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.

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 GDP[2] 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 costly[3]. 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 destitution[4].

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[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 phenomenon[5]. 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 indices[6].

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 offcial 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

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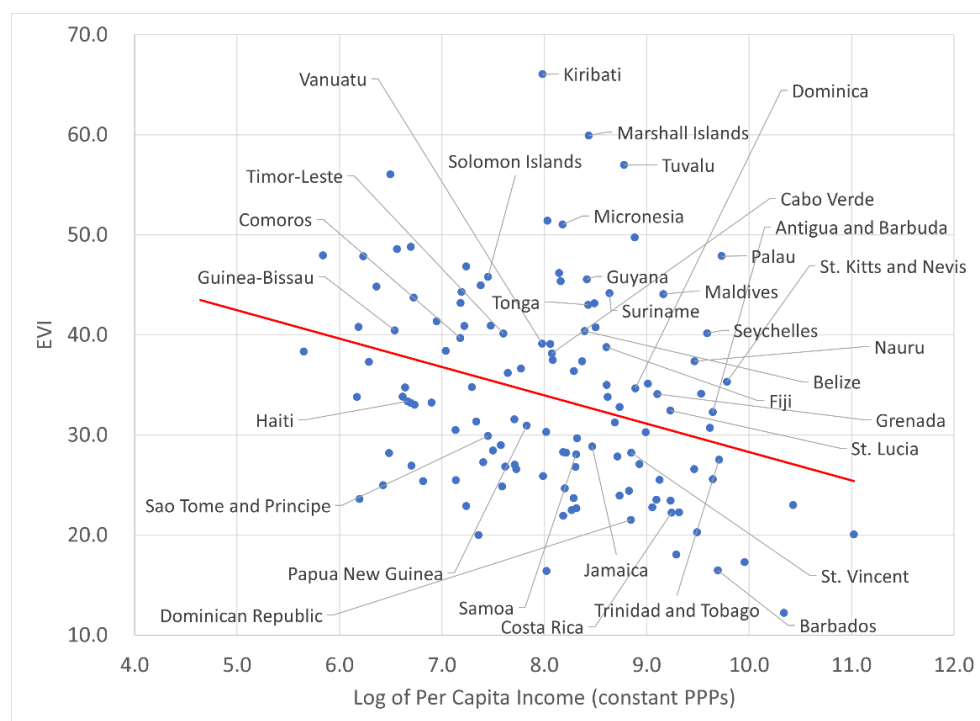
Data source: Authors' elaboration based on latest CDP data.

3 Lessons from COVID-19[8]

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 Offce (HDRO) has launched two new dashboards analyzing countries' vulnerability and preparedness to pandemics and other global shocks[9]. 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.

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[8] The discussion of COVID-19 here is meant to represent any major exogenous shock to vulnerable economies rather 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
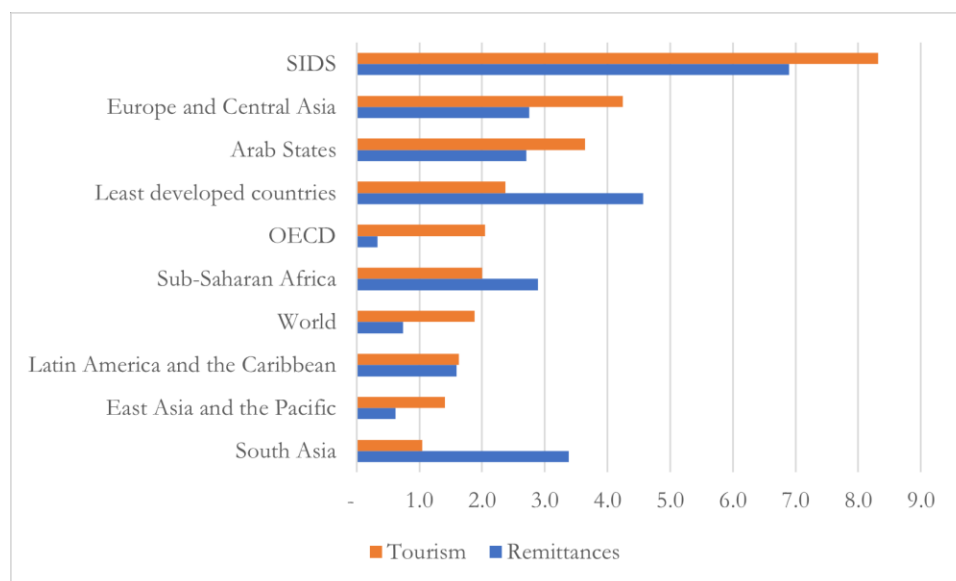
SIDS are also more dependent on inflows of Foreign Direct Investment (FDI) than most other developing countries, averaging 5.5% of GDP compared to 4.3%, respectively. Palau, for example, received 11.5% of its GDP in FDI, on average, between 2014 and 2018. FDI in SIDS is often tied to tourism, so global 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 storms[10]. 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, is has not been included in the current version of the MVI.

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[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	• Export concentration • Export instability • Agricultural instability
2. Financial vulnerability	• Tourism revenues as share of exports • Remittances as percentage of GDP • FDI inflows as percentage of GDP
3. Environmental vulnerability	• Agriculture and fishing as share of GDP • Victims of disasters
4. Geographic vulnerability	• 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 component[11].

Figure 3. Percentage of Variance Explained by Principal Components
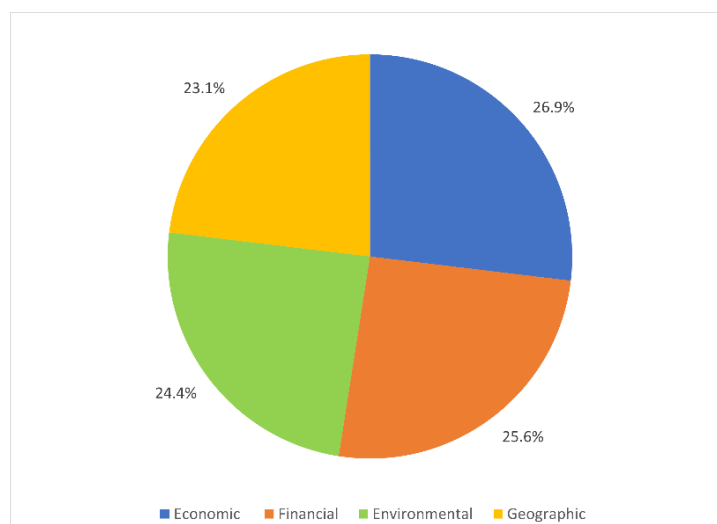
These four components are also helpful as an analytical tool. They can help decompose a country's overall vulnerability as captured by its MVI score into four separate dimensions. As Figure 4 shows, Tonga is very vulnerable in the financial and environmental dimensions, moderately vulnerable geographically, and not very vulnerable economically.

