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HIID/ESEPP
Planning Commission
Govt. of Bangladesh

Revised
December 14, 1989

THE EXTENT AND THE DISTRIBUTION OF THE 1988 FLOOD DAMAGES IN BANGLADESH

Research Team:

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ESEPP

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HIID/ESEPP Working Papers, 1987-89

Working Papers New No.	Old No.	Title	No. of Pages
1	1	A Historical Survey of Industrial Policies with Special Reference to Small Industries in Bangladesh	53
2	2	Methodology of Policy Analysis	77
3	3	Total-factor Productivity (TFP) and Efficiency by Size-Class of Manufacturing Enterprises	94+100
4	4	Impact of Policies since 1982: Evidence from the Economic Census--I	67+100
4a	4a	Appendix B -- Detailed Crosstabulations Economic Census 1986	98
5	5	Set of Questionnaires for the Multisectoral Economic Survey of Bangladesh	102
6	8	Methodological Note on Effective Rates of Assistance by Industries of the I-O Table	15
7	9	Estimates of Effective Assistance to Textile Products 1974-75--1987-88	20
8	13	An analysis of the Impact of Policies by Size-class of Establishments in Bangladesh: Paper presented at the HIID Research Conference, Marrakech, Morocco, Oct. 26-29, 1988	36
9	14	Set of 4 Documentations of Data Tapes	25
10	15	The Extent and the Distribution of the 1988 flood damages in Bangladesh	73+148

HIID/ESEPP Working Papers, 1987-89 Contd.

Working Papers New No.	Old No.	Title	No. of Pages
11	16	An Identification of Dynamic Sectors and An Assessment of the Impact of Policies: Econ. Census--II: More Analysis	58
12	18	An Identification of Dynamic Sectors and An Assessment of the Impact of Policies, Evidence from the DI Data on Investment	50
12a	18a	Appendix--An Identification of Dynamic Sectors and an Assessment of the Impact of policies: Evidence from the DI data on Investment: Basic Tabulations and Documentation of Variable Records	90
13	19	Impact of Policies: Evidence from a Survey of Industrial Leaders	61
14	20	Effective Rates of Assistance (ERAs)	32
15	21	Impact of Policies and Identification of Growth Sectors--An Econometric Analysis	180

*This working paper.

December 14, 1988

Prefatory Note

The interim report of October 19, 1988, on this survey presented mean estimates of damages to those units which had reported flood damages. Those estimates were not blown up for the entire country. That report was prepared in a rush -- within 19 days of the decision to do the survey, including days of field data collection for 1200 units in 77 upazilas. It was unedited. As a result, some estimates were not adequately explained, while a few errors also went in undetected.

This report blows up the assessment to national levels. It reports (1) the previously estimated damaged-unit means as well as (2) sample means, (3) national means, and (4) the absolute magnitudes of damages blown up to the national level by using appropriate expansion factors.

Since this report supersedes the earlier one, the earlier report and other handouts should be ignored.

The appendix of this report is voluminous. As such, it is not being distributed along with this report. Copies of it will, however, be supplied on request, while they last.

HIID/ESEPP
Planning Commission

Revised
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The Extent and the Distribution of the 1988 Flood Damages in Bangladesh

Executive Summary

The floods came on August 30, 1988, continued rising for 4, 5 days, receded in some rivers and swelled in others for about 12 days, and started receding gradually after that. Most areas were still inundated when the field survey for this study was done during October 3-9, 1988. The assessment reported here includes damages till the time of the survey. As such, the damages of the post-flood period for about a month are also very likely to be included, as are recoveries, if any by that time.

The purpose of the survey was a rapid assessment of (a) magnitude of flood damages and (b) its distribution, with special reference to its impact on employment, poverty, and small establishments. The damages are assessed for production and assets across various sectors: including agriculture, industry, public infrastructure, housing, employment, and so forth. The service sector was hardly picked up by the sample survey.

The emphasis of the study is on distribution, as the magnitudes of overall damages have been assessed by a number of government departments and private agencies. Apart from the distribution aspects, we addressed several questions to respondents, that other agencies, in their preoccupation with total magnitudes, did not.

The distribution of flood damages is estimated between socioeconomic classes, skill categories, occupations, size-classes of establishments, size-

holdings of farms, geographic areas, and other groups. The results reported here are based on a sample of 77 upazilas, out of a total of 460 in which the country is divided.

The overall sample consisted of 5 components or subsamples: (a) a subsample of 482 establishments, (b) a subsample of 420 households, (c) a subsample of 384 individuals in relief camps, (d) a subsample of 60 upazila head offices, and (e) a subsample of infrastructure.

The methodology consists, among other aspects, of analyzing damages by two parts: (a) one-shot, temporary loss of output due to the idling of productive capacity and labor during the inundation period, destruction of crops, spoilage of raw materials, and similar interruption in the flow of income, and (b) permanent losses due to damages to machinery and buildings, livestock, infrastructure, and similar capital stock. For the latter type of damages, both direct and indirect effects on employment and output are estimated.

Certain Magnitudes of Flood Damages

The assessment of short-run losses due to the idling of productive capacity during floods, and similar interruptions in the flow of output comes to the following magnitudes:

Damages to manufacturing establishments: 3.45% or US$62 million, varying between a low of 1.28% for textile cloth mills and 4.33% for handloom textiles;

Unemployment: 2.37% due to the direct effects, totalling to 4.11% due to the direct and indirect effects of damages to capital stock in manufacturing, estimated through the general-equilibrium I-O model.

Damage to agricultural and other sectors: King Aman suffered the heaviest damages: namely 76% of total rice by affected households: the mean loss to affected households comes to 76%, the sample mean is 25%, and the national mean is 17.35%. In absolute terms the national loss to Aman crop is assessed at 1.41 million tons and Aman and Aus together 1.67 million tons. The assessed losses to sugarcane and jute are 0.27 million tons and 0.20 million tons, respectively. Other losses assessed here include human lives, cattle, goats, poultry, buildings, roads/embankments, damages by I-O industries, and so forth. Detailed assessment of these magnitudes are not abstracted in the executive summary, lest it should distract the reader's attention from the main thrust of this analysis, which is the distribution of the incidence of flood damages, and which is of significance even if absolute magnitudes might be off the mark.

The Distribution of Flood Damages

The most important conclusion of this study is that natural disasters in disaster-prone Bangladesh hit the poor harder than the nonpoor. Defining the intensity of flood damages as the percentage loss to affected units and the extent of flood damages as the percentage of affected units to sampled units, we find that both the intensity and the extent of damages are higher among the poor. This conclusion is supported by a number of independent pieces of information derived from distinctly separate subsamples and alternative variables of the overall sample survey.

1. People interviewed in relief camps, almost all of whom must be regarded poor, estimated their losses of different assets—goats, poultry, cattle, dwellings, household effects—around two/thirds of the total. They are higher than the losses suffered by any other identifiable group of households. Many are not sure they will be able to get back their old jobs.

2. An investigation into the impact of floods on incomes from nine different sources shows that the losses of overall income of the lower rungs of socioeconomic classes are at least 10 percent higher than those of the rest of the society.

3. Distress sales by socioeconomic classes indicate that not only the intensity of distress sales of the poorman's (the nonpoorman's) assets is higher on the poor (the nonpoor) relative to the nonpoor (poor)--a trivial result--but more importantly, the extent of distress sales is approximately 2.5 times higher on the poor than the nonpoor.

4. The regression results of distress sales further support the nonstochastic results. To these results must be added the fact that while the nonpoor may withstand a dissipation of a good part of their assets without bankrupting themselves, the poor are on a thin ground. Once that ground slips under their feet, it will take much longer for them to firm their feet up again.

5. During the temporary layoff caused by floods, a good fraction of the workers of the modern sector, particularly the public sector, received partial compensations, but not small, cottage, and other informal sector employees.

6. A look at the flood-caused job situation of spouses tells the same story. Both the intensity and the extent of unemployment caused by floods were consisbently higher among spouses of lower socioeconomic classes in comparison to spouses from upper socioeconomic classes.

7. The ratio of administrative and office workers temporarily idled by flood damages is significantly lower than that of the production workers.

2. The employment and output multipliers are higher in manufacturing industries than the rest of the economy, one reason for which is stronger interindustry linkages of this sector. As such, the manufacturing employees suffered more from flood damages, and manufacturing employees are by no means on the lower economic rungs of the working class.

3. Losses are, by and large, uniform across skill classes in manufacturing industries; but not between occupations: Thus, office workers were not idled due to flood damages to the same extent as production workers.

Contents

Section	Page

List of Tables

HIID/ESEFP Project
Planning Commission

Revised
Dec. 14, 1988

THE EXTENT AND THE DISTRIBUTION OF THE 1988 FLOOD DAMAGES IN BANGLADESH

A. APPROACH AND METHODOLOGY

1. The Objective

The severity of the August-September, 1988, floods has surpassed all known floods in the history of Bangladesh. The purpose of this study is a rapid assessment of (a) the magnitude of the flood damages and (b) its distribution with special reference to its impact on employment, poverty, and growth. The assessment is made, as far as practicable, for damages of all type across various sectors, including agriculture, industry, services, public infrastructure, housing, employment, and so forth. Its distribution is estimated between geographic areas, socioeconomic classes, worker categories, size-classes of establishments, size-holdings of farms, and similar groups.

The worth of this study lies not as much in the assessment of total flood damages--because several other government department and private agencies, which have well-established and more extensive data-generation organizations, have also assessed overall flood damages--as in estimating the distribution of flood damages among various socioeconomic groups and industrial size-classes.

2. Special Field Survey

The need for a special rapid survey arose because while a number of government departments and private agencies had also undertaken such surveys, they were mainly concerned with the assessment of total damages. They did not ask some of the questions concerning the flood damages that this office wanted to. A byproduct of it was the creation of data-generating capacity at the grass-root (upazila) level, coodinated by the Planning Commission, a sort of an adjunct to the objective of creating analytical capacity at the Planning Commission, toward which the HIID/ESEPP Project is working.

The questionnaire, reproduced as Appendix A, was addressed to five different groups of respondents in 77 upazilas. The names of upazilas, along with the names of upazilas, along with the names of the assistant commissioners who collected the data by field surveys, are given in Appendix B. The 5 subsamples are described below:

2.1. The Questionnaire

The 23-page questionnaire consisted of the following 5 components:

Part A: The economic survey

Section 1: The upazila survey: addressed to upazila administration/ leadership. Objective: to get overall magnitudes of damages to life, property, dwellings, infrastructure, etc.

Section 2: The enterprise survey: addressed to establishments. Objective: to assess damages to industry, including cottage, small, medium, and large establishments.

Section 3: The household survey: addressed to households. Objective: to assess damages to crops and other agricultural economy as well as loss of jobs by agricultural labor, nonagricultural labor, and the rest of the economy.

Section 4: The relief camp survey: addressed to individuals in relief camps. Objective: to assess the loss of income, assets, and jobs of the poorer strata of the society who took shelter in relief camps.

Part B: The spatial survey

The preparation of a map of damages to public infrastructure, pinpointing where water hit a road, embankment, etc. Objective: to collect data for the eventual preparation of a physical plan for reconstruction.

The present study reports the results of the former 4 subsamples of the subsurvey, namely the upazila, the enterprise, the household, and the relief-camp subsamples. The raw data of the spatial survey, not analyzed here, becomes a part of the data bank at the Planning Commission.

2.2. The sample size

This is a rapid assessment of flood damages. The sample is smaller than what it should be in a scientific survey. Before judging its statistical significance, it should be noted that the typical sample size used by Bangladesh Bureau of Statistics for its periodical household and other surveys is approximately 6,000 households in a country of 16 million households, or 0.0375 percent. According to the theory of statistical inference, this sample size is improbable to represent the parent population. The reason for small samples in Bangladesh is presumably the large size of the country's population and the inadequacy of resources. Be that as it may, were we to use the 0.0375 percent sample as the benchmark in a country with 1.4 million permanent establishments, the comparable establishment sample size comes to 525. Our sample for establishments in 77 of the 460 upazilas is 482 units. The sizes of the other subsamples are 420 units for the households survey, 397 for relief-camp respondents, 60 upazila headquarters for the overall upazila survey, and 77 upazilas for the spatial survey.

2.3. Sample selection

The 60 enumerators (assistant commissioners), among themselves, surveyed 77 upazilas. Within each of the 77 upazilas, the selection of respondents was left to the discretion of enumerators, as travel conditions were not good to do a survey of randomly selected, pre-specified units. Investigators were instructed to travel as far out of the upazila headquarter towns as flood conditions and conveyance facilities permitted. Within the assigned period of 7 days, they were instructed to complete the specified questionnaires. Enterprises and households were enumerated by making sure that households by at least 5 size-holdings of farms and enterprises appeared in the survey for each upazila. Of the total of 410 (out of 482) industrial establishments for which econographic areas could be distinctly identified, 203 or 49.4% are in least-developed areas, 166 or 40.6% in less-developed areas, and 41 or 10% in developed areas. By and large, the survey is random in the inundated areas, though some tendency on the part of investigators to select badly affected units was detected. Uninundated divisions of Chittagong and Khulna were not surveyed. Greater Dhaka was included. As such, both agricultural and industrial areas are expected to be well represented.

2.4. The survey team

The 3-month training course at the Bangladesh Civil Service Academy for 60 young assistant commissioners was extended by one week with a view to using their services for the survey as well as providing them training in data generation for future. One of the objectives of this extension was to get the data collected by gazetted officers (at or near the top echelon of an upazila) who had already been posted in the respective upazilas for approximately 2 years and knew the terrain and economy of the respective upazila. It is presumed that this experiment in training in data gathering will be continued for future trainee batches also.

The supervision of the survey was provided through field tr ps by the academy's director, five experts of the HIID/ESEPP Proje t, and one national economist from the Economics Office of USAID/Dhaka. Be re the assistant commissioners went out, they received a day-long training filling the questionnaires.

