

VULNERABILITY AND RESILIENCE: A CONCEPTUAL FRAMEWORK APPLIED TO THREE ASIAN COUNTRIES—BHUTAN, MALDIVES, AND NEPAL

Patrick Guillaumont

NO. 53

October 2017

**ADB SOUTH ASIA
WORKING PAPER SERIES**

ADB South Asia Working Paper Series

Vulnerability and Resilience: A Conceptual Framework Applied to Three Asian Countries —Bhutan, Maldives, and Nepal

Patrick Guillaumont

No. 53 | October 2017

Patrick Guillaumont is professor emeritus at the University d'Auvergne, France and president of Fondation pour les Études et Recherches sur le Développement International (Ferdî); founder and former director of the Centre d'Études et de Recherches sur le Développement International (CERDI); and former member of The Committee for Development Policy (CDP) of the United Nations.

The bulk of the statistical work has been done at Ferdî by Sosso Feindounou. Sylviane Guillaumont Jeanneney reviewed several versions of the study. Sarah Carrington contributed to a preliminary version on Bhutan. They are all strongly acknowledged.



Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO)

© 2017 Asian Development Bank
6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines
Tel +63 2 632 4444; Fax +63 2 636 2444
www.adb.org

Some rights reserved. Published in 2017.

ISSN 2313-5867 (Print), 2313-5875 (e-ISSN)
Publication Stock No. WPS179069-2
DOI: <http://dx.doi.org/10.22617/WPS179069-2>

The views expressed in this publication are those of the authors and do not necessarily reflect the views and policies of the Asian Development Bank (ADB) or its Board of Governors or the governments they represent.

ADB does not guarantee the accuracy of the data included in this publication and accepts no responsibility for any consequence of their use. The mention of specific companies or products of manufacturers does not imply that they are endorsed or recommended by ADB in preference to others of a similar nature that are not mentioned.

By making any designation of or reference to a particular territory or geographic area, or by using the term “country” in this document, ADB does not intend to make any judgments as to the legal or other status of any territory or area.

This work is available under the Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO) <https://creativecommons.org/licenses/by/3.0/igo/>. By using the content of this publication, you agree to be bound by the terms of this license. For attribution, translations, adaptations, and permissions, please read the provisions and terms of use at <https://www.adb.org/terms-use#openaccess>

This CC license does not apply to non-ADB copyright materials in this publication. If the material is attributed to another source, please contact the copyright owner or publisher of that source for permission to reproduce it. ADB cannot be held liable for any claims that arise as a result of your use of the material.

Please contact pubsmarketing@adb.org if you have questions or comments with respect to content, or if you wish to obtain copyright permission for your intended use that does not fall within these terms, or for permission to use the ADB logo.

Notes: In this publication, “\$” refers to US dollars.
Corrigenda to ADB publications may be found at <http://www.adb.org/publications/corrigenda>

CONTENTS

FIGURES, TABLES, AND BOXES	v
ABBREVIATIONS.....	viii
ABSTRACT.....	ix
I. INTRODUCTION	1
A. What is Vulnerability? And Why Should it be Measured?.....	1
B. Need for Indices within a Conceptual Framework: Focus on Three Countries.....	2
C. Bhutan	3
D. Maldives.....	4
E. Nepal.....	4
II. A CONCEPTUAL FRAMEWORK FOR THE MEASUREMENT OF VULNERABILITY AND RESILIENCE	6
A. Conjunctural Approaches to the Measurement of Economic Vulnerability and Their Limitations	6
B. Structural Economic Vulnerability, Distinct from General Economic Vulnerability and from Resilience, Its Components.....	7
C. Economic Vulnerability Index: Origin, Revisions, Remaining Gaps Toward an Augmented Index	8
D. Structural Resilience, within a Broader Index of Structural Economic Vulnerability.....	11
E. Is Resilience Measurable?	12
F. Vulnerability to Climate Change: Physical versus General Vulnerability	13
G. Resilience, Possibly Undermined by Sociopolitical Vulnerability and State Fragility	15
H. Violent Events as an Alternative Approach to Fragility	17
I. Interconnected Vulnerabilities: The Conceptual Framework.....	18
III. ECONOMIC VULNERABILITY: STRUCTURAL VERSUS CONJUNCTURAL.....	20
A. First Approach: Income Growth and Volatility.....	20
B. Is the Volatility of Each Country Linked to that of the Others?	23
C. Structural Economic Vulnerability of Bhutan, Maldives, and Nepal: What the Economic Vulnerability Index Tells Us.....	23
D. What the EVI Does Not Tell Us, But Could Do	26
E. Has Structural Economic Vulnerability (According to Economic Vulnerability Index Components) Decreased during the 2000s?	34
IV. VULNERABILITY TO CLIMATE CHANGE: PHYSICAL VERSUS GENERAL.....	40
A. Vulnerability to Climate Change in Bhutan, Maldives, and Nepal, According to the Level of the Physical Vulnerability to Climate Change Index and its Components	40

B.	Besides or Inside the Physical Vulnerability to Climate Change Index: The Risk of Flooding Due to Ice Melting.....	42
C.	Mixing Physical Vulnerability to Climate Change Index with Economic Vulnerability Index: Relevance and Results.....	43
V.	SOCIOPOLITICAL VULNERABILITY AND RESILIENCE	45
A.	Sociopolitical Vulnerability and State Fragility in Bhutan, Maldives, and Nepal with Regard to Current Criteria.....	45
B.	Lessons from an Internal Violence Indicator.....	46
C.	Structural Vulnerability, Fragility, and Resilience.....	48
VI.	SUMMARY AND CONCLUDING REMARKS.....	49
A.	Bhutan, Maldives, and Nepal Compared.....	49
B.	Linking the Indicators: Vulnerability Profile Rather than Aggregate Index.....	51
C.	Improving Current Vulnerability Indices.....	52
D.	Early Warning Systems: When Are They Relevant?	53
E.	Final Remarks.....	54
APPENDIXES		
1.	Selected Indicators on Vulnerability.....	55
2.	Composite Indicators of Policy and State Fragility Used in Section V	70
REFERENCES		73

FIGURES, TABLES, AND BOXES

FIGURES

1	Economic Vulnerability Index, 2005–2009 and 2011–2012.....	9
2	The Physical Vulnerability to Climate Change Index	14
3	Conceptual Framework for Vulnerability Assessment	19
4a	Gross Domestic Product per Capita Growth Rate and Its Volatility of Bhutan, Maldives, and Nepal, 1991–2013.....	22
4b	Annual Growth Rate of Gross Domestic Product: Bhutan, India, Maldives, and Nepal	22
4c	Growth Rate of Gross Domestic Product (3-year Moving Average): Bhutan, India, Maldives, and Nepal	22
5	Evolution of the Exports of Goods and Services in Bhutan, Maldives, and Nepal.....	25
6	Evolution of Remittances, Observed and Fitted Values, Maldives and Nepal, 1999–2013.....	27
7	Evolution of the Economic Vulnerability Index (2006–2009 Definition) in Bhutan, Maldives, and Nepal, Compared to the Average of Least Developed Countries (1990–2011).....	36
8	Evolution of the Exposure Index (2006–2009 Definition) in Bhutan, Maldives, and Nepal, Compared to the Average of Least Developed Countries (1990–2011)	36
9	Evolution of the Shock Index (2006–2009 Definition) in Bhutan, Maldives, and Nepal, Compared to the Average of Least Developed Countries (1990–2011)	37
10	Exports: Share of the Three Main Partners and Geographical Concentration, 2005–2014	38
11	Structural Handicap Index: Evolution in Bhutan, Maldives, Nepal, and Groups of Countries, 1989–2011	39
12	Economic Vulnerability Index and Physical Vulnerability to Climate Change Index Combined for Asian Countries.....	44
13	Comparison of Vulnerability Indices in Bhutan, Maldives, and Nepal for the Three Dimensions of Vulnerability	50
14	Components of Vulnerability Indices in Several Dimensions for Bhutan, Compared to the Average for Least Developed Countries and Landlocked Developing Countries.....	51

TABLES

1	Correlation between the Internal or Domestic Violence Index and Other Indices	18
2	Average Growth Rate and Its Volatility in Bhutan, Maldives, Nepal, and Other Groups of Countries, 1991–2013, 2002–2013	21
3	Correlation Matrix of the Gross Domestic Product Growth's Volatility between Bhutan, Maldives, Nepal, and India	21
4	Economic Vulnerability Index in Bhutan, Maldives, and Nepal, Compared to Other Countries	24
5	Ratios of Exports of Goods and Services to GDP and Ratios of Remittances Inflows to GDP	27
6	Instability of Exports and Remittances, Compared and Combined, Bhutan, Maldives, Nepal, and Other Groups of Countries, 1999–2013	28
7	Geographical and Merchandise Export Concentration Compared, for Bhutan (2012), Maldives (2013), and Nepal (2013)	30
8	Evolution of the Geographical Concentration of the Exports of Goods	30
9	Comparison of the Relative Share of Agriculture in Gross Domestic Product and in Employment	31
10	Components of the Economic Vulnerability Index in 2011 (and 2000): Bhutan, Maldives, Nepal, and Various Country Groupings Compared	32
11	Level of the Structural Handicap Index in 2011: Bhutan, Maldives, Nepal, and Various Country Groupings Compared	39
12	Physical Vulnerability to Climate Change Index: Bhutan, Maldives, Nepal, and Various Country Groupings Compared	41
13	Main Components of the Vulnerability to Climate Change Index: Bhutan, Maldives, Nepal, and Various Country Groupings Compared	41
14	Components of the Physical Vulnerability to Climate Change Index: Bhutan, Maldives, Nepal, and Various Country Groupings Compared	42
15	Some Indicators of Fragility: Bhutan, Maldives, Nepal, and Various Country Groupings Compared	47
16	Internal Violence Index: Bhutan, Maldives, Nepal, and Some Country Groups	48
A1	EVI in 2011, According to the UN CDP 2012 Definition, and Change from 2000 to 2011 for Present and Former LDCs	55
A2	Bis. EVI in 2011, According to the UN CDP 2006 Definition, and Change from 2000 to 2011 for Present and Former LDCs	57
A3	Impact of the Change in the “Environment Component” of EVI on EVI Ranking among LDCs and Former LDCs	59
A4	Ranking Differences between LDCs and Former LDCs for Two Substitute Indicators, Homeless and Victims of Disasters, 2011	61

A5	PVCCI 2012 and Its Two Main Components for Present and Former LDCs	63
A6	PVCCI in Three Asian Countries. Value and Rank for Each Component and Subcomponent	65
A7	Composite Indicators of State Fragility in LDCs and Former LDCs	70

BOXES

1	Revising the Calculation of the Instability of Exports in the Economic Vulnerability Index.....	29
2	Frequency of Earthquakes in Nepal.....	33
3	Glacial Lake Outburst Flood, A Major Himalayan Water-induced Hazard, But Not the Only One	43
4	From Vulnerability Assessment to Graduation Prospects	52
5	Is There a Risk of Dutch Disease in Bhutan?	53

ABBREVIATIONS

ADB	Asian Development Bank
AfDB	African Development Bank
CDP	Committee for Development Policy
CIFP	Country Indicators for Foreign Policy
CPIA	Country Policy and Institutional Assessment
DLZ	dry land zone
EVI	economic vulnerability index
Ferdi	Fondation pour les Études et Recherches sur le Développement International
FSI	fragile states index
FY	fiscal year
GDP	gross domestic product
GNIPC	gross national income per capita
HAI	human assets index
ICIMOD	International Centre for Integrated Mountain Development
IDA	Internal Development Association
IVI	internal violence index
LDC	least developed country
LECZ	low elevation coastal zone
LLDC	landlocked developing country
OECD	Organisation for Economic Co-operation and Development
PRC	People's Republic of China
PSAV	political stability and absence of violence
PVCCI	physical vulnerability to climate change index
SHI	structural handicap index
SIDS	small island developing states
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNICEF	United Nations Children's Fund
WDI	World Development Indicators

ABSTRACT

This paper presents a conceptual framework for the study of the vulnerability of three Asian developing countries—Bhutan, Maldives, and Nepal—with a particular focus on structural vulnerability. It examines to what extent these countries may be considered resilient to exogenous shocks, and whether the application of macroeconomic early warning systems is relevant for them. Three kinds of vulnerability have been considered for each country: economic, climatic, and political. Comparative assessment of countries is likewise undertaken using available and comparable indicators such as the economic vulnerability index, physical vulnerability to climate change index and fragile state index. The assessment shows that each of the three countries seems the most vulnerable in one of the three dimensions of vulnerability: Bhutan for structural economic vulnerability, Maldives for physical vulnerability to climate change, and Nepal for state fragility.

I. INTRODUCTION

The last 3 decades of global economic development have presented the world economies with avenues for economic growth and development based on global integration and cooperation. Many Asian economies have taken this opportunity with open arms and leveraged the opportunity of an accommodating economic environment to obtain levels of growth thought inaccessible by preceding generations. However, these opportunities do not come without risk. As many Asian economies realized in the late 1990s, these risks can materialize into economic crises. Indeed, the recurrence of crises, shocks, and spillovers from within Asia and through interregional contagion in the past 2 decades has driven home the message to developing Asian economies the need to be alert to the dangers of economic shocks in such an open environment. To economies that have made such hard-won gains, the importance of identifying their exposure to adverse economic shocks early on and building resilience to their vulnerabilities is strongly recognized.

Vulnerability does remain an issue that needs to be addressed. Both cross-country econometric studies and case studies have documented the impact of external, climatic, and political shocks on growth, development, and poverty reduction in various parts of the world. Although some progress has been made in addressing economic vulnerability, it remains limited. Moreover, the scope of vulnerability itself has been changing with the emergence of new social and environment dimensions. Here, the three countries—Bhutan, Maldives, and Nepal—and their vulnerability are briefly introduced.

A. What is Vulnerability? And Why Should it be Measured?

Addressing vulnerability requires an identification of the sources and determinants of vulnerability, including a conceptual clarification with respect to its broadening scope. Since a country's vulnerability is the risk of being affected by exogenous events, it can be evidenced by an impact on economic variables (either related to welfare or to development), sociopolitical variables, or environmental variables. At first glance, it seems reasonable to identify *three main areas of macro-vulnerability: economic, social, and environmental*. These three areas of vulnerability correspond to the three dimensions generally referred to in the presentation of the agenda of sustainable development. In these three areas, vulnerability appears as the opposite of sustainability (Guillaumont 2013); it is a threat to sustainability.

Another distinction made in each of these three areas is between *structural vulnerability*, which depends on long-lasting or structural factors beyond the immediate control of a country, and *general vulnerability*, which depends both on structural factors and a country's policies. Thus, the next section proposes a conceptual framework in which structural economic vulnerability is distinguished from general economic vulnerability, from physical vulnerability to climate change, and from state fragility as well. Several vulnerability indices will take their place within this framework.

There are three main reasons why the measurement of vulnerability, in particular structural vulnerability, is needed. One is the use of vulnerability indicators as a *tool for monitoring the impact of policies* on reducing vulnerability. Another reason, related to structural vulnerability only, is that structural vulnerability indices, which are already used for the identification of the least developed countries (LDCs) both for inclusion into and the graduation from the list of these countries, can also be used as *criteria for the international allocation of concessional resources* dedicated to development or to adaptation to climate change. Indices of structural vulnerability provide a useful tool for the

international allocation of resources and not just guide policies aimed at structural transformation and sustainable development. Since it is exogenous to current policy, structural vulnerability, if adequately measured, may be a relevant criterion for the international allocation of concessional resources. A third reason, related to general vulnerability only, is the need to have indicators of the risk of occurrence of a crisis or a growth collapse, which is indeed the most difficult task. It should be remembered that the meaning of any index should be understood with respect to its expected use.

B. Need for Indices within a Conceptual Framework: Focus on Three Countries

Indices should be used comparatively, either over time or between countries. To be used over time and to assess the changes in vulnerability, so as to compare the levels of vulnerability between countries, indices should be designed and calculated in the same way and use equally reliable data. Most often, comparisons of vulnerability indices are made between countries. Comparisons over time (has vulnerability decreased or increased?) are quite less frequent.

Various vulnerability indices have been proposed reflecting economic, social, or environmental aspects of vulnerability, without a clear distinction between what is exogenous and what depends on country policy, and without an agreed conceptual framework combining the various kinds of vulnerability. In this paper, not only are proposed indices compared with those that already exist, but also tried to combine them in an integrated framework.

The main features and the evolution of vulnerability are analyzed for three specific Asian countries—Bhutan, Maldives, and Nepal—as compared to several groups of developing countries. All three countries are or have been LDCs. LDCs are the only United Nations (UN) official subgroup of developing countries, designated as poor countries suffering from structural handicaps to (sustainable) development, and identified using three criteria: (i) low level of income per capita, (ii) low level of human capital, and (iii) high structural economic vulnerability, measured by the economic vulnerability index (EVI). Bhutan and Nepal are landlocked countries and still considered LDCs, while Maldives is an island country and recently graduated from the list of LDCs as of 1 January 2011.

On the basis of the EVI, these three countries appear to be unequally and differently vulnerable, with Maldives often considered to be the most vulnerable. Indeed their vulnerability cannot be assessed only from the EVI index or any other single index. The EVI index has to be supplemented by other indices reflecting the various dimensions of vulnerability. Moreover, a more qualitative and specific assessment of the three countries' vulnerability is needed; and modifications to the current indices, including EVI, are suggested.

If the indices are designed specifically for each dimension, there may be some overlapping or interconnections in the measurement of the various dimensions of vulnerability. This increases the need for an integrated framework of vulnerability analysis, encompassing the indices which are designed specifically for each dimension. Within this framework, it should also be possible to examine the interactions both among economic, social, and environment vulnerabilities and between structural and policy-based vulnerabilities. In particular, the link between state fragility and various kinds of structural vulnerabilities will have to be evidenced.

While the larger and more established market economies may have the resources and capacity to develop defenses against future economic shocks, in Asia, as elsewhere, it is the small and/or remotely located, often transitional economies of the region that remain highly vulnerable to external shocks and often lack the wherewithal to protect themselves from the development reversals that usually accompany such shocks. Bhutan, Maldives, and Nepal deserve a special attention in this respect.

C. Bhutan

The Himalayan Kingdom of Bhutan, located between the People's Republic of China (PRC) and India, was considered a low-income country for a long time. Today, Bhutan is a middle-income country, committed to preserve its environment, culture, and religious values.

Although Bhutan's recent growth performance has been nothing less than astonishing—it has grown at an average rate of 7.9% during 1980–2012 and has tripled its gross domestic product (GDP) per capita during 2000–2012, according to the *World Development Indicators* (World Bank 2013a)—all of this has been achieved against the odds. Bhutan is a remote, landlocked country with a small population of around 766,000 inhabitants (UN Statistics Division 2014) that is largely dispersed across some of the most rugged terrains in the world. In Bhutan, natural disasters such as landslides and flooding are not uncommon, and are likely to become more common as the threat of global warming increases the likelihood of glacier lake outburst flooding. Geopolitically, Bhutan has a long history of tensions with neighboring countries and has become quite dependent on India, the large and highly dominant trading partner over recent years (74% of trade). Economically, Bhutan remains dependent on hydropower production, its one truly flourishing industry, with structural transition from small-scale agriculture to otherwise barely evident manufacturing and services and with the large majority of employment confined to agricultural low productivity activities. Finally, the economy's prevalence of low-skilled and vulnerable citizens makes it particularly exposed to exogenous economic shocks: The literate Bhutanese make up less than 53% of the adult population, the ratio of literate adult females to literate adult males is only 59.5% (United Nations Children's Fund [UNICEF] 2012), and about 53.1% of employment fall into the vulnerable employment category (World Bank 2014).

While the average GDP growth in Bhutan has been high during 2000–2013, the pattern of growth has been remarkably volatile with the standard deviation of the growth rate reaching 5.3 percentage points (from the mean growth of 7.9%) over this same period. Such volatile growth rates over such a long period (32 years) are a strong indicator of the susceptibility of output to economic disturbances. Although some of this vulnerability may be due to choices and policies made by economic managers, given Bhutan's distinct characteristics described above, it is probable that a lot of the observed output fluctuations are inherent in the structure and nature of the economic, geographic, and political characteristics of the state. Indeed, it is likely that this inherent vulnerability has played a key role in restraining Bhutan's development and its ability to deal with development challenges over time, instigating a vicious circle. Certainly, there is much evidence that economic volatility has the potential to cause severe negative impacts on development prospects, in particular on those of the economy's most vulnerable.

It is also important to note that, due to Bhutan's inherent development disadvantages, it has been a recipient of large sums of development assistance from multilateral institutions and bilateral aid agreements for over 3 decades. Hence, the growth volatility could have been much worse. The assistance is likely to have masked the underlying vulnerability by providing a buffer, without which Bhutan may have experienced large economic downturns. Consequently, while growth instability has

not historically led to significant contractions in GDP, the questions of whether Bhutan's exposure to macroeconomic shocks will increase and what it can do to counter it become important, as Bhutan consolidates its middle-income status and development assistance reduces. With this respect, the increasing share of national income generated by tourism is a growth driver as well as a source of vulnerability.

D. Maldives

Because of its very low elevation, Maldives, which is also a small middle-income country, is living under a clear threat of sea level rise due to global warming. The Maldivian economy is also threatened by the heavy dependence on just two main activities: fisheries and tourism. Like Bhutan, Maldives has a small population (around 352,000 inhabitants, UN Statistics Division 2014), that is unevenly distributed in many islands. In 2013, more than one-third of the population lived in the island capital city, Malé (Maldives Population and Housing Census 2014). Islam is the official religion of Maldives (mostly Sunni), and open practice of any other religion is forbidden.

With 90% of its territory covered by water and 80% of the land area being 1 meter or less above sea level, Maldives is vulnerable to natural disasters and environmental hazards such as sea level rise and tsunami (Maldives National Adaptation Program of Action [NAPA]). The Asian tsunami of 26 December 2004 destroyed an important part of the nation's economic and social infrastructure with a loss of approximately 62% of GDP (Maldives Monetary Authority 2012). Salinity and low water holding capacity of the sandy soils constrain crop cultivation. The agriculture sector contributes a small percentage only to the country's economy, the contribution declining to 3.4% in 2012 (Maldives Monetary Authority 2012) primarily due to the lack of cultivable land.

Maldives has experienced rapid economic growth and development since 2006. GDP in Maldives expanded by 8.5% in 2014 from the previous year. GDP annual growth rate in Maldives averaged 7.7% from 1997 to 2014, reaching a recent peak of 18% in 2006 (recovery after the tsunami) and a record low of -8.7% in 2005 (year following the tsunami) (according to the WDIs). The major income generator is the tourism industry, which is also the main source of foreign currency and generates employment in the tertiary sector of the country's economy. The country has successfully marketed its natural assets (beautiful beaches, small coral islands, blue waters with abundant tropical fish, glorious sunsets, and so on) contributing 30% of GDP and more than 60% of foreign exchange receipts in 2014 (The World Factbook 2014). The second main industry of Maldives is fishing, which represents about 1% of GDP in 2014 (Maldives Monetary Authority 2014). However, the catch has continuously declined since 2006, probably due to climate change (increase in sea surface temperature) and to the increase in fuel prices and other components. This trend, combined with the rapid development of tourism, led to the decline of the fishing industry's contribution to GDP.

E. Nepal

Landlocked between two powerful neighbors (the PRC and India), Nepal became a republic in 2008. Nepal is a low-income country and one of the poorest countries in Asia. It is highly diverse with numerous natural assets and landforms; and multiethnic, multilingual, and multireligious societies.

Compared with Bhutan and Maldives, Nepal is significantly larger in terms of population (28,121,000 inhabitants according to the UN Statistics Division 2014), and geographical area (147,181 square kilometers). The country has a relatively stable but moderate economic growth, and it benefits (although less than Bhutan) from its geographical proximity to India. At the beginning of the 2010s, the country received nearly 60% of its imports from India and sent an even higher percentage of its exports to India (more details below). Nepal's average growth in real GDP was 4.2% during 1974–2012. Annual GDP growth has been positive, except for some periods in the 1980s. In the 1990s, growth increased to 4.8%, and subsequently declined to 4% in the 2000s (the period of civil conflict in Nepal). During 2010–2012, the average GDP growth was 5.9%. GDP growth was again high (5.5%) in 2014 (World Bank 2014). Economic growth is partly due to an increasing population (the rate of population growth was 1.8% in 2014), and increases in GDP per capita are mainly due to labor moving from lower to higher productive economic sectors.

Economic growth is not driven by changes in productivity within specific economic sectors (United Nations Conference on Trade and Development [UNCTAD] 2013), and hence unlikely to be sustainable. Nepal is home to the highest mountains in the world; tourism has been steadily growing in importance, bringing considerable revenues—4.6% of the GDP in 2014 (World Travel and Tourism Council 2014)—and improving job creation. Likewise, remittances play an important role in Nepal's economy. The volume of remittances has increased and contributed more and more to the national economy. The remittances to GDP ratio increased from 0.5% in 1990–1991 to 16.0% in 2005–2006 and further to 25.5% in 2012–2013 (Nepal's Ministry of Finance). The impact of remittances on national economy is high, so that remittances have surpassed exports as the top contributor in Nepal's foreign exchange earnings. Additionally, remittances make an important contribution to reducing poverty and vulnerability in most households and communities; the poverty headcount ratio declined from 41.8% in 1995–1996 to 30.8% in 2003–2004 and further to 25.2% in 2010–2011 (Nepal Central Bureau of Statistics 2011).

Nepal, however, still remains one of the poorest countries in the world and also among the most prone to natural disasters. Each year, floods, landslides, fire, cyclonic winds, hailstorms, and drought cause significant loss of life and property, evidencing Nepal's vulnerability, revealed even more by the earthquake of April 2015.

While this rather large country is populated by a significant number of different ethnic, cultural, and social groups living in various geographic areas, this diversity instead of being an opportunity has resulted in fragmentation of society, making it difficult to build a consensus on a real project beneficial for the whole country.

Common issues. Bhutan, Maldives, and Nepal meet or have met difficulties graduating from the LDC category, mainly due to their vulnerability. However, their vulnerability takes various forms and challenges the usual concepts and measures of vulnerability. It is within this context that this report asks the following questions: Will the three countries' exposure to macroeconomic shocks increase as aid assistance reduces? And if so, to what extent it is within their power to voluntarily reduce this exposure? Essentially, the answers and their implications depend on the nature of vulnerability of each country. Whether some countries are innately more vulnerable to unstable growth than others is an area of research that has been gaining increasing attention in both the academic and policy-focused literature (Easterly, Islam, and Stiglitz 2001; Combes et al. 2000; Loayza and Raddatz 2007; Berg,

Ostry, and Zettelmeyer 2012).¹ This paper investigates the extent to which the countries' exposure to economic shocks is inherent, i.e., "structural" (Guillaumont 2009b, 2013), or brought about by actions taken by the economic managers, which is vulnerability we might define as policy induced.

Further, while such economic vulnerability is inherent in Bhutan, Maldives, and Nepal, these economies can build resilience through fostering economic adaptability and flexibility in the face of exogenous shocks. Given that the resilience of the country will impact the net vulnerability, the degree to which the countries remain resilient in the face of adverse shocks is also examined. The generation of an early warning system that forewarns of increased vulnerability is of potential interest for these countries as it can mitigate the development of general (policy-induced) vulnerability. Such early warning system is designed to indicate when an economy is accumulating imbalances in a way that makes it susceptible to the adverse effects of an economic shock. Correspondingly, this paper establishes a set of customized measures that form a benchmark against which structural features and policies can be assessed to achieve an adaptable, flexible, and resilient economy.

II. A CONCEPTUAL FRAMEWORK FOR THE MEASUREMENT OF VULNERABILITY AND RESILIENCE

The international community seems to be increasingly aware that vulnerability matters and has various dimensions. But, paradoxically, the more it is seen as being important, the more it becomes elusive and the more a general conceptual framework is needed. Addressing the vulnerability of countries requires an identification of the sources and determinants of vulnerability, including a conceptual clarification with respect to its broadening scope. The scope of the measure must necessarily be associated with the objectives for measuring vulnerability in the first place. As the international community has modified its understanding of the role that vulnerability plays in development over time, so have the measures that are used to capture the concept.

As seen above, it is possible to identify three main areas of macro-vulnerability: economic, social, environmental. Economic vulnerability can itself be assessed as a short term, conjunctural feature or as a long term, structural one.

A. Conjunctural Approaches to the Measurement of Economic Vulnerability and Their Limitations

Some earlier and recent measures of vulnerability were targeted to capture the circumstances under which countries were prone to crisis episodes (Dabla-Norris and Gündüz 2014). This vulnerability refers to the risk of occurrences of growth collapses or balance of payments crises triggered by exogenous shocks but only occur due to the underlying economic imbalances. At a time when financial crises were occurring throughout much of East Asia and in many other countries, international institutions such as the International Monetary Fund and the World Bank started to measure variables that were associated with financial crises and denote threshold levels of these variables as indicative of vulnerability. The risk of occurrence of a crisis, also called "early warning system," is estimated on a large set of countries by panel econometric models (probit models) with various kinds of explanatory

¹ Much attention has been given both to small island developing states (SIDS) and LDCs. As part of this, measures of a country's level of vulnerability have been developed (see details in Guillaumont 2009a). And see Loayza and Raddatz 2007 for an overview of the literature looking at macroeconomic volatility and welfare in developing countries.

variables, including (i) the size and exposure of the shocks, (ii) majority of policy variables such as the rate of exchange (mis)alignment, (iii) the stock of external reserves, (iv) debt-to-GDP ratios, and (v) the previous growth or the previous occurrence of crises. The level of crisis probability is then taken as a vulnerability index (Dabla-Norris and Günduz 2014). Where economic imbalances exist in key sectors of the economy, the economy becomes more susceptible to growth collapses or financial crises that arise from an exogenous shock.

