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Investigating Livelihood Security in Poor Settlements in Bangladesh

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Abstract

This paper examines the factors associated with different areas of livelihood security at the household level using simultaneous equation system. The approach is novel to identify the targeted area of intervention to improve livelihood security level of poor households. We have used extensive quantitative data on the outcome indicators of livelihood security and suggested programme improvement for poverty reduction based on evidences. An increasing number of organizations are now engaged in collecting this type of data and so would be benefitted from the methodology and analysis in this paper. The paper is organized including – introduction, methodology of measuring the components of livelihood security (such as economic, food, health, education and empowerment), and discussion of results followed by conclusions.

Key words – Livelihood security, poor settlements, Bangladesh

JEL Code: O10, Q10

1. Introduction:

The number of starving people increased from 848 million in 2003-05 to 923 million in 2007 to 963 million in 2008 (FAO 2008). The steep rise in global food prices in 2007 and 2008 as well as global financial and economic crisis in 2008 and 2009 added more people to this rank and additionally making them more vulnerable. The crisis added nearly 100 million people to the numbers who are chronically hungry, pushing the world total to nearly 1 billion people (Mehra and Rojas 2009). The international community responded to these shocks with increases in humanitarian assistance and commitments. The G8 Summit in L'Aquila, Italy in July 2009 established a common global framework for coordinated and comprehensive action to improve food security among governments, donors, civil society, the private sector, and other stakeholders at all levels – nationally, regionally, and globally.

Food security thus returned as the most important development agenda in the face of the extraordinary increase in food prices worldwide during the crisis and afterwards (Allen 2008). However, it is misleading to treat food security as independent of wider livelihood considerations. In addition to food, there are other interrelated dimensions of livelihood

security such as economic, health, nutrition, education, environment, empowerment etc. It would be over optimistic to achieve the objective of food security target without attention being paid simultaneously to other dimensions of livelihoods.

While working for the poor, many organisations adopt livelihoods approach (Hussein 2002). The approaches give emphasis to identify the real needs of the poor people and integrate them in the programmes for service delivery. We will expand this discussion in the next section.

In many countries, poverty has been shifting from rural to urban areas. Urban population is growing overwhelmingly. People move to the cities, either being pushed by poverty, or pulled by improved urban well-being, but often remain entangled in poverty. More than a billion of urban population live with inadequate basic resources. International Food Policy Research Institute (IFPRI), CARE and their collaborators have been investigating the complexities of urban livelihood security and noted that very little is known about the determinants of livelihood security (IFPRI 2002). Studies in this area are still scanty.

As a matter of fact, 65 per cent of the chronically poor people live in only seven countries including Bangladesh. One of the world's poorest and populous countries, Bangladesh always finds it difficult to feed its entire population. Understandably the country has attained some remarkable social and economic successes in terms of per capita income growth, reduction in population growth, decrease in child mortality, improvements in child nutrition, expansion of primary and secondary education, and reduction of gender inequality in education, maintaining food production close to self-sufficiency level, and sustained trends of decline in income-poverty. In spite of impressive progress, 40% of the population is still living below the poverty line according to Household Income and Expenditure Survey 2005 (BBS 2007). However, this may not be viewed as unusual for a country of 150 million people living on a tiny piece of land with very limited natural resources confronted frequently by natural calamities. Roughly, around 30 per cent of the population live in urban areas being around 15 million in Dhaka city alone. Poor people in urban areas routinely turn to slums and squatter settlements for shelter with high population density, poor services and extremely unsecured livelihoods. These people are

extremely vulnerable to ill health, economic dislocation and natural disasters. They are trapped in low-wage low-skilled work with little job security, inadequate food and shelter, deprivations of basic education and health, lack of clean water and sanitation.

Analysis of livelihood is complex (Ellis, 2000). CARE is one of the frontline NGOs has been using the livelihoods approach as its primary programming framework while working for the poor and vulnerable in developing countries. To learn more about poor people's livelihoods, IFPRI and CARE Bangladesh conducted baseline surveys in the slums of two secondary cities (Jessore and Tongi) in 1120 households. In Jessore, primary economic activities revolve around trade with India, and Tongi is a "suburb" of the megacity of Dhaka. The primary focus of this study is to analyse the factors associated with economic, food, health, education and empowerment as different domains of livelihood security using this household survey data set. The objective is to identify potential areas of intervention in order to improve poor people's livelihoods.

2. Methodology:

(a) Construction of the Livelihood Security index: a composite index approach

Livelihood security approach is an integral part of many organisations working for the poor. This approach evolved from Sen's (1981) theory on entitlement. Entitlement refers to the set of income and resource bundles (e.g. assets, commodities) over which households can establish control and secure their livelihoods. The evolution of the concepts and issues related to the theory of entitlements eventually led to the development of the broader concept of household livelihood security (HLS). There is diversity in defining HLS; many of the definitions were being derived from the work of Chambers and Conway (1992). According to them, a livelihood "comprises the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living; a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation".

In this study we adopt the concept of HLS as adequate access to income and assets to meet basic needs such as food, nutrition, education, health facilities, shelter, water and sanitation and participation in community and social activities. Our interest is to examine the factors associated with the domains of livelihood security in order to suggest priority areas of intervention. We ignore the debates on the security level or cut off point regarding secure and insecure. The investigation on this debate may not add value in this study because we are studying the livelihoods situation in poor settlements. Instead we concentrate on measuring continuous variables of LS domains so that we measure the variability and underlying causes.

