Shocks as a Source of Vulnerability: An Empirical Investigation from Pakistan

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ABSTRACT

The objective of this paper is to investigate the incidence of different types of shocks and identify the household characteristics that are associated with this phenomenon. It is observed that one-fourth of households experience an adverse shock, be it natural, agricultural, economic, social or relating to health.. The natural/agricultural shocks have major share in the total burden of shocks while the households' coping mechanism is overwhelmingly informal and largely asset-based. The poorest of the households adopt behaviour-based strategies like reducing food consumption, employ child labour, work more hours etc. Overall, large rural households with aged heads and ownership of land and livestock are more likely to suffer shocks, particularly of the natural/ agricultural kind. For all these reasons, a gradual shift from traditional emergency relief measures towards ex-ante actions to reduce and mitigate hazard impacts should be encouraged along with non-exploitative credit and more effective safety nets.

1. INTRODUCTION

A growing body of literature points to the role of risks, shocks and vulnerability in perpetuating poverty because poor households are relatively more negatively affected by uninsured shocks, as they are likely to lack the necessary human and physical capital to recover from them [Del Ninno and Marini (2005)]. Vulnerability as expected poverty can be defined as the ex-ante risk that a household if currently non-poor will fall below poverty line, or if currently poor, will remain in poverty in the future. The sources of vulnerability depend on the level of underlying shock, the ability to cope with shock management strategies, and long-term income generating capacity [Chaudhuri (2003)]. Some of these shocks can have long-lasting effects in perpetuating and increasing poverty and resulting in adverse human development outcomes [Foster (1995); Jacoby and Skoufias (1997)]. In developing countries where financial and insurance markets are incomplete or even absent, poor households are exposed to a variety of risks resulting in high income volatility [Baulch and Hoddinott (2000); Dercon (2002); Paxson (1992)]. Households protect their livelihood by employing risk management strategies in order to reduce the likelihood of shock occurrence ex-ante and to mitigate and cope with the impact of a shock ex-post [World Bank (2001)].

In economic terms when a risk materialises it can become a shock, whereby a shock is an event that leads to undesirable welfare outcomes, which can affect individuals, a community, a region, or even a nation. In other words, risks are prospects of a shock or, alternatively, shocks can be thought as the realisation of risks [Fafchamps (2009); Jensen (2009); Sinha and Lipton (2000)]. According to Sinha and Lipton (2000) the term 'shocks' has already a very specific connotation that encompasses: (i) unexpectedness, (ii) size, (iii) high damage due to concentration on persons with high vulnerability and low resilience; (iv) exogenousness in the source; and (v) physical or psychological strain to one or more individuals due to that stress.

Shocks can result in income loss or non income losses distributed across space and time, i.e., frequency, duration, intensity and scope. The typology of shocks typically classified and based on scope are idiosyncrasy and covariate. Households' idiosyncrasy shocks comprise household-specific shocks such as

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illness, injury, death, job loss, crop failure and loss of transfers which are compounded by lack of financial intermediation and formal insurance, credit market imperfections and weak infrastructure while covariate shocks such as weather adversity and market fluctuation tend to have an impact on a larger group of population in the same area at the same time [Dercon (2002)]. All these shocks can potentially contribute to high income volatility of the households.

Households are the starting point of the analysis and can be thought of as having tangible (natural, human, physical and financial capitals) and intangible assets (social capital, the proximity to markets, health and education facilities and empowerment) at their disposal, used to generate well being. More specifically, human capital alludes to the household members' education and their health status while physical capital is related to productive assets such as land, tools, equipment and work animal and. household assets like housing and household services, livestock, food and jewellery. Finally, financial capital will refer to cash, savings, and access to credit. Intangible assets result from the interaction of members within households as well as of households with each other inside the community and beyond. These include gender relations, social ties and networks, including participation in associations and organisations, and intra-household relations. Both types of assets are important in the context of risk management [Siegel and Alwang (1999)].

Shocks have adverse impact that lead to loss of household income, reduction in consumption, loss of productive assets, and/or serious concern/anxiety about household welfare. Shocks can also divide into a number of broad categories: natural/agriculture; economic; political/social/legal; crime; health; and life-cycle shocks. Natural/agriculture shocks include earthquake, flooding, erosion, pestilence affecting crops or livestock. Economic shocks include business closures, mass layoffs, job loss, wage cuts, loss of remittances. Political/social/legal shocks include court cases and bribery, as well as long duration general strikes, violence, crime and political unrest. Health shocks include death, injury and illness while life cycle shocks include dowry payments, wedding-related expenses, and property division.

When a shock affects the material welfare of households, some ex-post coping strategies i.e., behaviour and asset-based strategies and assistance from informal or public sources can be adopted, either to adjust the standard of living downward or to use other mechanisms to mitigate the effects of the shock. These commonly used coping strategies may have very harmful consequences over the short and long term, particularly for households with low consumption levels, low savings and limited access to non-exploitative credit. While spending precautionary savings or borrowing from friends and relatives may be relatively harmless, selling or mortgaging of land, house, and productive assets can seriously jeopardise the households' livelihoods [Heltherg and Niels (2009)].

Within South Asia, Pakistan is lagging more in human development than in economic growth. Incidence of poverty in 2010 was 20.7 percent: 22.4 percent in rural areas and 16.6 percent in urban areas [Arif and Shujaat (2012)]. The poor in Pakistan are not only suffering from average low consumption but also are subject to high fluctuations in consumption due to income risk and the lack of safety net measures. The landless are more deprived than the landed if focused on vulnerability [Kurosaki (2004)]. In rural areas, permanent non-farm employment is associated with the exit from poverty while education is key to such employment. Livestock is more pro-poor than crop agriculture but its role in economic growth may be limited. Social safety nets are weak; especially those provided by formal institutions while private networks based on personal relations are more important safety nets [Kurosaki and Khan (2001)]. Since the majority of households in Pakistan depend on agriculture for their livelihoods and experience frequent droughts, floods, and other unexpected adverse events such as illness, loss of job, and conflicts, etc., these can be referred to as shocks, that lead to income and asset loss. While there is an option of doing nothing in the wake of a shock, many also tend to use several coping strategies including informal insurance, savings, loans, receiving aid and remittances, reducing consumption, and liquidating assets to at least sustain their welfare levels maintained prior to the shocks.