While the probability of a crisis indeed reflects the current or conjunctural vulnerability of a country, it does not reflect the structural economic vulnerability, which does not depend on present policy stances and is less transitory. Similarly, approaches that for determining vulnerable economies primarily consider growth volatility—an indicator which is widely used on account of its apparent simplicity and alleged impact on average growth (as evidenced by Ramey and Ramey 1995)—also miss the mark. Growth volatility is generally a proxy by the standard deviation of the annual growth rate of GDP per capita over a given number of years (9–10 years in World Bank 2014). However, this approach is not appropriate for the measurement of structural economic vulnerability for several reasons. The main reason is that growth rate instability may result not just from structural factors, but also from transitory and reversible ones. It may then reflect changes in domestic policy, i.e., the present will of the country. Finally, the measurement of growth rate instability is highly sensitive to the length of the period covered. It should cover a minimum number of years to reflect a structural feature; but the longer the period, the higher the risk that the standard deviation simply reflects a trend change.

If the aim of measuring vulnerability is to capture the extent to which countries are intrinsically vulnerable, regardless of their policy choices, then a measure that captures the structural economic vulnerability is needed. This objective is shared by some multilateral donors, for example, when they use a vulnerability measure as an input to aid allocation decisions; a structurally vulnerable country is likely to be allocated a larger amount of grants or concessional loans.

B. Structural Economic Vulnerability, Distinct from General Economic Vulnerability and from Resilience, Its Components

To present the concept of structural economic vulnerability, to which we have devoted a lot of works, we unavoidably use wording similar to that we used in previous publications, in particular in a rather recent one where the same concept is applied to African countries (Guillaumont 2014a), instead to Asian ones, as in this paper. Vulnerability, at both macro and micro level, is the risk of being hampered by exogenous shocks, either natural (e.g., droughts) or external (e.g., fall in terms of trade). Structural vulnerability includes only factors that do not depend on a country's current policies, being entirely determined by exogenous and persistent factors; while general vulnerability also includes the effect of current and future policies, and therefore changes more rapidly (Guillaumont 1999, 2006). Accordingly, the index that we propose captures only the factors that make a country structurally vulnerable. A country's structural economic vulnerability should also be understood in a dynamic manner as the risk for a country seeing its economic growth, and more generally its development rate, durably slowed down by exogenous shocks, independently of its will (outside its control). It is not only a risk of static loss of welfare. The factors to be taken into account in the design and measurement of structural economic vulnerability should be likely to lower the rate of economic growth. An even broader meaning of structural economic vulnerability would include the risk that the country's development becomes unsustainable, again because of shocks and factors independent of its will.

Further, the proposed conceptual framework also makes sure to distinguish between vulnerability and lack of resilience. Resilience refers to the capacity to cope with exogenous shocks using decisive measures to become more adaptable. In this sense, there are two main dimensions of country vulnerability (intensity of shocks and the economy's sensitivity to these shocks) and one dimension of resilience, which encompasses the measures taken to improve the country's mitigation capacity when shocks hit. Thus, the essential elements to capture for each shock type are the

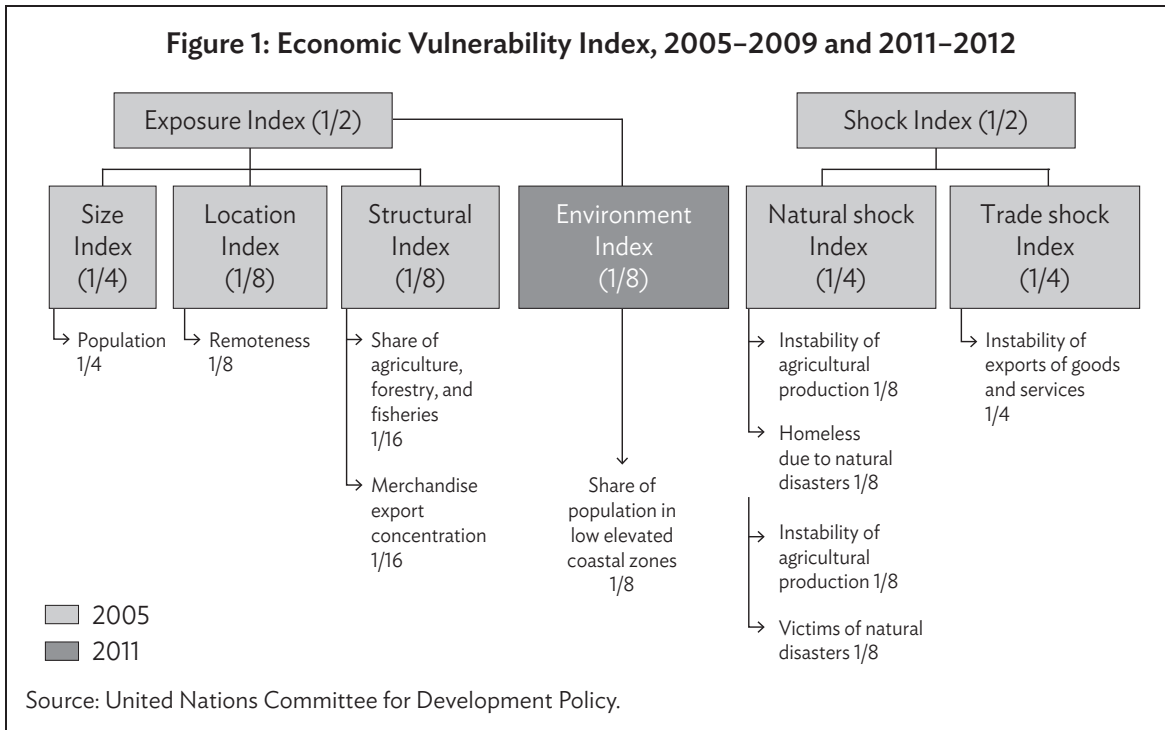
- size of exogenous shocks;
- country's *exposure* to those shocks (e.g., a small population size); and
- country's *resilience*, i.e., the capacity to cope with or adapt to them.

Structural vulnerability thus results from the sum of the expected impacts from shocks over a given period, which is based on the size of the shocks and the country's exposure to them. General vulnerability also depends on the resilience of the country to the shock, which is more linked to current policy and less to structural factors. There are indeed structural factors in the resilience of a country, such as its level of human capital and more generally its level of development or income per capita. However, most often these factors have not been taken into account in the measurement of structural economic vulnerability, because they are considered separately for the processes in which they are used. For instance, the EVI, an index of structural economic vulnerability devised by the UN for identifying LDCs, includes neither per capita income nor level of human capital, since their values are also and separately used as LDC identification criteria. However, in our framework for measuring vulnerability, we will be considering these structural factors in the assessment of vulnerability as we are not using them for separate functions at all. The ways by which these will be included are discussed in section IV.

C. Economic Vulnerability Index: Origin, Revisions, Remaining Gaps Toward an Augmented Index

One index that attempts to measure the structural economic vulnerability is the UN EVI. With the objective of quantifying innate macroeconomic vulnerability, the UN's Committee for Development Policy (CDP) began in 2000 to design a composite measure which reflects the intensity of recurrent shocks to economies, both natural and external. The present structure of this index was designed in 2005 (history and details in Guillaumont 2009a, 2009b; UN 2008). It was used for the triennial reviews of the list of LDCs in 2006, 2009, and 2012 when it was revised (Guillaumont 2013). Its principle is to combine with equal weights a group of three subindices which reflect the intensity of recurrent shocks, natural and external, and a group of four or five subindices reflecting exposure to those shocks.² The structure of the index is shown in Figure 1 in its 2006, 2009, and 2012 (revised) versions. The main change in the revised version was the addition of an environmental component, i.e., the share of population living in low coastal areas (located less than 5 meters above sea level), compensated by a reduced weight of another component, i.e., the (small) population size.

² The weights have been arbitrarily assigned by the CDP with the aim of setting a balance between exposure and shocks components.



The structure and components of the EVI are presented in Figure 1. The components are the following (see details in UN 2008; Guillaumont 2009b; 2015; Cariolle and Goujon 2013):

- a) As for the *intensity of recurrent shocks*, two indices are retained with equal weight: (i) one reflecting the trade shocks, measured by the intensity of the exports of goods and services; and (ii) the other reflecting the natural shocks, itself measured by the average of two indices: one being the instability of agricultural production, and the other an index of the number of victims of natural disasters (which has replaced in 2012 an index of homeless population due to natural disasters).
- b) As for the *exposure to these shocks*, the index now combines five (four before 2012) indicators: (i) an index of smallness of population size, with one-fourth of the exposure index, i.e., one-eighth of the EVI (previously one-half of the exposure index, i.e., one-fourth of the EVI); (ii) an index of location that measures the remoteness from the main world markets with the same weight; (iii) a structural index, still with the same weight, which itself is an average of the two following indices, namely an index of the share of agriculture, forestry, and fisheries in the GDP and an index of merchandise export concentration; and (iv) an environment index (since 2012) that is supposed to reflect the threat of climate change to the country, measured by the share of population living in low elevated coastal areas (less than 5 meters above the sea level).

Although the EVI set up by the CDP seems to be the best index of structural economic vulnerability presently used, and the only one officially endorsed by the UN for the identification of the LDCs and as an aid allocation criterion for smoothing their graduation, it is not a perfect index. While EVI has maintained a focus on structural characteristics to measure vulnerability, it has extended itself to allow for environmental sources of vulnerability, but has not done so comprehensively. As such, several key measures of vulnerability—even those that fall on the same spectrum—are missing from the framework.

Firstly, the new environmental component encompasses exposure to flooding from sea level rises but does not combine with a comparable indicator reflecting the exposure to aridity in those countries with a large share of dry land, which is prone to droughts and threatened by water scarcity. Correcting much of this bias (for the use of the index) is relatively straightforward. It would require balancing the low elevation coastal zones (LECZ) component with a dry land zones (DLZ) component. This could be the share of arid (but not desert) lands in the total nondesert area of the country, or the share of the population living in dryland (and possibly in desert areas). Such an index can easily be calculated using the definitions of arid and desert areas provided by the United Nations Environment Programme, as it has been done by the Fondation pour les Études et Recherches sur le Développement International (Ferdì) (principles and preliminary figures presented in Guillaumont 2014b). This index (DLZ) could be included either as averaged with the LECZ index, or by taking the maximum of the two indices (LECZ and DLZ).

Secondly, another default of the new LECZ component is that it only captures the risk of flooding due to the impact of global warming on sea level (indeed by a very high threshold—5 meters). However, the risk of flooding as a consequence of global warming is related not only to sea level rise (which is a real threat to Maldives and many Pacific economies), but also to melting of lake glaciers (which is particularly relevant for Bhutan and Nepal).

Another feature of the EVI is that it recognizes the exposure associated with having a high concentration of exports (the index of which is produced by UNCTAD), but only accounts for exports of merchandise and not of services. The concentration of exports of services may be a source of vulnerability, in particular for tourism. Indeed in Bhutan, Maldives, and Nepal, the export of services through tourism represents a significant (although changing) part of the total export of goods and services. According to the World Development Indicators (WDI), the figures for 2011 and 2012 are respectively 80.3% and 79.4% in Maldives, 22.3% and 19.6% in Nepal, and 10.2% and 13.5% in Bhutan. However, it should be noted that, even without a conceivable synthetic index of concentration of goods and services the vulnerability due to services exports is captured through the instability of exports of goods and services as a shock index rather than as an exposure index.

Not included (or only partially included) in the services, but in the private transfers, are the remittances that in the case of Nepal represent a major source of foreign exchange—e.g., 240% of the export of goods and services; and 71% of the aggregate flow of exports of goods, services, and remittances in 2013 (calculated from WDI). Compared with Nepal, remittances to Bhutan from abroad represent a small percentage of the exports of goods and services (2.7% of the exports of goods, services, and remittances, or 0.9% of GDP [WDI]). In the case of Maldives, on the opposite, while the amount of remittances from abroad is very small (0.11% of the exports of goods and services), the remittances paid by the foreign workers are quite high, close to the level of the exports of goods (72.4%, which is 9.7% of the exports of goods and services, and 12% of GDP).³ While the remittances received from abroad can be considered essentially exogenous, those remittances paid abroad may be considered more dependent on the country policy.

A related factor that impacts on vulnerability, and one that is likely to be specific to small countries such as Bhutan, is having a very *concentrated mix of output and exports*. In Bhutan's case, hydropower sector contributes 9.8% to GDP, and 31.2% to all exports for fiscal year (FY) 2014 (Annual Report 2013–2014 of Royal Monetary Authority), a proportion that indeed affects the export concentration

³ UNCTAD (2013).

coefficient of Bhutan. However, as we shall see, the level of this coefficient is not so high compared with those of other LDCs. It might be due to a rather diversified structure of exports other than hydropower (Annual Report of the Royal Monetary Authority, various years). For Bhutan, the dominant hydropower sector is the key driver of the economy, and anything that hurts or hinders its output, trade, or revenue also puts the entire economy at risk. The same applies to Maldives for tourism. With regard to the risks faced by the country, it also appears that the exposure components do not include any indicator of the geographical concentration of exports, which can be high in a country like Bhutan and Nepal, as seen in section III.

Finally, it should be remembered that the EVI, as it is presently designed or might be revised, can only give a partial assessment of structural economic vulnerability, since it does not take into account the *structural components of resilience*, which are numerous and depend on the overall level of development. Social factors of a structural nature include variables such as the level of human capital and its distribution throughout the economy, as well as the median or the average level of income. Further, a higher incidence of absolute poverty is likely to result in a reduced capacity to cope with adverse shocks.

Vulnerability indices are to be used comparatively, not only between countries, but also overtime. To be used overtime and to assess the changes in vulnerability, so as to compare the levels of vulnerability between countries, indices should be designed and calculated in the same way and use equally reliable data. Most often, comparisons using vulnerability indices are made between countries. Comparisons over time (has vulnerability decreased or increased?) are quite less frequent (see Cariolle et al. 2014). In the case of this study, we are actually interested in both aspects, and accordingly endeavor to use measures that are consistent across time and compatible with cross-country exercises as well.

To sum up, with reference to the case of Bhutan, Maldives, and Nepal, the present EVI may lack a few components which could have been included in what we can call an “augmented EVI” and which have been noted above: the risk of ice melting as an indicator of shock, plus the geographical concentration of exports and the share of the population living in arid or desert areas as indicators of exposure.

D. Structural Resilience, within a Broader Index of Structural Economic Vulnerability

The economy’s structural characteristics that create a lack of resilience are also essentially sources of structural vulnerability. Those are features linked to the overall level of development. Measures that give information as to the level of human capital (such as health and education, and variables that influence the ability of countries to respond to shocks), as well as overall level of income per capita (a variable which tells us how well the inhabitants of a country are able to face weather shocks on average) are critical characteristics impacting on structural vulnerability. Specifically, where human capital and income levels are particularly low, economies do not have the flexibility or resources to respond adaptively to shocks. Further, as such countries are prone to being hit harder by shocks, they fall into a “trap” or a vicious circle where, because they are underdeveloped, they bear more costs as the result of a shock, which further lowers their human capital and income levels over time, leaving them even more vulnerable in the future (Guillaumont 2009a). In essence, the risk of getting trapped results from the conjunction of structural economic vulnerability (*stricto sensu*) and low human capital

in countries with low income per capita. This is the reason why a low level of income per capita, a high EVI, and a low level of human capital are considered complementary criteria for the identification of the LDCs.

In this document we propose a measure that aims at incorporating all information that indicates the level of structural vulnerability of Bhutan, Maldives, and Nepal. The measure that is accepted as one encompassing human components of structural resilience is that of the human assets index (HAI). This is a composite index of health and education indicators. It is conceivable to aggregate the EVI and the low level of HAI in a composite structural handicap index (SHI), which is a measure of structural economic vulnerability *lato sensu*, allowing for a limited substitutability between EVI and HAI to remain consistent with the initial hypothesis of complementarity between these two handicaps (Guillaumont 2009a). These measures will be applied below.

E. Is Resilience Measurable?

Resilience depends on so many factors that, in the end, it is difficult to measure. However, a proxy indicator could be estimated through a regression of growth volatility on EVI, run on a large sample of countries (as suggested in Guillaumont 2009b). The residual, i.e., the part of growth volatility not explained by structural economic vulnerability, would be a proxy of economic resilience. If EVI only is considered as an explanatory variable, the proxy includes the impact of the structural factors of resilience, such as the level of human capital and income per capita. If these last two factors are added into the regression as well as EVI, the residual would only be a proxy of the nonstructural resilience.

There are several limitations to this tentative measurement of resilience. Some are related to the estimation method, in particular the measurement of growth volatility itself (see section III) and the possible omission of structural factors of volatility.

More importantly, resilience may also operate through a weak transmission of growth volatility to the average growth rate. Then a supplementary proxy of resilience would be given by the residual of an estimation of the average growth rate as a function of growth volatility (and other structural factors) and a proxy of total resilience in terms of growth would be given by the residual of an estimation of the average growth rate as a function of EVI. With other structural factors of growth included in the regression, in particular HAI and gross national income per capita (GNIPC), the residual would become a proxy of non-structural resilience.

Resilience may also operate through a weak transmission of exogenous shocks and income volatility to the social dimensions of development. For instance, as far as it is now well established on a cross-country basis that exogenous shocks and income volatility have detrimental consequences on variables such as poverty, crime, and corruption (Guillaumont 2009a, Cariolle 2014), a lower than expected reaction of these variables to shocks and volatility reveals the resilience of a country. In Bhutan, where the concept of gross national happiness is intended to replace the gross national income, resilience could be assessed as a weak reaction of gross national happiness to exogenous shocks.

F. Vulnerability to Climate Change: Physical versus General Vulnerability

The conceptual definitions given in the introduction of this section are those we previously used in other works applied to another set of countries (see for instance, Guillaumont 2015).

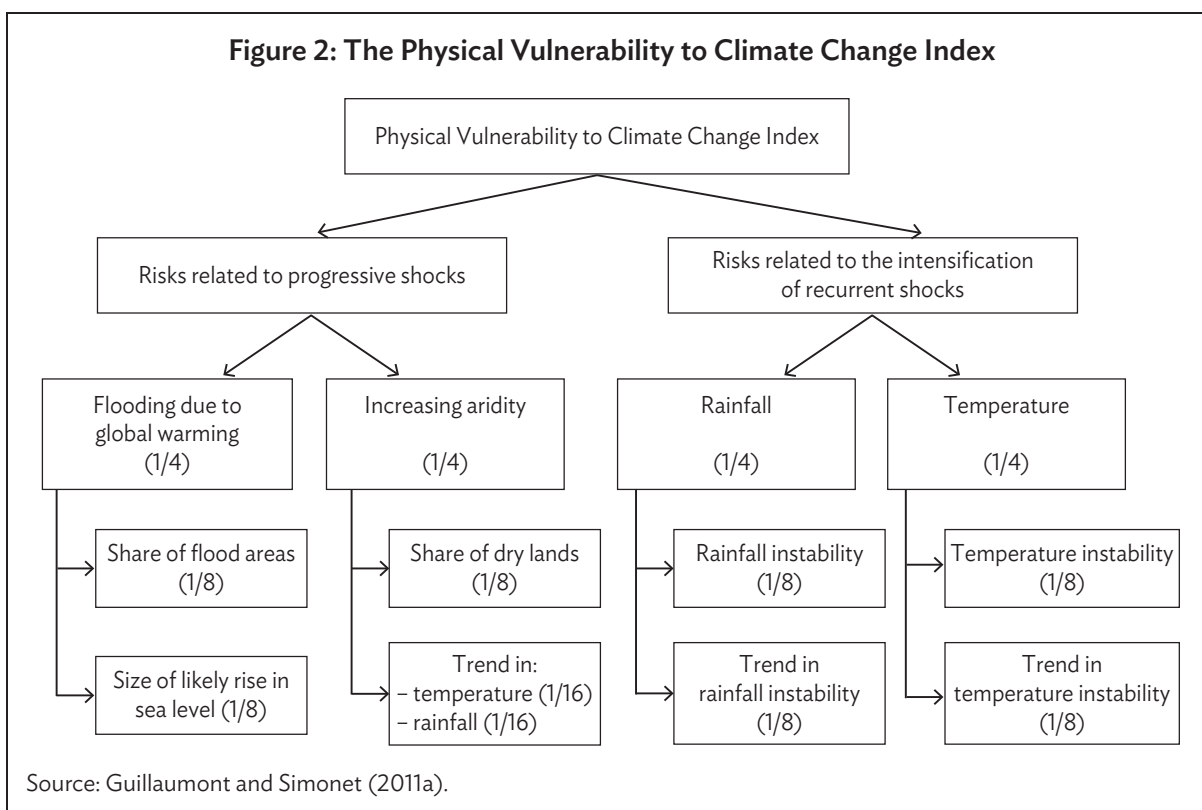
Since the meaning of sustainability, as reflected in the Sustainable Development Goals (SDGs) of the UN development post-2015 agenda, now covers several dimensions—economic, environmental, and sociopolitical—the vulnerability to climate change should deserve special attention. Indeed some climatic factors of economic vulnerability are already taken into account in the design of the EVI, in particular through the components of the index of natural shocks (the instability of agricultural production and the percentage of population victim of natural disasters) or through some of the components of exposure, in particular the share of agriculture, forestry, and fisheries in the GDP and the new indicator of population living in low elevated coastal areas. But these indicators are related to permanent geoeconomic features and to any kind of shocks, but not to climate change per se. Vulnerability to climate change, which is a vulnerability to a specific kind of shock, stems from a risk of long-term change in geophysical conditions rather than from a growth handicap in the medium term. In other words, it is more physical than economic, and has a longer time horizon. As with structural economic vulnerability, and in fact more so, the physical vulnerability to climate change is designed to be independent of present (and future) country policy. For this reason, its measurement should be based only on physical characteristics and trends, as is the case in the physical vulnerability to climate change index (PVCCI) set up at Ferdi (see Guillaumont and Simonet 2011a), which is a distinctive feature of this index compared to other assessments of the vulnerability to climate change.

Physical vulnerability to climate change, like structural economic vulnerability, should reflect two main kinds of components: shock intensity due to climate change (e.g., the sea level rise) and the exposure to this shock (e.g., the share of areas likely to be flooded). The lack of socioeconomic components in the design of a PVCCI is all the more legitimate given that any assessment of future adaptation capacity is highly uncertain. Because it is controversial to forecast the likely socioeconomic consequences of climate change, there is a rationale for setting up an index of vulnerability which relies solely on physical components. Further, blending the measurement of structural economic vulnerability and physical vulnerability to climate change is conceivable, but it would risk blurring information about the type of vulnerability a given country is facing. The weight that would then be given to each of the two indices depends on the country's time preference (see Guillaumont 2013).

The proposed index of vulnerability to climate change—PVCCI—is summarized in Figure 2.

This paper proposes the use of the PVCCI, as designed in Guillaumont and Simonet 2011a, and Guillaumont 2015. As shown in Figure 2, this index combines the physical impact of two kinds of shocks: (i) the progressive shocks, namely flooding due to global warming, most often caused by the sea level rise (but also through other specific channels in two of the three countries considered here, as we see below) and the aridification (two trends); and (ii) the intensification of shocks in temperature and rainfall (captured by the trends in the size of the shocks) (see details in Guillaumont and Simonet 2011a or Guillaumont 2015). For these kinds of shocks, we combine an indicator of shock

with an indicator of the country's exposure to the shock. Moreover, to better capture the vulnerability to any kind of shock linked to climate change we use a quadratic average of the main components instead of an arithmetic one.⁴



In the same way as with EVI, some important measures of vulnerability (now to climate change) may be missing in the PVCCI, as it is presently built. For instance, in the case of the risk of flooding, it is related only to the sea level rise in the PVCCI, but not to ice melting, which may be important in countries such as Bhutan and Nepal. An augmented PVCCI should replace the risk of flooding related only to sea level rise by the risk due to any reason. Also, the risks related to the intensification of recurrent shocks, presently limited to rainfall and temperature shocks, should be extended to violent winds and cyclones.

Since this index relies on physical components, it does not take into account the resilience to climate change, neither the structural resilience nor the resilience dependent on policy (like the EVI). The structural resilience to climate change depends on the same kinds of factors for economic vulnerability, essentially the level of income per capita and the level of human capital. The policy resilience (or the lack of it), as for economic vulnerability, depends on a set of factors closely linked to sociopolitical vulnerability.

⁴ A quadratic average is used to aggregate the various kinds of risks, those related to progressive shocks and to the intensification of progressive shocks, then for the two components of these two kinds of shocks, while each of the four components of exposure and shocks is averaged. A new version of the index in preparation will also use a quadratic average to combine shock and exposure indices.

G. Resilience, Possibly Undermined by Sociopolitical Vulnerability and State Fragility

The essence of the resilience concept. Conceptually, macroeconomic resilience comprises the policy or other transitory economic, environmental, and social factors that allow a country to be more adaptive and less exposed to an exogenous shock. One can compare two countries which are equally structurally vulnerable, but are differently able to weather shocks due to their levels of resilience. The more resilient economy will be one that is less exposed due to policy implementation. Policies that would fall into this category are those that (i) discourage the accumulation of large external financial imbalances (unless they are being used for productive investment that can finance the repayment of debt over time), (ii) promote financial market stability and prudent behavior by financial entities, (iii) foster depth of and access to the financial system including insurance, (iv) encourage responsible fiscal expenditure and adequate revenue collection, (v) facilitate a social welfare safety net to assist those who are hit adversely by exogenous shocks, (vi) enable a flexible but fair labor market that allows for easy job transfer while minimizing exploitation, and (vii) enable appropriate checks and balances with respect to the political and judicial systems such that accountability of decision makers is ensured.

Lack of resilience and state fragility. There are also sociopolitical factors that can play an important role in the resilience of a country. State fragility—a condition where the sociopolitical structure of the country is fragile—is often presented as close to structural vulnerability, although it is conceptually quite different. State fragility is designed and identified from present policy and institutional factors (lack of state capacity, political will, and political legitimacy); it is not independent of policy actions and outcomes (Guillaumont and Guillaumont Jeanneney 2009). Accordingly, this concept is best accounted for within the (low) resilience dimension of vulnerability.⁵

Definitions of state fragility have most often come from an assessment of policies and institutions through the World Bank's country policy and institutional assessment (CPIA).⁶ Countries with a low CPIA rating and/or civil conflict are often found to have weak resilience to external or natural exogenous shocks. Accordingly, countries with weak institutional and state capacity can find themselves in a “fragility trap” (Andrimihaja, Cinyabuguma, and Devarajan 2011); countries are more fragile because they lack resilience in the face of exogenous shocks, which, in turn, weaken the resources and capacity of the state to build resilience and reduce their exposure to shocks. Those that are more innately vulnerable due to structural and physical characteristics are even more at the mercy of this vicious circle. Thus, in the framework of this paper, state fragility is a concept related to a lack of resilience that can be partly addressed through voluntary actions over time.

Definition and measurement of state fragility. There are various (and often changing) definitions of “fragile states” and measurements of “state fragility” (see Guillaumont and Guillaumont Jeanneney 2009). Besides the lists and indices produced by private institutions or universities, lists have been

⁵ It is important to understand that while state fragility is a measure of a lack of resilience, structural economic vulnerability significantly influences state fragility. Consequently, there are structural determinants of resilience. It has been found that the level of the country policy and institutional assessment (CPIA) is significantly and negatively influenced by the level of EVI, and among the components of the CPIA particularly by the level of export instability. The impact is all the more important when the level of CPIA is lower (see Guillaumont, McGillivray, and Wagner 2013). Other works also show evidence of the impact of the various exogenous sources of instability on the risk of civil conflict (see for instance for price and/or export instability Chauvet and Guillaumont 2004, and for droughts Miguel, Satyanath, and Sergenti 2004; Brückner and Ciccone 2010).

⁶ The CPIA includes 16 criteria grouped in four clusters (see Annex II.2).

set up by international organizations either for (i) operational purposes (mainly aid allocation as explained below), in particular by the multilateral banks; or (ii) simply for statistical information and monitoring, in particular by the Organisation for Economic Co-operation and Development (OECD).

After using separate (and sometimes diverging) lists, the multilateral development banks now produce a “harmonized list” of fragile states or countries in fragile situation: in these countries, the CPIA (not higher than 3.2 [on a scale of 1 to 6]),⁷ or UN and/or regional peacekeeping missions or political and peacebuilding missions are present. The reference to the CPIA, which is a subjective assessment of policies, shows the contrast between state fragility and structural economic vulnerability as measured by EVI, and thus between the concepts of fragile states and LDCs.

As for the list of fragile states (revised annually) used at the OECD, “it is assembled by combining the latest harmonized list of fragile situations of the World Bank, African Development Bank (AfDB), and the Asian Development Bank (ADB) with those countries that have a Failed States Index above 90 on the failed states list developed by the Fund for Peace” (OECD 2014). For 2012, this OECD list included 47 countries, 27 of which were African countries, all south of the Sahara, all but four of which were LDCs. It is worth noting that at that time, it did not include Burkina Faso, Egypt, Libya, and Mali, showing how volatile and little informative it could be in terms of the real political risks faced by the countries. It seems more a tool for designing curative measures than for preventing the occurrence of failing states. The reason why Mali was not considered a fragile state until recently was due to previous policy improvement—Mali having a CPIA above 3.2, although it was highly vulnerable.⁸

The instability of the OECD’s list of fragile states is illustrated by the changes from 47 to 51 countries during 2012–2014 (OECD 2012; 2014). There were eight new countries considered fragile (three low income: Burkina Faso, Madagascar, Mali; and five middle income: Egypt, Libya, Mauritania, Syria, and Tuvalu). Four countries were no longer considered fragile (Georgia, Iran, the Kyrgyz Republic, and Rwanda). The latest OECD publication (2015) maintains the same number of 51 fragile states; however, Rwanda is back in the list, while Burkina Faso is not but would probably go back in the list of the 2016 publication due to recent events. The (shorter) harmonized list of the multilateral banks relying on the CPIAs of the World Bank, AfDB, and ADB has also changed between FY2013 and FY2014 with the inclusion of Madagascar, Malawi, and Mali, and with the exclusion of Angola and Guinea (the list increasing from 35 to 36 countries or territories).

