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Funding public adaptation to climate-related disasters. Estimates for a global fund

Stefan Hochrainer-Stigler [a,*], Reinhard Mechler [a,b,1], Georg Pflug [a,2], Keith Williges [a,3]

[a] IIASA – International Institute for Applied Systems Analysis, Risk, Policy and Vulnerability Program, Schlossplatz 1, A-2361 Laxenburg, Austria
[b] University of Economics and Business, Welthandelsplatz 1/D41020 Vienna, Austria

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ABSTRACT

Managing disaster risk is increasingly being considered a key line of response in climate adaptation. While funding support for adaptation has been pledged, rationales for support and cost implications are essentially unclear, which may explain why financing is currently only forthcoming at low levels. Various estimates for the costs of adaptation have been suggested, yet the rationale and robustness of the estimates have been difficult to verify. Focusing on weather-related extreme events, we conduct a global assessment of the public finance costs for financially managing extreme event risks. In doing so, we assess countries' fiscal disaster vulnerability, which we operationalize as the public sector's ability to pay for relief to the affected population and support the reconstruction of lost assets and infrastructure. Methods employed include minimum-distance techniques to estimate the tail behaviour of country disaster risks as well as the inclusion of non-linear loss and financing resources relationships. We find that many countries appear fiscal vulnerable and would require assistance from the donor community in order to bolster their fiscal resilience. Our estimates may inform decisions pertaining to a global fund for absorbing different levels of country risks. We find the costs of funds covering different risk layers to be in the lower billions of dollars annually, compared to estimates of global climate adaptation which reach to more than USD 100 billion annually. Our estimates relate to today's climate, and while disaster losses have currently not been robustly linked to climate change, physical science has made a strong case in attributing changes in climate extremes to anthropogenic Climate Change. We suggest that estimates of current weather variability and related risks, although also associated with substantial uncertainty, can be interpreted as a baseline for discussion and any future projections of risks.

1. Introduction

As evidence mounts regarding the contribution of climate change to altered intensities and frequencies of natural hazards, the management of extreme event risk has been receiving increasing attention in international climate policy (IPCC, 2012). As one consequence, at the 13th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in Bali, a *Climate Change Adaptation Fund* was created via a broad consensus to sponsor concrete adaptation projects in vulnerable countries. Furthermore, the *Loss and Damage* work programme under the UNFCCC is deliberating a rationale and mechanisms for supporting vulnerable countries by risk reduction and risk financing (Surminski and Oramas-Dorta, 2011). Other programmes such as the Green Climate Fund (GCF, 2013) and the Pilot Programme for Climate Resilience (PPCR, 2013) also are proceeding towards financing of adaptation in the most vulnerable areas.

Our assessment focuses on the costs of managing and financing today's public sector risks for weather extremes, which form a subset of the challenges posed to climate change adaptation. National governments are key actors in managing weather variability and change, yet many highly exposed developing countries - faced with the problem of inefficient use of money, inefficient tax bases and high levels of indebtedness - cannot raise sufficient and timely capital to replace or repair damaged assets and restore livelihoods following major disasters, leading to an exacerbation of poverty and delayed development (Mechler, 2004; Linnerooth-Bayer et al., 2005; Hochrainer, 2006; Cummins and Mahul, 2009). Realizing the shortcomings of such a "wait-and-see" -approach, a paradigm shift has occurred during the last decade in national and international responses to this problem with a move

* Corresponding author. Tel.: +43 2236 807 517; fax: +43 2236 807 466.
E-mail addresses: hochrain@iiasa.ac.at (S. Hochrainer-Stigler), mechler@iiasa.ac.at (R. Mechler), pflug@iiasa.ac.at (G. Pflug), williges@iiasa.ac.at (K. Williges).
[1] Tel.: +43 2236 807 313.
[2] Tel.: +43 2236 807 297.
[3] Tel.: +43 2236 807 437.

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towards more proactive efforts and upgrading the role of pre disaster risk management. Countries, communities, the private sector, donors and the international community have been working together to devise and implement risk management systems for reducing, pooling and sharing risk (Linnerooth-Bayer et al., 2005).

However, action has not been up to speed with rhetoric. Support from climate agenda funds has been slow to materialize, regardless of goodwill (see CFU, 2013). Also, overall support for disaster risk management may be considered insufficient. While the importance of funding risk management and adaptation is increasingly recognized, and global funding streams such as the Global Facility for Disaster Risk Reduction (GFDRR, 2013a) have been implemented as a source of funding and technical assistance, the brunt of disaster support is still dispensed for post-disaster spending. As one example, global spending on official development assistance (ODA) allocated to disaster-related activities from 1980 to 2009 was about USD 91 billion, or 2% of total development assistance. Of this, about 96% went into ex post response and relief, and only about 4% into ex ante risk management activities, which overall amounts to only 0.07% of total development assistance (Kellett and Caravani, 2013).