Despite the pervasive nature of shocks in Pakistan, particularly natural disaster related covariate shocks; there is limited knowledge of their incidence and the coping mechanisms adopted by households to deal with them, i.e., [Heltberg and Niels (2009); Alderman (1996)] This paper uses a nationally representative survey data of 'Pakistan Panel Household Survey-2010' to examine the nature of shocks experienced by households over the preceding five years and the type of coping mechanisms that were adopted to mitigate the welfare loss. The objective of this study is to describe the sources of vulnerability in Pakistan by:

(i) estimating the frequency, correlation structure, and severity of the shocks that affected the households in 2006-2010

(ii) identifying the household characteristics or location factors that are associated with the probability of reporting a shock and a natural/agricultural shock.

(iii) categorising the household characteristics or location factors that are associated with the likelihood of experiencing an income shock and a societal shock.

The remaining paper is structured as follows. Section 2 reviews the literature on shocks and vulnerability in Pakistan. Section 3 provides details on the data and methodology used for the paper and Section 4 discusses results in detail. Section 5 concludes the study.

2. REVIEW OF LITERATURES: SHOCKS AND VULNERABILITY

The increased focus on risk and vulnerability in understanding and designing anti-poverty policies motivated a series of studies aimed at theoretically conceptualising and empirically measuring and addressing household vulnerability. This section begins with a brief review of available literature on risk, shocks and vulnerability in Pakistan.

As one of the dimensions of vulnerability, Kurosaki (2006) investigates the inability of rural dwellers to cope with negative income shocks in KPK province of Pakistan. Estimated results show that the ability to cope with negative income shocks is lower for households that are aged, landless and do not receive remittances regularly. While illustrating various measures of vulnerability proposed in the literature Kurosaki (2010) applied it to a panel dataset collected in rural Pakistan. The empirical results show that different vulnerability rankings can be obtained depending on the choice of the measure. By utilising these measures, it can be identified who and which region is more vulnerable to a particular type of risk. This kind of information is useful in targeting poverty reduction policies. Kurosaki (2006) also investigated the measurement of transient poverty when each person's welfare level fluctuates due to exogenous risk. Theoretical results show that poverty measures associated with prudent risk preferences perform better than other measures in assuring that the value of transient poverty increases with the depth of chronic poverty and that the decomposition is not highly sensitive to the poverty line.

The literature on risk and vulnerability by using a cross-section survey to map and quantify shocks from all sources, ex-post responses and outcomes for a sample of relatively poor Pakistani households was explored by Heltberg and Niels (2009). They found high incidence and the cost of shocks, with health-related shocks easily the worst. Two-thirds of the sample experienced at least one major shock in the three years prior to the survey while more than half of the reported shocks were related to health and 75 percent of the most important shocks were idiosyncratic. These findings add to the evidence that health shocks often dominate and impose severe coping costs in terms of medical expenses while relying mostly on informal and ad hoc responses: informal borrowing, spending savings, and working more were the most frequently used responses.

The relationship between health and death risk and income decisions in rural Pakistan was explored by Jacobsen (2009). He showed how insurance against hospitalisation and accidental death influences the purpose of micro credit loans. He found that individuals are more likely to maintain the same loan purpose as their previous loan if they are insured. The result suggests that households that are insured against hospitalisation and accidental death pursue less diversified income portfolios. Hidayat and Kurosaki (2007) attempt to quantify the ill-effects of covariate shocks such as natural disasters on the

sustainability of microfinance in Pakistan. Based on the difference-in-difference approach, contrasting regions that were hit by the 2005 earthquake, and regions that were not, it was found that the delay in repayment in the affected areas was 52 percent higher than that in the unaffected areas. The observed difference in the repayment delay was decomposed into changes in borrowers' composition and borrowers' behaviour. The decomposition result shows that the changes in borrowers' behaviour accounted for a large portion of the difference, suggesting a serious difficulty faced by borrowers and microfinance institutions in the earthquake-hit regions.

The literature on natural hazards typically perceived disasters to be acts of God while restricting the examination of their causes to biophysical and geographical explanations. Yasir (2009) takes a different approach; first, he argues that disasters are socially constructed and, second, he situates the interactions of large-scale natural forces with local political-economic conditions within the context of vulnerability to contend that disasters are consequences of unresolved development challenges. Using the Pressure and Release (PAR) Model his paper suggested the usefulness of the concept of vulnerability that shapes local geographies of risk and weak institutions which transform and enhance the negative impact of 'natural' hazards into 'man-made' disasters.

One of the greatest humanitarian crises in the history of the world, the flood of 2010 was witnessed in Pakistan which severely affected the poorest regions of Pakistan—Southern Punjab and rural Sindh with high levels of deprivation and poor infrastructure. The majority of the population in these regions is highly dependent on agriculture with less diversification in their sources of income. The flood has eroded their limited assets and livelihoods and pushed many non-poor households into poverty, at least for the short period of time, but many poor households are also likely to have been pushed to an extreme poverty condition. In this scenario, the role of disaster management in relief and rehabilitation was inadequate [Arif, *et al.* (2010)].

The damages caused by the 2010 floods in Pakistan, the distribution of aid, and the extent of recovery at the household level was illustrated by Kurosaki, *et al.* (2012). With regard to the nature of damages, they showed that flood damages had both between-village and within-village variation, and damages to houses, crops, livestock, and other business assets were not highly correlated. In the distribution of aid from outside, they also found substantial between-village and within-village variation - the aid distribution across villages appeared well-targeted toward the severely affected villages, while aid within villages was targeted toward households with larger house damages, but not toward households with larger damages to land, crop, or other assets. With regard to the recovery from flood damages, they found that aid recipients did not show higher or lower recovery than non-recipients. They also explored that

households which had initially fewer assets and hit by larger flood damages had more difficulty in recovery.

An empirical model of profit variability at the individual farm level was proposed by Kurosaki (1995) and applied it to Pakistan's agriculture. Results show that adding idiosyncratic yield shocks and adjusting for input costs make the variability of net profits much larger than implied by the variability of average gross revenues. It is also demonstrated that the correlation between green fodder profit and milk profit at the farm level is substantially negative. This negative correlation implies an advantage, in terms of risk diversification, of combining fodder and milk production in one enterprise, which is commonly observed in the mixed farming system in Pakistan's Punjab.

Based on fieldwork, theoretical modelling and empirical testing that applied to agricultural households in Punjab, Kurosaki (1997) found households' characteristics that affect their production choices and the relationship between the individual decisions and the incompleteness of the rural market structure. He also observed that with substantial income uncertainties, the sample farmers were unable to share the risk efficiently with the outside world and they therefore had to diversify the risk through individual means such as crop choice and livestock management. He also sheds new light on the positive role of livestock in enhancing the welfare of households, especially of small land holders.