2.5. On the reliability of data

We do not have any presumption that our assessment of flood damages is in any way superior to those done by other agencies and government departments. A reason for a possible overestimation or underestimation is that the training period of only a day for field investigators (assistant commissioner trainees) was too short. We included alternative questions by way of cross-checks for eliciting correct information from respondents, for example, damages in terms of absolute quantity and value of output (and area in the case of agricultural products) as well as percentages of each of these measures. Investigators were further instructed to grope for unbiased assessment but, having done their best in assuring accurate information, record the answer given by the respondent and not that based on their own personal judgment. That guideline was given to generate objective estimates rather than base them on the surveyor's judgment. It is possible that expert personal judgment would have generated more realistic estimates. In any case, a careful check of the assessment of damages to various products convinced us that most answers in terms of absolute magnitudes probably overstated damages, some of which were unbelievable. On the other hand, answers in terms of damages as percentages of normal output or other magnitudes turned out to be quite plausible when checked against extraneous information. It appears that if assessment by respondents is made in terms of percentages of damages, it is easier and likely to be more realistic than if it is made in absolute quantities. The results of this study are based largely on answers given in percentages.

3. Methodology of Analysis

A few of the methodological issues involved in this study need be described. These pertain to the sampling procedure, the estimation of the distribution of damages among size-classes of various groups, blowing-up of sample estimates to the national level, and the like.

3.1. Sampling design

In this survey, only flood-affected areas were included. Within that domain, it is, by and large, a random survey as among geographic areas, inasmuch as the assistant commissioners who did the field work in their own upazilas, under the guidance of this project, happened to hail from randomly scattered upazilas of the country. Most of about a dozen female assistant commissioners, out of a total of 60, surveyed greater Dhaka, such that the industrial hub of Dhaka was also covered. Assistant commissioners from nonflooded areas were sent to flooded upazilas.

Insofar as the selection of units from various size-classes is concerned, however, the sample was not scientifically designed to represent various size-classes in proportion to parent populations. The main reason for this was the rapidity with which the sample had to be designed and the survey had to be carried out.

The smallness of the sample size is another reason. When compared to the distribution of the respective groups in the relevant censuses, it was found that large farm households were over-represented in the household survey, whereas large size-classes of enterprises were slightly under-represented in the establishment survey. While such disproportionalities of the sampled units of size-classes may or may not cause significant errors or biases in the mean values of size-classes, they will do so for overall mean-values. Accordingly, for calculating the overall means of various damages, class means were weighted not by the damaged or sampled units but by census-based weights. For agricultural products, the weights were drawn from the Census of Agriculture. For the industrial damages, weights were developed from the Economic Census, 1986. Unfortunately, the Economic Census reports only employment and the number of establishments, but not output. As such, employment weights were used in the absence of production weights.

3.2. Distribution of damages by Another classes and categories

The second methodological issue concerns the distribution of the incidence of damages. Among other dimensions, flood damages were assessed by the following classes:

1. Distribution of damages per household or per establishment among (a) affected units, (b) sampled units, and (c) national units, i.e., the affected-unit mean by size-class, the sample mean by size-class, and the national mean by size-class. The mean of the units which reported damages is informative, inasmuch as we learn about the severity of damages suffered by the affected units; the sample mean is useful for such purposes as channelling aid to affected areas; and the national mean is needed to estimate national aggregates.
2. Distribution by geographic areas. Estimates for the country and divisions are reported.

3. Distribution by I-O industries.

4. Distribution of damages to agriculture among households by different size-holdings of land. All households were classified by five land-holding classes; the landless class (which included households in nonagricultural activities) and four land-owning classes.

5. Distribution by size-class of establishments. This inquiry is in conformity with one of the objectives of this project, namely, how the most ravaging and frequent disaster of Bangladesh affects small, medium, and large enterprises.

6. Distribution of damages among workers by skill class and industry. Like the analysis of the distribution by size class of industries, the distribution of idled labor due to floods (whether by skill class or not) is also consistent with the objectives of the ESCPP Project.

7. Distribution by socioeconomic class. The distribution of Item 4. above pertained to losses of crops and other agricultural products only, and was assessed by individual product. The distribution by socioeconomic class takes into account income loss from all sources, even though the classification is done by size-holdings of land.

The first 5 distributions were derived from the data of the sample survey.

Despite our effort to survey various size-classes of farms, enterprises, workers, and households, however, evidently a rapid, small survey like the present one cannot capture all the detail that is necessary for assessing the distribution and the total impact of the damage on different groups of households, producers, workers, and areas. Accordingly, an indirect, supplementary procedure was also employed. To one dimension, output and employment multipliers were developed by 47 I-O industries to calculate the direct and indirect effects of the damage among workers of different skill classes. To another dimension, the overall magnitudes of damage in different sectors were allocated to various groups of producers on the basis of pre-existing basic distribution series. Among others, two distribution tables were prepared:

3.3. Employment and output multipliers

The purpose of making use of the pre-existing data series (the I-O table to be more specific) on employment distribution is two-fold: One, to develop the distribution of possible flood-caused unemployment among different skill-classes of workers across various industries. Two, to estimate the direct-plus-indirect effects of flood damages.

Data were classified by 10 categories (occupations and skills) of labor from the 1984-85 CMI tape for over half of the 47 sectors of the I-O table. Another classification was developed by one-digit occupational categories from the labor force survey. The latter source and additional information will be used in due course to develop labor coefficients for the remaining (agricultural, service, etc.) industries. For the purpose of this report, however, the series derived from the CMI data could only be used. These series were adjusted to match the aggregates used in the general equilibrium model of the Planning Commission. The missing entries of this source were filled from diverse sources. Some of the details of this procedure for the augmented I-O table are discussed in Appendix C where the I-O employment rows are given.

A special feature of the present calculations that ought to be underscored is that the main results are derived from a general equilibrium framework of the I-O table, such that the direct and indirect effects, or multiplier effects, of changes in output (employment) in one sector upon output (employment) in other sectors, informal and formal, are duly accounted for. The basic distribution data series are given in Appendix C (I-O labor coefficients).

3.3.1. The ℓ_{sj}

Let the relevant terms be defined as follows:

a_{ij} as the matrix of direct input-output coefficients of the transactions matrix of the I-O table

r_{ij} as the inverse matrix

h_{sj} as the matrix of direct labor-input coefficients in the labor rows (measured here as manyears per Taka 1000 of gross supply of Sector i in 1988, i=j)

ℓ_{sj} as the matrix of employment coefficients (multipliers) which include both direct and indirect labor requirements, a kind of "inverted" matrix of labor coefficients.

The methodology of overall employment effects of flood damages in any industry j on any labor category s is given in Eq. (1):

$$\Delta L_{sj} = \ell_{sj}\,\Delta X_j = \sum_i h_{si}\, r_{ij}\, \Delta X_j \qquad (1)$$

where change in labor, ΔL, of skill category s, ΔL_s, required for a unit change in the final demand or autonomous production of commodity j, ΔX_j1 is given by the summation over sectors j of the products of the row vector of sth labor input coefficients per unit of output of sectors i and the column vector of the input-output coefficients of X_j in the inverse I-O matrix. The direct coefficient h_{si} is defined as manyears of skill s required to produce one thousand takas of commodity i. The coefficient ℓ_{sj} may be interpreted to be equivalent to the input-output coefficient in the inverse Leontief Matrix. It measures both direct and indirect effects on employment.

The overall change in the employment of skill category s can be measured by taking into consideration changes in all sectors j:

$$\Delta L_s = \sum_j \Delta L_{sj} \qquad (2)$$

The data for basic functional income distribution by 24 categories of labor as derived from the CHI, i.e., before being blown up for the entire economy, appear in Appendix C, Table C1.

The blown-up series of labor at the national level appear in Table C2, the direct labor-input coefficients (h_{sj}) in Table C3, and direct+indirect labor-input coefficients (ℓ_{sj}) in Table C4.

3.4. Impact of floods on rural socioeconomic classes

The distribution of joblessness caused by flood damages is, by and large, equivalent to the distribution of losses in income insofar as urban population is concerned. As such, we shall not carry the urban income analysis much further. The distribution of the immiserization of rural population is not so straightforward. As such, losses of rural incomes by socioeconomic classes are traved by components of income. The basic income distribution series for rural socioeconomic classes by components of income was derived from two sources: (a) The BIDS 1982 Rural Sample Survey from which a distribution series was derived for different size-holdings of land by sources of income. The distribution derived from this source appears in Appendix D, Table D1. (b) The Census of Agriculture for the distribution of animals, fowls, and crops by size-holdings of land, which is given in Table D2.

3.5. Long-run and short-run effects

The assessment of flood damages is done for two runs of time, short-run and long-run. The short-run assessment is based on the loss of industrial output due to the idling of machines and men, damage to inventories, and destruction of crops and other agricultural products. The long-run assessment is made for additional loss of output due to damages to the means of production, e.g., machinery, buildings, irrigation equipment, infrastructure, and so forth.

The loss of output due to the stoppage of work for the equivalent of 30 to 40 full-time workdays, on the average, in the industry and the destruction of crops to the tune of roughly 10 percent of overall annual food production is a one-shot, and not sustained, loss, as illustrated by the dip D in Fig. 1. In the absence of future natural disasters, and assuming foreign aid and increased domestic effort for reconstruction and recovery offset the potential drop in effective demand due to the one-shot decline in incomes, the normal output trend should resume. Consequently, while the annual measures of output and income will decline, monthly flow of output and income in the post-flood period will not necessarily fall. This is what we call short-run change.

The long-run loss of output flow, which is likely to linger on beyond one year, is caused by damages to machinery and equipment and physical infrastructure. How soon the pre-flood levels of production can be attained depends upon the speed at which damaged capital can be repaired/rebuilt. That, in turn, will depend, in part, upon the speed at which the necessary imports of intermediate goods for the rehabilitation of damaged capital stock can be arranged. The dotted line in Fig. 1 depicts the indicated sustained (S) change in long-run output.

Both short-run and long-run effects will be simulated to obtain direct-plus-indirect effects through Bangladesh's general equilibrium I-O model, without estimating how long it will take for the two to work out.

3.6. Expansion factors

Most results are presented, in general, in a trivariate arrangement. To one dimension by three tiers: (a) for affected units at the upazila level, (b) for sampled units at the upazila level, and (c) for the nation as a whole, either by blowing up the sample values to obtain absolute aggregates or averaging them out by appropriate adjustment factors. To the second dimension, for each of the three tiers, three measures are calculated: (i) the mean per unit (household, establishment, etc.); (ii) percent damage, i.e., damage to a product, asset, etc., as a percentage of its normal value; and (iii) absolute value or quantity of the damaged product or other entity. To the third dimension by four to five size-classes of establishments/households.

It is apparent that expansion and averaging factors are needed for Tiers b and c of the first dimension across the other two dimensions.

The expansion factor for Tier b is simply the mean value of the affected unit times the sample size. Denoting the mean value, for example, of a damage to affected units by $\bar{x}1$ and that of the mean of the sample value by $\bar{x}2$, the sample mean, $\bar{x}2$, is

$$\bar{x}2 = \bar{x}1 \left(\frac{\text{No. of affected units}}{\text{Sample size}} \right) \qquad (3)$$

The expansion and averaging factors for the nation as a whole (Tier c) are not that strightforward. They are subject to measurement errors and are vulnerable to statistical manipulation. The main reason for this is that the sample survey was carried out only for 77 of the 337 inundated upaziles. Correct ratios of the products and assets in the inundated areas to national aggregates are needed but are not readily available.. Conceptually, if X1 is the absolute damage of affected units, the overall national damage, X3, of a product, etc., is

$$X3 = X1 * E3 \qquad (4)$$

and the national mean, denoting it as $\bar{x}3$, is

$$\bar{x}3 = \bar{x}2 * A3 \qquad (5)$$

where the national expansion factor, E3, is

$$E3 = \frac{\text{No. of "relevant" units in nation}}{\text{Sample size}} \gamma, \qquad (6)$$

where γ represents the ratio of inundated area or a similar adjustment factor. The national averaging factor, A3, is

$$A3 = \frac{\text{Normal production of the product damaged in the affected areas}}{\text{Normal national production of the product damaged}} \qquad (7)$$

Simple though they may appear, the numerator values of (6) and (7) are not easy to come by. Our choice, among others, is between 3 expansion factors: (1) the percentage of population or households in affected areas, estimated to be 41% of 13.8 million rural households; (2) the percentage of inundated areas to total national area, assessed to be 84%; and the share of the respective agricultural product or area cultivated in flooded upazilas. The three expansion factors may give different results. The expansion factors of Item 3 were developed from the census. They are given in Appendix D, Table D3. Alternative results are presented where considered relevant and useful.

4. Damage to Industry

The Enterprise Subsample

As discussed in Sec.3,5, floods caused two types of damages to industry: temporary damages caused by the idling of productive capacity of establishment during inundation and permanent or semi-permanent losses due to damages to plant and buildings. They are assessed separately.

4.1. <u>One-shot, temporary damages to industry</u>

The mean value of the damages due to the closure of plants during the inundation period to those establishments that reported such damages is assessed at 13 percent of their annual output.[1] The mean for the country as a whole is 3.45%. See Table 1 and Fig.2. Between size-classes of establishments, the incidence is not significantly different from one another. A slight variation in the cut-off points of size-classes alters the mean values to some extent. For instance, compare the means of Table 1 and Appendix Table G1.5. Therefore, minor variation in class means, which have standard errors as large as means themselves, should not be given any credence. Moreover, the affected-unit means could be biased. The sample bias is corrected significantly in the appropriately weighted national means. The national means, too, are not significantly different from one another. More evidence on this distribution will be presented in the interregional and intraregional distribution of flood damages in Section 9 below.

The absolute national loss from the reference type of damages comes to $62 million.[2]

Damages by manufacturing I-O sectors are presented in Table 2. It may be seen that they range from a low of 1.28% for Mill-Made cloth to 4.33% for handloom cloth.[3] At the I-O industry level, however, some of the values are not statistically significant.

