZED						RECEIVED LAMINA FREE OR SUBSIDIZED						RECEIVED LAMINA FREE OR SUBSIDIZED					
	NO		YES		TOTAL		NO		YES		TOTAL		NO		YES		TOTAL	
Household Ethnicity	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%	NO.	%
Ladino	30	44.8	37	55.2	67	20.4	16	72.7	6	27.3	22	31.9	46	51.7	43	48.3	89	22.4
Ladinized Indian	46	42.2	63	57.8	109	33.2	16	59.3	11	40.7	27	39.1	62	45.6	74	54.4	136	34.3
Traditional Indian	80	52.6	72	47.4	152	46.3	11	55.0	9	45.0	20	29.0	91	52.9	81	47.1	172	43.3
TOTALS	156	47.6	172	52.4	328	100.0	43	62.3	26	37.7	69	100.0	199	50.1	198	49.9	397	100.0

HIGH DAMAGE: CHI SQUARE = 3.03; PROBABILITY = .22; PHI = .10

LOW DAMAGE: CHI SQUARE = 1.579; PROBABILITY = .45; PHI = .15

TOTAL SAMPLE: CHI SQUARE = 1.739; PROBABILITY = .42; PHI = .07

Table 15-32

Relationship Between Household Ethnicity and Receiving A Reconstruction Loan
Classified by Damage

Household Ethnicity	High Damage						Low Damage						Total Sample					
	Received Loan						Received Loan						Received Loan					
	No		Yes		Total		No		Yes		Total		No		Yes		Total	
	No.	%	No.	%	No	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Ladino	44	65.7	23	34.3	67	20.4	16	72.7	6	27.3	22	31.9	60	67.4	29	32.6	89	22.4
Ladinized Indian	73	67.0	36	33.0	109	33.2	19	70.4	8	29.6	27	39.1	92	67.7	44	32.4	136	34.3
Traditional Indian	121	79.6	31	20.4	152	46.3	16	80.0	4	20.0	20	29.0	137	79.7	35	20.4	172	43.3
Total	238	72.6	90	27.4	328	100.0	51	73.9	18	26.1	69	100.0	289	72.8	108	27.2	397	100.0

High Damage: Chi Square = 7.095; Probability = .03; Phi = .15

Low Damage: Chi Square = .576; Probability = .75; Phi = .09

Total Sample: Chi Square = 7.203; Probability = .03; Phi = .14

.14). Of the Ladino households, 32.6 percent received loans while 32.4 percent of the Ladinized Indian households and 20.4 percent of the traditional Indian households received a loan to rebuild or assist in rebuilding. Clearly, substantially more Ladino and Ladinized Indian households received loans.

Essentially the same relational pattern is found among households suffering high levels of damage. Again, a significant, yet weak, relationship is found between receiving a loan and household ethnicity (Chi Square = 7.095, Probability = .03, and Phi = 15). Substantially higher percentages of both Ladino (34.3 percent) and Ladinized Indian (33.0 percent) households, as compared to traditional Indian households (20.4 percent), received reconstruction loans. No significant relationship was found among low damage households.

Ethnicity and Reconstruction aid: A Conclusion

The previous section examined the relationship between aid and ethnicity for several different types of reconstruction aid using the appropriate sample or subsample for each program type. On the basis of this analysis, the following statements can be made concerning ethnic differences in the distribution of reconstruction aid among households that sustained high levels of damage in the highland sample: (1) ignoring aid in the form of loans, a higher percentage of Ladino households (34.3 percent) received no aid as compared to traditional (27.6 percent) and Ladinized (21.1 percent) Indian households; 2) there were basically no ethnic differences with respect to lamina programs; 3) a higher percentage of Ladino households (35.8 percent), followed closely by Ladinized Indian households (31.2 percent), and then

traditional Indian households (25.0 percent) received temporary houses; (4) substantially higher percentages of Ladinized Indian, (23.9 percent) and traditional Indian (23.0 percent) households received permanent housing when compared to Ladino households (6.0 percent) and (5) substantially higher percentages of Ladino (34.3 percent) and Ladinized Indian households (33.0 percent) received reconstruction loans when compared to traditional Indians (20.4 percent).

On the basis of these findings, the following conclusions are drawn: (1) Ladinized Indian households appear to have faired better in terms of reconstruction aid because they had the smallest relative percentage in the no aid category and were at or near the top in terms of relative percentage in the temporary house, permanent house, and loan categories, (2) Ladino households faired below Ladinized Indians, for while they had the highest relative percentages in temporary house and loan categories, they also had the lowest relative percentage in the permanent housing category and a large percentage received no aid; and (3) traditional Indian households faired the least well of all ethnic categories. While a large percentage received permanent housing, a rather large relative percentage received no aid and they had the smallest relative percentage in both the temporary housing and loan categories.