Using three-year household data on production and consumption from the Punjab province, Kurosaki (1996), explored that the household's livestock holding contributes to a reduction in income variability through the negative correlation of livestock income with crop income and through ex- post decumulation of livestock assets contingent on a realised income in the crop sector. His results suggested that the rises in the livestock share in agricultural value-added in Pakistan during the 1980s should have improved the welfare position of smaller farm households with substantial livestock holding through reduced income variability.

Substantial evidence of consumption smoothing as well as differences in savings propensities between the rich and poor households was explored by Alderman (1992), using a three year panel data from Pakistan indicating that even poor households, however, use credit markets to maintain consumption in the presence of negative income shocks.

Displacement gives rise to particular vulnerabilities for those affected, necessitating special measures for assistance and protection that correspond to those vulnerabilities. The factors that have caused internal displacement in Pakistan in the recent past are a complex bunch and cannot be addressed by a one-size-fits-all approach. However, the official response has been largely reactive and characterised by a failure to formulate a comprehensive approach that focuses on preventing internal displacement, including through avoiding conditions that may lead to displacement [Din (2010)].

This review of literatures on risk, shocks and vulnerability relating to Pakistan indicating direct implications for welfare loss due to health shock, agricultural shock and natural disaster etc., ultimately, translated in income shock.

3. MATERIALS AND METHODS

3.1. Data Collection

Households in developing countries are frequently hit by severe idiosyncratic and covariate shocks, resulting in high income volatility. This study is based on 'Pakistan Panel Household Survey (PPHS)-2010' conducted by Pakistan Institute of Development Economics. The survey covers all four provinces (Punjab, Sindh, Khyber Pakhtunkhwa (KP) and Balochistan) with their urban and rural counterparts. The household survey questionnaire consists of two parts; a male questionnaire, a female questionnaire and a community level questionnaire that was also administered to key informants at this stage to obtain basic information on each village/block. The male questionnaire constitutes thirteen modules while female questionnaire has twelve modules. The total sample size of PPHS-2010 was 4142 households; 2800 in rural and 1342 in urban. After cleaning the data (deleting outliers, no responses and missing cases) a sample of 3500 households was selected for final analysis.

The data used in this section are based on a household-level 'Risk response module' similar to that developed in Hoddinott and Quisumbing (2003), but modified for the Pakistan context. The module asks households to report any unexpected events that were outside of their control and caused a drastic reduction in income during the last five years prior to the survey, 2006-2010. These shocks are divided into a number of broad categories: natural/agricultural; economic; political/social/legal; and health/life-cycle shocks that inflict welfare loss. Natural/agricultural shocks include flooding, drought, fire, earthquake but also erosion and pestilence affecting crops or livestock. Economic shocks include business closures, mass layoffs, job loss, wage cuts, loss of remittances and other reasons. Political/social/legal shocks in Pakistan include court cases and bribery, as well as long duration general strikes, violence, crime and political unrest. Health/life-cycle shocks include death, injury and illness. We distinguish between death of the primary income earner and death of other household members. The respondents were also asked whether the household was affected by idiosyncratic or covariate shocks and with the value of cost of burden. The frequency and intensity of major disasters is also of great relevance to the recovery of households. So finally, in addition to these questions about specific shocks, households were also asked about the most important coping strategies to manage the reduction in income such as sale of assets including land, livestock and stored crop, decrease food consumption, increase labour supply particularly of women and children, saving, borrowing and assistances from friends and relatives, etc.

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The analysis was based on this information together with other information concerning characteristics of the head of the household (e.i.,individual characteristics such as sex, age, education etc.) and household characteristics, like household size (taken as adult equivalent), dependency ratio,[1] poverty status,[2] quality of house—whether *Kaccha* (mud house) or *pucca* (bricks), agricultural land ownership, livestock ownership, log per adult equivalent consumption expenditure, wealth score[3] in addition to community characteristics like regions and provinces.

3.2. Method of Analysis

In this section three types of methodologies will be discussed to analyse the occurrence of shocks that lead to loss of household income, reduction in consumption, loss of productive assets, and serious concern/anxiety about household welfare:

  (i)   Bivariate analysis
 (ii)   Correlation structure of shocks and
(iii)   Multivariate analysis

In bivariate analysis simple cross tabulation with row or column percentage is presented to analyse the different types of shocks against socio-economic characteristics.

To understand the correlation structure of different shocks, factor analysis is applied which is a standard technique used to find the latent shocks that account for patterns of variation among observed shocks. Factor analysis is a method used to reduce the number of variables to a smaller number of underlying dimensions, with highly covariant variables loading on the same factor; in other words, shocks that tend to hit the same community.

In order to determine the characteristics of households which are likely to be affected by the occurrence of an adverse shock, a dependent variable was constructed in this study: an event of adverse shock, five years preceding the survey that leads to loss of household welfare. In this case, a dichotomous dependent variable was constructed to indicate whether or not a shock occurred. Because the indicator is dichotomous, a logistic regression model was estimated. This model makes it possible to estimate the probability of a shock conditional on independent variables. In the same way a probability of natural/agricultural shock is also estimated.

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[1]The dependency ratio takes the sum of the population under the years of 15 and over 64 and divided by the population in the   intermediate range of 15-64.

[2]The poor are defined as a household with per adult equivalent consumption expenditure below the poverty line Rs 1671.89 for the year 2010 [Arif and Shaujaat (2012)].

[3]Wealth Score: A composite index of household about the ownership of TV, telephone, mobile phone, computer, fridge, air conditioner/cooler, cooking range, stitching machine, iron, water pump, scooter and vehicle by using factor component analysis.

To construct the indicators of shock, households were classified into three groups- those that had not suffered any type of shock, those who face an income shock (natural/agriculture and economic shocks) and those who had an event of societal shock (health and social shocks). Because the variable is trichotomous, the multinomial logistic regression model is estimated. The independent variables are classified into three groups: individual, household and community-level factors for the estimation of this model.

4. EMPIRICAL RESULTS

4.1. Shocks and Coping Mechanisms: A Descriptive Analysis

In this section the data on the distribution of shocks in our sample are illustrated. The objective is to present a description of what kinds of shocks occurred, who was affected by them and what kind of coping mechanisms were adopted.