The category of fragile state was introduced to solve the problem of the multilateral development banks in the performance-based allocation (PBA) of their aid. The strict application of the PBA appeared to require an exception for the states considered fragile; below a given CPIA threshold, an exception to the strict PBA rule was applied. Without discussing the consistency of the rule and its exceptions (see Guillaumont, Guillaumont Jeanneney, and Wagner 2015; Guillaumont 2013), it should be noted that from a methodological viewpoint, there is a built-in weakness in the category of fragile states. State fragility is indeed a big issue, but it requires a qualitative (rather than quantitative) assessment, allowing observers and donors to adapt their diagnostic and support (Collier 2013). On the contrary, structural economic vulnerability, as well as physical vulnerability to climate change, can be roughly evaluated and legitimately used for international allocation of resources (Guillaumont, Guillaumont Jeanneney, and Wagner 2015).

⁷ This is using a harmonized average of the CPIA scores of the World Bank and ADB or the AfDB.

⁸ Information on the CPIA can be found at the World Bank Group, Country Policy and Institutional Assessment database (<http://www.worldbank.org/ida>)

Despite its widespread use and high visibility, the identification of the fragile states do not offer a great help for the assessment of the sociopolitical vulnerability of countries. As we will see when considering the case of Bhutan, Maldives, and Nepal, clearer information seems to emerge by using more specific and outcome-based indicators, such as those related to conflict and crime. Some components or subcomponents of the fragile states index (FSI), political stability and absence of violence (PSAV), and/or the country indicators for foreign policy (CIFP) may also offer clearer information than the composite indices in which they are included.

H. Violent Events as an Alternative Approach to Fragility

In the previous definitions, the state fragility is identified using indicators involving a subjective assessment of policies and institutions. An alternative or complementary approach would be to assess fragility from internal violence events which by their frequency or depth reveal state fragility. It would be an outcome-based fragility.

The majority of conflicts and crimes are in the developing countries, hindering their chances of development. A poor country is correlated with most forms of violence (UNDP 2008). Violence is a complex and multifaceted phenomenon; several indicators which are sometimes based on experts' judgments are available. Ferdi (Feindouno, Goujon, and Wagner 2016) is working to propose an internal violence index (IVI) built from actual quantitative data to capture as well as possible the internal violence events for 132 developing countries on an outcome basis.⁹ The IVI is a weighted mean of the level of internal violence for each country during 2008–2012, giving greater weight to the most recent years. Based on further analysis of the existing data, nine variables pertaining to the internal violence have been selected and divided into four clusters: internal conflicts, criminality, terrorism, and political violence.¹⁰ Equal weight (25%) is assigned to each cluster of the index. The scores of the IVI are ranked from the least violent country (0) to the most violent country (100). The average value of the index stands at 20.6. The three most violent countries are Pakistan (63.00), Colombia (59.90), and Syria (59.40); and the three least violent countries are Tuvalu (1.20), Singapore (0.95), and Brunei Darussalam (0.50).

A Spearman's rank correlation analysis between IVI and other fragility indices such as FSI, CPIA, and PSAV has been performed for a large sample of developing countries including small island developing states (SIDS). The results are recorded in Table 1. Clearly, the correlation between IVI and CPIA is low for the 70 Internal Development Association (IDA) eligible countries. Reflecting the aspects of state fragility, the components of the two indices are completely different. Nevertheless, the correlation between IVI and PSAV is relatively high for a sample of 132 countries, demonstrating that several components or variables (internal conflicts, terrorism, riots, etc.) appear in the two indices. In addition, for these common components or variables, the sources of data are the same most of time. Finally, IVI is moderately correlated with FSI which is composed of several social, economic, political, and military indicators grouped in 12 clusters. We emphasize that correlation between IVI and CPIA, PSAV, or FSI is very low for SIDS compared with non-SIDS developing countries, and even negative if we consider the correlation with CPIA.

⁹ Details in a 2016 document from Ferdi by Laurent Wagner, Sossou Feindouno, and Michaël Goujon. The authors try standing out against other indices often rooted in subjective judgments or experts' opinions.

¹⁰ We exclude all external conflicts.

Table 1: Correlation between the Internal or Domestic Violence Index and Other Indices

Indicators	Spearman's rank correlations		
	Mixed-sample	SIDS	Non-SIDS
IVI/CPIA*	0.19 (70)	-0.25 (17)	0.22 (53)
IVI/PSAV*	0.69 (132)	0.35 (30)	0.67 (102)
IVI/FSI*	0.51 (132)	0.11 (30)	0.53 (102)

CPIA = country policy and institutional assessment, FSI = fragile states index, IVI = internal violence index, PSAV = political stability and absence of violence, SIDS = small island developing states.

Notes:

1. We put the sample size between the brackets.
2. CPIA* = 100 – Rescaled CPIA
3. FSI* = Rescaled FSI
4. PSAV* = 100 – PSAV
5. The indicator for IVI is proposed by Fondation pour les Études et Recherches sur le Développement International.

Sources: Fund for Peace's Country Profiles online (www.statesindex.org); World Bank Group, Country Policy and Institutional Assessment database (<http://www.worldbank.org/ida>); Worldwide Governance Indicators database (<http://info.worldbank.org/governance/wgi/index.aspx#home>).

I. Interconnected Vulnerabilities: The Conceptual Framework

Figure 3 gives a summary of the conceptual framework outlined in the previous paragraphs.

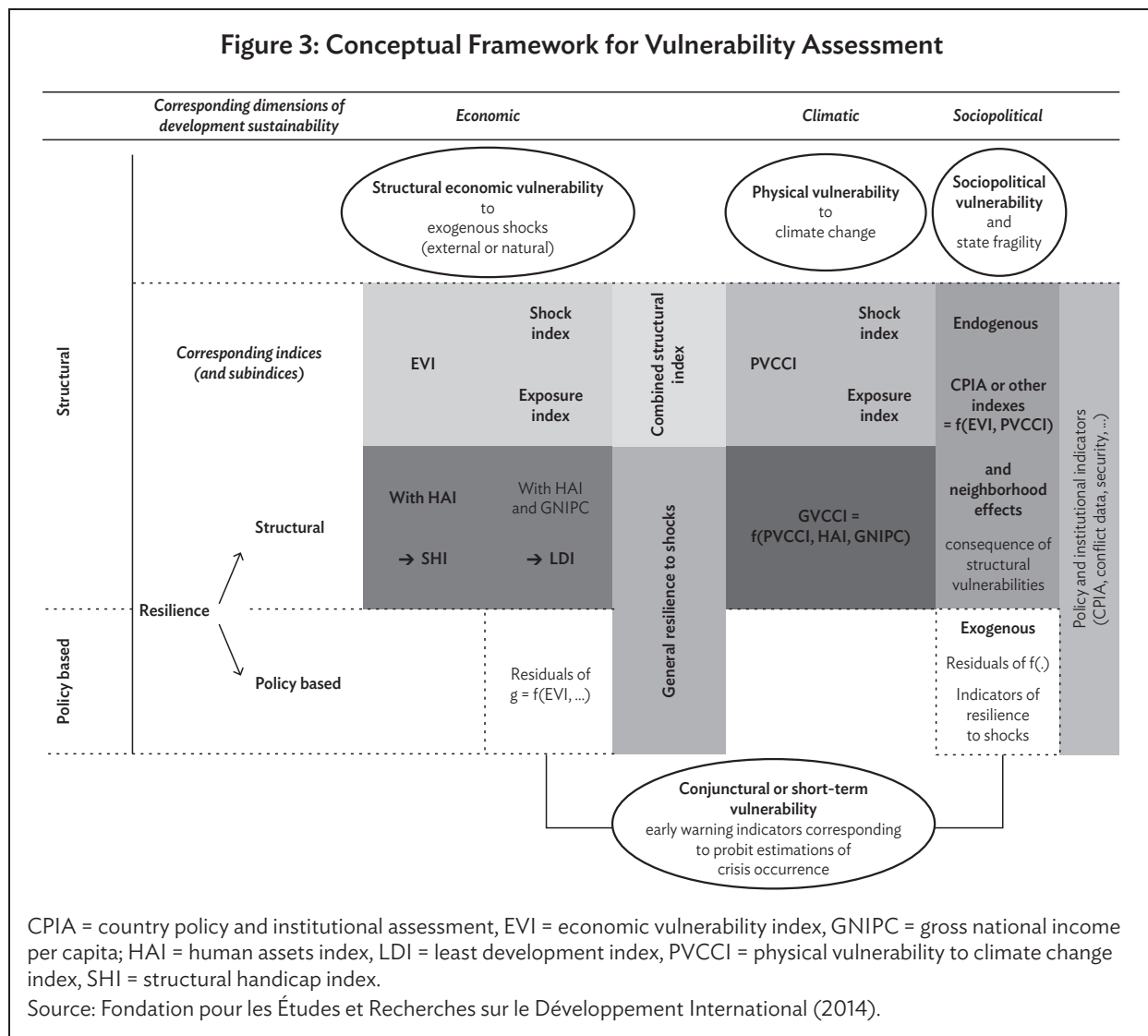
The three main dimensions of vulnerability (economic, environmental, and sociopolitical), corresponding to the three main dimensions of sustainable development, are presented in three vertical blocks or columns.

For each column, two horizontal parts are distinguished: (i) one corresponding to the *structural vulnerability*, EVI for the structural economic vulnerability, PVCCI for the vulnerability to climate change, both with their respective shock index and exposure index (and a possible combined structural index, in light gray); and (ii) the other one corresponding to the *policy-based vulnerability*. Resilience overlaps these two parts of vulnerability, since it is structural for one part, captured by the HAI and GNIPC indices, and it is related to policy for the other part. The structural part can be combined with EVI (medium gray) in broader indices of vulnerability, through the SHI combining EVI and HAI or the least development index (LDI) combining EVI, HAI, and GNIPC). Similarly, it can also be combined with PVCCI (dark gray), through an index of general or structural vulnerability to climate change, which is a function of PVCCI, HAI, and GNIPC. The policy-based resilience can be assessed *ex post* by the residual of cross-country regression where the rate of economic growth or any other indicator of progress is a function of the various structural components of shocks and vulnerability.

The third column, related to the sociopolitical vulnerability and state fragility and assessed by indicators such as the CPIA (although entirely related to policy), is itself the addition of two parts: (i) one which is “endogenous,” corresponding to the impact of structural vulnerabilities (EVI, PVCCI, HAI, GNIPC) as well as of neighboring country situation on the policy indicators; and (ii) one which is

“exogenous,” corresponding to the autonomous policy, i.e., the policy not determined by structural factors. This second part reflects well the factors of resilience linked to the present and autonomous will of the country.

Finally, at the bottom of the figure is the conjunctural or short-term vulnerability, i.e., the present risk of a growth collapse or of a balance of payments crisis. It is not a structural feature or a structural vulnerability, but it can be influenced not only by the macroeconomic variables likely to change in the short run, but also by the three kinds of vulnerability, including their structural components. It is this conceptual framework that we try to apply.



Following the conceptual framework presented above, we can successively consider the main kinds of possible vulnerability, with a special focus on structural vulnerability, then examine to what extent Bhutan, Maldives, and Nepal may be considered resilient to exogenous shocks, and whether the application of macroeconomic early warning systems is relevant for these countries.

In each case we will compare Bhutan, Maldives, and Nepal data or indices to those of comparable sets of countries, in particular the LDCs, and the landlocked developing countries.

III. ECONOMIC VULNERABILITY: STRUCTURAL VERSUS CONJUNCTURAL

In this section, we consider the economic vulnerability of Bhutan, Maldives, and Nepal, distinguishing structural vulnerability (beyond the present will or policy of the countries and moving slowly) from conjunctural vulnerability (influenced by the present policy and moving fast). We then focus on structural economic vulnerability, examined mainly through the EVI, and consider some additions or adjustments likely to be made to this index due to the limitations its application to the three countries reveal.

A. First Approach: Income Growth and Volatility

A first and usual approach to vulnerability is to consider the volatility of income growth, with the methodological issues explained in the previous section. As growth volatility over a given period cannot be assessed without considering the average growth rate over the same period, we consider both of them.

Bhutan. Since 1993, Bhutan has registered a high growth rate of GDP per capita, transforming this former low-income country into a middle-income one and probably making it eligible for graduation for the first time from the LDC category in 2015. Eligibility is assessed every 3 years at the UN triennial review of the list by the CDP which may recommend graduation by the UN General Assembly only after having found the country eligible at two successive reviews. The graduation becoming effective only 3 years after the decision of the UN General Assembly. It means that Bhutan may no longer be an LDC in 2021 (see Drabo and Guillaumont 2014 for the graduation process and prospects, and Marshall 2013 for an examination of the case of Bhutan).

Figures 4a, 4b, and 4c show a high and moderately stable growth rate during 1992–2006, then becoming quite more unstable (although still high): close to 4% in 2000, 15% in 2007, 3% in 2008, 7% in 2010, 3% in 2012, and is “expected to rebound in 2013” (World Bank 2014). The past and recent developments of Bhutan economy illustrate some specific aspects of its vulnerability.

First, although the average growth rate is high, compared with the average of LDCs or landlocked developing countries, its instability is also high and has been higher for the last 10 years. It may be supposed that the social consequences of a given growth volatility (as measured by the standard deviation of the growth rate) are smaller when the average growth rate is high, and never become negative (hence being less likely to generate poverty traps).

Second, the recent growth volatility in Bhutan is linked to few specific factors. Indeed Bhutan was indirectly affected by the world financial crisis of 2007–2008, but the main driver of volatility has been the hydropower activity—its timing, its building, and the electricity generation from the big new project—leading to a growth peak. Another source of volatility results from climatic conditions, which may affect both agricultural production and hydropower activity.

Third, an overwhelming and specific factor of Bhutan's vulnerability comes from its dependency on India, the population size is 200 times larger, with which it makes more than three-quarters of its trade, and with a rate of exchange pegged to the Indian rupee. We will have to test the relevance of the conceptual framework in the case of Bhutan, and examine whether it needs some adaptations. Figures 4b and 4c show the evolution of the annual growth rates in Bhutan and in India, with a 3-year moving average: the relation is strong and increasing, but leaves room for Bhutan-specific variations. It means that the income volatility of Bhutan is driven not only by Indian developments, but also by Bhutan-specific factors.

Table 2: Average Growth Rate and Its Volatility in Bhutan, Maldives, Nepal, and Other Groups of Countries, 1991–2013, 2002–2013

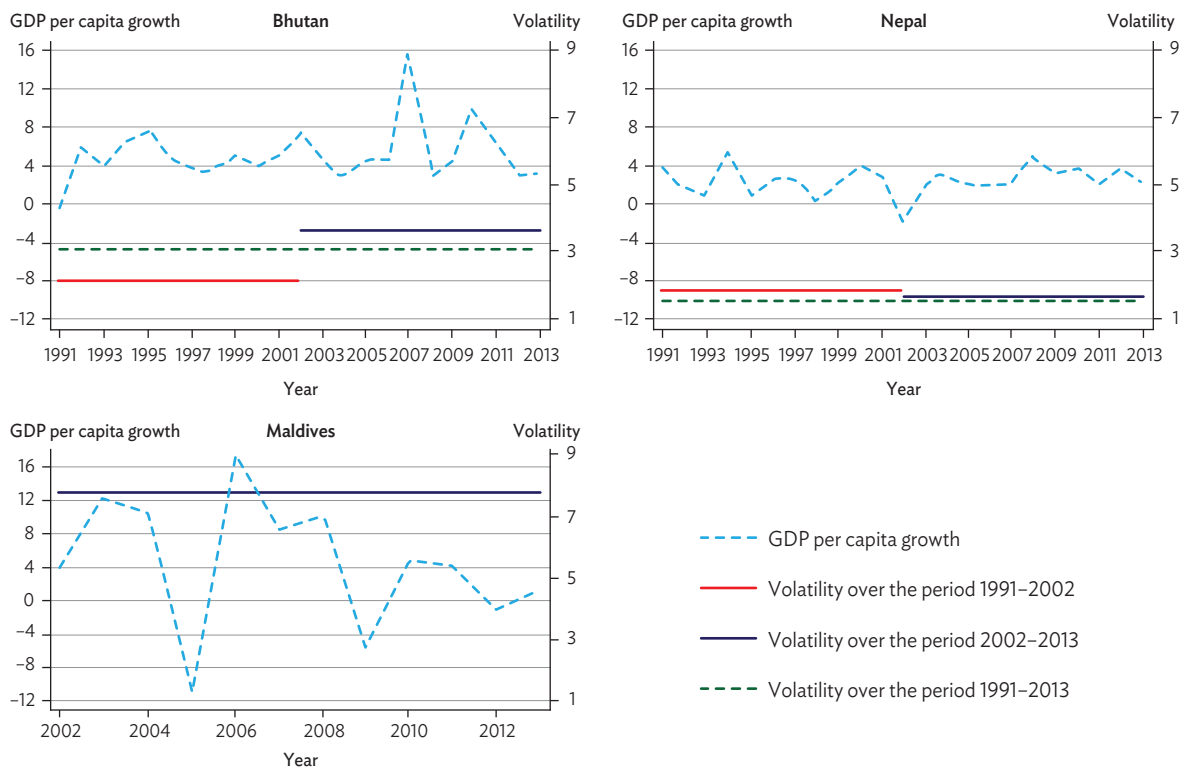
Country (Country category)	GDP growth per capita		Volatility of GDP growth per capita	
	1991–2002	2002–2013	1990–2001	2002–2013
Bhutan	5.00	6.11	2.13	3.72
Maldives	...	4.58	...	7.76
Nepal	2.17	2.96	1.86	1.60
Developing Countries (132)	1.45	2.92	3.38	2.89
ADB Developing Countries (30)	2.76	3.39	3.53	2.29
ADB – Asia Developing Countries (21)	3.28	4.77	2.21	2.06
ADB – Pacific Developing Countries (9)	1.93	1.02	4.38	2.97
LDCs (48)	0.99	2.86	4.02	3.15
ADB LDCs (13)	2.83	4.96	3.84	3.24
Developing Landlocked (29)	1.35	3.08	3.60	2.72
ADB Landlocked (5)	3.13	6.12	1.99	3.72
Fragile States (40)	0.77	2.86	4.30	3.35
ADB Fragile States (13)	2.83	3.96	2.94	2.06
SIDS (34)	2.10	1.68	3.70	3.23
ADB SIDS (11)	2.23	1.76	4.28	3.26

... = no sufficient data available for the period, ADB = Asian Development Bank, GDP = gross domestic product, LDCs = least developed countries, SIDS = small island developing states.

Source: Calculated using the World Bank's World Development Indicators data.

Maldives. Maldives registered in 2002–2013 the most rapid, but also the most unstable, growth rate, evidencing a high vulnerability. This instability seems mainly due to the tsunami and post-tsunami recovery. The tsunami was an exceptional event with a low probability of recurrence; its impact was of course influenced by geographical features of the country. Maldives' growth stability also appears to have been affected more than that of Bhutan and Nepal by the world recession in 2009 (through tourism receipts), and again in 2012 that was likely a recurrent source of instability.

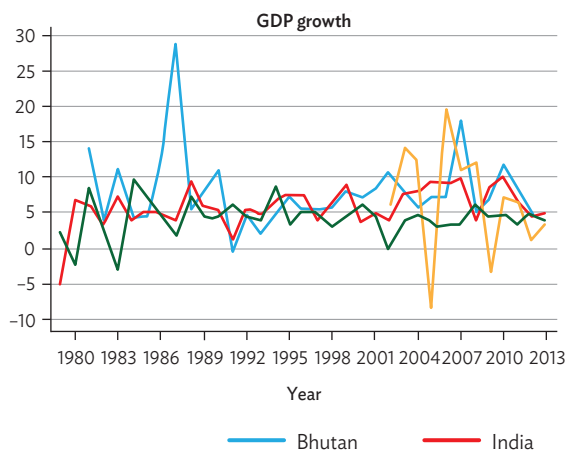
Figure 4a: Gross Domestic Product per Capita Growth Rate and Its Volatility of Bhutan, Maldives, and Nepal, 1991–2013



GDP = gross domestic product.

Sources: World Bank (2013a). Author's calculations of volatility using World Bank's *World Development Indicators 2013*. Washington, DC.

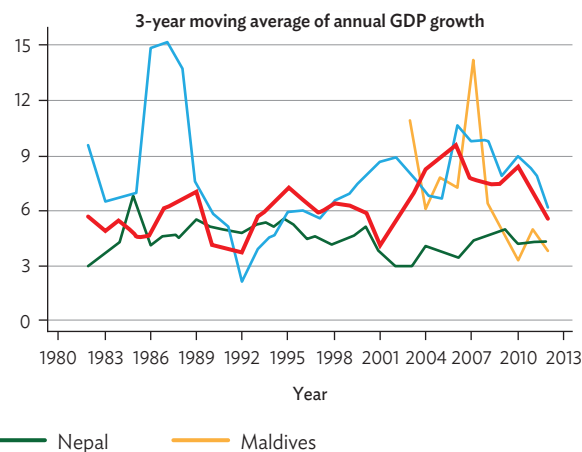
Figure 4b: Annual Growth Rate of Gross Domestic Product: Bhutan, India, Maldives, and Nepal (%)



GDP = gross domestic product.

Source: World Bank (2013a).

Figure 4c: Growth Rate of Gross Domestic Product (3-year Moving Average): Bhutan, India, Maldives, and Nepal



Nepal. Nepal is quite different from Bhutan and Maldives. While its average growth rate has been the lowest among the three, its growth volatility has been the lowest too. The main recession occurred in 2001–2002 in a special political context: the growth of the GDP per capita was negative, and the non-agriculture sector was the most affected. Indeed the economy could not grow being in an unhealthy situation due to several handicaps. A main handicap was the many insurrections of the Communist Party of Nepal (Maoist), which paralyzed the country’s economy and political system. This increased the political uncertainty within the country throughout 2002 and worsened the security situation, which resulted in the intervention of the king who dismissed the Prime Minister and assumed temporary executive authority (Congressional Research Service 2006).

B. Is the Volatility of Each Country Linked to that of the Others?

As it appears from the correlation matrix (Table 3), a significant (positive) correlation appears only between India and Bhutan, and to a quite lesser extent between India and Nepal. It is an indicator of a possible influence of the fluctuations of Indian activity on Bhutan and Nepal; but it is not a measure of their impact, which would require use of a model controlling for the impact of exogenous factors affecting the growth rate of the 3 countries dependent on India.

Table 3: Correlation Matrix of the Gross Domestic Product’s Growth Volatility between Bhutan, Maldives, Nepal, and India

	Bhutan	India	Maldives	Nepal
Bhutan	1.0000			
India	0.4620	1.0000		0.1257
Maldives	0.1365	0.0256	1.0000	0.0489
Nepal	-0.3891			1.0000

Source: Author’s calculations from World Development Indicators (WDI 2013).

C. Structural Economic Vulnerability of Bhutan, Maldives, and Nepal: What the Economic Vulnerability Index Tells Us

Given the choice to examine structural economic vulnerability and physical vulnerability to climate change separately, the 2006–2009 definition of EVI, all of whose components can be considered potential contributors to slower growth, is preferred to the revised EVI calculated in 2011. For that, we refer to the new calculations of the EVI made at Ferdi (Guillaumont et al. 2013) on the basis of the 2006–2009 UN definition of the EVI (Table 3). In the same way, the EVI’s evolution using a constant definition (Ferdinand “Retrospective EVI”), the 2006–2009 one rather than the 2012 one, is considered (Cariolle 2011, Cariolle and Guillaumont 2011, Cariolle and Goujon 2013).¹¹

From Table 4, it is clear that Maldives (49.4 EVI) and Bhutan (49.6 EVI) (using the 2006–2009 definition) have a significantly higher index than most of other groups of developing countries: LDCs, landlocked developing countries (LLDCs), all developing countries, and ADB developing countries (only ADB Asian developing countries, not ADB Pacific countries). Nepal has a lower level of EVI than all these groups.

¹¹ Several other improvements could be brought to the measurement of the EVI, in particular in the way by which the components are averaged (presently an arithmetic average) (see Guillaumont 2009a, 2009b).

Table 4: Economic Vulnerability Index in Bhutan, Maldives, and Nepal, Compared to Other Countries

Country (Country category)	Components of EVI 2011 definition		Components of EVI 2006–2009 definition		EVI 2011 (2011 definition)	EVI 2011 (2006–2009 definition)	EVI 2011– EVI 2000 (2006–2009 definition)
	Exposure	Shock	Exposure	Shock			
Bhutan	40.4	44.5	56.5	42.7	42.4	49.6	4.5
Maldives	69.3	35.0	66.0	32.8	52.1	49.4	5.4
Nepal	26.8	27.4	32.4	25.3	27.1	28.8	–8.5
Developing Countries (130)	37.2	36.3	43.5	30.8	36.7	37.2	–3.8
ADB Developing Countries (30)	41.0	35.7	42.2	32.3	38.3	37.3	–4.6
ADB – Asia Developing Countries (21)	31.7	32.2	29.6	29.1	31.9	29.3	–4.8
ADB – Pacific Developing Countries (9)	62.7	43.8	71.7	39.7	53.3	55.7	–4.0
LDCs (48)	42.1	47.0	48.9	38.4	44.5	43.6	–4.5
ADB LDCs (13)	49.3	44.3	53.2	39.3	46.8	46.2	–6.1
Developing Landlocked (22)	37.9	44.5	47.7	32.8	41.2	40.2	–2.2
ADB Landlocked (5)	32.9	46.5	41.9	33.3	39.7	37.6	–8.7
Fragile States (37)	36.6	47.5	41.8	37.3	42.0	39.5	–6.5
ADB Fragile States (9)	39.6	42.4	39.7	40.8	41.0	40.3	–1.9
SIDS (34)	51.8	37.3	62.2	32.2	44.6	47.2	–6.4
ADB SIDS (11)	60.9	41.3	68.1	39.9	51.1	54.0	–2.5

ADB = Asian Development Bank, EVI = economic vulnerability index, LDCs = least developed countries, SIDS = small island developing states.

Source: Calculated using the World Bank's World Development Indicators data.

The high level of EVI for Bhutan is due both to the shock and the exposure components of the index. For Maldives, it is due only to the exposure component. The low level for Nepal is due both to the exposure and shock components.

It should be noted that the results obtained with the 2011 definition, used for the 2012 review of the list of LDCs, differ significantly, in particular in the case of Bhutan. This evidences a lower EVI than the average of the LDCs, both for the exposure component (due to the zero value of the LECZ component) and the shock component (as a result of the shift from homeless due to natural disasters to victims of natural disasters).

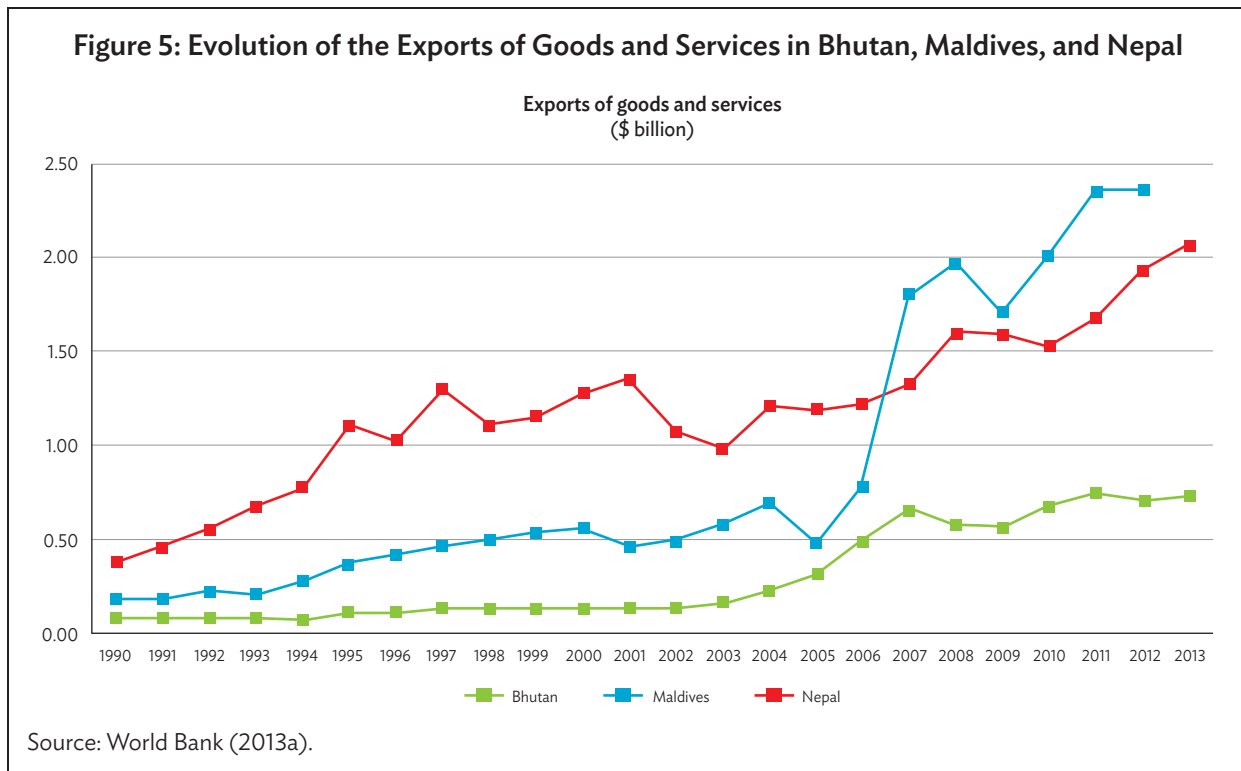
Indeed there are large differences between the relative levels of the EVI's components of Bhutan, Maldives, and Nepal, reflecting the heterogeneity of sources of structural vulnerability among countries (see Table 4 and Appendix 1).

