Crisis Coping Strategies
In
Bangladesh

Meherun Ahmed
Asian University for Women
Meherun.ahmed@gmail.com

Introduction

The relationship between poverty and natural disasters in the developing world has been a topic of interest and debate among the academics and the policy makers. There has been a revival of interest after the recent catastrophes like the tsunami in the Indian Ocean, the drought in the Sahel region in Africa and the earthquakes in Pakistan and also floods and droughts in various parts of the developing world.

Rural households face different types of shocks, some are particular to a one household (idiosyncratic) and some like natural disasters affect the entire village, or the community or a trade or an occupational group (systematic). Households plan strategically to smooth consumption in the event of income shocks followed by an exogenous natural calamity. The set of coping strategies adopted by households depend on a number of factors, especially, the types of crises the households face and opportunities available to them. It has been suggested in literature that, effective coping mechanism can break the cycle of intergenerational transmission of poverty. In order to survive during and after the shock, households may have to sell the productive assets. In the absence of any safety net, credit and insurance, these households may never be able to replenish their stock of assets and remain in poverty perpetually. Effective coping schemes would enable the poor to better adjust and mitigate shocks and contribute significantly to poverty alleviation and economic development of the country.

Using a new nationally representative dataset from Bangladesh, the broad objective of this paper is to identify different coping mechanism adopted by affected households in the presence of a very thin insurance market and differential access to formal and informal credit markets.

Literature Review

Natural disasters affect the consumption pattern of the households before and after the event. Forward looking households in trying to adopt risk mitigating techniques, incur ex-ante costs. Households also bear ex-post costs in coping with the aftermath of natural disasters. Examples of such costs according to the include loss of uninsured assets, reduction in current consumption, liquidation of assets, interest paid on loans from formal and informal sectors and the loss of human capital for the future generation.

The topic of risk coping and efficiency of the household has been extensively researched. In this section we try to provide a review of some of the most recent and relevant research pieces which is far from being exhaustive, rather, emphasizes the special research focus of this chapter. First we try to present the various coping mechanisms adopted by households for consumption smoothing purposes in the event of an income shock as seen in the literature pertaining to the developing countries. In the absence of formal insurance, and availability of credit, households resort to various behavioural responses and also some informal arrangements.

Corbett (1988) classified the coping techniques into two broad categories: precautionary and crisis strategies. Precautionary strategies are adopted in the wake of repeated exposure to similar type of non-acute risk. In contrast, severe threat to food-security forces households to resort to crisis strategies. In similar study, Dunn and Valdivia (1996) find that in Andean semi-arid regions, wealthier households owning more assets in the form of livestock, and therefore, are in advantageous positions to adjust or mitigate the shocks ex-post, are less likely to adopt ex-ante risk reducing strategies.

The most prominent *Ex-Ante* strategy adopted by households is to invest in different income sources. As long as the sources of income do not co-vary perfectly, risks to total income are reduced. Alderman and Paxson (1992) noted in their paper that crop and field diversification, mix of farm and non farm occupations are quite wide spread in the rural areas of developing countries. Morduch (1995) in his review paper lists similar findings. Variability reducing inputs and production techniques are often favored by households to smooth income. Households facing a higher farm profit volatility sends members abroad for steady income flow. Rosenzweig and Binswanger (1993) found that in India poorer farmers are more risk averse in the sense that they adopt less risky production strategies. Farmers facing unpredictable environment, select the blend of assets which are less sensitive to rainfall and generate low profit levels.

Rosenzweig (1988), Urdy (1994) have found that households in the developing world traditionally rely on social networks of extended family, friends and neighbors and other informal institutions to mitigate the effect of the shock as *Ex Post* strategies. They manage to only partially to insure against shocks by engaging in informal credit transactions and transfers. Fafchamps and Lund (2003) in a recent paper also find similar results.

Watts (1983) in his paper concluded that African households are forward looking and their responses are not arbitrary. In his survey he listed the following coping mechanisms in the order of frequency of adoption: storage of food during famine, borrow from kin, temporary migration, sale of livestock, borrow from money lenders, sale of domestic assets, sale of land and finally permanent migration. Cutler (1986) also listed similar coping mechanisms in his study of Beja famine migrants in Sudan.

More recently, in contrast to the African scenario, Morduch (2004) identified several coping strategies for the households in Honduras after Hurricane Mitch. In the presence of missing insurance markets, he found in his study using 1998 data that about 21% of the affected households drastically reduced consumption as a main response to the hurricane. These households were unlikely to draw on insurance, or erode assets, use savings or borrow funds.

It is well known that microcredit plays an important role in the lives of the poor people in Bangladesh. Pitt and Khandkar (1998, 2002) find in their papers that microcredit increases consumption and reduces poverty. It also helps smooth seasonal consumption during the lean periods. Amin, Rai and Topa (2002) find that poor households who participate in microcredit programs in Bangladesh tend to have relatively better access to insurance and other consumption smoothing devices than non-participants. Moreover, Rosenzweig (1988) found that access to financial mechanisms such as credit and remittances enable the household to manage risks and cope better.

Pleitez-Chavez (2004) finds evidence that households that are subject to adverse income shocks, tend to receive more transfers. He also found a positive correlation between the magnitudes of the negative shock and the amount of transfers. Yang and Choi (2007) found that in Philippines sixty percent of the exogenous reductions in income is matched by remittance inflows from abroad. The authors find evidence against the null hypothesis of unchanged consumption expenditures in households with migrant workers but they found strong significant evidence of variability in consumption expenditures in response to income shocks in households without any migrant workers.

The other most prominent coping mechanism adopted by poor households in response to shocks is accumulation or erosion of assets. In many parts of the developing world poor credit-constrained households disproportionately hold unproductive liquid assets as a

precautionary measure. These precautionary reserves take the form of livestock, foreign currency, durable goods, crop inventories, land etc. (Udry 1995; Jalan and Ravallion, 2001; Gomez-Soto, 2007).

Even though the relationship between natural disasters and poverty is extensively studied, there are still some gaps in this literature. There are only a few studies investigating the household coping mechanisms in Bangladesh. Using household level data from a nationally representative survey conducted in 2010 that has a quite rich, separate module on risk and coping strategies it is possible to address these gaps in the literature. Even though it is a small country geographically, Bangladesh is visited by many natural disasters and the atrociousness of loss of lives and properties reaches mammoth scale due to high population density. Thus this study bears important policy relevance. The data-set also contains a whole list of demographic and regional variables, allowing us to research the questions with better accuracy and statistical sophistication. In this paper, we try to address the following questions:

1. When individual households face economic shocks what type or combinations of coping strategies do they adopt?
2. Do they borrow from several Micro Finance Institutes (MFIs)? Or do they borrow from the informal credit market? Or a mixture of both?
3. How big a role do remittances play?
4. Do they desave? That is do they cope by eroding assets/capital?

Most of the papers on Bangladesh focus on a particular coping mechanism, e.g. migration or microcredit. This paper is comprehensive in the sense that it analyzes all possible strategies for almost all types of disasters, combination of all of these. The paper also focuses on the effective role of credit in mitigating the shocks considering the nature and severity of various shocks.

Organization of the paper

A summary of the incidence of income shocks, both exogeneous and endogeneous, by various household demographic characteristics and regional and supply side characteristics is discussed first. A mean level comparison of the various coping strategies is discussed in the following section. A comparison of various coping schemes by income level, various demographic characters, nature and intensity of the natural

disasters etc, is also provided. A regression based analysis is provided next investigating the impact of shocks, followed by a discussion on the choice of coping schemes.

Incidence of Various Crises Faced by the Households:

Table 1: Incidence of any type of shocks

	Total	Occupation of the Household Head	
		Agriculture	Agriculture and Others
Affected Households	44.68 (2,815)	37.62 (1,059)	16.20(456)
Not Affected Households	55.32 (3,485)	32.42 (1,130)	13.49(470)

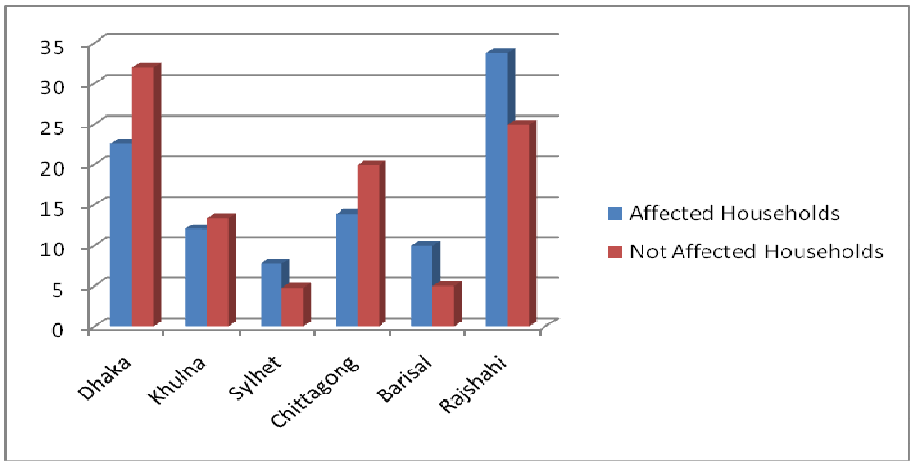
Note: number of observations in the parenthesis.

Table 1 gives the incidence of various disasters faced by the sample households. About 45% of the sample households report that they faced at least one crisis in the time span of last three years. Since weather related shocks affect households that are predominantly dependent on agriculture, we tested if there was a statistical difference between households whose head's sole occupation is agriculture as compared to non-agricultural households. It turns out that within the agricultural households, the incidence is not evenly distributed. Of the households whose head's only income source is agriculture, 37.62 percent of them reported that they suffered from some shock and 32.42 were not affected. A two-sample test of proportion with a z-value of 4.31 indicates that the incidence is significantly different. 16.20 percent of the households that are not solely dependent on agriculture and have an alternative source of income along with agriculture faced some income shock in the last three years and 13.49 percent reported no income shock and the difference is statistically significant. This finding is consistent as the major shocks faced by households are predominantly weather related. The significant share of the affected group also reported loss of crops or livestock and death or illness of adult working members as major shocks faced by them.

Demographic Characteristics of the Affected Households

The geographical spread of the disaster or crisis-struck households is more or less evenly distributed across 6 divisions of Bangladesh except Rajshahi and Dhaka.

Figure 1: Percentage of Affected and Unaffected Households by Division

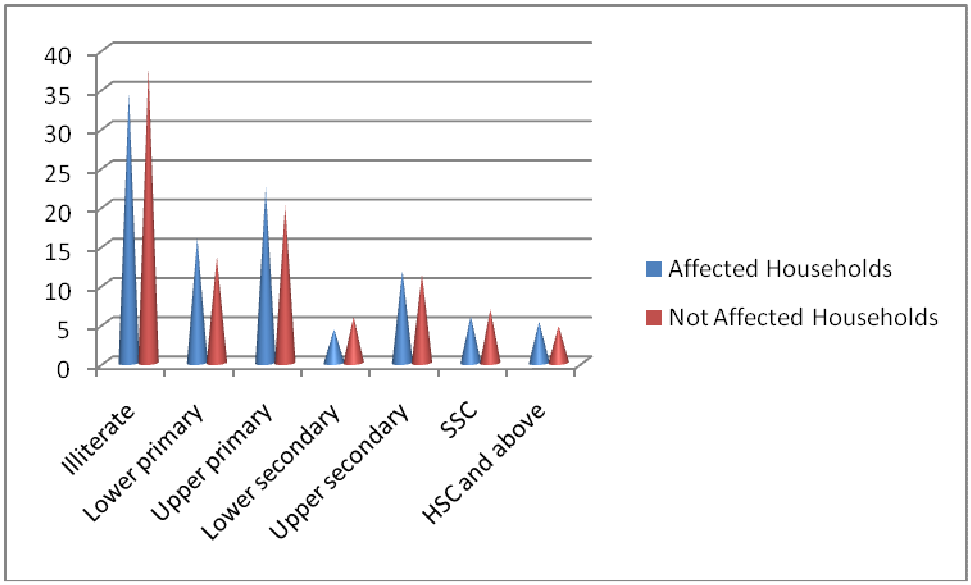


34% and 23% of the affected households are from Rajshahi and Dhaka division respectively.

There are significant differences in the proportions of the affected and not affected households in terms of the human capital stock of these households. The education level of the household head is used as a proxy for the human capital stock of the household.

In about 34 percent of the sample affected households and 38 percent of the unaffected households, the household head is illiterate. Significant share of the sample affected households are run by individuals who have at most primary level of education. About 20% of the household heads have secondary of higher level of education.

