PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS

Socio-Economic Losses of Flood and Household's Coping Strategies: Evidence from Flood Prone District of Pakistan

Ameer Hyder
Nasir Iqbal

September 2016

Socio-Economic Losses of Flood and Household's Coping Strategies: Evidence from Flood Prone District of Pakistan

Ameer Hyder
Pakistan Institute of Development Economics, Islamabad

and

Nasir Iqbal
Benazir Income Support Programme, Islamabad

**PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS
ISLAMABAD
2016**

C O N T E N T S

List of Tables

Page

List of Figures

(iv)

ABSTRACT

Pakistan is a developing country with excessive natural hazards. Flooding is the most devastating natural hazard in Pakistan. Pakistan has been witnessing the floods since its inception but the severity and occurrence of these floods have increased in recent years. Floods affect the households according to their vulnerability and capacity to deal with these shocks. The study seeks to understand the coping mechanism adopted by households and underlying factors which influenced the adaption of these mechanisms to recover from the floods of September, 2014. Furthermore, losses owing to these floods also have been analysed. A case study in twelve villages of district Chiniot, Punjab, has been conducted to understand the coping mechanisms of flood sufferers. Households have mainly relied upon three types of strategies: borrowings from informal sector, assets disposal and governmental cash grants. Results of Logit and Tobit model show that shock and demographic factors are major players which influence the adaption of these strategies. Only two types of losses have been reported by floods victims: loss of standing crops and damages to dwellings. Governmental flood warnings and cash grants have played a laudable role in mitigating the deleterious effects of floods. However, findings show that distribution mechanism of government cash grants lacks transparency and merit.

1. INTRODUCTION

Global warming is likely to intensify the rainfalls, storminess and distort the severity timing and predictability of weather patterns [Pryce and Chen (2011)]. The link between climate change caused by human interferences with the world and environmental vulnerability has now been well established. The human impact on the environment is creating a new kind of global casualty with potential impact on many different natural and social aspects [Naser (2012)]. Moreover, population growth and economic development has occurred simultaneously with increasingly unsustainable utilisation of the earth's physical environment [Khan, Inamullah, and Shams (2009)]. Industrial revolution has introduced degradation of the environment and subsequently causes global warming which is threat to peace and security in the world [Agena (2007)].

Over the last one and half decades, the intensity of natural disasters including floods in Pakistan and Sri Lanka, severe snow storms in Northern Europe, flooding and land-sliding in Brazil ,and tsunami in Japan have been increased substantially. Climate change tends to increase the frequency and intensity of many of these disasters. Drought and flood have taken on a new trend of occurring more and more frequently, often simultaneously and with rapid succession, and the characteristics are increasingly becoming more apparent, posing new challenges to the safety of ecology, water supply, food, and economy [Yan, *et al*. (2012)].

EM-DAT data indicates that a total of 4480 floods have been recorded in all the continents of the world over the 2000-2014. The total damage caused by floods exceeds $135 billion. About 41 percent of these flood disasters have occurred in South Asia, which covers about 3.2 percent of the world land area and 10 percent of Asia, with over a population of over 1.46 billion accounting for 25 percent of the world population, it constitutes houses about 40 percent of the world's poor. The global distribution of flood disasters of 30 years shows Asia's extreme vulnerability to flood disasters [Guha-Sapir, Below, and Hoyois (2016)].

Pakistan is highly vulnerable to the adverse effects of climate change, particularly those resulting from rising temperatures, increased variability of monsoon, melting of Himalayan glaciers, and an increase in the frequency and intensity of extreme weather events and natural disasters [Malik, Awan, and Khan (2012)]. Pakistan is ranked 9th in flood affected countries. Since its inception it has faced 22 major floods, starting from 1950 to 2014. The

catastrophic flooding in Pakistan in 2010 lays bare the multiplicity of fault lines that beleaguer the country as perhaps no other single event in its history, with estimated flood damages of $9.7 billion. Not only the flooding threatens the life and livelihoods of well over 20 million citizens, it exposes once again the gravity and complexity of unsolved governance issues in this 60-year-old nation, issues that are inextricably linked to the overall stability of the region and of the world [White (2011)]. The estimated economic damages occurs due to flood are US$ 1,800 million over the period 2010-15. These floods also causes more than 4000 causalities [Guha-Sapir, et al. (2016)].

To overcome damages of natural disasters especially flood, households adopt various coping strategies [Benfield (2009)]. Coping strategies vary along with different regions and adoption of these strategies is contingent to socioeconomic factors like households' head income level, education, and physical endowments. The literature revolves around these strategies: borrowings, assets disposals, local aids and migration, but there are some missing elements in the literature like government involvement in ameliorating the households' coping abilities, components of borrowings and assets disposals [Rashid (2000)]. Massive government involvement is inevitable during such emergent shocks and can be examined in two ways, before floods it puts all efforts to mitigate the floods and after floods it attempts to manage the crisis. Ex-ante steps mainly include structural measures which could be effective in preventing normal floods but ineffective in case of extreme floods. Ex-post steps consists of non-structural measures, for example, relief, supply of food, provision of shelter, rescue, and enhancing the coping abilities of individuals. After suffering from severe shocks like floods, households take actions for revival and rehabilitation of normal life which are called coping mechanisms [Khandker (2007)].

The government of Pakistan has actively involved in rehabilitation of flood prone districts, distributing large amount of cash transfers among the affected families. Now the obvious questions arise: Do households really rely on government grants and aids as they rely on other type of coping strategies like borrowings and asset disposals? If households depend upon borrowings and asset disposals than what are the borrowing sources of the households and what type of assets are disposed. It is imperative to focus on these angles for better targeting.

With this background, the core objective of this study is to investigate the effectiveness of government cash transfer along with like borrowings and asset disposals as coping strategies adopted by the households for the revival and rehabilitation. For this purpose we have chosen one of the most vulnerable and flood-prone district of Pakistan, Chiniot, which has highly suffered from flood of 2014. It also focuses on the losses borne by households and assesses the role of government cash grants for flood sufferers. To achieve the aforesaid objective, we have constructed flood exposure index to assess the severity of

floods. We also examine the underlying (shock and demographic) factors that influence the choice of coping strategies.

Paper has been divided into five following sections: Section Two provides the conceptual framework; Section Three discusses the data and methodology; Section Four discusses the households losses and coping strategies and determinants of these coping strategies while last section conclude the discussion with policy lessons.

2. CONCEPTUAL FRAMEWORK

A considerable literature is available to suggest different types of strategies to cope with natural disasters. Adoption of these strategies depends upon socioeconomic factors.

Corbett (1988) identifies that coping strategies adopted by African people during severe droughts include insurance (rationing of current food consumption) and gradual disposal of productive assets (inter-households transfers, disposal of assets, and sale of possessions). All the strategies have not been adopted simultaneously but in sequential pattern and this pattern starts from collecting food. Frankenberger (1992) shows that at first stage, households attempt to minimise risks and manage losses to ensure some minimal level of sustenance whereas second strategy employed by households is disposal of assets. This study finds that firstly liquid assets are disposed and then productive assets.

Schwarzer and Schwarzer (1996) describe four types of coping behaviour in a crisis: (i) reactive coping—is as an effort to deal with the crisis that has already taken place, coping efforts aim to either compensate for loss or alleviate harm; (ii) anticipatory coping—is as an effort to deal with an imminent threat; iii) preventive coping—is an effort to build up general resistance resources that result in less strain in the future (minimising the severity of the impact of potential distress) and an overall reduced risk of the crisis; and (iv) proactive coping—is an effort to build up general resources that facilitate promotion toward challenging goals/future.

Skoufias (2003) demonstrate that there are huge economics costs of ex-ante (mitigating) strategies and ex-post (coping) strategies adopted by households and governments. Government adopts different types of ex-post strategies like cash transfers, wage subsidies, microfinance, and social funds to target different beneficiaries. While households adopts different types of ex-post strategies like Mexican households decrease their fertility in response to the tequila crisis, rural households in Bangladesh borrow more soon after the 1998 floods, Ugandan households resort to fostering orphan children of relatives dying from AIDS, while South African households rely on local support networks. Floods affect household welfare through the destruction of human and physical capital stock. To handle these disasters, poorer households are less

equipped to deal with external shocks and they can only use informal insurance as their coping strategy which ultimately leads them to unescapable poverty trap. Such crisis also force households to decrease their investments on human capital like education of children. If economic and natural shocks come together than all coping strategies flop worst.