We suggest that one key hurdle for releasing support from these initiatives has been a lack of systematic and operationalizable methodologies for assessing vulnerability and risks from climate-related extreme events linked to cost implications. A host of estimates for adaptation costs have been worked out, yet the robustness and underlying basis of such estimates has often been difficult to verify. Additionally, relevant studies framed around climate adaptation for developed and developing countries have focused on the costs of adaptation rather than impacts and losses (see EEA, 2007; Solomon, 2007; Nordhaus, 2007; Agrawala and Fankhauser, 2008; UNFCCC, 2009; Parry et al., 2009). Some national level studies in the EU, UK, Finland and the Netherlands have been conducted or are underway, and a number of developing countries have undertaken assessments within the UNFCCC's NAPA programme (MMM, 2005; Van Ierland et al., 2006; DEFRA, 2006; Lemmen et al., 2008; UNFCCC, 2009). Overall, the evidence base on economic aspects including efficiency of adaptation remains limited and fragmented (Adger et al., 2007; Agrawala and Fankhauser, 2008; UNFCCC, 2009; IPCC, 2012). Further, most studies focus on the risk of sea level rise and slower onset impacts for the agricultural sector. Those studies considering extreme events, and finding or reporting net benefits over a number of key options (UNFCCC, 2009; Agrawala and Fankhauser, 2008) do so by treating it similarly to gradual onset phenomena and use deterministic impact metrics, which is problematic for disaster risk. A risk-focused study (ECA, 2009) went so far as to suggest the use of an adaptation cost curve approach, which organizes adaptation options around their cost-benefit ratios, yet the fundamental concepts of risk layering and portfolio approach (see IPCC, 2012) are not currently considered.

This paper reflects on the funding needs for a global disaster risk fund to support countries' ability to absorb risks from a public finance perspective. Based on an estimate of country-level risk for the 160+ countries most exposed to weather extremes, we assess countries' current fiscal vulnerability to climate-related extremes, which we operationalize as the public sector's ability to pay for relief to the affected population and support the reconstruction of affected public sector assets such as infrastructure. We find that a number of countries are highly fiscal vulnerable for smaller to medium sized events already, and suggest that efforts to reduce risk need to be seriously stepped up. In such cases of obvious risk aversion, where disaster risks faced by governments cannot be absorbed without major difficulty, there is a rationale for pre-financing disaster risks, as the benefits of financing risks would outweigh costs in many instances. Our estimates may inform decisions pertaining to a climate fund for absorbing extreme event country risk (or various layers of it), which exceeds the ability of a given country to absorb risk independently. We find the costs of such a high-risk layer backup fund to be between 4 and 28 billion dollars annually (depending on the risk layers covered). Our assessment relates to today's climate, yet we suggest that estimates of today's weather variability and related risks, although also associated with substantial uncertainty, can be interpreted as a baseline for very uncertain future projections, which may account for contributions by climate, but also socio-economic change.

The paper proceeds as follows. In Section 2, we discuss the developmental challenges imposed by disaster risk and the case for pre-financing disaster risk. In Section 3, we present in detail our methodology for assessing national fiscal vulnerability to extreme events. Section 4 presents salient findings and a discussion of key implications. Finally, Section 5 ends with a conclusion and outlook for the future.

2. Disasters, climate change and development: a need to bolster risk management

Climate-related disaster losses have escalated in the recent past with losses significantly increasing over the last few decades. Disaster impacts can be devastating, particularly in heavily exposed low- and middle-income countries and for the vulnerable within these countries who suffer the most. For example, during the 25 year period from 1979 to 2004, over 95% of natural disaster deaths occurred in developing countries and direct economic losses averaged USD 54 billion per annum (Arnold and Kreimer, 2004). In order to deal with the aftermath, exposed countries often have to rely on donors to aid them after catastrophic events, but the evidence regarding ex–post assistance shows that only partial relief and reconstruction funding is usually made available; furthermore, this support is often associated with substantial time lags (of at a minimum one year). Even when funding is made available, such post disaster aid commonly fails to reach those in need effectively (Becerra et al., 2012). We discuss this issue below and give examples of more efficient uses of available funds. There are considerable differences in the human and economic burden, and as well in insurance coverage. In the richest countries, average total losses during this period amounted to 0.2% as measured in gross national income (GNI) with about 30% of those losses being insured, as compared to low-income countries, where total losses amounted to 0.7% of GNI, and insured losses making up only 1% of the total (Munich Re, 2005). It should be emphasized that these disaster statistics do not (for the most part) reflect medium to long-term indirect losses, which can be very significant, particularly in countries with little capacity to cope with extremes, yet are generally very difficult to parcel out from other effects (Mechler et al., 2013).

At the same time, climate change is altering intensities and frequencies of natural hazards, such as heatwaves, droughts and heavy precipitation, many of which are expected to increase in frequency or severity in various places in a future warmer climate (IPCC, 2012). Yet, the case for climate change being a driver of increases in disaster losses has not yet been made (IPCC, 2012). In fact, the IPCC-SREX reports that exposure of people and capital at risk has been the dominant cause behind any increases in losses. This is only part of the story, however, and there are many uncertainties involved in studying trends in losses, projections and the attribution to climate change, and overall this comprehensive report concludes that "a role for climate change has not been excluded" (IPCC, 2012). Irrespective of the attribution question, managing disaster risk is considered a priority area for action on