Figure 2: Percentage of Affected and Unaffected Households by Education



It is not surprising to find that there is a significant difference in the sample proportions of the affected and not affected households at lower levels of education.

The households are more prone to various types of shocks when the head of the household is illiterate, has at most lower primary or upper primary level of education. The

difference between the affected and unaffected group is statistically significant at 5% level of significance or lower. But when the household head has upper secondary or more education, there are no significant differences between the proportions of the affected and unaffected groups. Households with lower level of human capital relatively face a gamut of shocks than household with higher education levels.

Since education is highly correlated with income and asset holdings, similar analysis was carried out for different income groups and also for diverse asset ownership status to check for consistency in the data. It is observed that in the sample, poorer households face relatively fewer shocks compared to relatively richer households. About 11.51 percent and 12.54 percent of the sample households fall in the income category of poor and moderately poor respectively who were affected by some shock in the past three years. A significant share 64.81 affected households are relatively well off.

Table-2: Percentage of Affected and Unaffected Households by Income and Land Holdings

	Income Level					Land Holding of the Household	
	Extreme poor	Moderate poor	Marginally non-poor	Well off	Landless	Home Stead Only	Agricultural Land
Affected Households	11.51(324)	12.54 (353)	14.14 (398)	61.81 (1,740)	8.42 (237)	34.85 (981)	56.73 (1,597)
Not Affected Households	14.29(498)	14.63 (510)	14.89 (519)	56.18 (1,958)	8.03 (280)	42.47 (1,480)	49.50 (1,725)

Table-3: Percentage of Affected and Unaffected Households by Participation in Credit Programs

Shocks	Microcredit			Formal Loan			Informal Loan		
	No Loan	Only One Loan	Multiple Loans	No Loan	Only One Loan	Multiple Loans	No Loan	Only One Loan	Multiple Loans
Affected Households	50.16 (1,412)	11.30 (318)	38.54 (1,085)	92.79 (2,612)	5.22 (147)	1.99 (56)	46.11 (1,298)	23.87 (672)	30.02 (845)
Not Affected Households	56.41 (1,966)	11.08 (386)	32.51 (1,133)	94.32 (3,287)	3.90 (136)	1.78 (62)	61.46 (2,142)	19.80 (690)	18.74 (653)

Table-4: Percentage of Households Facing Various Natural Shocks in the Last 3 Years

Shocks/Disasters	Affected Households	Participated in Microcredit Programs			Agricultural Households	
		No loan	Only one loan	Has multiples Loans	Only Agriculture	Agriculture and others
Flood	2.16 (136)	51.47 (70)	11.76 (16)	36.76 (50)	44.85 (61)	22.79 (31)
Storm/cyclone/Tornado	5.83 (367)	57.77 (212)	8.72 (32)	33.51 (123)	46.05 (169)	11.99 (44)
Droughts	2.57 (162)	55.56 (90)	6.17 (10)	38.27 (62)	55.56 (90)	21.60 (35)
River Erosion	0.22 (14)	85.71 (12)	0.00 (0)	14.29 (2)	7.14 (1)	28.57 (4)
Loss of Crops	3.41 (215)	55.81 (120)	6.98 (15)	37.21 (80)	60.47 (130)	19.53 (42)
Loss of livestock	17.03 (1,073)	49.30 (529)	12.86 (138)	37.84 (406)	40.07 (430)	16.50 (177)
Loss in Industry	0.29 (18)	38.89 (7)	11.11 (2)	50.00 (9)	27.78 (5)	5.56 (1)
Fire	0.24 (15)	53.33 (8)	26.67 (4)	20.00 (3)	20.00 (3)	33.33 (5)
Death/Illness in Family	23.44 (1,477)	49.49 (731)	11.20 (540)	33.92 (1,636)	34.26 (506)	15.37 (227)
Loss of Jobs, Remittances	0.48 (30)	73.33 (22)	3.33 (1)	23.33 (7)	30.00 (9)	13.33 (4)
Dowry Payment	1.30 (82)	34.15 (28)	12.20 (10)	53.66 (44)	36.59 (30)	21.95 (18)
Others	4.76 (300)	49.00 (147)	12.00 (36)	39.00 (117)	39.33 (118)	17.00 (51)

There is a significant difference in the sample proportions of affected and non-affected households by their income levels. Extreme and moderately poor households report less income shocks and the differences are significant at lower than 5 percent with absolute z-values 3.25 and 2.39 respectively. There is no difference in incidence of shock for marginally poor households. For relatively well off households incidence of shocks are disproportionately higher. This difference between the affected and not-affected households for this income group is significant at 1% with a z-value of 4.51.

A very similar pattern is observed when we study incidence of shocks by land holdings of the households. For the landless group there is no discernable difference in terms of shocks suffered by the sample households. The households that only own homestead face less shocks but the households that own agricultural or other land used for productive purposes report significant loss of income due to shocks. These differences are statistically significant at 1% level of significance. The aggregate mean level data reveal that households that are relatively well off income wise, that have relatively low level of human capital, and have ownership of agricultural land, are more prone to shocks or crises.

In tables 3 it is observed that most of the affected households have multiples loans from microfinance institutes (MFIs) and their participation levels are significantly different compared to non-affected households. They also borrow extensively from informal credit market in the event of any shock or crisis. 30 percent of the affected households borrowed from informal credit markets in last one year where as only 19 percent of the unaffected households availed informal loans. 16.20 percent of the affected households are involved in agriculture and other employment and only 13 percent of the non-affected households diversify occupations. This difference between the two groups is statistically significant at less than 5%. We have split the sample of households that have multiple loans from MFIs by all the exogeneous and endogenous shocks listed in the questionnaire. The exact same trend is visible in the data. Borrowing from multiple MFIs therefore should be a prominent coping tool adopted by households which would be analyzed in the following sections.

Various Exogenous and Endogenous Shocks in Bangladesh

Poor people in Bangladesh struggle to smooth consumption in the face of various income shocks. Acute and chronic illness, loss of productive resources, loss of livestock and

fisheries, floods, droughts and other natural disasters, river erosion, fire, crop failure, death of earning members etc. are some of the causes that affect family's income and consumption negatively.

We see in table 4, about 2.2 percent of the households were affected by floods and very similar percentage of households reported losses due to droughts (2.6). 5.9 percent of the sample households suffered some damage due to storms, cyclones or tornados. A very small number of households reported losses due to fire, or loss in industry or river erosion. Dowry payment as evident in the data is a major income shock for poorer households in event of a daughter's marriage. Because of legal consequences and associated social stigma, people often conceal or deny payment or receipt of any dowry during the marriages. Thus it is not surprising that only 82 of 6300 households report of an income shock while paying dowry in their daughter's marriage.

Since majority of our sample households are in rural areas and are predominantly agricultural households, the data reveals that only a very small, 0.48 percent of the households report any job loss or reduction in foreign remittances. The major shocks that affected most of the households are loss of livestock and death and illness in the family. About 17 percent of the sample households suffered some loss in income due to death of livestock. 23 percent of the households report death or illness of adult earning members of the households.

It is interesting to notice that the households that are affected by various types of shocks are predominantly members of multiple MFIs and have borrowed from them. Also as discussed earlier most of the affected household heads are engaged solely in agriculture.

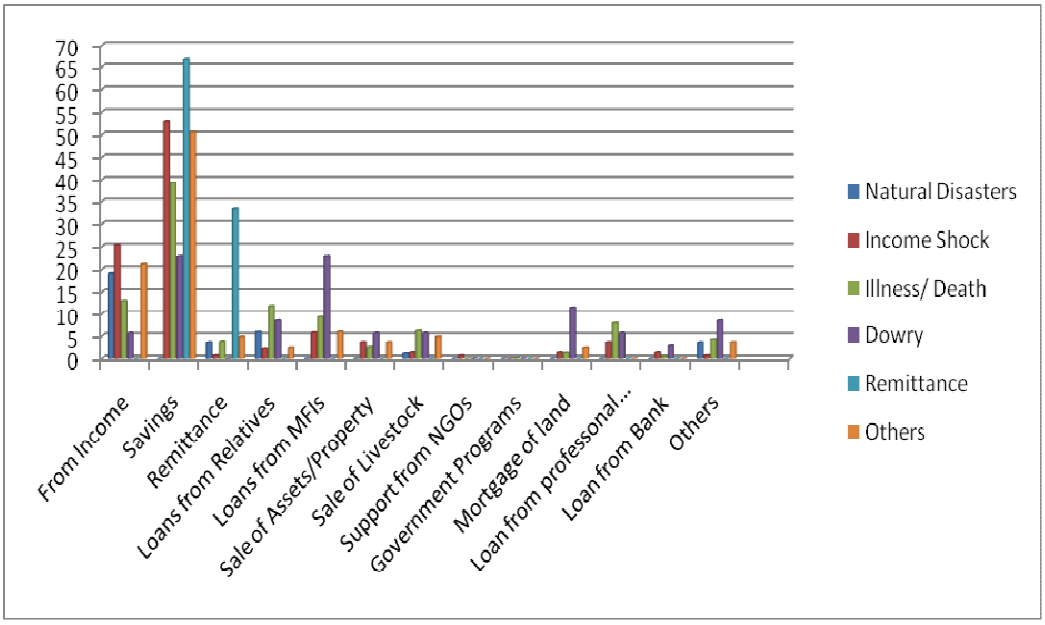
Adopted Coping Strategies

Depending on the severity and the nature of the shocks, households adopt a gamut of different strategies. They might also combine different strategies to guard against transitory and permanent shocks. The questionnaire listed several possible coping strategies (almost exhaustive) and also allowed the respondents to cite/mention other ones not included in the list. The coping methods listed in the questionnaire are: use of savings; financial help from relatives, NGOs, and government; new micro-loan, mortgage or sale of land etc. The literature suggests that informal insurance arrangements,

borrowing from kin, community cooperatives etc may be ineffective for shocks that are common to all members of the informal insurance groups. Households also cope by borrowing from multiple sources, formal and informal credit markets and MFIs. Remittances and sale of assets are also seen as coping mechanisms adopted by households. There is not much known about the simultaneous memberships of various MFIs, or combination of several techniques as coping strategies in Bangladesh.

With this background information in mind, we proceed to identify for each type of disaster or shock or crisis, the most likely coping method adopted by households. The coping strategies might vary by the demographic and socio-economic conditions of the affected households. We delve into that analysis with a view to recommend and formulate appropriate, efficient policies, and to help in identifying the right target groups etc.

Figure 4: Percentage of agricultural Households Using Various Coping Mechanisms for Any Shock



We observe that people who are tied to land, i.e., whose major occupation is agriculture cope by eroding savings to mitigate losses due to an exogenous natural disaster like floods, cyclones, storms and river erosion etc. About 67 percent of the households, facing such scenarios, spend their savings. The other prominent strategies adopted by these agricultural households are loans from relatives, receiving remittances, and using current incomes. Only a very small fraction of households, 1.19 percent to be exact sold their live stock for remedial expenditures.

A very similar pattern is observed in terms of adoption of various coping schemes when agricultural households face any income shock (loss in crop, livestock, industry etc.) or severe illness or death in the family or payment of dowry in the event of a daughter's wedding. But the only difference is that when faced with these particular shocks the household borrows from micro finance institutes along with the other aforementioned strategies. When a daughter is married off, a family is severely budget constrained because of the lumpy expenditures incurred. Dowry constitutes a major part of the expenditure. About 23% of the households borrow from MFIs, 11.43 percent mortgaged their lands and about 6% borrow from informal credit market and sold their livestock to meet this expenditure. Borrowing from MFIs is a major coping strategy when the household needs to make dowry payments and this pattern prevails irrespective of the household's income and land ownership status, occupation and education level of the household head.

We then carry out similar analysis by splitting the sample according to income, land ownership and education and occupation of the households. The same trend as those observed for agricultural households is observed when the data is disaggregated by various socio-economic and demographic characteristics. We tested if there is any statistical difference in the choice of coping strategies between households that are poor or rich, household-head has primary or less education or secondary or more education, household owns productive land or not etc. The results are presented in tables 5 to 8.

In almost all of these scenarios, the role of loans from NGOs, Government programs and loans from formal credit market seem negligible for all types of crises and for all types households irrespective of their socio-economic characteristics. Erosion of savings, use of current income, loans from MFIs and relatives prominently top the list of choices of coping strategies adopted by households.

