THE USE OF A CROSSCULTURALLY VALID LEVEL OF LIVING SCALE FOR MEASURING THE SOCIAL AND ECONOMIC EFFECTS OF EARTHQUAKES AND OTHER DISASTERS AND FOR MEASURING PROGRESS IN RECOVERY AND RECONSTRUCTION AS ILLUSTRATED BY THE CASE OF THE GUATEMALAN EARTHQUAKE OF 1976[1]

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Introduction

Social science research on disasters is hampered by the lack of a commonly accepted measuring instrument for assessing the social and economic impact of disasters. A need therefore exists for a valid and reliable measuring scale through which the impact of disasters on human social systems can be measured. Furthermore, there is a need for an instrument that not only measures the impact of a disaster on the social system but which permits the monitoring of the recovery process as it takes place over time.

Even though physical science measures for assessing the impact of disaster agents are available, these instruments do not yield the kind of information necessary to social research. A Richter scale number, for example, does not furnish an indicator of the social and economic impact of an earthquake. What the social sciences need is a scale that measures the impact in terms of social indicators. In short, it must measure the impact of a disaster agent on a human system and must permit the measurement of recovery of that system as the reconstruction process takes place.

Ideally, what is needed is a scale which can be applied to many different kinds of disaster situations involving various kinds of disaster agents. It should be usable in measuring the impact of hurricanes, floods, tornadoes and earthquakes, and even man-made catastrophies 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.

The Richter scale used for measuring the force of earthquakes is useful anywhere on the face of the earth. This means that an earthquake occurring in the Middle East can be compared in magnitude to one occurring in Central America. Furthermore, their physical characteristics can be compared along various dimensions measured by physical science methods. The social sciences need a similar sort of instrumentation so that the results of research in various parts of the world can be accurately compared and knowledge from social research accumulated and made cross-culturally relevant. It is of course a tall order to create a scale that has both cross-cultural and cross-disaster relevance. Nevertheless, efforts need to be made in this direction.

This paper reports on one such effort. Specifically it deals with the use of a modified level of living scale technique for measuring the social and economic impact of a disaster at the household level. To create the type of instrument described above, it will be necessary to add community and societal level measures to the household level scales so that the total impact of a disaster can be measured accurately.

Theoretical Perspective

Social scientists 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 indicators 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. They represent the sorts of figures useful to disaster relief 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 purposes. Aside from their inaccuracy, the major fault in such measures is that they represent aggregate level data and can not be easily broken down to the household level or to the level of small geographic areas such as neighborhoods or communities. High quality social science research on disasters must use a stable measure of the impact of the disaster on specific social units upon which other data are collected to test specific hypotheses concerning the relief and reconstruction process. Most often a social scientist needs to know how a disaster has affected specific households so that hypotheses concerning the effectiveness of relief and reconstruction programs can be tested. In a sense, the impact of the disaster represents the independent variable at the first stage of social research on the disaster process since it measures the effects of the disaster agent on a social unit. Later in the research process, recovery measures based on the same scaling technique used to measure impact can be used to measure recovery and thus become a measure of the dependent variable for the reconstruction process.

This paper proposes the use of a technique based on level of living scales to measure the social impact of disasters and to monitor the recovery process. Level of living scales 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 socio-economic status of a household relative to others that are part of the same social system. Early scales, such as that designed by Chapin [1935] and later modified and improved by Sewell [1940] and Belcher [1951], measured level of living by merely determining the possession or non-possession of certain physical characteristics in the household. For example, households were given points on the level of living scale if they possessed such physical objects or characteristics as: (1) running water (2) electric lights (3) a radio or television (4) a refrigerator or washing machine (5) etc. One defect of such scales lay in the fact that as the economic situation of a society or community changed, the items which were used on the scale had to be changed in order to measure differences in a population. If, for example, everyone in a society owned a radio, then radios could not be used as a means of differentiating the status of various household units and another item which was unequally distributed within the population would have to be added in its place. This meant that such scales could be used in cross-sectional studies performed at one point in time but had inherent weaknesses with respect to longitudinal studies. Furthermore, they had the more serious weakness of being highly specific to a given social and cultural context. A scale that would measure level of living in Mexico would be of little value in Western Europe or the U.S. One that measured well in the U.S. in 1900 would be useless in 1980.

Still another weakness lay in the fact that the underlying dimension being measured could 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, John C. Belcher [1972] created what he refers to as a cross-cultural level of living scale. It is this scale which is used as the basis for the work being discussed in this paper. 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 the 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.

In creating his new cross-cultural scale, Belcher reasoned 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 food may be stored or preserved within the household. One way is to simply place it on the ground or on the shelf. Another is to use a clay jar or 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 the function could be performed at the household level 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 1. 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 scale would be obtained at the opposite extreme. A copy of the Belcher scale is given in the appendix of this article.

