

UNITED NATIONS DEVELOPMENT PROGRAMME

Towards a Multidimensional Vulnerability Index

Discussion Paper

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Abstract

Most Small Island Developing States (SIDS) are still not eligible for concessional financing because they are classified as middle- or high-income countries. But they are more vulnerable than income data alone might suggest. SIDS face severe structural challenges due to their remoteness, economic concentration, and dependence on external flows such as remittances, foreign direct investment, and tourism revenues. The COVID-19 pandemic has greatly exacerbated these vulnerabilities by restricting travel, collapsing investment and tourism, and weakening the economies from which remittances are sent. This paper constructs a multidimensional vulnerability index (MVI) to account for both long-term structural vulnerabilities as well as the recent weaknesses uncovered by the pandemic. Using 11 indicators for 126 countries (including 34 SIDS), the MVI demonstrates that all but 5 SIDS are far more vulnerable than their income level would suggest. Using the MVI, we estimate that non-LDC SIDS would save close to 1.5% of GDP annually if their long term external public and publicly guaranteed (PPG) debt was funded at the same average interest rate of LDC-SIDS. This analysis implies the urgent need to reconsider eligibility for concessional financing to SIDS on vulnerability rather than just income criteria.

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1 Background

Small Island Developing States (SIDS) face a shared set of complex social, environmental, and economic development challenges first articulated at the United Nations Conference on Environment and Development in June 1992 and later in the outcome document of the Third International Conference on SIDS, the Small Island Developing States Accelerated Modalities of Action (S.A.M.O.A.) Pathway. Due to their unique geographical context, they face limited resource bases and barriers to integration into the global economy. First, SIDS are overdependent on imports, including food and energy, which account for as much as 30 percent of their GDP. Second, SIDS' economies are not diversified and are heavily dependent on tourism; in many island-states, tourism revenues account for over 30 percent of GDP² and lost revenue will have a devastating impact on these economies. These factors make them particularly vulnerable to external shocks. Third, many SIDS face heavy debt burdens, often as a consequence of responding to external factors, including the impacts of climate change trapping them in an unsustainable cycle. The intensifying impact of the climate crisis poses an existential threat to this group. While SIDS are responsible for only 1% of global greenhouse gas emissions, they are struggling disproportionately with issues such as severe biodiversity loss, rising sea-levels, and increasing severity of extreme weather events.

As the COVID-19 pandemic has evolved into a multidimensional development crisis and exacerbated these structural vulnerabilities, SIDS are stuck in a trap created by these compounding risks, inhibiting them from realizing their potentials for sustainable development. It is predicted that SIDS will experience contractions in GDP between 8 and 15 percent in 2020, and that recovery from the global crisis will take years and will be costly³. It will take time and resources that SIDS simply do not have. With progress on the 2030 Agenda threatened, SIDS reiterate the call for a multidimensional vulnerability index in line with objectives of the S.A.M.O.A. Pathway. A multidimensional vulnerability index will allow for the inclusion of more than just income-based criteria to assess eligibility for concessionary finance. As of the latest World Bank income classifications, only two SIDS are classified as low-income countries. The middle-income status of many SIDS greatly obscures the level of risk and vulnerability these countries face. A multidimensional vulnerability index will more accurately reflect this and their limited ability to absorb shocks. Such a mechanism will help SIDS create the fiscal space necessary to overcome structural and external vulnerabilities, and build the resilience they need to withstand future shocks.

2 Vulnerability of What?

Early discussions on vulnerability focused on the weaknesses and defenselessness of vulnerable groups such as informal workers, the elderly or landless people. More recently, however, the debate is shifting towards a broader view of reducing exposure to uncertainty and risk in order to minimize the likelihood of a shock resulting in a large drop in wellbeing, that is, a view of vulnerability as insecurity leading to destitution⁴.

² UNWTO 2020.

³ Rashid 2020.

⁴ Dercon (2005).

On the empirical side, a broad range of vulnerability indices have been created by a variety of researchers and institutions in the past twenty-five years. In some of these indices, vulnerability also embeds resilience. In others, vulnerability is measured as a multidimensional phenomenon⁵. Some cover only SIDS, while others apply to all or most developing countries.