This section defines the frequency, category, costliness and impact of shocks as reported by sample households five years (2006-2010) preceding the survey. The respondents also identified the main coping strategies and several other details of the shocks including whether the event affected only the individual household (idiosyncratic) or the entire community (covariate shocks).

As reported in Table 1, almost one- quarter (24.3 percent) of the sample households experienced one most severe shock over the five-year recall period. The most common types of shocks are natural /agriculture related (51.1 percent of total) and health shocks (35.8 percent) which has resulted in major fall in

Table 1

Extent of Shocks by Selected Shocks in Pakistan (%)

Type of Shock	Reported Shocks	Only Affected This Household Idiosyncratic	Affected Few Households	Affected Many Households	Affected Almost Every Households Covariate	All
Natural / Agriculture	51.1 (12.4)	20.3	8.8	18.7	52.2	100
Economic	3.3 (0.8)	78.6	14.3	7.1	0	100
Social	9.8 (2.4)	71.1	12.0	12.0	4.8	100
Health	35.8 (8.7)	94.4	2.3	0.7	2.6	100
Overall	100 (24.3)	53.7	7.0	11.2	28.1	100

Source: Computations are based on the micro data of PPHS-2010.

income. The natural/agriculture event includes loss of personal and business assets due to natural disaster, crop failure, loss of livestock and drop in crop income while health shocks comprise illness or disability and death of an income earner or other family members. Far less frequent are economic (3.3 percent) and social shocks (9.8 percent). The economic shocks consist of loss of personal or business assets due to violence or conflicts, business failure due to low sale/demand, unsuccessful investment and job loss while social shocks comprise internally displaced person and other social shocks including marriage/dower expenditure, land or family dispute, etc.

While analysing the spread of shocks, it is observed that the risk of shock may emanate from two broad sources: idiosyncratic shocks; or covariate shocks. Covariate shocks i.e., community level shocks, are typically natural disasters like floods, draughts and pest attack which affect agriculture production severely and potentially contribute to high income volatility of households. It is indicated that natural and agriculture shocks contribute a major share in covariate shocks. Household's idiosyncratic shocks that are household specific are shocks such as death of principal income earner, chronic illness or unemployment/ underemployment etc. Health shock added 94.4 percent share in this category. Health shocks may be having more importance because they affect the household's ability to produce and generate income. These types of shocks are fairly common in developing countries including Pakistan, mainly due to the absence of easy access to medical care, drinking water, unhygienic living conditions, and limited opportunities for diversifying income sources. These difficulties are compounded by lack of financial intermediation and formal insurance, credit market imperfections and weak physical infrastructure.

The effects of shocks are multi-dimensional and affect a variety of aspects of household welfare. Table 2 reports that all types of shocks invariably affect both poor and non-poor households while rural households are

Table 2

Incidence and Type of Shocks by Poverty Status and Residence

Household Characteristics	Type of Shock (%)				Incidence of shock (%)
	Natural / Agricultural	Economic	Social	Health	
Poor	52.2	4.3	9.3	34.2	26.0
Non Poor	50.8	3.1	9.9	36.2	23.8
Urban	16.6	10.8	19.8	52.7	19.6
Rural	59.6	1.5	7.2	31.8	25.7
Male head HH	51.6	3.5	10.0	34.9	23.8
Female head HH	42.2	0	6.7	51.1	36.0
Land ownership	70.6	1.3	6.0	22.1	45.3
Livestock ownership	65.4	0.5	6.9	27.2	51.6
Total	51.1	3.3	9.8	35.8	24.3

Source: Computations are based on the micro data of PPHS-2010.

disproportionately exposed to natural and agricultural shocks and are less exposed to economic shocks specific to a formal economy (in which they do not participate) than the urban residents. As far as family headship is concerned, female headed households are more vulnerable to overall shocks and its impact varies from shock to shock indicating a high share of health shock that is 51.1 percent of total shock while male headed households get major welfare loss due to natural/agriculture shocks that is 51.6 percent of the overall impact of shock. The impact of different types of shocks classified by assets ownership shows that households which had ownership of land and livestock suffer a major welfare loss due to natural and agriculture shocks; 70.6 percent and 65.4 percent respectively.

The severity of shocks is elaborated in Table 3. The mean total cost of the most severe shock as reported by sample households, is Rs 98359 (or $1230). This is equivalent to 40 percent of average per adult annual household expenditures in Pakistan. In respect of average cost of shock, social shocks (Rs 182,686 per event) are the most expensive followed by economic (Rs 144,464 per event) and natural/agricultural shocks (Rs 103,688 per event). Because of their high frequency and high costs, natural/agricultural shocks caused by far the largest share in total cost of shocks comprising 54 percent of the total burden while health shocks took 23 percent of the total burden.

Table 3

Costs and Scope of Shock, by Shock Type

	Cost of Shock			Scope of Shock	
Type of Shock	Mean Rupees per Shock	Standard Deviation	% of Total Burden	Idiosyncratic % of Shocks in Category	Covariate % of Shocks in Category
Natural / Agriculture	103688.46	130390.53	54.0	20.3 (19.3)	79.7 (88.0)
Economic	144464.29	282314.30	4.8	78.6 (4.8)	21.4 (1.5)
Social	182686.75	430814.17	18.2	71.1 (13.0)	28.9 (6.1)
Health	633828	105717.40	23.1	94.4 (62.9)	5.6 (4.4)
Overall	98359.03	185540.72	100	53.7 (100)	46.3 (100)

Source: Computations are based on the micro data of PPHS-2010.

Table 3 also highlights shocks according to scope indicating that the major share of idiosyncratic shocks originates from health shocks (94.4 percent) while a larger part of covariant shocks originates from natural/agricultural shocks (79.7 percent). Agricultural Census indicates that most crop-growing households also own some livestock, i.e., 50 percent households report owning at least one head of cattle, 51 percent report owning a buffalo, 46 percent report

owning a goat, and 11 percent report owning a sheep [Agricultural Census Organisation (2003)]. A limited households have access to formal insurance while social networks can provide some informal insurance but this insurance is unlikely to be completed. Health insurance is also rare in Pakistan where out of pocket expenditures accounted for 71 percent of total medical expenses, compared to 13.2 percent in the United States. When a risk materialises and becomes a shock it causes a significant major income loss to these households. These shocks can be large and may trigger substantial consumption fluctuation which can have important consequences for household welfare in the short and long run.