Table-5: Percentages of Households Using Various Coping Mechanisms for Any Shock

Coping Strategies	Agricultural Household						Non-Agricultural Households					
	Natural Disasters	Income Shock	Illness/ Death	Dowry	Remittance	Others	Natural Disaster	Income	Illness/ Death	Dowry	Remittance	Others
From Income	19.05 (16)	25.36 (35)	13.01 (77)	5.71 (2)	0.00 (0)	21.16 (18)	16.22 (6)	40.54 (45)	17.48 (107)	0.00 (0)	0.00 (0)	7.81 (5)
Savings	66.67 (56)	52.90 (73)	39.19 (232)	22.86 (8)	66.67 (2)	50.60 (42)	51.35 (19)	48.65 (54)	32.68 (200)	27.27 (6)	0.00 (0)	42.19 (27)
Remittance	3.57 (3)	0.72 (1)	3.72 (22)	0.00 (0)	33.33 (1)	4.82 (4)	2.70 (1)	3.60 (4)	12.25 (75)	0.00 (0)	0.00 (0)	6.25 (4)
Loans from Relatives	5.95 (5)	2.17(3)	11.82 (70)	8.57 (3)	0.00(0)	2.41(2)	8.11 (3)	0.00 (0)	10.78 (66)	18.18 (4)	100.00 (1)	12.50 (8)
Loans from MFIs	0.00 (0)	5.80 (8)	9.29 (55)	22.86 (8)	0.00 (0)	6.02 (5)	10.81 (4)	3.60 (4)	8.01 (49)	31.82 (7)	0.00 (0)	18.75 (12)
Sale of Assets/Property	0.00 (0)	3.62 (5)	2.53 (15)	5.71 (2)	0.00 (0)	3.61 (3)	2.70 (1)	0.00 (0)	3.27 (20)	0.00 (0)	0.00 (0)	4.69 (3)
Sale of Livestock	1.19 (1)	1.45 (2)	6.25 (37)	5.71 (2)	0.00 (0)	4.82 (4)	0.00 (0)	0.00 (0)	3.43 (21)	4.55 (1)	0.00 (0)	0.00 (0)
Government Programs	0.00 (0)	0.00 (0)	0.17 (1)	0.00 (0)	0.00 (0)	0.00 (0)	2.70 (1)	0.00 (0)	0.16 (1)	0.00 (0)	0.00 (0)	0.00 (0)
Mortgage of land	0.00 (0)	1.45 (2)	1.35 (8)	11.43 (4)	0.00 (0)	2.41 (2)	0.00 (0)	0.00 (0)	0.16 (1)	9.09 (2)	0.00 (0)	0.00 (0)
Loan from professonal sources,employer and landlord	0.00 (0)	3.62 (5)	7.94 (47)	5.71 (2)	0.00 (0)	0.00 (0)	5.41 (2)	0.90 (1)	6.21 (38)	9.09 (2)	0.00 (0)	3.13 (2)
Loan from Bank	0.00 (0)	1.45 (2)	0.51 (3)	2.86 (1)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.16 (1)	0.00 (0)	0.00 (0)	0.00 (0)
Others	3.57(3)	0.72 (1)	4.22 (25)	8.57 (3)	0.00 (0)	3.61 (3)	0.00 (0)	2.70 (3)	5.39 (33)	0.00 (0)	0.00 (0)	4.69 (0)

Table-6: Percentages of Households Using Various Coping Mechanisms for the Any Shock

Coping Strategies	Rich Households						Poor Households				
	Natural Disaster	Income Shock	Illness/ Death	Dowry	Remittance	Others	Natural Disaster	Income	Illness/ Death	Dowry	Others
From Income	20.00 (19)	30.35 (61)	14.81 (140)	2.22 (1)	0.00 (0)	16.81 (20)	11.54 (3)	39.58 (19)	16.99 (44)	8.43 (1)	10.71 (3)
Savings	58.95 (56)	51.74 (104)	38.41 (363)	31.11 (14)	50.00 (2)	52.10 (62)	73.08 (19)	47.92 (23)	26.64 (69)	0.00 (0)	25.00 (7)
Remittance	4.21 (4)	1.99 (4)	9.42 (89)	0.00 (0)	25.00 (1)	5.88 (7)	0.00 (0)	2.08 (1)	3.09 (8)	0.00 (0)	3.57 (1)
Loans from Relatives	7.37 (7)	1.00 (2)	10.58 (100)	15.56 (7)	25.00 (1)	4.20 (5)	3.85 (1)	2.08(1)	13.90 (36)	0.00 (0)	17.86 (5)
Loans from MFIs	3.16 (3)	5.47 (11)	7.94 (75)	20.00 (9)	0.00 (0)	7.56 (9)	3.85 (1)	2.08 (1)	11.20 (29)	50.00 (6)	28.57 (8)
Sale of Assets/Property	1.05 (1)	2.49 (5)	3.07 (29)	2.22 (1)	0.00 (0)	4.20 (5)	0.00 (0)	0.00 (0)	2.32 (6)	8.33 (1)	3.57 (1)
Sale of Livestock	0.00 (0)	0.50 (1)	4.44 (42)	6.67 (3)	0.00 (0)	2.52 (3)	3.85 (1)	2.08 (1)	6.18 (16)	0.00 (0)	3.57 (1)
Mortgage of land	0.00 (0)	1.00 (2)	0.63 (6)	13.33 (6)	0.00 (0)	1.68 (2)	0.00 (0)	0.00 (0)	1.16 (3)	0.00 (0)	0.00 (0)
Loan from professonal sources,employer and landlord	2.11 (2)	2.49 (5)	5.71 (54)	6.67 (3)	0.00 (0)	0.84 (1)	0.00 (0)	2.08 (1)	11.97 (31)	8.33 (1)	3.57 (1)
Loan from Bank	0.00 (0)	1.00 (2)	0.42 (4)	2.22 (1)	0.00 (0)	0.00 (0)					
Others	2.11 (2)	1.49 (3)	4.34 (41)	0.00 (0)	0.00 (0)	9.80 (5)	3.85 (1)	2.08 (1)	6.56 (17)	25.00 (3)	3.57 (1)

Table-7: Percentages of Households Using Various Coping Mechanisms for Any Shock

Coping Strategies	Household Head has Secondary or More Education						Household Head has Primary or Less Education					
	Natural Disaster	Income Shock	Illness/ Death	Dowry	Remittance	Others	Natural Disaster	Income	Illness/ Death	Dowry	Remittance	Others
From Income	30.23 (13)	34.29 (24)	15.74 (48)	0.00 (0)	0.00 (0)	18.00 (9)	11.54 (9)	31.28 (56)	15.13 (136)	4.00 (2)	0.00 (0)	14.43 (14)
Savings	53.49 (23)	55.71 (39)	46.89 (143)	42.86 (3)	50.00 (1)	50.00 (25)	66.67 (52)	49.16 (88)	32.15 (289)	22.00 (11)	50.00 (1)	43.36 (44)
Remittance	4.65 (2)	2.86 (2)	9.51 (29)	0.00 (0)	0.00 (0)	6.00 (3)	2.56 (2)	1.68 (3)	7.56 (68)	0.00 (0)	50.00 (1)	5.15 (5)
Loans from Relatives	4.65 (2)	0.00 (0)	10.16 (31)	14.29 (1)	50.00 (1)	8.00 (4)	7.69 (6)	1.68 (3)	11.68 (105)	12.00 (6)	0.00 0()	6.19 (6)
Loans from MFIs	4.65 (2)	1.43 (1)	3.93 (12)	0.00 (0)	0.00 (0)	6.00 (3)	2.56 (2)	6.15 (11)	10.23 (92)	30.00 (15)	0.00 (0)	14.43 (14)
Sale of Assets/Property	2.33 (1)	1.43 (1)	1.31(4)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	2.23 (4)	3.45 (31)	4.00 (2)	0.00 (0)	6.19 (6)
Sale of Livestock	0.00 (0)	0.00 (0)	4.59 (14)	0.00 (0)	0.00 (0)	0.00 (0)	1.28 (1)	1.12 (2)	4.89 (44)	6.00 (3)	0.00 (0)	4.12 (4)
Government Programs	0.00 (0)	0.00 (0)	0.33 (1)	0.00 (0)	0.00 (0)	0.00 (0)	1.28 (1)	0.00 (0)	0.11 (1)	0.00 (0)	0.00 (0)	0.00 (0)
Mortgage of land	0.00 (0)	0.00 (0)	0.66 (2)	28.57 (2)	0.00 (0)	2.00 (1)	0.00 (0)	1.12 (2)	0.78 (7)	8.00 (4)	0.00 (0)	71.03 (4)
Loan from professonal sources,employer and landlord	0.00 (0)	1.43 (1)	3.28 (10)	0.00 (0)	0.00 (0)	2.00 (1)	2.56 (2)	2.79 (5)	8.34 (75)	8.00 (4)	0.00 (0)	1.03 (1)
Loan from Bank	0.00 (0)	1.43 (1)	0.98 (3)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.56 (1)	0.11 (1)	2.00 (1)	0.00 (0)	0.00 (0)
Others	0.00 (0)	1.43 (1)	2.62 (8)	14.29 (1)	0.00 (0)	8.00 (4)	3.85 (3)	1.68 (3)	5.56 (50)	4.00 (2)	0.00 (0)	2.06 (2)

Table8: Percentages of Households Using Various Coping Mechanisms for the Any Major Shock

Coping Strategies	Household has No Agricultural Land					Household has Agricultural Land					
	Natural Disaster	Income Shock	Illness/ Death	Dowry	Others	Natural Disaster	Income	Illness/ Death	Dowry	Remittance	Others
From Income	6.25 (3)	35.44 (28)	16.70 (95)	3.70 (1)	12.00 (6)	26.03 (19)	30.59 (52)	14.02 (89)	3.33 (1)	0.00 (0)	17.53 (17)
Savings	66.67 (32)	46.84 (37)	28.47 (162)	11.11 (3)	32.00 (16)	58.90 (43)	52.94 (90)	42.52 (270)	36.67 (11)	50.00 (2)	54.64 (53)
Remittance	6.25 (3)	0.00 (0)	5.27 (35)	0.00 (0)	10.00 (5)	1.37 (1)	2.94 (5)	10.55 (67)	0.00 (0)	25.00 (1)	3.09 (3)
Loans from Relatives	6.25 (3)	1.27 (1)	12.65 (72)	11.11 (3)	14.00 (7)	6.85 (5)	1.18 (2)	10.08 (64)	13.33 (4)	25.00 (1)	3.09 (3)
Loans from MFIs	8.33 (4)	7.59 (6)	12.48 (71)	40.74 (11)	16.00 (8)	0.00 (0)	3.53 (6)	5.20 (33)	13.33 (4)	0.00 (0)	9.28 (9)
Sale of Assets/Property	0.00 (0)	0.00 (0)	87.50 (21)	0.00 (0)	12.50 (3)	1.37 (1)	2.94 (5)	2.20 (14)	6.67 (2)	0.00 (0)	3.09 (3)
Sale of Livestock	0.00 (0)	0.00 (0)	4.57 (26)	7.41 (2)	2.00 (1)	1.37 (1)	1.18 (2)	5.04 (32)	3.33 (1)	0.00 (0)	3.09 (3)
Support from NGOs	0.00 (0)	1.27 (1)	0.00 (0)	0.00 (0)	0.00 (0)						
Government Programs	2.08(1)	0.00 (0)	0.18 (1)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.16 (1)	0.00 (0)	0.00 (0)	0.00 (0)
Mortgage of land	0.00 (0)	1.27 (1)	0.35 (2)	0.00 (0)	0.00 (0)	0.00 (01)	0.59 (1)	1.10 (7)	20.00 (6)	0.00 (0)	2.06 (2)
Loan from professonal sources,employer and landlord	0.00 (0)	2.53 (2)	9.31 (53)	14.81 (4)	4.00 (2)	2.74 (2)	2.35 (4)	5.04 (32)	0.00 (0)	0.00 (0)	0.00 (0)
Loan from Bank	0.00 (0)	0.00 (0)	0.18 (1)	0.00 (0)	0.00 (0)	0.00 (0)	1.18 (2)	0.47 (3)	3.33 (1)	0.00 (0)	0.00 (0)
Others	4.17 (2)	3.80 (3)	6.15 (35)	11.11 (3)	4.00 (2)	1.37 (1)	0.59 (1)	3.62 (23)	0.00 (0)	0.00 (0)	4.12 (4)

Table-9: Extent of Loss from Various Natural Shocks in Last Year

Shocks/Disasters	Agricultural Households			Non-Agricultural Households		
	Loss Amount	Decline in Annual Income	Total Remedial Expenditure	Loss Amount	Decline in Annual Income	Total Remedial Expenditure
Flood	12994	1441	1131	5916	930	289
Storm/cyclone/Tornado	8848	754	989	7289	713	1216
Droughts	7878	1543	3356	7921	553	1229
River Erosion	569600	62460	44000	189556	16311	0
Loss of Crops	12704	564	2456	13673	847	3541
Loss of livestock	4427	1929	900	2175	1300	314
Loss in Industry	112143	47571	7143	27850	31333	1250
Fire	12875	6250	3875	20429	0	3286
Death/Illness in Family	12491	1580	10060	16240	1710	14014
Loss of Jobs, Remittances	32042	12923	9992	265	42559	706
Dowry Payment	37708	875	28638	35959	2141	32147
Others	2756	213	1033	4343	1098	990

Average Loss Amount

We compared the average loss amount between agricultural and non-agricultural households in the wake of various kinds of shocks. These households suffer significant loses due to river erosion, loss in industry and making dowry payments. The average size of the loss amounts to TK 5,69,600 for an agricultural households and TK 1,89,556 for a non agricultural households and the difference is highly significant. Dowry payments on an average lead to a loss of TK 37,708 for agricultural households and TK 35,959 for non-agricultural households. Both types of households on an average lose similar amounts of money when there is a death or incapacitating illness of a family member. Loss due to floods is significantly higher in agricultural households with an average amount of TK 12,994. Non-agricultural households lose TK 5916 on an average. There is no discernable difference in the mean amount of loss incurred by both types of households when they face other natural disasters as cyclones, storms and droughts or crop failure.