In terms of dimensions, all vulnerability indices cover one or more of the following dimensions: Economic, Social, Environmental, Governance, Peripherality. Some indicators can be included under different dimensions. For example, ‘transportation cost’ (which is related to remoteness) is classified as an economic indicator in one index but as a peripheral indicator in another. Likewise, ‘victims of natural disasters’ is primarily an environmental indicator but is often included in economic vulnerability indices⁶.

Table 1. Composite vulnerability indices by Author

Author(s)	Index Name
Adrianto and Matsuda (2004)	Economic composite index
Atkins et al. (2000)	Commonwealth vulnerability index
Briguglio and Galea (2004)	Economic vulnerability index augmented by resilience
Briguglio et al. (2009)	Resilience index
Briguglio (1995)	Economic vulnerability index
Esty et al. (2006)	Environmental performance index
Kaly et al. (2005)	Environmental vulnerability index
Turvey (2007)	Vulnerability assessment
UN Committee for Development Policy (2008)	Economic vulnerability index
Guillaumont (2009)	Economic vulnerability index
Center for Environment and Development (2002)	Vulnerability index
Wells (1997)	Composite vulnerability index

Source: Angeon and Bates (2015).

Of the 12 composite vulnerability indices listed in Table 1, only one is an official U.N. index. The Economic and Environmental Vulnerability Index (EVI) was created by the U.N. Committee for Development Policy (CDP) as part of the three criteria for inclusion in and graduation from the Least Developed Countries (LDC) category, along with Gross National Income (GNI) per capita and a Human Assets Index (HAI)⁷.

The EVI includes both economic and environmental aspects of vulnerability. The Economic Vulnerability sub-index includes:

- Share of agriculture (as well as fishing, forestry, and hunting) in GDP
- Remoteness and landlockedness
- Merchandise export concentration
- Instability of exports of goods and services

⁵ Scandurra et. al. (2018).

⁶ Briguglio and Galea (2004), Angeon and Bates (2015).

⁷ <https://www.un.org/development/desa/dpad/least-developed-country-category/ldc-criteria.html>

The Environmental Vulnerability sub-index includes:

- Share of population in low elevated coast zones
- Share of population living in drylands
- Victims of disasters
- Instability of agricultural production

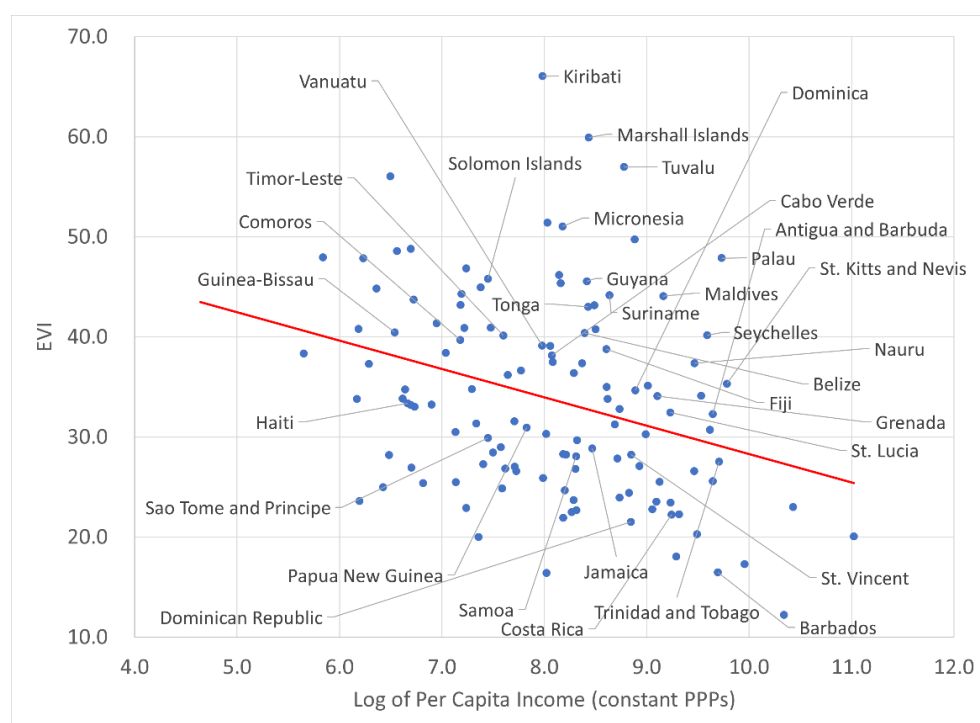
While EVI is one of the LDC categories, it is especially relevant for assessing the vulnerability of SIDS, seven of which are also LDCs. Of the 143 countries for which the CDP calculates the EVI, 9 of the top 25 most vulnerable are SIDS—and 20 of the top 50.