Lindenberg (2002) analysed livelihood security areas under five broad dimensions: economic security, food security, health security, educational security and empowerment. In this paper, we propose to develop a composite set of HLS indices (HLS) at the household level utilising a set of indicators representing each of these dimensions using an approach similar to Hahn et al. (2009). CARE developed a set of multiple indicators to assess each of the HLS dimensions based on a reflective workshop involving several other NGOs in Bangladesh (CARE 2004). We intend to select a suite of indicators from these recommended set that could be derived from the survey data to construct our livelihood security indices. A composite HLS index developed by CARE utilized rapid community appraisal technique where a few selected households were interviewed by a survey team of 10–12 persons spending about eight hours in a community (Lindenberg 2002). This qualitative measure is based on a few selected households and so does not represent broader communities. The results cannot be generalized as the sample is not a representative number. In addition, questions are being raised on the reliability of the information which often reflects the views of those involved in the exercises.

The general framework of constructing our proposed index is discussed below. The HLS index uses a balanced weighted average approach with a large number of indicators, where each indicator contributes equally to the overall index. The indicators are grouped into different domains representing security areas such as economic, food, nutrition, health, education, empowerment, water and sanitation etc. Since each indicator is measured on a different scale, indicators are standardised following the approach adopted in measuring

‘Life Expectancy’ in Human Development Reports (also adopted by Hahn et al. 2009). For example, a standardised indicator j is given by:

$$zind_j = \frac{indicator_j - \min j}{\max j - \min j} \quad (1)$$

where minimum and maximum values of the indicators are from the same community within which the household belongs. Once each indicator representing a particular livelihood security domain is standardised, then the relevant household livelihood security index for the particular domain is constructed by averaging the standardised indicators:

$$HLS_i = \frac{\sum_{j=1}^J zind_j}{J} \quad (2)$$

where J is the number of indicators used to construct the index. Once each HLS index is constructed, then the composite overall Livelihood Security (LS) index for the household is constructed by using the formula in equation (3):

$$LS_i = \frac{\sum_{i=1}^n w_i HLS_i}{\sum_{i=1}^n w_i} \quad (3)$$

where w are the weights determined by the number of indicators used to construct each HLS index. Weights vary between households because of household level variation in the number of indicators.

(b) Analytical framework

We have constructed five livelihood security indices such as: economic security, food security, health security, educational security and empowerment. In order to examine the determinants of these constructed HLS indices (eq. 2) we have specified the following system of equations. The i th equation from the system of equations can be expressed as:

$$\ln HLS_i = \alpha_i + \gamma_i \sum_{i=2}^6 \ln HLS_i + \sum_{k=1}^n \beta_{ik} \ln X_{ik} + \varepsilon_i \quad (4-9)$$

where HLS indices are the dependent/endogenous variables and X 's are the exogenous/instrumental variables representing household's socio-economic circumstances

as well as community level attributes. The estimation technique should explicitly take account for possible endogeneity of HLS indices (e.g., 3SLS could be the first candidate because estimates are more efficient asymptotically, but if the system is properly identified, for just identified equations 2SLS and 3SLS are equivalent, or if there is no cross equation covariation (Theil 1971)). The choice could be based on the standard model specification tests (e.g., Hausman's Test). As 3SLS requires normality and equal variance assumptions to be hold; so we first tested the possibility of the presence of non-normality heteroscedasticity. We then tested the possible endogeneity of HLS indices. Based on the test results we estimated 3SLS but also reported the results based on 2SLS method.

(c) Calculation of inverse Herfindahl-Hirschman Index measuring livelihood diversity

The Herfindahl-Hirschman Index was originally being developed for measuring the degree of market concentration that takes into account both the relative size and distribution of each source, increasing as the number of firms in the market falls and the disparity in the size of those firms increases. The inverse of this can be used to measure the degree of livelihood diversity that takes into account both the relative size and distribution of each source of livelihoods. The value of this index increases with the increase in the number of sources of livelihoods, and with the decrease of disparity in the share of those sources in the livelihood outcome or income. For example, a share of livelihood source j in income (I) of a household

is given by: $I_j = \frac{I_j}{I_i}$ (10)

The inverse of the Herfindahl-Hirschman Index (HHI) for this household is then calculated as:

$$HHI_i = \frac{1}{\sum_{j=1}^J I_j} \quad (11)$$

Household income sources are first categorised on the basis of flow of income into three categories. First regular occupation consists of either employment or self employment; second category consists of net income from farming (crop, livestock, fisheries and agro-forestry), which are seasonal in nature and third category consists of transfer, social assistance, pension, rent, interest, income from pawning assets etc.

(d) Study locations, data and variables:

Data are drawn from the *SHAHAR (Supporting Household Activities for Health, Assets and Revenue)* project implemented by CARE-Bangladesh for the purpose of intervention aiming to establish household livelihood security for vulnerable urban households. The SHAHAR Baseline Survey was conducted in slums and low-income settlements in August 2000 within the municipal areas of Jessore and Tongi districts (CARE 2001). These two secondary cities were selected purposively to consider diversities in city characteristics. Figure 1 shows the locations in a map of Bangladesh. The spatial form of Jessore is very different from that of Tongi. The latter is characterized by the presence of large slum areas that have distinct identities and are to a greater extent spatially isolated from neighboring communities. In contrast the slum communities in Jessore are to a large extent part and parcel of the city, located alongside middle-class and well-off neighbourhoods.