With respect to decisions at the household level there were undoubtedly a host of reasons that ethnic differences in the distribution of reconstruction aid occurred, even when controlling for amount of damage. Speculation might lead to one of the following conclusions. Ladino households, both because of their higher economic standing and greater access to loans, may have chosen not to participate

in housing programs. These households may have chosen to design and build their own houses rather then allowing an agency to determine their house design. Traditional Indian households may, because of their timidity in dealing with formal, especially Ladino structures, have been hesitant in participating in reconstruction programs (see Colby and van den Berghe; 1969). Ladinized Indian households, on the other hand, because of greater familiarity in dealing with official structures and greater fluency in Spanish than traditional Indians, may have actively sought reconstruction aid.

Decisions made at the agency or program level may have also influenced the distribution of reconstruction aid with respect to ethnicity. Many of the agencies had never worked in the communities to which they were assigned. Consequently, they may have relied on local inhabitants for assistance in structuring their programs. Other agencies, with already established projects and developed programs, may have included inhabitants as workers and clientele. In both cases, the individuals likely to have become involved were the more progressive elements of the community. In other words, the members of Ladinized Indian households were likely to be selected because, while still exhibiting some Indian characteristics, they were also more fluent in Spanish and had more western values, thus making them easier to work with. Given that this did indeed occur, one would expect that Ladinized Indian households would have greater access to reconstruction aid.

Ethnicity and Opinion of Reconstruction Aid

This section will examine the bivariate relationship between household ethnicity and the opinion, expressed by the respondent, on the

quality of reconstruction aid programs and on the fairness of the distribution of reconstruction aid. Presented in Table 15-33 is the relationship between ethnicity and the overall opinion of reconstruction aid to households. The opinions expressed by the respondents have been classified into two categories one ranging between very poor to average and the other category ranging between good and very good. Over 80 percent of all the respondents indicated that aid programs were good or very good. There is no relationship between ethnicity and the opinion of reconstruction aid.

The findings concerning the relationship between ethnicity and opinions of the fairness in distribution of reconstruction aid are presented in Table 15-34. Respondents were asked to indicate whether they thought reconstruction aid was distributed in a fair or unfair manner. Over 60 percent of the respondents indicated that they thought that aid had been distributed unjustly. There is a significant relationship between ethnicity and the opinion of aid distribution (Chi Square = 20.452, Probability = .0001, and Phi = .24). Only 21.8 percent of the Ladinos thought that the distribution of aid was fair as compared to 29.4 percent for Ladinized Indians and 48.8 percent of the traditional Indians.

Thus, with respect to opinions of the distribution of aid, the more Ladino the household in which the respondent resided, the more likely they were to feel that aid was distributed unfairly. A potential explanation for this finding is, as seen above, Ladinos received less aid than Ladinized Indians. Consequently, Ladinos may have perceived this and felt that the distribution was unjust. Ladinized individuals may have in turn felt that the distribution of aid was unfair because

Table 15-33

Overall Opinion of Outside Aid Programs in Your Community

Household	Opinion			
	Poor to Average		Good to Very Good	
Ethnicity	No.	%	No.	%
Ladino	9	16.1	47	83.9
Ladinized Indian	21	19.4	87	80.6
Traditional Indian	23	16.2	119	83.8
Total	53	17.3	253	82.7

Chi Square = .526 DF = 2 Prob. = .77

Phi = .04

Table 15-34

Opinion of Aid Distribution by
Household Ethnicity

Household Ethnicity	Opinion of Aid Distribution: Unfair No.	Unfair %	Fair No.	Fair %
Ladino	61	78.2	17	21.8
Ladinized Indian	89	70.6	37	29.4
Traditional Indian	82	51.3	78	48.8
Total	232	63.7	132	36.3

ChiSq = 20.452 DF = 2 Prob. = .0001

Phi = .24

Ladinos, a dominant economic group, also received a large amount of reconstruction aid.

Ethnicity, Recovery, and Restoration

In this, the final section of this chapter, ethnic differences in recovery and restoration will be examined. Both recovery and restoration will be defined as they were in Chapter 14. Restoration is said to have occurred when the median domestic assets of a particular category of households equals or surpasses its pre-earthquake median Domestic Assets score. Recovery, on the other hand, is said to have occurred when the ratio of median domestic assets of an experimental ethnic category to its equivalent control category equals or surpasses the same ratio for the pre-earthquake scores. Median Domestic Asset scores are utilized due to the extremely skewed nature of the distribution.

The ratios necessary for determining recovery and restoration and their respective median Domestic Assets scores are presented in Table 15-35. The numbers of particular importance for each ethnic category in this table are found in the last three of the experimental rows, indicating recovery, and in the last row for each ethnic category section.