In connection with the Guatemalan earthquake study, eleven of the fourteen items 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 house were made of at the time of the earthquake. This would allow 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 5. 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 0. If they were heavily damaged, it was multiplied by .33; if slightly damaged, by .67; and if no damage occurred, by 1.00. This procedure was used for all household functional areas upon which damage could be computed. As a consequence, a post-impact level of living scale 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 scale which reflected the physical impact of the disaster on the individual household.

The modified Belcher level of living scale employed in the Guatemalan earthquake study contains items particularly suited to the Guatemalan case and is also given in the appendix of this report. For example, wall types used in Guatemala did not conform completely to the Belcher list and additional types had to be included; adobe, for example. The scoring procedure, however, is identical to that used in the Belcher scale.

The Guatemalan earthquake study utilized a quasi-experimental design which called for collecting data on four points in time on experimental and control groups: (1) T_1, pre-earthquake (2) T_2, earthquake impact (3) T_3, 2 years after the earthquake (4) T_4, 4 years after the earthquake. At each one of these time periods a level of living measure was obtained using the strategy outlined above, so that four separate level of living measures of the same households are available. The idea was to use the level of living measure as a means of measuring earthquake impact on the household and of monitoring the recovery process. Thus the amount of loss reflected in the damage scale discussed above reflects the impact of the earthquake at the household level. Measures taken two and four years after the earthquake reflect recovery in level of living as a consequence of the reconstruction process. The pre-earthquake measure furnishes the base line against which to measure both impact and recovery.

During the course of analysis of these materials, 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." To resolve some of these questions, a new modified scale was created. The problem was as follows. The Belcher scale weights different alternatives for performing a given function along a 5 point scale representing technological efficiency. Each alternative is spaced equally with respect to those adjoining it. It was observed, however, that the household items represented by these scales varied considerably in cost. For example, taking the food preservation item, a clay jar or basket in Guatemala used for food storage costs in the neighborhood of $1.00 to $3.00, while an electric or gas refrigerator costs $700. If a person's clay jar were destroyed in the earthquake he would lose 1 point on the Belcher type level of living scale. Similarly, if he lost his refrigerator he would lose 5 points. This did not seem to reflect the value of the 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 like 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. 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, either at the bottom or the top, and the amount of change would be equivalent. If, however, the items on the scale were weighted according to cost, this could not happen. Furthermore, it was observed that the two ethnic groups in Guatemala, Indian and Ladino, 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 the 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, so to speak, 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 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 as to make the same change at the bottom of the Belcher scale. The observation that the Indians were improving faster than the 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 on the scale to create a new scale. This scale reflects the cost of obtaining the capital equipment to establish a given life style. When damage scores are figured it reflects 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 life style. To distinguish this scale from other level of living scales, it can be called an "Index of Domestic Assets." For convenience in this paper it will be referred to as a cost weighted level of living scale.

Another advantage claimed for this 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 level of living, 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 than the other, although both suffered loss of, say 50%, 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 socio-economic and upper socio-economic group will have quite different change implications for household level economies. The way aid is distributed could partially close the economic gap among strata in the same society and thereby set in motion modifications in the stratification system. This too has far-reaching policy implications for how disaster relief funds are utilized. In the following pages these two forms of level of living scales will be compared in terms of what they show about the impact of the 1976 Guatemalan earthquake and what they reveal about the recovery process.

Comparison of Findings from the Guatemalan Earthquake Study Using Various Level of Living Scales

It is possible, using the design of the Guatemalan earthquake study, to compare several level of living scales in terms of how they measure the impact of the earthquake and restoration of level of living over a four year period following it. The design for this study employed a group of earthquake-affected communities as a kind of experimental group in which to test hypotheses about the recovery process against a second set of lightly affected or unaffected communities which serve as a control group. In each community a random sample of households was interviewed using three waves of interviews coming about a year apart. On the basis of these interviews, level of living measures can be constructed for four points in time as shown below:

T_1, Pre-earthquake Level of Living, 1975

T_2, Level of Living Day After the Earthquake, 1976

T_3, Level of Living Two Years After the Earthquake, 1978

T_4, Level of Living Four Years After the Earthquake, 1980

From these various level of living scores differences in levels of living, or differences in amount of change between time periods can be computed for any sub-sample group of households. For purposes of this paper, three level of living measures will be compared in terms of what they reveal about experimental control group differences through time. The first will be the Belcher scale which uses the five point weighting technique in which each individual item is equally weighted. This scale employs eleven functional dimensions and therefore scores can vary from a maximum of fifty-five to a minimum of eleven.

The second scale is one in which eight of the same items employed on the Belcher scale have been weighted according to an estimate of their dollar cost. The total score on this scale for a given household reflects the dollar value of the household possessions they use to satisfy eight of the functions on the Belcher scale. This scale is called a "cost weighted" level of living scale, or an Index of Domestic Assets. It should be understood that individual functional areas are unequally weighted on this scale since their weight is determined by actual dollar cost of the item used to satisfy a given function. All in all, the cost of housing weighs heaviest compared to other functional areas.