As for the *shock index components*, the relative levels of the three component subindices appear to differ strongly among the three countries and within each of them. The *instability of exports* (of goods and services) is higher in Maldives (24.9) than in Bhutan (17.8) and Nepal (9.2), and higher than the

average of all developing countries and all ADB developing countries, but lower than the average of all LDCs and LLDCs. The instability of exports, as measured in the EVI, is an index calculated from a sample with upper and lower bounds, not the gross measure of instability. Moreover, since the population size on which the export to GDP ratio depends is taken into account separately in the EVI, the instability is not weighted by this ratio, although its impact is a function of this ratio. The instability of exports of goods and services weighted by the ratio of these exports to GDP (26.4) is even higher in Maldives than in Bhutan (6.1) and in Nepal (1.5) (Table 5).

The index of the number of *victims of disasters* is moderately high in Bhutan and Nepal, but lower than the average level of LDCs or LLDCs, and curiously low in Maldives, although severely affected by the 2004 tsunami. A quite different picture was given by the previous index of the number of the homeless: low for Bhutan (lower than any comparator group), very high in Nepal (higher than any comparator group), and low in Maldives.

The *instability of agricultural production* for Bhutan (index of 40.9) and Maldives (index of 41.2) is clearly higher than the average level of any other group of developing countries (index of 24.3 for LDCs and 27.1 for LLDCs), but it is particularly and curiously low in Nepal (index of 2.6), where the share of the value added is the highest.



As for the *exposure components*, it is clear that the component pulling up the level of Maldives exposure (with the 2006–2009 definition of EVI) and that of Bhutan is the population size, quite small in Maldives (300,000) and Bhutan (700,000). Smallness of the population size is indeed a major structural factor of vulnerability. With the 2011 definition of EVI, where the weight given to this component is reduced by half to allow the addition of the new LECZ component, the exposure index

of Maldives is still increased (LECZ being at its maximum level), while the index of Bhutan is reduced (instead of being higher than the average of the LDCs). Due to its much higher population size (28 million, i.e., around 100 times bigger than Maldives and 40 times bigger than Bhutan), and due to its low export concentration index (linked to its size) and to its zero level of LECZ with the 2011 definition, Nepal seems to be clearly less exposed to exogenous shocks than Bhutan and Maldives.¹²

D. What the EVI Does Not Tell Us, But Could Do

These measures should be taken as proxies of structural economic vulnerability for international comparison purposes. Their design and calculation could of course be discussed and improved. To better capture the vulnerability of a country such as Bhutan, *several adaptations* should be applied.

As for the shock index, the instability of the exports of goods and services does not take into account the level and possible *instability of remittances* (remittances are not a service income when the migrants are resident of the host country). In Nepal, as noted above, remittances from abroad are a very large source of external revenue (29% of GDP in 2013, see Table 4), while in Maldives they are very small (0.1%), and remittances to Bhutan are also small but slightly higher than Maldives (0.7%).¹³ Thus, the instability of exports and remittances can be compared only if they are weighted by the ratio of these flows to the GDP. Another possibility is to replace the instability of exports of goods and services by the instability of the aggregate flow of exports of goods, services, and remittances received. A third possibility, preferable if one considers the export and remittances as non-substitutable resources, is to calculate the sum of the two instabilities weighted by the ratio of their flow to GDP.¹⁴ Results are given in Table 5. The instability of remittances could not be calculated for Bhutan due to a lack of corresponding time series.

The results are different depending on the method of calculating instability. Using the benchmark method (as in the EVI), the difference is not significant between Maldives and Nepal. Using the augmented method, as explained in Box 1 and as reported by the figures in brackets in Table 5, Maldives' remittances seem more unstable than those of Nepal and other country groups (LDCs, landlocked, SIDS, and so on) during 1999–2013. This high instability of Maldives remittances seems to result from the 2004 tsunami which led to increased remittances from family members working abroad (*Tsunami impact assessment* 2005). But it should be kept in mind that this instability is related to a quite small ratio of remittances to GDP, which is not the case of the export to GDP ratio. As a result, the weighted instability of remittances is much lower in Maldives (0.2) than in Nepal (5.2). Similarly, the instability of Maldives' aggregate flow of exports and remittances is noticeably higher than that of Nepal and other country groups. Indeed, Maldives' economy is predominantly service-based (fundamentally tourism, secondarily exports of fishes). It appears from the figure in Box 1 that the evolution of exports in Maldives has been affected by the tsunami, then by the world crisis in 2008–2009, illustrating the reasons for the high export instability. It should be noted that the instability due to a downturn in the global demand is less easily reduced by export diversification than an instability linked to the export of specific commodities.

¹² The remoteness index is similar in the three countries and similar to the average of developing countries, a result of the expansion of the Asian markets.

¹³ The remittances sent abroad are high.

¹⁴ This sum corresponds to a weighted average of the instability of the exports and the instability of the remittances received, with each weight being the relative value of these 2 flows in their aggregate amount, this weighted average of instabilities being itself weighted by the ratio of the aggregate flow to GDP.

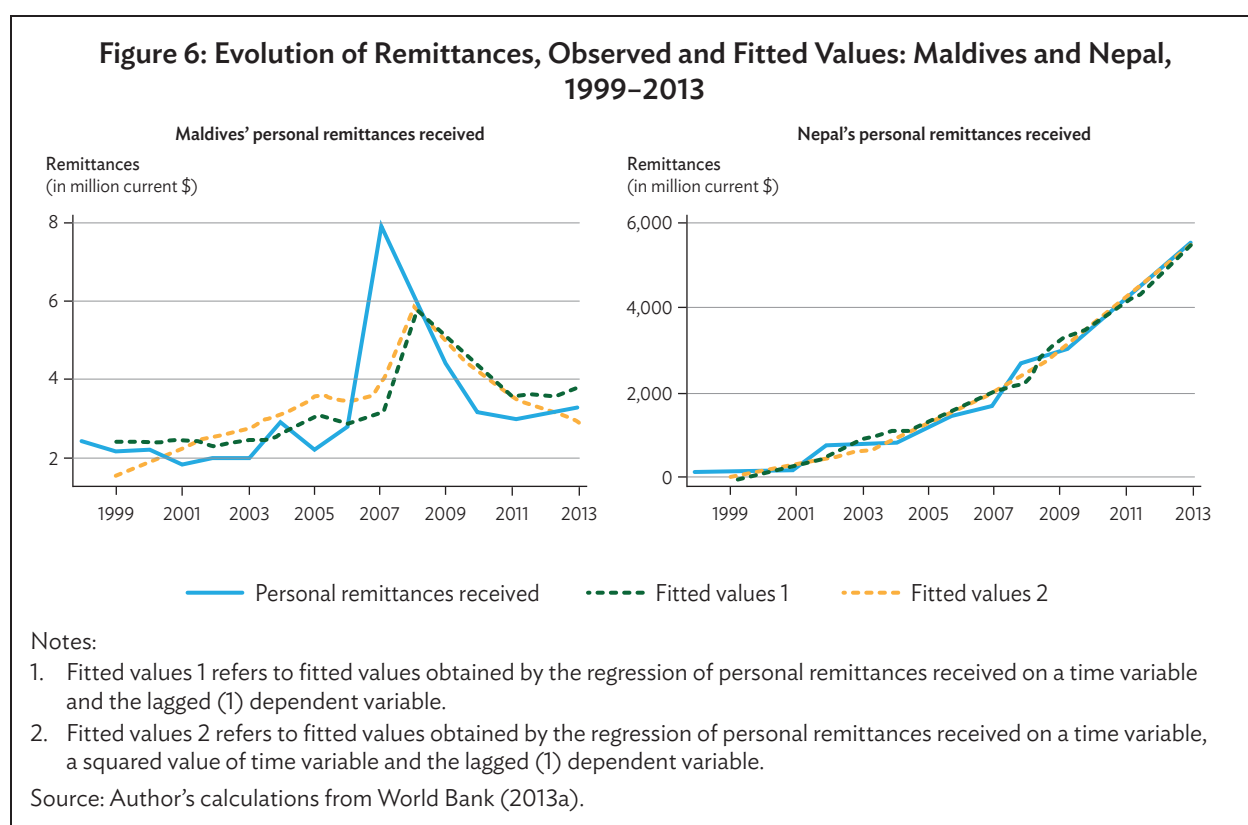
Table 5: Ratios of Exports of Goods and Services to GDP and Ratios of Remittances Inflows to GDP

Country (Country category)	Average ratios during 1990–2013		2013 ratios	
	Exports of goods and services	Remittances	Exports of goods and services	Remittances
Bhutan	36.16	–	40.84	0.66
Maldives	82.88	0.37	111.31	0.14
Nepal	16.52	11.36	10.70	28.77
LDCs	26.07	5.32	30.24	6.71

GDP = gross domestic product, LDCs = least developed countries.

Note: “En dash symbol” indicates no data for earlier years for Bhutan.

Source: From gross data of World Bank (2013a).



As for the *exposure* components, a first needed adaptation is related to the *concentration of exports* (besides that discussed in the general framework about the inclusion of services). The present coefficient captures the concentration by product, already high in Bhutan due to the exports of hydropower (although lower than in Maldives): this concentration by product is all the more a factor of vulnerability that it is associated with a concentration by destination, very high in Bhutan, and to a lesser extent in Nepal, but low in Maldives. We have calculated an index of geographical concentration of exports according to the same method as for the coefficient of concentration by product calculated by UNCTAD (normalized Herfindahl index). As it appears in Tables 5 and 6, the Bhutan index reaches three to four times the average level of Maldives and nearly twice the average level of LLDCs.

Table 6: Instability of Exports and Remittances, Compared and Combined, Bhutan, Maldives, Nepal, and Other Groups of Countries, 1999–2013

Country (Country category)	Instability						
	Exports of goods and services [A]	Remittances [B]	Exports of goods and services weighted by the share of exports in GDP [C]	Remittances weighted by the share of remittances in GDP [D]	Exports of goods and services + Remittances [E]	Exports of goods and services + Remittances weighted by the share of exports of goods and services + Remittances in GDP [F]	Sum of weighted instabilities of exports of goods and services and remittances [G]= [C]+[D]
Bhutan	16.76 (12.49)	–	6.06 (4.51)	–	–	–	–
Maldives	24.90 (24.90)	44.94 (37.70)	20.64 (20.64)	0.16 (0.14)	24.74 (24.74)	20.60 (20.60)	20.80 (20.78)
Nepal	9.15 (7.85)	45.68 (27.28)	1.51 (1.29)	5.19 (3.10)	5.97 (5.79)	1.69 (1.64)	6.70 (4.39)
Developing Countries	13.16 (11.86)	28.28 (22.96)	4.77 (4.35)	0.78 (0.61)	10.58 (9.58)	4.18 (3.79)	5.55 (4.96)
ADB Developing Countries	10.96 (10.18)	24.78 (21.02)	5.12 (4.85)	0.84 (0.68)	9.58 (9.06)	4.70 (4.52)	5.96 (5.53)
ADB – Asia Developing Countries	10.53 (9.71)	22.71 (18.77)	5.52 (5.21)	0.66 (0.48)	9.50 (8.90)	4.67 (4.46)	6.18 (5.69)
ADB – Pacific Developing Countries	12.32 (11.68)	31.41 (27.76)	3.85 (3.71)	1.38 (1.29)	9.87 (9.67)	4.82 (4.73)	5.23 (5.00)
LDCs	16.08 (14.25)	32.59 (28.20)	4.38 (3.88)	1.33 (1.03)	11.00 (10.14)	3.23 (2.92)	5.71 (4.91)
ADB LDCs	11.15 (10.06)	30.92 (26.30)	3.39 (3.09)	1.78 (1.40)	8.57 (8.39)	3.40 (3.33)	5.17 (4.49)
Developing Landlocked	14.60 (12.61)	31.64 (27.93)	4.30 (3.65)	1.46 (1.07)	11.71 (10.70)	4.93 (4.31)	5.76 (4.72)
ADB Landlocked	12.54 (11.00)	42.60 (35.98)	4.40 (3.89)	2.22 (1.50)	9.76 (9.27)	4.20 (3.94)	6.62 (5.39)
Fragile States	17.58 (15.51)	35.84 (29.93)	4.16 (3.70)	1.14 (0.84)	11.52 (10.73)	2.74 (2.58)	5.30 (4.54)
ADB Fragile States	10.72 (9.80)	22.43 (14.90)	2.52 (2.36)	1.43 (0.95)	7.18 (6.70)	2.27 (2.13)	3.95 (3.31)
SIDS	11.29 (10.42)	35.25 (29.32)	5.48 (5.15)	0.90 (0.77)	9.56 (9.03)	5.29 (5.02)	6.38 (5.92)
ADB SIDS	13.50 (12.96)	33.67 (29.42)	7.66 (7.45)	1.18 (1.10)	12.84 (12.68)	7.98 (7.90)	8.84 (8.55)

– = no data available, ADB = Asian Development Bank, GDP = gross domestic product, LDCs = least developed countries, SIDS = small island developing states.

Notes: In parentheses, we indicate the value of instability calculated from the best model's forecast accuracy among five models (see Box 1). We call it "revised method." Unlike instability calculated in the EVI, the values are not standardized here. The ratio of exports to GDP used for weighting is the ratio of the sum of exports to the sum of GDP over the period.

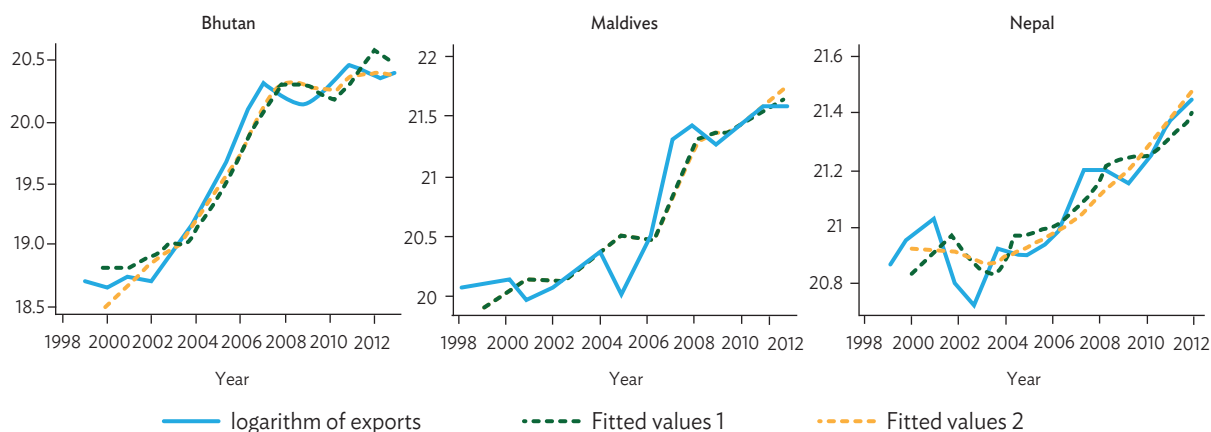
Source: Calculated from World Bank (2013a).

Box 1: Revising the Calculation of the Instability of Exports in the Economic Vulnerability Index

The instabilities, as calculated for some indices such as economic vulnerability index (EVI), suffer from a problem of estimating the trend value with respect to which they are measured (see a discussion of these issues in Cariolle 2014). The results may significantly change depending on the equation chosen for the trend estimation. The usual log-linear method is to regress flows (exports of goods and services, remittances, etc.) on a time variable and the lagged (1) dependent variable (a so-called mixed trend, both determinist and stochastic). Moreover, the length of the period covered by the estimation is likely to vary, as it has been the case for EVI (here taken at 15 years, differing from the last practice for EVI where a 20-year period was used). Referring to the export of goods and services series for Bhutan, Maldives, and Nepal, we have tested several ways for measuring the instability and concluded that the best model is that adding the squared value of the time variable to the usual model. The squared value of the time variable captures a possible nonlinearity of the determinist trend over the 15-year period. Below are the results for the three countries and several models for calculating trend fitted values. The impact of the shape of the fitted value by a graph for the case of Maldives and Nepal is also illustrated.

Country	Models				
	t	lag1	t+lag1	t+t ²	t+t ² +lag1
Bhutan	25.63 (89.28)	17.06 (94.33)	16.76 (94.56)	21.75 (91.55)	12.49 (97.13)
Maldives	26.89 (81.53)	33.61 (82.17)	24.90 (87.37)	26.87 (86.03)	25.15 (87.52)
Nepal	11.35 (69.95)	10.24 (71.96)	9.15 (79.21)	8.08 (85.01)	7.85 (85.27)

Note: Between brackets is the value of R².



Notes:

1. Fitted values 1 refers to fitted values obtained by the regression of logarithm of exports of goods and services on a time variable and the lagged (1) dependent variable.
2. Fitted values 2 refers to fitted values obtained by the regression of logarithm of exports of goods and services on a time variable, a squared value of time variable and the lagged (1) dependent variable.

Source: Author's calculations using World Bank's World Development Indicators database.

Table 7: Geographical and Merchandise Export Concentration Compared, for Bhutan (2012), Maldives (2013), and Nepal (2013)

Country	Geographical concentration of exports	Merchandise export concentration	Arithmetic mean	Quadratic mean
Bhutan	0.78	0.34	0.56	0.60
Maldives	0.27	0.70	0.48	0.53
Nepal	0.60	0.14	0.37	0.43

Sources: United Nations Conference on Trade and Development Statistics; calculations by the author from World Integrated Trade Solution data on exports.

To assess the vulnerability resulting from export concentration, it might be relevant to replace the present index of concentration by product by an average (arithmetic or preferably quadratic) of this index and the index of concentration by destination. It would give a ranking where the combined index is the highest for Bhutan, lower for Maldives, and lower still for Nepal (Table 7).

Table 8: Evolution of the Geographical Concentration of the Exports of Goods

Country (Country category)	2009	2010	2011	2012
Bhutan	0.78	0.67	0.61	0.78
Maldives	0.16	0.23	0.17	0.19
Nepal	0.56	0.58	0.60	0.61
Developing Countries (117)	0.31 (104)	0.32 (104)	0.30 (98)	0.31 (92)
ADB Developing Countries (27)	0.27 (23)	0.28 (24)	0.27 (24)	0.28 (23)
LDCs (43)	0.33 (32)	0.34 (31)	0.33 (30)	0.35 (25)
Developing Landlocked (20)	0.37 (17)	0.36 (17)	0.37 (17)	0.42 (15)
Fragile States (33)	0.30 (22)	0.31 (24)	0.30 (21)	0.35 (18)
SIDS (29)	0.33 (25)	0.35 (24)	0.36 (23)	0.33 (21)

ADB = Asian Development Bank, LDCs = least developed countries, SIDS = small island developing states.

Note: Figures in parentheses represent the effective sample size used for computation.

Source: Author's calculations from World Integrated Trade Solution data on exports.

Another index which could be debated is that of *remoteness*. This index is now a relatively low level in Bhutan due to the growth of the Chinese market, without taking into account the high *geographical barriers* between Bhutan and the PRC (though it already takes into account the landlockness). In another context (the assessment of the need for regional integration), we have proposed a new measure of the remoteness of foreign markets, combining the traditional (geographical distance) not only with the landlockness (already taken into account in EVI), but also with the level of infrastructures (on which the impact of landlockness depends) (Guillaumont and Jeanneney 2014). This index has only been calculated for African countries.

The way by which the *share of agriculture*, fishery, and forestry is calculated might be debated; and the percentage of value added could be replaced by the percentage of population working in this sector, quite higher in Bhutan than in other countries with similar level of income, and even in other LDCs. The share of agriculture in employment in 2013 was 62% for Bhutan and 75% for Nepal, but only 11% for Maldives; while the share of the value added by agriculture was 17% for Bhutan, 35% for Nepal, and 4% for Maldives (Table 9). For comparison, the average percentage for the LDCs is 29 for the share of the value added and almost 57 for the share of the agriculture employment.

And if we refer to the new definition, including LECZ, it would be useful to supplement this index by the consideration of the share of the population living in areas likely to be affected by ice melting. This will be discussed later in examining the vulnerability to climate change.

Table 9: Comparison of the Relative Share of Agriculture in Gross Domestic Product and in Employment

Country (Country category)	Value added by Agriculture (% of GDP)	Employment in agriculture (% of Total Employment)
Bhutan	17.07	62.20
Maldives	4.20	11.00
Nepal	35.09	75.00
Developing Countries (130)	16.01 (110)	30.24 (100)
ADB Developing Countries (30)	16.21 (25)	36.25 (24)
ADB – Asia Developing Countries (21)	15.26 (20)	34.01 (18)
ADB – Pacific Developing Countries (9)	19.99 (5)	42.98 (6)
LDCs (48)	29.32 (37)	56.89 (25)
ADB LDCs (13)	24.55 (9)	47.6 (8)
Developing Landlocked (22)	26.02 (22)	58.43 (14)
ADB Landlocked (5)	23.82 (5)	53.50 (3)
Fragile States (37)	30.28 (27)	49.77 (20)
ADB Fragile States (9)	21.60 (6)	41.71 (6)
SIDS (34)	11.48 (28)	18.92 (25)
ADB SIDS (11)	14.88 (7)	33.81 (8)

ADB = Asian Development Bank, GDP = gross domestic product, LDCs = least developed countries, SIDS = small island developing states.

Note: Figure in parentheses is the sample size used for each category of country.

Source: World Bank (2013a).

Table 10: Components of the Economic Vulnerability Index in 2011 (and 2000): Bhutan, Maldives, Nepal, and Various Country Groupings Compared

Country (Country category)	Components of EVI 2011								
	Exposure index					Shock index			
	Population	Remoteness	Merchandise export concentration	Share of agriculture	Share of LECZ	Instability of agricultural production	Instability of export of goods and services	Victims of disasters	Homeless
Bhutan	75.7 (79.6)	55.6 (70.2)	31.2 (32.7)	29.2 (48.4)	0 (0)	40.9 (22.6)	36.7 (32.9)	63.7 (63.8)	36.8
Maldives	87.8 (90.8)	56.2 (62.8)	61.4 (24.8)	4.7 (7.5)	100 (100)	41.2 (34.0)	24.0 (5.1)	50.7 (5.3)	43.4
Nepal	20.0 (22.5)	55.8 (69.2)	4.8 (25.5)	57.9 (62.1)	0 (0)	2.6 (16.6)	20.8 (27.2)	65.6 (60.1)	73.2
All Developing Countries (130)	42.8	55.9	33.7	27.3	19.5	24.1	30.1	60.8	54.3
ADB Developing Countries (30)	42.8	60.5	28.6	28.9	32.0	21.2	27.3	67.0	67.1
ADB – Asia Developing Countries (21)	25.4	49.2	20.8	27.8	27.9	20.9	20.2	67.5	66.1
Pacific Developing Countries (9)	83.7	86.8	46.7	31.4	41.4	21.7	43.8	65.7	69.4
LDCs (48)	43.4	60.9	42.8	48.2	18.6	24.3	47.4	68.8	55.3
ADB LDCs (13)	56.6	67.0	40.4	40.0	33.3	21.2	43.5	69.3	66.5
Developing Landlocked (22)	37.3	73.7	37.1	43.7	0.0	27.1	37.0	76.7	48.5
ADB Landlocked(5)	42.4	55.6	24.0	43.3	0.0	29.4	40.0	76.4	50.3
Fragile States (37)	31.1	55.3	44.4	49.8	12.7	20.9	50.2	69.0	54.6
ADB Fragile States (9)	35.9	57.9	33.1	38.9	28.5	14.7	41.7	71.8	68.7
SIDS (34)	78.9	63.7	37.8	19.5	35.9	31.0	29.9	58.5	57.3
ADB SIDS (11)	80.6	81.2	45.5	26.1	45.9	30.0	38.4	58.4	68.8

ADB = Asian Development Bank, LDCs = least developed countries, LECZ = low elevation coastal zones, SIDS = small island developing states.

Notes: Between parentheses are the values of the corresponding component for 2000. For comparison, the last column gives the values of the “homeless” (due to natural disasters) replaced in 2012 by “victims of disasters.” To be underlined, these figures are calculated by the Committee for Development Policy Secretariat as indices from gross figures with lower and upper bounds (to make the components comparable), not the gross figures themselves. So they may differ from the corresponding gross figures possibly given in other tables.

Source: Fondation pour les Études et Recherches sur le Développement International (Ferdj). 2013. A retrospective economic vulnerability index.

The earthquake of April 2015 in Nepal has provided a sudden and tragic light on the difficulty to measure *ex ante* the vulnerability to such an event and to introduce a reliable measure in the EVI. When the EVI will be calculated for the next triennial review of the list of LDCs in 2015, the component “victims of natural disasters” will probably be at the highest value for Nepal. It will thus capture *ex post* the human impact of a huge disaster, though such disaster is not probable to reoccur in the next years. There are scientific measures of the risk of seismic events, but without any probability for the date of occurrence. Nepal has been affected by many earthquakes in the past, but generally separated by many years (see Box 2). The previous earthquake of similar size was in 1934, 71 years earlier. This would militate for a measurement of the indicator “victims of natural disasters” on a much longer period than that used for the calculation of the instabilities of exports or of agricultural production.

It would meet statistical difficulties but probably not unmanageable. The vulnerability of Nepal with respect to earthquakes is to some extent similar to the vulnerability of Maldives with respect to tsunami (also resulting from a seismic shock). The EVI of Maldives reflects *ex post* the impact of the 2004 tsunami, but through the instability of exports (see Box 2), not clearly through a high level of the component “victims of disasters,” as it will be the case for Nepal in the future. One may also wonder why this component measured over past years for Nepal has a lower value than the average of LDCs, while its predecessor in EVI the homeless indicator had a quite higher value.¹⁵ It should be noted that these exceptional natural disasters will influence the assessment of the evolution of structural economic vulnerability according to EVI.

The 2015 earthquake in Nepal offers some lessons about resilience. First, it illustrates how much the *ex post* resilience, as that working through the management of emergency support, depends of the level of development, many kinds of help and support having been brought with more difficulties to poor and remote populations. Second, it shows that the *ex ante* resilience, as that resulting from the anti-seismic methods of building, had not been prepared as it could have been done in a quite richer country such as Japan, which is also threatened by earthquakes.

Box 2: Frequency of Earthquakes in Nepal

Nepal is prone to earthquakes due to the overlap of the Eurasian plate on the Indian plate. It is among the world’s most earthquake-prone countries, but also the least disaster-prepared ones. For instance, Japan tops the list of earthquake-prone countries in the world (United States Geological Survey), but thanks to its earthquake warning system the country is more resilient and succeeds in reducing human and economic damages from earthquakes.

On average, each century, a strong earthquake (around a magnitude of 8) occurs in Nepal. Likewise, every year, dozens of earth tremors with a magnitude of 4–5 take place in the country. The capital Kathmandu and its valley are among the most affected localities. The fact that the Kathmandu valley is the only area of soft earth in the region makes the city more sensitive to earth tremors. The lack of a reliable earthquake warning system, the current population explosion (due to an unprecedented rural exodus), and the boom in unsafe high-rise buildings have caused immense damage to life and property recently. The damage is also cultural. Indeed, every major earthquake, Kathmandu and neighboring regions lose temples and statues (mostly built during the 12th–18th century). Thus, many people fear the collapse of the enormous cultural patrimony of Nepal, which could thus cast a shadow over the future of the tourism sector.

Continued next page

¹⁵ Indeed, one should keep in mind that the average for LDCs depends on the distribution of the indices among all the countries considered. Nevertheless, the number of victims of natural disasters is normally higher than the number of the homeless, since the homeless could also be considered victims. For instance, in Nepal, during 1950–2013 and a high number of incidents (181), there were 9,662,366 victims and 254,125 homeless. In Bhutan, for 10 incidents, there were 86,645 victims and 1,000 homeless. But for Maldives, curiously, over the same period and 9 incidents, there were 26,821 victims and 36,849 homeless (Emergency Events Database EM-DAT).

Box 2: Continued**A Census of the Largest Earthquakes that have Occurred in Nepal**

Year	Magnitude	Damages
1255	–	1/3 to 1/4 population of the Kathmandu valley and many houses
1260	–	Heavy loss of lives (the exact number of fatalities is not available)
1408	–	Heavy loss of lives, destruction of the temple of Rato Matchendranath temple of Patan
1681	–	Heavy loss of lives
1767	–	No written or verbal records to indicate any human loss
1810	–	Loss of lives was limited but many houses and temples were destroyed
1823	–	No report of loss of lives or livestock
1833	around 7.8	The Kathmandu valley was devastated, nearly 500 persons died and 4,214 houses were destroyed
1834	–	No record of human casualties but over 18,000 houses collapsed all over the country
1934	8.4	16,000 deaths including from Nepal and India (just 8,519 in Nepal), 126,355 houses were damaged and around 80,893 buildings were completely destroyed
1936	6.8	Heavy loss of lives and many houses were destroyed
1980	6.5	Between 150 and 200 deaths and many houses were destroyed
1988	6.9	1,500 deaths and many destruction of houses and livestock
2011	6.9	100 deaths and significant property damages
2015	7.8	More than 7,000 deaths and 14,000 injuries and significant property damages (provisional report)

Some Important Earthquakes Recorded in Regions Neighboring Nepal

Year	Magnitude	Location	Damages
1905	7.8	Kangra (India)	More than 20,000 deaths and many buildings were destroyed
1934	8.4	Bihar (India)	Important damage in northern Bihar and in Nepal (7,253 deaths recorded in Bihar)
1950	8.7	Assam (India)	1,530 and 3,300 deaths and many houses were destroyed
2005	7.6	Pakistan and also affected India and Afghanistan	More than 79,000 deaths and important injuries and material damages

Sources: Nepal's Department of Mines and Geology; Disaster Preparedness Network Nepal.

E. Has Structural Economic Vulnerability (According to Economic Vulnerability Index Components) Decreased during the 2000s?

The evolution of the official EVI—as calculated for each triennial review of the list of LDCs—does not give information about the change in structural vulnerability, because the design of the official index (its composition and/or the calculation of the components) has changed from one review to another. To overcome this difficulty, the evolution in structural vulnerability has been assessed at Ferdi according to two *retrospective series of the EVI*, based on constant definitions, those used respectively for the 2006 and 2012 reviews of the list of LDCs. The real change in structural economic vulnerability is thus isolated from the impact of the change in the design of the index (components, weighting, methods of calculation, as well as data updating) (see Cariolle, Goujon, and Guillaumont 2014).