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[11] The full results of the PCA are available in Appendix II. For the sake of simplicity, however, the normalized indicators have been aggregated with equal weights using an arithmetic mean to form the MVI.

Figure 4. A Vulnerability Decomposition for Tonga
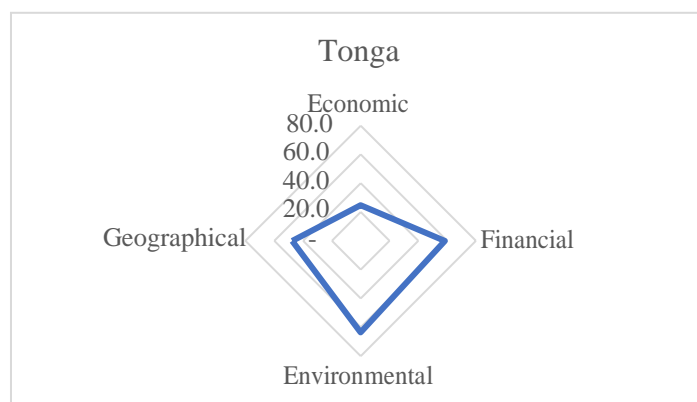
In turn, each component of the MVI can be further tracked down to its original indicator values. In the case of Tonga, the high financial vulnerability score (58.6) is due to its critical dependence on tourism (52.4% of all export revenues) and remittances (34.1% of GDP, the highest proportion of all countries). Tonga's high environmental vulnerability score (63.5) is reflected in its high shares of victims of disasters (5.3%) and reliance on agriculture, fishery, and forests (22% of GDP). By contrast, its low economic vulnerability score (24.9) is based on low export concentration (0.33 out of 1), low export instability, and low agricultural instability (6 out of 60). Finally, Tonga has a moderate geographical vulnerability score (47.5) despite its very remote location, due to a low proportion of people living in low elevated coastal zones (17.5) and no people living in drylands. Similar charts for all 34 SIDS in the MVI are included in Appendix III.

5 Results and Benchmarking

As mentioned above, the MVI can be calculated[12] for 126 countries from the EVI dataset. This number includes 34 of the 38 SIDS that are Member States of the United Nations. The Appendix includes a table with the full results of the index, decomposed by indicator score.

This new index, which builds on both the official EVI and the lessons learned from the COVID-19 pandemic, highlights even more dramatically the acute and multidimensional vulnerability of SIDS. Of the top 25 most vulnerable countries in MVI, 14 are SIDS (likewise 28 of the top 50). Thus, the MVI has more SIDS in its top ranks than the EVI[13].

	EVI	MVI
SIDS in Top 25	9	14
SIDS in Top 50	20	28

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[12] The MVI is calculated as the arithmetic mean (average) of the 11 indicators. A geometric mean was considered but not applied for three reasons. (a) It cannot work with zero value which were prevalent in many cases; (b) an arithmetic mean is easier to communicate; and (c) it is comparable to the method of calculating the EVI.

[13] A sensitivity analysis was performed whereby averaging the normalized scores of the 11 indicators for each country was compared with averaging the four component scores (which themselves are means of their respective indicators). The differences in rankings were minimal, with SIDS ranking on average 36 vs. 73 for non-SIDS using the first method, and 38 vs. 72, respectively, for the second method.

In terms of the *degree* of vulnerability, the 126 countries in the sample can be grouped into four quartiles using the range (44 points) between the lowest and highest score:

- **Low Vulnerability**: Countries with MVI values below 21. There is only one SIDS — Barbados — among these 17 countries
- **Medium Vulnerability**: Countries with MVI values between 21 and 32. Of these 59 countries, only five (8.5%) are SIDS (Papua New Guinea, Dominican Republic, Mauritius, Nauru, and Trinidad and Tobago)
- **High Vulnerability**: Countries with MVI values between 32 and 43. Of these 42 countries, 21 (50%) are SIDS
- **Very High Vulnerability**: Countries with MVI values greater than 43. Of these 8 countries, 7 (87.5%) are SIDS

Overall, 28 of the 34 SIDS in the sample (82%) have High or Very High Vulnerability. Some SIDS are classified by the World Bank as middle- or high-income countries. However, as with the EVI, the MVI also shows (Figure 5) that most SIDS are far more vulnerable than their income would imply (they are above the fitted line):