In general, these two scales represent the household situation quite differently conceptually. The Belcher scale posits a straight line relationship between levels of technological efficiency and level of living value, while the cost weighted scale builds in a curvilinear function. The relationship between the two can be diagrammed roughly as shown in Figure 1.

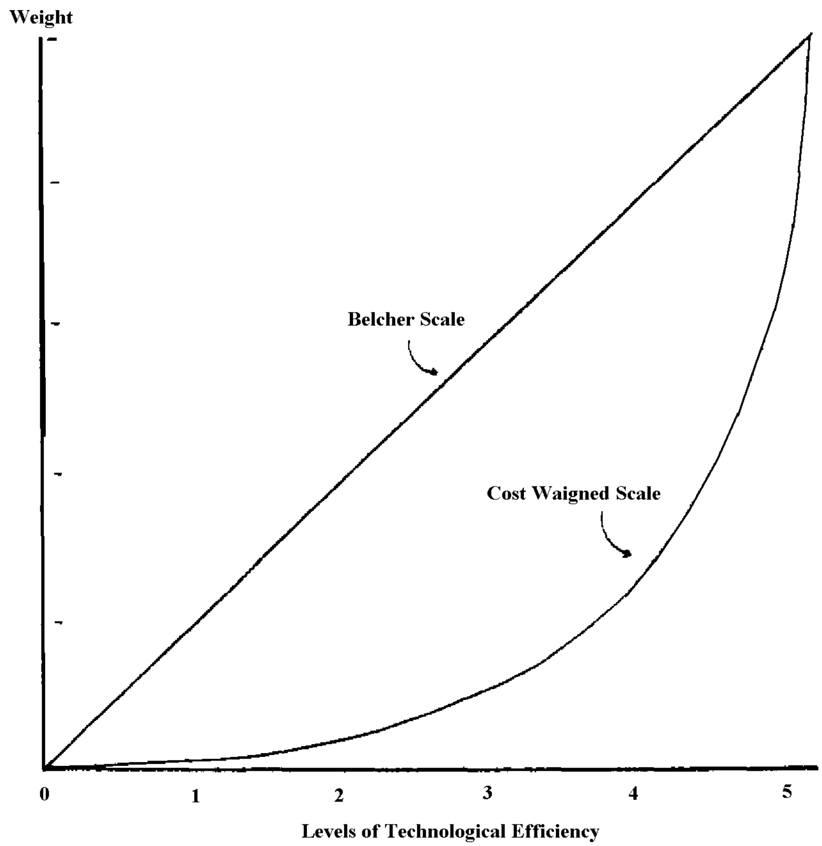

Figure I

General Relation Between Belcher and Cost Weighted Scales of Index of Domestic Assets

In order to make the cost weighted scale more usable employing parametric statistics and, at the same time, to dampen the effects of extreme values, a third scale is presented in this paper. This scale weights each functional area by the log of cost and then sums the logs of the items to obtain a score for an individual household. This scale will be called the Log Scale in the following discussion.

Table 1 shows the mean and medians for these three scales for the control and experimental groups at various points in time. It also gives the results of an appropriate test of significance between control and experimental group values. The t test is used for the Belcher scale and

Table 1

Comparison of Three Level of Living Scales with Respect to How They Measure Disaster Impact and Recovery

Year/Scale	Experimental Group				Control Group				Significance of Difference Probability
	N	X	Md.	S	N	X	Md.	S	
1975									
Belcher	791	28.16	26.00	8.49	346	28.79	26.13	10.91	.336(t)
Cost Weighted	804	1212	1022	729	348	1148	935	921	.165(X^2)
Log of Cost Weighted	804	53.42	51.36	12.89	348	54.38	51.10	14.99	.299(t)
1976									
Belcher	791	19.22	17.45	9.02	346	27.58	24.66	10.91	.0001(t)
Cost Weighted	804	466	283	664	348	1009	797	883	.0001(X^2)
Log of Cost Weighted	804	32.59	32.32	19.65	348	52.80	49.14	15.59	.0001(t)
1978									
Belcher	787	29.94	28.73	8.80	341	30.45	29.06	10.80	.445(t)
Cost Weighted	804	1110	884	882	348	1205	1009	868	.007(X^2)
Log of Cost Weighted	804	53.74	51.74	12.78	348	55.92	55.10	14.38	.015(t)
1980									
Belcher	661	31.95	30.60	9.11	299	31.52	30.46	10.98	.548(t)
Cost Weighted	676	1363	1013	1015	306	1388	1130	1027	.119(X^2)
Log of Cost Weighted	676	56.36	53.80	13.40	306	56.95	56.38	14.93	.552(t)

for the log scale since both form reasonably normal distributions. The median test is employed for the cost weighted scale since it is heavily skewed toward lower values.