The ratio between the Domestic Assets scores for 1976 and 1975, multiplied by one hundred, represents the percentage of the median pre-earthquake domestic assets held immediately following the earthquake. The Ladino ethnic category retained 31.5 percent of the median pre-earthquake assets in 1976, while the median assets retained by both the Ladinized and traditional Indian categories were only 13.2

Table 15-35

Recovery and Restoration Measures for Ethnic Categories by Experimental Status*

Ethnic Category	1975	1976	1978	1980	$\frac{1976}{1975}$x100	$\frac{1978}{1975}$x100	$\frac{1980}{1975}$x100
Ladino:							
Experimental	1636.00	514.55	1526.00	2073.25	31.45	93.28	126.73
Control	1644.25	1324.87	1644.25	1919.25	80.58	100.00	116.72
(Exp./Cntl.)100	99.50	38.84	92.81	108.02			
Ladinized Indian:							
Experimental	1043.75	137.93	780.00	978.00	13.21	74.73	93.70
Control	483.50	407.00	571.00	488.00	84.18	118.10	100.93
(Exp./Cntl.)100	215.87	33.89	136.60	200.41			
Traditional Indian:							
Experimental	889.00	68.13	628.00	628.00	7.66	70.64	70.64
Control	308.00	308.00	473.00	557.00	100.00	153.57	180.84
(Exp./Cntl.)100	288.64	22.12	132.77	112.75			

* All domestic assets scores for 1975-80 are median scores for respective categories.

percent and 7.7 percent respectively. Thus the two Indian categories lost much greater percentages of their median assets than the Ladino category.

During the period between 1976 and 1978 the bulk of the relief and reconstruction programs were completed. Therefore, the ratio between the median Domestic Assets score in 1978 and 1975, multiplied by one hundred is of particular interest. By 1978 the Ladino category had obtained 93.3 percent of the pre-earthquake median domestic assets. The percentage of the pre-earthquake Domestic Assets score obtained by both Indian categories was much smaller, with the Ladinized Indian and traditional Indian categories obtaining 74.7 percent and 70.6 percent respectively. On the basis of these findings it appears that while the Ladino category has almost reached its restoration level, both Indian categories are lagging behind.

The relative gain score between the years 1976 and 1978 is also of interest because it indicates the percentage gain in domestic assets during the reconstruction period. The relative gain for each category is: Ladino = 196.6 percent; Ladinized Indian = 465.5 percent; and traditional Indian = 821.8 percent. During the period of major reconstruction programs, both foreign and domestic, the Indian categories, especially traditional Indian, experienced the greatest relative gain. It must be noted that these scores are a function of the damage suffered as well as the amount of aid received. Consequently, given the amount of damage suffered by the two Indian categories, any aid represents a substantial increase in domestic assets.

Finally, noting the ratio between the 1980 and 1975 median Domestic Assets scores, multiplied by one hundred, one can assess the percentage

of the median 1975 domestic assets held in 1980 for each category. The Ladino category has surpassed its 1975 median Domestic Assets score by 26.7 percent. While the Ladinized Indian category is moving in on its median assets score for 1975, with 93.7 percent, the traditional Indian category has not gained in assets since 1978. Thus, while the Ladino category has restored, indeed surpassed, its 1975 domestic assets, and the Ladinized Indian category has almost reached restoration, the traditional Indian category has not neared restoration even after four years.

The relative gain in domestic assets between 1978 and 1980 is of interest because many reconstruction programs had ended by this time and thus, the respective categories were left for the most part on their own. Markedly different gain patterns were established during this period when compared to the 1976-1978 period. During this period, the Ladino category experienced a 35.9 percent gain in domestic assets and the Ladinized Indian category experienced a 25.4 percent gain. The traditional Indian category, on the other hand, experienced absolutely no gain in assets. After most reconstruction programs were completed, the Ladino category experienced the highest gains in domestic assets of the three groups. Structural differences between ethnic categories in their relationship to the economic and political structure of Guatemala prior to the earthquake probably reasserted themselves during this period. This may account for these differences in percentage gain between the three ethnic groups.

With respect to recovery, noting the last line for each ethnic category, while Ladinized Indians almost reached recovery, only Ladinos reached, and indeed surpassed, their recovery level. The ratio of the

experimental Ladino median domestic assets to control Ladino median domestic assets for 1975 was surpassed in 1980, indicating recovery. The ratio for experimental to control Ladinized Indian domestic assets for 1975 is almost equaled in 1980, indicating that the Ladinized Indian category almost recovered. The 1975 ratio for traditional Indians however was not equaled by 1980. It must be noted that the control categories for both Indian groups were extremely poor in 1975 and they experienced some improvement during the period from 1975-1980. Thus, to reach recovery level the Indian categories, especially the traditional Indian category, would have had to experience much greater levels of improvement. Figure 15-3 which plots domestic assets through time for the three groups will help illustrate these relationships.

Presented in Table 15-36 are the ratios of domestic assets, multiplied by one hundred, between the respective ethnic categories within the control and experimental areas. These measures give an indication of the relative economic standing of the respective ethnic groups. These ratios were calculated using the median Domestic Assets score for each ethnic category during each period. The following discussion will concern, except where indicated otherwise, the ethnic groups of the experimental category.