Ninno, *et al.* (2003) show that households have confronted the shock by reducing expenditures, selling assets and borrowing. Their results show inadequacy of government policies and exemplary role of private sector to adjust with this shock. The governments of developing nations face the challenge of scarce resources which further reduces its ability to effectively deal with deleterious effects of disasters. Dasgupta (2007) proposes early flood warning systems as a best strategy to mitigate the effects of floods. Study further emphasises upon pre-flood exodus, household flood insurance and financial support for the poor as coping mechanism for river floods. Hansson, *et al.* (2008) conclude that smaller the economy and larger the event, the more significant impact is, which depresses the already weak economy further. Study suggests two major components for the formation and implementation of ex-post strategies: structural defense (systems of water flows like rivers, dams), non-structural measures (warning systems and education, borrowing, insurance, cross border prospective, international aid, and multiple stakeholders). Ghorpade (2012) describes three types of coping strategies including: (i) risk reducing strategies—to achieve income smoothing or secured sources; (ii) self-insurance—include assets disposal to deal with climatic shocks and (iii) risk sharing strategies—include mechanisms that share risks within a group. Sultana and Rayhan (2012) highlights that major proportion of households borrowed money from informal sources.

What determine the choice of appropriate coping strategy? Corbett (1988) summarises that always same type strategies are not adopted during these events and all households are not equally vulnerable to food crisis during this event, rich seldom starve. This study finds income level of households an important determinant for adoption of particular strategy. The poor and the rich households do not have the same options, for example poor find it more difficult to obtain credit, have fewer assets to liquidate, and are constrained by high dependency ratios. Effectiveness of these strategies is further affected by presence or absence of relief programs. Canon (1994) argues that nature provides us many opportunities of production and hazards like floods, earthquakes. Study demonstrates that there are particular characteristics of different groups of people (derived from social and economic processes) which mean some avoid disasters while other do not. And vulnerability of people is classified by regarding class, gender, race, age, education and income. Cutter, *et al.* (2003) develop vulnerability index combining the biophysical and social vulnerability. Study considers wealth, gender, race, rural or urban, employment loss, property, occupation and family structure as important contributors for resilience to environmental and natural hazards.

Grothmann and Reusswig (2004) answer the question that why some households adopt precautionary measures to mitigate floods while others do not. This study finds that perceptual factors like experience of previous floods, fear and reliance upon public flood protection, are better than the socio-economic factors in coping with flood. There are three main determinants of floods vulnerability and damages: flood exposure, sensitivity, and adaption. Flood exposure level is measured by velocity, frequency, water level, and duration. Brouwer, *et al*. (2007) submit that poorer segments of society live closer to the river, and face a higher risk of flooding and are thus more vulnerable. Inundation levels are also higher for poorer households. So, higher exposure levels are associated with higher inequality and less access to land. Inequality also results in higher flood damage, confirming the hypothesis found in the literature that an unequal income distribution contributes to socioeconomic vulnerability. The poor suffer more in relative terms, but not in absolute term. So, there is clearly a need of more government involvement to either provide further flood protection or flood relief directly. Moreover, policies for income equality can also be effective. Paul, *et al*. (2009) recommend that people continuously battle against flood vulnerability in accordance with their level of exposure and abilities, with varied strategies employed at different geophysical locations. The paper reports that households' ability to cope varies depending on people's socioeconomic conditions, such as education, income and occupation. Although floods in Bangladesh generate socioeconomic misery and people's indigenous coping strategies have helped them to reduce significantly their vulnerability.

3. DATA AND METHODOLOGY

3.1. Data

To fulfil the objectives of study, micro-level data from twelve villages of district Chiniot, is collected. Collection of data starts from developing questionnaire (see appendix) to digitalisation the data. The questionnaire for survey has five sections: first section is about education information of all households, second contains employment and income while third section deals with assets and damages. Fourth and fifth sections inquire about coping mechanism and details of floods, respectively.

All the villages are supposed to suffer from floods and are chosen according to the criterion which is their distance from the river Chenab: first three villages (Monian da pump, Shah-datkathatha, Kacha) are on the bank of the river, next three (Mingini, Road e ki, Tahli) villages lie between 1-2 km away from the river, succeeding three villages (Ahmed Wala, Bahga, Kalri) are situated 2-3 km ahead and subsequent last three villages (Kunanwali, Puranabagha, Sahabanwali) are distanced more than 3 km's. From each village, twenty households have been selected via convenience sampling, making final

sample size of 229 households. According to Government sources, total victims in district are 35,000 households and with this population size optimum sample size is 166 households (confidence level (%): 99 and margin of error (%): 10).

Survey is conducted just after the two months of floods, in December, 2014. We have visited the affected areas and questionnaires are filled after face-to-face interviews to get highest response rates and to seek appropriate information. Firstly, pilot survey of thirty households have been conducted and after checking reliability of data we have visited the field again.

Data have been digitalised and process of digitalisation has been completed in January, 2015.

3.2. Methodology

3.2.1. *Construction of Flood Exposure Index (FEI)*

Severity of floods in Punjab at local levels is measured by height of flood water and duration of flood. Now, these indicators of severity of floods very across the flooded area due to embankments and height of lands, indicating the variation of exposure of flood in villages. In order to assess the direct exposure

Table 1

Construction of Flood Exposure Index

Variable	Range and Measurement		Constructed Category Variable	
	Range	Unit of Measure	Range	Categories
Depth of water in the homestead	0-15	Feet	0-6	0 to 5 : number of feet
				6: 6 or above feet
Depth of water in the home	0-10	Feet	0-5	0 to 4 : number of feet
				5: 5 or above feet
Ground table water rise	0-25	Feet	0-2	1: 1 to 12 feet
				2: 13 to 25 feet
Number of days water stayed in home	0-30	Days	0-6	1: 1 to 5 days
				2: 6 to 10 days
				3: 11 to 15 days
				4: 16 to 20 days
				5: 21 to 25 days
				6: 26 to 30 days
Number of days stayed out of home	0-60	Days	0-6	0: None
				1: $> 0 \leq 1$ week
				2: $> 1 \leq 2$ weeks
				3: > 2 weeks ≤ 3 weeks
				4: > 3 weeks ≤ 4 weeks
				5: > 4 weeks ≤ 5 weeks
				6: > 5 weeks or above
Index Range & Flood Exposed Categories			0 to 100	0: Not Exposed
				1 to 50: Moderate
				51 to 75: Severe
				76 to 100: Very Severe

of households we use the flood exposure index developed by Ninno, *et al*. (2002). This index is based on information of five measures given by households: depth of water in the homestead, depth of water in the home, ground table water rise, number of days water stayed in home and number of days stayed out of home. All five variables have been ranged (0–5 or 0–6) and these metrics are summoned to form a combined index ranging from 0–100. Variable, ground table water rise, has been given low weightage by ranging only 1-2 because of provision of unreliable information by respondents. Further it is also poor indicator of flood level. Other four variables have been allotted equal range. Lastly, based on combined index, we have created a category variable in which households are categorised as: (1) not exposed to floods, (2) moderately exposed to floods, (3) severely exposed to floods, and (4) very severely exposed to floods.

3.2.2. *Villages Exposedness under FEI*

The majority of household have been severely exposed to the floods of 2014 in Chiniot, Punjab and level of exposure to the floods varies among the households even of same villages [conform with results of Sultana, *et al*. (2012)]. The resulting frequency distribution of household-level flood exposure by village is reported in Table 2. Results show variations across households within villages in the severity of flood exposure. All together about 75 percent of households are exposed severely, 13 percent of households are exposed very severely while only 12 percent households are exposed moderately to the floods.

Table 2

Villages Exposedness

Village	Flood Exposure		
	Moderate (% of HH's)	Severe (% of HH's)	Very Severe (% of HH's)
Ahmed wala	5	95	–
Bagha	11	89	–
Kacha	10	65	25
Kalri	10	75	15
Kunan wali	15	70	15
Mingini	–	100	–
Monian da pump	–	65	35
Purana bagha	53	47	–
Road-e-ki	10	85	5
Sahaban wali	25	75	–
Shah-hadat ka thatha	–	47	53
Tahli	–	100	–
Grand Total	12	75	13

Two villages from the sample are fully exposed to severe level of floods: *Mingini* and *Tahli.* More than 75 percent of households of five villages are also severely exposed: *Sahaban wali, Road-e-ki, Bagha, Kalri* and *Ahmed wala.* In *Shah-hadat ka thatha, Monian da pump* and *Kacha,* 53 percent, 35 percent and 25 percent of households are very severely exposed to the floods. Whereas 53 percent, 25 percent and 15 percent households of *Purana bagha, Sahaban wali* and *Kunan wali*, respectively, are moderately exposed to the floods.