For the reasons given above and for the consistency of our conceptual framework, the series using the 2006 definition of EVI are here preferred.

According to these series, from 1990 to 2011 the structural economic vulnerability has evidenced a late and slight fall for the average of LDCs.¹⁶ The retrospective series with the 2006–2009 design, however, shows more variability over time than that with the 2012 design, due to the way some exposure components are now calculated (3-year averaged export concentration and agriculture share indices and the remoteness index). The slightly declining trend of EVI recorded for the average of LDCs is less than for the other developing countries (Cariolle, Goujon, and Guillaumont 2014), and results more from the trend in the exposure subindex than in the shock subindex. It should be noted that the exposure trend is highly influenced by population growth, a factor which does not really reflect a relevant structural change.

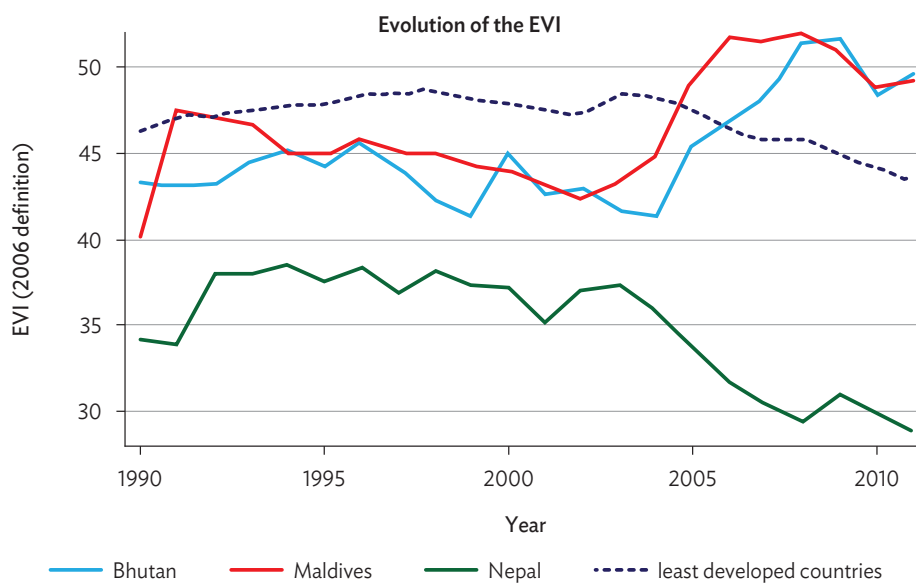
Did the structural economic vulnerability, assessed through an EVI calculated according to a constant definition, increase or decrease in Bhutan, Maldives, and Nepal during 2000–2011? While it declined for the average of ADB Asian countries (–4.8) and the average of developing countries (–3.8) or African countries (–2.6), it increased in Bhutan (+4.5) and Maldives (+5.4). Thus, during 2000–2011 as measured by EVI, the difference in structural economic vulnerability between Bhutan or Maldives and the average LDC or the average LLDC appears to have increased. On the other hand, the index has significantly decreased in Nepal (–8.5), reinforcing the image of a low structural economic vulnerability in this country, an image stained by the 2015 earthquake. From a pre-earthquake point of view, does that mean that out of these three countries only Nepal had managed to reduce its structural economic vulnerability?

The decrease in the “retrospective EVI” of Nepal, as its increase for Bhutan and Maldives, should be explained by the changes in the components of the index (see Table 3). Nepal has achieved an improvement in all the EVI components (except “victims of disasters” and the “homeless”), in particular in export concentration (index value of 4.8 instead of 25.5), remoteness (due to the PRC’s growth), and agricultural instability (from 16.6 to 2.6). That may really reflect a positive structural change. In Bhutan, where remoteness decreased, as in Nepal, and where the share of agriculture, forestry, and fishery dramatically decreased (index value of 29.2 instead of 48.4), the increase in the retrospective EVI was mainly due to the increase in agricultural instability (index value of 40.9 instead of 22.6) and in export instability (36.7 instead of 32.9). In Maldives, where all the exposure components improved, except (strongly) the export concentration index (61.4 instead of 24.8), the shock index evidenced a significant deterioration of its three components, in particular the instability of exports and the victims of disasters, due to the 2004 tsunami (as it will be the case for Nepal in the future series including 2015). Looking only at the exposure subindex, which may better reflect a structural change, the picture appears similar for Bhutan (–7.2) and Nepal (–7.1) according to the 2011 definition (see Table A1 in the Annex), the export concentration having fallen more in Nepal and the share of agriculture more in Bhutan.¹⁷ This exposure subindex slightly increased for Maldives (+1.8). The picture is of course more contrasted for the shock index, for the reasons given above.

¹⁶ The evolution of EVI either in LDCs or in non-LDCs is not significantly different between the two retrospective series.

¹⁷ According to the 2006–2009 definition, the figures are –9.6 for Bhutan, –6.7 for Nepal, and +1.2 for Maldives.

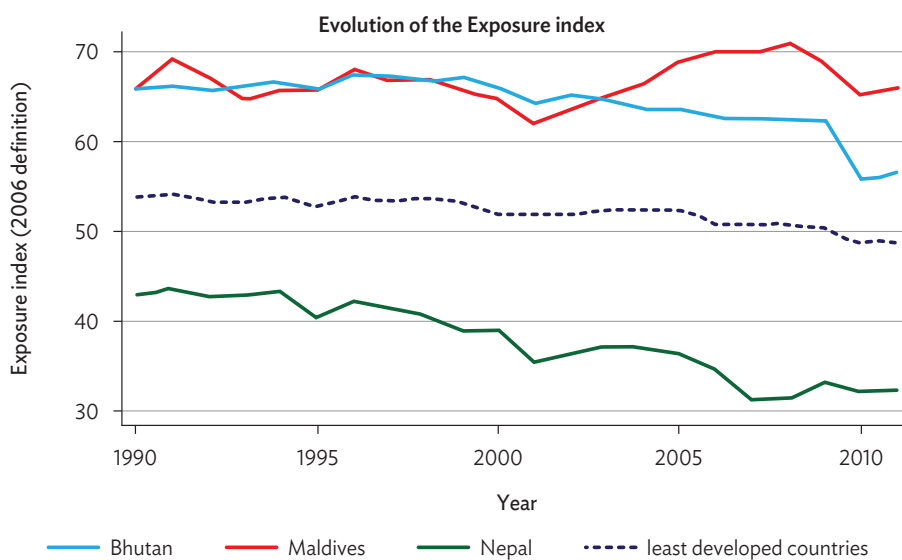
Figure 7: Evolution of the Economic Vulnerability Index (2006–2009 Definition) in Bhutan, Maldives, and Nepal, Compared to the Average of Least Developed Countries (1990–2011)



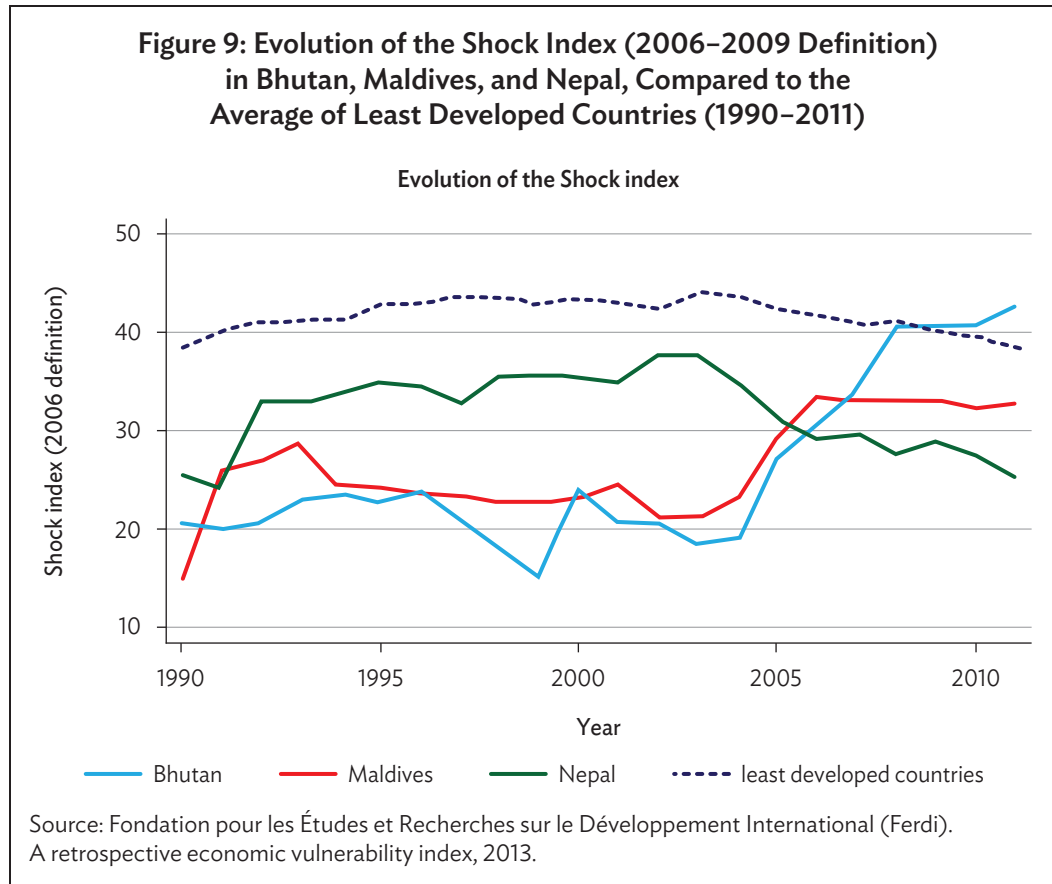
EVI = economic vulnerability index.

Source: Fondation pour les Études et Recherches sur le Développement International (Ferd). A retrospective economic vulnerability index, 2013.

Figure 8: Evolution of the Exposure Index (2006–2009 Definition) in Bhutan, Maldives, and Nepal, Compared to the Average of Least Developed Countries (1990–2011)



Source: Fondation pour les Études et Recherches sur le Développement International (Ferd). A retrospective economic vulnerability index, 2013.



To sum up, while Bhutan and Maldives have registered important structural changes during the last decade, their structural economic vulnerability assessed through the EVI does not seem to have decreased significantly. An additional indicator, not included in the EVI, underlines the remaining vulnerability of Bhutan: the high concentration of exports to its main partner, India, and this has been reinforced by the implementation of the new hydropower projects.¹⁸ It may not be a factor slowing down the growth rate in the long run. As for Nepal, the weakness and decrease of its structural economic vulnerability are probably overestimated, mainly because the share of remittances in current external resources has not been taken into account in EVI, nor its rapid increase in the “retrospective EVI.”

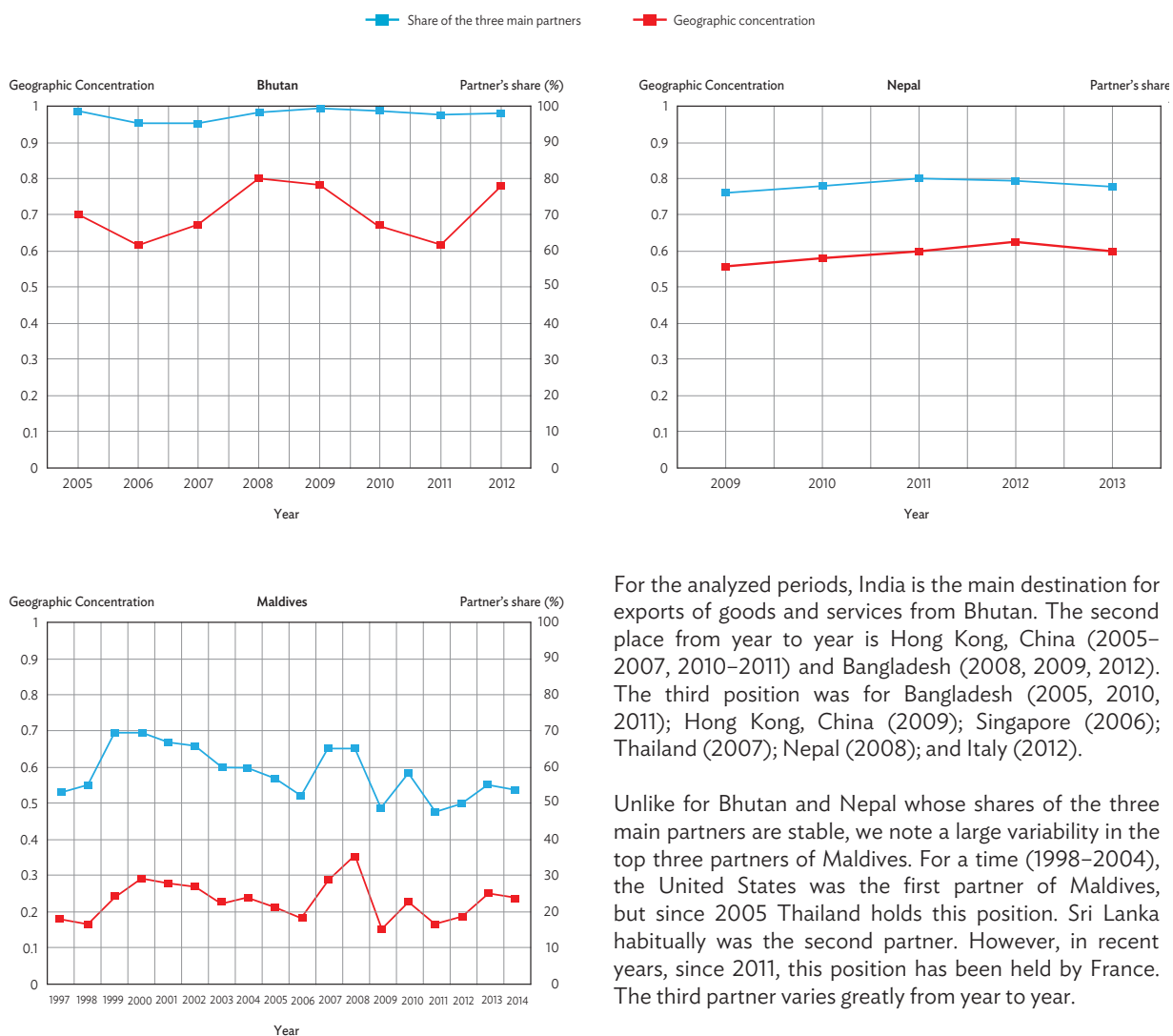
However, if we consider the structural economic vulnerability through a *broader index* taking into account the “structural resilience” resulting from the level of human capital, the picture looks differently. The structural handicap index (SHI) measured by an average of the EVI and the (low) human assets index (HAI) indices, either arithmetic (SHI1) or quadratic (SHI2), has dramatically decreased in Bhutan and Nepal from 1989 to 2011, more than the average for LDCs or LLDCs,¹⁹ and

¹⁸ As noted above, we have calculated an index of geographical concentration of exports comparable to other countries by the same way that the coefficient of concentration of exports by product (Herfindahl index). The evolution of this index is in Figure 8. Moreover, an increasing trend of export concentration by product is noted by the International Monetary Fund (IMF) in a recent document (July 2014) that also underlined the decreasing diversification into an extensive margin (number of active export lines) using the method of Cadot et al. (2012).

¹⁹ The respective levels of SHI1 and SHI2 were in 2011 38.2 and 37.9 for Bhutan, 46.7 and 45.2 for the average of LDCs, 43.8 and 42.4 for the average of LLDCs, 31.1 and 27.7 for the average of all developing countries (Source: Ferdi [2014]).

it decreased even more for Maldives from 1989 to 2003, but without any clear trend after 2004, due to the evolution of the shock index after the tsunami. The future evolution of the index in Nepal is likely to evidence a similar shape (increase and stagnation or slowing decline). In the three countries, the decline was due to the rapid improvement of the level of health and education.

Figure 10: Exports: Share of the Three Main Partners and Geographical Concentration, 2005–2014



For the analyzed periods, India is the main destination for exports of goods and services from Bhutan. The second place from year to year is Hong Kong, China (2005–2007, 2010–2011) and Bangladesh (2008, 2009, 2012). The third position was for Bangladesh (2005, 2010, 2011); Hong Kong, China (2009); Singapore (2006); Thailand (2007); Nepal (2008); and Italy (2012).

Unlike for Bhutan and Nepal whose shares of the three main partners are stable, we note a large variability in the top three partners of Maldives. For a time (1998–2004), the United States was the first partner of Maldives, but since 2005 Thailand holds this position. Sri Lanka habitually was the second partner. However, in recent years, since 2011, this position has been held by France. The third partner varies greatly from year to year.

Like for Bhutan, the main partner of Nepal is India. Since 2011, the second partner is the United States; and since 2012, Bangladesh is the third partner.

Note: The time coverage for each country depends on the availability of data.

Source: Author’s calculations from World Integrated Trade Solution data on exports.

**Table 11: Level of the Structural Handicap Index in 2011:
Bhutan, Maldives, Nepal, and Various Country Groupings Compared**

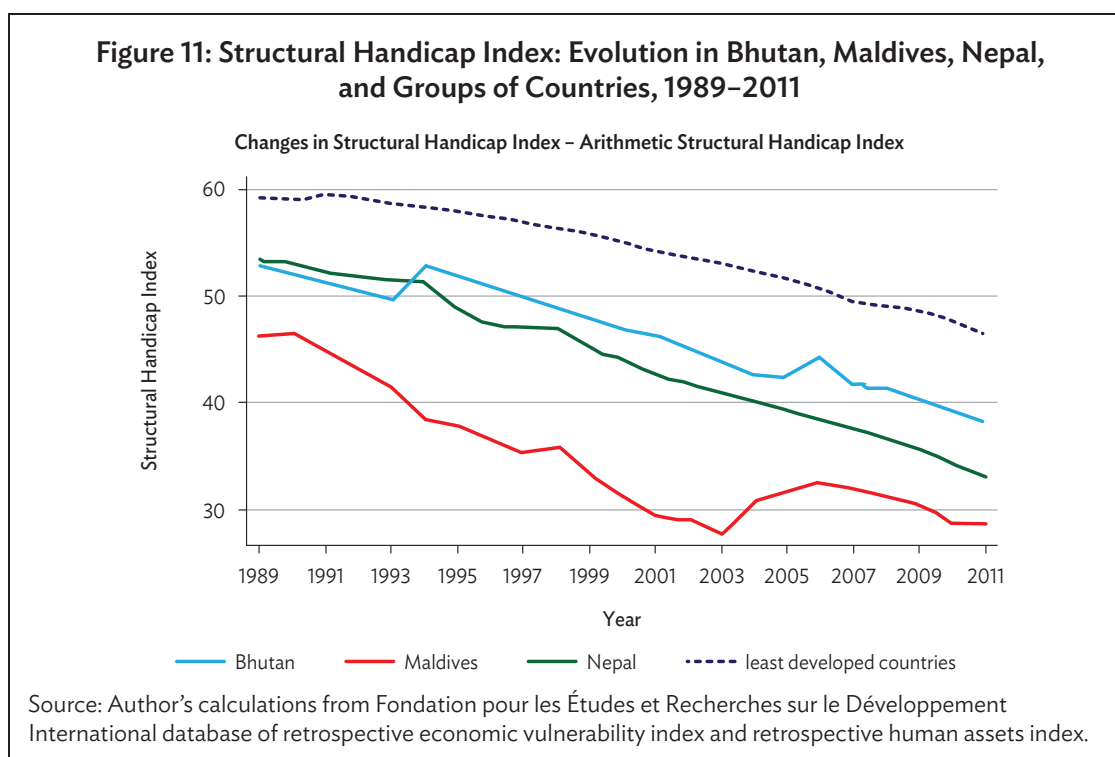
Country (Country category)	SHI1	SHI2
Bhutan	38.17	37.93
Maldives	28.61	16.31
Nepal	33.12	32.57
Developing Countries (117)	31.14	27.72
ADB Developing Countries (27)	29.30	25.27
ADB – Asia Developing Countries (20)	27.08	24.36
ADB – Pacific Developing Countries (7)	35.66	27.88
LDCs (43)	46.73	45.21
ADB LDCs (12)	38.30	35.49
Developing Landlocked (20)	43.80	42.38
ADB Landlocked (5)	37.69	35.98
Fragile States (33)	45.36	43.74
ADB Fragile States (9)	37.29	34.62
SIDS (29)	29.00	21.78
ADB SIDS (8)	34.78	26.44

ADB = Asian Development Bank, EVI = economic vulnerability index, HAI = human assets index, LDCs = least developed countries, SHI = structural handicap index, SIDS = small island developing states.

Notes: 1. $SHI1 = 0.5 * [(100 - HAI) + EVI] \rightarrow$ Arithmetic SHI

2. $SHI2 = \sqrt{(100 - HAI) * EVI} \rightarrow$ Geometric SHI

Source: Author's calculations from Fondation pour les Études et Recherches sur le Développement International database of retrospective economic vulnerability index and retrospective human assets index.



IV. VULNERABILITY TO CLIMATE CHANGE: PHYSICAL VERSUS GENERAL

Vulnerability to climate change, as designed in the conceptual framework, is understood as a vulnerability to a specific global and progressive shock, likely to translate into country-specific shocks through various events.

A. Vulnerability to Climate Change in Bhutan, Maldives, and Nepal, According to the Level of the Physical Vulnerability to Climate Change Index and its Components

According to the physical vulnerability to climate change index (PVCCI), calculated through an arithmetic or a quadratic average, the physical vulnerability to climate change in Nepal and even more in Bhutan may seem moderate. With an arithmetic or quadratic average, the index is 34/43 for Nepal and 26/34 for Bhutan, compared to an average of 37/44 for LDCs and 39/47 for LLDCs. On the other hand, it is very high for Maldives, with a level of 59/65, even higher than the average of the SIDS (34/38).

The moderate or low level of PVCCI for Nepal or Bhutan is due mainly to the subindex of progressive shocks, and to a quite lesser extent to the subindex of intensification of recurrent shocks for Bhutan, while for Nepal the intensification index is a little higher than the average of LDCs or LLDCs. The high level of PVCCI for Maldives is mainly due to the progressive shocks (the sea level rise index here reaches its maximum level), and also to the intensification of the recurrent shocks. Of course the impact of the sea level rise is nil in Bhutan and Nepal, while the trend in aridification is weak.

As for the *intensification of recurrent shocks*, while the level of Bhutan (46.1) is lower than the average of LDCs or of ADB Asian developing countries, the level of Maldives and Nepal is higher. This is due to a significantly lower intensification of rainfall shocks (20.8 in Bhutan versus 63.6 in Nepal and 50.6 in Maldives), while the intensification of temperature shocks is nearly the same in Bhutan (61.8) as in Maldives (63.9) and higher than in Nepal (55.3). The sources of this discrepancy remain to be elucidated, since the value of each index is the product of a “shock index” (i.e., the trend in the rainfall or temperature instability), and of an “exposure index” (i.e., the average level of this rainfall or temperature instability). Bhutan shows both a lower trend and a lower level of rainfall shocks than the other two countries, while its index of intensification of temperature shocks, similar to that of Nepal, results from a lower trend in temperature instability combined with a higher average level of this instability.

Due to this difference between the rainfall and temperature components of vulnerability in the case of Bhutan, it is not surprising that the gap between the index of intensification of recurrent shocks in Bhutan and Nepal is lower when the average of the temperature and rainfall subcomponents is quadratic rather than arithmetic (Table 12).

**Table 12: Physical Vulnerability to Climate Change Index:
Bhutan, Maldives, Nepal, and Various Country Groupings Compared**

Country (Country category)	Arithmetic			Quadratic		
	Progressive shocks	Recurrent shocks	PVCCI	Progressive shocks	Recurrent shocks	PVCCI
Bhutan	10.7	41.3	26.0	15.2	46.1	34.3
Maldives	60.7	57.3	59.0	72.3	57.6	65.4
Nepal	9.3	59.5	34.4	13.2	59.6	43.2
Developing Countries (132)	25.4	47.5	36.4	33.5	48.4	42.8
ADB Developing Countries (41)	26.6	46.9	36.8	33.3	48.0	42.9
ADB – Asia Developing Countries (28)	24.0	49.7	36.9	32.6	50.8	44.4
ADB – Pacific Developing Countries (13)	32.2	40.8	36.5	35.0	41.7	39.6
LDCs (48)	23.8	50.6	37.2	31.8	51.6	44.0
ADB LDCs (13)	21.9	47.8	34.8	26.2	49.0	40.9
Developing Landlocked (29)	27.7	50.5	39.1	39.1	51.8	47.2
ADB Landlocked (12)	31.1	48.6	39.9	44.0	50.2	48.9
Fragile States (40)	25.7	49.1	37.4	34.3	50.2	44.1
ADB Fragile States (13)	27.7	46.2	36.9	34.3	47.0	43.0
SIDS (29)	24.9	43.5	34.2	27.8	44.4	37.8
ADB SIDS (10)	30.9	41.5	36.2	34.5	42.6	39.8

ADB = Asian Development Bank, LDCs = least developed countries, PVCCI = physical vulnerability to climate change index, SIDS = small island developing states.

Source: Physical vulnerability to climate change index database, 2013 from Fondation pour les Études et Recherches sur le Développement International.

**Table 13: Main Components of the Vulnerability to Climate Change Index:
Bhutan, Maldives, Nepal, and Various Country Groupings Compared**

Country (Country category)	PVCCI			
	Progressive shocks		Recurrent shocks	
	Sea level rise	Increasing of aridity	Rainfall	Temperature
Bhutan	0.0	21.4	20.8	61.8
Maldives	100.0	21.5	50.6	63.9
Nepal	0.0	18.6	63.6	55.3
Developing Countries (132)	6.6	44.2	41.8	53.2
ADB Developing Countries (41)	15.2	38.0	40.3	53.5
ADB – Asia Developing Countries (28)	5.0	43.0	43.0	56.5
ADB – Pacific Developing Countries (13)	37.2	27.1	34.5	47.1
LDCs (48)	5.2	42.4	45.7	55.5
ADB LDCs (13)	15.4	28.3	42.5	53.0
Developing Landlocked (29)	0.0	55.4	43.2	57.8
ADB Landlocked (12)	0.0	62.2	39.7	57.6
Fragile States (40)	6.6	44.8	43.0	55.2
ADB Fragile States (13)	18.3	37.1	41.9	50.4
SIDS (29)	20.8	28.9	38.2	48.8
ADB SIDS (10)	35.3	26.6	34.3	48.7

ADB = Asian Development Bank, LDCs = least developed countries, PVCCI = physical vulnerability to climate change index, SIDS = small island developing states.

Source: Physical vulnerability to climate change index database, 2013 from Fondation pour les Études et Recherches sur le Développement International.

Table 14: Components of the Physical Vulnerability to Climate Change Index: Bhutan, Maldives, Nepal, and Various Country Groupings Compared

Country (Country category)	PVCCI							
	Progressive shocks				Intensification of recurrent shocks			
	Flood risk due to sea level rise	Temperature trend	Rainfall trend	Dryland	Rainfall shocks level	Temp. shocks level	Trend of rainfall shocks	Trend of temperature shocks
Bhutan	0.0	10.2	75.5	0.0	31.3	69.6	10.4	54.0
Maldives	100.0	19.6	66.4	0.0	68.8	73.9	32.4	54.0
Nepal	0.0	8.1	66.4	0.0	100.0	47.8	27.2	62.8
Developing Countries (132)	6.6	34.0	72.5	35.2	48.7	49.2	35.0	57.1
ADB Developing Countries (41)	15.2	31.1	74.2	23.4	46.5	50.9	34.1	56.1
ADB – Asia Developing Countries (28)	5.0	34.1	69.6	34.2	51.9	57.1	34.2	55.8
ADB – Pacific Developing Countries (13)	37.2	24.7	83.9	0.0	34.9	37.5	34.1	56.8
LDCs (48)	5.2	32.9	75.4	30.7	54.8	51.6	36.7	59.4
ADB LDCs (13)	15.4	20.4	78.9	7.0	52.4	49.8	32.6	56.2
Developing Landlocked (29)	0.0	44.4	69.5	53.8	53.1	58.2	33.4	57.5
ADB Landlocked (12)	0.0	53.5	68.4	63.4	49.7	58.0	29.7	57.2
Fragile States (40)	6.6	35.0	74.5	34.8	49.9	50.1	36.0	60.3
ADB Fragile States (13)	18.3	28.9	76.9	21.2	48.6	44.5	35.3	56.4
SIDS (29)	20.8	30.3	78.1	3.7	43.0	39.4	33.4	58.1
ADB SIDS (10)	35.3	21.1	85.1	0.0	36.3	40.9	32.4	56.5

ADB = Asian Development Bank, LDCs = least developed countries, PVCCI = physical vulnerability to climate change index, SIDS = small island developing states.

Source: Physical vulnerability to climate change index database, 2013 from Fondation pour les Études et Recherches sur le Développement International.

B. Besides or Inside the Physical Vulnerability to Climate Change Index: The Risk of Flooding Due to Ice Melting

The PVCCI is a tentative index set up to show that a cross-country comparison of the exogenous vulnerability to climate change is possible, and could be used for policy purposes, in particular for the allocation of concessional resources for adaptation (Guillaumont 2015). We have already noted some improvements which can be brought to the index, in particular the increase in the risk of storms or hurricanes, the recurrence of which is poorly reflected in the intensification of the instability of rainfall and temperature. The recent hurricane in Vanuatu illustrates how much it can affect some small island countries.²⁰ It could be a relevant component for Maldives too.

A quite more specific vulnerability to climate change concerns Bhutan and Nepal. Due to global warming some highly elevated ice lakes may burst out, their disruption being likely to destroy and flood downward areas, with disastrous immediate impact on people and crops, and longer term impact on material capital and fertility in this area. A side effect is indeed the lower fertility of areas flooded by the ice melt water and all that it carries (or brings down). While this risk is well identified by the authorities of the two countries and by the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu, it is difficult to assess the extent of arable areas likely to be flooded (or the size of the

²⁰ Preliminary results of a Ferdi-revised PVCCI, including the intensification of storms besides those of rainfall and temperature instabilities, show a significant upward change in the relative level of the Vanuatu index.