In 1975, the median domestic assets for the Ladinized Indian category was 63.8 percent of the median for Ladino households. During the same year, the median domestic assets for traditional Indian households was 54.3 percent of the Ladino household median domestic assets. Immediately following the earthquake, the percent of the Ladino median domestic assets for both Indian groups fell markedly to 26.8 percent for Ladinized Indians and 13.2 percent for traditional Indian

FIGURE 15-3
RELATIVE ECONOMIC STANDING OF ETHNIC CATEGORIES
MEASURED BY MEDIAN DOMESTIC ASSETS

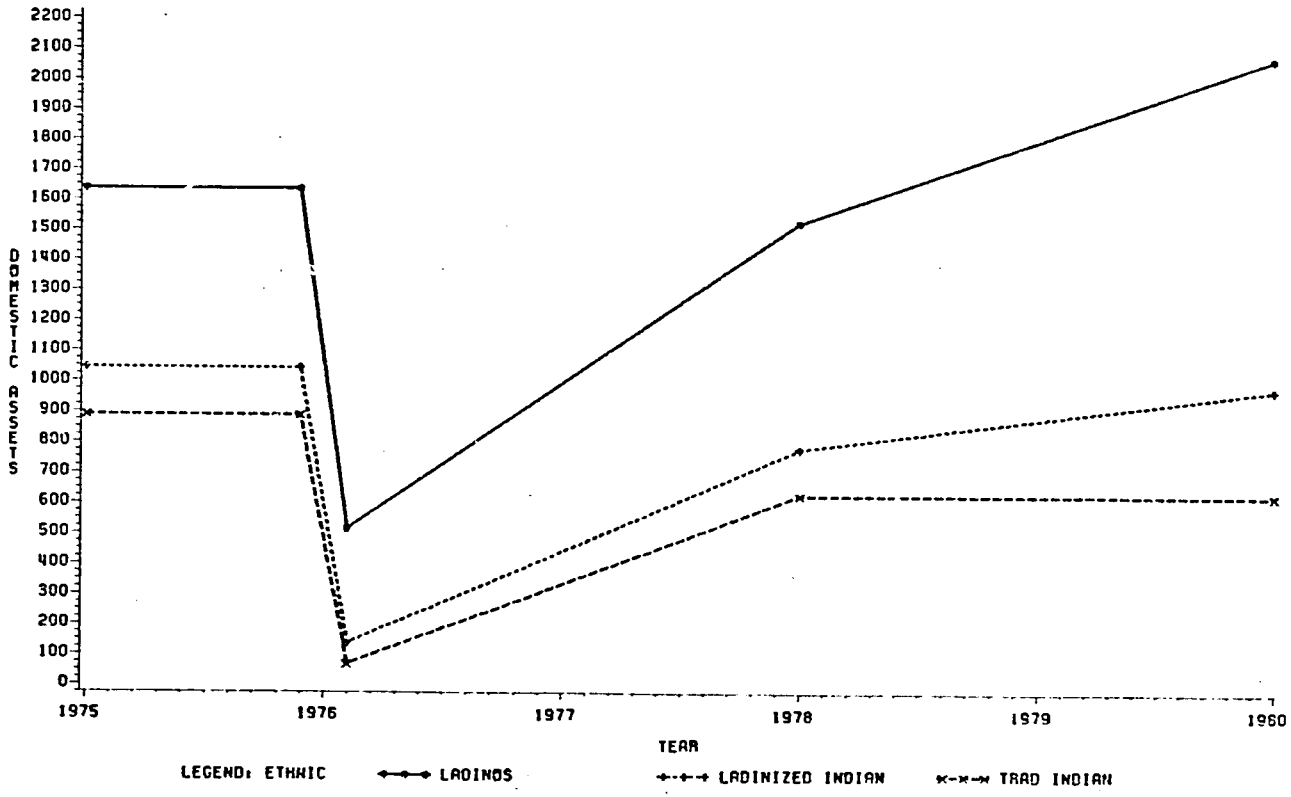


Table 15-36

Distribution of Wealth Between Ethnic Categories
by Experimental Status for Specific Years

	1975	1976	1978	1980
Experimental:				
(Ladinized Indian/ Ladino) 100	63.80	26.81	51.11	47.17
(Traditional Indian/ Ladino) 100	54.34	13.24	41.15	30.29
(Traditional Indian/ Ladinized Indian) 100	85.17	49.39	80.51	64.21
Control:				
(Ladinized Indian/ Ladino) 100	29.41	30.72	1.44	25.43
(Traditional Indian/ Ladino) 100	18.73	23.25	28.77	29.02
(Traditional Indian/ Ladinized Indian) 100	63.70	75.68	91.48	114.14

households. This sharp drop is indicative of greater relative damage suffered by both Indian categories.

By 1978, the Indian categories had gained in their percentage of median Ladino assets from that indicated in 1976. The median assets for Ladinized Indians was 51.1 percent of the median assets of Ladinos and the median assets of traditional Indians was 41.2 percent of Ladinos. However, while both Indian groups gained from 1976 to 1978, they had not yet reached the levels established for the pre-earthquake period. Indeed, in terms of relative standing between the Indian categories and Ladinos, Ladinized Indians were 12.7 percentage points and traditional Indians 13.2 percentage points behind the 1975 level.