The villages, *Monian da pump, Shah-dat ka thatha,* and *Kacha*, are on the bank of the river, hence households of these villages are severely and very severely exposed to the floods. *Kunan wali, Purana bagha* and *Sahaban wali* are distanced more than 3 km's from the river, so households of these villages are also moderately exposed to the floods. The more village is away from the river, the more chance to be exposed moderately or less.

3.3. Diagnostic Tests

After conducting pilot survey of thirty households, Cronbach's Alpha test of reliability has been utilised. This test provides satisfactory results. To check out heteroscedasticity, Breusch–Pagan test has been used. Results confirm the homoscedasticity and hence, these is no issue of heteroscedasticity.

4. HOUSEHOLDS LOSSES AND COPING STRATEGIES

The present chapter deals with the losses of households in the consequence of floods and coping strategies adopted by households.

4.1. Losses

Extreme level of floods deluge large areas and cause damages to crops and property [Paul (1997); Few (2003)]. Two types of losses are reported by respondents: agricultural and dwellings (falling of rooms) losses. Floods forecasting information is an important mechanism to mitigate floods effects and results of chapter 7 show that 72 percent households get this information more than week before the arrival of floods via government announcements. Governmental success is also visible by the fact that floods cast damage only to immoveable goods of households, crops and dwellings.

4.1.1. *Agricultural Losses*

Near about 89 percent area of crops has been lost by floods with the estimated value of 59,968 thousand rupees. Five villages, *Ahmed wala, Kacha, Road-e-ki, Shah-hadat ka thatha,* and *Tahli* have lost more than 90 percent of crops while six villages, *Bagha, Kalri, Kunan wali, Sahaban wali, Purana bagha,* and *Mingini* have lost 80-90 percent crops. There is only one village, *Monian da pump,* having loss of crops less than 80 percent.

Table 3

Aggregate Agricultural Losses

Village Name	Flood Exposure	Total Cultivated Land (acres)	Total Harvested Land (acres)	Loss (acres)	Loss in Value (Rs Thousand)
Ahmed Wala		122	10 (8)	112 (92)	4042
	Moderate	25		10 (10)	908
	Severe	97	10 (10)	87 (90)	3134
Bagha		159	26.5 (17)	132.5 (83)	4711
	Moderate	67	12.5 (19)	54.5 (81)	1970
	Severe	92	14 (15)	78 (85)	2741
Kacha		132.2	12 (9)	120.2 (91)	3838
	Moderate	10		10 (100)	230
	Severe	104.2	9 (9)	95.2 (91)	3138
	Very Severe	18	3 (17)	15 (83)	470
Kalri		158	22 (14)	136 (86)	4491
	Moderate	19	3 (16)	16 (84)	627
	Severe	139	19 (14)	120 (86)	3864
Kunan Wali		221	21 (10)	200 (90)	6961
	Moderate	31		31 (100)	904
	Severe	190	21 (11)	169 (89)	6057
Mingini		172.5	24 (14)	148.5 (86)	5139
	Moderate	43.5	7 (16)	36.5 (84)	1371
	Severe	129	17 (13)	112 (87)	3768
Monian da pump		151.5	34 (22)	117.5 (78)	4316
	Severe	88.5	23 (26)	65.5 (74)	2358
	Very Severe	63	11 (17)	52 (83)	1958
Purana Bagha		271	29 (11)	242 (89)	8145
	Moderate	221	26 (12)	195 (88)	6434
	Severe	50	3 (6)	47 (94)	1711
Road-e-Ki		149.2	6.2 (4)	143 (96)	4060
	Moderate	17		17 (100)	476
	Severe	132.2	6.2 (5)	126 (95)	3584
Sahaban Wali		137	19 (14)	118 (86)	3757
	Moderate	94	14 (15)	80 (85)	2576
	Severe	43	5 (12)	38 (88)	1181
Shah-hadat ka thatha		183	11 (6)	172 (94)	6012
	Severe	163	11 (7)	152 (93)	5374
	Very Severe	20		20 (100)	638
Tahli		124	11 (9)	113 (91)	4496
	Severe	124	11 (9)	113 (91)	4496
	Grand Total	1980.4	225.7 (11)	1754.7 (89)	59968

Note: Percentage is given in parenthesis.

Out of 1980 acres, only a small share of 226 acres (11 percent), is harvested somehow or used as a fodder for the animals. This small represents the crop to sugarcane which has height more than 10 feet, strong coating and is also a water thirsty crop. All these elements have helped in saving this crop. The villages which cultivated high portion of sugarcane, can be easily identified by

green bars in the Figure 1. So, it can be induced that *Monian da pump, Purana bagha* and *Bagha* have sowed high portion of sugarcane and ultimately, this remains safe from the disastrous clutches of floods.

Fig. 1. Aggregate Agricultural Losses
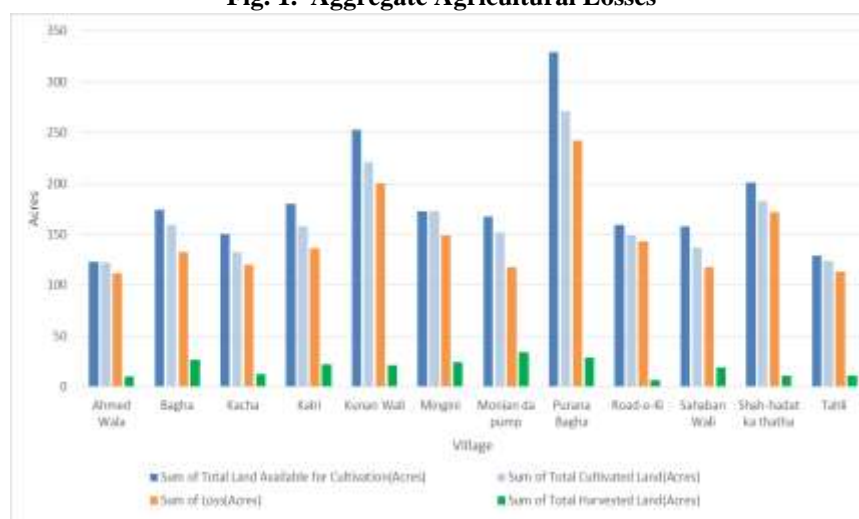
Four types of crops have been cultivated in these villages: fodder (888 acres), rice (625 acres), sugarcane (226 acres) and cotton (99 acres). Percent wise fodder, rice, sugarcane and cotton are 44, 31, 11 and 4, respectively, whereas 10 percent entails with other type of crops (includes all crops other than the major four crops).

Table 4

Crop-wise Losses

Village	Acres									Loss in Value (Rs Thousand)
	Total Land Available for Cultivation	Total Cultivated Land	Sugar-cane	Fodder	Rice	Cotton	Other Corps	Total Harvested Crops	Loss	
Ahmed Wala	123	122	10	59	53	–	–	10	112	4042
Bagha	174	159	26.5	43	44	14	32	26.5	133	4711
Kacha	150	132	12	77	36	7	–	12	121	3838
Kalri	180	158	22	82	44	9	1	22	136	4491
Kunan Wali	253	221	21	101	79	7	13	21	200	6961
Mingini	173	173	24	81	51	14	3	24	149	5139
Monian da pump	168	152	34	60	57	2	–	34	118	4316
Purana Bagha	286	279	29	80	64	28	85	22	257	8581
Road-e-Ki	159	149	6	107	30	6	–	6	143	4060
Sahaban Wali	137	133	19	60	36	3	17	19	118	3757
Shah-hadat ka thatha	201	183	11	96	73	3	–	11	172	6012
Tahli	129	124	11	43	59	7	4	11	113	4496
Grand Total	2121	1995	226	888	625	99	155	219	1770	60404

4.1.2. *Dwelling's Losses*

Other reported loss is of dwellings, falling or damaging of rooms. Dwellings are categorised according to their make-up of cement and raw bricks. 42 percent households have cemented homes while other 58 percent have homes made up of raw bricks. Dwelling formed of raw bricks are more vulnerable to floods because of their less resistant capacity to confront with high level of water. So, only 30 percent cemented rooms have fallen while 70 percent of rooms with raw bricks have yielded to floods. Poor people in villages normally have houses of raw bricks which further increases their vulnerability as compared to rich people having cemented adobes. The villages which are very severely exposed to the floods have 75 percent damaged rooms of raw bricks while severely exposed villages have 69 percent. The moderately exposed villages have lost 58 percent rooms made of raw bricks. Finally, 27 percent rooms have affected to the deleterious effects of floods.