This rather complex table reveals several important conclusions about the earthquake and the reconstruction process, and about the three level of living scales. First is the fact that just before the earthquake in 1975 the control and experimental groups were similar in level of living as revealed by all three scales. For example, the Belcher scale shows the experimental group's average level of living as 28.16 as compared to 28.79 for the control group. Medians also show remarkable similarity on this scale, 26.00 and 26.13. The cost weighted scale shows that the average cost of household possessions contained in the scale was $1212 for the experimental group as compared to $1148 for the control group. The difference is not statistically significant. Examination of the median cost of household equipment for the two groups shows $1022 for the experimental group and $935 for the control group; again not statistically significant. It can be seen by comparing the mean and median, however, that the cost weighted scale is skewed considerably, with most of the cases falling at the lower end of the scale. Finally, the log scale, which shows a mean for the experimental group of 53.42, and one for the control group of 54.38, also does not achieve statistical significance. In short, all three ways of measuring pre-earthquake level of living show similar results for the control and experimental groups. This means that differences which emerge at the time of the earthquake or later can be viewed as a consequence of things associated with the earthquake or with the reconstruction process.

The 1976 figures represent level of living the day after the earthquake. These figures were obtained by depreciating the 1975 level of living scale by the proportion of damage to each item which occurred in the earthquake as described earlier in this paper. The first thing to note is that all three scales show a significant difference between the control and experimental groups. 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 level of living did occur in the control group, but not much, compared to the experimental group. The experimental group dropped from 28.16 to 19.22 on the Belcher scale, from $1212 to $466 on the cost weighted scale, and from 53.42 to 32.59 on the log scale. Both means and medians reveal major losses in the experimental as compared to the control group.

At this point it is well to note that the cost weighted scale reveals a loss of $746 out of $1212 for the average person in the experimental group. This amounts to a 61.55 percent loss in level of living as measured by this scale. It can be assumed that at least an investment of this amount per household would be necessary to restore the level of living of families in the earthquake area to their previous level. Since the scale only measures losses on a selected group of household items, it is more useful to view this figure as an indicator of the disaster's magnitude than an actual cost figure.

Differences between the Belcher scale and the others show up as the levels of living two years after the earthquake are examined. In 1978 the Belcher scale shows that the experimental and control groups are again statistically similar on level of living, with the experimental group scoring 29.94 on an average and the control group 30.45, a difference which is similar to that observed before the earthquake. If this scale is used to measure recovery, then it appears that it has taken place by 1978. Because of the nature of the Belcher scale, however, changes at the bottom of the scale and changes at the top are counted equally and compensating errors may lead to incorrect conclusions.

As can be seen, the cost weighted scale leads to an opposite conclusion. It shows the control and experimental groups to remain unequal in 1978, with the experimental group lower in the dollar value of level of living. Similar results are obtained from the log scales. The results of the cost weighted scale reveal that the experimental group remains 8.4 percent below its pre-earthquake level of living, while the control group has increased its level of living 5 percent above its pre-earthquake level, leaving a gap of 13.4 percent between them. At the bottom of the table, change scores are given for the period 1975-1978. It can be seen that a similar situation is registered here where the cost weighted and log scales show the experimental group still below 1975 pre-earthquake levels, while the Belcher scale shows them as essentially equal. For the cost weighted and log scales it is necessary to conclude that recovery had not yet taken place in 1978.

By 1980 the three scales show no difference between the control and experimental groups and therefore would lead to the similar conclusion that recovery, as measured by household level of living, had substantially occurred by that time. However, the three scales would lead to different conclusions where the total amount of change in level of living between 1975 and 1980 is concerned. Here the Belcher scale shows a significant difference in the amount of change between the control and experimental groups, with the experimental group increasing in level of living more than the control group. This leads to the conclusion that the earthquake and the reconstruction process actually resulted in positive gains in the experimental group and not just recovery. The cost weighted scale leads to the opposite conclusion. It shows that the experimental group gained $178 in level of living as compared to $244 for the control group, but that the difference is not statistically significant. The log scale shows that the control group gained less (2.49) than the experimental group (3.10), but again the results are not statistically significant.

When the median levels of living, as represented by the cost weighted scale, are plotted on a graph, they reveal both a general economic trend which was affecting the control and experimental groups alike, gradually raising their levels of living and also the effects of the earthquake (Figure 2). They show the experimental group slightly higher than the control group at the beginning of 1975, and slightly below it in 1980, five years later. In the meanwhile, the earthquake devastated the experimental group and drove its level of living down by around 60 percent. During the next four years the experimental group recovered to very near its original level. Meanwhile the control group which was only slightly affected by the disaster gradually improved in level of living.