The coping responses practised by households to deal with shocks are illustrated in Table.4. Survey respondents were asked how they managed the reduction in income caused by the most severe shock and about their use of saving, credit and assistance in general. It is observed that coping mechanisms are overwhelmingly informal and largely asset-based using savings, sale of livestock or borrowing. Ex-post coping strategies can be divided into three main categories: (i) behaviour-based strategies; (ii) asset-based strategies; and (iii) assistance-based strategies. These strategies can depend on formal or informal coping mechanisms.

Table 4

Most Important Coping Strategy by Type of Shocks

Strategy	Type of Shocks				
	Natural/Agricultural	Economic	Social	Health	Total
Behaviour-based strategies	60.6	6.4	13.3	19.7	100
	(28.3)	(46.4)	(32.5)	(13.2)	(24.)
Asset-based strategies	51.1	2.4	9.1	37.4	100
	(65.0)	(46.4)	(60.2)	(68.0)	(65.0)
Assistance-based strategies	30.9	2.1	6.4	60.6	100
	(6.7)	(7.1)	(7.2)	(18.8)	(11.0)
Total	51.1	3.3	9.8	35.8	100
	(100)	(100)	(100)	(100)	100

Source: Computations are based on the micro data of PPHS-2010.

Behaviour-based strategies such as consuming less, increasing labour supply or taking children out of school for work, were used as the primary coping response in 24 percent of the households hit by the worst shocks. This type of coping strategies were practised more often for natural/agricultural shocks than for economic shocks. In addition, many households reduced food consumption, non-food consumption and increased labour supply of children or women in response to shocks as a secondary coping strategy. Asset-based coping strategies were used by 65 percent households experiencing shocks. This coping mechanism includes use of borrowing, saving and sale of assets such as agricultural land, livestock or stored crop. It is used primarily to cope with

natural/agricultural and health shocks. Informal instruments of coping mechanism dominate across all strategies. Credit is almost entirely informal, offered by friends (28 percent of all loans and credit), family (40 percent) and moneylenders (22 percent); formal credit sources such as banks or microfinance (10 percent) are of marginal importance for this analysis. Saving is likely to be held in cash that constitutes 31 percent of assets-based strategy while sale of livestock and other assets (land or stored crop) contributes 34 percent and 7 percent respectively of all asset-based responses.

Assistance-based strategies were reported to have been used in 11 percent of shocks; assistance is used largely to cope with health shocks (60.6 percent) and rarely to cope with economic shocks (2.1 percent). All types of assistance received by respondents comes from relatives and friends while formal coping instruments (government/NGOs) are lacking. These findings are quite comparable with Heltberg and Niels (2009) who had reported the results of a novel survey of shocks, coping, and safety nets in Pakistan. They found high incidence and cost of shocks borne by these households and in the absence of formal and effective coping options they use mostly self-insurance and informal credit.

Serious adverse natural/agricultural shocks affect households in a variety of ways, but typically the key consequences work through assets. Assets themselves may be lost directly due to the adverse shocks—such as crop failure, loss of livestock, animals, soil erosion, while assets also play a central role in attempts to buffer income fluctuations, and may therefore be used or sold, affecting the ability to generate income in the future. The extent to which assets are relied on for coping strategies depend on the scope, virulence and frequency of the hazards faced, and on the extent of the development of different alternative mechanisms to handle fluctuations, such as formal and informal credit and insurance markets or state-funded mechanisms such as safety nets and social security [Fuent and Dercon (2008)]. Major natural/agricultural types of shock and assets-based coping strategies which had 65 percent share in overall smoothing purposes are presented in Table 5. For the three major shocks, loss of assets, crop failure and drop in crop income, self insurance strategies as sold livestock are adopted while for loss of livestock savings are spent. Informal insurance which consist of household borrowing from friends, relatives or money lenders contribute 13.7 percent while formal borrowing and help from government or NGOs contribute to only 3 percent as the affected people's main coping strategy. During disasters, and even if households have assets that can be sold during a crisis, the covariance of the shock to income across a large number of people tends to affect asset prices severely, as many people are trying to dispose of assets at the same time. In particular, in spatially relatively restricted asset markets, such as for livestock or other possessions in remote rural areas or in conflict zones, many may sell these possessions at the same time, depressing prices and therefore the effectiveness of the coping response. This process has

Table 5

Major Natural/Agriculture Shocks and Asset-based Coping Strategies

Type of Shock	Sold Livestock	Sold (Land/Crop)	Spent Savings	Borrowing (Informal)	Borrowing (Banks/ NGOs)	% of Shocks	Cost of (Rs)
	Coping Strategies					Severity of shock	
Loss of assets due to natural disaster	47.7	12.7	26.4	12.6	1.1	34.2	154614 (47.9%)
Crop failure	30.3	9.8	33.3	20.5	6.1	47.1	121483 (36.7%)
Loss of livestock	24.0	12.0	52.0	12.0	0	8.9	973250 (9.7%)
Drop in crop income	60.7	0	28.6	7.1	3.6	10.0	69590 (5.7%)
Overall	40.4	9.9	32.4	13.7	3.6	100	103688 (100)

Source: Computations are based on the micro data of PPHS-2010.

often been observed during floods, famines, earthquake or other natural disasters. The severity of shocks documented that loss of assets due to natural/ agriculture contribute the highest share both in percentage and absolute term.

Shocks for the rich and poor against expenditure quintiles are presented in Table 6. Natural/agriculture shocks hit the upper two quintiles more than the bottom quintiles as the rich have land or livestock that are more vulnerable to natural disaster. Social shock makes the poor more vulnerable due to conflict/ disputes, marriage or funeral expenditure. Health shock affects the second quintile as compared to the richest households due to uninsured risk.

Table 6

Shocks for the Rich and Poor

Type of Shock	Q 1 Poorest	Q 2	Q3	Q4	Q5 Richest	Incidence of Shock
	Expenditure Quintiles					
Natural and Agriculture	51.9	44.4	48.4	54.9	55.4	12.4
Economic	3.8	3.1	2.6	3.7	3.3	0.8
Social	10.9	9.3	14.3	6.1	8.7	2.4
Health	33.3	43.2	35.1	35.4	32.6	8.7
Main Coping Strategies						
Behaviour-based strategies	27.3	29.6	22.7	23.8	16.8	24.0
Asset-based strategies	61.2	60.5	63.6	67.7	71.2	64.9
Assistance-based strategies	11.5	9.9	13.6	8.5	12.0	11.1

Source: Computations are based on the micro data of PPHS-2010.