Table 5

Losses of Dwellings

| Flood Exposure | Villages | Rooms (%) | | | Loss of Rooms (%) | | |
		Cemented	Raw Bricks	Total Number of Rooms	Cemented	Raw Bricks	Total Affected Number of Rooms
Very Severe		22	78	98	25	75	67
	Kacha	13	88	16	20	80	10
	Kalri	0	100	7	0	100	4
	Kunan Wali	100	0	16	100	0	15
	Monian da pump	0	100	31	0	100	18
	Road-e-Ki	100	0	4	–	–	–
	Shah-hadat ka thatha	0	100	24	0	100	20
Severe		42	58	534	31	69	116
	Ahmed Wala	17	83	59	–	–	–
	Bagha	60	40	43	–	–	–
	Kacha	8	92	38	0	100	21
	Kalri	20	80	46	38	63	24
	Kunan Wali	86	14	43	86	14	22
	Mingini	70	30	67	–	–	–
	Monian da pump	0	100	45	0	100	13
	Purana Bagha	53	47	36	–	–	–
	Road-e-Ki	52	48	56	46	54	13
	Sahaban Wali	85	15	41	–	–	–
	Shah-hadat ka thatha	10	90	29	0	100	17
	Tahli	26	74	31	33	67	6
Moderate		60	40	88	42	58	12
	Ahmed Wala	100	0	4	100	0	2
	Bagha	100	0	12	–	–	–
	Kacha	0	100	7	0	100	2
	Kalri	0	100	11	0	100	4
	Kunan Wali	77	23	13	100	0	3
Moderate							
	Purana Bagha	74	26	23	–	–	–
	Road-e-Ki	0	100	6	0	100	1
	Sahaban Wali	83	17	12	–	–	–
	Grand Total	42	58	720	30	70	195

4.2. Coping Strategies Adopted by Households

Four different types of mechanism are taken by flood sufferers: borrowing, asset disposal, savings and government cash grants. Rashid, *et al.* (2006) have also found same patterns of coping mechanisms for households in Bangladesh. These measures are analogous to our hypothesis. Some of households also adopt more than one strategies.

Table 6

Coping Strategies Adopted by Households

Village	Number of Households				
	Borrowing	Asset Disposal	Savings	Government Cash Grant	Total Households
Ahmed Wala	15	14	–	8	20
Bagha	8	9	–	11	20
Kacha	17	9	2	13	20
Kalri	14	14	–	11	20
Kunan Wali	14	14	–	10	20
Mingini	19	7	3	14	20
Monian da pump	12	12	2	19	20
Purana Bagha	16	7	–	6	20
Road-e-Ki	14	9	–	10	20
Sahaban Wali	16	11	–	10	20
Shah-hadat ka thatha	15	14	4	13	19
Tahli	6	5	1	7	10
Grand Total	166	125	12	132	229

Majority of households, 38 percent, rely on borrowing for the revival the floods while 30 percent people used government cash grants. 29 percent households have disposed their assets and only 3 percent have contented by using their savings.

Fig. 2. Coping Strategies Adopted by Households
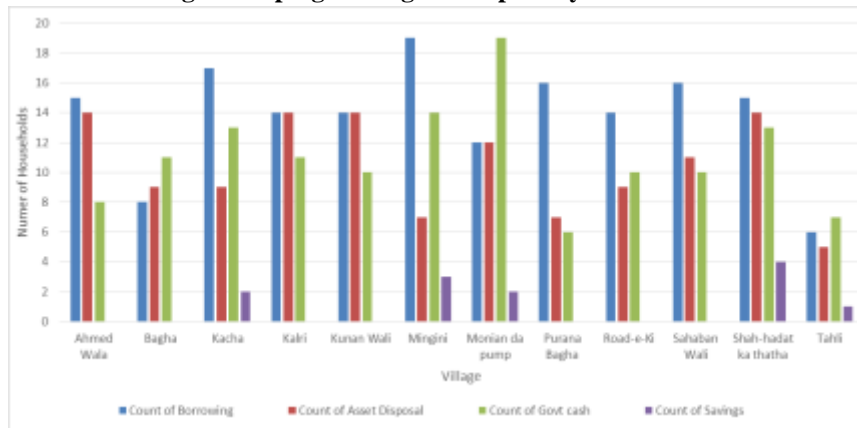
One hundred and sixty-six households have gone for borrowings, 132 households depends upon government cash grants, 125 households dispose their assets and only 12 households sustains by using their savings. Almost every village has highest frequency of borrowing. After borrowing, some villages prefer to rely on government cash grants while others like to go for assets disposal. Minimal role of savings is noticeable because majority of respondents have been poor and others laugh out when they are inquired about their savings. Other reason is that villages, which are on the bank of the river, have been suffering from these epidemic floods since 2007. Floods leave poverty as its aftermath effects, making poor a destitute. Government cash grants have played a commendable role as ex-post coping strategy for the flood victims.

This measure has been also pivotal in rescuing people from disposing their assets and loaning, which can further depart victims vulnerable to poverty-trap.

4.2.1. *Assets Disposals*

Third most widely used coping mechanism, after borrowing and government cash grants, is asset disposal. 96 percent households have stated their occupation agriculture. Having no savings and losing all cash crops like rice and cotton, people have been left behind with only asset, livestock.

Table 7

Components of Assets Disposal

Village	Total Number of Households	Number of Households		
		Cows	Buffalos	Sheep/Goat
Ahmed Wala	14	3	11	–
Bagha	9	5	6	1
Kacha	9	2	8	1
Kalri	14	6	11	2
Kunan Wali	14	8	8	2
Mingini	7	7	1	–
Monian da pump	12	8	9	2
Purana Bagha	7	2	6	1
Road-e-Ki	9	4	4	2
Sahaban Wali	11	4	8	2
Shah-hadat ka thatha	14	6	9	1
Tahli	5	3	3	1
Grand Total	125	58	84	15

Three types of livestock have been marketed: buffalos, cows and the sheep/goat. 84 households have sold buffalos and 58 households have disposed cows. Only 15 households are informed to sell the sheep/goat. Out of 125, 32 households have sold more than one type of animal. If we ignore this this double counting than 53 percent households have sold buffalos, 37 percent households have disposed cows and 10 percent households have marketed the sheep/goat.

4.2.2. *Borrowings*

Borrowing is the most common strategy adopted by the flooded households. Borrowings are gotten from four type of sources: friends/ relatives/ neighbours, private banks, government banks and middle man. Highest frequency of households have borrowed from friends/relatives/neighbours and then from middle man. Both of these sources are interest free, complying with religion, and easily approachable. Majority of households are illiterate and avoid cumbersome procedures to take loans from banks. On other hand banks are highly risk averse and do not provide loans of agricultural lands which are prone to flood.

One hundred and fourteen households borrow from friends/relatives/ neighbours while 42 households get money from intermediaries, which expresses the role of strong informal economy as well as failure of banks to fulfil the gap. Only 20 households loan from government and private banks. Loaning of private banks is more risk averse than government banks, hence only 7 households have successfully borrowed from private banks while 13 households get loans from public banks.

Sixty-five percent households get borrowing from friends/relatives/ neighbours while other 35 percent utilise other three sources of borrowings.

Table 8

Components of Borrowings

| Village | Total Number of Households | Number of Households | | | |
		Friends/Relatives/ Neighbours	Private Banks	Government Banks	Intermediaries
Ahmed Wala	15	12	1	–	2
Bagha	8	8	–	–	1
Kacha	17	13	–	–	5
Kalri	14	6	–	4	5
Kunan Wali	14	6	2	2	6
Mingini	19	15	–	–	4
Monian da pump	12	7	–	4	2
Purana Bagha	16	15	–	–	1
Road-e-Ki	14	12	–	–	2
Sahaban Wali	16	12	3	1	–
Shah-hadat ka thatha	15	5	1	2	11
Tahli	6	3	–	–	3
Grand Total	166	114	7	13	42

4.2.3. *Flood Forecasting Information*

Timely flood information accomplishes effective results as it does in case of Chiniot. In this regard, land record and revenue department of the district have played a crucial role and they have been given charges decimate flood information. Moreover they have been also answerable for making sure

displacement of households near the bank of river. This strategy of government have worked well and as a result no loss of moveable goods, like animals, has been reported. Seventy-two percent of households get flood information from government sources: announcements and visits of public servants. Only 28 percent have acquired flood information from non-governmental sources.