For the one-shot damages that are being analyzed in this section, output losses are data. Part of the employment effects are also data. The complete effects on employment have, however, to be simulated. That takes the analysis to the short-run domain.

4.2. <u>Long-run damages to industry's productive capacity and output and employment multipliers</u>

Insofar as labor is concerned, firms varied in the degree to which different types of workers were temporarily laid off or simply idled. Production workers were idled during the inundation period largely because firms were closed. Besides, workers of some firms could not make it to the factories as their houses and surrounding areas were submerged. Some firms, particularly public enterprises, reported that a substantial fraction, upto half, of the monthly wage was paid to production workers during the closure period. In some firms, administrative and technical staff were considered on leave if their leave was due. Irrespective of whether employees were paid a fraction of wages (a distribution matter), any idling of productive capacity reduces GDP.

Overall employment losses were simulated from output losses by introducing flood-caused output loss by industries into the I-O table. This exercise yields additional results by skill classes of workers, even where skill data were not satisfactorily generated in the sample survey. The procedure for short-run and long-run effects is explained below.

The terms of the input-output table were defined in Sec.3. Let the two types of flood dam ges, one causing short-run impact (D) and the other long-run effect (K) be defined as D and K, respectively. More precisely, let

D_J = the vector of assessed output losses as proportions of total output due to the idling of capacity caused by floods

K_J^* = the vector of assessed proportionate damages to capital stock (machinery and equipment and buildings) measured in terms of reduction in usable productive capacity (since in the context of the I-O table fixed proportions of capital and labor are assumed)

The short-run employment effect of the one-shot reduction in output due to the damages to crops and temporary idling of industrial capacity as a proportion of the respective total is calculated by

$$\frac{\Delta L_s}{L_s} = \frac{\sum_J h_{sJ} D_J X_J}{\sum_J X_J h_{sJ}}, \qquad (8)$$

where D_J are data and h_{sJ} and x_J are taken from the augmented I-O table.[4] Apparently, in this case only the first-round results are relevant. The results of (8) are presented in Table 3.1.

It may be seen from this table that the short-run effects of flood damages probably idled 2.87% of industrial workers and 1.91% of all workers. The incidence of forced idleness among male workers by skill classes is as follows: professional and technical 2.79%: service 2.89%: production workers: skilled 2.98%, semi-skilled 2.46%; unskilled 2.57%. The percentage incidence is lower on unskilled workers than any other class, presumably because idling by skill class is done only for manufacturing industries where the ratio of unskilled male production workers to skilled male production workers, for instance, is only 16%. Since some manufacturing industries are more intensive in skilled workers (as defined in Bangladesh) than others as a class, which skill class bears a higher burden depends upon which industry has suffered more damage. The same explanation applies to the relative incidence between male and female workers, which at the level of the aggregate manufacturing industry comes out 2.73% idling of male workers and 3.20% of female workers.

The lower value of the independent multiplier for the entire economy in comparison to the weighted mean multiplier for manufacturing is not to be explained by higher or lower labor intensities but by higher or lower damages to the respective industries. The values of Table 3.1 suggest that the manufacturing industry probably suffered heavier damages than the rest of the economy.

The loss of output due to floods is only a part of the story. Damages were also caused to the stocks of buildings, machinery and equipment, bullocks, and so forth. The respondent-reported losses to capital stock are reported in Appendix H.

For the long-run effects of damages to capital stock, simulations of the effects of both output multiplier and employment multiplier are relevant.

4.2.1. Long-run employment multiplier effects

The long-run negative employment multiplier effect of flood damages as a proportion of total employment of the respective skill, s, is given by (9):

$$\frac{\Delta L'_s}{\Delta L'_s} = \sum_j \ell_{sj} \frac{K_j X_j}{[illegible]}, \qquad (9)$$

The results are presented in Table 3.2. It may be seen that the general equilibrium employment multipliers raise the direct-and-indirect effects of flood damages to industrial employment from 0.029 to 0.041.

Comparisons of the one-period employment effects of Table 3.1 and the multiperiod employment multiplier effects of Table 3.2 are given in Table

It may be seen that the overall manufacturing sector employment multiplier for male workers is 1.44 and that for female workers 1.22. The overall multiplier for the manufacturing sector is 1.43 while that for the overall economy is a low 1.19. That is, the employment-multiplier effect of flood damages to capital stock (1.43) is more than twice as high in manufacturing as the rest of the economy (1.19). The low indirect effect of investment in nonindustrial projects reflects weak linkages or low spread effects in nonindustrial sectors, at least insofar as the production (as distinguished from consumption) process goes, i.e., insofar as Leontief output multipliers in contrast to Keynesian consumption multipliers are concerned.[5]

4.2.2. Long-run output-multiplier effects

Finally, the long-run output losses as proportions of total supplies are given by

$$\frac{\Delta X_i}{X_i} = \frac{\sum_j r_{ij} K_j X_j}{\sum_j r_{ij} X_j}, \quad i = j. \qquad (10)$$

The results appear in Table 3.4. The calculated values of output multipliers are significantly higher in general in the industrial sectors (I-O sectors 10 through 30) than agricultural or service sectors. The overall effect of flood damages to productive capacity is 2.54 percent. Output multipliers for individual I-O sectors may be read from Table 3.4, Col.4.

High output and employment multipliers are not an unmixed blessing. They are good in expansion but impose heavy losses in contraction of the type caused by floods in Bangladesh. Good or bad, these facts should be known to policymakers.

Several policymakers and donors have inquired about estimates of the effect of flood damages on GDP. The outcome will depend to a significant extent on the pace and quantum of reconstruction, public investment behavior, the extent to which losses may be made up by recovery and so forth. If one were to hazard a prediction about the loss of GDP on the basis of long-run damages to productive capacity (including infrastructure, see Table C5), then, assuming other things unchanged, the last number in Table 3.4 is that prediction, namely a drop of 2.54% (or approximately US$407 million) in GDP. To this has to be added the one-shot, temporary loss of output for 1988-89 only, which will roughly double this figure. The rebounding of economic activity due to recovery, reconstruction, and other development programs may (let us hope) wipe much of it out.

5. Damages to Agricultural Products

The Household Subsample Survey

5.1. King Aman

The long-run employment and output effects of flood damages to capital stock in both agricultural and nonagricultural sectors were analyzed in Sec. 4. In this section, we present the short-run impact of floods on agricultural products.

The quantity damages to Aman suffered by affected households are assessed at 0%, 77%, 69%, 73%, and 87%, respectively, to size-holdings I through V. See Table 4. The results indicate little change of damages between different farm holdings. The value losses, however, show a discernible falling trend as the holding size increase, as may be seen from Table 4 and Fig. 3.

The discrepancy between the distributions of quantity losses and value losses probably reflects the fact that the respondents had marketed surplus in mind when they answered the value-loss question.

For calculating means for affected-unit damages the affected-unit weights are relevant. For sample means, sample weights serve one purpose, but national means are more relevant to correct the sampling bias. For national means, we consider acreage weights to be more relevant. According to this scheme, the affected-unit mean of damages to the quantity produced of Aman is 76%, the sample mean is 25.15%, and the national mean is 17.35%. The national loss in absolute terms works out around 1.41 million tons and Tk. 10.7 billion, with a standard error of about equal size.

5.2.--Aus, sugarcane and jute

Damage to other crops are given in Table 5. It may be verified that combined with Aus, the cereal damage comes to 1.67 million tons and including sugar, food damage adds up to 1.94 million tons. The plight of affected households may be judged from Col. 2 of Table 5, which, combined with the total quantity damage to Aman in Row 1.2 of Table 4, gives percentage loss of 60% to 80% of their produce.

5.3.--<u>Historical statistics</u>

<u>of flood damages</u>

Annual damages due to floods and droughts since 1973-74 are given in Table 6 and are sketched in Fig.4. The Planning Commission's estimates for the 1987 flood damages--of 2.72 million tons for Aman alone, 3.04 million tons for all rice, and 3.40 million tons for both flood and drought damages--as available from the <u>Memorandum for the Bangladesh Aid Group (Consortium), 1987-88</u> are apparently overblown. On the other hand, the assessment made in this study for the 1988 flood damages includes neither those due (the Almighty forbid) to drought if there is any in the later part of the year nor those due to the cyclone and ocean surge that devastated South Bangladesh only four days ago (today's date Dec.4, 1988). Almost all those districts which escaped the floods (other than Chittagong Hill districts) have been hit equally hard, indeed harder, by the cyclone and sea surge. Incomplete reports of the first 4 days indicate 1500 persons died, one million homeless, and widespread damages to crops, wild animals (in the Sundarban Forest), dwellings, and electric and other installations. The scope of this analysis is, however, confined to floods only.

6. Damages to Life and Property

The Upazila Subsample Survey

Selected statistics collected for aggregate damages to the upazila as a unit of observation are given in Appendix F. The respondents for this subsurvey were upazilla headquarters, most of which had compiled the basic data before the arrival of our investigators. This subsample consists of 60 upazilas.

Damages to life, buildings, and public infrastructure from this subsample are given in Table 7. It may be seen that, according to the survey, the loss of human life in the country was 5 thousand, cattle 135 thousand, and poultry birds 1.25 million. Over 2.2 million or 1/7th of all types of buildings and 19,743 km of roads and embankments were fully destroyed. If the figure of almost complete destruction of 2.2 billion structures is correct, which we as surveying team have little reason to doubt (it was supplied to us by upazila administrations), the damage is a colossus. Marvel the indomitable spirit, fortitude, and resilence of the people of Bangladesh who have restarted humming activity from which it looks as if nothing has happend!

7. The Relief Camp Subsample Survey

The 4th subsurvey was addressed to individuals still in relief camps as well as those who had gone back home, as most relief camps had closed down by the time of the survey, although weekly rations were still distributed at the relief camp sites to approved households. For all practical purposes, this subsample was a survey of the poorman. Questions about job and migration, both realized and planned, were also addressed to this group.

Answers to a few questions of interest are tabulated in Table 8. Some of the statistics quoted here may not appear in Table 8, but are given in Appendix H.

Assessment of damages to goats and poultry, as estimated by upazila administrations, were given in the upazila subsample survey in Sec. 6 above. The losses of poultry, goats, cattle, dwellings, and household effects among these destitutes are assessed at 67%, 77%, 66%, 73%, and 56%, respectively, of the total value of the respective asset. The average respondent household lost assets worth about Taka 10,000 or approximately 70% of all assets.

A verification of these figures suggest that while percentage loss estimates are quite plausible, the absolute prices put on dwellings and household effects are probably on the high side. Some engineers estimate that rebuilding the bamboo-thatch-mud houses that most of these people lost (with the possibility of some recovery) would cost around Taka 1000 to 1500 rather than the mean value of Taka 4021 calculated from respondents' answers. Making adjustments to the overstated prices of dwellings and household effects, the total mean damage to the assets of these people is probably of the order of Taka 5,000 (instead of Taka 10,000), or approximately $150 per household. It is by a coincidence, though it implies little significance, that this loss is almost exactly the per capita (not per household) income of Bangladesh.

To understand the effect of flood on job conditions, individuals' occupational background was explored. Prior to the flood, about half of them (51.4%) did not have a steady job, and almost two-thirds (64%) were daily laborers. While 25.9% had already gotten their jobs back at the time of the interview, 51.6% of the remaining respondents were confident that they would get their jobs back. During the floods, 11.1% found some type of productive employment.

Most relief camp inhabitants have hitherto returned to their place of origin or plan to do so shortly (78.6%). Conversely, 13.6% have expressed intent to migrate. Whether the intent to migrate is high or low relative to the propensity to migrate during normal times is to be judged by migration patterns prevailing independently of floods. If 13.6% is a high figure, it should serve as a precursor of population displacement of a permanent nature, from rural areas to towns and to relatively less flood-prone areas. If 13.6% is a low figure, perhaps the widespread floods, by which the capital city of Dhaka was also adversely affected, dampened any hope of a haven, free of future floods and/or better job opportunities. Whether it is high or low cannot be judged without additional data, because the 13.6% figure reflects the desire to migrate, and at an abnormal time, which may be fickle and may or may not be realized.

It is interesting to note that almost half of those interviewed (44.6%) sought refuge in a relief camp during the flood of 1987 also. Recurrence of similar floods most likely will force a certain segment of the population to become dependent on outside help, at least for a certain time period, each time. Once relief camps open (after the arrival of a flood), some may find the living conditions superior in the camps compared to their existing hand-to-mouth existence, perhaps even less arduous. Thus, when asked "If they can stand on their own feet without outside help," an overwhelming 87.7% responded that they cannot.

Policymakers are not unaware of this predicament. For instance, a rather vexing question on the reference tendency was posed by a senior policy-maker in the seminar--attended by the 60 assistant commissioner investigators of the present survey, the Planning Minister, secretaries and senior members of the Planning Ministry, and several donors and other outsiders--where the interim report of this survey was presented. Participants and several assistant commissioners narrated their impressions to the effect that with repeated relief, people were becoming more and more dependent on outside assistance which dependency was having deleterious effect on self-help. One of the speakers went so far as to state that some people build their shacks deliberately in very lowland locations with the expectation that even slightly abnormal river surges will wash them away, qualifying them to ask for relief. This is a disturbing aspect of relief.

In summary, the findings of the relief camp survey suggest that the 1988 flood damage to this typically poor segment of the population has been colossal. They have lost more than half of their assets, paltry though they were to begin with. Many are not sure if they will be able to get their old jobs back. Dependency motive is suspected to be feeding on itself, thereby corroding the spirit of self-reliance. Yet the survival and rehabilitation of the relief camp refugees is critically dependent upon the extent of assistance that they will receive while in the camps and after. Outside help will evidently be needed quite frequently for this natural disaster-prone delta country, at least until severity of Bangladesh's national disasters is substantially reduced by the regulation and control of river waters and/or people's capacity to cope and live with the remaining degree of disasters, through, e.g., improvement in their economic capacities, is significantly enhanced. Doubtlessly the outside response has been excellent.

8. The Impact of Flood Damages by Socioeconomic Classes

8.1.--Who bears the incidence of natural disasters?