Figure 1 here

Jessore is located in the southwest of Bangladesh on the main transport route linking Bangladesh to India. Administratively Jessore is divided into 9 wards¹. Of these 9 wards some 63 slum communities known as *bastis* were identified².

Tongi is an industrial area located 25 km north of Dhaka, a fast growing mega-city in the world. Many of the inhabitants in Tongi including women work in the neighboring mills and factories. Some 21 slum communities from 6 wards were selected for the survey.

Study sites in Jessore consist of a mix of rich, middle class and absolutely poor households living together whereas in Tongi the residents are purely slum dwellers. Also, a few sites in Jessore are located at the fringes of *pourashava*, which has a complex mix of urban and rural lifestyles, including extensive crop agriculture.

¹ A ward is the smallest administrative unit in the urban/suburb setting in Bangladesh.

² A *basti* is often defined as an unplanned settlement of households typically without secure tenure, adequate sanitation and other urban services needed to maintain minimum environmental health standards.

In Jessore 563 households were surveyed, as were 557 in Tongi. Households were selected randomly from a complete listing done as part of a census in the areas in April-May 2000. The sample size was statistically representative (CARE 2001). The size was determined using the following equation:

$$n = \frac{(1.645)^2 \times [p(1-p)]}{(0.05)^2}$$

where,

1.645 is the standard error associated with 90 per cent confidence level of a standard normal distribution,

p = proportion of a key variable of interest, estimated prevalence of stunting in this case, because the survey was a baseline meant for action research to improve food and nutrition security. 0.05 = error level (5 per cent)³

According to this formula and the above values, n is approximately 271, this number was doubled because stunting was measured for children under 5 and 50% of the households do not have children. Another 10% was added to this number to consider non-response due to mobility of households because slum dwellers are highly mobile. Thus the upper bound of the randomly chosen sample size was $(271 \times 2) \times 1.10 = 596$, approximately 600 and actual sample size was 563 in Jessore and 557 in Tongi as reported in Table 1.

A structured questionnaire consisting of 17 modules was used for data collection. Topics comprise household composition, migration and education, status of employment and earnings, transfers, social assistance and other income, household assets, urban agriculture, savings, loans, housing, environment, water and sanitation, daily food, consumption, diarrhoea and other illnesses, health, nutrition knowledge and practice, pre-school feeding, utilization of health care facilities for pregnancy/birth, anthropometry, community participation, general household livelihood security.

The enumerators visited each household 2-3 times in September 10-26, 2000 to complete all sections of the questionnaire. Table 1 shows the sample distribution such as the number of households, population size by gender and average family size (average number of

³ Rapid assessment was used to estimate the prevalence of stunting (p), which was 38 per cent of boys and 41 per cent of girls. A higher rate of 50 per cent was used to select the sample size to account for any error in the assessment as well as to maximise sample size.

persons in household). Family size was slightly higher in Jessore but not different statistically.

(Insert Table 1 here)

Data of regular activities and income of last 30 days for four broad activity groups were collected in the survey. The activity groups are wage labourer, salaried worker (with and without salary or pay) and self-employed. Several activities were identified under each of these broad groups. Data were also collected for seasonal income from enterprises, social assistance and other irregular sources for the last six months. Income from all these sources was aggregated and per person monthly income is reported in Table 1. Monthly average income is slightly higher in Tongi but statistically average income is the same in two areas. We subdivided all the activities, enterprise income and other sources of income into 12 groups and calculated Herfindahl-Hirschman Index (HHI as in 11). The value of this index ranges from 1 to the number of activities (12 in this case). Livelihoods appeared nearly equally diversified in the settlements of both the districts. Diversification in the settlements is low; 1.42 out of 12 activities. Diversity is slightly higher in Jessore. A slightly higher income in Tongi was due to a greater degree of engagement in salaried income; 50% of the income was generated from wage and salaried income in place of about 28% in Jessore. This is consistent with Tongi's industrial nature and proximity to Dhaka city. On the other hand, income share from trading in Jessore (36%) was significantly higher than Tongi (26%). This evidence tends to reflect Jessore's convenience of trade with India; many people in this area engage in inter-country trade. Enterprise income, which includes agriculture, was also higher in Jessore where land and natural resources are relatively more accessible. Particularly, income from vegetables, fruits and livestock was much higher in Jessore.

For detailed investigation we have chosen five security areas: economic security, food security, health security, educational security and empowerment. Table 2 includes a set of indicator/component variables that we constructed from the baseline survey data to calculate the indices. These indicators are assumed to differentiate household status substantially. For example, income levels differentiate economic status and so it is a component of economic security.

(Insert Table 2 here)

3. Results

(a) Descriptive analysis

Table 3 reports the mean and standard deviation of 33 chosen indicators for two regions: Jessore and Tongi. The two regions are different in terms of many indicator variables. For example, households in the Jessore settlements are endowed more with land based resources as well as machinery and equipment and so intervention with land based enterprises may be more appropriate for Jessore but may not be suitable for Tongi settlements. On the other hand, female participation in employment is higher in Tongi. Livelihoods and poverty related interventions usually target women beneficiaries. Females in Tongi would benefit from exiting employment status improvement programmes.