Figure 5. Multidimensional Vulnerability Index (MVI) vs. Per Capita Income
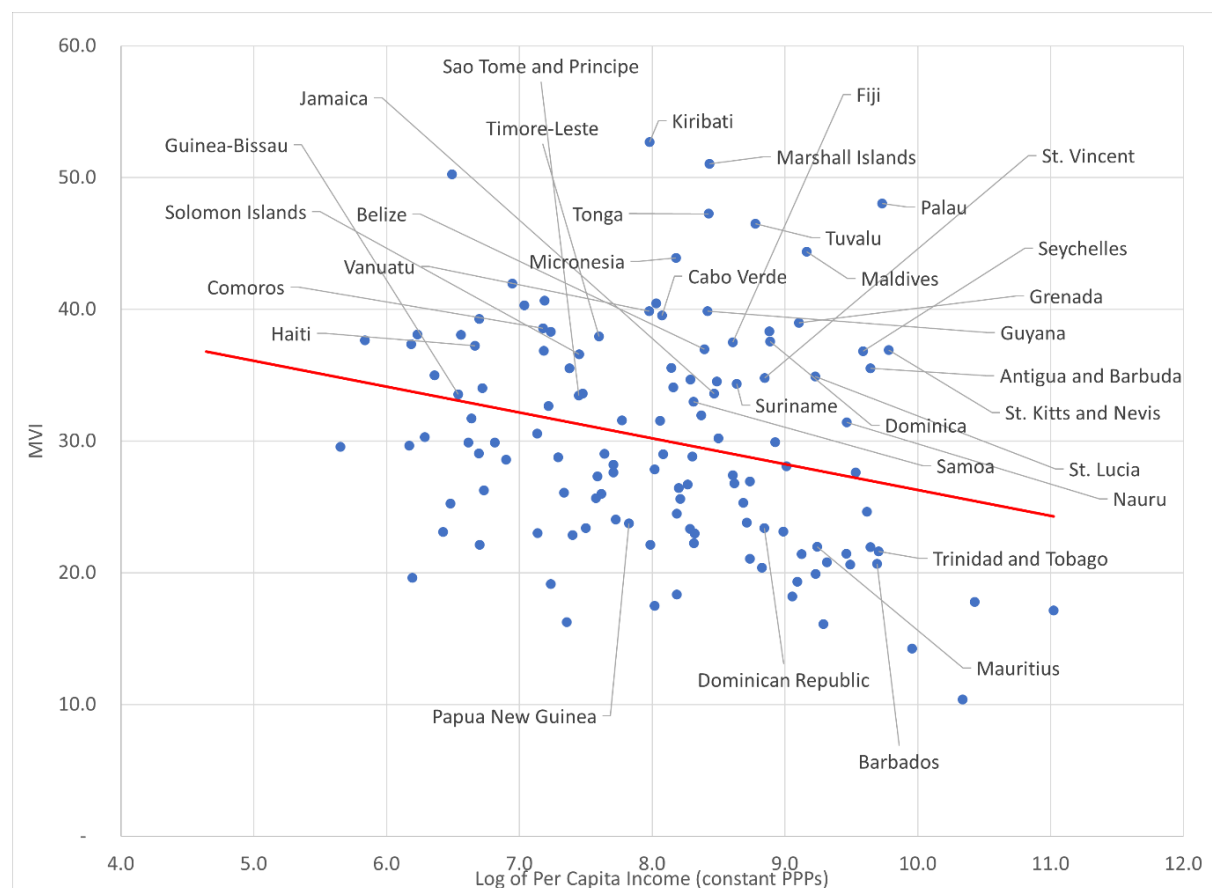
In contrast to the EVI – where 10 SIDS were below the fitted line – plotting MVI against income shows all but 5 SIDS above the fitted line, implying greater vulnerability than suggested by income.

Table 4 shows the changes in SIDS' vulnerability rankings between EVI and MVI.

Table 4. Rankings by MVI and EVI and Their Difference for 34 SIDS

Country	MVI Rank	EVI Rank	Change in Vulnerability Rank
Kiribati	1	1	0
Marshall Islands	2	2	0
Palau	4	11	+7
Tonga	5	26	+21
Tuvalu	6	3	-3
Maldives	7	22	+15
Micronesia (Federated States of)	8	6	-2
Vanuatu	13	37	+24
Guyana	14	16	+2
Cabo Verde	15	42	+27
Grenada	17	57	+40
Comoros	18	36	+18
Timor-Leste	23	35	+12
Dominica	25	55	+30
Fiji	26	39	+13
Haiti	28	61	+33
Belize	29	33	+4
Saint Kitts and Nevis	30	50	+20
Seychelles	32	34	+2
Solomon Islands	33	15	-18
Antigua and Barbuda	36	67	+31
Saint Lucia	38	66	+28
Saint Vincent and the Grenadines	39	82	+43
Suriname	42	21	-21
Jamaica	46	79	+33
Guinea-Bissau	47	32	-15
Sao Tome and Principe	48	76	+28
Samoa	49	85	+36
Nauru	55	45	-10
Papua New Guinea	92	71	-21
Dominican Republic	94	118	+24
Mauritius	104	116	+12
Trinidad and Tobago	106	87	-19

An important point to note in this table is that, of the 34 SIDS, 24 *increased* their vulnerability ranking from EVI to MVI, two countries did not change in rankings, and only eight have decreased their vulnerability ranking. The two biggest increases in vulnerability ranking occurred in Grenada and St.

Vincent. In Grenada's case this increase in the vulnerability ranking is due to the inclusion of data on tourism, which accounts for 83% of the country's exports (third-highest dependency among developing countries) and FDI (12.6% of GDP). Likewise, St. Vincent shows increased vulnerability in the MVI due its high reliance on FDI (15.2% of GDP) and tourism (73.6% of total exports).

On the other hand, Suriname and Papua New Guinea saw the largest decreases in their vulnerability rankings. Suriname is hardly dependent on tourism (4.1% of export revenues), remittances (0.1% of GDP) or FDI (3.4% of GDP). Papua New Guinea is even less dependent on tourism (0.1% for export revenues) and remittances (0% of GDP), and receives only 1.4% of its GDP in FDI.

On average, however, SIDS increased their vulnerability ranking by 12 positions, whereas non-SIDS dropped in the MVI rankings by 4 positions. Thus, while MVI has higher scores than EVI for some SIDS but lower for others, MVI registers a higher relative vulnerability for SIDS overall.

This increase in vulnerability ranking of most SIDS can be seen in Figure 6, below. Countries above the line have increased their vulnerability ranking from EVI to MVI. Those below the line have dropped in vulnerability ranking.