Different types of coping mechanisms are given against household's economic status indicating that the poorest bottom quintiles adopted behaviour-based strategies which include reducing food consumption, employing child labour , working more hours, etc. It is also observed that when a shock hits, the main strategy adopted by households is to use their assets in some way rather than to ask for help from friends and relatives, while private and public social safety nets exist but offer little effective protection. The poor are less resilient than the rich and the coping strategies used by the poor damage their prospects to escape poverty. Recent studies show that there are considerable poverty related movements depending on the type of shocks and degree of risk and uncertainty that households are faced with. Even if aggregate poverty levels remain constant over time, the share of the population which is vulnerable to poverty might be much higher [Azam and Katsushi (2012)].

4.2. Correlation Structure of Shocks

To measure the degree of covariance of the occurrence of a shock at a particular location all primary sampling units (PSUs) in which no one reported experiencing a shock in last five years were excluded from this exercise. First, the information on the incidence of the shocks at the level of the primary sampling unit was aggregated, and then the number of households reporting the shock was estimated in each PSU. The present survey records information on 16 specific shock, plus two catch-all categories; idiosyncratic or covariate.

The standard variance-covariance matrix can be used to find the pairs of shocks with the strongest association, i.e., 'crop failure—drop in income' pair. The standard technique used to find the latent shocks that account for patterns of variation among observed shocks is factor analysis which is a method used to reduce the number of variables to a smaller number of underlying dimensions, with highly covariant variables loading on the same factor (in other words, shocks that tend to hit the same community/household).

The present study employed factor analysis (its results are presented in Table 7) in which five components considered as 'bunched-shocked' are extracted from covariate natural/agriculture shock (loss of livestock, personal or business loss due to natural disaster, drop in crop income and crop failure); (ii) idiosyncratic economic shock (business failure, job loss and unsuccessful investment); (iii) social shocks (loss of personal or business assets due to conflict, internally displaced persons and other shocks); and health shocks (illness or disability of income earner or other family members, death of income earner or other family members) as reported in Figure 1.

Table 7

Bunched Shocks: Understanding the Correlation Structure
using Factor Analysis

Shocks	Factor1	Factor 2	Factor 3	Factor 4	Factor5
Illness/disability of HH member	.670	–.199	–.241	–.122	.086
Death of an income earner	.621	–.075	.068	.112	–.308
Loss of livestock _ disease/ causes	.595	.190	–.191	–.128	.124
Death of other household member	.378	.141	.274	–.204	–.362
Loss of personal assets _natural disaster	–.364	.011	–.360	–.157	–.166
Business failure _ low sale/demand	–.014	–.559	.265	.355	.114
Drop in crop income	.274	.546	.235	.236	.005
Crop failure	.016	.503	.403	.337	.144
Job loss	.112	–.478	.394	.286	.025
Loss of personal assets _ conflict	.283	.407	–.097	.192	–.068
Illness/disability of income earner	.265	–.184	.565	–.406	–.059
Other social shocks	–.072	.011	.506	–.530	.045
Internally displaced person	.316	–.238	–.196	.417	–.251
Unsuccessful investment	.242	–.232	.019	.071	.582
Loss of business assets _ conflict	.315	.057	–.275	–.254	.539
Loss of business assets _ natural disaster	–.186	.255	.294	.231	.333

Source: Computations are based on the micro data of PPHS-2010.
Reported statistic: Factor loadings after oblique rotation.

Fig. 1. Share of Reported Shocks (%)
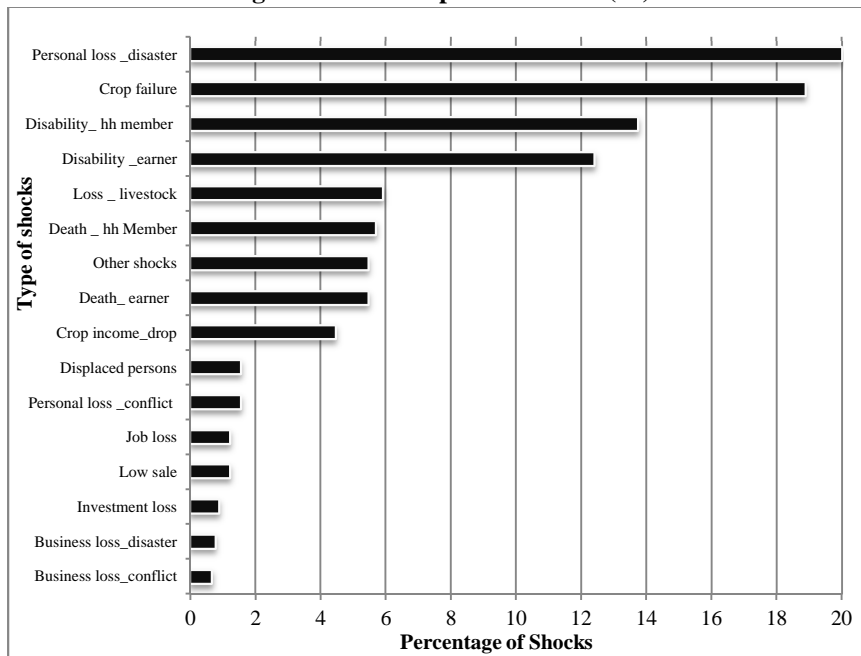
While analysing the principal components, it is observed that factor one which contributes high variance includes five variables related to natural/agriculture shock and health shocks. The second factor also includes five variables showing that crop failure results in drop in crop income and business failure leads to mass-layoffs. The third factor includes illness/disability of income earner which is not bunched with any factor while the fourth factor is bunched with internally displaced households and other social shocks. The last factor is income related shocks which comprise three events including unsuccessful investment, loss of business assets due to violence/conflict and natural/agricultural disaster which are correlated with each other.