Having looked at the four subsamples individually, next we examine the net incidence of overall flood damages (other than hardship and death) by socioeconomic classe- In the absence of more appropriate data for basic distribution, we u   he distribution of size-holdings of land to demarcate rural socioeconomic classes. Their economic losses were then measured by nine sources of income. The idea is to see whether people in different stations in their lives suffer to disparate degrees from natural disasters, although nature in general discriminates neither in its bounties nor furies against any economic class (or might it?). The nature of jobs, the location of workplaces and dwellings, the type of occupation, the degree of resilience and propensity to face disasters, and similar other factors may distribute losses of even a nondiscriminant disaster unequally.

The basic distribution series for the purpose appears in Appendix D and detailed calculations in Appendix E. The summary results are presented in Table 9 and are sketched in Fig.5. It may be seen that the poor do suffer significantly more than the nonpoor in the sense that the losses of overall income of the poor are at least 10-percent higher than those of the other strata of the society. This is the case even when the nonpoor in this case are landholders and the calamity has hit land and crops the hardest.

8.2. Distress sales

Perhaps not all families whose dwellings were destroyed took refuge in relief camps. A large number of them were sheltered by relatives and friends whose homes were not affected. Middle class families especially are known to have avoided the degradation of refuge in relief camps. One of the alternatives to families (whether they availed themselves of relief or not) to survive the calamity is to sell some of their assets during the "rainy day."

A number of questions about such sales were asked in the household survey. Distress sales of several assets are tabulated in Table 10. It may be seen that as many as 8.1% of sampled households resorted to distress sales. In interpreting these results a word of caution is needed: we suspect that these sales were grossly overstated. Subject to that warning, it may be seen that

9. Interregional and Intraregional Distribution of the Incidence of Flood Damages

Flood damages by the 4 divisions of the country are presented in Tables 12.1 through 12.4. Basic data tables with many more details by division are given in Appendix G.

9.1.--Flood damages by size-class and geographic division

The results by size-class for Khulna and Chittagong are not statistically significant and should, therefore, be ignored. The information provided at the division aggregate level as well as by size-classes for Dhaka and Rajshahi divisions should, however, not be thrown away.

It may be seen from Table 12.1, that the 1988 floods affected 14% of the 135 establishments sampled in Rajshahi, 15% of the 20 establishments sampled in Khulna, only 1 out of the 72 sampled establishments in Chittagong (not significant) and 24% of the 197 establishments sampled in Dhaka. The affected units suffered output losses of 14% in Rajshahi, 80% in Khulna, 18% in Chittagong (not statistically gnificant), and 12% in Dhaka. The intensity (as measured by flood damages to the output of the affected units FQL) and the extent (in the sense of percentages of units affected, PN) of damages reveal little trend across size-classes in Dhaka, whereas they tend to rise with the size of the establishment in Rajshahi, as may be seen from Table 10.1 and Fig.6. On the other hand, the extent of damage is higher in Dhaka but the intensity lower relative to I :shahi. Medium and large establishments in

Rajshahi are probably not more favorably located and insulated from floods than small, whereas in Dhaka the effect of the natural disaster was more non-discriminating than in Rajshahi. For instance, Bawa Jute Mills of Dhaka was affected as badly as the newly mushroomed small establishments in Gingira, Dhaka.

9.2.--Flood damages by size-class division and skill category

Next, we look at the idling of workers by occupation and skill across divisions (Table 12.2). It may be seen that in the country as a whole, there is practically no difference in the percentages of production workers idled, whether skilled or unskilled, part-time or full-time. Significant differences exist between office and administrative workers with a flood-caused idleness of only 4% to 5% and production workers with three times as much. Between size-classes, the results by skill are almost identical to aggregate results, namely a practically flat line for Dhaka and upward-rising curve for Rajshahi. The pattern in Dhaka tends to dominate the overall curve.

9.3.--Incidence on the employment of spouses

It may be recalled that insofar as manufacturing industry is concerned, female employees form only 0.87 of one percent of total employees. In the rest of the economy, women mostly form family labor. A question was asked about the effects of flood damages on the employment of spouses, who happened invariably to be female, and not all male heads of households are married. The results are given in Table 12.3. See also Fig.7.

In this case, there is consistent evidence that both the intensity and the extent of unemployment caused by floods among spouses of lower socioeconomic classes were higher in comparison to spouses from upper soci-economic classes. The evidence is also consistent with previous results about the rich and the poor.

9.4.--Distress sale by size-class

Finally, we return to distress sales; this time by size-class. The results are given in Table 12.4, from where it may be seen that both the quantities and the values of distress sales of all kinds rise with economic status. The multiple by which (a) the quantity or value of the distress sale and (b) the ratio of affected to sample units of an asset is higher in Class 5 relative to Class 1 (see Col.6), however, is much lower, as expected, for poorman's assets, namely goats (a = 2.63 and b = 0.38) and poultry (a = 1.35 and b = 0.40) relative to the nonpoorman's assets, e.g., cattle (a = 18.7 and b = 1.30), ornaments, land, and so forth. While the former multiple may state only the obvious fact of the poor owning more and distress-selling more of goats and chicken than other assets in comparison to the corresponding relative for the nonpoor, the latter multiple reflects the relative incidence of distress sales, i.e., the percentage of the nonpoor resorting to distress sales relative to the percentage of the poor doing so.

Any ratio in the cell of Col. 6 and Line 2 for each asset of Table 12.4 that is less than unity means the nonpoor bear a lower incidence of distress sales than the poor. This happens for 4 of the 6 assets reported in Table 12.4. That is, the incidence of distress sales on the nonpoor relative to the poor (using Class 5 to represent the nonpoor and Class 1 the poor) is only 38% for goats, 40% for poultry, 80% for "other assets," and 98% for ornaments.

10. Brief Analysis of Answers to Ticklers

This study is aimed primarily at an assessment of flood damages. However, we also took advantage of the survey to elicit the views of affected households and establishment-occupiers/enterpreneurs regarding such ticklers as the causes and remedies of floods and flood damages as well as possible governmental and donor-agency assistance programs.

The frequency distribution measures of answers by entreprencurs are presented in Appendix 1-1-5 Tables and those by households in Table 1.6. The results are summarized in Table 13. Before referring to the findings, the reader should be warned that some of these questions are technical, involving complex, technical and extra-territorial issues. Most respondents were probably laymen, who may or may not have the proper perspective to really understand the complexities involved. The results of this section should, therefore, be interpreted with caution.

In some of the questions, the respondents were given a number of alternative solutions to which "yes" or "no" answers were to be checked out. Other questions were open-ended, to which respondents wrote down what they thought was the fit answer. In Table 12, we report three alternatives which acquired top three positions in yes answers among about a dozen such alternatives for each of the six question. For details, see Appendix Tables 11 through 16.

Interestingly, entrepreneurs consider dredging of rivers as the most effective measure against floods. They are probably unaware of its cost. Rapport with neighbors, meaning bilateral or multilateral regional cooperation to solve the flood and drought problem, gets the third top position in 12 alternative solutions.

The top priority need for agriculture is the provision of fertilizer and seeds. Cash credit is next. Credit gets top priority for assistance to industry and is also stated to be a constraint on attaining preflood levels of production. Anticipated shortages of domestic raw materials are considered a major hurdle to the attainment of preflood levels by the industry, while households give priority to materials to build dwellings next only to fertilizer-seed and cash credit. Seeds and fertilizer supplies seem to be well taken care of by the timely action of donors and the government. The shortage of credit remains the major bottleneck.

Agrarian household respondents ranked the need for food very low. Acute shortages of agricultural inputs (both in their own stocks and in the market place) were experienced during the immediate post-flood period. On the other hand, many households were able to save their stocks of food grains and the availability of food grains in the market place was rarely scanty.

While road repair is deemed very important by entrepreneurs, they seemed less concerned about rescheduling of various types of taxes. The finance minister should take note of it.

11. Impact of Flood Damages on Investment

Finally, an investigation was made to discerning possible effects of floo on the will, capacity, and incentives of entrepreneurs to expand industrial capacity. The idea was to assess possible discouragement to investors due to floods, because their expectations and incentives are apt to be materially influenced by their experience of two devastating floods in two consecutive years. Nearly half of the respondents admitted such an effect. A pointed question was asked as to whether floods have prompted the respondent to shut down his/her plant. Of the total of 147 respondents, a surprisingly high number of 13 answered "yes." The rest, 134, answered "no."

The yes-no answers were subjected to a discriminant analysis, to see if chosen independent variables could discriminate between those who did not intend to shut down because of flood damages (given a value of 1) and those who did (assigned a value of 2).

11.1. Discriminant analysis

The following model was tested:

X65 = f(PQL,X22,X37,X3,TWL,X8)

where

X65 = Intend to shut down plant due to flood(1=Yes; 2=No)

PQL = Proportionate output loss

X22 = Percent of monthly wage bill paid

X37 = Repair cost of machinery and equipment as % of total

X3 = [illegible]r the enterprise started

TWL = T[illegible]l workdays lost

X8 = Workdays lost with no production

The results of the discrimin[illegible] analysis are given in Table 14. The unweighted [illegible] independent [illegible]les suggest that those who intend to shut down have experienced bigger losses (namely, PQL = 0.81; X37=34.15; TWL= 24.33 than those who don't name[illegible] =0.52; X37=19.21; TWL=15.57). The survivors, howev[illegible] [illegible]id a higher pe[illegible]ge of monthly wage bill during the flood (X22=44.97) as opposed to the [illegible]ial quitters (X22=15.23). A look at Wilk's Lambda (U-Statistic) and Univari[illegible]-ratio suggests that higher repair cost of machinery and equipment (X37) had a strong influence on the intention to quit or stay. A [illegible] the inclusion of the inde[illegible]dent variables suggests that X37: repair cost of machinery [illegible]nd equipment, X22: percent of monthly wage bill paid, and PQL: proportionate output loss played a significant role in discriminating between the two groups. Age of the enterprise and total work days lost did not have a significant effect. Since the group mean (centroid) for those who plan to shut down is higher (0.69568) than for those who intend to stay in business (-0.06749), higher discriminant function values increase the probability that the respondent is a member of the quitter group.

Thus, floods are clearly a damper on private industrial expansion. Floods increase the risk of physical investment significantly. On the other side, public sector's net investment is almost certain to go down because some development resources will have to be diverted from new investment to reconstruction. This potential negative influence on long-run growth is additional to the actual destruction of capital stock analyzed in Sec. 4 above.

can withstand a dissipation of a good part of their assets without bankrupting themselves, the poor are on a thin ground. Once that ground slips under their feet, it will take much longer for them to firm their feet up again.

5. During the temporary layoff caused by floods, a good fraction of the workers of the modern sector, particularly the public sector, received partial compensations, but not small, cottage, and other informal sector employees.

6. A look at the flood-caused job situation of spouses tells the same story. Both the intensity and the extent of unemployment caused by floods were consistently higher among spouses of lower socioeconomic classes in comparison to spouses from upper socioeconomic classes.

7. The ratio of administrative and office workers temporarily idled by flood damages is significantly lower than that of the production workers.

8. Finally, the two back-to-back annual floods, not to mention the cyclone accompanied by the devastating sea surge that followed on the heels of the second flood, seem to have left a debilitating effect on entrepreneurs' will and incentive to invest in machines and buildings. As many as 13 out of 14 respondents answered "yes" to the question on whether they are seriously considering to close down their plants due to the recurrent spectre of floods. For plant and structure cannot be insulated against natural disasters. Nor does there exist any scheme of insurance against the risk of natural disasters in the country. This dampened impact on investment is even more disturbing from the viewpoint of long-run poverty.

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An overwhelming evidence has, thus, been found in this study indicating that the poor are more vulnerable to the ravages of natural disasters than the average household in Bangladesh. The country herself being a disaster-prone delta land and its poorer strata even more, any program to mitigate natural disasters or their impacts is a pro-poor program. Additionally, any program that is focused on alleviating poverty is a step toward minimizing the damages from natural disasters because poorer a group of people the more vulnerable it is to incur heavy damages from such disasters.

On the other side, the following results may also be noted.

1. In this survey, very little differences of flood damages have been found between large and small establishments of the same area, e.g., Dhaka. Different configurations have, however, suffered disparately. For instance, the handloom industry suffered a loss of 4.33% of its annual output due to temporary idling during floods as compared to 1.28% for textile cloth mills.

2. The employment and output multipliers are higher in manufacturing industries than the rest of the economy, one reason for which is stronger interindustry linkages of this sector. As such, the manufacturing employees suffered more from flood damages, and manufacturing employees are by no means on the lower economic rungs of the working class.

3. Losses are, by and large, uniform across skill classes in manufacturing industries, but not between occupations. Thus, office workers were not idled due to flood damages to the same extent as production workers.

Table 1.--Establishment damages

Output		Mean Damage per Establishment by Establishment Size					
		I <3 Workers (1)	II 3-9 Workers (2)	III 10-19 Workers (3)	IV 20-50 Workers (4)	V More than 50 workers (5)	Total (6)
1.1	Mean Damage to Damaged Units as a ratio of total value	.15	.13	.11	.11	.14	.13
1.2	N of damaged Units[a]	41	57	27	12	9	146
1.3	Sample N	158	178	80	30	36	482
1.4	Sample class weights	.33	.37	.16	.06	.08	1.0
2.	Sample Mean	.0389	.0469	.0371	.044	.035	.0394
3.	Mean Damage to Aggregate National Units (National Mean) Using Adjustment Factor 0.84(% area inundated)	.0327	.0394	.03116	.03696	.0294	.0331
4.1	Estab. Empl. in 53 affected districts (000's)	983	1417	466	334	[illegible]	[illegible]
4.2	Estab. Empl. in all 64 districts (000's)	1221	1760	554	339	[illegible]	[illegible]
4.3	Distrib. weights in Line 4.2	.25	.35	.11	.07	.21	1.00
4.4	Line 4.1/Line 4.2	.81	.81	.84	.98	.77	.80
5.	National mean using weights of Line 4.3	.0327	.0394	~~.0312~~	.0370	.0274	.0345[b]
6.	Output loss = 3.45% of industry GDP(approx.$1800 million) (Million $)[c]	...	...	...	...	...	[illegible]

[a]The symbol N stands for number of establishment.