Figure 6. Multidimensional Vulnerability Index (MVI) vs. Economic-Environmental Vulnerability Index (EVI)
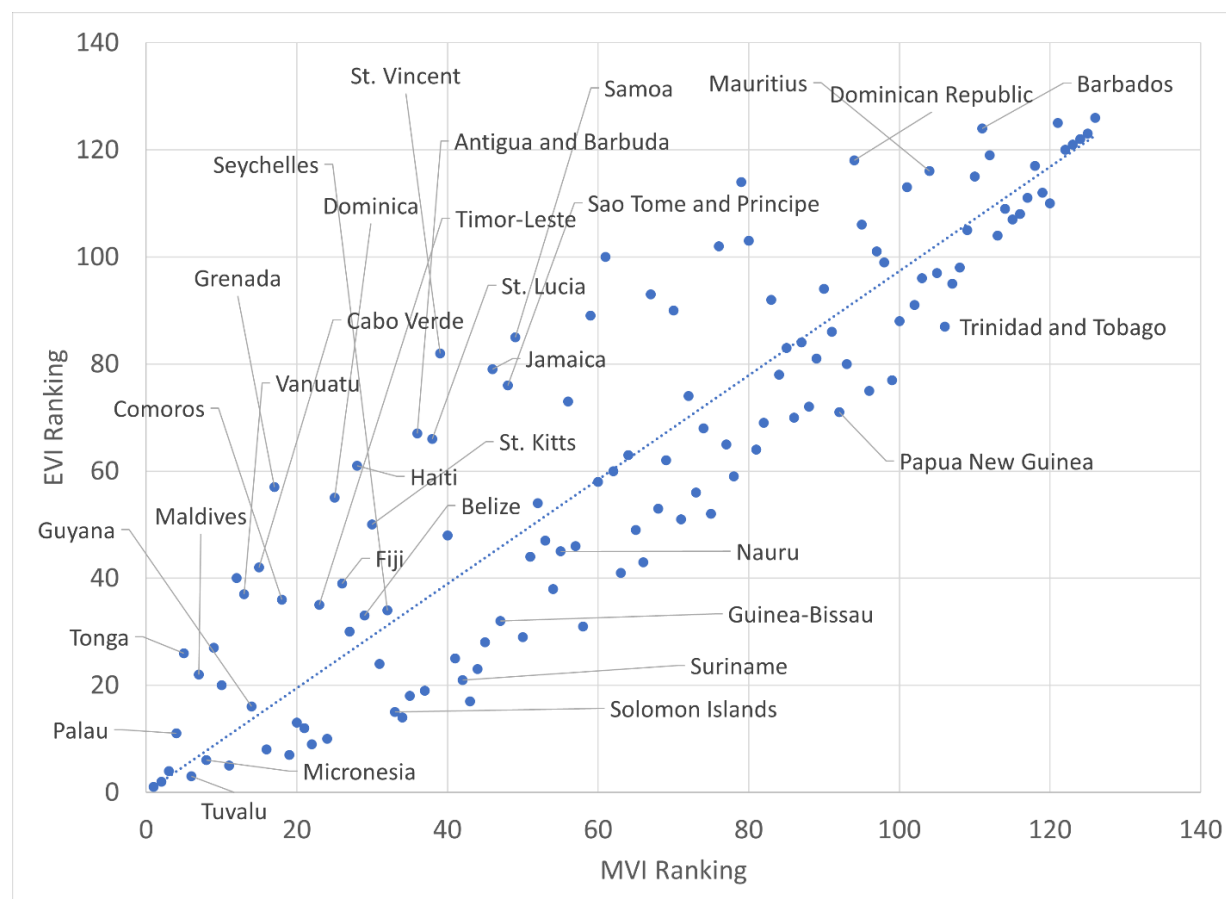
The MVI can be used for evaluating countries' eligibility for concessional financing. Currently only low-income countries (LICs) or least-developed countries (LDCs) are eligible. However, as shown above, many SIDS are far more vulnerable than their income levels would imply. Therefore Very High and High Vulnerability could be added to Low Income and LDC status as criteria for concessional financing. Table 5 compares these criteria for the 21 SIDS which are included in the MVI and also have data on debt. Seven of these are LDCS and thus already eligible for concessional financing but 14 are not. The non-LDC SIDS have much higher average borrowing costs (5.0% vs. 0.75% in 2020). The table also estimates the implied annual savings if non-LDC SIDS were eligible for the same average rate as LDC-SIDS (0.75). ***The average 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 average LDC-SIDS interest rate, i.e. if the MVI was used instead of just income levels.

Table 5. Debt stocks (public and publicly guaranteed), average interest rate and potential savings for LDC-SIDS and non-LDC-SIDS

Country	Debt Stock 2019 (PPG)	Average Interest Rate (2016-2020)[14]	Savings in % of 2020 GDP
Vanuatu	335,543,902	1.52	NA
Comoros	243,320,528	0.45	NA
Timor-Leste	191,217,194	2.25	NA
Haiti	2,012,358,564	0.43	NA
Solomon Islands	98,075,091	1.36	NA
Guinea-Bissau	506,983,074	1.41	NA
Sao Tome and Principe	225,209,570	0.72	NA
LDC SIDS total	**3,612,707,922**	**0.75**	**NA**
Tonga	177,383,472	1.72	0.34
Maldives	2,228,151,048	3.28	1.19
Guyana	1,251,123,759	1.81	0.19
Cabo Verde	1,808,484,671	1.14	0.38
Grenada	500,760,017	3.43	1.25
Dominica	250,663,620	2.84	0.96
Fiji	700,938,327	3.50	0.49
Belize	1,285,549,806	3.79	2.51
St. Lucia	542,261,526	4.33	1.10
St. Vincent and the Grenadines	341,240,818	2.24	0.66
Jamaica	9,407,055,404	5.97	3.45
Samoa	387,604,110	1.39	0.30
Papua New Guinea	4,312,702,624	3.22	0.46
Dominican Republic	27,584,094,473	5.46	1.67
Non-LDC SIDS total	**50,778,013,675**	**4.95**	**1.49**

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[14] We used long-term external public and publicly guaranteed debt from the IDS dataset and averaged across the latest five years. Interest rates are estimated by dividing period t interest payments by t-1 debt stock. One very large interest payment in Fiji for 2019 which seems to be an outlier was omitted.

6   Conclusion: Sustaining Development Depends on Countries' Vulnerabilities

The need for reassessing the eligibility of SIDS for concessional aid, given their acute vulnerability — masked by simple income-based criteria — has long been widely acknowledged. The COVID-19 pandemic has upended economies and societies across SIDS, marking a tipping point where urgent, systemic change must ensue. As the Alliance of Small Island States (AOSIS) declared in their Statement on Debt: "The way we aid vulnerable economies today will ultimately decide whether we can attain the future we want. Every action delayed is a future left more uncertain."