Box 3: Glacial Lake Outburst Flood, A Major Himalayan Water-induced Hazard, But Not the Only One

A glacial lake outburst flood (so-called GLOF) occurs when the dam containing a glacial lake fails. Glacial lakes are very numerous in the Himalayan region (several thousands), and the risk of outburst floods is significantly increased by global warming. This is a serious concern for Bhutan and Nepal, where it may affect large fractions of the population.

The knowledge about these possible events has become more and more robust—in particular thanks to the work of the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu—covering a large set of countries.

At the country level, in particular Nepal, progress has been made to have a better understanding of this risk, assessed in the context of the Disaster Review of the Department of Water Induced Disaster Prevention of the Minister of Irrigation.

The natural risk faced by Bhutan and Nepal is not only the outburst of glacial lakes, but also erosion, sedimentation, landslides, and floods. The strategy implemented uses a “river basin approach,” including cooperation with some extra-regional partners. It involves the possibility to also have “early warning” instruments to inform people about the risk of flooding. New information technology appears particularly useful in that context. And since technology needs human support, the ICIMOD approach is to promote a “community-based flood risk management.”

Among the other water-induced risks in Nepal is the risk of landslides, which is likely to affect large fractions of the population. Unfortunately, information remains fragmented and difficult to aggregate.

Source: Author.

population to be affected by such a flooding) in a way which could allow aggregation of this figure in the PVCCI with the percentage of population likely to be flooded by the sea level rise. We have raised this issue with many people in Thimphu and Kathmandu without having yet obtained a quantitative answer. We are pursuing our dialogue with them, in particular ICIMOD, with the hope to come to a proxy evaluation which will then be immediately incorporated in the PVCCI.

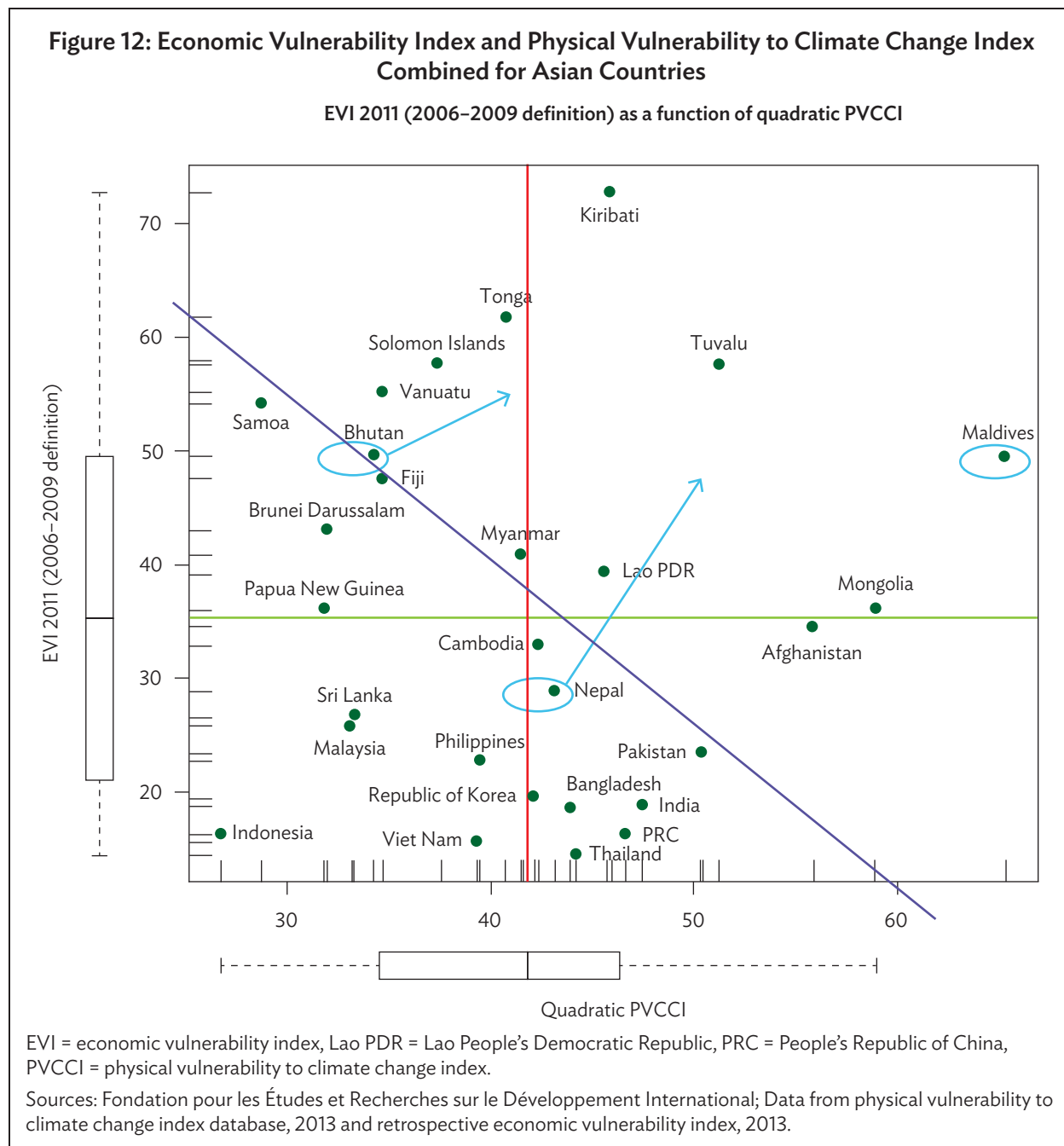
C. Mixing Physical Vulnerability to Climate Change Index with Economic Vulnerability Index: Relevance and Results

It would be possible to combine the PCCVI with the EVI (taking its 2005–2009 definition) to avoid partial overlap through the share of population living in low coastal zones (the new EVI component introduced in 2001). Due to the different time horizons of the EVI and the PCCVI, the weight given to each of them would reflect a time preference. If the EVI and the PCCVI were given equal weights, the highest average values would be for Sudan, Gambia, and Eritrea. Without calculating such a heterogeneous average, a picture of the two vulnerabilities can be given by representing the two indices on the same graph, as in Figure 12 for Asian and Pacific countries, where the horizontal and vertical lines correspond to the medians of the two indices. Above the oblique line are the 40% of countries which have the highest average combined index.

We can locate Bhutan, Maldives, and Nepal on this graph according to the present—and to some extent debatable for reasons given above—values of the two indices. Maldives has both a high EVI and a high PVCCI. Bhutan has a high EVI and a rather low but underestimated PVCCI. Nepal has a rather low EVI, although highly underestimated with respect to the 2015 earthquake, and a high PVCCI. But, as we have seen, the EVI of Nepal is underestimated not only with respect to the 2015 earthquake,

but also because of the excluded instability of remittances. And both in Bhutan and Nepal, the PVCCI is itself underestimated due to the risk of the glacial lake outburst flood. The likely underestimation is approximately represented in Figure 12 by an arrow for each of the two countries.

When mixing the two indices, it would be useful to check their mutual consistency and to refine each of them accordingly, taking into account the suggestions above.



V. SOCIOPOLITICAL VULNERABILITY AND RESILIENCE

State fragility is a sociopolitical dimension of vulnerability. It is not “structural” like the previous economic vulnerability and the physical vulnerability to climate change. Do Bhutan, Maldives, and Nepal suffer from state fragility, according to current assessments? And to what extent does it result from structural vulnerability?

A. Sociopolitical Vulnerability and State Fragility in Bhutan, Maldives, and Nepal with Regard to Current Criteria

According to the current lists, only Nepal out of the three Asian countries examined above is presently considered a fragile state, while Bhutan and Maldives have been considered so in the past.

They were all above the country policy and institutional assessment (CPIA) 3.2 threshold in 2013—indeed slightly above for Maldives (3.23), moderately for Nepal (3.37), and more clearly above for Bhutan (3.68). The CPIA score for Maldives has decreased from 3.32 in 2011 to 3.28 in 2012, then to 3.23 in 2013 with a slight change in terms of ranking. In a ranking of countries from the most fragile to the least fragile, Maldives moved from the 35th position in 2011 and 2012 to the 32nd position in 2013.²¹ As for Nepal, its CPIA score fell slightly during 2011–2012 from 3.28 to 3.26 before increasing in 2013 to 3.38. This change significantly impacts the ranking of the country, which mainly improved in 2013. So in terms of the CPIA score, Nepal appears as the 31st (2011), 33rd (2012), and 44th (2013) most fragile country. Of the three countries, Bhutan seems the least fragile even though its CPIA score decreased during 2011–2012 and remained flat in 2013. Bhutan was ranked the 73rd (2011), 61st (2012), and 65th (2013) most fragile country.

According to the Failed States Index (FSI) of the Fund for Peace²² (used as a supplementary information to the OECD list), again only Nepal is above the threshold of 90²³ used by the OECD for the identification of fragile states, even if the evolution of the index over time shows that the score of Nepal has slightly and steadily decreased during 2012–2014. Nepal with the scores of 93, 91.8, and 91 was respectively ranked 27th (2012), 30th (2013), and 31st (2014), placing equal with Egypt and Timor-Leste in 2014. Among the 12 clusters of the FSI, group grievance (score of 9.0), fractionalized elites (score of 8.3), demographic pressures (7.8), and uneven development (7.8) contribute the most to the fragility of Nepal. Filed under the category of “very high warning” with a relatively high score (but small compared to Nepal), Bhutan recorded a slight decline in its fragility. The FSI score dropped from 82.4 in 2012 (ranked 59th) to 81.8 in 2013 (ranked 62nd), and 80.9 (ranked 64th) in 2014, wedged between Georgia and Tanzania. The high scores for the group grievance (7.6), the fractionalized elites (7.5), the refugees and internally displaced persons (7.2), and uneven development (7.2) increase the fragility of Bhutan. The score for Maldives, although lower than Bhutan and Nepal, has not decreased since 2012. It slightly increased from 75.1 to 75.4 during 2012–2013 before stagnating in 2014. However, according to the Fund for Peace, the ranking has not changed

²¹ These rankings should be interpreted with caution because the number of countries is not the same per year: 78 in 2011, 80 in 2012, and 81 in 2013.

²² The Failed States Index is created by the Fund for Peace and published by *Foreign Policy*.

²³ The entry's threshold in the “alert” category is 90. According to their score, countries are grouped in several categories established by the Fund for Peace: sustainable, very stable, stable, less stable, warning, high warning, very high warning, alert, high alert, very high alert.

since 2012. Maldives appear as the 88th most fragile state. Legitimacy of the state (8.4), fractionalized elites (8.3), and human rights (7.4) are the components which contribute the most to the fragility of Maldives and classify the country in the category of “high warning.”

It thus appears that the ranking of the three countries with regard to the two composite indices used for assessing fragility, CPIA and FSI differs: Bhutan appears less fragile than Maldives with the CPIA, but more fragile with the FSI. This can be explained by the composition of the two indices. While the CPIA is an average of 16 indices of the quality of policy and institutions gathered in four clusters (economic management, structural policies, policies for social inclusion and equity, and public sector management and institutions), the FSI is an average of 12 more heterogeneous indicators (each of them relying on an average of 14 sub-indicators) gathered in 3 clusters (social indicators, economic indicators, political and military indicators). Some indicators (or sub-indicators) refer to objective outcomes (e.g., demographic pressures), but many indicators refer to more subjective assessments (e.g., human rights and rule of law, factionalized elites, and so on) (see Annex II.1 for more details). The high number of components of the FSI makes the interpretation of its level and change difficult.

Finally, it may be useful to look not only at the CPIA and FSI levels, but also at the Country Indicators for Foreign Policy (CIFP) index, which was previously taken into consideration by the OECD (as well as) for setting up its list of fragile states (OECD 2010).²⁴ The CIFP index is also a composite indicator relying on around 85 sub-indicators gathered in 6 clusters (governance, economics, security and crime, human development, demography, and environment). According to the index values for 2012, the best score for the three countries, as with the FSI, is obtained by Maldives, closely followed by Bhutan, with Nepal lagging behind. This should not come as a surprise given the composition of the CIFP, which is even more heterogeneous than that of the FSI (see Annex II.3).

Clearer information seems to emerge from more specific and outcome-based indicators, such as those related to conflict and crime. Some FSI and/or CIFP components or subcomponents may offer clearer information than the composite indices where they are included.

B. Lessons from an Internal Violence Indicator

We have presented above the main lines of an internal violence index taken to be a revealed indicator of fragility. The state fragility here is approached through violent events, divided into four clusters: internal conflicts, criminality, terrorism, and political violence, with equal weight (25%) assigned to each cluster.²⁵ The scores of this indicator are ranked from the least violent country (score of 0) to the most violent country (score of 100). Maldives is ranked 23rd out of 132 countries, Bhutan 30th, and Nepal 92nd. Only Nepal is above the average of LDCs; Bhutan and Maldives are way below the average.

Out of the four clusters of the index, political violence seems to be the most important element in the score. The ranks and scores of the three countries are the following: Maldives 33rd (23.7), Bhutan 48th (36.1), and Nepal 91st (61.6). The three countries have low scores for the other clusters, except Nepal for terrorism.

This “outcome approach” of sociopolitical state fragility confirms the higher fragility of Nepal compared with the other two countries and average LDCs.

²⁴ Look also at the Brookings Index of State Weakness in the Developing World (2008).

²⁵ We exclude all external conflicts.

Table 15: Some Indicators of Fragility: Bhutan, Maldives, Nepal, and Various Country Groupings Compared

Country (Country category)	CPIA*	FSI*	PSAV*	IVI
Bhutan	43.03	67.42	27.64	9.37
Maldives	53.10	62.83	61.67	7.03
Nepal	54.23	75.83	92.10	24.51
Developing Countries	54.01 (81)	66.74 (124)	60.25 (132)	20.56 (132)
ADB Developing Countries	53.48 (20)	65.61 (26)	55.55 (30)	19.03 (30)
ADB – Asia Developing Countries	52.01 (12)	64.97 (21)	65.02 (21)	25.43 (21)
ADB – Pacific Developing Countries	55.67 (8)	68.30 (5)	33.43 (9)	4.09 (9)
LDCs	56.88 (46)	77.00 (46)	64.17 (49)	19.94 (49)
ADB LDCs	55.13 (12)	73.75 (10)	50.31 (13)	15.02 (13)
Developing Landlocked	54.34 (19)	74.08 (22)	68.01 (22)	20.80 (22)
ADB Landlocked	53.98 (5)	70.13 (5)	61.84 (5)	20.88 (5)
Fragile States	60.37 (33)	81.58 (37)	77.43 (38)	28.03 (38)
ADB Fragile States	57.95 (8)	78.92 (8)	72.86 (9)	27.17 (9)
SIDS	53.62 (17)	58.73 (23)	37.39 (30)	8.39 (30)
ADB SIDS	55.39 (9)	62.04 (7)	33.51 (11)	4.07 (11)

ADB = Asian Development Bank, CPIA = country policy and institutional assessment, FSI = fragile state index, IVI = internal violence index, LDCs = least developed countries, PSAV = political stability and absence of violence.

Notes:

1. The sample size is between brackets.
2. CPIA* = 100 – Rescaled CPIA
3. FSI* = Rescaled FSI
4. PSAV* = 100 – PSAV
5. ICI = Internal Violence Index (Ferdinand-proposed)

Sources: Fund for Peace's Country Profiles online (at www.statesindex.org); World Bank Group, Country Policy and Institutional Assessment database (at <http://www.worldbank.org/ida>); Worldwide Governance Indicators database (at <http://info.worldbank.org/governance/wgi/index.aspx#home>); Fondation pour les Études et Recherches sur le Développement International.

Table 16: Internal Violence Index: Bhutan, Maldives, Nepal, and Some Country Groups

Country (Country category)	Internal conflict	Criminality	Terrorism	Political violence	IVI
Bhutan	0.0	1.1	0.3	36.1	9.4
Maldives	0.0	4.4	0.0	23.7	7.0
Nepal	0.4	3.4	32.6	61.6	24.5
Developing countries (132)	7.7	14.0	12.9	47.7	20.5
LDCs (49)	9.8	10.8	11.6	47.6	19.9
Developing Landlocked (22)	9.6	13.8	11.5	48.3	20.8
Fragile States (38)	15.6	10.4	23.7	62.5	28.0

IVI = internal violence index, LDCs = least developed countries.

Source: Fondation pour les Études et Recherches sur le Développement International. Internal violence index database, 2015 version.

C. Structural Vulnerability, Fragility, and Resilience

To fit the conceptual framework presented in section II (see Figure 1), one may ask whether the state fragility as measured by the CPIA (or by a similar index) is structural or dependent on the present will of the country, and so “voluntary” or “transitory.”

Resilience as residual. A partial answer can be given from the relationship linking the CPIA to the EVI and other structural factors, such as the level of human capital (measured by the HAI index) and the level of income per capita (Guillaumont, McGillivray, and Wagner 2013). The expected value of the CPIA is a proxy of the structural fragility, while the residual of the regression may reflect the fragility which is more linked to the current policy. From a regression estimated on 55 IDA-eligible countries and during 1996–2007—while for this period the level of the World Bank CPIA was on average similar for Bhutan and Maldives and significantly higher than for Nepal—the structural component of the CPIA was the highest for Maldives, followed by Nepal, then Bhutan. By difference, it follows that the residual, i.e., the “voluntary” component that may be seen as an indicator of resilience, was significantly higher in Bhutan than in Maldives, and even more than in Nepal, underlining the differences in the quality of policy and the “autonomous resilience.” According to this test, Bhutan was even found to have the highest residual out of the 55 IDA-eligible countries.²⁶

It should be remembered that the validity of this test of “autonomous resilience” depends both on the quality of the explained variable (the CPIA) as a proxy for resilience, and on the quality of the structural explanatory variables, in particular the EVI, the limitations of which have been underlined above.

Resilience as development: lessons from the Nepal earthquake. The 2015 earthquake in Nepal provides lessons for the assessment of resilience. The lack of *ex post* resilience has been evidenced by the difficulty in providing food and support to the most remote and poor population: lack of resilience resulted from inequality, defective communication infrastructure, health fragility, in brief underdevelopment. A lack of *ex ante* resilience was also shown by the fragility of buildings. It is well known that new buildings in Japan take seismic risks into account, and that the extra cost of seismic-resistant buildings is more difficult to cover in a country such as Nepal.

²⁶ For this period the level of the CPIA in Bhutan was 3.91 (rank 2nd), its expected or structural value was 3.15 (28th), and its residual value 0.77 (1st).

VI. SUMMARY AND CONCLUDING REMARKS

This paper presents a conceptual framework for the study of the vulnerability of three Asian developing countries—Bhutan, Maldives, and Nepal—with a particular focus on the structural vulnerability, either economic or climatic (see Figure 1). For each country, three kinds of vulnerability have been considered: economic, climatic, and political. Political vulnerability is considered through the debated notion of state fragility. The identification of structural vulnerability is indeed more relevant for the economic and climatic vulnerabilities than for state fragility. For a comparative assessment of countries, the examination has to rely on available and comparable indicators, such as the EVI and PVCCI. Although the measurement and the comparison of state fragility indicators remain debatable, a tentative index of internal violence has been proposed as an outcome-based index of fragility, for it is less subjective and more parsimonious than other indices of state fragility.

A. Bhutan, Maldives, and Nepal Compared

Taking the indicators as they are, it is possible to summarize and compare the profile of vulnerability of Bhutan, Maldives, and Nepal.

Figures 13 and 14 show the level of the main indicators considered for each kind of vulnerability and for the three countries. In order to make them comparable, these indicators have been put on the same scale. Figure 13 (histogram) compares three indicators in each of the three dimensions (i.e., indicators for each country): (i) EVI using two definitions and structural handicap index (SHI) for the economic vulnerability; (ii) PVCCI and its two main components (progressive shocks and intensification of recurrent shocks) for the vulnerability to climate change; and (iii) low CPIA, FSI, PSAV, and IVI for the state fragility. In Figure 14 (cobweb diagram) the comparison is limited to six indicators: the two main components of EVI (shock and exposure), the two main components of PVCCI (progressive shocks and intensification of recurrent shocks), and the two main indices of state fragility (CPIA and FSI).

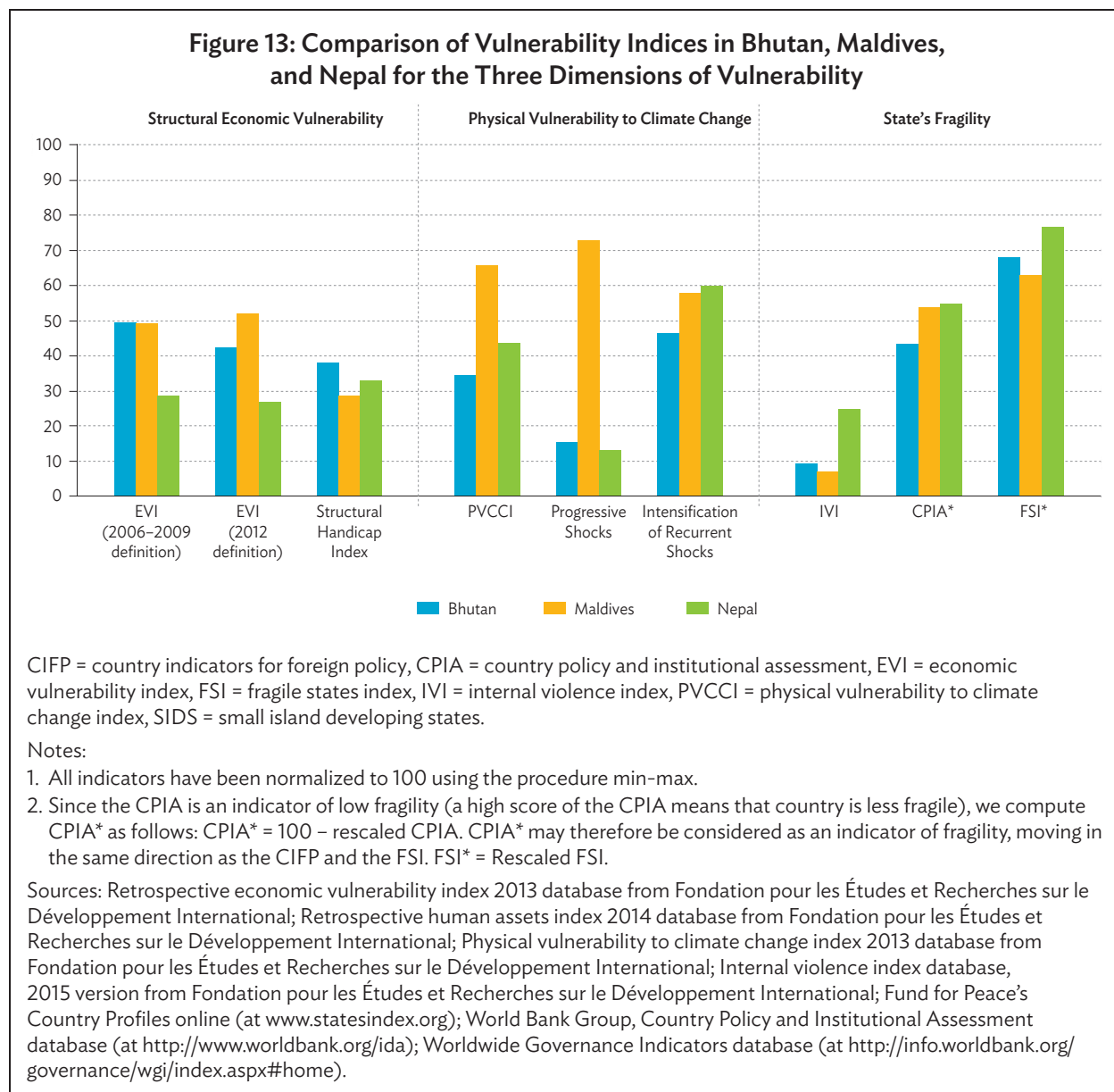
As for structural economic vulnerability, Maldives has the highest level with the 2012 definition of the EVI index (or with a revised definition as suggested above) due to the exposure component. However, Bhutan has the highest level with the 2006–2009 definition. The lowest level is observed for Nepal (both definitions), which is a significantly larger country. But, as we have seen, the EVI does not capture the possible instability of remittances, which is a larger source of foreign exchange than exports, nor the risk of earthquake, tragically evidenced in 2015. If the structural resilience due to the level of human capital is taken into account, as in the SHI, Maldives becomes the least vulnerable and Bhutan the most vulnerable.

As for vulnerability to climate change, Maldives has the highest level of the PVCCI because of its bigger exposure to sea level rise (“progressive shock index”) and high index of “intensification of recurrent shocks,” similar to that of Nepal. For the PVCCI, Maldives is ranked 1st, Nepal 27th, and Bhutan 46th among 51 LDCs and former LDCs. But for the two Himalayan countries (Bhutan and Nepal) the PVCCI is clearly underestimated, as it does not presently capture the risk of flooding due to ice melting.

As for state fragility, Nepal seems to be the most fragile, whatever the index used, except with regard to the CPIA, which is at the same low level as in Maldives. While of the three countries Bhutan is the least fragile with regard to CPIA (highest level of the CPIA), it seems more fragile than Maldives with regard

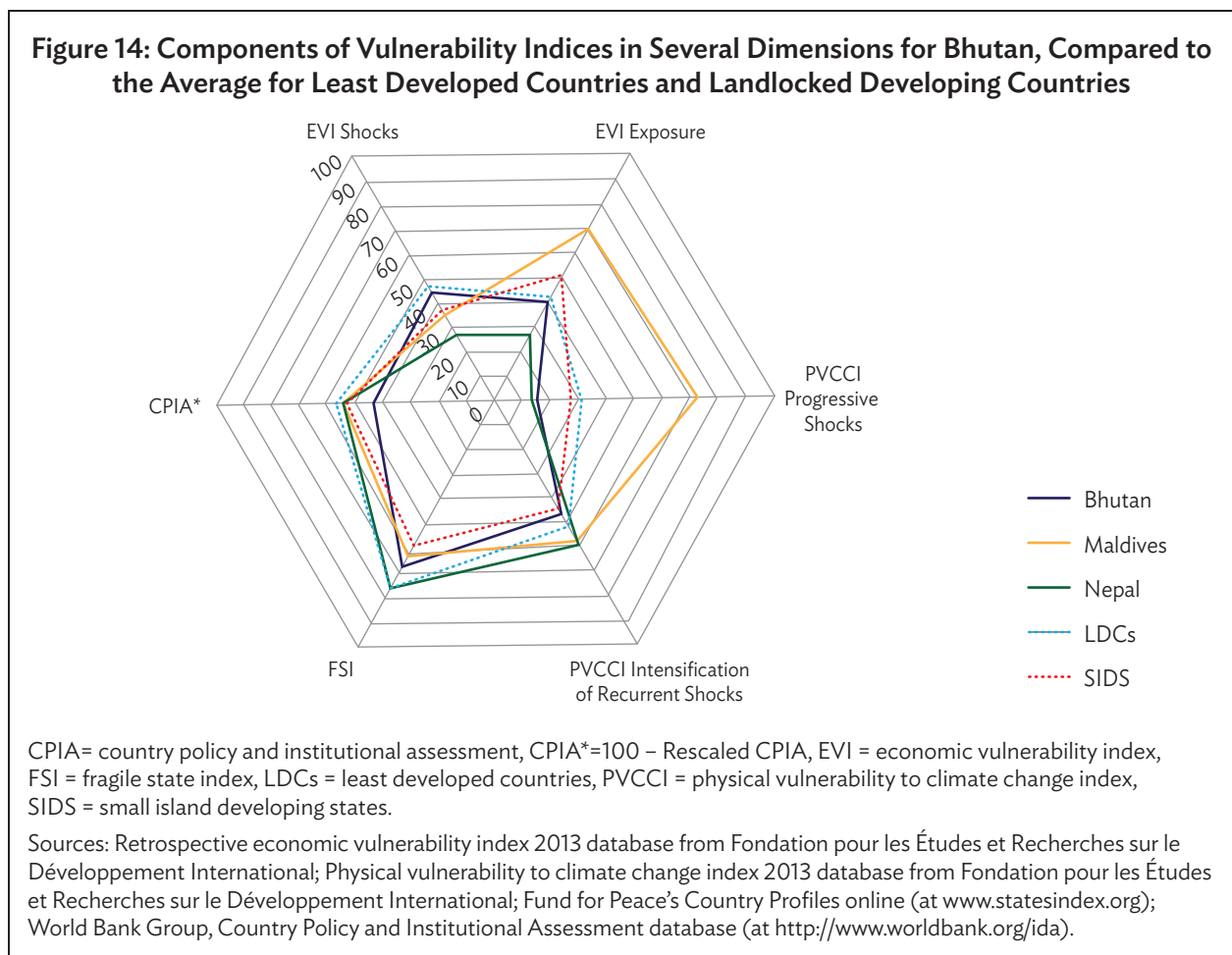
to the FSI of the Fund for Peace, which illustrates the difficulty in assessing state fragility. The internal violence index (IVI) clearly shows Nepal as the most fragile of the three countries, and Bhutan as the least fragile.

To summarize, each of the three countries seems the most vulnerable in one of the three dimensions of vulnerability: Bhutan for structural economic vulnerability, Maldives for physical vulnerability to climate change, Nepal for state fragility. Such a rough ranking depends on the validity of the indices used.



B. Linking the Indicators: Vulnerability Profile Rather than Aggregate Index

Since it is difficult to merge in a single index all the components of vulnerability, even only those of structural vulnerability, it appears more relevant to design a vulnerability profile such as that represented in Figure 10. The point is that the aggregation of too many heterogeneous indices in a composite index, although it is a popular exercise, blurs the meaning of the index. It is better to handle a small set of well specified indices, each of which relies on a small number of relevant and well identified components. A “vulnerability profile,”²⁷ which gathers such indices in a consistent framework and possibly supplements them by more qualitative information, is preferable to very broad and elusive composite indices.