Even though the descriptive statistics gives us some indication of the coping behaviour of the households, it may be misleading as various forces can confound the actual behavioural pattern. We try to precisely estimate the crisis coping behaviour of households through regression analysis when they incur some income shocks.

Regression Analysis

The households that are prone to various kinds of income shocks adopt a gamut of different strategies. Depending on the location, availability, severity and the nature of the shocks, these strategies vary. They might also combine different strategies to guard against transitory and permanent shocks. Our questionnaire listed an almost exhaustive range of coping strategies. The methods listed in the questionnaire are: use of savings; income; remittance, sale of properties, financial help from relatives, NGOs, and government; micro-loan, mortgage or sale of land etc. A total of 27 coping schemes are listed. Also an option is given to the respondents to cite/mention other ones not included in the list. There is not much known about the possibility of use of simultaneous memberships of various MFIs, or combination of several schemes.

With this background information in mind, we proceed to identify –

First, likelihood of adoption of a particular strategy if the household suffers from some shock.

Second, we want to investigate if the frequency of shocks matter. We compare the likelihood of choices if the household faces only one shock or two more shocks in the last year.

Third, for each type of disaster or shock or crisis, we identify the most likely coping method adopted by households. The coping strategies might vary by the regional, demographic and socio-economic conditions of the affected households. We delve into this analysis with a view to recommend and formulate appropriate, efficient policies, and to help in identifying the right target groups etc.

In order to examine more rigorously the impact of natural disasters on consumption expenditure, income and savings, we specify an empirical model which permits tests of hypotheses concerning the type and severity of shocks, availability of microcredit, erosion of savings and assets, migration of family members etc.

We basically interested in the following

What are the most likely strategies adopted by households depending the nature and intensity of the shocks?

Whether having access to finance enabled the households to cope better in the event of an income shock?

To assess the likelihood of various choice strategies adopted by households based on the observed characteristics of the households and the nature of the income shocks, we would adopt both bi-variate probit and multinomial conditional logit model for our estimation.

In our data 28 coping strategies are listed. The multinomial logit response probabilities of various coping strategies would be given by

$$P(y = j \mid x) = \exp(x\beta_j) / [1 + \sum_{h=1}^{j} \exp(x\beta_h)]$$

Where x is the vector of choice variables. The coping strategies, a random variable y takes on values, *J=1,…,28.*

It is important that relative probabilities for the alternative coping strategies depend only on the attributes of those strategies only, i.e., relatives odds between two alternatives pass the Independence from Irrelevant Alternatives (IIA) assumption. Given that individuals may simultaneously choose several of the coping strategies at one point in time, it is clear that the response probabilities will not pass IIA test.

In order to tackle this problem we perform factor analysis. This process will identify common coping capability of the households and reduce the number of 28 variables to a smaller number according common covariates. And these grouped variables are mostly independent of each other. This is crucial for the IIA assumption.

Factor analysis basically is a statistical technique which explains a set of observed variables in terms of a smaller number of latent variables called factors. These latent factors are assumed to account for the correlations among observed variables. Thus the common covariate of all these coping variables would capture the latent coping capability of the affected households. We do not assume at the outset the number of factors that would overwhelmingly explain the entire common covariance matrix of these 28 variables. On the contrary, we let the data determine the number of factors to be retained and try to interpret them according to the factor loadings of the variables[1]. The following tables and figures show the results of the factor analysis in a nutshell.

```
Factor analysis/correlation                       Number of obs    =      6300
    Method: maximum likelihood                    Retained factors =         4
    Rotation: (unrotated)                         Number of params =        74
                                                  Schwarz's BIC    =    783.48
    Log likelihood = -68.05274                    (Akaike's) AIC   =   284.105
     ------------------------------------------------------------------------------
         Factor  |   Eigenvalue   Difference        Proportion   Cumulative
    -------------+----------------------------------------------------------------
        Factor1  |      1.96723      0.89766           0.3853       0.3853
        Factor2  |      1.06957      0.02778           0.2095       0.5948
        Factor3  |      1.04179      0.01448           0.2040       0.7988
        Factor4  |      1.02731            .           0.2012       1.0000
    ------------------------------------------------------------------------------
    LR test: independent vs. saturated: chi2(190) = 2.0e+04 Prob>chi2 = 0.0000
```

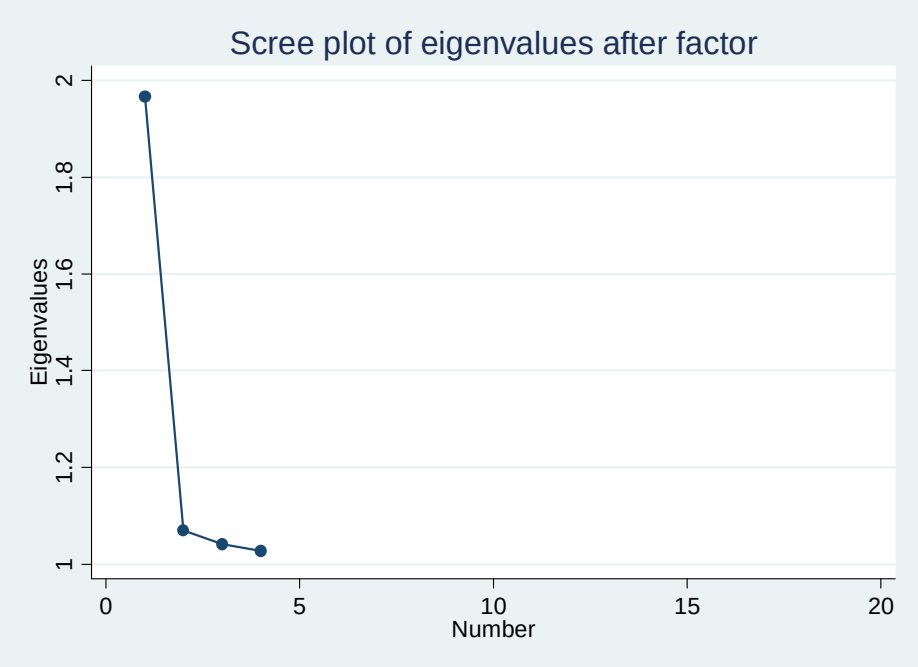
[1] We use factor analysis instead of principle component analysis as the latter imposes the restriction that all the components completely explain the correlation structure among the variables. Factor analysis, accounts for the covariance of these variables in terms of a much smaller number of common covariates (factors). Factor analysis does not force the common factors to explain the entire covariance matrix. That is it allows the individual-variable specific influences to explain the remaining variances.

LR test: 4 factors vs. saturated: chi2(116) = 135.89 Prob>chi2 = 0.1001

Factor loadings (pattern matrix) and unique variances

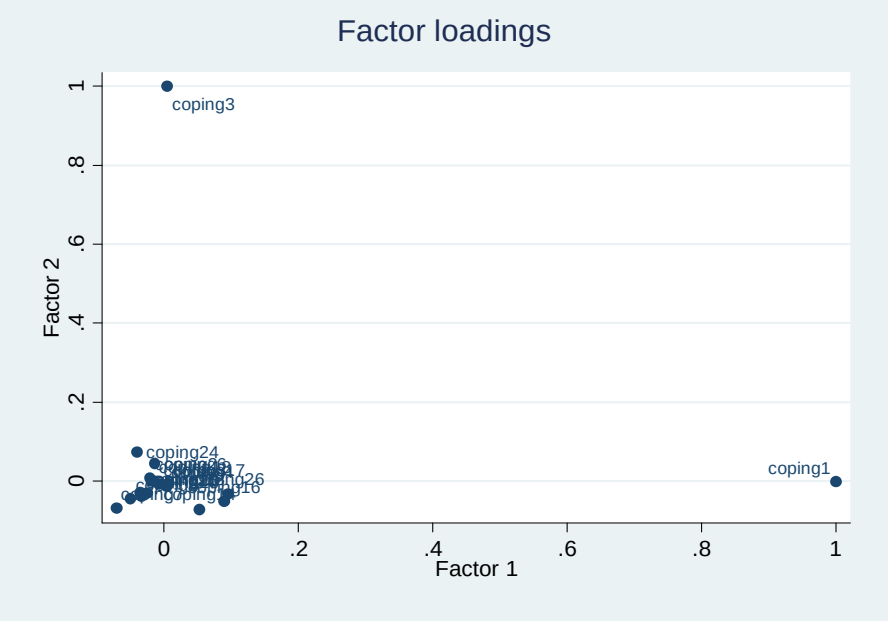
Variable	Factor1	Factor2	Factor3	Factor4	Uniqueness
coping1	-0.0775	**0.9970**	0.0027	-0.0005	0.0000
coping2	-0.0439	0.0674	0.0023	-0.0111	0.9934
coping3	-0.0855	-0.0281	**0.9952**	0.0388	0.0000
coping4	-0.0028	0.0051	-0.0147	-0.0014	0.9997
coping5	-0.0158	-0.0722	-0.0874	-0.0077	0.9868
coping6	-0.0178	-0.0726	0.1506	0.0034	0.9717
coping7	-0.0062	-0.0206	-0.0280	-0.0028	0.9987
coping8	-0.0015	-0.0070	-0.0088	-0.0008	0.9999
coping9	-0.0155	-0.0708	-0.0883	-0.0077	0.9869
coping13	**0.9750**	0.0109	0.0002	-0.0002	0.0492
coping14	-0.0089	-0.0015	-0.0380	-0.0040	0.9985
coping15	**0.9900**	0.0079	0.0009	0.0001	0.0000
coping16	-0.0049	0.0090	-0.0308	0.1337	0.9811
coping17	-0.0040	0.0078	-0.0486	**0.9988**	0.0000
coping18	-0.0031	-0.0141	-0.0038	-0.0009	0.9998
coping20	-0.0063	-0.0131	-0.0181	0.1000	0.9895
coping23	-0.0015	-0.0070	-0.0088	-0.0008	0.9999
coping24	-0.0049	-0.0223	-0.0104	-0.0016	0.9994
coping26	-0.0178	0.2301	-0.0795	-0.0097	0.9403
coping28	-0.0044	-0.0093	-0.0245	-0.0022	0.9993

Figure 9: Scree Plot After Factor Analysis



Both the Kaiser-Guttman (only the eigenvalues that are greater than one) and Scree plot[2] (the curve levels off after the eigenvalue) suggest that we consider only 4 factors.

Figure 10: Factor Loadings after Factor Analysis



The factor-loading graph indicates that the variables coping1 and coping3 are distinctly different and the rest of the 26 variables co-vary closely. But the factor loading table above indicates that coping13 and coping 15 loads factor 1 heavily and coping17 loads factor 4 heavily. These four factors are distinct from each other and the rest 23 coping variables. We group rest of the variables as one strategy. The first mechanism is no action taken as suggested by factor 2 in factor loading table. We list coping through eroding savings as another mechanism as evident from factor 3. Loan from MFIs and formal banks are grouped to form our third mechanism as suggested by factor 1. Mortgage of permanent asset forms the 4th choice. Thus our dependent variable would take j=4 values with “no action taken” as base. Since the data on its own through factor analysis reflects that these four mechanisms are independent of each other, the IIA assumption would not be violated.

Estimating Equation:

The model of coping scheme choice is given by:

[2] See appendix for the Scree plots for factor analysis.

$$prob(Y_i = j) = \frac{e^{\beta_j' x_j'}}{\sum e^{\beta_j' x_j}}, j = 0,1,..4$$

J takes 5 values in one model where we investigate the relative likelihood of adoption In case of probit models, J takes only one value. X represents the vector of control variables. We discuss the included controls and variables of interest in the following section.