In addition to its being the only official UN vulnerability index, the EVI has the following benefits:

- It has consistent data coverage across countries (143) and time (since 2000)
- Its methodology has been agreed upon by CDP and is reviewed every three years (whereas other indices are only subject to academic peer review)
- EVI is already used to assess the vulnerability of another group — the LDCs — beyond the income criterion, which is exactly what is now needed for SIDS

This last point is directly relevant for access to concessional financing. Normally this depends on income (GNI per capita), but, as Figure 1 shows, *most SIDS are much more vulnerable than their income level would suggest*. While in general there is a negative relationship between income and vulnerability, the 24 SIDS above the fitted line have higher-than-expected vulnerability, whereas the 10 SIDS below the line have lower-than-expected vulnerability, given their income.

Figure 1. Economic Vulnerability Index (EVI) vs. Per Capita Income (log)



Data source: Authors' elaboration based on latest CDP data.

3 Lessons from COVID-19⁸

The current COVID-19 pandemic has highlighted existing and new dimensions of vulnerability for all countries but for SIDS in particular. UNDP's Human Development Report Office (HDRO) has launched two new dashboards analyzing countries' vulnerability and preparedness to pandemics and other global shocks⁹. HDRO notes that the current pandemic is "more than a global health emergency; it is a systemic human development crisis, reflecting our interaction with the ecosystem we are part of, which is already affecting the economic and social dimensions of development in unprecedented ways."

The *Preparedness Dashboard* includes indicators on human development, countries' health systems, and connectivity infrastructure. The *Vulnerability Dashboard* includes statistics on multidimensional poverty, social protection, and 'immediate economic vulnerability.' This last category includes the inflow of remittances (as a percentage of GDP), net Official Development Assistance received (as a percentage of GNI), and inbound tourism expenditure (percentage of GDP).

Of all these factors, the nearly universal reduction in travel prompted by the pandemic (both in terms of travel restrictions and voluntary cancellation of travel) has hit SIDS especially hard. On average, the 38 countries in this group derive 42% of all their export revenues from inbound tourism, compared with 11% for all other developing countries. The UNDP dashboards also aggregate regions and country groups by vulnerability levels, with Arab States as well as Europe and Central Asia classified as having Medium Vulnerability on the tourism indicator, and only the SIDS group as having High Vulnerability in this domain.