(Insert Table 3 here)

Regarding food security indicators, household level food baskets collected on 24 hour recall basis were divided into 8 groups. These groups were cereals, roots and tubers, pulses, foods of animal origin, vegetables, fruits, fats and oils, and snacks. Only 2% of the households had diets consisting of all 8 types of food. Other households missed one or more types. About 66% of the households missed four types of food other than cereals in 24 hours. Missed foods are mainly protein-rich high value products such as foods of animal origin (milk, milk products, eggs and meat) and fruits. Data were also collected on number of times each type of food was consumed in a 24 hour period (food frequency). Food frequency was significantly highly correlated positively to the number of types food groups consumed (correlation equals 0.78 significant at 1% level). This means that the peoples, who eat more frequently, also eat more types of food. In other words, food frequency and dietary diversity are highly correlated variables. Any of these two variables may be used to represent food diversity; here we have used both food diversity and food frequency indicators. This is because both have specific implications on food security. Some households' intake was

frequent but not diverse to provide with adequate nutrition. On the other hand a considerable number of households' intake comprises diverse food type only 2/3 times a day. The frequency of taking food ranged from 2 to 27 times a day. Some households eat food only twice a day, others eat more frequently up to a maximum of 27 times. Cereals (rice and wheat) are common in the diet of everybody. More than half of the households in both locations consumed roots and tubers, particularly potatoes. Fish was also common. Vegetable intake was quite low in Tongi, particularly for the female-headed households. In general, intake of protein-rich foods (e.g., meat, milk and milk products, eggs and fruits) was lower in female-headed households than male-headed households in both areas.

We found very little difference between the regions on the health related indicators, though some are significantly different. An example is the 'number of days unable to work due to sicknesses. This is significantly higher in Tongi, may be due to higher level of industrial pollution. So measures to reduce sickness, may be to reduce industrial pollution, is a priority area in Tongi. A data digging exercise shows that an estimated 81 per cent of households in Jessore and 83.3 per cent in Tongi had at least one member who was sick during the 30-day recall period. Consistently, body mass index is significantly lower in Tongi. In Tongi almost 49 per cent of girls and 41 per cent of boys under age 5 were stunted while in Jessore 33 per cent of girls and 40 per cent of boys were stunted. Another 20 per cent of the children in Tongi and 15 per cent in Jessore were underweight for their height. This indicates the existence of alarming malnutrition.

The performance of Tongi in terms of educational indicators is relatively worse. All of the seven indicators have lower average value in Tongi in spite of its proximity to capital city Dhaka. These may be the combined effects of a number of factors. Both cities comprise population with a majority rural migrants but Tongi holds more. As the literacy rate is lower in rural areas, this is reflected in the education indicators in Tongi. Also, this may be the impact of industrial/ manufacturing job opportunities. The short run impact of this is higher per capita earnings but the long run and vulnerability impacts may not be pleasant. Tongi is more congested and so basic services are extremely poor. Nearly two thirds of the households in Tongi and more than half of the households in Jessore are struggling in

absolute poverty. Female-headed households, which account for 21 per cent of households in Tongi and 11 per cent in Jessore, with 85 per cent and 70 per cent, respectively, are not able to meet basic needs.

Community participation is one of the three indicators of empowerment. It is measured by number of months of active involvement with any organisation that deliver community services. The second indicator is the access to services. This is measured based on whether households received any service (yes=1 and no=0) such as training, credit, health awareness, water and sanitation, sports, culture and other urban amenities from any provider. The third indicator is the household participation in the planning process. This variable was measured from the answers (yes=1 and no=0) to question that 'Have any of the household members ever participated in any planning process with the Pourashava (suburb city council) regarding future of your community?' Only 6 per cent of the households reported participation in the Pourashava (city council) planning process. In spite of longer involvement with different organizations, Tongi people had lower access to services, perhaps because the area is overcrowded.

(b) Different security indices

The security indices were calculated using the standardised values of the indicator variables; standardisation was done using their ward level maximum and minimum values. The results are reported in Table 4. The two regions are almost equally insecure in terms of economic, food, health, education and empowerment. The differences in terms of food, education and empowerment are small but statistically significant. The average security indices are low in both regions. We conclude that the slum population in Bangladesh is extremely insecure. Location of the settlements does not matter. This indicates policy intervention is equally necessary in all urban poor settlements but definitely not the same intervention appropriate in all locations as there are differences among the indicators.

(Insert Table 4 here)

Peoples in the settlements are much better in terms of food security relative to other domains of livelihoods security but still the average is in the middle of the scale of 0 to 1. There are differences between Jessore and Tongi in terms of foodgrain stocks. Access to food is more secured in Jessore, perhaps due to the availability of higher foodgrain stocks. The difference appears small but statistically highly significant. There is a common tendency of female members to skip meals and eat less after feeding all other members. Obviously, this has food security implications. So we have included 'number of main meals took by women in household' in the indicator list of food security. There is no difference between Tongi and Jessore with respect to this indicator. Data on food quantity were not recorded to examine whether female members eat less quantity than required in each meal.

Empowerment has the lowest values among the five domains of livelihood security. People are slightly more empowered In Jessore but not statistically significant.