Comparative Likelihood of Adoption of Various Strategies

First we try to analyse the likelihood of adoption of the 4 strategies compared to 'no action taken' depending on the type of shocks or the intensity of shocks by running multinomial logit models. The coefficients, even though difficult to interpret, provide us with the direction of the likelihood and relative strength of each choice. The four coping options are coping through eroding savings, borrowing from MFIs and formal banks, mortgage of permanent assets and all of the others listed in the questionnaire. The base is no action taken.

In addition to the standard household level demographic control variables like family size, region of residence, age and gender of the household head, some important household level and supply side variables namely, education, electricity coverage, duration of MFI membership, distance from Union Parishad etc. are included in our regression analysis. Among the household level characteristics, household head's education level plays an important role in the choice of coping strategies. Higher education implies access to information about potential income shocks and available coping strategies. The household is able to make better informed decisions regarding ex-ante and ex-post coping strategies when faced with income shocks. A relatively poor household's marginal disutility from income loss is much higher than a wealthier household. Household's permanent income level would affect the choice of coping mechanisms. Education of household head and the electricity coverage are used as proxies for household level permanent income. We also included a binary indicator whether the household is poor or not. An individual having a longer term relationship with a MFI would have more information and more faith on the activities of the MFIs. It also reflects larger loan sizes which enable the household to access bigger sums of money and confirms the bankability of the client. Duration of MFI membership is included to capture this effect. Rural areas are characterized by a high

degree of economics fragmentation. Long distances, difficult geography, lack of paved roads, lack of public transportation make accessibility to markets difficult and expensive. We control for district fixed effects and the distance from Union Parishad from the village, electricity coverage to capture the importance of regional and infrastructural facilities in the choices of coping strategies.

The choice variables of interest are

1. A binary indicator whether the household suffered any shock last year (model 1)
2. To capture the intensity of shocks, we include two binary variables “only one shock” and “two or more shocks last year” with no shocks as the control (model 2)
3. Coping behaviour vary by the types of shocks faced. We include binary indicators of five types of shocks, e.g. natural, income loss or death in the family etc.

Thus, model 2 studies the intensity and model 3 investigates the types of shocks and their influence on households’ choice of shock mitigating schemes.

Table 10 gives the multinomial regression results for the relative adoption of strategies. The first column lists the three models. Only the variables of interest from each regression are reported. The first variable is ‘shocks’ which is a dummy indicating if the household faced any shock last year coming the model 1. The second panel portrays regression results of model two. The variables of interest are binary indicating, if the household just faced one shock or it suffered two or more shocks last year. The third panel reports regression results of model 3. Shockcat1 represents natural disasters, shockcat2 is income loss from agriculture, business or self-employment, shockcat3 indicates death or illness of a family member, shockcat4 is dowry payments, shockcat5 is reduction in remittances. The final category is all the other shocks and is treated as the control category.

Under full sample, the four columns represented by 1, 2 3 and 4 are the coping options that came from factor analysis. The dependent variable mcope takes on value 0 when no action is taken by the household. It takes the value 1 when the household erodes savings, it takes the value 2 when the household mortgages permanent assets. It takes the value 3 when the household borrows from MFIs or formal banks. Finally it takes the value 4 for all the other possible strategies listed in the questionnaire.

We find that relative to no action taken, the household is positively likely to borrow from MFIs and formal institutions in the event of any shock. This is highly significant at 1 percent or less. But relative to no action taken the household is significantly unlikely to mortgage assets or adopt the “others” coping scheme.

In the second panel we see that the number of shocks faced in the last one year significantly affects the likelihood of choice of the three of the four coping methods. The log-odds of the choices to base outcome are statistically significant for the options mortgaging assets, borrowing from MFIs and formal banks and the group of others in case of both binary variables ‘only one shock’ and ‘two or more shocks’. The log odds are positive for borrowing credit but negative for mortgage and other available options for only one shock faced by the households. But when frequency of shocks increases, the households are subject to two or more shocks, the log odds become positive for borrowing.

In panel 3, we see that the log odds of adopting any of the coping schemes is negative if the households are affected by natural disasters compared to the base. The log odds are positive for borrowing and ‘others’ strategies. Also they are significant and positive if there is an income shock. It is interesting to note that only in case of death and injury of adult working member in the family, the household is significantly likely to adopt all possible options available to them. In case of an income shock arising because of dowry payments, makes it more likely that the household would significantly erode savings. This pattern is not observed for any other type of disasters faced by the households.

To test the consistency of the results we split the sample according to the occupation of the head of the household. For the households where the head’s occupation is mainly agriculture, any income shock through natural disasters, makes it more likely for these households to borrow from MFIs or formal banks to mitigate the shock as the log odds compared to the base are positive. Any health injury or death in the family prompts the household to adopt all 4 of the strategies compared to the base in case of both agricultural and non-agricultural households.

Likelihood of Adoption of Financial Instruments

In order to identify how the households avail the financial instruments in case of different types of disasters, we run several probit models where the dependent variable is a binary indicator of borrowing from MFIs, formal bank sources, erosion of assets and savings. The results are presented in tables 11 to 25. We focus on these variables as the mean level analysis indicates the significance of these variables. The multinomial regression analysis also shows that erosion of savings is more likely relative to other options only in case of death and injury of a family member. Erosive strategies are not significant in cases of other income shocks affecting the households. In the multinomial regressions, the relative comparisons of choices were analyzed but we also wanted to know individual likelihood of adoption of various financial instruments for policy reasons. As factor analysis indicated particular grouping of the data, this type of analysis was not possible in the multinomial framework because of the IIA assumption.

First we investigate the likelihood of eroding any types of assets to mitigate the shocks. Again, the first model shows the effect of any type of shocks faced last year. The second model analyzes the impact of the intensity of the shocks and the third model looks the probability of adoption of this scheme by the nature of the shocks. In table 11 the marginal effects and the standard errors are provided for all the three models. We find that the probability of eroding assets is 0.043 when a household encounters any type of shock and it is highly significant. In column four, the likelihood of eroding assets when the households face only one shock and two or more shocks is 0.032 and 0.026 respectively. These probabilities are also statistically highly significant at 1%. The probability for eroding any assets is bigger (0.03) when the households face an income shock compared to natural disasters (0.01). Since agricultural households are at the vagaries of uncertainty from natural and other disasters, we split our sample into two groups based on the occupation of the household head. In table 12, where household head is engaged in agriculture only, we find exactly same pattern in the marginal effects. Positive and significant probabilities are associated with erosion of assets irrespective the specification of the three models. The same is observed for non-agricultural households except that agricultural households are more likely to adopt this strategy when they face two or more shocks compared to one (the probability of the former is 0.02 compared to 0.007 of the later). But this is opposite for non-agricultural households. All these marginal effects are highly significant. Since agricultural households are more prone to shocks, they erode

assets gradually with increased intensity of shocks. These households would have difficulty to replenish their assets and unwilling to erode them at lesser degrees of severity of shocks. Non-agricultural households on the other hand, probably have access to alternatives sources of funds and this pattern of behaviour is not observed for them. Similar findings were observed in literature too. Death or illness in the family also positively and significantly increases the likelihood of eroding assets for non-agricultural and poorer households as these families relatively rely more on wage income of household members. A very similar behavioural trend is documented when the sample is split based on the income status of the households.

In tables 14-16 we investigate the probabilities of erosion of savings in the wake of different types and intensity of shocks. Literature and our own analysis in the previous section highlight the important role played savings in mitigating the after effects of shocks. The households are significantly more likely to erode savings when the intensity of the shocks rises. The probability of using up savings is almost 3 times higher when the households face two or more shocks. The probability of withdrawal of savings is almost twice as high for dowry payments compared to natural disasters. Almost all the models indicate that savings is a dominant mode of coping and the likelihood of adoption of this means varies significantly with the nature and intensity of shocks.

Splitting the sample according to the income status or the occupation of the household head generates very similar trends in the estimated probabilities. The dependency on savings to cope with shocks is positively and incrementally associated with the degree of intensity of the shocks for both agricultural and non-agricultural households. Dowry payments pose as a severe income shock to the households. The estimated probabilities of erosion of savings for dowry payment are quite high ranging from 0.201 to 0.412 for various types of households.

Table 17 depicts the marginal effects from the probit model estimating the likelihood of borrowing from MFIs to cope with shocks. It is interesting to note that the households are unlikely to borrow from MFIs to cope with any shocks except for dowry payments. The probability of borrowing from MFIs for dowry payment is significant and quite high with a magnitude is 0.377. Even though in full sample the households are unlikely to borrow from the MFIs but when we split the sample according to the occupation status of the household head, we find an interesting picture. Agricultural households that are mostly

located in rural or less developed areas are likely to borrow from MFIs with a positive and significant probability of 0.09 in case of any shocks faced. MFI loans are used to mitigate the income shocks for these households irrespective of the number of shocks faced. These agricultural households borrow with a positive and significant probability of 0.481 in the event of dowry payments. But we observe a very distinct and dissimilar pattern for the non-agricultural households. These households are unlikely to borrow in the event of any shock. These marginal effects are significant 5% or lower. The only scenario where non-agricultural households consider MFI loans, is dowry payment. The probability of borrowing in this event is 0.406 which is significant at 1% level of significance. The reason for such different behavioural pattern between agricultural and non-agricultural households mostly stems from the availability and access of alternative sources of funds. Household heads that do not report agricultural as their chief occupation, most probably work in the formal or informal labor markets and may have access to alternative sources like formal or informal lending. Poorer non-agricultural households are less likely to borrow from MFIs too irrespective of model specification. Table 19 corroborates these findings. Rich households are less likely to avail MFI loans for any shocks except for income shocks and dowry payments. Relatively they have access to more alternative sources of funds and probably avail other mechanisms to cope with shocks. Poorer households borrow more from MFIs but the striking result is the estimated probability of 0.472 of borrowing in case if dowry payments. The corresponding number for rich households is 0.414. Both probabilities are highly significant. Dowry payments thus pose a shock that makes the households vulnerable enough to avail almost any coping scheme, that is use any possible source of credit.

In our next set of tables 20-22, we delve into the estimation of probabilities of borrowing from an informal source in the event of any shocks faced by the households. The process of borrowing from informal sector is relatively less complex and efficient in terms of timely disbursements of funds. It is not surprising to find that irrespective of types, nature, intensity of shocks, households have positive and significant likelihood of borrowing from informal sources. This pattern is consistently and strongly found in all specifications and models and for all types of households, agricultural, non-agricultural, rich or poor. Irrespective of usual high interest rates, the convenience of quick and less complicated borrowing process makes informal credit a lucrative option in the event of any shock.

Next we investigate the likelihood of borrowing from formal banks and the marginal effects from the probit equations are presented in tables 23-25. It is seen that if a household is affected by any shock in the last year, it has a significant probability of 0.021 of borrowing from the formal credit market. If the household faces two or more shocks, it has a significant probability of 0.045 of availing formal credit. In case of only one shock the probability of borrowing is insignificant. In case of illness and death in family and natural disasters, the formal credit is a effective source for coping. Very similar but stronger results are seen when sample is split according to income and occupation. Irrespective of model and specification the positive and highly significant marginal effects indicate strong association between formal credit and shock management.

There is an increased influx of remittances if the household suffers from two or more shocks. There is a significant association between remittance inflow and natural disasters controlling for household demographic, income and region fixed effects.

To summarize the marginal effects of the probit coefficients from the set of tables 11-25, indicate that households have a strong preference for informal credit. And these probabilities are higher in case of less affluent households. When the households face two or more shocks and there is a death and illness in the family the household is more likely to borrow from formal banks and informal sources in almost all scenarios.

We find that households are less likely to borrow from MFIs if it is subject to any type of shocks. Also when the household needs to make a dowry payment or there is an income shock or death and illness in the family, it is more likely to borrow from formal or informal sector. For making dowry payments, households adopt all of the sources significantly. . Micro-credit appears as one of the major instrument choice in coping against any shock for agricultural households who have less access to alternative sources of credit.

