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Living on the edge: Household vulnerability to food-insecurity in the Punjab, Pakistan

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ABSTRACT

This study investigates the prevalence, sources and distribution of household vulnerability to food-insecurity in the Punjab, Pakistan. Applying a multilevel model on a large dataset of about 90,000 households, we find that the share of households at risk of becoming food-insecure (vulnerability) is higher than the share that is current food-insecure. Households in rural areas are least vulnerable. In contrast, residents of cities and urban areas experience high level of vulnerability that exceeds the average in the Punjab. The risk-induced vulnerability is higher than the structural-induced vulnerability and vulnerability to idiosyncratic shock is higher than vulnerability to covariate shocks. Findings imply that households in the Punjab are vulnerable not as a result of poor resource endowments but because of risk. The Pakistani government should go beyond mere observed food-insecurity to address the needs of the relatively larger population that is at risk of being food-insecure in the future.

1. Introduction

The food-security literature has recently emphasised the importance of vulnerability measurement because focusing only on *current* food-insecurity (as proxied by the level of current calorie intake) excludes a substantial portion of population at risk of becoming food-insecure in the near future, i.e., vulnerability[1] to food-insecurity (Capaldo et al., 2010). While the literature on the conceptual and theoretical frameworks of vulnerability measurement is extensive, empirical research on implementing these measures in different countries is scarce (Klasen and Waibel, 2015). Particularly in the case of Pakistan, studies on household vulnerability to food-insecurity are lacking despite the fact that the level of undernourishment in the country is considered worst in South Asia (Ahmad and Farooq, 2010). Although some studies estimate vulnerability to monetary poverty in Pakistan (see, Baulch and McCulloch, 2002; Kurosaki, 2007; Kurosaki, 2010; and Azeem et al., 2016a), the outcome of these studies cannot serve as a proxy to indicate vulnerability to food-insecurity. The reason for this is the weak correlation between monetary and non-monetary metrics of household welfare (Baulch and Masset, 2003) and the resultant divergences of poverty and food-insecurity estimates (Alderman and Garcia, 2008; Maitra and Rao, 2015; and Azeem et al., 2016b).

This research is motivated by the following gaps in the vulnerability literature. **First**, studies on vulnerability usually capture the impacts of idiosyncratic shocks[2] only (see e.g. Ozughalu, 2014; Imai et al., 2015). These are household level shocks such as illness and death of head of household. In reality, households in developing countries are equally prone to various covariate shocks such as floods. For example, the annual report of National Disaster Management Authority (NDMA) of Pakistan reports that the destructions of 2010 Flood was "*more than twice that of the Indian Ocean Tsunami of 2004, Pakistan Earthquake of 2005, Cyclone Katrina of 2005, Cyclone Nargis of 2008 and Haiti Earthquake of 2010, all put together in terms of geographical scale and population affected*" (NDMA, 2011: pp. 13). Keeping in view the magnitude of such disasters, especially in the

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[1] While vulnerability is the likelihood of experiencing a consumption loss, resilience is the ability of households to withstand and recover from shocks. The notion of sensitivity refers to the degree to which a household is likely to be affected by shocks (Adger, 2006).

[2] Studies on food-insecurity define vulnerability mainly in relation to calorie-shortfall, but seldom with causal factors of calorie deficiencies such as exogenous events or shocks (see, Dilley and Boudreau, 2001, for detail).

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context of Pakistan, it is desirable to estimate the impacts of both these shocks on household vulnerability to food-insecurity.

Second, studies on vulnerability generally do not take into account the multilevel (hierarchical) structure of the data. However, there are a few exceptions in the case of studies conducted within the poverty framework such as Günther and Harttgen (2009) and Échevin (2014). In reality, households (at lower level) are normally nested in various communities/villages/towns/tehsils/districts[3] (at higher level) such that any shock at the community level will affect households within the community. Günther and Harttgen (2009) and Hart (2009) argue that vulnerability measurement at only one level is inadequate as various shocks intersect and interact differently at different levels. In order to estimate correct standard errors and significance tests, it is important to build a model which allows inclusion of both individual observations and group observations simultaneously in the same model. Ignoring this data structure means violation of the assumption of independent observations and hence a downward bias in the standard errors and overestimation of t-values (Goldstein, 2011). Moreover, the advantage of using a hierarchical model is that it does not require extensive data on various kinds of idiosyncratic and covariate shocks because the heterogeneous nature of cross-sectional data can be exploited to investigate the variability in consumption based on the observable household and community characteristics rather than series of shocks (Celidoni, 2012).