The conclusion that can be drawn from the data presented in Tables 1 and 2 is that the three types of scales yield similar results in most cases. The Belcher scale, however, has a tendency to mask differences at the extremes, and therefore to be less useful in dealing with change than in cross-sectional comparisons. The cost-weighted scale has certain

Table 2

Comparison of Three Level of Living Scales with Respect to How They
Measure Change Between Various Time Periods

Year/Scale	Experimental Group				Control Group				Significance of Difference Probability
	N	X	Md	S	N	X	Md.	S	
1976-1975									
Belcher	791	-8.94	-9 00	5 42	346	-1.21	0.00	2 58	.0001(t)
Cost Weighted	804	-745	-805	456	348	-139	0.00	272	0001(X^2)
Log of Cost Weighted	804	-20 83	-22.18	15.14	348	-1 59	0.00	5 56	0001(t)
1978-1975									
Belcher	782	1 93	1.97	4.65	341	1 71	0 00	4.79	.456(t)
Cost Weighted	804	-101	-150	658	348	57	0 00	535	.0001(X^2)
Log of Cost Weighted	804	.31	-.22	8.54	348	1.53	0.00	7 27	.013(t)
1980-1975									
Belcher	659	4 08	3.67	5.00	297	2 72	1.60	5.34	.0002(t)
Cost Weighted	676	178	15	726	306	244	57	663	.215(X^2)
Log of Cost Weighted	676	3.10	1.81	9.04	306	2.49	.46	8.64	.323(t)
1980-1978									
Belcher	657	1 98	1.34	3 48	266	1.04	03	3.22	0001(t)
Cost Weighted	676	261	34	566	306	1.79	0 00	451	.0002(X^2)
Log of Cost Weighted	676	2 49	.60	6.14	306	90	0.00	5.47	.0001(t)

definite advantages associated with the fact that it measures difference and change in monetary units that are easily understood. It furthermore has the advantage of giving heavy weight to losses of expensive items and light weight to the loss of less costly ones. Thus it comes closer to representing change and loss in units meaningful to policy decisions. It has the disadvantage of weighting the losses of a rich man heavier than a poor man. This is the price for using the value of what is lost as the underlying metric. The scale, however, contains the information necessary to create a proportion of loss score and thus to equate people in different economic strata in terms of how hard they were hit relative to their economic base. The log scale is most useful in dealing with change, and in using level of living as a variable in regression analysis or with other parametric statistics. Each scale has a use and is of value in analyzing disaster impact and recovery.

Now that the three scales have been examined in relation to one another, it will be useful to examine what the cost weighted scale reveals concerning the disaster's impact on various sub-samples and what it shows about the recovery process for these groups.

Political Status of Communities

Table 3 shows median cost weighted level of living scores for each type of community studied in the Guatemalan earthquake study for each year that data exist. These data are shown in graphic form in Figure 3. The highest median level of living was registered in departmental capitals before the earthquake ($1233), the next in the city, then the municipios and, finally, the aldeas or rural villages. The city sample used in this study was unlike the samples drawn in other types of units. It consisted of four urban neighborhoods which were formed after the earthquake to house lower socio-economic status disaster victims and therefore does not represent a random sample of Guatemala City. In all other cases the samples represent the type of unit listed. If a random sample of the city had been drawn, it would have undoubtedly resulted in the highest level of living being registered there. In other words, level of living in Guatemala before the earthquake varied directly with the size of place or with its political status in the Guatemalan Governmental administrative system.

The 1976 figures show that the earthquake seems to have had its greatest impact on the municipios studied and a relatively smaller impact on department capitals, with the city and aldeas ranking in between. When the 1978 and 1980 figures are examined the effects of the reconstruction process show up. Indications are that the city not only recovered quickly, but exceeded its previous level of living by a relatively large amount. Similarly, but not as dramatically, municipios recovered and exceeded their previous level. Aldeas, in contrast, recovered more slowly and from all appearances, have not yet reached pre-disaster levels of living. Interestingly enough, department capitals seem to display this same pattern, but to a lesser degree. These differences at present are believed to be the consequence of differences in housing programs in the various types of communities. In both of the department capitals studied, and in all but one of the aldeas, temporary housing programs dominated. In the municipios, and in two out of four cases in the city, permanent housing programs dominated. Permanent housing programs, for the most part, furnish more costly houses to people and, along with them, such housing amenities as running water,

Table 3

Median Scores on Cost Weighted Level of Living Scales for Various Points in Time, Showing Median Changes Between Time Intervals

	1975	1976	1978	1980	1976-1975	1975-1978	1975-1980
Political Status (Experimental Group Only)							
City	1183	501	1208	1565	-600	3	220
Dept. Capitols	1233	881	1006	1208	-850	-203	17
Municipios	1029	238	979	1202	-818	- 35	100
Aldeas	880	257	657	680	-481	-144	- 5
Ethnicity (Highlands Experimental Group Only)							
Indians	937	125	826	946	-844	-150	0
Ladinos	1087	383	940	1145	-738	-119	57
Region (Experimental Group Only)							
East	980	411	940	1157	-570	0	57
Highlands	1029	195	808	1002	-853	-160	7
Experimental Status (Excluding City)							
Control	935	797	1009	1130	0	0	57
Experimental	1022	283	884	1013	-805	-150	15

