A novel framework for analyzing idiosyncratic and covariate shocks in developing countries

R. A. Balgah\textsuperscript{1,2}  
\textsuperscript{1}University of Bamenda, Cameroon  
\textsuperscript{2}Bamenda University of Science and Technology, Cameroon

Abstract

The observed and predicted increases in idiosyncratic and covariate shocks in developing countries demands new approaches and tools to analyze and manage such events. The social risk management (SRM) framework developed by the World Bank at the end of the 20th century no longer seems very appropriate in empirically analyzing the increasing frequency and contemporary complexity accompanying small and large scale extreme events witnessed especially in developing countries where states and risk markets often fail, are missing or function only partially. This paper suggests a novel multidimensional framework, which is more appropriate for analyzing shock dynamics in developing countries. The SRM framework is succinctly presented. The novel, multidimensional framework is then presented, emphasizing its links to and distinctions from the SRM framework. Contemporary empirical applications of the Multi-sector framework in Cameroon are then presented, and conclusions are made on the implications of applying the novel framework for analyzing and managing idiosyncratic and covariate shocks especially in developing countries.  

Keywords: SRM framework, shocks, novel framework, developing countries.

1 Introduction

The world currently witnesses an increasing frequency and severity of natural shocks. About 240 million livelihoods have been disrupted by natural disasters world-wide annually between 2000 and 2005 [1]. This is further worsened by manmade shocks such as ethnic and religious conflicts and terrorism [2]. The anthropogenic influence and magnitude of climate change and its effects on natural disasters remain largely unknown. It is nevertheless agreed that climate
change will increase natural shocks, resulting mainly from rising sea levels, global temperatures and precipitation [3–5]. Resulting idiosyncratic and covariate shocks will strongly negatively impact developing as compared to countries [6]. Idiosyncratic shocks describe welfare depriving events that affect only a few households when they occur (e.g. illness of a household member), while covariate shocks usually impact wider populations (e.g. floods) [7–9].

The growing complexity and frequency of idiosyncratic and covariate shocks warrants new forms of thinking. The World Bank’s Social Risk Management (SRM) framework no longer seems appropriate to deal with the complexity and the compounding effects of these shocks [6–8, 10, 11]. This is because institutional failure – hitherto attributed mainly to informal, community based responses, is increasingly also being observed in public institutions especially in developing countries, with increasing frequency of extreme events. In addition, market mechanisms for buffering shocks are grossly missing in many of these countries.

This paper proposes a novel, multidimensional framework which is more appropriate to deal with contemporary challenges emerging from welfare reducing events especially in developing countries. An empirical case study from Cameroon on which the novel framework has been tested will also be presented. The paper concludes with implications for applying and further testing of the framework and the probable implications of vulgarizing the framework for managing shocks especially in developing countries.

2 Theoretical frameworks for analyzing shocks in developing countries

The World Bank’s SRM framework is widely used for conceptualizing and analyzing shocks in developed and developing countries [7, 8, 10–12]. Its conceptualization is illustrated in Figure 1. Proponents of the SRM framework make strong distinction between formal and informal responses and their resilience to idiosyncratic and covariate shocks. [12, 13]. Informal response mechanisms are construed as measures operating at individual, household or community levels for the purpose of protecting these units against risks or shocks, in the presence or absence of public or market based arrangements. Examples include crop diversification, informal lending, buying and selling of real assets and risk sharing networks [11–13]. Covariate shocks are hypothesized to overwhelm these (informal) mechanisms, justifying the application formal (state and market) interventions to evade disastrous, irreversible outcomes such as poverty and vulnerability [7–10, 12]. Formal mechanisms include both market services and public actions that have evolved for the management of risks or shocks [11]. They provide formal arrangements to disaster victims such as financial assets, formal savings, insurance contracts or disaster relief, which usually require well-functioning market institutions such as insurance companies, and welfare maximizing states [12]. But formal mechanisms often also fail in the wake of large extreme events. The success of insurance markets for instance is strongly contingent on the fact that shocks are usually not
correlated [14]. The likelihood that insurance markets may fail when shocks are correlated is high. This is also true for state mechanisms that are particularly prone to failure especially in developing countries [15].