[b]The grand mean in the cell of last column and Line 5 (namely .0345) is calculated as follows:

$$\sum_i (\text{Line } 2)_i \cdot (\text{Line } 4.3)_i, \; i = 1, \ldots, 5 \text{ classes.}$$

The use of the number of establishments instead of establishment employment yields a mean value close to the national mean of Line 3. The differences are minor.

[c]Absolute class-wise damages at the national level (Line 6) are not calculated as the data on output by size-classes are not available. Only national aggregates makes sense. For damage estimates by size-class, sample means provide useful information.

[d]The class means are not robust in the sense that they change when the class cut-off points are altered. Compare, e.g., the mean of the less-than-three worker class of this table (.15) and the 1-3-worker class of Appendix Table G1.5(.12).

Table 2.--Damage to manufacturing industry by I-O classification

Industry	Percent Loss of Annual Output		No. of Units	
	Affected Units	National Mean	Reporting Loss	No. in Sample
01 Rice[a]	12.0	3.05	28	69
04 Cotton[a]	23.0	5.87	2	3
06 Other Crops[a]	9.0	2.30	1	2
07 Livestock[a]	9.0	2.30	1	3
10 Sugar	12.0	3.06	1	1
11 Edible Oil	9.0	2.30	2	16
12 Salt	4.9	1.25	11	12
13 Tobacco Products	14.0	3.57	8	14
14 Other Food	7.0	1.79	16	42
15 Cotton Yarn	18.0	4.59	2	6
16 Cloth: Mill Made	5.0	1.28	9	55
17 Cloth: Handloom	17.0	4.33	15	39
18 Jute textile	8.0	2.04	4	7
19 Paper	12.0	3.05	1	2
23 Other Chemicals	14.0	3.57	2	3
26 Metal Products	10.0	2.55	1	13
27 Machinery	17.0	4.33	3	6
28 Transport Equipment	13.0	3.32	1	1
29 Wood Products	12.0	3.05	17	50
30 Misc. Industries	12.0	3.05	3	27
34 Construction: Elec. and Gas	11.0	2.81	1	2
41 Trade Services	12.0	3.05	20	51
47 Other Services	13.0	0.014	11	35
All Establishments	13.0	3.32	158	459

[a]Note that this is the manufacturing industry loss. Crop losses are reported in a subsequent table.

The sample size in different tabulations may differ from the overall size of 482 establishments (and the same applies to other subsamples) due to blank spaces in some cells of some completed questionnaires.

Table [illegible].—Direct employment effects of [illegible]

$$\sum_j h_{sj} D_j X_j \,/\, \sum_j h_{sj} X_j$$

Skill s (1)	$\sum_j h_{sj} D_j X_j$ (2)	$\sum_j h_{sj} X_j$ (3)	2/3 (4)
	hdx	hx	hdx/hx
1	7227	258896	0.027915
2	41	1403	0.029239
3	22145	766436	0.028893
4	660	18141	0.036360
5	94712	3181999	0.029746
6	563	18507	0.030395
7	11833	481258	0.024587
8	279	9356	0.029861
9	13164	512444	0.025688
10	220	8083	0.027235
11	137076	5016198	0.027326
12	1416	44190	0.032040
Weighted mean[a]			[illegible]
Independent mean[a]			[illegible]

[a]The "weighted mean" is based on the employment multipliers of only the manufacturing sectors of the I-O table, as only for these sectors the data on workers by skill are available. The "independent mean" is calculated for total labor in all the [illegible] sectors of the I-O table.

Table 3.2.–Long-run Direct-plus-Indirect employment effects of flood damages

$$\sum_{j} \ell_{sj} K_j X_j / \sum_{j} \ell_{sj} X_j$$

Skill s (1)	$\sum_j \ell_{sj} K_j X_j$ (2)	$\sum_j \ell_{sj} X_j$ (3)	$\frac{\sum \ell_{sj} K_j X_j}{\sum \ell_{sj} X_j}$ (4)
	lkx	lx	lkx/lx
1	18651	482419	0.038660
2	116	2937	0.039396
3	59864	1476359	0.040548
4	946.942605	24824	0.038146
5	196714.537	4679021	0.042041
6	1280.04363	32941	0.038859
7	45326.0529	1157672	0.039152
8	772.891811	19741	0.039151
9	41681.6370	1063736	0.039184
10	626.434128	16982	0.036888
11	373536.636	9430521	0.039609
12	3125.32632	83677	0.037349
Weighted mean[a]			0.041076
Independent mean[a]			0.022783

[a]See the note to Table 3.1.

Table 3.3.--Employment multipliers[a]

Occupation or Skill Class	Employment Multipliers	
	Male	Female
1. Adm. and tech. workers	1.39	1.35
2. Service workers	1.40	1.05
3. Production workers: skilled	1.41	1.28
4. Production workers: semiskilled	1.59	1.31
5. Production workers: unskilled	1.53	1.35
6. Total	1.45 (1.44)	1.17 (1.22)
Weighted overall mean of multipliers	(1.43)	
Indepdnedent overall employment multipliers	(1.19)	

[a]The coefficients of this table are calculated by dividing the elements in the last column of Table 3.2 by the corresponding elements of the last column of Table 3.1. The resulting values are defined as employment multipliers. The values in parentheses are weighted means.

Table 3.4.--Direct-plus-indirect output multiplier effects of permanent flood damages[a]

$$\sum_j r_{ij} K_j X_j \,/\, \sum_j r_{ij} X_j$$

SEC (INDUSTRY) (1)	$\sum_j r_{ij} K_j X_j$ (2)	$\sum_j r_{ij} X_j$ (3)	2/3 (4)
code	rkx	rx	rkx/rx
1	417852	191231187	0.002185
2	371270	17857777	0.020790
3	489211	37375161	0.013089
4	617570	25981664	0.023769
5	634372	27476540	0.023087
6	404276	20991853	0.019258
7	660716	72521334	0.009110
8	975779	65187203	0.014968
9	226297	16313202	0.013872
10	1300669	40481981	0.032129
11	721402	29563837	0.024401
12	1227166	21538042	0.056976
13	1511897	34422176	0.043922
14	1964564	55966914	0.035102
15	1026376	38824580	0.026436
16	1200351	43817530	0.027394
17	2544159	82690517	0.030767
18	1190389	51128602	0.023282
19	1322032	55601514	0.023776
20	1867355	90632293	0.020603
21	1793656	48798734	0.036756
22	~~2082622~~	66007614	0.031551
23	2012226	69118338	0.029112
24	1313427	46416389	0.028296
25	1241117	36615999	0.033895
26	1415524	35688796	0.039662
27	2561584	71522004	0.035815
28	1029793	31200549	0.033005
29	915246	25967305	0.035246
30	6232593	168303549	0.037031
31	2710651	90492595	0.029954
32	1336753	39456555	0.033879
33	2890347	87865401	0.032895
34	1615605	51157504	0.031580
35	2867441	91017495	0.031504
36	1912710	56586421	0.033801
37	1606773	91962559	0.017472
38	1551261	51334368	0.030218
39	378894	8304866	0.045623
40	4882814	64116686	0.076155
41	930132	64182600	0.014491
42	946199	66726076	0.014180
43	1997498	47246905	0.042277
44	1873123	18046896	0.103791
45	3135189	45415617	0.069033
46	603346	22619341	0.026673
47	459479	30416343	0.015106
Weighted mean			0.025419

Table 4.--Damage to Aman Crop

Damage	0 0-0.04	I 0.05-.49	II .5-1.0	III 1.1-5.0	IV Over 5	Total: Using Sample Weights[a]	Total: Using Census Weights[b]	N
	Mean Damage per Household by Size Class of Holdings							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Mean Household Damage to Damaged Units								
1.1. Damage in terms of: acres	0	1.17	1.19	2.83	6.86	3.74	1.52-3.43	110
1.2. % quantity	0	77.00	68.75	73.26	87.22	76.33	45.21-70.4	40
1.3. % value	0	100.00	91.43	84.92	92.52	68.92	55.02-86.69	74
1.4. Affected N	0	14	16	43	37	..	..	110
1.5. Sample N	25	59	54	134	115	..	..	420
1.6. Ag. Census								
1.6.1. N (millions)	3.77	2.42	1.64	4.8	1.17	..	..	13.82
1.6.2. Ratio	.27	.18	.12	.35	.08	..	..	1.00
1.6.3. Acres (mill)	..	.62	1.15	11.03	9.88	..	22.68	
1.6.4. Ratio	...	.03	.05	.49	.43	...	..	1.00
2. Mean Household Damage to Sampled Units (Sample Mean)								
2.1. Acres	0	9.28	0.35	0.90	2.21	0.98	.399-1.42	
2.2. % quantity	0	18.27	20.37	23.51	28.06	19.99	11.84-25.15	
2.3. % value	0	23.73	27.09	27.25	29.76	23.29	14.42-17.35	
3. National Mean Damage per Household (Adj. factor: Affected Area Production: 69%)								
3.1. Acres	0	0.19	0.24	0.62	1.52	0.67	.28-.98	
3.2. % quantity	0	12.61	14.06	16.22	19.36	13.79	8.17-17.35	
3.3. % value	0	16.37	18.69	18.80	20.53	16.07	9.97-11.98	
4. National Aggregates: (Lines of Panel 3) by (Line 1.6.1 or 1.6.3)								
4.1. Acres (million)[c]	0	.46	.39	2.98	1.78	..	5.61	
4.2. Tons (million)[d]	0	.0308	.0572	.6466	.1556	..	.93-1.41	
4.3. Value								
Taka billions[e]	0	.224	.427	4.204	4.035	..	8.89-10.63	
US$ Million		7	14	140	134	..	295-354	

[a]Weights of Line 1.4, i.e., mean damage of households reporting damage (Panel 1) or sample mean (Panel 2) or national mean (Panel 3).

[b]Census weights, given in Lines 1.6.1-2 or Lines 1.6.3-4, are more appropriate. They

Table 4.--(Contd.)

correct the bias of the sample weights of the preceding column. The lower value of the range is calculated by using the household weights of Lines 1.6.1-2 and the upper value of the range by employing the acreage weights of Lines 1.6.3-4. We consider that the former weights apply to Line 4.1 and the latter are more appropriate for Lines 4.2 and 4.3. Accordingly, the damage caused to Aman is probably close to 1.41 million tons.

[c]Calculated as follows: (Line 3.1/100)*(Line 1.6.1).

[d]Calculated as follows: (Line 3.2/100)*(Line 1.6.3)*(8.136 million tons).

[e]Calculated as follows: (Line 3.3/100)*(Line 1.6.4)*(Tk 45.69 billion), where Tk 45.69 billion is the value of 8.136 million tons of Aman at farmgate price.

Since the three estimates of this table--namely, acreage, quantity, and value—are made from three different answers of the questionnaire, the results do not necessarily tally.

Table 5 .--Damages to crops other than Aman (Taka values are in millions)

Product Damaged	Damaged Unit Mean	Sample Mean	National Mean: Using Adj. Factor: Prodn[a]	National Mean: Using Adj. Factor: Households (=.41)	Blown-up National Damage (in million): Using Col.6	Blown-up National Damage (in million): Using Col.7
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	(%)	(%)	(%)	(%)	(Mill.)	(Mill.)
Aus:						
Quantity Tons	61	11.91	8.46	4.88	.260[b]	.150[b]
Value in Takas	79	15.42	10.9	6.32	1094	631
Value in $S	..	..	..	..	35.0	20.0
Sugarcane:						
Quantity Tons	60	5.28	4.01	1.64	.272	.111
Value in Takas	65	5.72	4.34	1.78	182	74
Value in $S	..	..	..	..	5.7	2.3
Jute:						
Quantity Tons	67	18.5	16.28	6.67	.196[c]	.080[c]
Value in Takas	85	23.48	20.66	8.47	914	374
Value in $S	..	..	..	..	29.0	12.0

[a]Production-based adjustment factors are given in Table D3. We consider that the estimates based on production-based expansion/adjustment factors are more appropriete.

[b]Calculated by taking 8.46% of Col.6 and 4.88% of Col.7, respectively, of the normal annual output of Aus rice (3.08 millions tons) for Cols. 8 and 9.

[c]Calculated by taking 16.28% and 6.67%, respectively, of the normal output of Jute (1.286 million tons) for Cols. 8 and 9.

Table 6.--Loss of rice crop by flood and drought since the early 1970s

Year		Loss Due to Flood and Drought in Million Tons			Potential or Actual Output in Million Tons		
		Aman	Aus	Total	Aman	Aus	Total
(1)		(2)	(3)	(4)	(5)	(6)	(7)
1973-74				0.90	6.70	2.80	11.72
1974-75				0.72	6.00	2.86	11.11
1975-76				0.16	7.05	3.23	12.56
1976-77				0.95	6.91	3.01	11.57
1977-78				0.11	7.42	3.10	12.74
1978-79				0.10	7.43	3.29	12.65
1979-80				0.06	7.30	2.81	12.54
1980-81				0.44	7.84	3.24	13.66
1981-82				0.03	7.10	3.22	13.42
1982-83				0.18	7.48	3.01	13.99
1983-84				0.59	7.81	3.17	14.28
1984-85				1.32	7.81	2.74	14.39
1985-86				.02	8.41	2.78	14.80
1986-87				NA	8.12	3.08	15.16
1987-88	Floods	2.72[b]	0.32	3.04	6.47[c] (8.14[d])	3.20	17.5[d]
	Drought	0.06	0.30	0.36			
1988-89	Floods	1.41	.262	1.672	8.14[d]	..	17.5[d]

Sources: Cols. 4 through 7 upto year 1984-85: 1986 Statistical Yearbook of Bangladesh, Tables 4.80 and 4.83. Cols. 1 through 7 for 19 Estimates for Year 1988-89: This study.