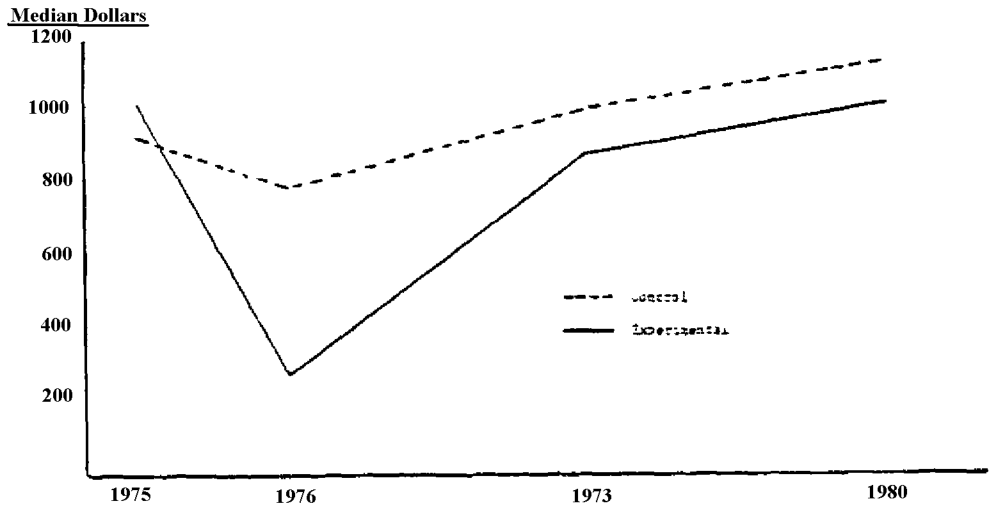

Figure 2

Change in Median Value, Level of Living, Cost Weighted Scale, Experimental and Control Groups, 1975-1980

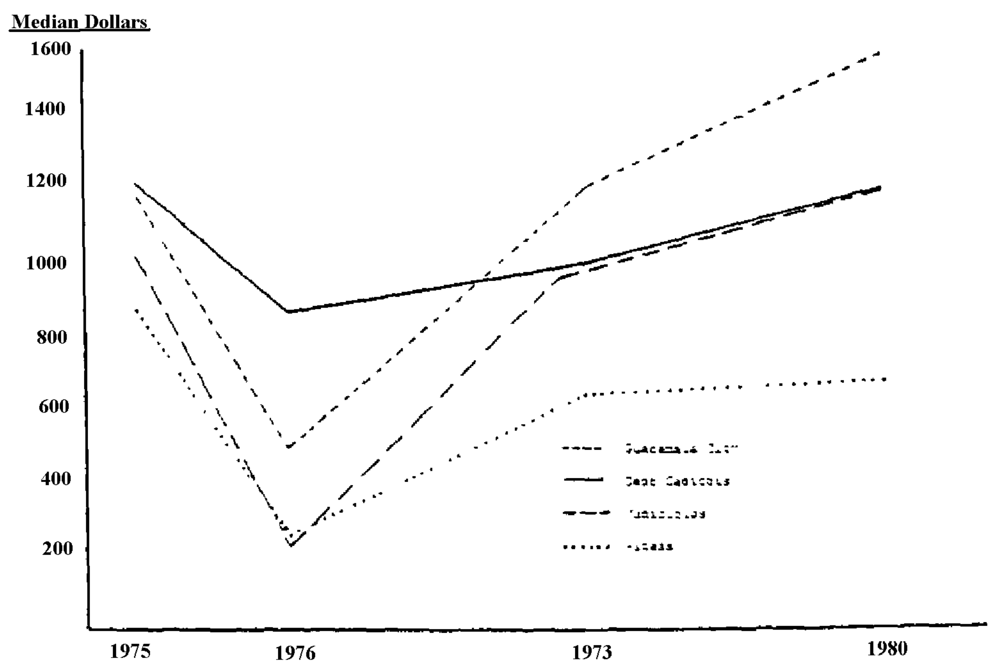

Figure 3

Change in Median Value, Level of Living, Cost Weighted Scale, By Type of Community, 1975-1980 electricity and sewage. Further analysis is needed to determine if this interpretation is correct, but if it is, then Figure 3 may present a picture of how temporary housing programs slow down recovery from a disaster.

Figure 4, along with data in Table 3, show differences between the two major ethnic groups in Guatemala comparing Indians and Ladinos from the Highlands experimental group at various points in the disaster process. It can be seen that Indians scored lower on level of living at each point in time. For a period of two years, they appear to have recovered more quickly from the disaster than Ladinos in the same communities, but during the last two years the spread between Indians and Ladinos appears to have increased. Differences at every point along this line are significant statistically. The explanation for these facts probably lies in the nature of the management of the reconstruction process during these time intervals. Most of the work by foreign agencies was done in the first couple of years following the earthquake. They seemed to prefer to work with Indians in the Highlands and may have given preference to this ethnic group in reconstruction. During the last two-year period, reconstruction became more of an internal Guatemalan effort, with self help being more important than agency programs in general. This meant that the more well-off, better placed Ladinos of the Highlands had a greater chance to improve their situation since they had greater economic and political resources to begin with.