This reality – and the expected increase in shocks – raises a number of questions. For instance, what happens in practice in developing countries where natural shocks often occur under conditions characterized by failing states and markets? How will developing countries expected to be highest hit by the effects of climate change, deal with the consequences [6]? The topical literature predicts disastrous and irreversible outcomes for such countries [7, 8, 10, 16]. In fact higher impacts of shocks in developing than developed countries are attributed to the absence of satisfactory state and market mechanisms in these countries [8]. The novel framework proposed here is based on the hypothesis that appropriate (or improper) mix of formal and informal mechanisms determine whether victims become resilient or further exposed in the event of an idiosyncratic or covariate shock. This is based on the assumption that risk management mechanisms – formal or informal are both likely to function or fail under certain conditions. An improper understanding of the dynamics of informal response mechanisms seems to be responsible for the overestimation of the role of formal responses to covariate natural events in developing countries. In fact a deeper understanding of how informal mechanisms can be appropriately combined with the formal ones and vice versa arguably provides a clearer picture of the crucial role that the convergence of both forms of mechanisms can play in managing

Figure 1: Hypothetical presentation of the Social Risk Management framework. (Source: [9: 9], originally based on [7, 8, 10].) (Note: The size of the arrows from the shock indicates the hypothesized dominance of covariate over idiosyncratic shocks. Circles indicate that formal responses are more important to manage shocks, compared to informal ones.)
shocks especially in developing countries. The new framework therefore emphasizes analysis as a fundamental precondition for adopting any shock management practice, as opposed to outright exclusion of informal mechanisms as currently perceived in the literature. This approach finds favour first in developing countries, where informal responses are abundant.

It is assumed that when covariate shocks occur, failing states often become welfare maximizing, at least for political reasons (Figure 2). However, informal responses are not passive in the process. Through learning, collective action, experience and ability to organize, informal instruments are subjected to dynamic processes that significantly improve their capacities to deal with shocks (see for instance Campbell [17] for responses to drought in Kenya).

Figure 2: Multidimensional framework for analyzing shocks in developing countries. (Source: [14: 12], following [10, 11].) (Note: NPOs = nonprofit organizations; CBOs = community based organization.)

A critical issue on this framework is the emergence and consolidation of informal agency in formalized, persistent nonprofit organizations (NPOs) that eventually play key roles for short and long term management of idiosyncratic and covariate shocks. In addition, the role of external actors in disaster management is clearly demonstrated. External actors often include NPOs that emerge for altruistic reasons [18, 19]. The actions of these organizations stimulate changes in formal/informal structures that remain stable long after the shock and contribute to long term risk reduction, adaptation and resilience. These change processes are more important when states and markets do not function properly. In the presence of active states and markets, NPOs might act as watch dogs, ensuring that contracts between states, markets and communities are properly implemented. For instance nonprofits can promote collaborative risk management between states and communities, social private risk management
between communities and markets, and more rarely moderate public private partnerships for risk management.

In summary, the multidimensional framework suggests that the specific and omnipresent conditions of failing states and markets warrants a serious consideration of the role of informal instruments in managing both idiosyncratic and covariate shocks. These instruments can be conceptualized and analyzed as stand-alone mechanisms, or complementary to (deficient) state and market mechanisms. This framework is particularly relevant for developing countries, where state and market failures for risk management are common and informal mechanisms are abundant [8]. An important issue is to define the boundary of the system and therefore the unit of analysis. In this sense, anything occurring out of the defined boundaries will be considered external to the defined system.

It is worth mentioning that there may also be internal shocks occurring within the boundaries of clearly defined systems. For simplicity reasons, this has not been indicated in the proposed framework. Nevertheless, the nature of internal or external shocks will influence to what extent formal and informal mechanisms will be applied independently or collectively to prevent, mitigate, resist or cope with the shock effects.