²⁷ The usefulness of a “vulnerability profile” was recognized in 1999 by the expert group of the CDP which adopted the principle of using an EVI as a criterion for the identification of the LDCs. Vulnerability profiles are now regularly produced by UNCTAD during the process of identification of the LDCs eligible for graduation (more detail in Guillaumont, 2009). Such profiles give information supplementing the measurement and ranking of EVI, for that specific purpose, which is different from the broader present framework.

From this figure it appears that Bhutan exhibits a lower general vulnerability than Maldives, and lower than Nepal with respect to the CPIA, FSI, and PVCCI, but higher than Nepal with respect to the EVI as calculated at the United Nations. The figure also allows comparison of the vulnerability profile of each of the three countries with the average vulnerability profiles of the LDCs and the SIDS. For instance, Bhutan has

- (i) a structural economic vulnerability, close to the average of LDCs and LLDCs, both for the exposure and the size of the shocks (although with some high values for several components);
- (ii) a physical vulnerability to climate change lower than the average of these two groups, in particular for the vulnerability to progressive shocks, but with the omission of some specific possible factors of vulnerability, such as ice melting; and
- (iii) a lower state fragility, reflected both by the CPIA and the FSI and corresponding to a part of Bhutan's resilience to exogenous shocks.

Box 4: From Vulnerability Assessment to Graduation Prospects

The possibility and difficulties of mixing the economic vulnerability index (EVI) and the physical vulnerability to climate change index were examined. Any other mix of the various components of the structural vulnerability in its economic, climatic, and political dimensions is conceivable. In particular, it would be possible to include the structural resilience resulting from the levels of human capital, with the structural handicap index (SHI), and from the level of income per capita in an even more mixed structural index. For instance, combining EVI, human assets index, and gross national income per capita in a synthetic measure, reflecting the structural likelihood of growth over a given future period, or what we call "natural expected future income," allows us to rank the least developed countries (LDCs) according to their prospects of graduation from the category. We find that Bhutan is the 5th or 7th out of 46 LDCs for which graduation has not yet been decided by the United Nations General Assembly (Drabo and Guillaumont 2014). And the estimation did not take into account the expected impact of the last hydroelectric power project. This mixed index still has a limited scope since it does not include components reflecting the physical vulnerability to climate change. As for structural components of state fragility, they would not add anything since they correspond to structural factors of resilience, which could already be taken into account with SHI.

Source: Author.

C. Improving Current Vulnerability Indices

The previous analyses relied on three main kinds of indices unequally recognized in the international community. Their application to Bhutan, Maldives, and Nepal has revealed some drawbacks in their design, and the need for revising or refining their content, if they are to be used in the formulation of international policies. It is particularly the case for the UN EVI used for the identification of the LDCs and proposed as an aid allocation criterion. We briefly recall here the main adjustments proposed for this index:

- (i) taking the relative share of the world population rather than the absolute number;
- (ii) using an ad hoc export concentration index, including the exports of goods and services, instead of only the exports of goods;
- (iii) adding the share of population threatened by flooding due to ice melting to share of the population living in low elevated coastal areas;
- (iv) replacing the share of population living in low elevated coastal areas by the average of this share and the share of the dryland areas in the total of nondesert areas (Guillaumont 2014b); and

- (v) calculating the instability of exports of goods and services on a 15-year period and from a trend estimated with explanatory variables, using not only the lagged value and time, but also the squared time.

As for the PVCCI, its present formulation and calculation should also be improved by a better measurement of the intensification of storms and typhoons, as well as by an assessment of the impact of ice melting.

D. Early Warning Systems: When Are They Relevant?

At the beginning and end of our conceptual framework we have noted the attempts to set up early warning systems to predict and possibly avoid growth collapses or external payments crises. Most recent papers (e.g., Dabla Norris and Gündüz 2014) use two approaches: (i) a multivariate probit model, where the dependent variable is the occurrence of the shock event and the explanatory variables are the various likely factors (policy, institutions, and size of the exogenous shocks); and (ii) a calculation of a vulnerability index from bivariate probit regressions, the results of which are used as weights for the index. In that case three groups of factors are examined: (i) overall economy and institutions (e.g., CPIA), (ii) external sector (e.g., reserve coverage and lagged export growth), and (iii) fiscal sector (e.g., government budget balance and public debt). In both cases the estimations are made from pooled data covering a large set of years and countries. “The results show that country fundamentals, exchange rate regimes, institutional quality, and the size of shocks are important determinants of growth crises in low income countries” (Dabla Norris and Gündüz 2014).

Box 5: Is There a Risk of Dutch Disease in Bhutan?

One risk is that of climatic shocks, which affects both agricultural and hydropower production, the latter being also dependent on the Indian demand. Moreover, the emerging activities of tourism and manufacturing are also dependent on India’s activity, as well as the world demand and the real rate of exchange. In the case of Bhutan, whose currency (ngultrum) is pegged to the Indian rupee, one might wonder whether there is a risk of an overvaluation. The risk could either come (i) from an overvaluation of the Indian rupee itself, again underlining the dependence on the Indian economy, but with limited impact on Bhutan exports due to the high concentration of trade with India; or (ii) from an overvaluation with regard to the Indian rupee, which has a moderate probability due to the high correlation observed in the past between price movements in Bhutan and India. But if there is a rise in domestic demand based on hydropower investment and production, there might be a risk of an increase of the price of domestic (not tradable) goods, a so-called Dutch disease, like if Bhutan was an oil exporter. A risk is not a curse, and an overvaluation can be avoided by an appropriate use of additional resources to increase the supply of domestic goods. The risk depends on the quality of governance, which in Bhutan is assumed to be high.

Source: Author.

These models offer useful general lessons, but their results do not seem very informative when applied to the three countries. For instance, Bhutan did not suffer from a growth crisis as defined by the authors, and the overall vulnerability index drawn from the second approach barely deviates from the minimum level. This does not mean that Bhutan is not vulnerable, even in the short term, but its vulnerability results from structural and specific factors, as explained in this report. It does not mean that the early warning is useless to reduce vulnerability, but its most useful application may be with regard to geo-climatic events. The Nepal earthquake might have led to less tragic consequences if a better use of the information available about the risk had been made, although there is always a huge

uncertainty about the temporal proximity of the risk. But as well documented by the work of the ICIMOD, very useful early warning systems can be implemented to learn about the proximity of river floods in countries such as Nepal and Bhutan.

E. Final Remarks

The purpose of this study was to design a conceptual framework of the various kinds of vulnerability, mainly the structural ones, which are likely to affect LDCs, in particular in Asia, and applicable to Bhutan, Maldives, and Nepal. Two difficulties have been met.

One difficulty is both to have a conceptual framework general enough to make comparisons between countries, mainly LDCs, and to capture specific country features of vulnerability. In order to design a general framework acceptable for international comparisons, we have started from agreed measures of the various kinds of vulnerability and tried to combine them consistently. But the application to the three countries has led to consideration of some possible improvements or component additions to the usual measures, such as the UN EVI. Case studies lead to improvements in general concepts and measures.

A second difficulty is to establish a link between the assessment of the structural vulnerabilities, which concern a long period or are likely to affect long-term growth, and the estimation of the risk of occurrence of a growth collapse or a payments crisis in the short term. Short-term risks depend not only on the structural vulnerabilities, but also on specific dated exogenous events and current macroeconomic situation, the latter being linked to the current policy rather than to structural features. Attempts to predict a short-term risk through early warning systems neglect structural vulnerability. Structural vulnerability analyses fail to be used as early warning of specific events. For each country, only an exchange with local authorities permits casting light on the link between specific structural vulnerabilities and current economic policy. Let us flag major vulnerabilities as they appear.

For now it seems that the main structural vulnerability of Bhutan, linked to its small population size and its geographical location, is the persistently strong concentration of its exports on hydropower to India. To some extent it makes the vulnerability of Bhutan determined by that of India. Another vulnerability, which is difficult to assess and common to Bhutan and Nepal, is that resulting from the impact of global warming on ice melting. As for Nepal, a major vulnerability is that resulting from the huge and increasing share of remittances in foreign exchange earnings and GDP, but the 2015 earthquake revealed an even more structural vulnerability. A similar vulnerability was revealed in Maldives by the 2004 tsunami, with quite a lesser impact. In Maldives, while the long-term vulnerability is indeed that resulting from the sea level rise, the expansion of tourism receipts can remain the major source of economic growth for several decades. It also creates a short- and medium-term vulnerability to external demand, involving appropriate macroeconomic management, as for any resource-rich country.

Appendix 1: Selected Indicators on Vulnerability

Table A1: EVI in 2011, According to the UN CDP 2012 Definition, and Change from 2000 to 2011 for Present and Former LDCs

EVI 2011 (2012 definition)									
Country	Exposure index		Shock index		EVI 2011		Change in exposure index (Exposure index 2011 – Exposure index 2000)	Change in shock index (Shock index 2011 – Shock index 2000)	Change in EVI (EVI 2011–EVI 2000)
	Value	Rank	Value	Rank	Value	Rank			
Afghanistan	26.04	1	48.93	33	37.48	17	-11.07	14.10	1.52
Angola	38.06	21	61.34	42	49.70	35	0.32	-3.26	-1.47
Bangladesh	34.40	13	28.51	6	31.46	6	-5.11	-0.90	-3.00
Benin	37.85	20	31.70	10	34.78	8	-6.95	-13.30	-10.13
Bhutan	40.37	26	44.50	28	42.43	24	-7.23	6.45	-0.39
Botswana	47.12	39	34.54	14	40.83	21	2.63	-11.27	-4.32
Burkina Faso	34.99	15	38.85	19	36.92	16	-2.70	-12.11	-7.40
Burundi	42.18	31	65.64	45	53.91	43	-6.02	10.59	2.28
Cambodia	41.91	29	58.76	40	50.34	37	-5.51	-23.25	-14.38
Cape Verde	43.10	33	27.16	4	35.13	9	-1.29	-5.03	-3.16
Central African Republic	43.43	35	19.11	1	31.27	4	-5.04	2.17	-1.43
Chad	37.68	19	74.33	47	56.01	46	-4.24	35.96	15.86
Comoros	57.32	44	38.45	18	47.89	33	-0.98	-14.53	-7.75
Democratic Republic of the Congo	29.68	8	45.72	30	37.70	18	-5.59	1.66	-1.97
Djibouti	48.09	40	44.13	27	46.11	31	1.65	-24.24	-11.29
Equatorial Guinea	43.13	34	41.12	24	42.12	22	-4.08	-14.65	-9.37
Eritrea	29.27	6	88.70	51	58.99	47	-0.72	...	....
Ethiopia	30.13	9	32.63	13	31.38	5	-5.81	...	...
Gambia	49.78	42	84.90	50	67.34	50	-2.28	37.08	17.40
Guinea	34.59	14	20.27	2	27.43	3	-1.34	3.31	0.98
Guinea-Bissau	58.02	45	61.64	43	59.83	48	1.41	-4.92	-1.76
Haiti	35.14	16	54.17	38	44.65	26	2.95	-0.01	1.47
Kiribati	85.50	51	78.75	49	82.13	51	2.36	-7.65	-2.65
Lao People's Democratic Republic	35.38	17	36.03	16	35.71	12	-7.58	-28.72	-18.15
Lesotho	44.56	38	39.82	21	42.19	23	-0.88	-3.35	-2.11
Liberia	49.30	41	53.60	37	51.45	40	-2.16	-22.93	-12.54
Madagascar	33.56	10	40.10	22	36.83	15	-1.59	14.04	6.22
Malawi	41.55	28	54.51	39	48.03	34	-3.30	-4.72	-4.01
Maldives	69.26	49	34.96	15	52.11	41	1.81	22.58	12.19
Mali	38.14	22	32.47	12	35.31	10	-1.57	4.10	1.27
Mauritania	43.56	36	47.79	32	45.67	30	-4.65	22.38	8.87
Mozambique	39.62	25	51.13	34	45.37	29	0.96	-4.88	-1.96

continued on next page

Table A1 continued

Country	Exposure index		Shock index		EVI 2011		Change in exposure index (Exposure index 2011 – Exposure index 2000)	Change in shock index (Shock index 2011 – Shock index 2000)	Change in EVI (EVI 2011–EVI 2000)
	Value	Rank	Value	Rank	Value	Rank			
Myanmar	34.24	12	46.00	31	40.12	20	-6.74	11.50	2.38
Nepal	26.80	2	27.44	5	27.12	2	-7.06	-5.34	-6.20
Niger	34.09	11	41.68	25	37.89	19	-1.94	-7.97	-4.95
Rwanda	38.76	24	51.16	35	44.96	27	-3.98	-4.75	-4.37
<i>Samoa</i>	68.97	48	32.06	11	50.51	38	-0.93	-13.41	-7.17
Sao Tome and Principe	55.84	43	29.96	8	42.90	25	-2.53	-24.78	-13.65
Senegal	35.79	18	37.03	17	36.41	14	-1.32	-4.32	-2.82
Sierra Leone	41.01	27	59.11	41	50.06	36	-3.65	4.70	0.53
Solomon Islands	61.95	47	39.80	20	50.88	39	-1.10	-5.51	-3.31
Somalia	42.83	32	51.17	36	47.00	32	-3.25	-25.34	-14.30
Sudan	29.52	7	75.24	48	52.38	42	2.63	-1.96	0.34
United Republic of Tanzania	26.81	3	26.90	3	26.86	1	-2.86	-2.78	-2.82
Timor-Leste	43.65	37	64.18	44	53.91	44	-7.01	...	...
Togo	38.34	23	28.76	7	33.55	7	-0.97	-9.93	-5.45
Tuvalu	81.29	50	40.90	23	61.10	49	2.99	-22.64	-9.83
Uganda	28.60	5	42.79	26	35.69	11	-8.17	-16.16	-12.16
Vanuatu	59.97	46	30.54	9	45.25	28	0.28	-20.37	-10.04
Yemen	27.11	4	44.72	29	35.92	13	-5.17	-17.63	-11.40
Zambia	41.96	30	67.25	46	54.60	45	1.66	17.05	9.36

... = no available data, CDP = Committee for Development Policy, EVI = economic vulnerability index, LDCs = least developed countries, UN = United Nations.

Note: Bhutan, Maldives, and Nepal in **bold** and former LDCs in *italics*.

Source: Fondation pour les Études et Recherches sur le Développement International.

Table A2: Bis. EVI in 2011, According to the UN CDP 2006 Definition, and Change from 2000 to 2011 for Present and Former LDCs

Country	Exposure index		Shock index		EVI 2011		Change in exposure index (Exposure index 2011 – Exposure index 2000)	Change in Shock Index (Shock index 2011 – Shock index 2000)	Change in EVI (EVI 2011–EVI 2000)
	Value	Rank	Value	Rank	Value	Rank			
Afghanistan	28.74	3	40.41	34	34.57	9	-16.25	9.32	-3.47
Angola	44.28	21	40.44	35	42.36	28	-1.82	-19.71	-10.76
Bangladesh	14.80	1	22.61	7	18.70	1	-6.10	-1.53	-3.82
Benin	41.35	16	31.30	19	36.32	13	-5.02	-6.57	-5.80
Bhutan	56.50	37	42.62	37	49.56	38	-9.57	18.66	4.55
Botswana	65.59	43	32.40	24	49.00	34	-0.03	1.77	0.87
Burkina Faso	44.23	20	39.77	33	42.00	26	0.68	7.14	3.91
Burundi	52.26	32	53.70	44	52.98	39	-5.94	15.61	4.83
Cambodia	34.77	11	30.99	16	32.88	8	-6.18	-43.31	-24.75
Cape Verde	57.84	40	21.77	6	39.81	19	-6.66	-5.85	-6.25
Central African Republic	57.59	39	25.56	10	41.58	24	-3.03	3.42	0.20
Chad	47.92	24	67.65	48	57.79	46	-6.64	34.59	13.98
Comoros	72.76	46	34.70	27	53.73	41	-6.75	-9.77	-8.26
Democratic Republic of the Congo	34.06	8	49.87	43	41.96	25	-2.39	3.97	0.79
Djibouti	52.31	33	32.00	23	42.16	27	-0.01	-32.63	-16.32
Equatorial Guinea	61.91	42	31.77	22	46.84	32	-5.77	-23.40	-14.59
Eritrea	49.03	28	76.62	50	62.83	49	7.93	...	...
Ethiopia	31.94	5	15.20	2	23.57	3	-5.77	...	...
Gambia	53.79	34	85.30	51	69.54	50	-1.24	36.76	17.76
Guinea	40.60	15	9.36	1	24.98	4	-3.89	1.28	-1.30
Guinea-Bissau	61.85	41	46.53	41	54.19	43	-4.15	-16.53	-10.34
Haiti	39.76	14	33.39	26	36.57	14	-1.72	-26.55	-14.14
Kiribati	84.68	51	60.95	46	72.82	51	8.03	-0.98	3.52
Lao People's Democratic Republic	42.58	18	35.74	28	39.16	16	-8.91	-25.80	-17.36
Lesotho	56.95	38	21.31	5	40.62	21	-1.56	2.34	-0.10
Liberia	56.33	36	26.28	12	41.31	23	-2.23	-46.49	-24.36
Madagascar	39.06	13	40.47	36	39.77	18	-3.71	17.58	6.94
Malawi	48.51	26	38.92	31	43.72	29	-6.46	-15.98	-11.22
Maldives	66.01	44	32.78	25	49.40	36	1.24	9.48	5.36
Mali	47.74	23	31.61	21	39.67	17	-1.10	5.85	2.37
Mauritania	47.96	25	44.20	39	46.08	31	-3.59	25.80	11.10
Mozambique	41.76	17	31.54	20	36.65	15	-1.16	-10.63	-5.90

continued on next page

Table A2 *continued*

Country	Exposure index		Shock index		EVI 2011		Change in exposure index (Exposure index 2011 – Exposure index 2000)	Change in shock index (Shock index 2011 – Shock index 2000)	Change in EVI (EVI 2011–EVI 2000)
	Value	Rank	Value	Rank	Value	Rank			
Myanmar	25.85	2	55.94	45	40.89	22	-6.10	9.87	1.89
Nepal	32.42	6	25.26	9	28.84	5	-6.69	-10.24	-8.47
Niger	43.54	19	20.72	4	32.13	7	-2.00	-6.72	-4.36
Rwanda	48.61	27	31.06	18	39.84	20	-3.46	-8.73	-6.09
<i>Samoa</i>	80.27	49	28.10	14	54.18	42	2.82	-13.42	-5.30
Sao Tome and Principe	73.17	47	25.75	11	49.46	37	-1.70	-2.69	-2.19
Senegal	34.25	9	36.83	29	35.54	10	-1.48	7.95	3.23
Sierra Leone	49.85	29	38.47	30	44.16	30	-5.38	-13.45	-9.41
Solomon Islands	72.56	45	43.06	38	57.81	47	0.26	4.20	2.23
Somalia	52.09	31	45.93	40	49.01	35	-5.16	-31.73	-18.44
Sudan	35.27	12	71.65	49	53.46	40	1.33	-1.21	0.06
United Republic of Tanzania	30.51	4	16.56	3	23.54	2	-4.41	-4.26	-4.34
Timor-Leste	54.66	35	62.67	47	58.67	48	-8.18	...	...
Togo	47.18	22	24.51	8	35.85	12	-1.60	-9.55	-5.57
Tuvalu	84.26	50	30.89	15	57.57	45	13.13	-44.30	-15.59
Uganda	34.33	10	27.03	13	30.68	6	-6.69	-17.19	-11.94
Vanuatu	79.33	48	30.99	17	55.16	44	2.30	-15.22	-6.46
Yemen	32.61	7	38.96	32	35.79	11	-6.82	-33.36	-20.09
Zambia	49.86	30	47.58	42	48.72	33	-0.85	20.84	9.99

... = no available data, CDP = Committee for Development Policy, EVI = economic vulnerability index, LDCs = least developed countries, UN = United Nations.

Note: Bhutan, Maldives, and Nepal in **bold** and former LDCs in *italics*.

Source: Fondation pour les Études et Recherches sur le Développement International.

Table A3: Impact of the Change in the “Environment Component” of EVI on EVI Ranking among LDCs and Former LDCs

Country	EVI 2012 (According to official definition)		EVI (Using maximum of LECZ/Dryland)		Difference in ranking (2)=[C]-[A]	EVI (Using mean of LECZ/Dryland)		Difference in ranking (3)=[D]-[A]
	Value	Rank [A]	Value	Rank [C]		Value	Rank [D]	
Afghanistan	37.5	17	48.8	29	12	43.1	22	5
Angola	49.7	35	52.0	37	2	50.9	40	5
Bangladesh	31.5	6	31.5	4	-2	27.2	3	-3
Benin	34.8	8	34.8	7	-1	34.2	7	-1
Bhutan	42.4	24	42.4	16	-8	42.4	21	-3
<i>Botswana</i>	40.8	21	53.3	40	19	47.1	31	10
Burkina Faso	36.9	16	47.7	25	9	42.3	20	4
Burundi	53.9	43	53.9	41	-2	53.9	43	0
Cambodia	50.3	37	50.3	31	-6	47.5	32	-5
<i>Cape Verde</i>	35.1	9	45.4	21	12	40.3	15	6
Central African Republic	31.3	4	31.9	5	1	31.6	5	1
Chad	56.0	46	67.5	48	2	61.8	48	2
Comoros	47.9	33	47.9	26	-7	46.6	30	-3
Democratic Republic of the Congo	46.1	31	51.4	35	4	48.7	35	4
Djibouti	37.7	18	37.7	11	-7	37.7	12	-6
Equatorial Guinea	42.1	22	42.1	15	-7	41.5	18	-4
Eritrea	59.0	47	71.1	50	3	65.0	49	2
Ethiopia	31.4	5	38.3	12	7	34.8	8	3
Gambia	67.3	50	71.0	49	-1	69.2	50	0
Guinea	27.4	3	27.4	2	-1	26.7	1	-2
Guinea-Bissau	59.8	48	59.8	45	-3	57.4	46	-2
Haiti	44.7	26	44.7	18	-8	44.4	25	-1
Kiribati	82.1	51	82.1	51	0	75.9	51	0
Lao People's Democratic Republic	35.7	12	35.7	8	-4	35.7	9	-3
Lesotho	42.2	23	45.5	22	-1	43.8	23	0
Liberia	51.5	40	51.5	36	-4	50.1	39	-1
Madagascar	36.8	15	37.6	10	-5	37.2	11	-4
Malawi	48.0	34	48.4	28	-6	48.2	34	0
<i>Maldives</i>	52.1	41	52.1	38	-3	45.9	29	-12
Mali	35.3	10	46.5	24	14	40.9	17	7
Mauritania	45.7	30	52.8	39	9	49.3	37	7
Mozambique	45.4	29	45.9	23	-6	45.6	28	-1

continued on next page

Table A3 *continued*

Country	EVI 2012 (According to Official Definition)		EVI (Using Maximum of LECZ/Dryland)		Difference in Ranking (2)=[C]-[A]	EVI (Using Mean of LECZ/Dryland)		Difference in Ranking (3)=[D]-[A]
	Value	Rank [A]	Value	Rank [C]		Value	Rank [D]	
Myanmar	40.1	20	40.1	13	-7	37.8	13	-7
Nepal	27.1	2	27.1	1	-1	27.1	2	0
Niger	37.9	19	50.4	32	13	44.1	24	5
Rwanda	45.0	27	45.0	19	-8	45.0	27	0
<i>Samoa</i>	50.5	38	50.5	33	-5	47.6	33	-5
Sao Tome and Principe	42.9	25	42.9	17	-8	40.6	16	-9
Senegal	36.4	14	41.3	14	0	38.8	14	0
Sierra Leone	50.1	36	50.1	30	-6	49.2	36	0
Solomon Islands	50.9	39	50.9	34	-5	49.4	38	-1
Somalia	47.0	32	58.6	44	12	52.8	41	9
Sudan	52.4	42	64.7	47	5	58.6	47	5
United Republic of Tanzania	26.9	1	31.0	3	2	28.9	4	3
Timor-Leste	53.9	44	53.9	42	-2	53.6	42	-2
Togo	33.5	7	33.5	6	-1	32.5	6	-1
Tuvalu	61.1	49	61.1	46	-3	54.8	44	-5
Uganda	35.7	11	37.3	9	-2	36.5	10	-1
Vanuatu	45.3	28	45.3	20	-8	44.8	26	-2
Yemen	35.9	13	48.0	27	14	42.0	19	6
Zambia	54.6	45	57.3	43	-2	55.9	45	0

EVI = economic vulnerability index, LDCs = least developed countries, LECZ = low elevation coastal zone.

Note: Bhutan, Maldives, and Nepal in **bold** and former LDCs in *italics*.

Source: Fondation pour les Études et Recherches sur le Développement International.

**Table A4: Ranking Differences between LDCs and Former LDCs
for Two Substitute Indicators, Homeless and Victims of Disasters, 2011**

Country	Victims		Homeless		Difference in Ranking [A]-[B]
	Value	Rank [A] ⁽¹⁾	Value	Rank [B] ⁽²⁾	
Afghanistan	73.16	27	50.77	21	+6
Angola	55.93	13	51.53	22	-9
Bangladesh	93.31	46	75.27	42	+4
Benin	72.30	25	73.63	39	-14
Bhutan	63.70	16	36.80	13	+3
<i>Botswana</i>	65.78	19	63.45	31	-12
Burkina Faso	52.71	10	0.00	1	+9
Burundi	85.39	38	53.71	24	+14
Cambodia	95.25	48	64.48	32	+16
<i>Cape Verde</i>	67.33	23	57.97	27	-4
Central African Republic	36.89	6	66.08	35	-29
Chad	81.40	32	55.68	25	+7
Comoros	80.59	31	79.63	46	-15
Democratic Republic of the Congo	37.83	7	47.50	19	-12
Djibouti	96.00	49	72.29	36	+13
Equatorial Guinea	6.42	3	31.52	8	-5
Eritrea	96.20	50	43.71	17	+33
Ethiopia	81.42	33	41.74	14	+19
Gambia	55.62	12	52.37	23	-11
Guinea	49.38	8	5.33	3	+5
Guinea-Bissau	71.16	24	46.81	18	+6
Haiti	88.68	40	81.97	47	-7
Kiribati	91.11	44	31.83	9	+35
Lao People's Democratic Republic	85.30	37	90.72	51	-14
Lesotho	85.69	39	18.83	4	+35
Liberia	65.79	21	33.00	11	+10
Madagascar	78.62	30	76.35	44	-14
Malawi	96.58	51	60.88	29	+22
<i>Maldives</i>	50.66	9	43.37	16	-7
Mali	66.88	22	65.42	33	-11
Mauritania	88.93	42	73.70	40	+2
Mozambique	90.30	43	60.08	28	+15

continued on next page

Table A4 *continued*

Country	Victims		Homeless		Difference in Ranking [A]-[B]
	Value	Rank [A] ⁽¹⁾	Value	Rank [B] ⁽²⁾	
Myanmar	57.99	14	88.56	50	-36
Nepal	65.63	18	73.18	38	-20
Niger	92.56	45	32.36	10	+35
Rwanda	72.66	26	35.03	12	+14
<i>Samoa</i>	83.08	35	86.32	49	-14
Sao Tome and Principe	0.00	1	0.00	1	0
Senegal	63.80	17	50.19	20	-3
Sierra Leone	53.42	11	26.2	5	+6
Solomon Islands	75.66	29	83.64	48	-19
Somalia	93.78	47	74.57	41	+6
Sudan	83.26	36	72.38	37	-1
United Republic of Tanzania	74.66	28	42.1	15	+13
Timor-Leste	34.46	5	28.71	6	-1
Togo	60.82	15	61.24	30	-15
Tuvalu	0.00	1	75.94	43	-42
Uganda	65.79	20	56.8	26	-6
Vanuatu	81.7	34	77.65	45	-11
Yemen	31.66	4	65.63	34	-30
Zambia	88.83	41	31.34	7	+34

LDCs = least developed countries.

Note: Bhutan, Maldives, and Nepal in **bold** and former LDCs in *italics*.

⁽¹⁾ Ranking made from the country with the fewest number of victims to the country with the highest number of victims.

⁽²⁾ Ranking made from the country with the fewest number of the homeless to the country with the highest number of the homeless.

Source: Fondation pour les Études et Recherches sur le Développement International.