4.3. Multivariate Analysis

The result of the most robust shock created through logistic regression models to determine factors influencing the incidence and occurrence of natural/agricultural shocks is demonstrated in Table 8. Model one represents an event of shock versus no shock which resulted in welfare loss due to decrease in

Table 8

The Probability of Experiencing the Worst Shock: 2006-2010

Correlates	Model-1 Shock/No Shock		Model-2 Natural/Agriculture Shock/No shock	
	Coefficient	S.E	Coefficient	S.E
Male Headed Households	−0.341***	0.24	−0.423	0.313
Age of HH head	0.240	0.328	0.480	0.729
Primary	−.200***	0.115	−0.783**	0.289
Higher	−0.128	0.12	0.108	0.238
No of Adult equivalents	0.016	0.13	−0.045	0.031
Dependency ratio	−0.15	0.56	0.103	0.123
Poverty status	0.168	0.141	−0.218	0.313
Quality of house	−0.318**	0.100	−0.37***	0.219
Log per adult expenditure	0.291	0.258	−0.699	0.547
Land ownership	0.365*	0.099	0.732**	0.214
Livestock ownership	0.048	0.102	0.720**	0.234
Wealth score	−0.19***	0.01	.032***	0.018
Region	0.301***	0.125	1.16**	0.336
Punjab	2.57*	.303	1.22**	0.464
Sindh	2.10*	0.306	0.791***	0.478
KPK	0.886***	0.343	−0.054	0.575
Covariate shock	–	–	5.64*	0.221
Constant	−4.696	2.94	−3.66	2.296
LR Chi-square	340.364		1651.75	
−2 Log likelihood	3527.18		2291.64	
Pseudo R²	0.139		0.168	
Observations	3500			

Source: Computations are based on the micro data of PPHS-2010.
*significant at 1 percent, **significant at 5 percent and significant at ***10 percent.

income which is based on risk response module of PPHS, 2010. The shocks include natural/agricultural, social, economic and health which were faced by households during 2006 to 2010. Three types of explanatory variables have been used: individual characteristics of the head of household i.e., sex, age and education; household characteristics including family size (as adult equivalents) ownership of land and livestock, household assets (wealth score), quality of housing (*kaccha*), poverty status(poor/non-poor), per adult equivalent consumption expenditure, scope of shock (covariate) and community level variables i.e., place of residence(rural/urban) and province.

Most of these determinants of the occurrence of shock are however, themselves affected by shocks. For instance, while acquisitions of such assets as ownership of land and livestock have been taken as determinant of shock, they themselves could be influenced by shocks. Another vicious circle may exist between the poverty status of the household and different types of shock.

A number of patterns emerge while using the full sample for model 1 as presented in Table 8. With respect to individual level characteristics, male headed households are less likely to experience a shock as compared to female headed households with 10 percent significance level. As the number of adults' equivalents in the household and age of household head increases, the probability of occurrence of a shock increases. The education level of the household head as primary or higher as compared to no education is negatively related with occurrence of a shock but only primary education is significant. The poor households are more likely to face a shock i.e., health shock or conflicts. Quality of the house such as *Kaccha* is taken as the economic status of the household which is negatively related to an event of shock with 5 percent level of significance. Households with agricultural land and livestock ownership have greater probability of a shock than those with landless and having no livestock.

Households located in rural areas, as expected are more likely than those in urban areas to suffer from shock as in descriptive analysis it is observed that more than 50 percent households had natural/ agricultural shock (crop failure, loss of livestock, drop in crop income). The result also confirms that rural households are more likely to face shocks due to agro-climatic factors (Santos,2011). The wealth score of households is an index of long-term socio-economic status (household assets include items like television, fridge, freezer, washing machine, bicycle, etc.) of household and is computed by the factor analysis method. A higher value of the index is associated with better-off households. So the richest households are less likely to face a shock as compared to poor households. All the three provinces, Punjab, Sindh and Khyber Pakhtunkhwa (KP) are more likely to suffer from different types of shocks as compared to the province of Balochistan.

Natural disasters such as floods, droughts, earthquakes, and other weather-related phenomena can affect household welfare through the destruction of physical and human capital stock. These shocks are more frequent in

developing countries, and the poor are more likely to suffer damages from natural hazards as usually they can only afford to live in marginal areas and have a limited ability to manage these risks [UNDP (2007-08)].

Model 2 explores the factors that make households more likely to experience from natural/agriculture shock that had also resulted in loss of income and assets. Male headed households are less likely to have an event of a shock as compared to female -headed while high dependency ratio and elderly household head with high school education had high probability to experience a natural/agriculture shock. With land holding as compared to landless and livestock ownership and wealth score are more likely to suffer this shock compared to their counterparts. The level of significance shows that these factors had high impact on welfare loss. Community level characteristics such as rural area are more vulnerable to shocks. As far as the scope of shock is concerned, covariate shock had significantly high probability of occurrence of an agricultural shock as compared to no shock as it affects a large area or community.

Are the poor more often the victims of shocks? One may expect a spurious correlation between poverty and experiencing shocks. Shocks that cause income or asset losses are also likely to reduce consumption if credit constraints are binding or if the shock reduces expected life-time earnings by destroying the household's asset base. This relationship is investigated in Figure 2 showing clustered predicted probability of shocks around the vertical poverty line. An adverse shock in the absence of formal insurance or credit will make majority of the households vulnerable or future poor.

Fig. 2. Per Adult Equivalent Consumption and Incidence of Shocks
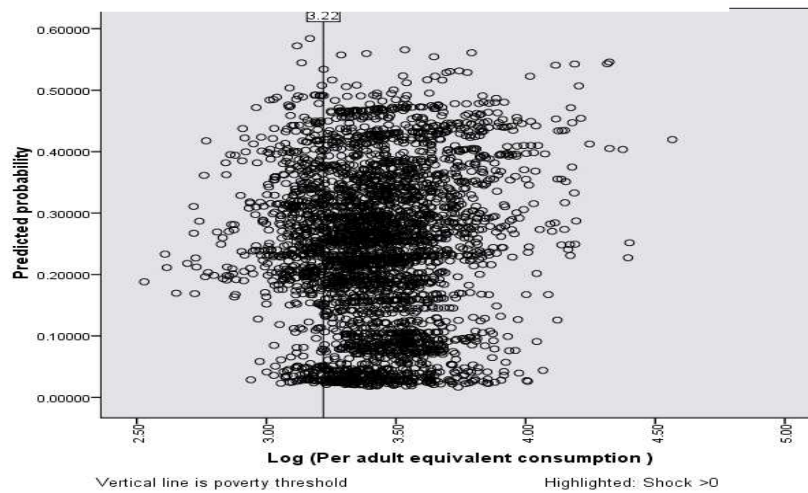
Note: For each household, the predicted shock-consumption pair is illustrated by circle.