3 Empirical application of the multidimensional framework: case study of the 1986 Lake Nyos disaster

3.1 Problem background and the study area

Cameroon is amongst the most exposed to natural shocks in Africa [20]. These shocks often translate into disasters with severe impacts on the poor and the near poor. The 1986 natural gas explosion from Lake Nyos is empirically used to test the novel framework was. Lake Nyos is a crater lake located in NW Cameroon, some 200 miles from the capital, Yaoundé and 31 miles from Cameroon’s boarder line with Nigeria. It spans to a length of 20 kilometres, a width of 1.2 kilometres, a depth of 208 meters and a surface elevation of 1.091 kilo meters [21]. On August 21 1986, a violent volcanic eruption at Lake Nyos emitted natural Carbon dioxide (CO₂) and minimal amounts of Hydrogen sulphide that asphyxiated over 1,700 inhabitants and almost all livestock in three villages (Nyos, Cha, Subum), located within a diameter of about 25 kilometres around the lake. Initial scientific analysis confirmed huge amounts of CO₂ (300 million m³) in the deeper layers of the lake, with a high probability of further release.

This disaster is classified as a geological hazard as it resulted from internal, tectonic processes beneath the earth [22]. However, this could not be established immediately after the disaster. While initial scientific interest was naturally tilted towards determining the cause of this natural shock, a high level conference on the Lake Nyos disaster held in Yaoundé, Cameroon in 1987 proposed that surviving victims should be resettled immediately [23]. To this end, seven resettlement camps were established between 1987 and 1988 in NW Cameroon, in Kimbi, Buabua, Yemngeh, Ipalim, Kumfutu, Esu and Upkwa villages. Most
households were moved immediately after construction from the affected villages into these camps where a majority still live today.

The shock-affected villages were declared disaster zone by the government and rehabilitation was legally prohibited. Nevertheless, in the last decade, a substantial number of households from the resettlement camps have been stubbornly moving back into these villages, in spite of government restriction. Self-relocation and the fact that the disaster occurred before the SRM framework was developed by the World Bank provided a double incentive to use the case study to test the novel framework. State failure to deal with the aftermaths of the shock and underdeveloped risk markets in Cameroon further justified the choice of the case study [24]. The disaster provides an opportunity to assess how households deal with a covariate shock under state and market failure conditions.

3.2 Materials and methods

We purposively selected three resettlement camps located closest to the official disaster zone (that is, Kimbi, Buabua and Yemngeh) and the three villages affected by the 1986 disaster (Cha, Nyos and Subum). This selection aims at controlling to a large extent for extraneous variables, assuming that cultural, economic and climatic factors are very similar amongst these villages. As illegal rehabilitation is taking place in the original disaster villages, we concentrate our data collection only on victims in both village types, to understand and explain this natural experiment and to check if the response dynamics will be different.

The original villages are still considered dangerous for habitation, as any further release of gas from the lake is still likely to affect people in these villages [20].

The sampling unit was the household. Unique primary data were collected with a standardized questionnaire. A census of 100% of returned disaster households and over 80% of all those still staying in the resettlement camps was done. A total of 208 households (71 illegally returned and 137 in camps) were surveyed.

The pre-tested questionnaire mainly based on the World Bank’s SRM framework, allowed for eliciting how formal and informal mechanisms influenced disaster management at household level. Two pertinent variables were used to analyze shock dynamics: (1) membership in formal and informal groups/networks, and (2) risk management responses implemented at household level. To elicit the latter, the relative importance of formal and informal responses in managing the 1986 Lake Nyos disaster was analyzed. Participant observation and focused group discussions complemented the quantitative survey. Data was collected between November 2009 and February 2010.