The MVI updates the EVI using three indicators which have been shown to be critical by the COVID-19 pandemic — tourism revenue, remittances, and FDI inflows. Travel restrictions and the drying up of both remittance and investment flows during the pandemic have demonstrated how dependent many countries — especially SIDS — are on such international flows of people and capital. This expanded measure of MVI finds 82% of SIDS in the Very High Vulnerability or High Vulnerability grouping. In fact, 7 of the top 10 — and 14 of the top 25 — vulnerable countries under MVI are SIDS.

EVI and MVI show how SIDS are far more multi-dimensionally vulnerable than their income levels would suggest. EVI has the advantage of being an official UN index whose data and methodology are reviewed by the CDP every three years. MVI, while not official, adds three indicators shown to be critical by the pandemic, and thus provides a richer lens on vulnerability. It also finds more SIDS at the top vulnerability ranks than EVI.

Either way, a vulnerability index that reflects SIDS' environmental as well as socio-economic vulnerabilities will allow policymakers, creditors and investors to more accurately understand the context of SIDS and address their structural constraints. Such a tool could help enable access to concessional finance to support SIDS in addressing their overwhelming debt burdens and the reticence of creditors to extend more favorable terms on existing debt, as well as the sovereign rating downgrades underway or forthcoming. Such a move is essential if SIDS are to overcome the socio-economic shocks caused by the COVID-19 pandemic while safeguarding progress made on the 2030 Agenda and S.A.M.O.A. Pathway.

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Appendix I: Multidimensional Vulnerability Index (MVI)

Country	Group	MVI Rank	Economic Vulnerability			Environmental Vulnerability		Geographical Vulnerability			Financial Vulnerability			MVI	EVI Rank	Rank Diff.
			Exp. conc.	Exp. inst.	Agr. inst.	Agr/GDP	Victims of Dis.	Pop. in LECZ	Dry Lands	Remote	Tourism	FDI	Remit.			
Kiribati	SIDS	1	94.7	44.0	72.6	39.8	91.3	100.0	4.6	81.6	12.5	10.8	27.6	52.7	1	0
Marshall Islands	SIDS	2	72.4	21.5	100.0	25.3	81.6	100.0	-	78.6	25.7	14.1	42.0	51.0	2	0
Gambia		3	41.0	62.9	73.5	36.8	76.0	12.3	100.0	45.7	54.0	12.1	38.5	50.3	4	1
Palau	SIDS	4	60.9	65.9	36.8	4.2	56.1	100.0	-	59.1	100.0	43.0	2.4	48.0	11	7
Tonga	SIDS	5	27.3	20.9	26.4	35.3	91.6	50.0	-	92.4	61.5	14.3	100.0	47.3	26	21
Tuvalu	SIDS	6	55.3	100.0	0.6	33.7	79.3	100.0	-	86.9	13.7	12.0	30.1	46.5	3	-3
Maldives	SIDS	7	59.5	32.0	39.0	9.2	59.6	100.0	-	53.2	98.9	36.5	0.2	44.4	22	15
Micronesia (Federated States of)	SIDS	8	85.7	17.6	24.3	45.9	94.4	66.3	-	74.0	27.0	28.0	19.9	43.9	6	-2
Tajikistan		9	23.9	14.8	19.6	36.3	90.3	-	95.7	50.4	21.4	20.3	88.9	42.0	27	18
Lesotho		10	24.0	28.6	27.4	8.7	94.6	-	72.0	99.1	3.3	27.0	62.3	40.6	20	10