Another comparison that can be made is between two major regions of Guatemala, the predominantly Indian Highlands, and the totally Ladino East. Figure 5, along with figures in Table 3, give comparisons along these lines for the experimental group only. These data show that no real significant difference existed between these regions at any point except in terms of disaster impact. The Highlands lost more than the East but has recovered about as fast and there are now no significant differences in their level of living scores as measured by the median on the cost weighted scale.

Summary

This discussion illustrates the utility of a level of living scale for measuring the impact of a disaster and for monitoring the recovery process. There are a number of weaknesses present in the scales used in this particular study that are not inherent in the technique in general. Because the idea of cost weighting did not occur to the researchers until late in the project, it was not possible to go back and change the data collected to conform to this idea. Instead, available data had to be employed. Essentially this meant that only eight household items could be employed in the final scale. These eight are treated as indicators of what overall costs would have been, had exhaustive information been available.

Future scales designed specifically to be cost weighted can easily employ a different set of items more reflective of the cost of maintaining a given level of living. It is believed, however, that the work in Guatemala demonstrates the utility of using such scales as a means of obtaining reliable measures of disaster impact and recovery. Belcher has demonstrated in his work that these scales have cross-

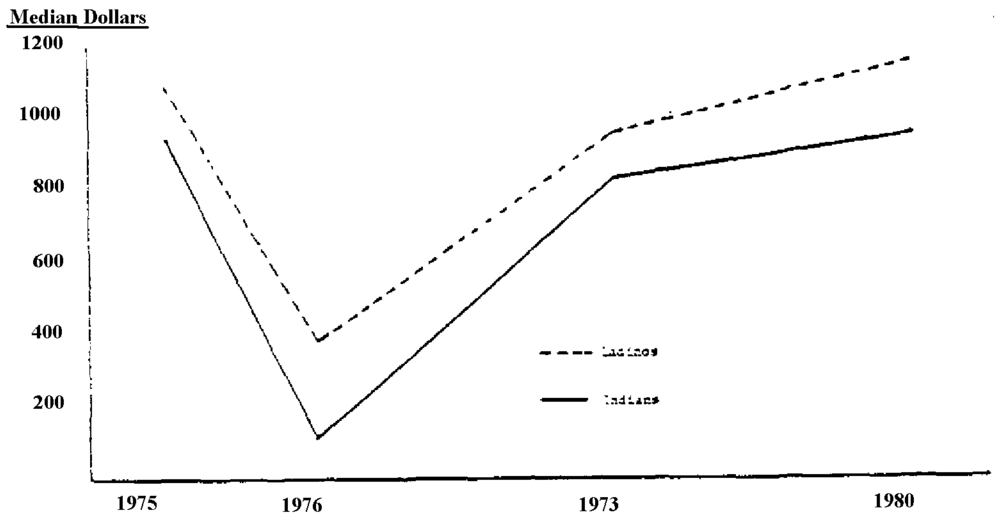

Figure 4

Change in Median Value, Level of Living, Cost Weighted Scale, By Ethnic Group, 1975-1980

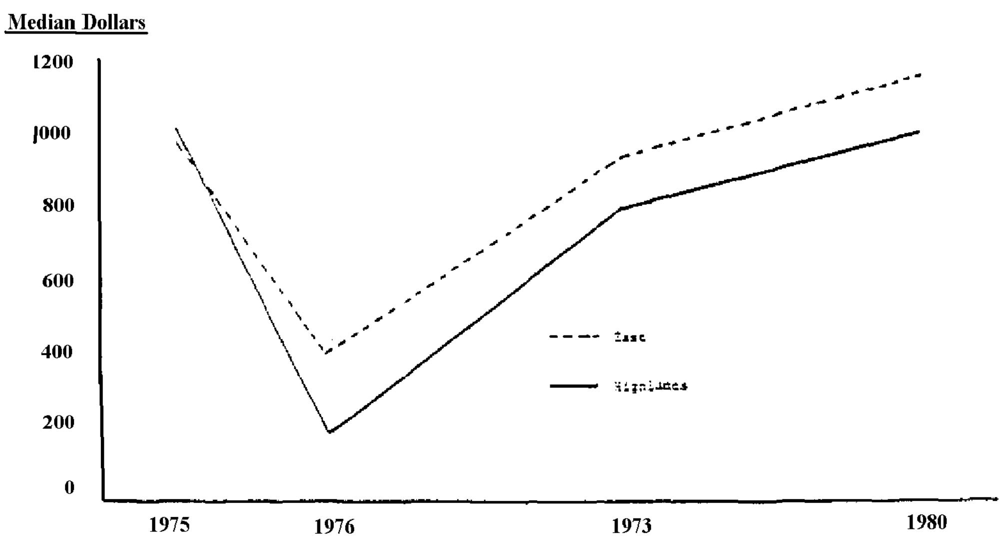

Figure 5

Change in Median Value, Level of Living, Cost Weighted Scale, By Region, 1975-1980 cultural relevance. It is obvious that they can be applied in many different kinds of disaster situations, regardless of the disaster agent, since the measure is of impact on household assets and not the force of impact as a physical measure.