4 Results and discussions

4.1 Socioeconomic characteristics of households

The elicited population literacy rate (58.3%) is ten percentage points lower than the national average for Cameroon [25]. The literacy rate is even lower amongst household heads (HHHs): 46.6% and 40% for HHHs in the disaster zone villages and state-supported resettlement camps, respectively. This partly explains why
83% of all HHHS are self-employed in subsistence agriculture, as illiteracy is a major handicap to access more specialized labor markets [8]. 40% of the entire population is self-employed in agriculture, while only 35% are students or pupils.

Long term food insecurity was captured as household’s inability to have a regular food supply over a 12-month period [26]. 21.4% of the households in the disaster zone compared to 31.3% in the resettlement camps reported long term food insecurity. This suggests that the movement into the potential disaster zone might be partly driven by the desire to enhance food security, due to access to more abundant and fertile land in the disaster zone. This conjecture is supported by the fact that the number of farm plots per capita for households in the potential disaster zone is significantly higher than for those in the resettlement camps. The agricultural expenses of the former are also higher, even if they are not statistically significant. With the exception of household size, households that had moved back have presently significantly higher monthly consumption as well as annual clothing and footwear expenditures. Self-relocated households also have consistently higher values of assets compared to those in the resettlement camps. If one leans on the assumption of Bang [20] that the socio-economic situation of disaster affected households was originally more or less the same after the disaster, then moving back culminates in asset accumulation.

Households in the disaster zone were found to have lost significantly higher livestock assets in 1986. This suggests that even before the disaster, these households were better off, and crucially could have, based on their stronger agency and risk-taking abilities recovered faster from the shock. In this light, it is the wealthier households that take the risk of moving back to the disaster zone [34]. This conclusion is supported by other scholars such as Binswanger [28], Fellner and Maciejevsky [29] and Van den Berg et al. [30], who state that wealth is negatively correlated with risk aversion.

4.1.1 Formal and informal risk response mechanisms
Fundamental to the multidimensional framework are the assumptions that an improper estimation of informal response mechanisms is responsible for underestimating its role in managing shocks, and that failure is not limited to the informal institutions [13]. The framework hypothesizes a stronger role of informal responses under market and state failure conditions. To test this, an analysis of active membership in formal and informal groups and networks for managing the 1986 Lake Nyos disaster was done for the two household types. This paper presents the analysis of the first two networks (Table 1).

Over 80% of all membership is in informal networks. Nevertheless, a significantly higher percentage of households in the camps access formal networks, compared to the disaster zone. The limited access of mobile households to formal networks is logical, as their relocation remains illegal. Access to formal networks and the development of informal mechanisms may be important for long term risk management for returning households. This suggestion aligns with the ideological supposition of Bang [20] that strategic institutional coordination across scales (that is, formal with informal) is essential for successful adaptive, collaborative long term risk management.
Table 1: Membership dynamics by household type in formal and informal networks.

<table>
<thead>
<tr>
<th>Network numbers</th>
<th>Formal</th>
<th>Informal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Households in former disaster zone (%)</td>
<td>Households in resettlement camps (%)</td>
</tr>
<tr>
<td>I</td>
<td>27.1</td>
<td>1.6</td>
</tr>
<tr>
<td>II</td>
<td>6.1</td>
<td>3.6</td>
</tr>
<tr>
<td>I and II (mean)</td>
<td>16.6</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Source: Field data analysis.

Table 2 presents the risk management arrangements employed by all households. The first figures in parenthesis represent actions directly related to the 1986 disaster, while the second ones are any other key shock that was witnessed by the household after the 1986 disaster. Approximately one-third of the entire sample took no physical action against the shocks. Group discussions revealed that taking no action was synonymous with entrusting the outcome in the hands of God and theology [20, 31]. When any action was taken (on average 65% of all the cases), excess food was sold while holding livestock assets constant. Network based informal lending and money lenders played an important role too in shock management. Similar results have reported for instance by Makoka [32] for rural Malawi and Zimmerman and Carter [33] for post apartheid South Africa. The empirical results show that informal mechanisms increase in their importance in managing shocks at lower levels of development characterized by weak state and market institutions.