Overall livelihood security index comprises five major livelihood security areas: economic security, food security, health security, educational security and empowerment. On an average, overall security is higher in Jessore. The difference is small but statistically significant at 1% level. This variation arises from the significant difference in food, education and empowerment. The other two domains (economic security and health security) are statistically the same in both regions. In both regions education and empowerment much lower median than average indicating that the distribution is skewed towards the lower values of the indices. This means that the majority are less secured than the average.

(C) Determinants of livelihood security

This section provides the quantitative estimates of the determinants of livelihood security domains. In order to estimate the models 4-9 we include the variables as defined in Table 5. In addition to livelihood security indices, we specified 10 variables to represent household circumstances (X variables in equation 4-9). For example the household which have higher

level of family size and dependency ratio, their demand for basic needs is also higher. We would expect these variables to affect livelihood security negatively, other things being equal. The security variables would affect each other positively. Other variables included are the characteristics of the household heads. We would expect their age and education to associate positively with the security level but other variables such as marital status, gender etc. may be associated with security level either positively or negatively depending on the circumstances.

Test results

We first conducted specification tests. Some of the tests are not available in the simultaneous equation framework. For example we have to decide whether we carry out aggregate model combining Jessore and Tongi together or model them separately. Here we applied Chow test and identified that they should be modelled separately or use independent set of dummy variables to represent their differences. Separate models are preferable due to fewer numbers of parameters to be estimated in each model.

We also carried out tests for normality, constant variance and endogeneity in the 2SLS framework. Breusch-Pagan / Cook-Weisberg test for heteroskedasticity identified that the variance is not constant (STATA 2008). Cameron and Trivedi's decomposition of IM-test shows heteroscedasticity and non-normality problems (Cameron and Trivedi 2009). The models can be simultaneously estimated by 3SLS but it requires normality, constant variance assumption to be hold. We transformed the variables into log as in Table 5 to reduce the statistical problems. Results are shown below.

Jessore analysis

In Jessore all other security variables except empowerment are highly significant determinants of economic security (Table 6). Signs of the coefficients are positive, as expected. For example, with a 10% increase in education security economic security rises by 2%. Those heads had access to business training were economically more secured by 3%.

Average economic security in Jessore is only 15%. It may be much easier to implement programmes to enhance education security, which could also improve economic security. Family size and dependency ratio are significantly negatively associated with economic security as expected.

Tongi analysis

In Tongi, results are consistent for education, food and health security. Some factors are negatively associated with economic security. Reasons are not however clear. For education, a 10% increase would result in the rise in economic security by 1.5%. So education enhancing policy would even produce better outcomes in Tongi. Except for family size, dependency ratio and land, all other variables are insignificant. The effect of family size and dependency ratio is extremely consistent; virtually the same in both regions. The goodness of fit of the Jessore model is much better than the Tongi model. Some changes may be necessary in the Tongi model to improve the results.

(c) Conclusions and Implications

This study measures livelihood security in selected urban settlements in Bangladesh. Five security areas such as economic, food, health, education and empowerment were chosen and indices were computed based on a number of components. They were estimated using 3SLS and 2SLS models. From the results we conclude that urban settlements in Bangladesh are insecure, wherever it locates. Irrespective of regional differences in opportunities, people in urban squatters appear almost equally insecure. This does not mean that the same intervention strategy is equally applicable everywhere. There are geographical differences in the component indicators. Access to assets/capital endowment should be taken into consideration to design programmes. Areas where land/housing/ponds more

accessible, livestock/fisheries based livelihoods may be encouraged. Education enhancing policies are suitable for everywhere.

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Table 1. Sampling distribution, income and diversity, Jessore and Tongi, Bangladesh

Locations	Households N	Male member	Female member	Total member	Family size	Per person Income (TK)	12 activity diversity (HHI)
Jessore	563	1337	1347	2684	4.77	820.86	1.44
Tongi	557	1292	1289	2581	4.63	891.88	1.40
Total	1120	2629	2636	5265	4.70	856.12	1.42

Note: TK is Bangladesh currency Taka (also abbreviated as BDT), US\$ 1.00 = TK 52.14 in 2000.

Table 2. Livelihood security indicators with summary statistics, Bangladesh 2000.

Security Components	Indicators	Mean	Standard deviation
Economic	Per person income (TK per person per month)	856.12	1039.46
	Per person value of land/house/animal shed/pond (TK)	16929.36	51741.12
	Per person current value of livestock asset (TK)	146.08	754.89
	Per person current value of machineries & equipment (TK)	909.66	8947.39
	Per person current value of other asset (TK)	2152.14	2979.02
	Active population ratio (15-59 yrs population/family size)	0.60	0.20
	Proportion of 15-59 population in employment	0.58	0.27
	Household income earned by women (TK/person)	110.20	226.66
	Per person current savings (TK)	928.47	7348.29
	Per person current loan (TK)	941.87	2444.95
Food	Dietary diversity: number of food groups consumed per day	11.87	3.86
	Food frequency (number of meals and snacks per day)	4.95	1.28
	Household foodgrain stock (TK per person)	43.31	299.71
	Number of food convenient months in the year	9.56	2.50
	Number of main meals taken by women in household	2.92	0.30
Health	Family members suffer from diarrhea (days/month)	0.7	2.1
	Family members suffer from other sickness (days/month)	7.4	7.8
	Number of days unable to work due to sickness	4.6	5.4
	Frequency of antenatal consultation	4.2	2.1
	Doses of tetanus vaccination	2.2	0.9
	Body Mass Index women	20.7	3.4
	Body Mass Index children ≤ 5 yrs	15.1	6.0
Education	7+ population read and write (Literacy)	2.17	1.87
	Adult male literacy 15+ literate	0.87	1.01
	Adult female literacy 15+ female literate	0.59	0.76
	Adult members 10 years or more education	0.26	0.74
	6-10 years children enrolled	0.40	0.61
	11-15 years boys enrolled	0.16	0.40
	11-15 years girls enrolled	0.16	0.40
	16-23 years per son in household enrolled	0.12	0.45
Empowerment	Community participation/involve with institution (months)	4.31	11.92
	Access to services/organisations that offer services	0.12	0.32
	Household participation in planning process	0.06	0.24