[a]Total production of Col.7 includes Boro rice, a winter crop which is not affected by floods.

[b]Planning Commission's pre iminary estimates. Perhaps these were overestimated.

[c]Outlook.

[d]Target.

Table 7.--Damage to life and property as assessed by upazila headquarters

Life and Property	National Total in Millions	Damage Assessment		
		41 Sample Survey Upazilas	Blown-Up for Nation	
		No.	No.	% of Total
(1)	(2)	(3)	(5)	(5)
1. Loss of lives				
1.1. Human (lives)	110	605	4972	.0045
1.2. Cattle (heads)	[illegible]	16463	137317	0.62
1.3. Poultry (birds)	74	151329	1243850	1.68
2. Cropland area affected				
2.1. Partial (Ha)	.056 sq.miles	31490	258832	84.0
2.2. Full (Ha)		600807	4938341	
3. Buildings affected				
3.1. Partial (No.)	15	745242	6125526	49.8
3.2. Full (No.)		268180	2204308	
4. Roads/Embankments damaged				
4.1. Full (Km)	..	[illegible]	19743	..
4.2. Partial (Km)	..	[illegible]	46703	..

Source: Appendix Table E.1, where assessment for individual upazilas is also presented.

Table 3

Frequency Measures of Occupational and Migration Characteristics of Relief Camp Refugees (in percentage terms)

Statement	Yes	No Response	No
Had a steady job(before the flood)?	44.8	3.8	51.4
Was a daily labourer(before the flood)?	64.0	3.5	32.5
Found any productive employment (during the flood)?	11.1	1.0	87.9
Have you gotten back your previous job?	25.9	5.3	68.8
Can you get your job back?	51.6	18.1	30.2
Do you plan to return to your previous place?	78.6	5.5	15.9
Do you plan to migrate?	13.6	10.1	76.3
Did you stay in a relief camp last year?	44.6	1.0	54.4
Can you stand on own feet without outside help?	10.6	1.8	87.7

Total Sample(N) = 397

Table 9.--The impact of flood damages by rural socioeconomic classes in technologically backward areas

Socioeconomic Class based on Land Ownership (1)	Percent Loss Aggregated from Nine Different Sources of Income (2)
1. Landless	11.60
2. Size-class with < 0.5 acres of land	11.60
3. Size-class with 0.5 - 1.0 of land	9.75
4. Size-class with 1.1 - 5.0 of land	8.07
5. Size-class with 5 acres or more	8.71
Mean	8.91

Source: For detailed calculations, see Appendix Tables E1-E4.

Table 10.--Distress Sales

Asset	Mean per Household Distress Sale of those Who Reported Distress Sale		
	Quantity	Value	Price Received as % of Normal Price
	(1)	(2)	(3)
	(No.)	(Taka)	(%)
1. Land	.65 acres	14446	55.1
2. Cattle	1.66	3762	65.1
3. Goats	2.4	1164	64.1
4. Poultry	8.4	[illegible]	62.0
5. Ornaments	2.8	4325	62.0
6. Raw material	..	5650	..
7. Other	5.57	3237	60.6

Table 11.--Possible determinants of distress sale[a]

Independent Variable	Coefficient (t Value) of Dep. Variable				
	LnLAND (1)	H90 (2)	H92 (3)	LnCAT (4)	H91 (5)
H5	.0902(.61)	.0141(1.68)	.7475(1.45)	..	3.4020(1.85)
H118	.4799(1.56)	.0235(1.24)	1.3466(1.17)	.2729(1.52)	6.9564(1.65)
H88	.0093(0.91)	-.0000(-.03)	.0101(.57)	..	.0836(1.26)
H120	-.5215(-1.61)	.0012(0.06)	.5619(.44)	-.3527(-1.79)	-6.2149(-1.32)
H86	.0006(.23)	.0000(.12)	.0006(.20)	..	.0053(.46)
H87	..	..	..	.0017(.48)	..
H89	..	..	..	-.0014(-.31)	..
Constant	3.9199(7.31)	-.0112(-.33)	.2644(.13)	3.2922(16.09)	-1.9551(-.26)
R^2 Adj	.1447	.0003	.0021	.0015	.0107
Obs	34	41	41	65	41

[a]The variables are defined below:

LnLAND	Natural log of distress sale of land in hundreds of takas
LnCAT	Natural log of distress sale of cattle in hundreds of takas
H5	Cultivable land owned in acres
H86	Dwellings damage in hundreds of takas
H87	Dwelling damage as percentage of total value of dwelling
H88	Damage to household effects in hundreds of takas
H89	Damage to household effects as percentage of total
H90	Distress sale of land in acres
H91	Distress sale of land in hundreds of takas
H92	Distress sales of land at price as a percentage of normal market price
H118	Head of household has been employed in a steady job
H120	Head of household has gotten back previous job

Table 12.1.--Percent output loss (POL) and percentage of establishments (PN) by size-class and by division

Division	Percent Loss of Output Per Estab and Percentage of Estabs Affected (PN) by No. of Workers					
	0-3	4-9	10-20	21-50	50+	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rajshahi						
1. POL(%)	11	13	11	15	20	14
2. PN(%)	6	16	15	33	29	14
Khulna						
1. POL(%)	8	8	8	0	0	8
2. PN(%)	14	11	33	0	0	15
Chittagong						
1. POL(%)	0	18	0	0	0	18
2. PN(%)	0	5	0	0	0	1
Dhaka						
1. POL(%)	12	11	12	12	11	12
2. PN(%)	20	31	15	17	33	24
Bangladesh						
1. POL(%)	12	11	12	15	12	12
2. PN(%)	26	36	34	40	33	34

Source: Appendix Tables G1.1-G1.5.

Table 12.2--Contd.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dhaka: Sample Means						
Full-time						
1. All (%)	27	27	14	8	21	22
2. Unskilled (%)	0	9	11	17	17	8
3. Adm. (%)	2	7	3	0	1	3
4. Clerical (%)	4	2	5	6	6	4
Part-time						
5. All (%)	7	37	27	19	19	22
6. Skilled (%)	5	7	14	18	15	10
7. Unskilled (%)	1	14	15	27	13	11
Bangladesh: Sample Means						
Full-time						
1. All (%)	22	22	20	15	22	22
2. Unskilled (%)	5	12	12	11	14	10
3. Adm. (%)	4	8	5	0	1	5
4. Clerical (%)	2	5	6	3	4	4
Part-time						
5. All (%)	17	26	24	20	25	23
6. Skilled (%)	8	11	14	18	18	12
7. Unskilled (%)	8	10	11	19	17	11
Bangladesh: Affected-Unit Means						
Full-time						
1. All (%)	95	92	73	73	89	88
2. Unskilled (%)	100	87	83	83	90	81
3. Adm. (%)	77	74	80	0	6	66
4. Clerical (%)	40	48	57	100	39	47
Part-time						
5. All (%)	69	85	75	86	90	79
6. Skilled (%)	45	65	81	75	73	67
7. Unskilled (%)	91	63	86	73	69	76

Table 12.3.--No. of days spouses idled (H126) and the percentage of spouses idled by flood damages by size-holdings of land and by division

Division	Landless (1)	0-.5 (2)	.06-1 (3)	1.1-5 (4)	5+ (5)	Total (6)
Rajshahi						
1. Days per head	30	33	11	13	0	18
2. % spouses	13	7	10	7	0	5
Khulna						
1. Days per head	30	0	0	0	0	30
2. % spouses	25	0	0	0	0	3
Chittagong						
1. Days per head	45	10	25	15	30	24
2. % spouses	50	91	11	11	10	10
Dhaka						
1. Days per head	0	14	15	21	29	22
2. % spouses	0	6	11	7	11	7
Bangladesh						
1. Days per head	35	18	15	17	29	22
2. % spouses	12	7	9	7	6	7

Source: Appendix Tables G2.1-G2.5.

Table 12.4.--Distress sale of various assets by size-class and division

Distress Sale of	Size-Class Landless	.01-.5	.6-1	1.1-5	5+	Col.5/ Col.1[a]	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Land							
1. Acres	.20	.34	.38	1.01	.76	3.8	.65
2. Affected N	1	5	6	9	10	2.18[a]	33
Cattle							
1. Heads	.1	1.17	1.60	1.67	1.87	18.7	1.66
2. Affected N	4	6	5	24	24	1.30[a]	67
Goats							
1. Heads	1.25	1.40	2.20	2.65	3.29	2.63	2.40
2. Affected N	4	5	5	17	7	0.38[a]	40
Poultry							
1. No.	7.50	4.33	9.86	9.21	10.18	1.36	8.39
2. Affected N	6	9	7	19	11	0.40[a]	54
Ornaments							
1. Taka	500	4000	350	6200	4489	8.98	4325
2. Affected N	2	2	2	9	9	0.98[a]	28
Other assets							
1. Taka	933	875	2020	1962	7418	7.96	3237
2. Affected N	3	4	5	16	11	0.80[a]	40
Sample N	25	59	54	134	115	..	420
Census N(mill)	3.77	2.42	1.64	3.00	2.97	..	13.82
Acres (mill)	0.0	0.62	1.15	11.03	9.88	..	22.68

[a]The ratio of the 2nd line of each asset in Col. 6 is calculated as follows:

$$\left(\frac{\text{Affected units of Class 5}}{\text{Sample units of Class 5}}\right) / \left(\frac{\text{Affected units of landless}}{\text{Sample units of landless}}\right)$$

Table 13.--Prioritization of flood-related problems and solutions thereto as suggested by respondents

Respondents and Question Relating to	Priority on the Basis of Maximum Votes Received[a]		
	Top	2nd	3rd
(1)	(2)	(3)	(4)
A. Entrepreneurs			
1. Strategies to avert floods (Table I.1)	Dredging of Rivers	Embankments of major rivers	Rapport with neighbors
2. Strategies to avert flood damages (Table I.2)	Dredging of rivers	Temporary relief centers on embankments	Shifting of enterprise to highland
3. Factors causing production loss during the flood (Table I.3)	Water in building	Water in machine rooms	Rail and road disruption
4. Factors that may prevent attainment of pre-flood levels (Table I.4)	Shortage of domestic raw materials	Power failure	Disruption in bank facilities
5. Assistance programs (Table I.5)	Provide credit	Repair roads	Build embankments
B. Households			
6. Assistance desired for immediate rehabilitation (Table I.6)	Fertilizer and seeds	Cash credit	Materials to rebuild dwellings

[a]Out of approximately a dozen choices.

Table 1?.--DISCRIMINANT ANALYSIS OF INTENDED INDUSTRIAL EXPANSION

DEPENDENT VARIABLE: X65 Intend to shut down plant due to flood

1=yes	No of observations	13
2=no		134

INDEPENDENT VARIABLE:

PQL	Proportionate Output Loss
X22	Percent of monthly wagebill paid
X37	Repair cost of machinery & equipt as a % of total
X3	Year enterprise started
TWL	Total workdays lost
X8	Workdays lost with no production

GROUP MEANS

X65	PQL	X22	X37	X3	TWL	X8
1	.08077	15.23077	34.15385	79.92308	24.23077	30.30769
2	.05189	44.97015	19.21269	75.25373	15.56716	28.28358
TOTAL	.05444	42.34014	20.53401	75.66667	16.33333	28.46259

GROUP STD DEVIATIONS

	PQL	X22	X37	X3	TWL	X8
1	.10159	28.20802	42.76456	9.87810	30.47719	19.33212
2	.07288	78.74208	23.02241	19.97280	21.86302	18.63363
TOTAL	.07586	76.06193	25.51998	19.31794	22.75670	18.63723

WILK'S LAMBDA (U-STATISTIC) AND UNIVARIATE F-RATIO
WITH 1 AND 145 DEGREES OF FREEDOM

VARIABLE	WILK'S LAMBDA	F	SIGNIFICANCE
PQL	.98824	1.726	.1910
X22	.98759	1.822	.1792
X37	.97218	4.150	.0435
TWL	.99526	.6909	.4072
X3	.98824	1.726	.1910

Table 14.--Cont'd.

SUMMARY TABLE

STEP		VARS IN	WILK'S LAMBDA	SIG	LABEL
1	X37	1	.97218	.0435	% Pres val of machy
2	X22	2	.96233	.0630	% of month wagebill paid
3	PQL	3	.95456	.0831	% output loss

Classification Function Coefficients
(Fisher's Linear Discriminant Functions)

X65 =	1	2
PQL	12.85416	8.585554
X22	.4116316E	.8709910E-02
X37	.5108864E	.2950073E-01
CONSTANT	-3.848377	-.7945844

DISCRIMINANT FUNCTION

WILK'S LAMBDA	CHISQUARE	DF	SIG
.9546	6.673	3	.0831

Canonical Discriminant Functions evaluated
at Group Means (Group Centroids)

GROUP		FUNC 1
Yes	1	.59568
No	2	-.06749

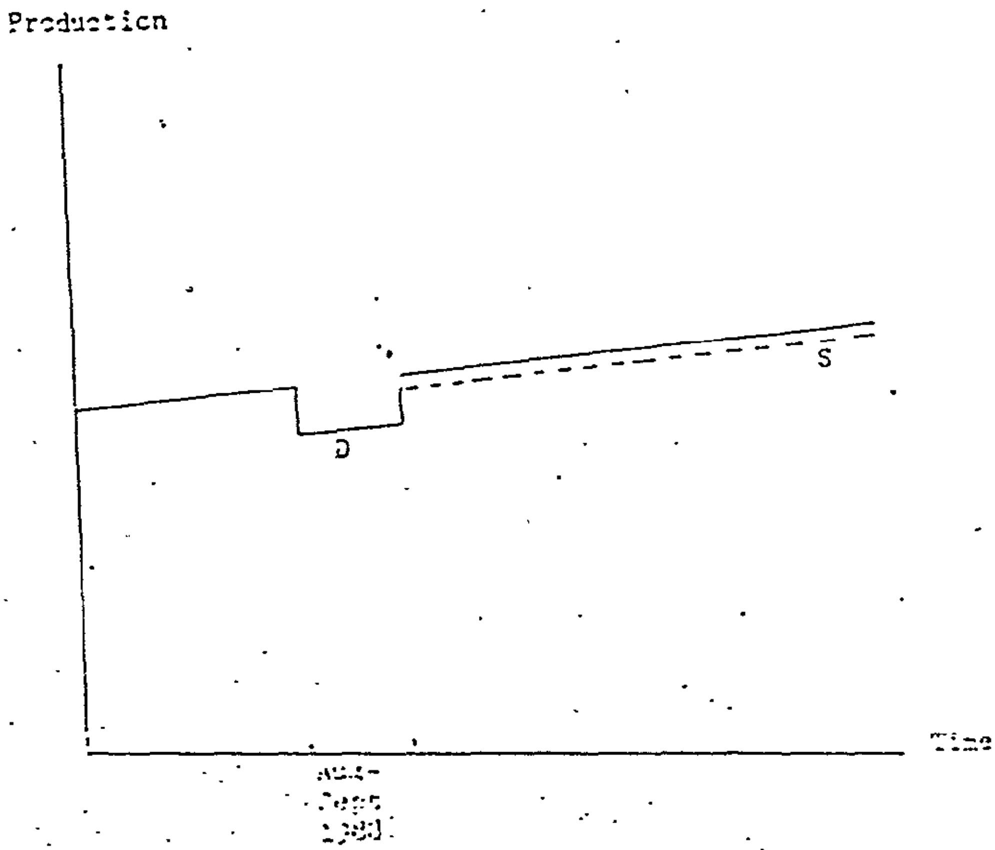

Fig. 1.--Illustrative graph of one-shot (D) and sustained (S) losses in GDP from flood damages.