An innovative outcome from this study is the observation that households used different informal instruments in isolation or in combination with formal ones. For instance, over 6% and almost 10% of sampled households combined different informal mechanisms to manage the first and second shocks respectively. This supports the argument in favour of stronger, not well known dynamism of informal mechanism in dealing with shocks, reiterating the importance of informal mechanisms and their inclusion into broad based risk management as considered in the multi-sector framework proposed in this paper. The empirical results suggest that experience and learning can enhance the potential of informal responses, for managing household idiosyncratic or covariate shocks in isolation – when states and market (formal) institutions fail, or in combination with these, when they function at least partially. Further research is needed to ground such conclusions and render the multi-dimensional framework more plausible. Such research has greater potentials in developing countries, where formal institutions are generally weak and informal mechanisms often relatively abundant.
Table 2: Response mechanisms to shocks applied by the sampled households.

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Level of formality</th>
<th>Informal</th>
<th>Market-based</th>
<th>Public</th>
<th>Various combinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention</td>
<td>Use skills acquired through formal trainings (0, 1.1)</td>
<td>(1.2, 0)</td>
<td>Free vaccinations/medications (0.6, 0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combinations of different informal instruments only (6.2, 9.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitigation</td>
<td>Free vaccinations/medications (0.6, 0)</td>
<td>(0, 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combinations of different formal instruments only (0.6, 0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combinations of formal and informal instruments (1.2, 5.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coping</td>
<td>Visiting traditional doctor (0.6, 0)</td>
<td>(0.6, 0)</td>
<td>Microfinance institution (0, 1.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combinations of different informal instruments only (6.2, 9.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combinations of different formal instruments only (0.6, 0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combinations of formal and informal instruments (1.2, 5.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field data analysis. Figures in brackets represent corresponding percentage of households applying a particular response mechanism to manage the 1986 Lake Nyos disaster and a second shock respectively.

5 Conclusions and recommendations

The aim of this paper is to propose a novel framework for analysing shocks, especially in developing countries. The multidimensional framework emphasizes the need for a theoretical consideration of the dynamics between formal and informal mechanisms, rather than assuming away the role of informal mechanisms especially in dealing with covariate shocks, as conceived in the SRM framework. Using the example of the Lake Nyos disaster in NW Cameroon, we empirically show that informal responses are vital for managing
both idiosyncratic and covariate shocks, especially under imperfect state and market conditions. When states and markets are absent, fail or function only partially, informal institutions become more useful in dealing with shocks. Through learning and experience, new mechanisms develop that enable agents to cope, reduce, resist, mitigate or prevent future shocks. The empirical results support the suggested multidimensional framework and its relevance for analyzing (covariate) shocks especially in developing countries. This calls for an adjustment of the SRM framework to be informal response inclusive in developing covariate shock management strategies especially in developing countries. The case study clearly demonstrates the potential of the novel framework for analyzing idiosyncratic and covariate shocks in developing countries.

The conjecture held in the topical literature pioneered by the SRM framework suggesting greater importance of covariate over idiosyncratic shocks does not clearly emerge in this case study. Although the novel framework aligns with the SRM framework, it further emphasizes the need for an appropriate combination of informal and formal responses based on analysis, for all shock types. This places the multidimensional framework as a better analytical tool for shock analysis. This modification allows the novel framework to capture and effectively utilize the dynamics of informal responses in a manner that until now has not been possible with the World Bank’s SRM framework. One case study is however not enough. Further empirical research is necessary to validate the multidimensional framework for modelling shocks, especially in developing countries where states and markets are either absent, dysfunctional or operate sub-optimally. Floods and droughts will provide crucial case studies as they are the most common water-related shocks occurring worldwide, and especially in developing countries.

References


academy for Social Vulnerability at the United nations University-Institute for Environmental and Human Security (UNU-EHS) in Germany 9–11 October 2008.