FOOTNOTE

1. This research was supported by a grant from the National Science Foundation, Division of Problem Focused Research Applications. The authors, and not the Foundation, are fully responsible for the contents of this report. Dr. W.T. Farrell and Dr. JoAnn K. Glittenberg are co-principal investigators of the larger project from which these data derive and contributed substantially to conceptualization and data collection related to it. Thomas E. Edwards and Walter G. Peacock assisted in all stages of the larger project.

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Appendix A

Preliminary Cross-cultural Scale for Measuring Level of Living

Function 1. Shelter: construction of exterior walls	Score
Brick, concrete block masonry, painted frame	5
Asbestos or asphalt siding	4
Unpainted frame	3
Scrap wood, Coca-cola signs	2
Grass, leaves, none	1

Function 2. Shelter: construction of living room floor	Score
Finished hardwood, tile, terrazo	5
Finished or painted softwood, bare concrete	4
Unfinished hardwoods or softwood with tongue and groove	3
Wood with cracks	2
Earth	1

Function 3. Shelter: construction of roof	Score
Concrete, tile, good shingles	5
Corrugated or sheet metal, warped shingles	4
Roll roofing, thatch	3
Straw, Coca cola sign	2
None, roof with large holes	1

Function 4. Storage of water	Score
Automatic: house piped	5
Cistern	4
Clay barrel designed solely for water storage	3
Large clay jar	2
Buckets, tin pails	1

Function 5. Transportation of water to home	Score
Automatic, faucet in home	5
Hand pump, faucet in yard	4
Bucket with pulley in yard	3
Bucket from well or stream in own yard	2
Carry over 100 yards	1

Function 6. Lighting	Score
Electric fixture, lamps	5
Electric bare bulb	4
Carbide or gasoline lantern	3
Kerosene lamp	2
Candle, open fireplace	1

Function 7. Preservation of perishable food	Score
Electric or gas refrigerator	5
Ice box	4
Spring house, cellar	3
Window box, clay jar	2
None	1

Function 8. Eating: place settings of flatware	Score
Over two per person--(sets of knife, fork, and spoon)	5
One to 1.9 per person	4
One utensil or more per person, but less than one place setting per person	3
Partial for entire household--fewer utensils than people	2
None--use hands	1

Function 9. Disposal of human wastes	Score
Flush toilets	5
Modern pit toilet	4
Privy	3
Trench and stick in fence corner	2
None	1

Function 10. Transportation	Score
Owned or leased automobile; in some situations, a motor boat or airplane	5
Motorcycle or other small motorized vehicle	4
Horse with wagon or buggy	3
Bicycle, horse or mule	2
Foot only, or public facilities	1

Function 11. Cooking food: equipment	Score
Electric or gas range	5
Hot plate, kerosene or oil stove	4
Manufactured wood stove	3
Clay stove, mud table, hibachi	2
Three rocks, bare ground	1

Function 12. Fuel for cooking	Score
Electricity or gas	5
Oil	4
Wood or charcoal	3
Small sticks, scrap wood	2
Weeds, leaves, dung	1

Function 13. Cleaning floors of home	Score
Vacuum cleaner	5
Electric broom or sweeper	4
Purchased dust mop and/or good grade broom	3
Native broom or mop	2
None	1

Function 14. Washing dishes	Score
Automatic dishwasher	5
Sink with drain	4
Dishpan (no sink)	3
Multipurpose pan: kettle or washpan	2
Wash in stream or at pump	1

Appendix B

Comparison of Items Used on Belcher Scale and Scales Used in Guatemalan Earthquake Study

Function Areas on Belcher Scale	Used in Eleven Item Earthquake Study Belcher Type Scale	Used in Eight Item Cost Weighted Scale
1. Shelter: Construction & Walls	Yes	Yes**
2. Shelter: Construction of Floor	Yes	Yes**
3 Shelter: Construction of Roof	Yes	Yes**
4. Storage of Water	No*	No
5. Transportation of Water (water source)	Yes	Yes
6. Lighting in Home	Yes	Yes
7. Preservation of Perishable Food	Yes	Yes
8. Eating: Place Setting of Flatware	No	No
9. Disposal of Human Wastes	Yes	No
10. Transportation (of family members)	No	No
11. Cooking Equipment	Yes	Yes
12. Fuel for Cooking	Yes	No
13. Cleaning of Floors	No	No
14. Washing Dishes	Yes	Yes

*Distance to water used instead on 11 item scale in Guatemala The greater the distance, the lower the weight given.

**Cost figures were applied using a standard house of 3 x 4 meters containing either one or two rooms. If house had more than two rooms, the cost of walls, roof and floor were multiplied by following factors: 3 = x1 25, 4 = x1.50, 5 = x1.75, 6 = x2.00, 7 = x2.25, 8+ = x2.50. This means that number of rooms represents an additional item used in cost weighted scale.