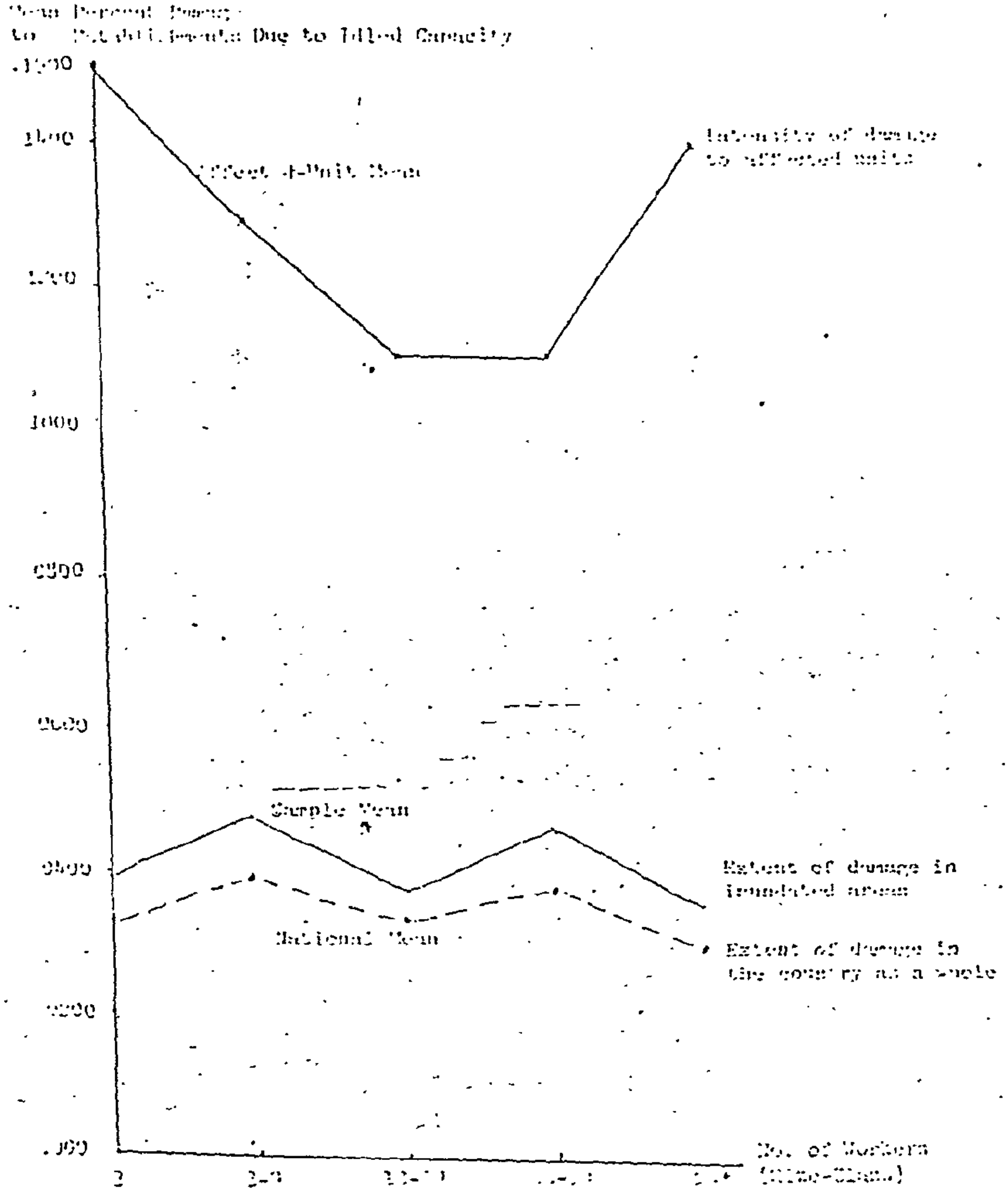

Fig.2.--Percent damages due to idled capacity by size-class of establishments: affected-unit mean, sample mean, and national mean.

Source: Table 1.

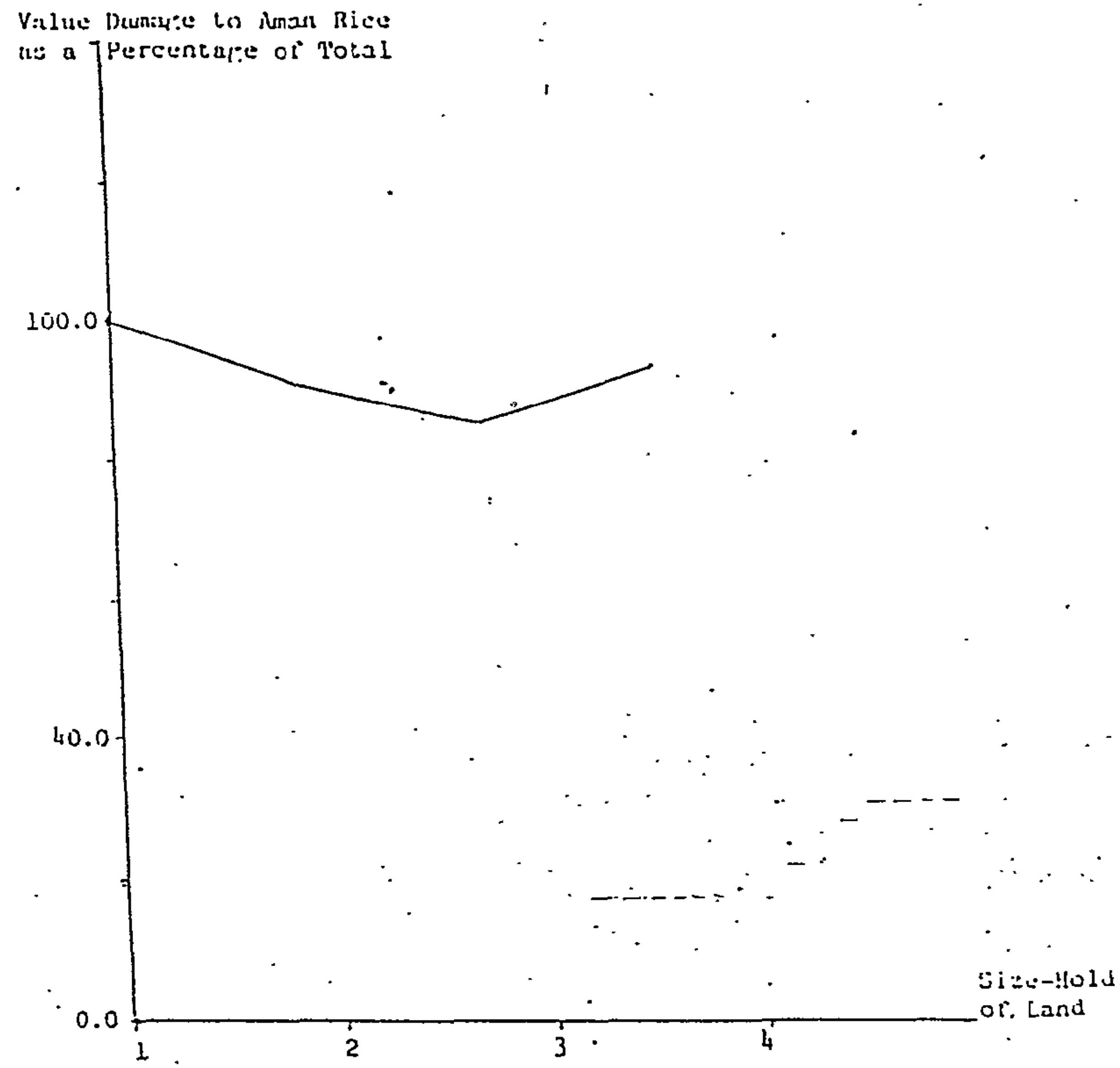

Fig. 3.--Value damage to Aman by size-holdings of agricultural land, 1988 floods.

Source: Table 4.

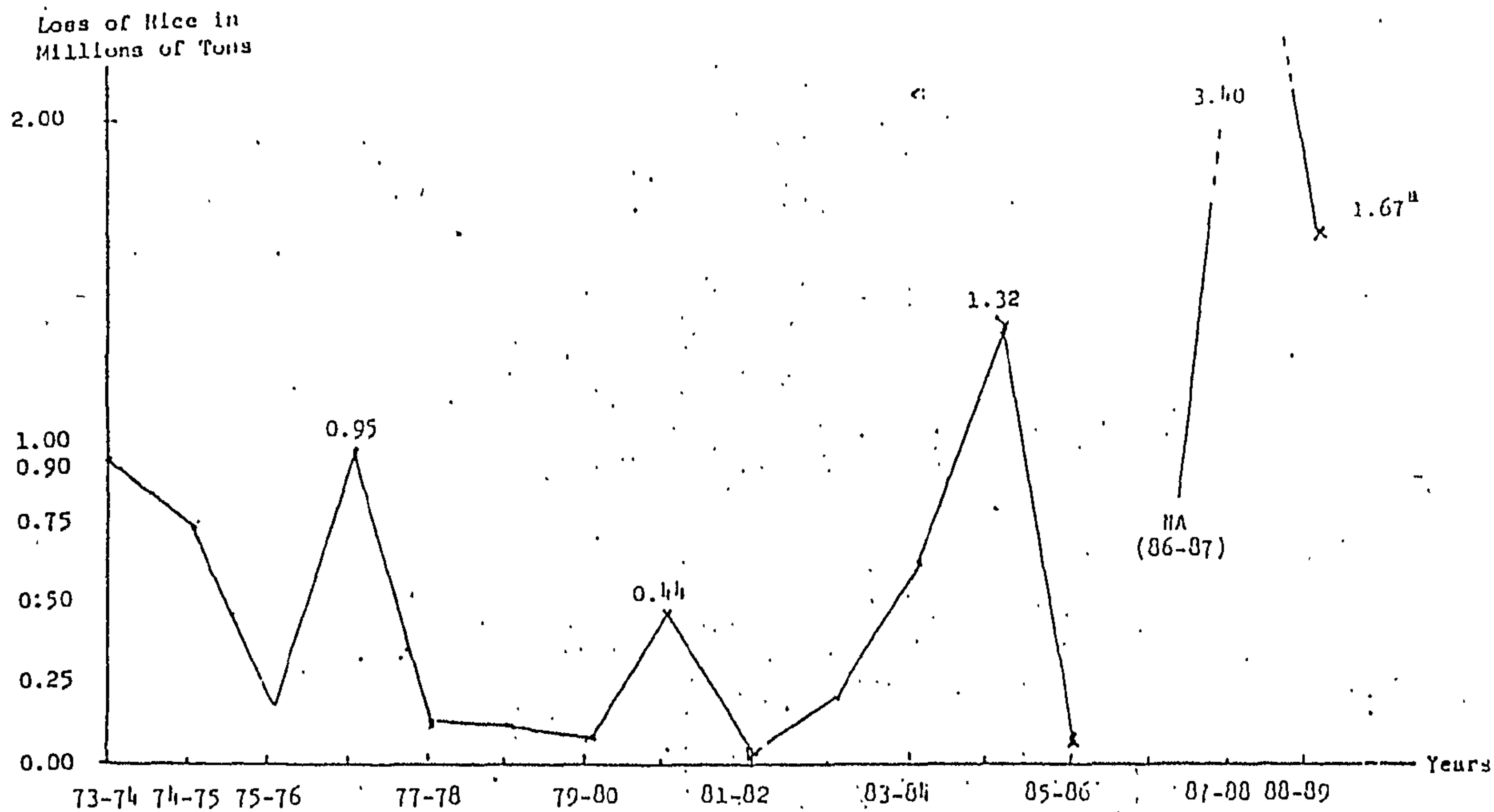

Fig. 4.--Historical statistics of damages to rice by floods and drought

[a]Damage due to floods only.