Djibouti		11	10.3	100.0	30.4	0.7	93.2	31.6	100.0	45.2	1.1	27.4	5.0	40.4	5	-6
Kyrgyzstan		12	30.8	20.9	6.5	21.7	78.4	-	99.4	49.6	21.2	27.7	87.0	40.3	40	28
Vanuatu	SIDS	13	18.2	13.4	31.6	36.8	95.6	28.9	-	88.6	83.6	21.1	20.7	39.9	37	24
Guyana	SIDS	14	42.6	21.1	29.8	23.2	88.2	100.0	-	59.7	5.7	42.2	26.1	39.9	16	2
Cabo Verde	SIDS	15	32.2	23.5	17.4	11.4	56.4	18.4	100.0	45.8	64.5	30.0	35.2	39.5	42	27
Mali		16	69.2	12.7	16.7	66.4	77.6	-	85.6	62.1	7.2	16.7	17.7	39.3	8	-8
Grenada	SIDS	17	14.1	26.8	65.7	9.6	83.7	16.7	-	56.2	97.5	46.0	12.4	39.0	57	40
Comoros	SIDS	18	61.1	10.7	4.4	52.0	83.8	37.8	-	67.8	58.2	11.0	37.4	38.6	36	18
Botswana		19	92.6	24.5	23.1	2.1	59.9	-	100.0	95.9	8.1	14.8	0.6	38.3	7	-12
Zimbabwe		20	32.7	37.7	30.0	13.6	92.9	-	77.2	90.8	5.1	15.7	25.5	38.3	13	-7
Niger		21	27.6	6.2	33.0	64.2	96.2	-	98.2	57.5	7.3	22.8	6.2	38.1	12	-9
Burkina Faso		22	65.5	10.8	38.3	39.0	80.1	-	94.9	60.2	6.1	15.1	8.8	38.1	9	-13
Timor-Leste	SIDS	23	47.2	100.0	20.9	16.0	62.3	8.5	-	66.3	67.1	14.8	14.3	37.9	35	12
Malawi		24	54.2	11.0	53.0	51.8	95.0	-	30.9	87.7	3.3	23.0	4.0	37.6	10	-14
Dominica	SIDS	25	36.5	18.7	9.6	26.0	96.4	36.7	-	53.3	89.1	20.7	26.1	37.6	55	30
Fiji	SIDS	26	13.3	12.0	29.8	21.0	91.5	52.2	-	90.4	56.9	30.4	15.1	37.5	39	13
Mozambique		27	23.2	25.4	36.0	44.1	86.0	8.0	25.6	78.1	5.0	75.7	4.0	37.4	30	3
Haiti	SIDS	28	48.2	9.5	12.3	29.3	93.3	11.6	8.0	54.6	39.0	15.1	88.4	37.2	61	33
Belize	SIDS	29	20.9	13.1	24.8	18.6	85.0	96.7	-	64.0	46.4	22.2	14.8	37.0	33	4
Saint Kitts and Nevis	SIDS	30	25.0	18.5	100.0	0.2	43.4	43.4	-	52.0	74.0	42.2	7.2	36.9	50	20
Senegal		31	14.8	3.4	74.5	26.6	71.0	20.1	90.6	44.6	12.4	17.4	30.0	36.9	24	-7
Seychelles	SIDS	32	43.4	32.1	27.5	2.3	70.7	81.4	0.6	63.5	43.1	36.4	4.0	36.8	34	2
Solomon Islands	SIDS	33	69.3	31.3	17.0	41.6	73.6	51.0	-	82.8	14.6	17.1	4.2	36.6	15	-18
Mongolia		34	38.4	16.8	50.2	18.9	98.1	-	98.8	48.3	7.0	6.5	8.1	35.5	14	-20
Mauritania		35	29.0	22.1	6.7	37.7	99.0	60.0	65.2	39.9	1.7	26.9	2.7	35.5	18	-17
Antigua and Barbuda	SIDS	36	47.7	10.8	31.0	1.6	80.5	34.8	-	51.9	95.2	31.7	5.5	35.5	67	31
Afghanistan		37	31.1	22.5	31.6	38.0	84.3	-	99.0	52.2	5.1	11.1	9.9	35.0	19	-18
Saint Lucia	SIDS	38	41.9	8.9	49.5	1.4	94.4	9.1	-	54.3	95.0	23.4	6.1	34.9	66	28
Saint Vincent and the Grenadines	SIDS	39	24.6	18.1	9.5	12.4	80.7	25.3	-	55.1	86.4	53.4	16.9	34.8	82	43
Armenia		40	21.1	18.8	44.2	26.1	63.7	-	85.2	32.0	33.2	17.0	39.9	34.7	48	8
Namibia		41	19.2	10.4	43.8	10.5	94.4	0.5	91.4	75.1	12.6	20.5	1.4	34.5	25	-16
Suriname	SIDS	42	70.0	20.2	30.8	18.2	54.3	100.0	-	59.7	4.7	19.5	0.2	34.3	21	-21
Angola		43	98.1	13.9	43.6	15.1	68.1	4.4	57.2	62.8	2.8	8.9	-	34.1	17	-26
South Sudan		44	40.2	61.5	23.1	3.2	89.7	-	64.2	67.9	0.8	9.8	13.9	34.0	23	-21
Sudan		45	40.2	10.0	44.9	41.6	68.0	1.5	85.4	35.9	22.4	17.3	2.7	33.6	28	-17
Jamaica	SIDS	46	43.3	12.2	5.2	11.3	75.5	26.2	-	57.2	64.7	26.0	48.2	33.6	79	33