**Table A5: PVCCI 2012 and Its Two Main Components
for Present and Former LDCs**

Country	Progressive Shocks		Intensification of Recurrent Shocks		PVCCI	
	Value	Rank	Value	Rank	Value	Rank
Afghanistan	56.91	47	54.97	32	55.95	+46
Angola	28.21	30	60.29	44	47.07	+33
Bangladesh	13.00	2	60.67	45	43.87	+27
Benin	24.88	25	47.99	18	38.22	+14
Bhutan	15.17	5	46.10	12	34.31	+6
<i>Botswana</i>	60.87	50	50.29	23	55.83	+45
Burkina Faso	50.71	36	56.48	36	53.67	+41
Burundi	23.33	23	71.97	51	53.50	+40
Cambodia	19.00	13	56.90	37	42.42	+24
<i>Cape Verde</i>	50.59	35	50.21	22	50.40	+35
Central African Republic	14.87	4	44.06	7	32.88	+4
Chad	52.39	38	53.35	28	52.87	+39
Comoros	29.43	32	28.96	1	29.19	+3
Democratic Republic of the Congo	18.21	11	43.54	6	33.37	+5
Djibouti	53.50	42	38.86	5	46.76	+31
Equatorial Guinea	18.06	9	47.10	15	35.67	+9
Eritrea	50.15	34	46.43	14	48.33	+34
Ethiopia	35.41	33	45.53	10	40.79	+20
Gambia	51.79	37	58.03	41	55.00	+43
Guinea	20.87	14	53.01	27	40.28	+18
Guinea-Bissau	22.28	20	62.39	47	46.84	+32
Haiti	25.19	26	50.33	24	39.80	+16
Kiribati	54.99	43	34.64	3	45.96	+30
Lao People's Democratic Republic	11.74	1	63.52	48	45.68	+28
Lesotho	22.02	19	49.60	21	38.37	+15
Liberia	18.96	12	47.16	16	35.94	+10
Madagascar	22.76	22	53.77	29	41.29	+21
Malawi	25.59	27	51.37	26	40.58	+19
<i>Maldives</i>	72.33	51	57.64	40	65.40	+51
Mali	52.59	39	51.06	25	51.83	+37
Mauritania	56.01	44	57.28	38	56.65	+48
Mozambique	26.91	28	55.25	33	43.46	+26

continued on next page

Table A5 *continued*

Country	Progressive Shocks		Intensification of Recurrent Shocks		PVCCI	
	Value	Rank	Value	Rank	Value	Rank
Myanmar	16.37	6	56.47	35	41.57	+22
Nepal	13.17	3	59.60	43	43.16	+25
Niger	56.88	46	55.49	34	56.19	+47
Rwanda	21.99	18	54.63	31	41.64	+23
<i>Samoa</i>	<i>21.16</i>	<i>15</i>	<i>34.64</i>	<i>3</i>	<i>28.71</i>	<i>+2</i>
Sao Tome and Principe	18.18	10	71.29	50	52.02	+38
Senegal	53.29	40	54.22	30	53.76	+42
Sierra Leone	24.65	24	46.11	13	36.97	+11
Solomon Islands	22.60	21	47.86	17	37.43	+12
Somalia	53.32	41	57.44	39	55.42	+44
Sudan	58.24	49	62.09	46	60.20	+49
United Republic of Tanzania	28.81	31	48.45	19	39.86	+17
Timor-Leste	18.03	8	33.24	2	26.74	+1
Togo	17.93	7	46.06	11	34.95	+8
Tuvalu	57.36	48	44.34	9	51.27	+36
Uganda	21.92	17	48.89	20	37.88	+13
Vanuatu	21.67	16	44.14	8	34.77	+7
Yemen	56.25	45	66.47	49	61.57	+50
Zambia	28.21	29	58.45	42	45.89	+29

LDCs = least developed countries, PVCCI = physical vulnerability to climate change index.

Note: Ranking made from the less vulnerable country to the most vulnerable country.

Bhutan, Maldives, and Nepal in **bold** and former LDCs in *italics*.

Source: Fondation pour les Études et Recherches sur le Développement International.

**Table A6: PVCCI in Three Asian Countries.
Value and Rank for Each Component and Subcomponent**

Indices	Bhutan		Maldives		Nepal	
	Value	Rank	Value	Rank	Value	Rank
PVCCI	34.3	6	65.4	51	43.2	25
Progressive shocks	15.2	5	72.3	51	13.2	3
Intensification of recurrent shocks	46.1	12	57.6	40	59.6	43
Flooding due to SLR	0.0	1 ^a	100.0	51	0.0	1 ^a
Increasing aridity	21.5	5	21.5	6	18.6	3
Rainfall	20.8	3	63.9	30	63.6	47
Temperature	61.8	40	50.6	42	55.3	29
Share of drylands	0.0	1 ^a	0.0	1 ^a	0.0	1 ^a
Rainfall instability	31.3	9 ^a	68.8	35	100.0	51
Temperature instability	69.6	41 ^a	73.9	44 ^a	47.8	21
Trend in temperature	10.2	8	19.6	15	8.1	7
Trend in rainfall	75.5	37	66.4	1 ^a	66.4	1 ^a
Trend in rainfall instability	10.4	2	32.4	6 ^a	27.2	5
Trend in temperature instability	54.0	4 ^a	54.0	4 ^a	62.8	41

PVCCI = physical vulnerability to climate change index, SLR = sea level rise.

^a The country has the same rank with at least one another country.

Source: Fondation pour les Études et Recherches sur le Développement International. Physical vulnerability to climate change.

Table A7: Composite Indicators of State Fragility in LDCs and Former LDCs

Country	Composite indicators of state fragility							
	CPIA index score 2011 [A]		CPIA index score 2012 [B]		CPIA index score 2013 [C]		FSI 2013 [D]	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank
Afghanistan	2.68	41	2.68	42	2.65	43	106.7	43
Angola	2.69	40	2.67	43	2.67	42	87.1	20
Bangladesh	3.28	22	3.28	20	3.27	21	92.5	31
Benin	3.47	11	3.47	12	3.51	10	77.9	6
Bhutan	3.85	3	3.68	9	3.68	8	81.8	10
<i>Botswana</i>	-	-	-	-	-	-	64.0	1
Burkina Faso	3.77	6	3.77	5	3.77	5	90.2	26
Burundi	3.11	28	3.24	24	3.24	24	97.6	36
Cambodia	3.41	17	3.45	14	3.43	15	88.0	22
<i>Cape Verde</i>	4.01	2	3.92	2	3.94	2	73.7	3
Central African Republic	2.76	39	2.71	40	2.50	46	105.3	41
Chad	2.43	44	2.51	45	2.60	44	109.0	45
Comoros	2.65	43	2.78	38	2.76	41	84.0	15
Djibouti	3.18	27	3.09	27	3.09	27	85.5	17
Democratic Republic of the Congo	2.67	42	2.71	40	2.88	38	111.9	47
Equatorial Guinea	-	-	-	-	-	-	86.1	18
Eritrea	2.16	46	2.08	47	1.99	48	95.0	33
Ethiopia	3.46	13	3.44	15	3.44	13	98.9	37
Gambia	3.47	11	3.35	19	3.27	21	81.8	11
Guinea	2.86	37	2.97	33	2.97	33	101.3	40
Guinea-Bissau	2.83	38	2.62	44	2.53	45	101.1	39
Haiti	2.90	36	2.90	36	2.83	39	105.8	42
Kiribati	3.03	30	2.88	37	2.91	37	-	-
Lao People's Democratic Republic	3.36	19	3.40	17	3.36	19	83.7	14
Lesotho	3.43	16	3.48	11	3.47	11	79.4	7
Liberia	3.03	30	3.06	28	3.13	26	95.1	34
Madagascar	3.23	25	3.04	30	3.02	31	82.7	12
Malawi	3.27	24	3.16	26	3.07	28	89.2	23
<i>Maldives</i>	3.33	20	3.28	20	3.23	25	75.4	5
Mali	3.64	10	3.38	18	3.38	17	89.3	25
Mauritania	3.20	26	3.23	25	3.29	20	91.7	29
Mozambique	3.68	9	3.73	7	3.62	9	82.8	13
Myanmar	-	-	-	-	2.95	35	94.6	32
Nepal	3.28	23	3.27	22	3.38	18	91.8	30
Niger	3.40	18	3.48	10	3.46	12	99.0	38
Rwanda	3.82	4	3.84	3	3.93	3	89.3	24
<i>Samoa</i>	4.10	1	4.06	1	4.00	1	68.7	2
Sao Tome and Principe	3.05	29	3.05	29	3.05	30	74.6	4
Senegal	3.78	5	3.82	4	3.82	4	81.4	9
Sierra Leone	3.31	21	3.27	22	3.27	21	91.2	27
Solomon Islands	2.93	35	2.96	35	2.93	36	85.2	16
Somalia	-	-	-	-	-	-	113.9	48
Sudan	2.36	45	2.32	46	2.36	47	111.0	46

continued on next page

Table A7 *continued*

Country	CPIA index score 2011 [A]		CPIA index score 2012 [B]		CPIA index score 2013 [C]		FSI 2013 [D]	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank
United Republic of Tanzania	3.70	8	3.75	6	3.76	6	81.1	8
Timor-Leste	3.02	32	3.02	31	3.06	29	91.5	28
Togo	2.99	33	2.97	33	2.97	33	87.8	21
Tuvalu	–	–	2.77	39	2.77	40	–	–
Uganda	3.77	6	3.72	8	3.72	7	96.6	35
Vanuatu	3.43	15	3.44	15	3.44	13	–	–
Yemen	2.98	34	2.99	32	2.99	32	107.0	44
Zambia	3.46	13	3.46	13	3.42	16	86.6	19

Country	IVI [E]		CIFP fragility score 2012 [F]		CIFP security and crime component 2012 [G]	
	Value	Rank	Value	Rank	Value	Rank
Afghanistan	52.7	50	7.05	47	8.77	49
Angola	17.7	32	5.67	15	3.35	27
Bangladesh	26.5	39	5.53	13	4.9	37
Benin	12.3	21	5.77	19	2.46	6
Bhutan	9.4	13	5.2	8	2.22	4
Botswana	10.0	15	4.46	2	2.32	5
Burkina Faso	11.2	18	5.71	17	3.21	24
Burundi	29.3	42	6.67	42	5.74	40
Cambodia	15.3	25	5.4	11	3.15	21
Cape Verde	5.5	9	4.9	5	3.82	32
Central African Republic	41.1	45	7.17	49	7.95	45
Chad	19.2	34	6.58	41	3.16	22
Comoros	3.7	6	5.94	24	3	18
Djibouti	12.0	19	5.92	22	2.71	12
Democratic Republic of the Congo	52.2	49	7.09	48	8.1	46
Equatorial Guinea	19.8	37	6.1	30	2.09	3
Eritrea	27.0	41	6.34	37	3.2	23
Ethiopia	33.2	43	6.52	39	7.14	42
Gambia	16.3	30	6.28	35	2.61	9
Guinea	16.3	29	6.52	39	3.11	19
Guinea-Bissau	9.3	12	6.92	45	5.17	38
Haiti	12.0	20	6.07	28	3.33	26
Kiribati	2.5	4	4.68	4	1.16	2
Lao People's Democratic Republic	9.4	14	5.74	18	3.23	25
Lesotho	16.2	28	5.3	9	2.91	17
Liberia	11.0	16	6.31	36	3.64	30
Madagascar	19.4	35	6.08	29	3.5	29
Malawi	11.1	17	5.82	20	2.83	16
Maldives	7.0	11	5.16	7	2.47	7
Mali	19.7	36	6.81	43	7.32	43
Mauritania	17.3	31	6.16	33	3.11	19
Mozambique	13.3	23	5.96	25	3.89	33

continued on next page

Table A7 *continued*

Country	IVI [E]		CIFP fragility score 2012 [F]		CIFP security and crime component 2012 [G]	
	Value	Rank	Value	Rank	Value	Rank
Myanmar	41.2	46	6.4	38	7.61	44
Nepal	24.5	38	5.69	16	5.47	39
Niger	12.5	22	6.17	34	4.67	36
Rwanda	37.3	44	6.12	32	6.73	41
<i>Samoa</i>	3.4	5	4.63	3	2.62	10
Sao Tome and Principe	1.3	3	6.01	27	4.06	34
Senegal	18.4	33	5.6	14	4.63	35
Sierra Leone	7.0	10	6.11	31	2.56	8
Solomon Islands	1.2	2	2.04	1	2.74	14
Somalia	57.4	51	7.81	50	8.8	50
Sudan	52.2	48	7.01	46	8.55	47
United Republic of Tanzania	15.4	26	5.51	12	2.75	15
Timor-Leste	4.2	8	5.92	22	3.68	31
Togo	14.0	24	5.98	26	2.66	11
Tuvalu	1.2	1	–	–	–	–
Uganda	26.6	40	5.91	21	3.39	28
Vanuatu	3.8	7	4.98	6	1.14	1
Yemen	51.8	47	6.83	44	8.59	48
Zambia	15.7	27	5.36	10	2.72	13

Country	Difference in ranking: Rank[C]–Rank[A]	Difference in ranking: Rank[C]–Rank[B]	Difference in ranking: Rank[C]–Rank[D]	Difference in ranking: Rank[E]–Rank[G]
Afghanistan	+2	+1	0	+1
Angola	+2	–1	+22	+5
Bangladesh	–1	+1	–10	+2
Benin	–1	–2	+4	+15
Bhutan	+5	–1	–2	+9
<i>Botswana</i>	–	–	–	+10
Burkina Faso	–1	0	–21	–6
Burundi	–4	0	–12	+2
Cambodia	–2	+1	–7	+4
<i>Cape Verde</i>	0	0	–1	–23
Central African Republic	+7	+6	+5	0
Chad	0	–1	–1	+12
Comoros	–2	+3	+26	–12
Djibouti	0	0	+10	+7
Democratic Republic of the Congo	–4	–2	–9	+3
Equatorial Guinea	–	–	–	+34
Eritrea	+2	+1	+15	+18
Ethiopia	0	–2	–24	+1
Gambia	+10	+2	+10	+21
Guinea	–4	0	–7	+10
Guinea-Bissau	+7	+1	+6	–26

continued on next page

Table A7 *continued*

Country	Difference in ranking: Rank[C]-Rank[A]	Difference in ranking: Rank[C]-Rank[B]	Difference in ranking: Rank[C]-Rank[D]	Difference in ranking: Rank[E]-Rank[G]
Haiti	+3	+3	-3	-6
Kiribati	+7	0	-	+2
Lao People's Democratic Republic	0	+2	+5	-11
Lesotho	-5	0	+4	+11
Liberia	-4	-2	-8	-14
Madagascar	+6	+1	+19	+6
Malawi	+4	+2	+5	+1
<i>Maldives</i>	+5	+5	+20	+4
Mali	+7	-1	-8	-7
Mauritania	-6	-5	-9	+12
Mozambique	0	+2	-4	-10
Myanmar	-	-	+3	+2
Nepal	-5	-4	-12	-1
Niger	-6	+2	-26	-14
Rwanda	-1	0	-21	+3
<i>Samoa</i>	0	0	-1	-5
Sao Tome and Principe	+1	+1	+26	-31
Senegal	-1	0	-5	-2
Sierra Leone	0	-1	-6	+2
Solomon Islands	+1	+1	+20	-12
Somalia	-	-	-	+1
Sudan	+2	+1	+1	+1
United Republic of Tanzania	-2	0	-2	+11
Timor-Leste	-3	-2	+1	-23
Togo	0	0	+12	+13
Tuvalu	-	+1	-	-
Uganda	+1	-1	-28	+12
Vanuatu	-2	-2	-	+6
Yemen	-2	0	-12	-1
Zambia	+3	+3	-3	+14

CIFP = country indicators for foreign policy, CPIA = country policy and institutional assessment, FSI = fragile state index, IVI = internal violence index, LDCs = least developed countries, PVCCI = physical vulnerability to climate change index.

Note: Bhutan, Maldives, and Nepal in **bold** and former LDCs in *italics*.

The ranking is made from less fragile to more fragile country.

Rank [A] excludes Botswana, Equatorial Guinea, Myanmar, Somalia, and Tuvalu.

Rank [B] excludes Botswana, Equatorial Guinea, Myanmar, and Somalia.

Rank [C] excludes Botswana, Equatorial Guinea, and Somalia.

Rank [D] excludes Kiribati, Tuvalu, and Vanuatu.

Rank [F] and Rank [G] exclude Tuvalu.

Sources: Fund for Peace's Country Profiles online (at www.statesindex.org); World Bank Group, Country Policy and Institutional Assessment database (at <http://www.worldbank.org/ida>); Fondation pour les Études et Recherches sur le Développement International; country indicators for foreign policy from Carleton University (at <http://www4.carleton.ca/cifp/>).

Appendix 2: Composite Indicators of Policy and State Fragility Used in Section V

1. Failed states index developed by the Fund for Peace

The failed states index (FSI) is based on the proprietary Conflict Assessment System Tool (CAST) analytical platform of the Fund for Peace. Using comprehensive social science methodology, data from three primary sources are triangulated and subjected to critical review to obtain final scores for the FSI. The following 12 primary social, economic, and political indicators of the CAST methodology, developed by the Fund for Peace, are used:

1. social indicators
 - a. demographic pressures
 - b. refugees and internally displaced persons
 - c. group grievance
 - d. human flight and brain drain
2. economic indicators
 - a. uneven economic development
 - b. poverty and economic decline
3. political and military indicators
 - a. state legitimacy
 - b. public services
 - c. human rights and rule of law
 - d. security apparatus
 - e. factionalized elites
 - f. external intervention

The rank order of the states is based on the total scores of the 12 indicators. For each indicator, the ratings are placed on a scale of 0 to 10, with 0 being the lowest intensity (most stable) and 10 being the highest intensity (least stable). The total score is the sum of the 12 indicators and is on a scale of 0–120.

2. Country policy and institutional assessment

The overall country score of the country policy and institutional assessment, as developed by the World Bank, is obtained from a set of 16 criteria grouped in four equally weighted clusters:

1. economic management
 - a. Monetary and exchange rate policies
 - b. fiscal policy
 - c. debt policy and management

2. structural policies
 - a. trade
 - b. financial sector
 - c. business regulatory environment
3. policies for social inclusion and equity
 - a. gender equality
 - b. equity of public resource use
 - c. building human resources
 - d. social protection and labor
 - e. policies and institutions for environmental sustainability
4. public sector management and institutions
 - a. property right and rule-based governance
 - b. quality of budgetary and financial management
 - c. efficiency of revenue mobilization
 - d. quality of public administration
 - e. transparency, accountability, and corruption in the public sector

For each of the 16 criteria, countries are rated on a scale of 1 (low) to 6 (high). The scores depend on the level of performance in a given year assessed against the criteria, rather than on changes in performance compared to the previous year. The ratings depend on actual policies and performance, rather than on promises or intentions.

For further information on the criteria, go to this page: <http://www.worldbank.org/ida/IRAI/2011/webFAQ11.pdf>

3. Country indicators for foreign policy

Country Indicators for Foreign Policy's fragile states index, developed by Carleton University, is obtained by grouping structural indicators into six clusters, capturing different facets of state fragility and robustness: governance, economics, security and crime, human development, demography, and environment. Global scores are distributed across a nine-point index. The best performing state receives a score of one, the worst a score of nine. The rest are continuously distributed between these two extremes based on relative performance.

To know more about the six clusters used for the computation of the global score, visit this page: http://www4.carleton.ca/cifp/ffs_indicator_descriptions.htm

4. Political stability and absence of violence measured by the worldwide governance indicators

Political stability and absence of violence, as measured by the Worldwide Governance Indicators, is one of the six broad dimensions of governance. It captures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political violence and terrorism.

For further information about the variables used to construct the indices, visit this page: <http://info.worldbank.org/governance/wgi/pdf/pv.pdf>

REFERENCES

- Andrimihaja, N. A., M. Cinyabuguma, and S. Devarajan. 2011. Avoiding the Fragility Trap in Africa. *World Bank Policy Research Working Paper*. No. 5884.
- Berg, A., J. D. Ostry, and J. Zettelmeyer. 2012. What Makes Growth Sustained? *Journal of Development Economics*. 98 (2). pp. 149–166.
- Boussichas, M., and Guillaumont, P., eds. 2015. *Financing Sustainable Development: Addressing Vulnerabilities*. Paris: Economica. p. 442.
- Bruckner, M. 2012. Climate Change Vulnerability and the Identification of Least Developed Countries. *UN CDP Background Paper*. No. 15.
- Brückner, M., and A. Ciccone. 2010. International Commodity Prices, Growth and the Outbreak of Civil War in Sub-Saharan Africa. *The Economic Journal*. 120 (544). pp. 519–534.
- Cadot O., C. Carrère, and V. Strauss-Kahn. 2013. Trade Diversification, Income, and Growth: What Do We Know? *Journal of Economic Surveys*. 29 (4).
- Cadot, O., M. Malouche, and S. Sáez. 2012. *Streamlining Non-tariff Measures: A Toolkit for Policy Makers*. World Bank Publications.
- Cariolle, J. 2011. The Economic Vulnerability Index: 2010 Update. *Ferdi Working Paper Innovative Indicators Series*. No. 109.
- . 2014. Corruption in Turbulent Times: a Response to Shocks? No. P106. FERDI.
- Cariolle, J., and M. Goujon. 2013. A Retrospective Economic Vulnerability Index, 1990–2011: Using the 2012 UN-CDP definitions. *Ferdi Working Paper Innovative Indicators Series*. No. 117.
- Cariolle, J., and P. Guillaumont. 2011. A Retrospective Economic Vulnerability Index: 2010 update. *Ferdi Policy Brief*. No. 17. <http://www.ferdi.fr/uploads/sfCmsContent/html/111/B17-Guillaumont-Cariolle.pdf>
- Cariolle, J., M. Goujon, and P. Guillaumont. 2014. *Has structural economic vulnerability decreased in Least Developed Countries? Lessons drawn from retrospective indices*. Ferdi.
- Carment, D., and Y. Samy. 2012. *Assessing State Fragility: A country Indicators for Foreign Policy Report*. Country Indicators for Foreign Policy. Ottawa: Carleton University.
- Chauvet, L., and P. Guillaumont. 2004. Aid and Growth Revisited: Policy, Economic Vulnerability and Political Instability. In annual World Bank Conference on Development Economics, *Europe 2003: Toward Pro-Poor Policies: Aid, Institutions, and Globalization*, ed. B. Tungodden, N. Stern, and I. Kolstad. Washington, DC: World Bank and New York: Oxford University Press.
- Collier, P. 2013. Aid as a catalyst for pioneer investment. *WIDER Working Paper* No. 2013/004.
- Combes, J. L., P. Guillaumont, S. G. Jeanneney, and P. M. Combes. 2000. Ouverture sur l'extérieur et instabilité des taux de croissance. *Revue française d'économie*, 15 (1), pp. 3–33.
- Congressional Research Service. 2006. *Annual Report for Fiscal Year 2006*.
- Dabla-Norris, E., and Y. B. Gündüz. 2014. Exogenous Shocks and Growth Crises in Low-Income Countries: A Vulnerability Index. *World Development*. 59. pp. 360–378.

- Drabo, A., and P. Guillaumont. 2014. Assessing the Prospects of Accelerated Graduation of the Least Developed Countries. In *LDC IV Monitor, Istanbul Programme of Action for the LDCs (2011–2020). Monitoring Deliverables, Tracking Progress—Analytical Perspectives*. pp. 71–103.
- Easterly, W., R. Islam, and J. E. Stiglitz. 2001. Shaken and Stirred: Explaining Growth Volatility. In *Annual World Bank Conference on Development Economics*, 191–211. Washington, DC: The World Bank.
- Feindouno, S., M. Goujon, and L. Wagner. 2016. Internal Violence Index: A Composite and Quantitative Measure of Internal Violence and Crime in Developing Countries (No. P151).
- Fund for Peace. 2013. The Failed States Index.
- Füssel, H. M. 2010. How Inequitable is the Global Distribution of Responsibility, Capability, and Vulnerability to Climate Change: A Comprehensive Indicator-based Assessment. *Global Environmental Change*. 20 (4). 597–611.
- Guillaumont, P. 1999. On the Economic Vulnerability of Low Income Countries. *CERDI Etudes et Documents*.
- . 2006. Macro Vulnerability in Low-Income Countries and Aid Responses. In F. Bourguignon, B. Pleskovic, and J. van der Gaag, eds. *Securing Development in an Unstable World*. Annual World Bank Conference on Development Europe. Washington, DC: World Bank. pp. 65–108.
- . 2009a. Caught in a Trap: Identifying the Least Developed Countries. *Economica*. p. 386.
- . 2009b. An Economic Vulnerability Index: Its Design and Use for International Development Policy. *Oxford Development Studies*. 37 (3). pp. 193–228.
- . 2010. Assessing the Economic Vulnerability of Small Island Developing States and the Least Developed Countries. *Journal of Development Studies*. 46 (5). pp. 828–854.
- . 2013. Measuring Structural Vulnerability to Allocate Development Assistance and Adaptation Resources. *Ferdi Working Paper*. p. 68.
- . 2014a. *Measuring Structural Economic Vulnerability in Africa*.
- . 2014b. A Necessary Small Revision to the EVI to Make It More Balanced and Equitable. *Ferdi Policy Brief*. No. 98.
- . 2015. Measuring Structural Economic Vulnerability in Africa. In J. Yifu Lin and C. Monga, eds. *The Oxford Handbook of Africa and Economics. Volume I: Context and Concepts*, Oxford University Press, pp. 407–426.
- . 2016. Vulnerability and Resilience: A Conceptual Framework Applied to Three Asian Countries Bhutan, Maldives and Nepal. May. *Ferdi Working Paper*. Ferdi.
- Guillaumont, P., and S. G. Jeanneney. 2000. Options for Exchange Rate Policy in Selected Least Developed Countries (Bangladesh, Bhutan, Cambodia, Lao People’s Democratic Republic, and Nepal). In United Nations Economic and Social Commission for Asia and Pacific. ESCAP. *Options for Exchange Rate Policies. Least Developed Countries Series*. No 3. pp. 13–47.
- . 2009. State Fragility and Economic Vulnerability: What is Measured and Why? Paper prepared for the European Report of Development. Barcelona. 7–8 May.
- Guillaumont, P., and S. G. Jeanneney. 2014. Un Indicateur de Besoin D’intégration Régionale. *Revue D’économie du Développement*. 22 (4). pp. 83–93.

- Guillaumont, P., S. G. Jeanneney, and L. Wagner. 2015. How to Take Into Account Vulnerability in Aid Allocation Criteria. Forthcoming in *World Development*.
- . 2017. How to take into account vulnerability in aid allocation criteria and lack of human capital as well: improving the performance based allocation. *World Development*, 90, pp. 27–40.
- Guillaumont, P., M. McGillivray, and L. Wagner. 2013. Performance Assessment: How it Depends on Structural Economic Vulnerability and Human Capita: Implications for the Allocation of Aid (No. P71).
- Guillaumont, P., and C. Simonet. 2011a. Designing an Index of Structural Vulnerability to Climate Change. *Ferdi Policy Brief*, B. 18, March.
- . 2011b. To What Extent are African Countries Vulnerable to Climate Change? Lessons from a New Indicator of Physical Vulnerability to Climate Change. *Ferdi Working Paper*. No. I.08. November.
- . 2014. Facing Climate Change in the LDCs: How to Fit the Istanbul Programme of Action. In LDC IV Monitor, *Istanbul Programme of Action for the LDCs (2011–2020): Monitoring Deliverables, Tracking Progress – Analytical Perspectives*. Commonwealth Secretariat, London. pp. 287–317.
- International Monetary Fund (IMF). 2010. The IMF-FSB Early Warning Exercise: Design and Methodological Toolkit.
- . 2014. Bhutan Selected Issues. *IMF Country Report* No. 14/179. July.
- Loayza, N. V., and C. Raddatz. 2007. The Structural Determinants of External Vulnerability. *The World Bank Economic Review*, 21 (3), pp. 359–387.
- Loayza, N. V., R. Ranciere, L. Servén, and J. Ventura. 2007. Macroeconomic volatility and welfare in developing countries: An introduction. *The World Bank Economic Review*, 21 (3), pp. 343–357.
- Maldives Monetary Authority. 2012. *Annual Economic Review 2012*. Maldives. <http://www.mma.gov.mv/ar/ar12.pdf>
- . 2014. *Monthly Statistics 2014*. January. Malé.
- Marshall, R. 2013. Graduation from the Group of Least Developed Countries: Prospects and Challenges for Bhutan. 12th Round Table Meeting, 11–12 December, Thimphu, UNDP.
- Miguel, E., S. Satyanath, and E. Sergenti. 2004. Economic Shocks and Civil Conflict: An Instrumental Variables Approach. *Journal of Political Economy*. 112(4). pp. 725–753.
- Nepal Central Bureau of Statistics. 2011. *National Population and Housing Census (2011)*.
- Organisation for Economic Co-operation and Development (OECD). 2012. *Fragile States 2013: Resource flows and trends in a shifting world*. DAC International Network on Conflict and Fragility.
- . 2014. *Fragile States 2014: Domestic Revenue Mobilisation in Fragile States*.
- Ramey, G., and V. A. Ramey. 1995. Cross-Country Evidence on the Link between Volatility and Growth. *The American Economic Review*. 85 (5). pp. 1138–1151.

- Republic of Maldives. National Bureau of Statistics. Ministry of Finance and Treasury. Analytical Report 2014: Population and Housing Census 2014. Statistical Release: 1 Population and Households.
- United Nations (UN). 2008. *Handbook on the Least Developed Country Category: Inclusion, Graduation and Special Support Measures*. New York: Committee for Development Policy and UN Department of Economic and Social Affairs.
- . 2012. General Assembly Resolution (A/C.2/67/L.51) on Smooth transition for countries graduating from the list of least developed countries.
- United Nations Children’s Fund. 2012 data. http://www.unicef.org/infobycountry/bhutan_statistics.html
- United Nations Conference on Trade and Development (UNCTAD). 2013. *World Investment Report 2013. Global Value Chains: Investment and Trade for Development*. New York/Geneva: United Nations Conference on Trade and Development.
- United Nations Development Programme (UNDP). 2008. *A Users’ Guide to Measuring Corruption’ United Nations Development Program*. Norway: UNDP Oslo Governance Centre.
- United Nations Statistics Division (UNSD). 2014. *Demographic Statistics Yearbook*. <http://comtrade.un.org/db/> (accessed 9 October 2013).
- Wheeler, D. 2011. Quantifying Vulnerability to Climate Change: Implications for Adaptation Assistance. *Center for Global Development Working Paper*. No. 240.
- World Bank. 2013a. *World Development Indicators 2013*. Washington, DC: World Bank.
- . 2013b. *World Development Report 2014: Risk and Opportunity—Managing Risk for Development*. Washington, DC: World Bank.
- . 2014. *World Development Indicators 2014*. Washington, DC: World Bank.
- The World Factbook. 2014. Washington, DC: Central Intelligence Agency. Retrieved from <https://www.cia.gov/library/publications/download/download-2014/index.html>
- World Travel and Tourism Council. 2014. *Travel and Tourism, Economic Impact Report 2014 – Nepal*.

Vulnerability and Resilience: A Conceptual Framework Applied to Three Asian Countries— Bhutan, Maldives, and Nepal

This paper presents a conceptual framework for the study of the vulnerability of Bhutan, Maldives, and Nepal with a particular focus on the structural vulnerability. Three kinds of vulnerability have been considered for each country: economic, climatic, and political. Comparative assessment of countries is likewise undertaken using available and comparable indicators, e.g., economic vulnerability index and fragile state index. The assessment shows that each of the three countries seems the most vulnerable in one of the three dimensions of vulnerability: Bhutan for structural economic vulnerability, Maldives for physical vulnerability to climate change, and Nepal for state fragility.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to a large share of the world's poor. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