Note: TK is Bangladesh currency Taka (also abbreviated as BDT), US\$ 1.00 = TK 52.14 in 2000.

Table 3. Description of indicators by geographical region, Bangladesh 2000.

Indicators	Jessore		Tongi	
	Mean	Std Dev	Mean	Std Dev
Economic security indicators				
Per person income	820.86	664.87	891.88	1314.39
Per person own land/housing/pond (TK)	25252.17	67261.75	8516.89	25961.28
Per person livestock (TK)	252.64	1018.12	38.36	275.73
Per person machinery & equipment/transport (TK)	1504.96	12435.48	307.94	2021.85
Per person other asset (TK)	2435.58	3357.07	1865.65	2511.12
Proportion of 15-59 population	0.60	0.19	0.60	0.21
Proportion of 15-59 in employment	0.55	0.27	0.62	0.28
Per person female income (TK)	65.32	163.93	156.41	269.22
Per person current savings (TK)	1419.71	10288.64	431.93	1088.40
Per person current loan (TK)	791.96	2699.52	1093.39	2149.20
Food security indicators				
Food frequency (meals and snacks per day)	11.7	3.5	12.0	4.2
Dietary diversity: number of food groups consumed per day	5.1	1.2	4.8	1.3
Household foodgrain stock (TK per person)	57.6	383.7	28.9	177.7
Number of food convenient months in the year	9.6	2.7	9.5	2.3
Number of main meals taken by women in household	2.9	0.3	2.9	0.3
Health security indicators				
Per person incidence of diarrhea in last 30 days	0.5	2.0	0.8	2.1
Per person days of other sickness in last 30 days	7.3	8.0	7.4	7.6
Number of days an active person unable to work due to sickness	3.6	4.4	5.6	6.1
Per women frequency of antenatal consultation	4.1	2.0	4.2	2.2
Per women doses of tetanus vaccination	2.2	0.9	2.2	1.0
Body Mass Index per women	21.2	3.5	20.2	3.1
Body Mass Index per children<=5 yrs	15.3	6.7	15.0	5.3
Education security indicators				
7+ population read and write (Literacy)	2.43	1.87	1.91	1.84
Adult male literacy 15+ literate	1.00	1.08	0.74	0.91
Adult female literacy 15+ female literate	0.70	0.78	0.49	0.72
Adult members 10 years or more education	0.36	0.88	0.15	0.53
6-10 years children enrolled	0.44	0.62	0.36	0.60
11-15 years boys enrolled	0.17	0.42	0.14	0.39
11-15 years girls enrolled	0.19	0.44	0.14	0.37
16-23 years per son in household enrolled	0.16	0.53	0.08	0.34
Empowerment indicators				
Community participation/active involvement with organisation (months)	2.12	5.23	6.51	15.78
Access to services/organisations that offer services	0.13	0.34	0.10	0.30
Household participation in planning process	0.06	0.24	0.06	0.25

Table 4. Livelihood security in urban slums and settlements in Jessore and Tongi, Bangladesh, 2000.

	Mean	Median	Skewness	Kurtosis
<i>Jessore</i>				
Economic security index	0.170	0.160	1.296	5.986
Food security index	0.555	0.560	-0.746	4.880
Health security index	0.506	0.503	-0.072	0.063
Education security index	0.146	0.06	1.802	6.178
Empowerment index	0.108	0.050	1.708	5.875
Overall livelihood security index	0.248	0.242	0.675	4.109
<i>Tongi</i>				
Economic security index	0.172	0.160	1.065	4.919
Food security index	0.526	0.540	-0.656	4.166
Health security index	0.499	0.484	0.184	0.079
Education security index	0.098	0.020	2.412	9.646
Empowerment index	0.090	0.040	1.840	6.163
Overall livelihood security index	0.238	0.235	0.549	4.280
<i>Both regions</i>				
Economic security index	0.171	0.16	1.190	5.518
Food security index	0.540	0.55	-0.662	4.539
Health security index	0.503	0.494	0.060	0.061
Education security index	0.122	0.04	2.064	7.506
Empowerment index	0.099	0.04	1.786	6.129
Overall livelihood security index	0.243	0.238	0.679	4.372

Table 5. Variable definitions, mean and standard deviation by region, Bangladesh, 2000