Table 9

Flood Forecasting Information

| Village | Source of Flood-forecasting Information | |
	Government Announcement (%)	News (%)
Ahmed Wala	75	25
Bagha	90	10
Kacha	80	20
Kalri	65	35
Kunan Wali	45	55
Mingini	70	30
Monian da pump	65	35
Purana Bagha	90	10
Road-e-Ki	50	50
Sahaban Wali	80	20
Shah-hadat ka thatha	95	5
Tahli	50	50
Grand Total	72	28

4.2.4. *Government Cash Grants*

Paul and Routray (2010) argue that provision of access to income-generating sources for the most vulnerable households can both help to reduce poverty as well as increase their coping capacity against floods. Government is second most widely used coping mechanism by households of sample villages. These cash grants are distributed by considering agricultural losses and dwellings damages. 132 households have received these cash grants. From moderately exposed households, only 33 percent households get these grants while 60 percent sevely exposed households have obtained these grants. 66 percent very severely exposed households have received grants. But households which have not received these grants are also severely exposed to the floods as well as also have substantial agricultural losses for the qualification of these grants, for example, in *Ahmed wala* and *Kalri* more than half of severely exposed households with sizeable agricultural have not received grants. The fact remains evident that households highly have relied upon these grants but distribution mechanism of these grants is still questionable.

Table 10

Government Cash Grants

Village	Moderate			Severe			Very Severe		
	Total HH's	HH's Received GCG	HH's No GCG	Total HH's	HH's Received GCG	HH's No GCG	Total HH's	HH's Received GCG	HH's No GCG
Ahmed Wala	1 [316]	–	1 [316]	19 [3726]	8 [1020] (690)	11 [2706]	–	–	–
Bagha	3 [385]	2 [128] (130)	1 [257]	17 [4326]	9 [2384] (180)	8 [1942]	–	–	–
Kacha	2 [230]	1 [60] (20)	1 [170]	13 [2526]	9 [1394] (580)	4 [1132]	5 [1082]	3 [672] (300)	2 [410]
Kalri	2 [492]	1 [210] (25)	1 [282]	15 [3327]	10 [2509] (435)	15 [818]	3 [672]	–	3 [672]
Kunan Wali	3 [923]	1 [338] (20)	2 [585]	14 [4628]	8 [2910] (437)	6 [1718]	3 [1410]	1 [150] (40)	2 [1260]
Mingini	–	–	–	20 [5139]	14 [3653] (651)	6 [1486]	–	–	–
Monian da pump	–	–	–	13 [2102]	12 [1934] (765)	1 [168]	7 [2214]	7 [2214] (515)	–
Purana Bagha	10 [3152]	3 [701] (130)	7 [2451]	10 [4993]	3 [1545] (120)	7 [3448]	–	–	–
Road-e-Ki	2 [476]	–	2 [476]	17 [3524]	10 [2432] (650)	7 [1092]	1 [60]	–	1 [60]
Sahaban Wali	5 [1295]	2 [458] (55)	3 [837]	15 [2462]	8 [1072] (410)	7 [1390]	–	–	–
Shah-hadat ka thatha	–	–	–	9 [3510]	5 [2190] (370)	4 [1320]	10 [2502]	8 [1884] (460)	2 [618]
Tahli	–	–	–	10 [4496]	7 [3686] (555)	3 [810]	–	–	–
Grand Total	28	10	18	172	103	69	29	19	10

HH's=households, RCG= government cash grants, [agricultural loss in rupees thousand], (government cash grants in rupees thousand)

4.3. Determinants of Coping Strategies

Firstly, in both logit and tobit model determinants of all coping strategies have been sorted. Here coping strategies, borrowing, saving, asset disposal and government cash grants are taken as dependent variable while shock factors (depth of water in homestead, number of days water stayed at home, number of days spent out of home, agricultural loss) and demographic factors (household size, household head age, education of household head, gender of household head, occupation of household head) have been taken as independent variables. Constructions of these variables is consisted with the studies of Ninno, *et al*. (2002) and Sultana, *et al*. (2012).

Then, relationship between these coping mechanisms and flood exposure has also been checked by both models.

4.3.1. *Results of Logit Model*

All shock factors are highly significant determinants of households coping strategies while for government cash grants demographic factors like gender of household head and education level of households head have significant role. These results are analogous with the previous studies of Ninno, *et al*. (2002) and Sultana, *et al*. (2012). In the case of saving two factors number of days water stayed at home and education of household head are significant. In

case of number of days water stayed at home there is 1.15 more likelihood that households will consume its savings. Usage of savings depends on households income, if household have high income level it will have more saving to spent in the time of crisis as compared to poor households. In this survey only twelve households from sample have some savings to use, so results for saving are not fully justifiable as there is a negative relationship between number of days spent out of home and savings.

Table 11

Determinants of Saving and Government Cash Grants, Logit Model

Variable	Saving			Government Cash Grants		
	MFX	Odds Ratio	z	MFX	Odds Ratio	z
Depth of water in homestead	0.0104	0.8714 (0.1291)	–0.93	0.0327	1.146 (0.1016)*	1.54
Number of days water stayed at home	0.0107	1.1524 (0.0904)**	1.81	0.0041	0.983 (0.0708)	-0.24
Number of days spent out of home	–0.0029	0.9627 (0.0323)	–1.13	0.0107	1.0457 (0.0183)***	2.55
Agricultural loss	–0.0001	0.9984 (0.0024)	–0.65	0.0450	1.0002 (0.0006)**	0.26
Household size	0.0077	1.1073 (0.1505)	0.75	–0.0115	0.9532 (0.0612)	-0.75
Household head age	–0.0008	0.9894 (0.0326)	–0.32	0.0072	1.0303 (0.0119)***	2.6
Education of household head	0.0145	1.2126 (0.1205)**	1.94	0.0183	1.0793 (0.0436)**	1.89
Gender of household head(male =1)	–	–	–	0.5566	24.0616 (26.6228)***	2.87
Occupation of household head(agriculture =1)	–	–	–	–	–	–
Village dummy 1 (Monian da pump = 1)	–0.0422	0.5303 (0.6003)	–0.56	0.2858	4.4872 (6.3707)	1.06
Village dummy 2 (Shah-hadat ka thatha = 1)	0.2214	6.7018 (9.6886)	1.32	–0.0181	0.9278 (0.9869)	–0.07
Village dummy 3 (Kacha = 1)	0.0128	1.1774 (1.3745)	0.14	0.0857	1.4495 (1.5022)	0.36
Village dummy 4 (Kunan Wali = 1)	–	–	–	–0.1118	0.6348 (0.6738)	–0.43
Village dummy 5 (Bagha = 1)	–	–	–	0.0656	1.3245 (1.4313)	0.26
Village dummy 6 (Purana Bagha = 1)	–	–	–	–0.1477	0.5494 (0.6015)	–0.55
Village dummy 7 (Sahaban Wali = 1)	–	–	–	–0.0052	0.9784 (1.086)	–0.02
Village dummy 8 (Road-e-Ki = 1)	–	–	–	–0.1278	0.5953 (0.6493)	–0.48
Village dummy 9 (Kalri = 1)	–	–	–	–0.0618	0.7764 (0.8732)	–0.23
Village dummy 10 (Mingini = 1)	–	–	–	0.1505	1.973 (2.119)	0.63
Village dummy 11 (Ahmed wala = 1)	–	–	–	–0.1305	0.5888 (0.6282)	–0.5
Constant	–	0.2234 (0.5522)	-0.61	–	0.0026 (0.0055)***	–2.82
Log pseudo likelihood		–22.71			–128	
Number of observations		71			224	
Prob > chi2		0.0375			0.0013	
Pseudo R2		0.213			0.1648	

(robust standard errors), *** significance at 1 percent, ** significance at 5 percent, * significance at 10 percent.