In 1980, one can clearly see the relative economic position of the two Indian categories vis-a-vis the Ladino category has eroded even further. The median domestic assets of Ladinized Indians was 47.2 percent of Ladino median domestic assets. The median domestic assets of traditional Indian households was only 30.3 percent of Ladinos. These figures represent a further drop in the relative economic standing of the Indian categories, especially traditional Indians. During the period from 1975 to 1980 Ladinized Indians lost 16.6 - percentage points and Indians lost an incredible 24.1 percentage points.

At the same time that the distance between the economic standing of the two Indian categories and the Ladino category was widening, the distance between the two Indian categories was also widening. In 1975 the median assets of traditional Indians was 85.2 percent of the median assets of Ladinized Indians. However, by 1980 the median assets of the traditional Indian category, even though it appeared that two years prior they were regaining their pre-earthquake position, had fallen to

64.2 percent of Ladinized Indians. This represents a drop of 20.9 percentage points. In other words, while Ladinos are pulling away from both Indian categories, they are pulling away from traditional Indians at a greater pace.

The erosion of the economic standing of Indians to Ladinos in the experimental communities during this five year period was accompanied by a gain for Indian categories in the control group. While the comparability of the two samples must certainly be questioned, the control communities are much poorer then experimental communities and the distribution of wealth was tremendously skewed in 1975, it must be noted that except for the 1980 figure for Ladinized Indians, there was an upward trend for both Indian categories in terms of relative economic standing during the five year period. Thus, the Indian loss in economic standing in experimental communities occurred during a period of economic gain for Indians in control communities.

In conclusion, it appears that only the Ladino ethnic category can be said to have reached and exceeded restoration and recovery levels. Of the two Indian categories, only the Ladinized Indians came close to meeting their restoration and recovery levels. Further, it appears that the relative economic standing of the two Indian categories vis-a-vis the Ladino category was drastically lowered by the earthquake. Even given the high levels of reconstruction aid acquired by Ladinized Indians they were unable to make up for the substantial amount of damage suffered in the earthquake. Traditional Indians, during the four years following the earthquake, never came close to their restoration or recovery levels. It appears possible therefore, that the destructive effects of the earthquake and the manner in which aid was distributed

following it have widened the gap between ethnic categories in Guatemala.

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Chapter 16

A Multivariate Analysis of Factors Affecting Earthquake Recovery

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Background

The relationship between the type of housing reconstruction program a household was associated with and its economic standing four years after the earthquake has been examined in previous chapters. A significant relationship was found between program type and the level of recovery and restoration attained by the household as measured by domestic assets. Other chapters, however, have found significant relationships between program type and other household characteristics such as ethnicity and the type of community in which a household resides. Perhaps more important, many of these same characteristics have been shown to have an effect on economic standing and hence, on the levels of restoration and recovery attained by households. Given the interrelatedness of such characteristics as community of residence, ethnicity, program involvement and economic standing, the simple bivariate relationship between program involvement and subsequent economic standing is informative, but potentially misleading.

In this chapter a more detailed multivariate analysis will be performed in an attempt to assess the consequences of involvement by households in particular types of programs on their 1980 economic standing

and subsequent level of recovery. This multivariate analysis is designed to determine whether there are significant differences between households which can be attributed to the type of assistance they received.

In order to do this, other factors which affect the level of domestic assets associated with a household and which were also related to a household's selection by programs, must be statistically controlled. Previous chapters have established that the amount of damage suffered by a household, its ethnicity, pre-earthquake economic standing, and community of residence had an effect on its economic standing following the earthquake. Not only do these factors have consequences for economic standing, but they vary across and are related to reconstruction program involvement. Thus, it is imperative that the effects of these factors be removed or controlled so that a more direct assessment of the effects of program type on post-earthquake economic standing can be made. The technique employed to accomplish this type of analysis with non-equivalent groups is Analysis of Covariance.

Application of Analysis of Covariance

The logic of analysis of covariance is to purge the effects of those factors, termed covariates, which may partially determine a particular outcome and may also vary across the comparison groups so that the variance which remains can be explained by true differences between the groups and an error term. The comparison groups in this analysis are types of reconstruction programs. Specifically, households have been categorized on the basis of their association with particular types of housing programs. The categories are: (1) "no

program," (2) "lamina programs," (3) "temporary housing programs," and (4) "permanent housing programs."

The outcome or dependent variable to be explained in this analysis is the post-earthquake economic standing of the household as measured by 1980 domestic assets scores. Following the earthquake, measures of a household's domestic assets were obtained at two points in time, 1978 and 1980. The 1980 domestic assets score will be employed in this analysis for two reasons. First, previous chapters have indicated that while most of the reconstruction programs had been completed by 1978, the levels of restoration and recovery were not met until 1980, if at all. These findings may indicate that the full impact of programs was not realized immediately upon their completion, or for that matter, even by 1980. Secondly, the long range impact of disaster relief is of central importance in this analysis and the 1980 data are the last available for use in assessing it.