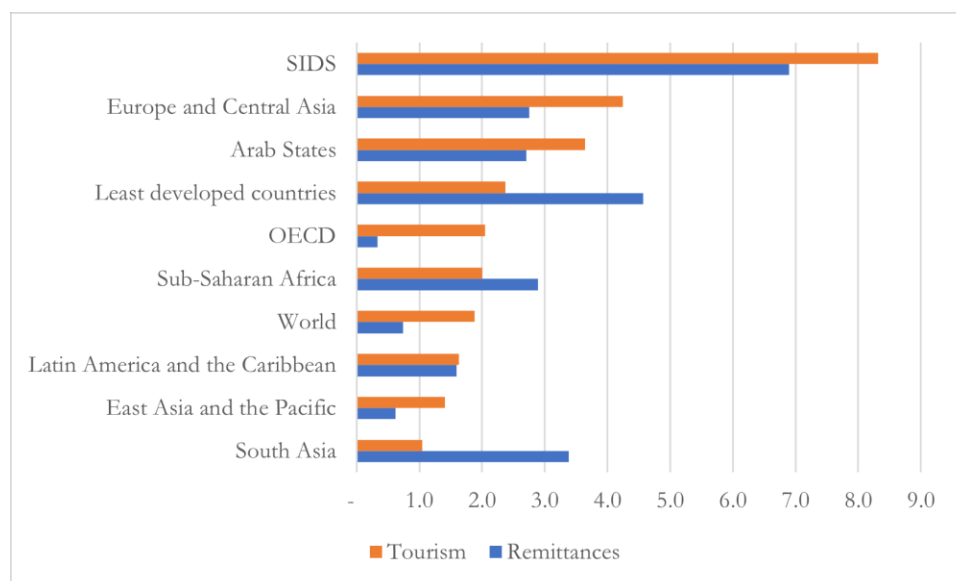
Being highly dependent on tourism as a major source of export earnings, SIDS are vulnerable to external economic shocks. The tourism sector accounts for more than 30 percent of total exports in many SIDS, resulting in negative impacts on their ability to service their debt. SIDS are heavily reliant on export revenues for debt servicing with rates amounting to an average of 15% of export revenues and 5.3% of GDP, a level four times as high as that of low-income countries. Furthermore, with their reliance on imports, especially for food and energy supply, SIDS' trade deficits since 2000 have been between 2-3 times higher than the median for developing countries.

Likewise, SIDS are more dependent on inflows of remittances than other developing countries. On average, personal remittances account for 7.6% of GDP in SIDS, compared to 4.8% in other developing countries. However, this is only an average. Some of the most vulnerable SIDS (with the highest EVI scores) have a far greater reliance on remittances, with Tonga and Haiti receiving 34.1% and 30.1% of their GDP in remittances, respectively. It is true that for some countries, such as Mexico, remittances have helped cushion the blow during the current pandemic, but Mexico depends on remittances for only 2.6% of its GDP. Overall, then, it is the disproportionate reliance on such an external flow of funding that makes remittances a vulnerability.

⁸ The discussion of COVID-19 here is meant to represent any major exogenous shock to vulnerable economies rather than a specific health risk or pandemic. This is why we have not included any health-related variables in the MVI, in order to keep its focus more generally on structural vulnerabilities.

⁹ <http://hdr.undp.org/en/content/global-preparedness-and-vulnerability-dashboards>

Figure 2. Inbound tourism expenditure (2016-2018) and remittances inflows (2018) as % of GDP



SIDS are also more dependent on inflows of Foreign Direct Investment (FDI) than most other developing countries, averaging 5.5% of GDP compared to 4.3%, respectively. Palau, for example, received 11.5% of its GDP in FDI, on average, between 2014 and 2018. FDI in SIDS is often tied to tourism, so global shocks such as the COVID-19 pandemic can have a double impact on these countries due to travel restrictions — less export revenues from tourism and less FDI at the same time.

Another key dimension of vulnerability in SIDS is biodiversity. Both tourism and fisheries depend in different ways on large biodiversity, and its loss can be economically devastating. Biodiversity also has cultural value for SIDS, as well as links to water supply, fresh water, formation of soil and sands, and protection against both coastal erosion and storms¹⁰. However, a country's vulnerability based on its biodiversity is already partly captured by the EVI's indicator on the share of agriculture (as well as fishing, forestry, and hunting) in GDP.

4 Data and Methodology

Against this context, it is proposed to add three indicators — tourism revenues, remittances, and FDI — to the eight existing indicators of the EVI. Furthermore, given the high vulnerability to biodiversity loss, we initially also explored adding the dimension of biodiversity. However, multivariate analysis revealed very low explanatory power of the biodiversity indicator (around 2% of variance). Coupled with the fact that biodiversity would reduce the sample size from 126 to 122 countries, it has not been included in the current version of the MVI.

¹⁰ UN-OHRLLS 2019.