Third, most of the studies on vulnerability are focused on estimating only headcount vulnerability (see, e.g. Zhang and Wan, 2009; Bogale, 2012). From a food-security standpoint, the headcount measure of vulnerability indicates the proportion of households who are expected to fall, in the future, below a minimum dietary energy requirement but it does not indicate the depth of vulnerability as measured by vulnerability gap and vulnerability severity. Vulnerability gap is the distance of the actual probability of being vulnerable to the pre-defined vulnerability threshold. Similarly, vulnerability severity is the weighted sum of vulnerability gap within a vulnerable population (more on this in the methodology section). Adger (2006) argues that anti-vulnerability policies could focus either on reducing headcount vulnerability or the depth of vulnerability measured through vulnerability gap and severity.

Finally, measurement of vulnerability using cross sectional data requires a large sample size because it is assumed that the entire cross sectional variability in households' consumption represents the inter-temporal variations of consumption. Imai et al. (2010) argue that there should be a large sample size of the cross sectional data where some households experience a good period while other experience negative shocks. However, most of the empirical literature on vulnerability measurement using cross sectional data relies on small sample sizes; for example, Capaldo et al. (2010) relies on a sample size of 1831 rural households while Bogale (2012) uses a dataset of 277 households only.

The goal of this research is to bridge these gaps in the existing literature by investigating the prevalence, sources and distribution of household vulnerability to food-insecurity in the Punjab province of Pakistan. Applying the multilevel model proposed by Günther and Harttgen (2009) on a large cross-sectional data of about 90,000 households, this study investigates whether vulnerability is structural or risk induced. As per Alwang et al. (2001), structurally induced vulnerability is mainly associated with chronic poverty (chronic food-insecurity in the case of this study) and is a result of lack of resource endowment at a household level. On the other hand, risk-induced vulnerability is mainly associated with transient food-insecurity. We further decompose risk induced vulnerability into two components: vulnerability to idiosyncratic shocks and vulnerability to covariate shocks. Finally, we estimate the extent of vulnerability measured by the vulnerability gap and vulnerability severity.

The rest of the paper is organized as follows: Section 2 provides a brief overview of status of food-insecurity in Pakistan. Section 3 presents the methodology; Section 4 provides the results and discussion; and Section 5 concludes and highlights the limitations of the study.

2. The context: food (in) security in pakistan

Pakistan is the sixth most populous country of the world with an estimated population of about 192 million. The GDP growth rate of the country in 2015 was estimated to be 4.2% with a per capita income of $1512 per annum. The share of the agriculture sector to GDP is 20% (Government of Pakistan, 2015–16). Punjab[4] is the most populous province of the country with an annual population growth rate of 2.6% (BoS, 2013). The Punjab Food Department is responsible for maintaining food-security in the province by ensuring sufficient supply of wheat and wheat-based products. This is in line with the national food-security policy that focuses on maintaining adequate supply of national food through wheat self-sufficiency. The result of the policy seems positive from the perspective of per capita food availability that exceeds the recommended average at the national level (Ahmad and Farooq, 2010). However, despite this policy, 22% households in Pakistan are food-insecure (FAO, 2014). The per capita availability of food at the national (or provincial) level has therefore little meaning if households face economic and physical constraint to access food.

Using meta-data from FAOSTAT, we show trends in food-insecurity in Pakistan based on two measures: prevalence of chronic undernourishment and prevalence of food-inadequacy (Fig. 1). The former is a conservative measure of chronic food-insecurity or hunger, which is defined as the proportion of population below *minimum* required daily dietary energy consumption. The latter is a less conservative measure of food-insecurity, defined as the percentage of population dietary energy requirements associated with normal *physical activity*. We also show the trends in domestic food-price volatility index, which measures the variability in the relative prices of foods in Pakistan. It is calculated using monthly price level index, which is averaged to get the annual volatility indicator.

Fig. 1 shows that the percentage of undernourished population has been around 20–25%, during 1990–2014. The share of households consuming inadequate food for normal physical activity (food-inadequacy) has been even higher, 30–35%, during the same period. We also observe considerable volatility in food prices. It is worth noting that despite high price fluctuations during global food price crises and its aftermath (2005–2014), the prevalence of undernourishment and vulnerability remained remarkably stable over time. However, this overall picture of food-insecurity might hide large heterogeneity between rural versus urban areas of the country.

The Government of Pakistan uses expenditure-based monetary poverty line to estimate the share of poor population. The monetary poverty line is derived on the basis of consumption expenditures required to buy a minimum calorific intake of 2350 calories per adult equivalent per day, with some modest allowance for non-food expenditures on education, health, shelter, and so forth.

[3] Town/tehsil is an administrative unit. There are total of 150 towns/tehsils belonging to the total 36 districts in the Punjab province.

[4] There are total of four provinces in the country: Punjab, Sindh, Baluchistan, and Khyber-Pakhtunkhwa. Punjab is the most urbanized and agriculturally well-off province of the country. It is also relatively secure from militancy as compared to other three provinces.