Appendix I: Multidimensional Vulnerability Index (MVI)

Country	Group	MVI Rank	Economic Vulnerability Exp. conc.	Exp. inst.	Agr. inst.	Environmental Vulnerability Agr/GDP	Victims of Dis.	Geographical Vulnerability Pop. in LECZ	Dry Lands	Remote	Financial Vulnerability Tourism	FDI	Remit.	MVI	EVI Rank	Rank Diff.
Guinea-Bissau	SIDS	47	91.2	17.2	5.8	83.4	65.7	13.0	-	47.2	7.4	14.5	23.5	33.5	32	-15
Sao Tome and Principe	SIDS	48	69.9	23.2	11.9	18.0	-	62.4	-	53.9	82.3	31.5	15.0	33.5	76	28
Samoa	SIDS	49	29.2	5.9	1.1	15.1	60.4	25.2	-	87.7	72.7	15.5	50.2	33.0	85	36
Zambia		50	67.2	17.6	25.6	6.1	77.1	-	45.1	88.5	8.8	22.4	0.9	32.7	29	-21
Azerbaijan		51	84.7	23.5	16.1	8.4	36.5	-	92.5	37.3	15.1	30.1	7.1	31.9	44	-7
Ethiopia		52	23.5	7.9	11.8	58.2	84.7	-	26.6	65.2	44.9	22.4	3.7	31.7	54	2
Uzbekistan		53	31.2	11.9	4.4	54.1	42.0	-	100.0	49.5	8.4	14.7	31.2	31.6	47	-6
Bolivia (Plurinational State of)		54	30.3	9.0	3.7	20.6	78.6	-	71.9	98.6	9.9	14.0	10.4	31.5	38	-16
Nauru	SIDS	55	53.5	62.0	-	2.4	-	100.0	-	81.0	7.9	9.8	29.2	31.4	45	-10
Cambodia		56	23.1	15.5	25.0	40.5	92.6	5.7	-	41.6	30.2	43.9	17.9	30.6	73	17
Sierra Leone		57	19.1	41.5	48.4	100.0	29.2	10.1	-	50.2	5.0	25.8	3.9	30.3	46	-11
Iraq		58	99.0	15.2	70.0	3.2	22.0	13.1	84.1	19.6	4.8	-	1.3	30.2	31	-27
Lebanon		59	3.1	9.8	13.8	3.7	66.5	8.4	100.0	11.4	46.9	24.1	41.4	29.9	89	30
Rwanda		60	30.9	10.8	28.6	52.5	72.5	-	-	75.4	32.9	18.7	6.7	29.9	58	-2
Nepal		61	4.9	10.0	9.3	48.8	78.9	-	-	51.3	29.2	10.9	85.4	29.9	100	39
Madagascar		62	22.0	23.0	9.5	41.9	80.9	12.3	7.2	73.8	26.3	21.2	8.3	29.7	60	-2
Burundi		63	39.3	11.0	35.2	64.2	80.4	-	-	76.8	1.5	12.4	4.4	29.6	41	-22
Yemen		64	33.5	28.9	10.3	30.6	31.6	4.5	85.0	41.2	12.2	7.0	34.8	29.1	63	-1
Nigeria		65	79.3	9.6	17.6	34.3	55.5	10.1	36.1	47.2	2.9	12.0	14.7	29.0	49	-16
Eswatini		66	27.7	13.6	6.8	13.6	100.0	-	41.0	97.1	0.9	10.6	7.7	29.0	43	-23
Jordan		67	7.8	11.8	22.1	8.1	54.9	0.2	95.2	14.3	44.0	22.1	36.5	28.8	93	26
Kenya		68	15.5	3.4	14.7	58.7	94.7	1.2	32.6	57.4	17.7	13.0	7.7	28.8	53	-15
United Republic of Tanzania		69	20.5	3.8	27.1	49.9	68.7	1.1	31.6	63.2	29.9	16.3	2.2	28.6	62	-7
Honduras		70	15.0	13.1	18.5	19.9	79.0	5.2	-	65.5	11.8	27.2	55.0	28.2	90	20
Kazakhstan		71	52.2	8.0	34.9	6.4	30.6	-	99.2	49.6	4.5	22.6	0.8	28.1	51	-20
Morocco		72	8.8	5.0	33.0	21.7	58.9	4.1	100.0	11.1	27.4	17.8	18.5	27.8	74	2
Chile		73	25.9	3.7	4.6	5.4	74.6	2.7	65.5	90.7	5.6	25.2	0.1	27.6	56	-17
Viet Nam		74	12.2	11.5	0.0	27.3	82.5	84.8	-	34.2	4.9	26.9	19.4	27.6	68	-6
Paraguay		75	28.2	18.0	35.3	17.3	79.2	-	2.0	100.0	3.1	13.5	4.8	27.4	52	-23
Congo		76	55.6	16.0	3.4	14.5	48.6	2.7	-	58.0	0.9	100.0	0.7	27.3	102	26
Peru		77	22.6	3.9	9.0	10.9	78.9	1.9	55.2	79.8	10.8	19.0	4.2	26.9	65	-12
South Africa		78	3.2	5.8	15.5	2.6	78.1	0.6	81.2	83.6	11.0	12.6	0.7	26.8	59	-19
Georgia		79	12.3	13.5	47.5	11.4	70.1	11.0	1.8	12.4	41.8	39.5	32.5	26.7	114	35
El Salvador		80	13.1	7.7	15.0	8.0	84.3	2.5	-	66.8	20.8	15.5	57.3	26.4	103	23
Benin		81	30.1	15.4	32.8	40.9	65.2	20.7	11.4	47.5	5.6	14.0	5.1	26.3	64	-17
Pakistan		82	12.9	4.4	3.9	39.5	76.4	1.3	79.1	33.2	3.4	11.9	20.8	26.1	69	-13
Nicaragua		83	15.4	9.4	15.9	26.6	75.7	5.1	-	66.5	13.0	27.0	31.0	26.0	92	9
Ghana		84	42.8	28.7	8.2	34.3	59.4	6.1	3.4	49.1	6.2	26.6	17.6	25.7	78	-6
Philippines		85	18.8	10.2	11.0	14.5	96.6	30.1	-	44.6	10.7	16.9	28.5	25.6	83	-2
Ecuador		86	31.7	3.5	20.8	15.3	67.3	20.6	18.6	72.2	7.9	12.5	7.8	25.3	70	-16
Uganda		87	15.9	12.3	12.1	41.2	67.2	-	3.6	73.4	24.1	17.6	10.5	25.3	84	-3
Oman		88	40.5	18.4	32.5	2.0	29.1	19.6	64.0	39.7	7.2	17.8	0.1	24.6	72	-16
Tunisia		89	4.4	9.0	47.9	15.7	23.8	25.5	99.9	-	13.3	15.8	13.8	24.5	81	-8
Lao People's Democratic Republic		90	16.0	12.6	16.8	29.6	82.6	-	-	55.0	16.4	31.3	4.0	24.0	94	4
Thailand		91	-	13.0	14.0	12.5	93.8	49.9	-	39.5	20.2	14.7	4.3	23.8	86	-5
Papua New Guinea	SIDS	92	21.6	14.1	0.7	31.2	80.9	21.6	-	77.3	0.0	13.7	0.0	23.7	71	-21
India		93	3.2	6.0	11.2	27.3	90.0	5.4	50.6	34.1	6.0	14.8	8.7	23.4	80	-13