Table 10: Mechanisms of coping

	Full sample				Agri cultural				Non-agricultural			
	1	2	3	4	1	2	3	4	1	2	3	4
Affected by shock or not	.30	-88	4.51	-24.1	.81	-.52	9.8	-23.9	-.27	-17.2	460.8	-24.7
	.58	10795***	8891***	.55***	.82	23591***	5144.2	.74***	428.5	414.4	1.5***	414.4
Affected by one shock	.12	-.23	.10	-23.5	1.7	-.60	379.1	-22.6	3.70	-6.3	47.6	-3.01
	.12	11946***	12922***	.55***	.18***	18376.9***	2636.3	.74***	3.8	-3.7*	226.5	3.1
Affected by two or more shock	-.21	1.3	5.1	-23.7	1.3	.38	759.2	-23.2	1.6	-4.3	209.2	-6.5
	__	11946***	12922***	.57***	__	18376.9***	__	.76***	5.1	6.08	1001.7	4.3
Natural	-1.3	-4.5	-4.9	-1.6	-0.36	-0.5	-3.2	-1.6	-9.5	-6.9	.93	-5.8
	0.24***	__	1.6**	.24***	0.20*	0.54	0.51***	0.19***	0.89***	8.6	1.9	.83***
Income	-4.5	-2.9	2.1	-5.7	12.2	-3.0	0.88	-2.6	-2.06	-2.4	-1.5	-8.7
	.21***	1.0**	0.9**	0.21***	0.14***	0.27***	0.32**	0.14***	0.78***	1.4	1.4	.80***
Illness/Death	1.65	3.3	26.6	-1.07	1.4	-2.5	2.67	0.15	6.40.75***	4.4	4.9	-3.3.
	0.23***	1.16**	12366*	-2.3***	0.19***	0.35***	0.47***	0.18	1.4	1.8**	2.6*	72***
Dowry	3.5	-41.5	-38.7	-2.9	0.33	0.35	1.83	-1.12	1.4	-4.2	-1.06	-9.6
	0.80***	__	__	87**	1.18	2.22	2.12	1.07	2.8	9.5	4.4	1.5***

Table 11: Marginal Effects from Probit Estimates Measuring the Likelihood of Erosion of Any Asset due to Shocks

Dep Var: Erosion of Assets	**Model 1_mfx**		**Model2_mfx**		**Model3_mfx**	
	Coef	**se**	**Coef**	**Se**	**Coef**	**Se**
Poor/Non-poor households	-0.075***	0.010	-0.074***	0.010	-0.070***	0.010
Electricity	-0.001	0.004	-0.001	0.004	-0.001	0.003
Distance from Union parishad	0.005***	0.002	0.004***	0.002	0.003*	0.001
Duraton of Microcredit(years)	0.004***	0.001	0.004***	0.001	0.003***	0.001
Gender of householdhead	-0.042***	0.006	-0.041***	0.006	-0.033***	0.005
Householdhead education	-0.001**	0.000	-0.001**	0.000	-0.000**	0.000
Household size(member type1)	0.015***	0.002	0.016***	0.002	0.014***	0.002
Age of Household head	0.001***	0.000	0.001***	0.000	0.000***	0.000
Affected hh or Not affected hh	0.043***	0.006				
Only 1 shock			0.032***	0.004		
2 or more shocks			0.026***	0.004		
Natural Disasters					0.014***	0.003
Income shock					0.039***	0.004
Illness/Death					0.003	0.003

note: *** p<0.01, ** p<0.05, * p<0.1, Regressions control for District FE.

Table 12: Marginal Effects from Probit Estimates Measuring the Likelihood of Erosion of Any Asset due to Shocks by Occupation of the Household Head

Dep Var Erosion of any asset	**Model 1_mfx**		**Model2_mfx**		**Model3_mfx**		**Model 1_mfx**		**Model2_mfx**		**Model3_mfx**	
	Occupation of Household head: Agri culture						**Occupation of Household head: Non-Agri culture**					
	Coef	**Se**	**coef**	**Se**	**Coef**	**se**	**Coef**	**Se**	**Coef**	**Se**	**Coef**	**Se**
Poor/Non-poor households	-0.042***	0.010	-0.031***	0.009	-0.038***	0.011	-0.110***	0.020	-0.084***	0.017	-0.116***	0.020
Electricity	0.002	0.003	0.001	0.002	0.002	0.002	-0.024**	0.010	-0.022**	0.009	-0.016*	0.010
Distance from Union parishad	0.003**	0.001	0.003**	0.001	0.004***	0.001	-0.003	0.003	-0.006**	0.003	-0.006	0.003
Duraton of Microcredit(years)	0.001***	0.000	0.001**	0.000	0.000	0.000	0.007***	0.001	0.006***	0.001	0.006***	0.001
Gender of householdhead	-0.016***	0.006	-0.006	0.004	-0.012**	0.006	-0.070***	0.010	-0.049***	0.010	-0.061***	0.010
Householdhead education	-0.001***	0.000	-0.000**	0.000	-0.000**	0.000	0.001	0.001	0.000	0.000	0.001*	0.001
Household size(member type1)	0.008***	0.002	0.006***	0.002	0.008***	0.002	0.019***	0.003	0.020***	0.003	0.019***	0.003
Age of Household head	0.000	0.000	0.000	0.000	0.000	0.000	0.001***	0.000	0.001***	0.000	0.001***	0.000
Affected hh or Not affected hh	0.026***	0.006					0.063***	0.010				
Only 1 shock			0.007***	0.003					0.062***	0.007		
2 or more shocks			0.020***	0.004					0.015**	0.006		
Natural Disasters											-0.021	0.018
Income shock					0.029***	0.006					0.050***	0.007
Illness/Death					0.003	0.002					0.015*	0.008

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 13: Marginal Effects from Probit Estimates Measuring the Likelihood of Erosion of Any Asset due to Shocks by the Income Status of the Households

Dep var: Erosion of any asset	**Model 1_mfx**		**Model2_mfx**		**Model3_mfx**		**Model 1_mfx**		**Model2_mfx**		**Model3_mfx**	
	Non Poor households						**Poor Households**					
	Coef	**Se**	**coef**	**Se**	**Coef**	**se**	**coef**	**Se**	**coef**	**Se**	**Coef**	**Se**
Electricity	-0.004	0.003	-0.009*	0.005	-0.002	0.001	0.019	0.014	0.018**	0.007	0.016	0.014
Distance from Union parishad	-0.001	0.001	0.003	0.002	0.000	0.001	0.024***	0.006	0.010**	0.004	0.024***	0.007
Duraton of Microcredit(years)	0.003***	0.001	0.005***	0.001	0.001***	0.000	0.006***	0.002	0.003**	0.001	0.004**	0.002
Gender of householdhead	-0.007*	0.004	-0.005	0.008	-0.002	0.002	-0.118***	0.019	-0.049***	0.014	-0.113***	0.020
Householdhead education	-0.000	0.000	0.000	0.000	0.000	0.000	-0.002**	0.001	-0.002***	0.000	-0.001**	0.001
Household size(member type1)	0.008***	0.002	0.015***	0.003	0.004***	0.001	0.038***	0.006	0.030***	0.005	0.038***	0.007
Age of Household head	-0.000***	0.000	-0.001***	0.000	-0.000**	0.000	0.004***	0.000	0.003***	0.000	0.003***	0.000
Affected hh or Not affected hh	0.023***	0.005					0.084***	0.015				
Only 1 shock			0.012**	0.005					0.076***	0.011		
2 or more shocks									-0.001	0.010		
Natural Disasters					0.009***	0.003					-0.337**	0.136
Income shock					0.016***	0.003					0.073***	0.013
Illness/Death					-0.000	0.001					0.020*	0.012

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 14: Marginal Effects from Probit Estimates Measuring the Likelihood of Erosion of Savings due to Shocks

Dep var: Erosion of Savings	**Model 1_mfx**		**Model2_mfx**		**Model3_mfx**	
	coef	**se**	**coef**	**Se**	**coef**	**Se**
Poor/Non-poor households	-0.139***	0.016	-0.144***	0.016	-0.160***	0.016
Electricity	0.018	0.013	0.013	0.014	0.006	0.014
Distance from Union parishad	0.016***	0.005	0.020***	0.006	0.020***	0.006
Duraton of Microcredit(years)	0.012***	0.002	0.012***	0.002	0.011***	0.002
Gender of householdhead	-0.124***	0.021	-0.131***	0.021	-0.111***	0.021
Householdhead education	0.000	0.001	0.000	0.001	0.000	0.001
Household size(member type1)	0.027***	0.004	0.026***	0.005	0.030***	0.005
Age of Household head	0.002***	0.000	0.002***	0.000	0.001***	0.000
Affected hh or Not affected hh	0.072***	0.014				
one_s			0.036**	0.015		
t_m_s			0.117***	0.015		
Natural Disasters					0.115***	0.018
Income shock					0.035**	0.014
Illness/Death					-0.006	0.014
Dowry					0.298***	0.014

note: *** p<0.01, ** p<0.05, * p<0.1

Table 15: Marginal Effects from Probit Estimates Measuring the Likelihood of Eroding Savings as a Coping Strategy in case of Shocks

D. Var: Erosion of Savings	**Household Head's Occupation: Agriculture**						**Household Head's Occupation: Non-Agriculture**					
	Model1_mfx		**Model 2_mfx**		**Model 3_mfx**		**Model 1_mfx**		**Model 2_mfx**		**Model 3_mfx**	
	Coef	**se**	**coef**	**Se**	**coef**	**se**	**coef**	**se**	**coef**	**Se**	**Coef**	**Se**
Poor/Non-poor households	-0.092***	0.022	-0.090***	0.022	-0.092***	0.022	-0.163***	0.025	-0.175***	0.025	-0.193***	0.026
Electricity	0.004	0.018	-0.003	0.018	-0.011	0.018	0.037*	0.022	0.033	0.022	0.027	0.022
Distance from Union parishad	0.019**	0.008	0.024***	0.008	0.029***	0.008	0.001	0.009	0.006	0.009	0.001	0.009
Duraton of Microcredit(years)	0.009***	0.002	0.008***	0.002	0.006***	0.002	0.018***	0.003	0.018***	0.003	0.017***	0.003
Gender of householdhead	-0.091**	0.036	-0.081**	0.035	-0.041	0.036	-0.205***	0.029	-0.216***	0.029	-0.192***	0.029
Householdhead education	0.005***	0.001	0.005***	0.001	0.007***	0.001	-0.007***	0.001	-0.007***	0.001	-0.008***	0.001
Household size(member type1)	0.026***	0.006	0.022***	0.006	0.029***	0.006	0.018**	0.008	0.016**	0.008	0.019**	0.008
Age of Household head	0.000	0.001	0.000	0.001	-0.000	0.001	0.005***	0.001	0.005***	0.001	0.005***	0.001
Affected hh or Not affected hh	0.089***	0.020					0.102***	0.021				
Only 1 shock			0.041*	0.021					0.056**	0.023		
2 or more shocks			0.144***	0.020					0.148***	0.022		
Natural Disasters					0.230***	0.017					0.004	0.038
Income shock					0.029	0.019					0.040*	0.022
Illness/Death					-0.024	0.019					0.040*	0.022
Dowry					0.266***	0.022						

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 16: : Marginal Effects from Probit Estimates Measuring the Likelihood of Eroding Savings as a Coping Strategy in case of Shocks by Income Status of the Households

Dep Var: Erosion of Savings	**Rich**						**Poor**					
	Model1_mfx		**Model2_mfx**		**Model3_mfx**		**Model1_mfx**		**Model2_mfx**		**Model3_mfx**	
	Coef	**se**	**coef**	**se**	**coef**	**se**	**coef**	**se**	**coef**	**se**	**Coef**	**Se**
Electricity	-0.020	0.014	-0.027*	0.014	-0.031**	0.015	0.145***	0.033	0.155***	0.033	0.147***	0.034
Distance from Union parishad	0.003	0.006	0.011*	0.007	0.014**	0.007	0.045***	0.013	0.041***	0.013	0.062***	0.014
Duraton of Microcredit(years)	0.011***	0.002	0.011***	0.002	0.011***	0.002	0.013***	0.004	0.012***	0.004	0.005	0.005
Gender of householdhead	-0.087***	0.024	-0.079***	0.024	-0.088***	0.024	-0.196***	0.042	-0.171***	0.043	-0.160***	0.044
Householdhead education	0.001	0.001	0.002	0.001	0.002*	0.001	-0.000	0.002	0.001	0.002	-0.001	0.002
Household size(member type1)	0.025***	0.005	0.021***	0.005	0.025***	0.005	0.051***	0.012	0.050***	0.012	0.064***	0.012
Age of Household head	-0.000	0.001	-0.000	0.001	-0.000	0.001	0.005***	0.001	0.005***	0.001	0.004***	0.001
Affected hh or Not affected hh	0.050***	0.016					0.102***	0.029				
Only 1 shock			-0.010	0.017					0.140***	0.030		
2 or more shocks			0.121***	0.017					0.015	0.040		
Natural Disasters					0.153***	0.017					-0.479***	0.049
Income shock					0.018	0.016					0.003	0.034
Illness/Death					0.005	0.015					-0.026	0.033
Dowry					0.201***	0.063					0.412***	0.017

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 17: Marginal Effects from Probit Estimates Measuring the Likelihood of Availing Micro-Credit as a Coping Strategy in case of Shocks