The effects of shocks are multi-dimensional and affect a variety of aspects of household welfare. For this multivariate analysis, all shocks are decomposed into income shock and societal shock. Income shock is computed by aggregating natural/agricultural shocks and economic shocks while all societal shocks add up health shocks and social shocks. The results show the effects of the independent variables on the probability of an income shock vs. no social shock and societal shock vs. no social shock in Table 9 by employing a multinomial logistic regression models. Income shock contributes the highest burden of shock with 58.8 percent in total loss with 89.5 percent in covariate shock while societal shock takes 41.2 percent burden of shock in total loss with 75.9 percent idiosyncratic shock as seen in previous Table 3. With respect to the individual level characteristics, a male household head with lower age are found to be less likely to suffer an income shock vs. no shock and societal shock vs. no shock. Head of households with primary and higher education level with small household size have less probability of an income shock vs. no shock while in

Table 9

Multinomial Logit Model: The Probability of Experiencing the Worst Shock

Correlates	Income Shock /No shock		Societal shock/No shock	
	Coefficient	S.E	Coefficient	S.E
Intercept	–4.48	1.23	–6.53***	1.61
Male headed Households	–0.059	0.280	–0.661**	0.24
Age HH Head	0.001	0.004	0.002	0.004
Primary	–0.379***	0.159	0.036	0.155
Higher	–0.072	0.137	0.051	0.145
No of adult equivalents	–0.012	0.018	0.055**	0.019
Poverty status	0.210	0.179	.048	0.191
Dependency ratio	0.033	0.071	–0.049	0.078
Quality of house	–0.329**	0.125	–0.300	0.15
Log per adult expenditure	0.056	0.322	0.353	0.347
Land ownership	0.822*	0.124	–0.275***	0.144
Livestock ownership	0.253***	0.134	–0.132	0.137
Wealth score	–0.003***	0.012	–0.37***	0.015
Region	0.824*	0.191	–0.013*	–0.155
Punjab	1.95*	0.324	4.349*	1.006
Sindh	1.607*	0.328	3.75**	1.009
KPK	0.166	0.401	2.737	1.028
Chi-square	483.17			
–2 Log likelihood	4.558			
Pseudo R²	0.169			
Observations	3500			

Source: Author's computation is from the micro data of PPHS-2010.
*significant at 1 percent, **significant at 5 percent and significant at ***10 percent.

comparison education and large household size are more likely to experience a societal shock vs. no shock. A poor household with high dependency ratio are more likely to face an adverse event of income shock vs. no shock while poor households and low dependency ratio indicate a high probability of societal shock vs. no shock. While discussing expenditure, a household with high per adult equivalent consumption expenditure are more likely to experience an income shock and societal shock vs. no shock. When the effect of asset ownership was examined, it was found that households with agriculture land and livestock were significantly more likely to have an event of income shock while the risk of societal shock is less for these households. Households with more durable assets which were taken as wealth score were substantially less likely to suffer these two shocks as compared to no shock.

With respect to the indicators of geographic location, rural households are more likely to suffer an income shock whereas for societal shock vs. no shock rural households have less probability. With respect to relationship with provinces it is shown that the provinces of Punjab and Sindh are positively and significantly related with adverse income shocks and societal shock as compared to Balochistan.

These shocks can affect assets in many ways. First, through the impact on their amount, value and productivity, this could be the direct result from the shock or a ramification of its impact through the absence or inadequate application of coping mechanisms. Poor households tend to pay a higher cost for mitigating and coping with risk due to their reduced asset base.

5. CONCLUSIONS

The objective of this study is to investigate sources of vulnerability defined as households' exposure to shocks and their limited ability to mitigate the impact of shocks. It uses data from PPHS-2010 focusing on the module on risks and shocks to explore the incidence of different types of shocks, burden of shocks, risk management strategies, correlation structure of shocks and identifying the household characteristics that are associated with the probability of suffering different types of shocks, i.e., a natural/agricultural shock, economic shock and social shock. For this purpose, factor component analysis and logistic regression models have been used.

The findings of this study elaborate that approximately one fourth of the sampled households experience an adverse shock during the last five years 2006-2010, including natural/ agricultural shocks (51.1 percent), economic shocks (3.3 percent), social shocks (9.8 percent) and health shocks (35.8 percent). In rural areas the incidence of shock is greater particularly from natural/agriculture events than in the urban areas where health related shock is concentrated. Households with agriculture land and livestock ownership are more vulnerable to face shocks. As far as the scope of shock is concerned, 53.7

percent households suffer from idiosyncratic shocks, particularly health related while 46.3 percent had covariate shocks focusing on natural disasters. The natural/agricultural shocks contribute the major share of the total burden of shocks. It is observed that coping mechanisms are overwhelmingly informal and largely asset-based using savings, sale of livestock or borrowing whereas the poorest bottom quintiles adopted behaviour-based strategies which include reducing food and non-food consumption, employment of child labour and increased working hours, etc. The analysis also sheds new light on the positive role of livestock in mitigating adverse impact of shocks.

To find the correlation structure of shocks, factor component analysis is used that extracted five factors indicating that the first component which contributes the highest variance had the strongest association with personal loss due to natural disaster and health shocks while the second component was associated with four economic shocks, i.e, job loss, crop failure, drop in income and business failure.

To determine factors influencing the incidence of shock, a number of patterns emerge while using the full sample for all type of shocks illustrating that male headed households are less likely to experience a shock as compared to female -headed households. As household size and age of household head increases, the probability of occurrence of a shock increases while the poor head of the household are more vulnerable to face a shock. The education level of the household head as primary or higher as compared to no education is negatively related with occurrence of a shock while rural households with agricultural land and livestock ownership have greater probability of an event of shock. As far as occurrence of natural/agricultural shock is concerned, male headed households are less likely to suffer this shock as compared to female headed households because of their smaller average resource base and customary or formal laws that prevent their access to household possessions. A high dependency ratio and a rural elderly household head with land and livestock ownership and high wealth score have high probability to experience a natural/agriculture shock.

When the full sample is decomposed into all income and societal shocks, male headed households are less likely to suffer these shocks while poor elderly household heads are more likely to suffer these shocks. Large household size with primary or higher education level and household assets are less risky to suffer an income shock while a rural resident with high per adult equivalents expenditure, land and livestock ownership are more vulnerable to economic shocks. As far as all societal shocks are concerned, land and livestock ownership with high wealth score are less probable to experience this shock in rural areas.

Shocks will continue to occur, however to mitigate their impact in the future requires a reduction in the socio-economic vulnerability and increased resilience that can be achieved through policies geared towards improving social conditions and living standards.

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