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Country	Group	MVI Rank	Economic Vulnerability			Environmental Vulnerability		Geographical Vulnerability			Financial Vulnerability			MVI	EVI Rank	Rank Diff.
			Exp. conc.	Exp. inst.	Agr. inst.	Agr/GDP	Victims of Dis.	Pop. in LECZ	Dry Lands	Remote	Tourism	FDI	Remit.			
Dominican Republic	SIDS	94	12.0	5.8	8.8	8.7	76.1	5.3	2.2	53.6	42.6	20.0	22.4	23.4	118	24
Sri Lanka		95	11.3	4.8	12.3	12.6	88.5	11.0	-	49.2	29.0	13.5	24.7	23.3	106	11
Venezuela (Bolivarian Republic of)		96	74.5	5.2	18.0	8.0	46.9	11.6	18.8	59.2	1.8	10.4	0.1	23.1	75	-21
Togo		97	16.0	12.4	17.3	45.0	54.8	3.2	3.1	48.0	16.5	12.5	25.1	23.1	101	4
Myanmar		98	17.5	11.6	13.1	40.7	63.8	19.5	-	37.7	16.8	22.3	10.0	23.0	99	1
Algeria		99	45.3	4.5	31.1	19.5	37.4	3.6	96.2	-	0.7	11.5	3.3	23.0	77	-22
Bangladesh		100	35.9	5.5	9.8	22.5	86.7	23.9	-	33.8	0.7	13.1	19.5	22.9	88	-12
Guatemala		101	5.2	3.1	3.8	15.7	86.4	0.6	-	66.8	14.3	14.6	34.3	22.2	113	12
Guinea		102	45.0	30.6	2.6	31.2	49.7	6.7	-	49.8	0.5	25.3	2.1	22.1	91	-11
Bhutan		103	32.5	19.6	30.9	28.5	45.2	-	-	50.5	21.2	10.6	4.4	22.1	96	-7
Mauritius	SIDS	104	13.0	10.8	28.0	4.1	42.6	4.9	-	74.7	40.1	18.1	5.3	22.0	116	12
Uruguay		105	15.1	5.5	26.6	8.6	53.7	6.3	-	88.9	16.6	19.7	0.5	21.9	97	-8
Trinidad and Tobago	SIDS	106	28.8	28.5	32.2	0.3	61.8	11.5	-	57.4	7.3	8.6	1.7	21.6	87	-19
Argentina		107	11.8	3.0	19.5	10.3	47.5	2.9	28.5	89.1	8.9	14.1	0.2	21.4	95	-12
Mexico		108	3.6	7.8	-	4.3	64.4	3.0	52.9	68.2	5.5	18.3	7.6	21.4	98	-10
Colombia		109	25.1	2.7	5.1	10.3	73.5	6.7	1.2	67.1	13.3	21.9	5.0	21.1	105	-4
Costa Rica		110	19.0	4.5	7.4	7.3	67.2	5.7	-	67.0	23.0	24.6	2.9	20.8	115	5
Barbados	SIDS	111	7.3	9.5	14.2	0.8	39.0	6.3	-	54.7	47.6	39.6	8.7	20.7	124	13
Panama		112	5.2	16.5	4.1	2.5	51.2	17.2	-	65.7	26.3	35.1	2.9	20.6	119	7
Gabon		113	48.9	7.1	0.6	7.4	50.7	27.2	-	53.3	0.8	27.7	0.4	20.4	104	-9
Malaysia		114	11.2	14.1	11.1	12.4	61.2	28.9	-	48.6	10.9	19.1	1.4	19.9	109	-5
Democratic Republic of the Congo		115	45.2	19.7	-	33.0	32.5	0.0	0.2	58.1	0.1	18.5	8.5	19.6	107	-8
Brazil		116	5.4	2.3	6.6	7.4	70.0	6.4	10.2	80.1	3.1	20.6	0.4	19.3	108	-8
Cameroon		117	26.8	3.6	8.5	25.0	38.2	6.5	25.4	49.1	9.2	15.9	2.4	19.2	111	-6
Indonesia		118	4.1	7.3	4.1	21.5	55.5	25.2	-	57.8	8.2	15.2	2.9	18.3	117	-1
China		119	-	4.8	-	11.8	95.2	13.9	29.4	27.2	2.0	15.1	0.7	18.2	112	-7
Kuwait		120	56.6	16.0	27.9	-	-	13.6	43.0	26.9	1.3	10.3	0.0	17.8	110	-10
Egypt		121	5.7	14.0	9.5	18.1	-	46.7	23.4	14.0	21.1	16.9	23.0	17.5	125	4
Qatar		122	45.1	17.4	45.1	-	-	19.3	-	33.8	16.7	10.4	0.8	17.1	120	-2
Côte D'Ivoire		123	33.7	9.3	10.8	37.9	8.8	9.3	-	50.4	3.2	13.5	2.1	16.3	121	-2
Turkey		124	-	5.4	11.7	9.8	47.9	7.4	62.2	-	18.0	14.5	0.4	16.1	122	-2
Saudi Arabia		125	55.0	7.6	12.4	2.5	1.0	9.2	19.6	31.2	6.1	12.2	0.1	14.3	123	-2
Republic of Korea		126	8.6	7.7	4.3	1.7	34.5	6.1	-	34.9	3.4	11.8	1.2	10.4	126	0

Appendix II: Principal Component Analysis

Principal components/correlation   Number of obs   =   126

Rotation: orthogonal varimax (Kaiser off)   Rho   =   0.5794

Component	Variance	Difference	Proportion	Cumulative
Comp1	1.7150	0.0857	0.1559	0.1559
Comp2	1.6293	0.0723	0.1481	0.3040
Comp3	1.5569	0.0847	0.1415	0.4456
Comp4	1.4722	.	0.1338	0.5794

Rotated components (blanks are abs(loading)<.2)

Variable	Comp1	Comp2	Comp3	Comp4
Agriculture and fishing as share of GDP			0.4096	
Remoteness				-0.4788
Export concentration	0.6159			
Export instability	0.4900			
Share of population in low elevated coast zones				-0.232
Share of population living in drylands				0.6596
Agricultural instability	0.3802			
Victims of disasters			0.6452	
Tourism revenues as share of exports		0.6463		
FDI inflows as % of GDP		0.4238		
Remittances as % of GDP		0.2395		

Appendix III: MVI Vulnerability Decomposition for 34 SIDS in MVI

Antigua and Barbuda

Barbados

Belize

Cabo Verde

Comoros

Dominica

Dominican Republic

Fiji

Grenada

Economic
60.0
40.0
20.0

Geographical — Financial

Environmental

Guinea-Bissau

Economic
80.0
60.0
40.0
20.0
-

Geographical — Financial

Environmental

Guyana

Economic
60.0
40.0
20.0
-

Geographical — Financial

Environmental

Haiti

Economic
80.0
60.0
40.0
20.0
-

Geographical — Financial

Environmental

Jamaica

Economic
50.0
40.0
30.0
20.0
10.0
-

Geographical — Financial

Environmental

Kiribati

Economic
80.0
60.0
40.0
20.0
-

Geographical — Financial

Environmental

Maldives

Economic
60.0
40.0
20.0
-

Geographical — Financial

Environmental

Marshall Islands

Economic
80.0
60.0
40.0
20.0
-

Geographical — Financial

Environmental

Mauritius

Economic
30.0
25.0
20.0
15.0
10.0
5.0
Geographical   -   Financial

Environmental

Micronesia

Economic
80.0
60.0
40.0
20.0
Geographical   -   Financial

Environmental

Nauru

Economic
80.0
60.0
40.0
20.0
Geographical   Financial

Environmental

Palau

Economic
60.0
40.0
20.0
Geographical   -   Financial

Environmental

Papua New Guinea

Economic
60.0
50.0
40.0
30.0
20.0
10.0
Geographical   -   Financial

Environmental

Sao Tome and Principe

Economic
50.0
40.0
30.0
20.0
10.0
Geographical   -   Financial

Environmental

Saint Kitts and Nevis

Economic
50.0
40.0
30.0
20.0
10.0
Geographical   -   Financial

Environmental

Saint Lucia

Economic
50.0
40.0
30.0
20.0
10.0
Geographical   Financial

Environmental

Saint Vincent and the Grenadines

Samoa

Seychelles

Solomon Islands

Suriname

Timor Leste

Tonga

Trinidad and Tobago

Tuvalu

Economic

Geographical — Financial

Environmental

Vanuatu

Economic

Geographical — Financial

Environmental