Table 12

Determinants of Borrowing and Asset Disposal, Logit Model

Variable	Borrowing			Asset Disposal		
	MFX	Odds Ratio	z	MFX	Odds Ratio	z
Depth of water in homestead	0.0037	0.9788	-0.27	0.0596	1.2735	3.05
		(0.0784)			(0.1009)***	
Number of days water stayed at home	0.0011	0.9934	-0.12	0.0223	0.9135	-1.6
		(0.0536)			(0.0515)*	
Number of days spent out of home	0.0029	1.0172	1.18	0.0045	1.0183	1.22
		(0.0147)			(0.0152)	
Agricultural loss	0.0005	1.0027	2.23	0.0006	1.0023	3.2
		(0.0012)***			(0.0007)***	
Household size	0.0187	1.1147	1.68	0.0105	1.0435	0.74
		(0.0719)*			(0.0603)	
Household head age	-0.0045	0.9741	-2	-0.0038	0.9847	-1.29
		(0.0128)***			(0.0118)	
Education of household head	-0.0126	0.9294	-1.68	-0.0038	0.9848	-0.38
		(0.0406)*			(0.04)	
Gender of household head (male=1)	- 0.0693	0.6682	-1.35	-0.0699	0.753	-1
		(0.2002)			(0.2129)	
Occupation of household head (agriculture=1)	0.287	3.6654	0.42	0.1047	1.5228	0.24
		(11.2832)			(2.6884)	
Village dummy 1 (Monian da pump = 1)	-0.1474	0.4775	-0.77	-0.021	0.9188	-0.08
		(0.4561)			(0.9695)	
Village dummy 2 (Shah-hadat ka thatha = 1)	0.019	1.1189	0.11	-0.0382	0.8573	-0.15
		(1.1402)			(0.9097)	
Village dummy 3 (Kacha = 1)	0.1056	2.0893	0.72	-0.1067	0.6514	-0.44
		(2.1376)			(0.6317)	
Village dummy 4 (Kunan Wali = 1)	-0.0458	0.7772	-0.25	0.1905	2.3102	0.82
		(0.7826)			(2.3506)	
Village dummy 5 (Bagha = 1)	-0.2429	0.3168	-1.18	0.0760	1.3703	0.32
		(0.3077)			(1.3346)	
Village dummy 6 (Purana Bagha = 1)	0.0934	1.8869	0.57	-0.0974	0.6762	-0.39
		(2.0948)			(0.6762)	
Village dummy 7 (Sahaban Wali = 1)	0.1149	2.2679	0.78	0.2135	2.5964	0.95
		(2.3878)			(2.6133)	
Village dummy 8 (Road-e-Ki = 1)	0.0358	1.2455	0.22	0.0887	1.4466	0.37
		(1.2295)			(1.4482)	
Village dummy 9 (Kalri = 1)	-0.0019	0.9888	-0.01	0.2417	3.0218	1.1
		(0.9288)			(3.0267)	
Village dummy 10 (Mingini = 1)	0.2317	11.9793	1.83	-0.1177	0.6229	-0.48
		(16.2932)**			(0.6185)	
Village dummy 11 (Ahmed wala = 1)	0.0589	1.4552	0.38	0.2674	3.502	1.27
		(1.4323)			(3.4574)	
Constant	–	0.7911	-0.07	–	0.114	-0.92
		(2.7747)			(0.269)	
Log pseudo likelihood		-113.21			-133.5	
Number of observations		227			227	
Prob > chi2		0.0178			0.0051	
Pseudo R2		0.143			0.1449	

(robust standard errors), *** significance at 1 percent, ** significance at 5 percent, * significance at 10 percent.

Table 13

Borrowing, Asset Disposal and Flood Exposure, Logit Model

Variable	Borrowing			Asset Disposal		
	MFX	Odds Ratio	z	MFX	Odds Ratio	z
Flood exposure	0.0270	1.0189	1.26	0.0110	1.0457	3.27
		(0.0151)**			(0.0143)***	
Constant		0.8727	-0.15		0.0808	-2.99
		(0.7916)			(0.0679)***	
Log pseudo likelihood		-131.24689			-150.38494	
Number of observations		227			227	
Prob > chi2		0.2067			0.0007	
Pseudo R2		0.0065			0.0371	

(robust standard errors), *** significance at 1 percent, ** significance at 5 percent, * significance at 10 percent.

Table 14

Saving, Government Cash Grants and Flood Exposure, Logit Model

Variable	Saving			Government cash grants		
	MFX	Odds Ratio	z	MFX	Odds Ratio	z
Flood exposure	0.0003	1.008	0.25	0.0104	1.0437	3.22
		(0.0325)			(0.0138)***	
Constant		0.0282	-1.77		0.0999	-2.86
		(0.057)**			(0.0806)***	
Log pseudo likelihood		-40.9651			-149.6697	
Number of observations		227			227	
Prob > chi2		0.8039			0.0013	
Pseudo R2		0.0009			0.034	

(robust standard errors), *** significance at 1 percent, ** significance at 5 percent, * significance at 10 percent.

For government cash grants household head age, education of household head, gender of household head, number of days spent out of home, depth of water in homestead and agricultural loss are coming up with high level of significance. All these variables have positive relationship with government cash grants. Only household size have negative relationship with government cash grants.

All variables have positive relationship with borrowing and asset disposal except household head age, education of household head, and gender of household head (male=1). Agricultural loss is very significant for both of strategies. If household head is male, educated and aged there are high chances to get government cash grants which is visible from Table 4. Hence, households head have received government cash grants and avoided from borrowing and asset disposal.

Lastly relationship between coping mechanisms and flood exposure is significant as well as positive. Only for saving this relationship is positive but insignificant. These results are consistent with the study of Ninno, *at al*. (2002).

4.3.2. *Results of Tobit Model*

Results of tobit model are consistent with the results of logit model like all shock factors are positively related with coping strategies and agricultural

losses are highly significant. Results of tobit model are also coherent with the findings of Sultana, *et al*. (2012).

Flood exposure is also highly significant as well as have positive relationship with asset disposal, government cash grants and borrowings.

Table 15

Determinants of Borrowing, Asset Disposal and Government
Cash Grants, Tobit Model

Variable	Coefficient of Asset Disposal	Coefficient of Borrowing	Coefficient of Government Grants
Depth of water in homestead	9508(6342)	3655(3571)	4601(2328)**
Number of days water stayed at home	5232(2722)**	2445(2680)	908(1289)
Number of days spent out of home	1444(871)*	383(559)	795(457)*
Agricultural loss	155(38)***	316(129)***	61(29)***
Household size	-58(3447)	5554(2935)**	-2291(1810)
Household head age	-1333(652)**	-447(474)	708(344)**
Education of household head	-858(2253)	941(1889)	1468(1064)
Gender of household head (male = 1)	-32594(51188)	-22444(13286)*	10816(8249)
Occupation of household head (agriculture = 1)	16677(107835)	79112(120228)	32996(15893)***
Village dummy 1 (Monian da pump = 1)	56221(50387)	-124604(90202)	8500(31271)
Village dummy 2 (Shah-hadat ka thatha = 1)	15403(37864)	-121750(95043)	-24226(30666)
Village dummy 3 (Kacha = 1)	22939(47310)	-79412(78776)	309(30069)
Village dummy 4 (Kunan Wali = 1)	80040(47980)*	-119842(97106)	-30959(30664)
Village dummy 5 (Bagha = 1)	54067(49483)	-148890(91032)*	-21511(28329)
Village dummy 6 (Purana Bagha = 1)	-961(52711)	-126475(101956)	-51482(32599)*
Village dummy 7 (Sahaban Wali = 1)	84952(52526)*	-14664(79874)	-10750(29903)
Village dummy 8 (Road-e-Ki = 1)	60431(54629)	-84831(79977)	-14693(30647)
Village dummy 9 (Kalri = 1)	91452(42442)***	-97716(80930)	-22848(29458)
Village dummy 10 (Mingini = 1)	25951(51203)	-71485(80866)	-5098(28838)
Village dummy 11 (Ahmed wala = 1)	103288(46436)***	-54896(85184)	-8975(32828)
Constant	-49965.24 (161518.2)	-83261 (144395)	-44863 (47103)
Uncensored observation	125	166	130
Log pseudo likelihood	-1694.7259	-2213.6503	-1681.6936
Pseudo R2	0.0132	0.0206	0.0146
Prob > F	0.0005	0.4625	0

(robust standard errors), *** significance at 1 percent, ** significance at 5 percent, * significance at 10 percent.

Table 16

Saving, Government Cash Grants and Flood Exposure, Tobit Model

Variable	Coefficient of Asset Disposal	Coefficient of Borrowing	Coefficient of Government Grants
Flood exposure	2767(-820)***	961(634)*	1714(396)***
Constant	-156547(-52958)***	-26083(39113)	-93981(25423)***
Uncensored observation	125	166	130
Log pseudo likelihood	-1711.7843	-2259.695	-1699.6508
Pseudo R2	0.0033	0.0002	0.004
Prob > F	0.0009	0.1317	0

(robust standard errors), *** significance at 1 percent, ** significance at 5 percent, * significance at 10 percent.