Dep var: Micro Credit	**Model1_mfx**		**Model 2_mfx**		**Model 3_mfx**	
	Coef	**Se**	**Coef**	**Se**	**coef**	**se**
Poor/Non-poor households	-0.130***	0.017	-0.129***	0.017	-0.143***	0.017
Electricity	-0.063***	0.015	-0.062***	0.015	-0.055***	0.016
Distance from Union parishad	-0.010*	0.006	-0.011*	0.006	-0.012*	0.006
Duraton of Microcredit(years)	0.051***	0.002	0.051***	0.002	0.051***	0.002
Gender of householdhead	-0.317***	0.026	-0.316***	0.026	-0.304***	0.027
Householdhead education	0.003***	0.001	0.003***	0.001	0.003***	0.001
Household size(member type1)	0.038***	0.005	0.038***	0.005	0.039***	0.005
Age of Household head	-0.009***	0.001	-0.009***	0.001	-0.009***	0.001
Affected hh or Not affected hh	-0.032**	0.016				
Only 1 shock			-0.022	0.017		
2 or more shocks			-0.047**	0.019		
Natural Disasters					-0.076***	0.023
Income shock					-0.001	0.016
Illness/Death					-0.032**	0.016
Dowry					0.377***	0.035

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 18: Marginal Effects from Probit Estimates Measuring the Likelihood of Availing Micro-Credit as a Coping Strategy in case of Shocks by Occupation of the Household Head

Dep Var: Micro Credit	Model1_mfx		Model2_mfx		Model3_mfx		Model1_mfx		Model2_mfx		Model3_mfx	
	Household Head's Occupation: Agriculture						Household Head's Occupation: Non Agriculture					
	Coef	Se	coef	Se	coef	se	Coef	se	coef	se	coef	Se
Poor/Non-poor households	0.038	0.024	0.040*	0.024	0.031	0.024	-0.427***	0.026	-0.423***	0.026	-0.445***	0.026
Electricity	-0.041**	0.020	-0.045**	0.020	-0.035*	0.020	-0.140***	0.026	-0.130***	0.027	-0.154***	0.027
Distance from Union parishad	-0.046***	0.008	-0.044***	0.008	-0.043***	0.008	0.034***	0.010	0.029***	0.010	0.031***	0.011
Duraton of Microcredit(years)	0.037***	0.002	0.037***	0.002	0.037***	0.002	0.105***	0.004	0.106***	0.004	0.105***	0.004
Gender of householdhead	-0.155***	0.043	-0.152***	0.043	-0.166***	0.043	-0.585***	0.046	-0.593***	0.047	-0.580***	0.046
Householdhead education	0.002	0.001	0.002	0.001	0.001	0.001	0.005***	0.002	0.006***	0.002	0.004**	0.002
Household size(member type1)	0.032***	0.006	0.030***	0.006	0.029***	0.006	0.010	0.010	0.009	0.010	0.010	0.010
Age of Household head	-0.007***	0.001	-0.007***	0.001	-0.008***	0.001	-0.009***	0.001	-0.008***	0.001	-0.009***	0.001
Affected hh or Not affected hh	-0.007	0.021					-0.067**	0.026				
Only 1 shock			-0.030	0.024					-0.008	0.030		
2 or more shocks			0.028	0.026					-0.141***	0.032		
Natural Disasters					-0.020	0.029					0.062	0.049
Income shock					0.020	0.022					-0.061**	0.028
Illness/Death					0.032	0.021					-0.151***	0.027
Dowry					0.374***	0.071					0.426***	0.034

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table1 9: Marginal Effects from Probit Estimates Measuring the Likelihood of Availing Micro-Credit as a Coping Strategy in case of Shocks by Income Status of the Households

Dep Var: Micro Credit	Rich						Poor					
	Model1_mfx		Model2_mfx		Model3_mfx		Model1_mfx		Model2_mfx		Model3_mfx	
	Coef	Se	coef	se	coef	se	coef	se	coef	Se	Coef	Se
Electricity	-0.071***	0.017	-0.070***	0.017	-0.064***	0.017	-0.033	0.041	-0.050	0.041	-0.026	0.043
Distance from Union parishad	-0.006	0.008	-0.006	0.008	-0.009	0.008	-0.079***	0.013	-0.070***	0.013	-0.064***	0.014
Duraton of Microcredit(years)	0.045***	0.002	0.045***	0.002	0.044***	0.002	0.098***	0.005	0.101***	0.005	0.098***	0.006
Gender of householdhead	-0.311***	0.033	-0.312***	0.033	-0.301***	0.033	-0.296***	0.053	-0.332***	0.054	-0.281***	0.053
Householdhead education	0.008***	0.001	0.008***	0.001	0.008***	0.001	-0.010***	0.002	-0.013***	0.002	-0.012***	0.002
Household size(member type1)	0.036***	0.006	0.036***	0.006	0.037***	0.006	0.037***	0.013	0.041***	0.014	0.045***	0.014
Age of Household head	-0.011***	0.001	-0.011***	0.001	-0.011***	0.001	-0.005***	0.001	-0.005***	0.001	-0.005***	0.001
Affected hh or Not affected hh	-0.029	0.018					-0.048	0.033				
Only 1 shock			-0.021	0.021					-0.106***	0.036		
2 or more shocks			-0.039*	0.022					0.101**	0.047		
Natural Disasters					-0.051*	0.026					0.069	0.077
Income shock					0.033*	0.019					-0.119***	0.037
Illness/Death					-0.051***	0.018					0.062*	0.037
Dowry					0.414***	0.041					0.472***	0.051

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 20: : Marginal Effects from Probit Estimates Measuring the Likelihood of Availing Formal Loan as a Coping Strategy in case of Shocks

Dep Var: Formal Loan	**Model1_mfx**		**Model2_mfx**		**Model3_mfx**	
	coef	**se**	**Coef**	**Se**	**Coef**	**Se**
Poor/Non-poor households	-0.035***	0.005	-0.034***	0.005	-0.030***	0.005
Electricity	0.049***	0.006	0.048***	0.006	0.047***	0.006
Distance from Union parishad	-0.004*	0.002	-0.002	0.002	-0.000	0.002
Duraton of Microcredit(years)	0.001	0.001	0.001	0.001	0.001***	0.001
Gender of householdhead	-0.025**	0.010	-0.023**	0.010	-0.027***	0.009
Householdhead education	-0.001***	0.000	-0.001***	0.000	-0.001***	0.000
Household size(member type1)	-0.003*	0.002	-0.003**	0.002	-0.004***	0.001
Age of Household head	0.002***	0.000	0.002***	0.000	0.002***	0.000
Affected hh or Not affected hh	0.021***	0.005				
Only 1 shock			0.008	0.007		
2 or more shocks			0.045***	0.009		
Natural Disasters					0.030***	0.010
Income shock					-0.008*	0.005
Illness/Death					0.062***	0.007

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 21: Marginal Effects from Probit Estimates Measuring the Likelihood of Availing Formal Loan as a Coping Strategy in case of Shocks

Dep Var : Formal Loan	**Model 1_mfx**		**Model2_mfx**		**Model3_mfx**		**Model 1_mfx**		**Model2_mfx**		**Model3_mfx**	
	House Head's Occupation: Agriculture						**House Head's Occupation: non Agriculture**					
	Coef	**Se**	**Coef**	**Se**	**Coef**	**se**	**coef**	**se**	**coef**	**se**	**Coef**	**Se**
Poor/Non-poor households	-0.050***	0.009	-0.047***	0.009	-0.043***	0.009	-0.001	0.006	-0.002	0.005	0.001	0.001
Electricity	0.093***	0.011	0.088***	0.011	0.085***	0.011	-0.018***	0.003	-0.014***	0.003	-0.001*	0.001
Distance from Union parishad	0.007**	0.004	0.008**	0.004	0.009**	0.004	-0.000	0.001	-0.000	0.001	-0.000	0.000
Duraton of Microcredit(years)	0.001	0.001	0.001	0.001	0.001	0.001	-0.074***	0.016	-0.064***	0.014	-0.022***	0.009
Gender of householdhead	0.032*	0.018	0.042**	0.018	0.015	0.017	0.001*	0.001	0.001	0.000	0.000	0.000
Householdhead education	-0.002***	0.001	-0.002***	0.001	-0.002***	0.001	0.003	0.003	0.004*	0.002	0.002**	0.001
Household size(member type1)	-0.007***	0.003	-0.009***	0.003	-0.013***	0.002	0.001***	0.000	0.001***	0.000	0.000	0.000
Age of Household head	0.002***	0.000	0.002***	0.000	0.002***	0.000						
Affected hh or Not affected hh	0.019**	0.009					0.005	0.007				
Only 1 shock			-0.003	0.011					-0.017***	0.006		
2 or more shocks			0.056***	0.015					0.021**	0.009		
Natural Disasters					-0.002	0.012					0.362***	0.080
Income shock					0.015*	0.009					-0.014***	0.005
Illness/Death					0.100***	0.013					0.000	0.001

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 22: Marginal Effects from Probit Estimates Measuring the Likelihood of Availing Formal Loan as a Coping Strategy in case of Shocks by Income Status

Dep Var: formal Loan	**Rich**						**Poor**					
	Model1_mfx		**Model 2_mfx**		**Model 3_mfx**		**Model 1_mfx**		**Model 2_mfx**		**Model 3_mfx**	
	Coef	**se**	**Coef**	**se**	**coef**	**se**	**coef**	**se**	**coef**	**se**	**coef**	**Se**
Electricity	-0.011	0.017	-0.017	0.017	-0.032*	0.017	0.069	0.051	0.043	0.052	0.154***	0.060
Distance from Union parishad	-0.120***	0.007	-0.116***	0.007	-0.109***	0.007	-0.147***	0.013	-0.141***	0.014	-0.121***	0.014
Duraton of Microcredit(years)	0.010***	0.002	0.010***	0.002	0.012***	0.002	0.029***	0.005	0.035***	0.005	0.029***	0.005
Gender of householdhead	-0.047	0.030	-0.038	0.030	-0.052*	0.031	-0.136**	0.053	-0.243***	0.059	-0.141***	0.054
Householdhead education	0.002	0.001	0.002*	0.001	0.003**	0.001	-0.001	0.002	-0.005**	0.002	-0.003	0.002
Household size(member type1)	0.012**	0.005	0.010*	0.005	0.010**	0.005	0.065***	0.013	0.079***	0.014	0.080***	0.013
Age of Household head	-0.004***	0.001	-0.004***	0.001	-0.004***	0.001	-0.006***	0.001	-0.006***	0.001	-0.007***	0.001
Affected hh or Not affected hh	0.180***	0.017					0.376***	0.029				
Only 1 shock			0.144***	0.020					0.306***	0.036		
2 or more shocks			0.244***	0.021					0.647***	0.035		
Natural Disasters					0.270***	0.026					0.026	0.076
Income shock					-0.038**	0.018					0.274***	0.036
Illness/Death					0.149***	0.017					0.383***	0.044
Dowry					-0.271***	0.058					0.766***	0.030

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 23: Marginal Effects from Probit Estimates Measuring the Likelihood of Availing Informal Loan as a Coping Strategy in case of Shocks

Dep Var: Informal Loan	**Model1_mfx**		**Model2_mfx**		**Model3_mfx**	
	coef	**Se**	**coef**	**Se**	**Coef**	**Se**
Poor/Non-poor households	0.025	0.018	0.022	0.018	0.007	0.018
Electricity	0.018	0.015	0.012	0.015	0.003	0.015
Distance from Union parishad	-0.119***	0.006	-0.115***	0.006	-0.110***	0.006
Duraton of Microcredit(years)	0.013***	0.002	0.012***	0.002	0.014***	0.002
Gender of householdhead	-0.076***	0.025	-0.082***	0.025	-0.078***	0.025
Householdhead education	-0.000	0.001	-0.000	0.001	-0.001	0.001
Household size(member type1)	0.018***	0.005	0.017***	0.005	0.019***	0.005
Age of Household head	-0.003***	0.001	-0.003***	0.001	-0.003***	0.001
Affected hh or Not affected hh	0.218***	0.014				
Only 1 shock			0.184***	0.017		
2 or more shocks			0.292***	0.018		
Natural Disasters					0.251***	0.024
Income shock					0.038**	0.015
Illness/Death					0.171***	0.015
Dowry					0.148**	0.058

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 24: Marginal Effects from Probit Estimates Measuring the Likelihood of Availing informal Loan as a Coping Strategy in case of Shocks