Source: Table 6

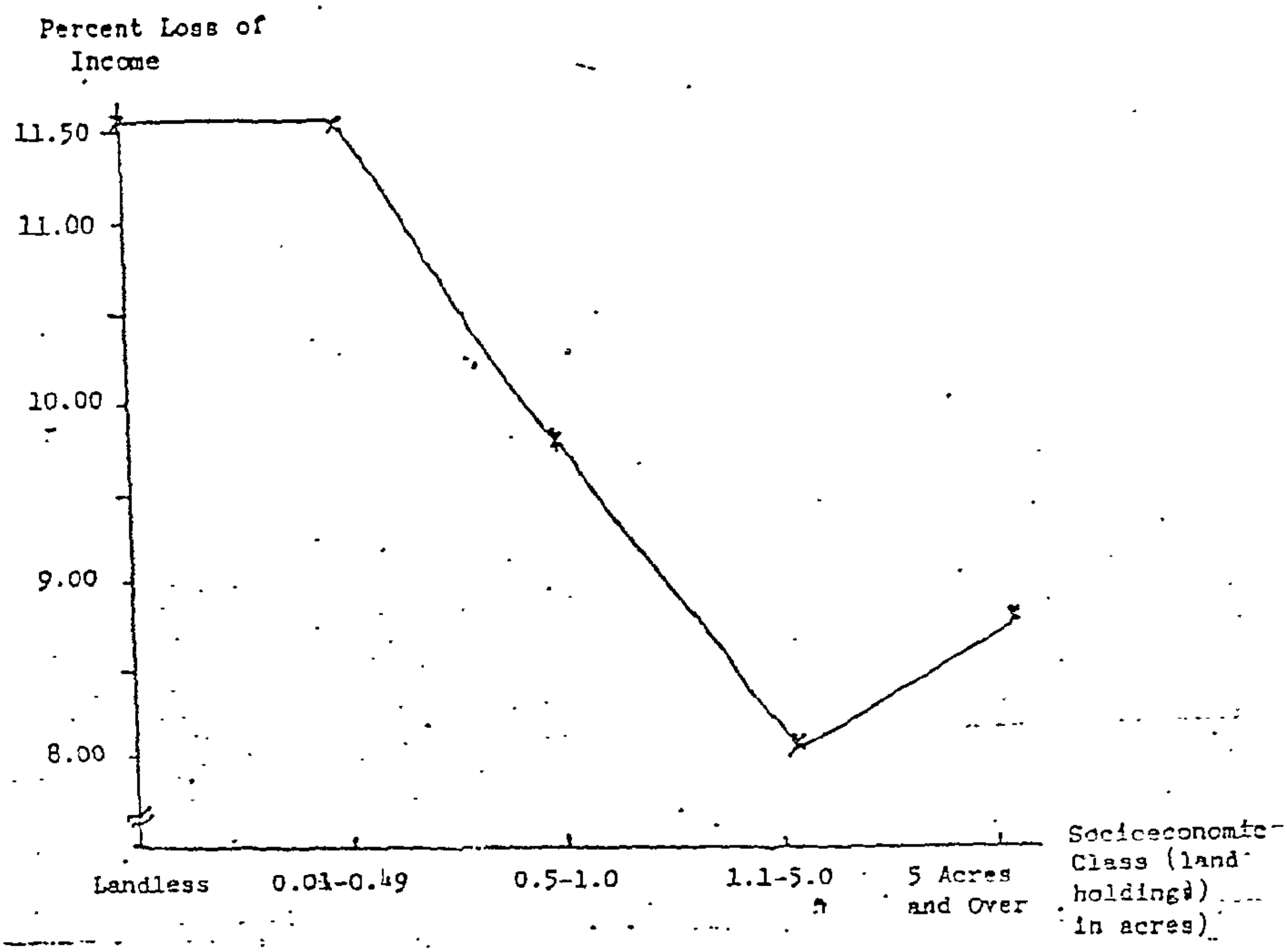

Fig. 5.--Incidence of flood damages by socioeconomic class

Source:- Table 9.

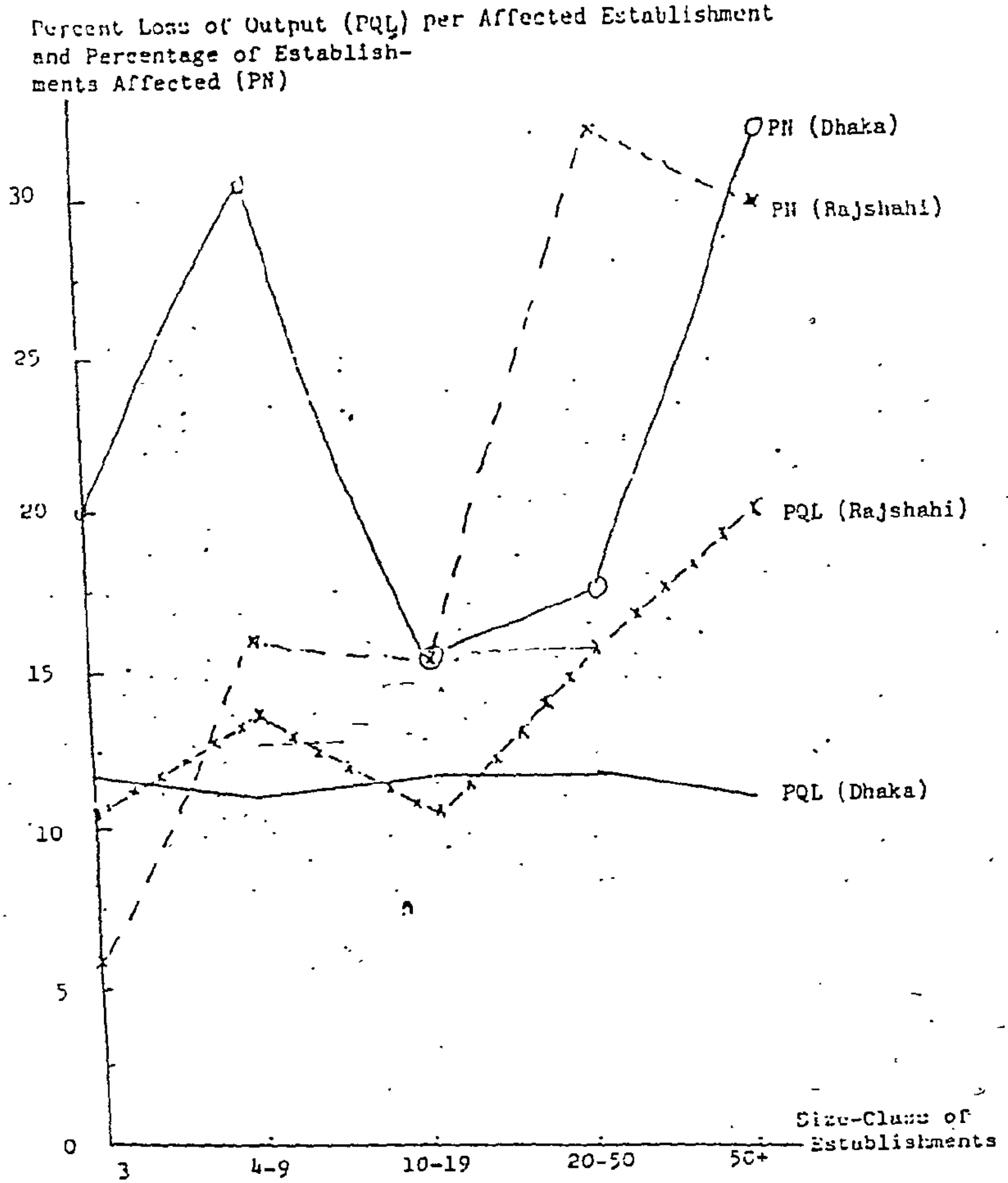

Fig. 6.--Flood damages to industrial output by size-class of establishments: Dhaka and Rajshahi

Source:- Table 12.1.

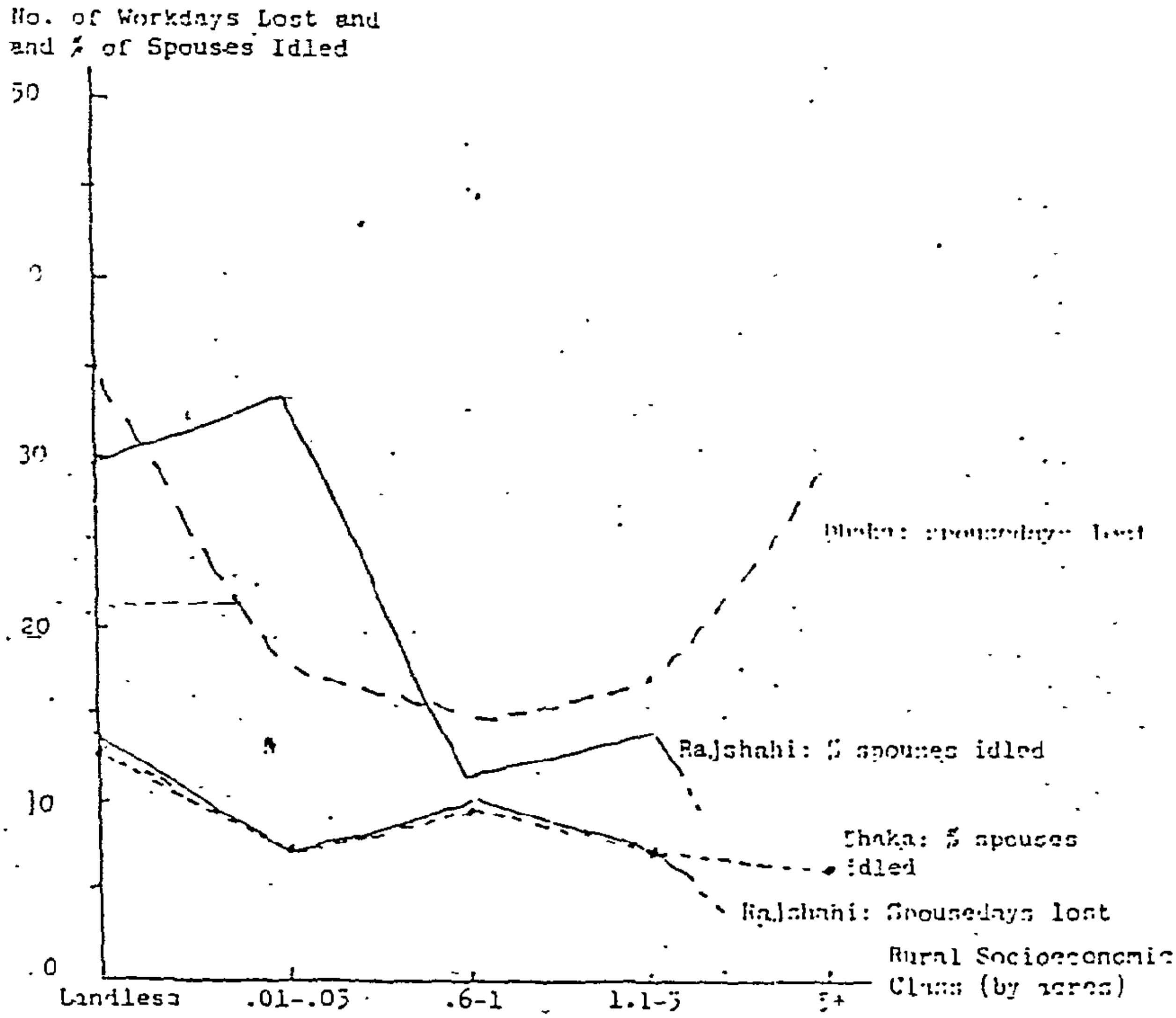

Fig. 7.--Impact of floods on the employment of spouses.

Source:- Table 12.3.

Footnotes

[1] Note that the mean values fall within wide range of damages. The standard errors are usually larger than means.

[2] The damages assessed by units that reported damages come to 3.45% of total output. How much that is in absolute takas depends upon the population that is represented by our sample. If the entire nonagricultural sector (accounting for about 60% of GDP) suffered 3.45% damages, then the loss comes to approximately half a billion US dollars. Our sample, however, covered mainly manufacturing establishments, which contribute approximately 10% to GDP, the 3.45% of which is $82 million. This damage, however, relates only to the flow of output. To be added to it is the stock damage to plant and buildings, which is reported in a subsequent section.

[3] Flood damages to the handloom sector are assessed by the Handloom Board as follows:

Private sector Taka 10.67 billion

Public sector Taka 0.18 billion

Total Taka 10.85 billion or US$ 342 million

The assessment of damages to small and cottage industries made by BSCIC is Taka 4731 million or $150 million, which comes to about one--fourth of this sector's contribution of about 4.[illegible]% GDP. We suspect that the assessments of the BSCIC and the Handloom Board include both stock and flood damage. For the rest, we leave it to the reader to judge which assessment is close to reality. As we have said in the opening paragraph of the report, we do not claim our assessment, done through a survey, rather than personal judgment of experts, is [illegible]. The contribution of this study is rather in its assessment of the relative distribution of damages across various size-classes. Yet we believe our assessment of damages is closure to reality.

[4]The conceptualization of Relation (6) may be attained by grouping the terms in the numerator as $\Delta L_s = \sum h_{sj}(K_j X_j)$, in which the grouped terms $K_j X_j$ convert proportionate change in output capacity (K_j) into absolute change in output capacity. When multiplied by labor coefficients h_{sj} for skill class s and summed over j, the relation yields absolute change in the total employment of skill class s, namely ΔL_s. The denominator is simply total employment of skill class s, namely $L_s = \sum_j h_{sj} X_j$. The meaning of $\Delta L_s / L_s$ is then obvious.

Alternatively, one may conceptualize the relation by grouping $h_{sj} X_j$ separately from K_j, in which $h_{sj} X_j$ is nothing but the sxj matrix of absolute workers (L) which when multiplied by changes in X, denoted by K_j, yields ΔL.

Similar interpretation applies to Relations (7) and (8).

[5]One may wonder whether high values of Leontief output multipliers are more growth-promoting than high-valued Keynesian or Kaleckian consumption multipliers. The Leontief multipliers are higher for low value-added-ratios while Keynesian multipliers are likely to be higher for high value-added ratios. The answer is not categorical. Usually, the Keynesian model has weak applicability to agrarian economies. In the context of developing countries, high-valued Leontief multipliers would be more growth-promoting if leakages in the form of imported raw materials and other intermediate goods are not high.

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