The covariates in this analysis are damage, ethnicity, pre-earthquake domestic assets and type of community. A number of measures of damage have been employed throughout this analysis, ranging from absolute loss of domestic assets to a measure indicating the degree of destruction experienced by walls and roofs. A measure of relative loss in assets incurred by the household will be used here because of its comparability across households in earthquake impact. This damage estimate is computed by subtracting from one hundred, the percent of 1975 domestic assets held by the household immediately following the earthquake, (100 - (1976/1975) x 100).

The type of community in which the household resides has also been previously referred to as "political status" in the Guatemalan government's administrative system. The communities in this sample are designated as "department capitals," "municipios," and "aldeas." While political status is representative of the community's political designation, it is also indicative of other community characteristics such as relative size, complexity, infrastructure, and accessibility. In general, those communities identified as department capitals are larger, more complex, and have a more extensive infrastructure, and greater accessibility to communication and transportation systems than the others. The aldeas are at the other end of this ordered hierarchy and municipios stand between aldeas and department capitals.

The final two factors to be included in this analysis are household ethnicity and pre-earthquake domestic assets. Household ethnicity will be measured by the relative household ethnicity score as described in Chapter 15. The pre-earthquake domestic assets of the household will be measured using its 1975 score.

The assessment of whether program involvement had an effect on the 1980 domestic assets of the household, specifically, if the group means are different, while controlling for the covariates, can be made only if it is assumed that the effect of the covariates are homogeneous across program types. In other words, the assumption must be made that the effects of the covariates, ethnicity for example, on 1980 domestic assets are equal across all program types. Fortunately, the validity of this assumption can be assessed empirically. The assumption of homogeneity of

effects, or slopes, can be assessed in the following manner. First, an equation, hereafter termed "restricted," is estimated in which the effects of the covariates are forced to be equal across program types. Following this, a second equation, hereafter termed "full," is estimated that allows the effects of the covariates to vary across program types by means of interaction terms. A test for the statistical significance of the increment to explained variance between the equations is then performed. If there is not a significant change in the variance explained by allowing the effects to vary, then the assumption of homogeneous effects can be retained and differences in the groups can be assessed.

Results of Analysis of Covariance

Presented in Table 16-1 are the results of the test discussed above for homogeneous effects across program types. The different types of reconstruction programs and the community type covariate have been entered in both equations using two dummy coding schemes. The excluded category, given the two schemes, is "no program" households residing in departmental capitals. Both equations are significant with the restricted equation accounting for 55.42 percent of the variance in 1980 domestic assets while the full equation accounts for 57.05 percent. The F-test for the increment in explained variance, presented at the bottom of this table, indicates that the full model does not account for a significant amount of the variance above the restricted one. Thus, the assumption of equal effects is retained.

The next step in this analysis is to determine if there are differences in the intercepts or means between the program types. This

Table 16-1

Regression of 1980 Domestic Assets on Program Types and Covariates: Full and Restricted Models for the Experimental Areas

Independent Variables	Restricted Model Parameter Estimate	Restricted Model Standard Error	Full Model Parameter Estimate	Full Model Standard Error	Mean	Standard Deviation
Constant	467.97	(115.63)	421.76	(178.83)		
Lamina	- 55.72	(76.56)	- 41.28	(300.55)	0.25	0.44
Temporary	-373.29	(79.92)	-208.48	(297.96)	0.25	0.44
Permanent	624.36	(88.23)	1271.51	(442.43)	0.16	0.37
Domestic Assets	0.95	(0.04)	1.00	(0.06)	1183.29	683.23
Damage	- 1.69	(1.00)	- 1.31	(1.52)	67.53	30.59
Ethnicity	134.77	(42.90)	156.64	(80.30)	- 0.03	0.69
Aldea	-360.52	(85.29)	-409.47	(161.38)	0.26	0.44
Municipio	-188.21	(75.53)	-245.90	(117.26)	0.46	0.50
Lamina x Assets			0.10	(0.12)	263.32	534.36
Lamina x Damage			- 2.38	(2.44)	16.91	33.01
Lamina x Ethnicity			- 12.91	(118.55)	- 0.00	0.33
Lamina x Aldea			6.33	(239.14)	0.12	0.33
Lamina x Municipio			157.69	(212.40)	0.09	0.29
Temporary x Assets			- 0.11	(0.11)	309.46	621.02
Temporary x Damage			- 1.81	(2.88)	19.46	35.33
Temporary x Ethnicity			- 23.19	(114.24)	- 0.01	0.36
Temporary x Aldea			249.96	(213.40)	0.06	0.25
Temporary x Municipio			117.40	(192.82)	0.05	0.21
Permanent x Assets			- 0.61	(0.19)	182.23	450.97
Permanent x Damage			2.83	(3.51)	12.14	29.45
Permanent x Ethnicity			17.08	(132.73)	- 0.04	0.31
Permanent x Aldea			-118.28	(432.33)	0.01	0.11
Permanent x Municipio			-150.33	(306.36)	0.14	0.34
	R^2 = .5542 Probability = .0001		R^2 = .5705 Probability = .0001			

F-Test for increment in R^2:
F = 1.62 with 15 and 641 df.
Probability > .05

amounts to testing whether knowledge of a household's participation in these programs significantly increases our ability to predict their 1980 domestic assets. The formal procedure to test this is similar to that used above. Two regression equations are estimated, one in which information about program participation is included and the second equation contains only the covariates.