Dep Var: Inforrmal Loan	**Household Head's Occupation: Agriculture**						**Household Head's Occupation: non-Agriculture**					
	Model1_mfx		**Model2_mfx**		**Model3_mfx**		**Model1_mfx**		**Model2_mfx**		**Model3_mfx**	
	Coef	**se**	**coef**	**se**	**coef**	**se**	**coef**	**se**	**coef**	**se**	**Coef**	**Se**
Poor/Non-poor households	-0.060***	0.024	-0.056***	0.024	-0.068***	0.024	0.153***	0.028	0.143***	0.028	0.107***	0.028
Electricity	0.007	0.020	-0.001	0.020	0.005	0.021	0.030	0.024	0.025	0.024	-0.000	0.025
Distance from Union parishad	-0.116***	0.008	-0.114***	0.008	-0.110***	0.008	-0.126***	0.008	-0.117***	0.009	-0.107***	0.009
Duraton of Microcredit(years)	0.007***	0.002	0.007***	0.002	0.009***	0.002	0.015***	0.003	0.015***	0.003	0.018***	0.003
Gender of householdhead	-0.055	0.040	-0.041	0.040	-0.013	0.041	-0.096***	0.034	-0.122***	0.034	-0.107***	0.035
Householdhead education	0.004***	0.001	0.005***	0.001	0.004**	0.001	-0.008***	0.002	-0.008***	0.002	-0.009***	0.002
Household size(member type1)	0.007	0.006	0.003	0.006	0.001	0.006	0.021**	0.009	0.020**	0.009	0.031***	0.009
Age of Household head	-0.003***	0.001	-0.003***	0.001	-0.003***	0.001	-0.005***	0.001	-0.006***	0.001	-0.006***	0.001
Affected hh or Not affected hh	0.278***	0.019					0.175***	0.022				
Only 1 shock			0.256***	0.024					0.091***	0.026		
2 or more shocks			0.373***	0.026					0.289***	0.028		
Natural Disasters					0.225***	0.031					0.474***	0.035
Income shock					0.083***	0.021					-0.035	0.023
Illness/Death					0.226***	0.021					0.106***	0.024
Dowry					0.427***	0.069					0.174*	0.095

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 25: Marginal Effects from Probit Estimates Measuring the Likelihood of Availing informal Loan as a Coping Strategy in case of Shocks

Dep Var: Informal Loan	**Poor**						**Rich**					
	Model1_mfx		**Model2_mfx**		**Model3_mfx**		**Model1_mfx**		**Model2_mfx**		**Model3_mfx**	
	Coef	**se**	**Coef**	**se**	**coef**	**Se**	**coef**	**Se**	**coef**	**se**	**Coef**	**Se**
Poor/Non-poor households	-0.030	0.029	-0.023	0.030	-0.052*	0.030	0.164***	0.028	0.155***	0.029	0.121***	0.029
Electricity	0.023	0.024	-0.002	0.025	0.037	0.025	0.024	0.025	0.021	0.025	-0.005	0.025
Distance from Union parishad	-0.127***	0.010	-0.127***	0.010	-0.127***	0.010	-0.127***	0.009	-0.119***	0.009	-0.109***	0.009
Duraton of Microcredit(years)	0.011***	0.003	0.010***	0.003	0.013***	0.003	0.016***	0.003	0.015***	0.003	0.019***	0.003
Gender of householdhead	-0.051	0.050	0.019	0.052	0.005	0.052	-0.038	0.036	-0.073**	0.037	-0.054	0.038
Householdhead education	0.003*	0.002	0.004**	0.002	0.002	0.002	-0.007***	0.002	-0.008***	0.002	-0.009***	0.002
Household size(member type1)	0.038***	0.009	0.038***	0.009	0.033***	0.009	0.010	0.010	0.012	0.010	0.021**	0.010
Age of Household head	-0.001	0.001	-0.001	0.001	-0.001	0.001	-0.004***	0.001	-0.005***	0.001	-0.006***	0.001
Affected hh or Not affected hh	0.255***	0.025					0.156***	0.023				
Only 1 shock			0.196***	0.033					0.079***	0.027		
2 or more shocks			0.371***	0.033					0.262***	0.028		
Natural Disasters					0.122***	0.034					0.454***	0.034
Income shock					0.104***	0.029					-0.045*	0.024
Illness/Death					0.225***	0.026					0.085***	0.025
Dowry					0.534***	0.052					0.167*	0.093

note: *** p<0.01, ** p<0.05, * p<0.1. Regressions control for District FE

Table 26: Probit Model: Remittance Income					
	Full Sample	Agri	Non-Agri	Rich	Poor
Model 1					
Shock or nor	5932.40	11137.15	12684.99	6893.39	-86.39
	1559.96***	2298.03	1280.72***	1754.14***	514.57
Model 2					
One Shock	-967.03	5783.21	12312.58	-2128.02	852.51
	1759.52	2407.87**	1655.01***	1941.91	135.21
Two or More shock	13536.01	23667.68	12853.92	18520.68	-1123.18
	1801.00****	2898.64***	1366.32***	2065.93***	659.24*
Model 3					
Natural disaster	21123.54	21784.93	16434.78	21321.06	4740.45
	1755.43	2680.11***	1685.71***	1881.55***	1211.86***
Income shock	5205.25***	20919.43	-12960.04	5995.61	-1587.07
	1378.93***	1828.35***	1493.20***	1565.89***	673.19**
Death	-25232.14	-17112.16	-9218.765	-26610.17	-1312.59
	1542.38***	2188.06***	1583.66***	1765.38***	600.71**
Dowry	-8477.37	-10763.55	8573.91	-2172.64	876.25
	3644.95**	15609.9	2226.99***	5226.29	837.53

Table 27: Can Households Cope Better with Access to Credit

	Difference		Erosion of Savings		Erosion of Assets		Cons exp		Income	
	Credit=1	Credit=0	Credit=1	Credit=0	Credit=1	Credit=0	Credit=1	Credit=0	Credit=1	Credit=0
Shock or not	2426.91	9343.35	-0.01	0.22	0.01	0.03	301.49	13849.37	-3996.83	17747.85
	270.40***	644.89***	0.01***	0.01***	0.00**	0.00***	3401.24	3697.07**	25030.18	13528.15
One Shock	1552.83	5803.72	-0.14	0.27	-0.01	0.02	-2202.68	12558.18	-19122.16	15768.88
	308.52***	755.56***	0.01***	0.01***	0.00*	0.00**	3575.17	4220.18**	26341.17	15448.98
Two or More shock	3274.04	13181.3	0.11	0.17	0.04	0.03	7079.19	15899.33	36940.82	20889.77
	306.39***	774.99***	0.01***	0.01***	0.00***	0.00	4568.91	4906.69**	33662.85	17962.11
Natural	1128.27	1419.98	0.34	0.16	0.04	0.02	1121.82	14089.84	-9432.37	10600.28
	294.00***	903.43	0.01***	0.02***	0.00***	0.01**	5026.16	6064.68**	37091.99	22405.97
Income	2772.91	10099.19	-0.05	0.17	0.02	0.00	-2951.14	8055.32	-24649.69	27722.88
	262.98***	523.37***	0.01***	0.01***	0.005***	0.00	3650.44	3951**	26939.5	14597.75**
Death	2143.70	14490.62	-0.23	-0.23	-0.06	0.02	5577.71	13594.89	11749.78	20793.51
	296.40***	621.22***	0.01***	0.01	0.00***	0.00**	3310.24*	4405.34**	24428.89	16275.54
Dowry	626.82	-10552.33	0.30	-0.23	0.02	0.01	-5287.62	26868.34	19764.67	29416.91
	723.73	1276.27***	0.30***	0.03***	0.01	0.01	10695.74	11797.38**	78932.15	43585.42

Do Households with Access to Finance Mitigate Shocks Better?

It is hypothesized that households that have access to credit can better cope with shocks. The availability of credit enables the household to reduce the gap between the loss amount and the accumulations of money for remedial purposes. Also these households should be less likely to erode savings. They may be not required to make big changes in their consumption expenditure. Also they might face less fluctuation in annual incomes.

In table 27 the first column shows the ordinary least square estimates where the dependent variable is the difference between the total financial loss from shocks from two major crises and the remedial expenses. It is observed that the gap is much smaller for households that have access to credit irrespective of model and specification choice, and types and intensity of shocks. A chow test reveals that the coefficients in both regressions are significantly different from each other.

Again in similar manner, it is observed that in most cases the household having access to credit are less likely to erode their savings in the event of any shock. The households that have access to credit enjoy less fluctuations in their consumption expenditures as in all models all the coefficient of interest are not statistically significant except one. But the households that experience various shocks significantly increase their annual consumption expenditure in all scenarios. Exact same pattern is observed in case if annual income. There is less fluctuations in income irrespective models and specifications and types and intensity of shocks.

Conclusion and Policy Recommendations

There is a dearth of literature analyzing the combinations of various pathways by which households cope during a crisis in Bangladesh. To our knowledge this is first study that investigated the relative likelihood various coping strategies for almost all kinds of shocks faced by the households. It is quite comprehensive in that sense. The study gives special attention to role of credit as being used as a coping strategy by the poor segment of the society.

We observe that people who are tied to land, i.e., whose major occupation is agriculture cope by adopting a group strategy involving new MFI loan, Sale and mortgage of

permanent assets to mitigate losses due to an exogenous natural disaster like floods, cyclones, storms and river erosion etc. The other prominent strategies adopted by these agricultural households are erosion of savings, mortgage of assets and combinations of all the other strategies when there is a death or sickness in the family.

A very similar pattern is observed in terms of adoption of various coping schemes when agricultural households face any income shock (loss in crop, livestock, industry etc.) or severe illness or death in the family. For dowry payment, households adopt erosive strategies. This causes a considerable dent in the savings accumulation of the households. Borrowing from formal banks is a major coping strategy when a household member dies or becomes ill and this pattern prevails irrespective of the household's income and land ownership status, occupation and education level of the household head (not all the tables are reported, are available upon request from the author).

In almost all of these scenarios, the role of loans from NGOs, Government programs and loans from relatives and kin seem negligible for all types of crises and for all types households irrespective of their socio-economics characteristics. Erosion of savings, loans from MFIs and mortgage of assets top the list of choices of coping strategies adopted by households. The significant role of microcredit and formal banks in mitigating shocks has important policy implications. Death and health shocks makes the household most vulnerable and forces it to erode savings, mortgage permanent assets, and seek out other options. This finding has some important policy relevance for asset accumulation and growth of the country. Increases in accessibility of life insurance and other medical facility would prevent erosion of physical and financial capital which is vital for productive efficiency of the households. Once diminished it is often impossible for the poor households to replenish this capital and as a result they might fall into poverty trap for good. Policy makers ought to pay attention to this as well very carefully.

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Technical Note on Factor Analysis

In common factor analysis a small number of factors are extracted to account for the inter-correlation among the measured variables. This helps to identify the latent dimensions that explain most of the correlations among variables. We have a set of bargaining measure variables, $x_{1j},.....,x_{Nj}$. We want q common factors which accounts for most of the covariance of the measured variables, x_N.

The standardized vector of observed variables can be expressed as a function of correlation of variables and uniqueness associated with each variable.

$$x = fA' + e$$

where,

A=Nxq factor loading matrix represents the correlation coefficient s between N variables and q factor factors. The squared factor loading is the percent of variance in that variable explained by the factor.

$f = 1xq$ matrix of factors

e=1xN vector of uncorrelated errors with covariance equal to the uniqueness matrix, ψ, which is NxN diagonal matrix.

The variance of bargaining measures x, denoted by Z is composed into two parts

$$z = AA' + \psi$$

The factor scores can be obtained by (regression scoring, Thomson 1951)

$$\hat{f} = A'Z^{-1}x$$

The scores are the indices that are estimates of components.

A very similar statistical procedure to factor analysis is PCA which accounts for the maximum portion of the variance present in the original set of variables. PCA is typically applied when the researcher instead of using all variables, wants to use some indices that contain all the information present in the measures is the PCA which derives a small number of components accounting for the variability found in a relatively large number of variables. There are major differences between PCA and FA. In FA, it is assumed that the variance of a single variable can be decomposed into a common variance shared by all observed variables and a unique variance particular to a variable. While in FA, only the common variance of the measured variables are taken into account, Principle components are defined simply as a linear combinations of all observed variables and PCA makes no distinction between common and unique variance. PCA contains both common and unique variance.

Determining the number of factors in FA:

The most commonly used criteria in determining the optimal number of factors to be extracted are Kaiser-Guttman rule and the scree test.

The Kaiser-Guttman rule states that the number of factors to be extracted should be equal to the number of factors having eigenvalues (variance) greater than 1.

A Scree plot illustrates the rate of change in the magnitude of eigenvectors for the factors. The point where eigenvalues gradually levels off indicates the maximum number of factors to be retained.