Variable	Description	Jessore		Tongi	
		Mean	Std dev	Mean	Std dev
lHlseco4	Log of economic security index	-1.87	0.49	-1.85	0.45
lHlsfood	Log of Food security index	-0.64	0.42	-0.68	0.32
lhlsh1	Log of health security index	-0.72	0.49	-0.76	0.55
lhlse1	Log of education security	-3.61	2.46	-4.47	2.50
lhlsempo	Log of empowerment index	-4.30	2.60	-4.36	2.47
lFamsize	Log of family size (number of persons in the household)	1.48	0.39	1.44	0.45
llandhpc	Log of per person own land/housing/pond (TK)	1.74	8.27	1.17	7.82
lDeprati	Log of dependency ratio (dependant members/active members)	-0.89	2.02	-1.13	2.40
lAgeh	Log of age of household head	3.68	0.28	3.63	0.30
lclasscomh	Log of highest education (years) of household head	-2.38	4.40	-3.41	4.24
femh1	Female headed household (female head=1)	0.13	0.34	0.14	0.35
mstd1	Head is currently married and living with spouse = 1	0.89	0.32	0.85	0.36
slitd1	Head is able to only read or only write or only sign name=1	0.27	0.45	0.31	0.46
litdummy4	Head is able to both read and write=1	0.51	0.50	0.40	0.49
tdum2	Head received business related training=1	0.04	0.19	0.03	0.17
Instruments					
Zasopc	Standardised value of household assets other than land/housing/pond	0.14	0.19	0.13	0.17
Zactpro	Standardised value of 15-59 member proportion in household	0.50	0.25	0.54	0.26
zfdv1	Standardised value of household food frequency	0.44	0.22	0.40	0.20
Zfdv2	Standardised value of household dietary diversity	0.51	0.23	0.47	0.23
Zmntcf	Standardised value of household	0.79	0.23	0.79	0.19
Zsick	Standardised value of per person days of sickness in last 30 days	0.24	0.27	0.25	0.25
zl7plus	Standardised value of literacy (7 years and above can read & write	0.23	0.26	0.16	0.23
Zserv	Standardised value of household access to organisation/services	0.16	0.24	0.13	0.18

Table 6. Determinants of livelihood security security in Jessore.

	economic		Food		Health		Education		Empowerment	
Variables	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS
Lfamsize	-0.4434	-0.6839	0.0804	0.2754	-0.1053	-1.2099	3.7768	3.4481	-0.2644	-1.4267
	0.1144	0.0983	0.1102	0.1078	0.3183	0.2918	0.3314	0.328	0.8272	0.8068
Llandhpc	0.0074	0.0054	-0.0013	-0.0036	0.0102	0.0135	0.0039	-0.0173	0.011	0.0165
	0.0028	0.0028	0.0026	0.0026	0.0074	0.0073	0.013	0.0127	0.0195	0.0195
Ldeprati	-0.007	0.0141	0.0059	-0.0013	0.0648	0.0638	-0.104	-0.1071	0.0882	0.144
	0.0111	0.0107	0.0099	0.0099	0.0274	0.0271	0.0483	0.0474	0.0744	0.0739
Lageh	-0.2797	-0.46	0.0921	0.2406	-0.3107	-1.0522	2.0994	2.3603	-1.4126	-2.1906
	0.1057	0.1011	0.0978	0.0968	0.28	0.2718	0.4247	0.4243	0.7282	0.7212
lclasscomh	0.0251	0.0295	-0.0182	-0.025	0.0824	0.0627	0.0356	-0.0507	-0.1403	-0.0827
	0.0154	0.0152	0.0139	0.0138	0.0388	0.0386	0.0698	0.0685	0.1043	0.1038
femh1	0.117	0.1537	-0.2072	-0.2294	0.3112	0.3830	0.5392	-0.1965	0.2882	0.4782
	0.1213	0.12	0.1078	0.1077	0.3116	0.3100	0.5410	0.5362	0.816	0.8146
mstd1	0.0844	0.1975	-0.0611	-0.1438	0.5200	0.7138	-0.4320	-1.0177	1.49	1.8933
	0.1286	0.1278	0.115	0.1148	0.325	0.3248	0.5737	0.5710	0.8566	0.8547
slitd1	0.0884	0.0547	-0.0288	-0.0532	0.0134	0.1411	0.0621	-0.2068	0.4912	0.4906
	0.0718	0.0717	0.0646	0.0645	0.1868	0.1861	0.3235	0.3217	0.4837	0.4837
litdummy4	-0.473	-0.8393	0.2328	0.4654	-1.1189	-1.8096	3.0098	3.5655	0.2482	-1.4143
	0.1869	0.1809	0.1719	0.1702	0.4756	0.4680	0.7893	0.7838	1.2951	1.2812
tdum2	0.0128	-0.1401	0.0889	0.1352	-0.2933	-0.5448	0.5012	0.8302	-1.5987	-1.9088
	0.1278	0.127	0.1139	0.1138	0.3272	0.3264	0.5679	0.5663	0.848	0.8473
Lhlseco4			0.4314	0.6883	-0.6184	-1.6571	1.8134	3.263	1.2487	-0.0354
			0.0888	0.0769	0.2588	0.2175	0.4204	0.3138	0.7001	0.6904
Lhlsfood	0.2547	0.6937			-0.6184	-1.6571	1.8134	3.263	1.2487	-0.0354
	0.0764	0.0662			0.2588	0.2175	0.4204	0.3138	0.7001	0.6904
lhls1	0.1511	0.3132	0.0757	0.194			0.1088	1.4739	0.6332	1.5688
	0.0496	0.0417	0.0462	0.0438			0.3615	0.348	0.5403	0.5361
lhlse1	0.1118	0.1881	-0.0114	-0.0737	0.1293	0.4088			-0.6241	-1.3643
	0.0234	0.0175	0.0233	0.0226	0.0652	0.0571			0.3459	0.3266
Lhlsempo	0.0127	-0.0115	0.0109	0.0255	-0.0259	-0.1483	0.0574	0.2124		
	0.0105	0.0104	0.0094	0.0093	0.0272	0.0255	0.047	0.0448		
_cons	0.4625	1.812	-0.235	-0.6369	-0.6996	3.0083	-989	-10.6469	1.3633	5.0526
	0.5696	0.5026	0.5102	0.5066	1.4714	1.3857	1.9214	1.8617	3.8272	3.7604
N=563										