5. CONCLUSION

The study have manifested that majority of household have been severely exposed to the floods of 2014 in Chiniot, Punjab. The level of exposure to the floods varies among the households even of same villages. Seventy-two percent households have received flood warnings by governmental sources. Households have been unable to save only immoveable possessions, crops and rooms. All types of crops have been drenched by flood water and only the sugarcane have resisted effectively. Other type of loss households suffer in the form of falling and damaging of rooms. Most of households' adobes are made of raw bricks which have been more vulnerable to floods than cemented houses and hence, such households have suffered more in these losses. Households have relied upon major three type of coping strategies after the floods: borrowing, assets disposal and government cash grants. All shock factors are significant determinants of households coping strategies while for government cash grants demographic factors like gender of household head and education level of households head have significant role. Government cash grants and early flood warnings have played a laudable role in mitigating and coping the aftermaths of floods but the distribution mechanism of these grants reveals lacks of transparency and meritocracy.

Although government has achieved its objective by timely provision of cash grants to households but still there is a vast room of improvement. Following recommendations could be useful to address this issue:

(1) Transparent distribution mechanism and target-based approach will increase the effectiveness of these grants. Main focus of grants should be poor households: households with female heads and small farmers because of their high level of vulnerability.

(2) Provision of easy loaning by banks and initiatives for the formulation of crop insurance in floods prone areas can also be crucial in mitigating the effects of floods.

During floods of 2014 in Punjab, prices of fodder have risen but on other hand prices of livestock have decreased in the market because of households asset disposal strategy, excessive supply of livestock. Skin diseases and fever-like health hazards have been reported by majority of households of the sample. Floods also exacerbate the poverty levels in these areas. Future research in these areas will be constructive in understanding the multidimensional and complex flood-related risks.

REFERENCES

ADB (2013) *Indus Basin Floods: Mechanisms, Impacts, and Management*.

ADB, Government of Pakistan, and the World Bank (2010) *Pakistan Floods 2010: Preliminary Damage and Needs Assessment*. Islamabad.

Adger, W. Neil (2006) Vulnerability. *Global Environmental Change* 16:3, 268–281.

Agena, Torese (2007) The Relationship between Economic Activities and Environmental Degradation in Africa. *Journal of the Historical Society of Nigeria*, 28–40.

Ahmad, Farooq, Syeda Farhana Kazmi, and Tahir Pervez (2011) Human Response to Hydro-meteorological Disasters: A Case Study of the 2010 Flash Floods in Pakistan. *Journal of Geography and Regional Planning* 4:9, 518–524.

Ahmad, Zulfiqar, Mohsin Hafeez, and Iftikhar Ahmad (2012) Hydrology of Mountainous Areas in the Upper Indus Basin, Northern Pakistan with the Perspective of Climate Change. *Environmental Monitoring and Assessment* 184:9, 5255–5274.

Ali, Ghazanfar, S. Hasson, and Arshad M. Khan (2009) Climate Change: Implications and Adaptation of Water Resources in Pakistan. GCISC-RR-13, Global Change Impact Studies Centre (GCISC), Islamabad.

Baqir, Maryam, Zain A. Sobani, Amyn Bhamani, Nida Shahab Bham, Sidra Abid, Javeria Farook, and M. Asim Beg (2012) Infectious Diseases in the Aftermath of Monsoon Flooding in Pakistan. *Asian Pacific Journal of Tropical Biomedicine* 2:1, 76–79.

Benfield, Aon (2012) Annual Global Climate and Catastrophe Report: Impact Forecasting 2013. 96.

Bukhari, Syed Iazaz Ahmad and Shahid Hassan Rizvi (2010) *Pakistan's Flooding of July-August 2010: Not Only a Natural Disaster*.

Cannon, Terry (1994) Vulnerability Analysis and the Explanation of 'Natural' Disasters. *Disasters, Development and Environment*, 13–30.

Centre for Research on the Epidemiology of Disasters (CRED). EM-DAT: The International Disaster Database.http://cred01.epid.ucl.ac.be:5317/?after=2000&before=2015&continent%5B%5D=Asia&dis_group%5B%5D=Natural&dis_subgroup%5B%5D=Hydrological&dis_type%5B%5D=Flood&agg1=dis_type&agg2=dis_type (accessed Nov 2015).

Chakravarty, Sumit, S. K. Ghosh, C. P. Suresh, A. N. Dey, and Gopal Shukla (2012) Deforestation: Causes, Effects and Control Strategies. ISBN, 2012.

Corbett, Jane (1988) Famine and Household Coping Strategies. *World Development* 16:9, 1099–1112.

Cutter, Susan L., Bryan J. Boruff, and W. Lynn Shirley (2003) Social Vulnerability to Environmental Hazards*. *Social Science Quarterly* 84:2, 242–261.

Dasgupta, Amrita (2007) Floods and Poverty Traps: Evidence from Bangladesh. *Economic and Political Weekly*, 3166–3171.

Del Ninno, Carlo (ed.) (2001) The 1998 Floods in Bangladesh: Disaster Impacts, Household Coping Strategies, and Response. Vol. 122. International Food Policy Research Institute.

Del Ninno, Carlo, Paul A. Dorosh, and Lisa C. Smith (2003) Public Policy, Markets and Household Coping Strategies in Bangladesh: Avoiding a Food Security Crisis Following the 1998 Floods. *World Development* 31:7, 1221–1238.

Dorosh, Paul, Sohail J. Malik, and Marika Krausova (2010) Rehabilitating Agriculture and Promoting Food Security After the 2010 Pakistan Floods: Insights from the South Asian Experience. *The Pakistan Development Review* 49:3, 167–192.

Embrechts, Paul, Claudia Klüppelberg, and Thomas Mikosch (1997) *Modelling External Events* 33. Springer Science & Business Media.

Fair, C. Christine (2011) *Pakistan in 2010*. 97–110.

Frankenberger, Timothy. (1002) Indicators and Data Collection Methods for Assessing Household Food Security. Household Food Security: Concepts, Indicators, and Methods.

Galarneau Jr, Thomas J., Thomas M. Hamill, Randall M. Dole, and Judith Perlwitz (2012) A Multiscale Analysis of the Extreme Weather Events Over Western Russia and Northern Pakistan during July 2010. *Monthly Weather Review* 140:5, 1639–1664.

Ghorpade, Yashodhan (2012) Coping Strategies in Natural Disasters and under Conflict: A Review of Household Responses and Notes for Public Policy. Households in Conflict Network. (No. 136.)

Greene, William H. (2003) *Econometric Analysis*. Pearson Education India.

Grothmann, Torsten and Fritz Reusswig (2006) People at Risk of Flooding: Why Some Residents Take Precautionary Action While Others Do Not. *Natural Hazards* 38:1-2, 101–120.

Hansson, Karin, Mats Danielson, and Love Ekenberg (2008) A Framework for Evaluation of Flood Management Strategies. *Journal of Environmental Management* 86:3, 465–480.

Hasan, Syed Shabib ul, and Syed Shahid Zaheer Zaidi (2012) Flooded Economy of Pakistan. *Journal of Development and Agricultural Economics* 4:13, 331–338.

Hussain, Zamir (2011) Application of the Regional Flood Frequency Analysis to the Upper and Lower Basins of the Indus River, Pakistan. *Water Resources Management* 25:11, 2797–2822.

Ibarrarán, María Eugenia, Matthias Ruth, Sanjana Ahmad, and Marisa London (2009) Climate Change and Natural Disasters: Macroeconomic Performance and Distributional Impacts. *Environment, Development and Sustainability* 11:3, 549–569.

Israel, Danilo C. and Roehlano Mariano Briones (2014) Disasters, Poverty, and Coping Strategies: The Framework and Empirical Evidence from Micro/ Household Data-Philippine Case. Philippine Institute for Development Studies.

Istomina, M. N., A. G. Kocharyan, and I. P. Lebedeva (2005) Floods: Genesis, Socioeconomic and Environmental Impacts. *Water Resources* 32:4, 349–358.

Kale, Vishwas On the Link between Extreme Floods and Excess Monsoon Epochs in South Asia. *Climate Dynamics* 39:5, 1107–1122.

Kazi, Asadullah (2014) A Review of the Assessment and Mitigation of Floods in Sindh, Pakistan. *Natural Hazards* 70:1, 839–864.

Khan, A. A., W. De Jong, P. J. Jansens, and H. Spliethoff (2009) Biomass Combustion in Fluidized Bed Boilers: Potential Problems and Remedies. *Fuel Processing Technology* 90:1, 21–50.

Khan, Amir Nawaz (2011) Analysis of Flood Causes and Associated Socio-economic Damages in the Hindukush Region. *Natural Hazards* 59:3, 1239–1260.