Table 16-2 presents these two regression equations. The model containing only the covariates explains 48.48 percent of the variance in domestic assets in 1980, while, on the other hand, the model with program information and covariates explains 55.42 percent. This seven percent increase is significant,as the F value of 34.04 reveals. This indicates that there are indeed differences in mean 1980 domestic assets among the groups. From this analysis, the adjusted expected values for each program type are calculated.

Prior to examining the adjusted means for program types, the effects of the covariates in the model should be noted. The coefficients associated with these covariates indicate the amount of expected change in 1980 domestic assets. The pre-earthquake or 1975 domestic assets coefficient of 0.95 may be interpreted as the net return in 1980 assets expected for each dollar increase in 1975 assets across households. The coefficient associated with ethnicity indicates that the more Ladinized the household, the greater its expected assets in 1980. As expected, damage has a negative effect. The coefficient indicates that each percentage increase in level of damage is associated with a 1.69 dollar loss in 1980 assets. The coefficients for aldeas and municipios represent average

Table 16-2

Test for Increment in R^2 Between Model With Covariates and Program Type and Model With Covariates Only

Independent Variables	Model With Groups and Covariates	Model With Covariate Only	Means	Standard Deviation
Constant	467.97 (115.63)*	341.31 (118.79)		
Lamina	- 55.72 (76.56)		0.25	0.44
Temporary	-373.29 (79.92)		0.25	0.44
Permanent	624.36 (88.23)		0.16	0.37
Domestic Assets	0.95 (0.04)	0.95 (0.05)	1183.29	683.23
Damage	- 1.69 (1.00)	- 2.51 (1.03)	67.53	30.59
Ethnicity	134.77 (42.90)	80.40 (45.51)	- 0.03	0.69
Aldea	-360.52 (85.29)	-286.28 (87.37)	0.26	0.44
Municipio	-188.21 (75.53)	124.06 (72.41)	0.46	0.50
	R^2 = .5542 Prob. = .0001	R^2 = .4848 Prob. = .0001		

F-Test for increment in R^2:
F = 34.04 with 3 and 656 df.
Probability < .01

*Standard Error of the estimate.

dollar deviations from households in department capitals. Both are deductions from that amount, with residence in an aldea amounting to a 360 dollar difference on the average. These covariates, taken as a whole, account for nearly half the variance in 1980 domestic assets. However, program type contributes significantly to the explanatory power of this model, as can be seen by calculating their respective means.

Results of the calculation of adjusted means are presented in the following table.

Table 16-3

Mean 1980 Domestic Assets for Program Types

	No Program	Lamina Program	Temporary House Program	Permanent House Program
Unadjusted Mean	$1436	$1035	$ 985	$1820
Adjusted Mean	$1290	$1234	$ 917	$1914

All means are significantly different from each other except the "no program" and "lamina program" means of $1290 and $1234, respectively. Clearly, permanent house recipients fared better than all other types, and households which received temporary housing fared the poorest. It must be recalled that these adjusted means reflect program differences statistically controlling for both initial differences in and the effects of pre-earthquake economic standing, level of damage, ethnicity, and type of community.

The differences in these means again indicate that temporary housing programs acted to retard restoration and recovery. Those who received only lamina roofing and those who received no assistance at all rank over thirty percent higher in mean domestic assets, despite the fact that the dollar value of temporary housing was substantially higher.

Predicted Values for Domestic Assets Under Various Conditions

In order to illustrate the simultaneous effects of the covariates on 1980 domestic assets, Table 16-4 was prepared. This table uses the regression equation to calculate expected or predicted domestic assets for various combinations of situations with respect to the covariates. Across the top of this table the three types of communities are shown. Under each community type the three ethnic groups are given. For each of these ethnic groups two levels of damage are presented and along the left side of this table, the four program types are broken down by different levels of pre-earthquake domestic assets. An individual cell in the table represents the 1980 domestic assets for a case falling in this combination of categories as predicted by the regression equation. Thus, the upper left hand cell in the table which shows $1855 indicates that a Ladino household residing in a departmental capital which experienced 60 percent damage and received no program assistance, but started off having domestic assets equal to $1500, was predicted to achieve a level of $1855 in domestic assets by 1980. By moving across the first row of the table, program type and level of domestic assets is held constant and the effects of ethnicity, degree of damage and predicted values for community of

Table 16-4

Predicted 1980 Domestic Assets for Various Levels of Covariates in Each Program Type