Table 7. Determinants of livelihood security security in Tongi.

	economic		Food		Health		Education		Empowerment	
Variables	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS
Lfamsize	-0.12	-0.3637	0.1187	0.2245	0.5585	-0.1374	2.7049	2.444	0.2125	1.1232
	0.075	0.0689	0.0618	0.0612	0.1996	0.1926	0.2896	0.2842	0.4612	0.4434
Llandhpc	0.0019	-0.0098	-0.0023	0.0013	-0.0118	-0.032	0.0188	0.0444	0.0996	0.1005
	0.0028	0.0026	0.0023	0.0022	0.0075	0.0073	0.013	0.0128	0.015	0.0149
Ldeprati	-0.0512	-0.0215	0.0376	0.0368	0.0508	0.0454	-0.0246	0.0056	0.0177	0.0352
	0.0102	0.0099	0.009	0.0087	0.0311	0.0298	0.0542	0.0513	0.0696	0.0667
Lageh	-0.2122	-0.3354	0.0249	0.1009	-0.5386	-0.8887	1.0511	1.6203	1.4984	2.2345
	0.0657	0.0645	0.0569	0.0555	0.1806	0.1785	0.3167	0.3113	0.4049	0.3976
lclasscomh	-0.0006	-0.0182	-0.0014	0.0047	-0.0078	-0.0424	0.0843	0.1051	0.103	0.1301
	0.0114	0.0113	0.0093	0.0093	0.0314	0.0314	0.0534	0.0533	0.0686	0.0685
femh1	0.076	0.1084	-0.0166	-0.0158	0.6265	0.5125	0.2004	-0.2403	-0.4774	-0.8535
	0.0775	0.0764	0.064	0.0638	0.2023	0.2021	0.3678	0.3641	0.4715	0.4653
mstd1	0.084	0.1739	0.0197	-0.0131	0.5914	0.6792	-0.3522	-0.7897	-0.8809	-1.3508
	0.0737	0.0726	0.061	0.0607	0.193	0.1929	0.3497	0.3467	0.4457	0.4406
slitd1	-0.0208	-0.1162	0.0845	0.1031	0.0587	-0.0678	0.1528	0.342	0.5033	0.6161
	0.0472	0.0467	0.0383	0.0382	0.1304	0.13	0.2229	0.2224	0.2842	0.2836
litdummy4	-0.1084	-0.2329	0.1252	0.1628	0.0927	-0.1217	1.4709	1.3756	-0.3936	0.4383
	0.1059	0.1048	0.087	0.0868	0.2943	0.2928	0.4899	0.4894	0.6458	0.6427
tdum2	-0.0397	-0.2287	-0.0092	0.0469	-0.4802	-0.7341	0.4672	1.0063	1.489	1.8659
	0.1069	0.1061	0.088	0.0878	0.2905	0.2898	0.5045	0.5027	0.6399	0.6381
Lhlseco4			0.5612	0.6908	-0.6868	-1.3129	2.4144	3.8005	2.2265	4.5647
			0.0722	0.0568	0.272	0.2327	0.4464	0.3595	0.6	0.5085
Lhlsfood	0.4764	0.8345			-0.6868	-1.3129	2.4144	3.8005	2.2265	4.5647
	0.0809	0.0636			0.272	0.2327	0.4464	0.3595	0.6	0.5085
lhls1	-0.1189	-0.2165	-0.0442	-0.0131			-0.1913	-1.492	-0.7267	-2.3818
	0.0409	0.0354	0.0349	0.0337			0.4467	0.4186	0.5715	0.5387
lhlse1	0.0634	0.1464	-0.0059	-0.0455	0.0621	0.2718			0.897	1.6634
	0.0153	0.0123	0.0137	0.013	0.0454	0.0421			0.2502	0.2202
Lhlsempo	0.0326	0.109	-0.0125	-0.0448	0.0759	0.2637	-0.089	-0.3787		
	0.012	0.0102	0.0102	0.0097	0.0332	0.0293	0.0583	0.0541		
_cons	-0.4627	1.1004	-0.1134	-0.5425	-2.0295	0.8505	-7.6433	-7.384	-4.5632	-5.8848
	0.3194	0.2986	0.2653	0.261	0.8603	0.8384	1.4032	1.3537	1.9302	1.868
N=563										

Figure 1. Study locations of Jessore and Tongi in Bangladesh.