Given the many dimensions affected by economic disruptions in SIDS and other developing countries — employment, income, debt service — the adjusted EVI can be thought of as a Multidimensional Vulnerability Index (MVI). It thus includes the following 11 indicators:

1. Merchandise export concentration
2. Share of agriculture (as well as fishing forestry and hunting) in GDP
3. Remoteness and landlockedness
4. Instability of exports of goods and services
5. International tourism, receipts (percentage of total exports)
6. Personal remittances, received (percentage of GDP)
7. Foreign direct investment, net inflows (percentage of GDP)
8. Share of population in low elevated coast zones
9. Share of population living in drylands
10. Victims of disasters
11. Instability of agricultural production

Broadening the scope of the EVI comes at the cost of reduced country coverage, as the three new indicators have lower data availability as shown in Table 2.

Table 2. Indicators Considered for MVI by Source and Data Coverage

Indicator	Source	# of countries	# of SIDS
1. Export concentration	EVI (UN CDP)	143	38
2. Share of agriculture in GDP	EVI (UN CDP)	143	38
3. Instability of exports of goods and services	EVI (UN CDP)	143	38
4. International tourism, receipts (% of total exports)	World Bank (WDI)	132	37
5. Personal remittances, received (% of GDP)	World Bank (WDI)	131	34
6. Foreign direct investment, net inflows (% of GDP)	World Bank (WDI)	140	37
7. Share of population living in drylands	EVI (UN CDP)	143	38
8. Remoteness	EVI (UN CDP)	143	38
9. Share of population in low elevated coast zones	EVI (UN CDP)	143	38
10. Victims of disasters	EVI (UN CDP)	143	38
11. Instability of agricultural production	EVI (UN CDP)	143	38

Since different indicators are missing data for different countries, the intersection of all datasets covers 126 countries and 34 SIDS. All indicators are normalized using the min-max procedure (as in the EVI) to reduce the impact of extreme outliers.

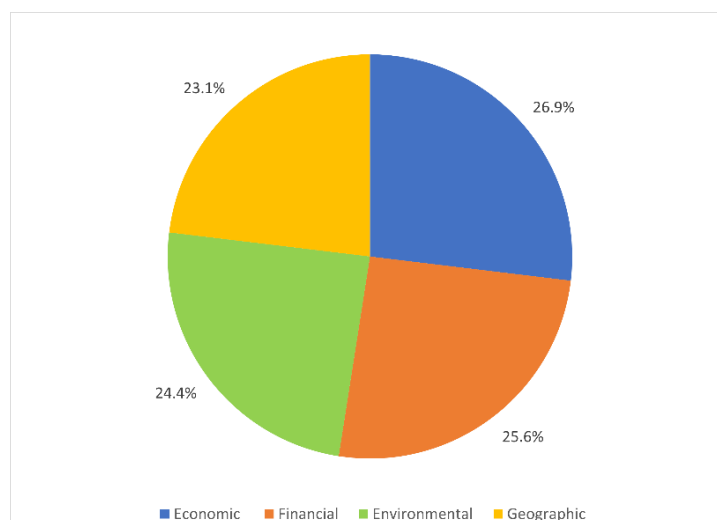
To understand the structure of the data, we apply a multivariate statistical procedure — principal component analysis — which reveals the key drivers of differences between countries in the sample. The first four principal components explain nearly 60% of the variation in the data.

Table 3. Principal Components of the MVI Dataset

Component	Indicators
1. Economic vulnerability	<ul style="list-style-type: none">• Export concentration• Export instability• Agricultural instability
2. Financial vulnerability	<ul style="list-style-type: none">• Tourism revenues as share of exports• Remittances as percentage of GDP• FDI inflows as percentage of GDP
3. Environmental vulnerability	<ul style="list-style-type: none">• Agriculture and fishing as share of GDP• Victims of disasters
4. Geographic vulnerability	<ul style="list-style-type: none">• Remoteness• Share of population in low elevated coast zones• Share of population living in drylands

These components are orthogonal (i.e., not correlated) to each other, thus reducing the overlap and maximizing the information from the original indicators. Figure 3 shows the share of variance explained by each principal component¹¹.

Figure 3. Percentage of Variance Explained by Principal Components



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