Program Type	Pre-E.Q. Domestic Assets	Department Capitals						Municipios						Aldeas					
		Ladino		Ladinized Indian		Indian		Ladino		Ladinized Indian		Indian		Ladino		Ladinized Indian		Indian	
		Damage		Damage		Damage		Damage		Damage		Damage		Damage		Damage		Damage	
		60%	80%	60%	80%	60%	80%	60%	80%	60%	80%	60%	80%	60%	80%	60%	80%	60%	80%
No Program	1500	1855	1821	1788	1754	1626	1592	1667	1633	1600	1566	1438	1404	1494	1460	1427	1393	1265	1231
	1200	555	1521	1488	1454	1326	1292	1367	1333	1300	1266	1138	1204	1194	1160	1127	1093	965	931
	700	1055	1021	988	954	826	792	867	833	800	766	638	604	694	660	627	593	465	431
Lamina	1500	1799	1765	1732	1698	1570	1536	1611	1577	1544	1510	1382	1348	1438	1404	1371	1337	1209	1175
	1200	1499	1465	1432	1398	1270	1236	1311	1277	1244	1210	1082	1048	1138	1104	1071	1037	909	875
	700	999	965	932	898	770	735	811	777	744	710	582	548	638	604	571	537	409	375
Temporary Housing	1500	1482	1448	1414	1380	1253	1219	1274	1260	1226	1192	1065	1031	1121	1087	1053	1019	892	858
	1200	1182	1148	1114	1080	953	919	994	960	926	892	765	731	821	787	753	719	592	558
	700	682	648	614	580	453	419	494	460	426	392	265	231	321	287	253	219	92	58
Permament Housing	1500	2479	2446	2412	2378	2250	2216	2291	2258	2224	2190	2062	2028	2118	2085	2051	2017	1889	1855
	1200	2179	2146	2112	2078	1950	1916	1991	1958	1924	1890	1762	1728	1818	1785	1751	1717	1589	1555
	700	1679	1646	1612	1578	1450	1416	1491	1458	1524	1390	1262	1228	1318	1285	1251	1217	1089	1055

residence can be compared between various cells. For example, it is possible to look at how Ladino households with low damage differ across community types by focusing on the figures 1855, 1667 and 1494. These numbers show how different communities of residence would have affected three Ladino households which were otherwise alike in that they had low damage and received no program assistance and also had $1500 in domestic assets in 1975. Similar comparisons can be made throughout the table by holding constant any combination of variables and looking at variation in any dimension chosen for examination.

These predicted values represent hypothetical cases and all are not equally meaningful or likely to occur in the real world of Guatemala. They do give some indication of how households exhibiting different combinations of characteristics would fare under different types of assistance, assuming the regression equation depicts the operation of this system of variables.

The relationship between program types and the covariates can be seen by comparing different combinations of cells in this table. Examination of the numbers in this table will reveal that, for those receiving no assistance, households in department capitals and municipios attained or exceeded restoration levels even when suffering as much as 80 percent damage. This can be seen by comparing the predicted 1980 domestic assets for each cell in a row to the pre-earthquake value given at the left. The only exception to this statement is found with respect to traditional Indian households suffering these damage levels in municipios. Households in aldeas would not be predicted to achieve restoration, regardless of

ethnicity. This same pattern holds true for lamina recipients.

On the other hand, those receiving temporary housing would not be expected to attain pre-earthquake levels of domestic assets from these levels of damage, regardless of type of community or ethnic composition of the household. In sharp contrast, receiving a permanent house insures that restoration is more than met across all categories.

Whether restoration is achieved or not, a uniform pattern is present for all four types of programs. Households in the more complex types of communities consistently outscore those in the more remote villages which lack such infrastructure. The exception to be made here is that the Ladinos in a less complex community environment rank higher in predicted domestic assets than traditional Indians in the adjacent, more complex type of community. Within each type of community, the more Ladinized households come closer to meeting or exceeding restoration levels.

Though not immediately apparent from this table, careful examination of the predicted values using ratios among status categories reveals that permanent housing programs relative to self-help strategies and temporary housing solutions would be predicted on the basis of the regression equation to produce a sort of leveling in social structure. It appears on the basis of predicted values that self-help and temporary housing strategies permit,or perhaps encourage structural factors,otherwise operating in the society, to come into play as determinants of economic standing. Class differences, ethnic differences and rural-urban differences are much less evident under the permanent housing scenario. One interpretation or evaluation of such programs is that they have a potential developmental

effect in addition to a recovery effect. Another interpretation is that such programs may have a status homogenization effect which may disrupt the status quo and have potential repercussions politically, economically and socially. In a sense, the other types of programs may be characterized as preserving the status quo and therefore of being politically, economically and socially conservative in comparison. Of these three more conservative strategies, there is some indication that temporary housing programs tended to exacerbate inequalities by widening already existing differences in the system. It is important to remember that these conclusions are derived from comparisons of the predicted domestic assets associated with one group as compared to another and not from actually observed differences across all combinations of covariates.

It must be understood that the suggested consequences which have been drawn from this table are based on hypothetical situations over a range of household characteristics. Some are realistic and in fact occurred. Others are strictly hypothetical because actual cases to fit the cell are either extremely rare or non-existent in the Guatemalan social structure. However, the data upon which the regression equation is based exhibit these relationships over a more narrow range of situations.