Khan, Amir Nawaz (2013) Analysis of 2010-flood Causes, Nature and Magnitude in the Khyber Pakhtunkhwa, Pakistan. *Natural Hazards* 66:2, 887–904.

Khan, Bushra, Muhammad Jawed Iqbal, and M. Ayub Khan Yosufzai (2011) Flood Risk Assessment of River Indus of Pakistan. *Arabian Journal of Geosciences* 4:1-2, 115–122.

Khan, Himayatullah, and Aburab Khan (2008) Natural Hazards and Disaster Management in Pakistan.

Khan, Himayatullah, Ehsan Inamullah, and Khadija Shams (2009) Population, Environment and Poverty in Pakistan: Linkages and Empirical Evidence. *Environment, Development and Sustainability* 11:2, 375–392.

Khandker, Shahidur R. (2008) Coping with Flood: Role of Institutions in Bangladesh. *Agricultural Economics* 36:2, 169–180.

Kreibich, Heidi, and Annegret H. Thieken (2009) Coping with Floods in the City of Dresden, Germany. *Natural Hazards* 51:3, 423–436.

Kronstadt, K. Alan (2010) *Flooding in Pakistan: Overview and Issues for Congress*. DIANE Publishing.

Looney, Robert (2012) Economic Impacts of the Floods in Pakistan. *Contemporary South Asia* 20:2, 225–241.

Malik, Sadia Mariam, Haroon Awan, and Niazullah Khan (2012) Mapping Vulnerability to Climate Change and Its Repercussions on Human Health in Pakistan. *Globalisation and Health* 8:1, 31.

Maxwell, Daniel G. (1996) Measuring Food Insecurity: The Frequency and Severity of "Coping Strategies. *Food Policy* 21:3, 291–303.

Morrow, Betty Hearn (1999) Identifying and Mapping Community Vulnerability. *Disasters* 23:1, 1–18.

Mustafa, Daanish (2009) Structural Causes of Vulnerability to Flood Hazard in Pakistan. *Economic Geography* 74:3, 289–305.

Mutton, David and C. Emdad Haque (2004) Human Vulnerability, Dislocation and Resettlement: Adaptation Processes of River-bank Erosion-induced Displacees in Bangladesh. *Disasters* 28:1, 41–62.

Naser, Mostafa Mahmud (2015) Climate Change, Environmental Degradation, and Migration: A Complex Nexus. Mostafa Mahmud Naser, Climate Change, Environmental Degradation, and Migration: A Complex Nexus 36.

National Disaster Management Authority (2012) Government Update, 27 November 2012. Government of Pakistan Islamabad. http://www.ndma.gov.pk/ flood2012.php accessed Nov 2015.

National Disaster Management Authority (2014) *Pakistan Floods 2014: Recovery Needs Assessment and Action Framework 2014-16*.

Ninno, Carlo, Paul A. Dorosh, and Nurul Islam (2002) Reducing Vulnerability to Natural Disasters. *IDS Bulletin* 33:4, 98–107.

Pakistan, Government of (2006) *Ministry of Water and Power, Federal Flood Commission*. Islamabad: Flood Protection Plan. Islamabad.

Pakistan, Government of (2010) *Rainfall Statement July 2010*. Islamabad: Ministry of Defense, Pakistan Meteorological Department (PMD).

Pakistan, Government of (2011) Annual Report 2010. Islamabad. http://www.ffc.gov.pk/download/flood/archieve/Annual.report2010.pdf?bcsi_scan_97e98328e2b67804=0&bcsi_scan_filename=Annual.report2010.pdf (accessed 22 March 2013).

Pakistan, Government of (2011) *National Water Policy* (Draft). Islamabad: Ministry of Water and Power.

Pakistan, Government of (2011) *Supreme Court of Pakistan 2011*. Islamabad: Enquiry Report of Flood Commission Appointed by the Supreme Court of Pakistan.

Pathan, Pervez, A. Razzaq Khan, S. Razzaq, and Gulam Jariko (2012) Reduction of Disaster Vulnerability Through Indigenous Knowledge.

Paul, Shitangsu Kumar, and Jayant K. Routray (2010) Flood Proneness and Coping Strategies: The Experiences of Two Villages in Bangladesh. *Disasters* 34:2, 489–508.

Paulikas, M. J. and M. K. Rahman (2015) A Temporal Assessment of Flooding Fatalities in Pakistan (1950–2012). *Journal of Flood Risk Management* 8:1, 62–70.

Pryce, Gwilym and Yu Chen (2011) Flood Risk and the Consequences for Housing of a Changing Climate: An International Perspective. *Risk Management* 13:4, 228–246.

Qureshi, Asad Sarwar (2011) Water Management in the Indus Basin in Pakistan: Challenges and Opportunities. *Mountain Research and Development* 31:3, 252–260.

Rashid, Sabina Faiz (2000) The Urban Poor in Dhaka City: Their Struggles and Coping Strategies during the Floods of 1998. *Disasters* 24:3, 240–253.

Rehman, Gohar, Sajjad Ahmad, Shuhab D. Khan, Fayaz Ali, Taqweemul H. Ali, and Sadaf F. Khan (2014) Threat of Glacial Lake Outburst Flood to Tehsil Gupis from Khukush Lake, District Ghizer, Gilgit Baltistan, Pakistan. *Natural Hazards* 70:2, 1589–1602.

Sayed, Sayeeda Amber and Pedro Arcos González (2014) Flood Disaster Profile of Pakistan: A Review. *Science* 2:3, 144–149.

Schwarzer, Ralf and Christine Schwarzer (1996) A Critical Survey of Coping Instruments. *Handbook of Coping: Theory, Research, Applications* (1996): 107–132.

Shahzad, Umair (2014) Impact Assessment of Natural Disasters upon Economic Growth in Pakistan. Lahore School of Economics. (PhD Dissertation).

Shrestha, Mandira Singh and K. Takara (2008) Impacts of Floods in South Asia. *Journal of South Asia Disaster Study* 1:1, 85–106.

Siddiqui, Qazi Tallat Mahmood, Hashim Nisar Hashmi, and Abdul Razzaq Ghumman (2011) Flood Inundation Modelling for a Watershed in the Pothowar Region of Pakistan. *Arabian Journal for Science and Engineering* 36:7, 1203–1220.

Sim, Malcolm R. (2011) Disaster Response Workers: Are We Doing Enough to Protect Them? *Occupational and Environmental Medicine* 68:5, 309–310.

Skoufias, Emmanuel (2003) Economic Crises and Natural Disasters: Coping Strategies and Policy Implications. *World Development* 31:7, 1087–1102.

Sultana, Nayeem and Md. Israt Rayhan (2012) Coping Strategies with Floods in Bangladesh: An Empirical Study. *Natural Hazards* 64:2, 1209–1218.

Syvitski, James P. M. and G. Robert Brakenridge (2013) Causation and Avoidance of Catastrophic Flooding Along the Indus River, Pakistan. *GSA Today* 23:1, 4–10.

Tariq, Muhammad and Atiq Ur Rehman (2013) Risk-based Flood Zoning Employing Expected Annual Damages: The Chenab River Case Study. *Stochastic Environmental Research and Risk Assessment* 27:8, 1957–1966.

Tariq, Muhammad, Atiq Ur Rehman, and Nick van de Giesen (2012) Floods and Flood Management in Pakistan. *Physics and Chemistry of the Earth*, Parts A/B/C 47, 11–20.

Uitto, Juha I. (1998) The Geography of Disaster Vulnerability in Megacities: A Theoretical Framework. *Applied Geography* 18:1, 7–16.

Warner, Koko, Mohamed Hamza, Anthony Oliver-Smith, Fabrice Renaud, and Alex Julca (2010) Climate Change, Environmental Degradation and Migration. *Natural Hazards* 55:3, 689–715.

WFP (2010) *Pakistan Flood Impact Assessment*.

White, Stacey (2011) The 2010 Flooding Disaster in Pakistan: An Opportunity for Governance Reform or another Layer of Dysfunction. (CSIS Background Paper).

Wi, Sung-Wook, Gun-Hui Chung, and Tae-Woong Kim (2008) Development of a Comprehensive Flood Index Through Standardising Distributions of Runoff Characteristics. *Journal of Korea Water Resources Association* 41:6, 605–617.

Yan, Deng-Hua, Jing Feng, Chuan-Zhe Li, Tian-Ling Qin, Bai-Sha Weng, and Xin Jin (2012) General Framework and Key Issues Concerning Integrated Strategies for Coping with Drought and Flood in China in a Changing Environment. *Natural Hazards* 64:1, 577–592.