



United Nations High Level Panel on the Multi-Dimensional Vulnerability Index

Technical Presentation

April 28, 2023

Please also see supplementary materials on:

<https://www.un.org/ohrlls/mvi>



Why is an MVI needed?

- Wide agreement that poorer countries need and deserve assistance.
 - Country assistance need often measured by GNI PC, which is both narrow and a weak measure of material well-being.
- Downward volatility of well-being also problem – recovery costs can be high.
 - External shocks are a big risk.
 - Stressors such as climate change that lower or eliminate prospects for future income gain also relevant to country needs.
- Countries with **structural risk of lower well-being** also deserve special assistance, especially if countries **structurally lack resilience**.
- **No international, widely accepted, quantitative benchmark to measure structural vulnerability or lack of resilience across multiple dimensions of sustainable development at the national level.**

UN resolution: Develop and disseminate an MVI

(UNSG REPORT A/76/211)



Multiple use cases for an MVI – depends on stakeholder



- **Identify main sources of structural vulnerability and lack of resilience** in countries, across all dimensions, at national level.
 - Example – long coastline, which increases risk of lower future well-being owing to climate change
- **Assist countries in developing strategies** to improve well-being by pinpointing their sources of vulnerability and benchmarking these across countries.
- **Assist in allocation of development finance** by complementing other measures of country need (especially the GNI which does not have a risk adjustment).
- **Tool for research/analysis** of vulnerability and development.



The MVI framework – Principles from UNSG report



Multidimensionality

- ***Indicators should be drawn from all three dimensions of sustainable development***

Universality

- ***the vulnerabilities of all developing countries must be included in the index.***
- ***the index needs to employ available, recognized, comparable and reliable data.***

Exogeneity

- ***only factors that are structural should be considered.***
 - *Structural: factors that are inherent or slow-moving, independent from current or recent policy choices*

Evidence-based

- ***There should be evidence relating index concepts to vulnerability***

Simplicity

- ***the framework of the MVI should be based on a simple structure.***

MVI includes 2 pillars



From UNSG report (A/76/211):

- **2 pillars, *Vulnerability and Resilience***

Panel decisions *(see interim report):*

➤ Structural **vulnerability:**

- *the risk of a country's sustainable development being hindered by recurrent adverse exogenous shocks and stressors.*

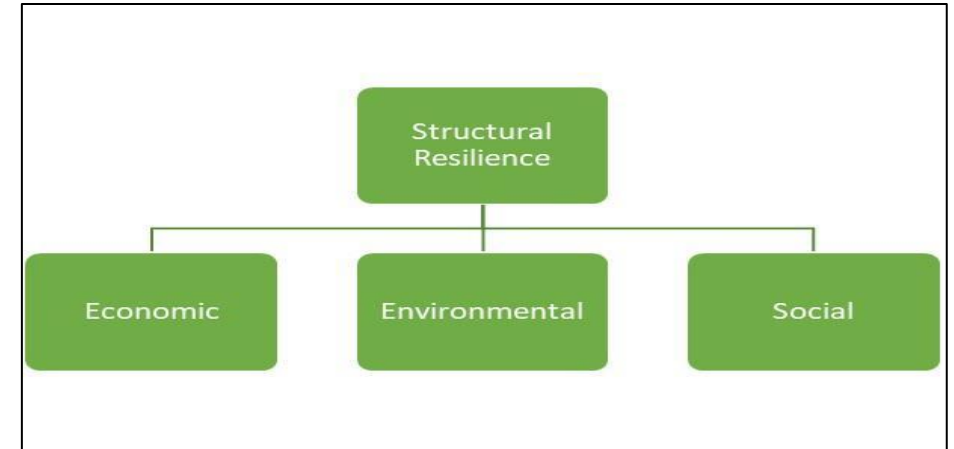
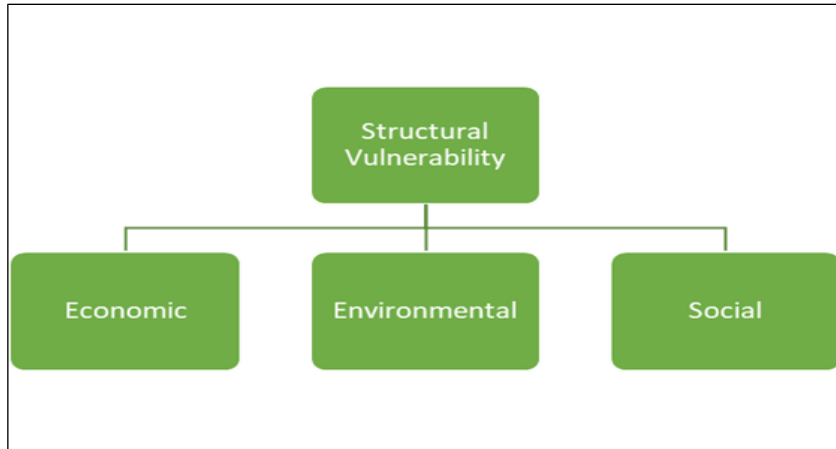
➤ Structural **resilience:**

- *the inherent characteristics or inherited capacity of countries to withstand, absorb, recover from or minimize the adverse effects of shocks or stressors*

The MVI framework



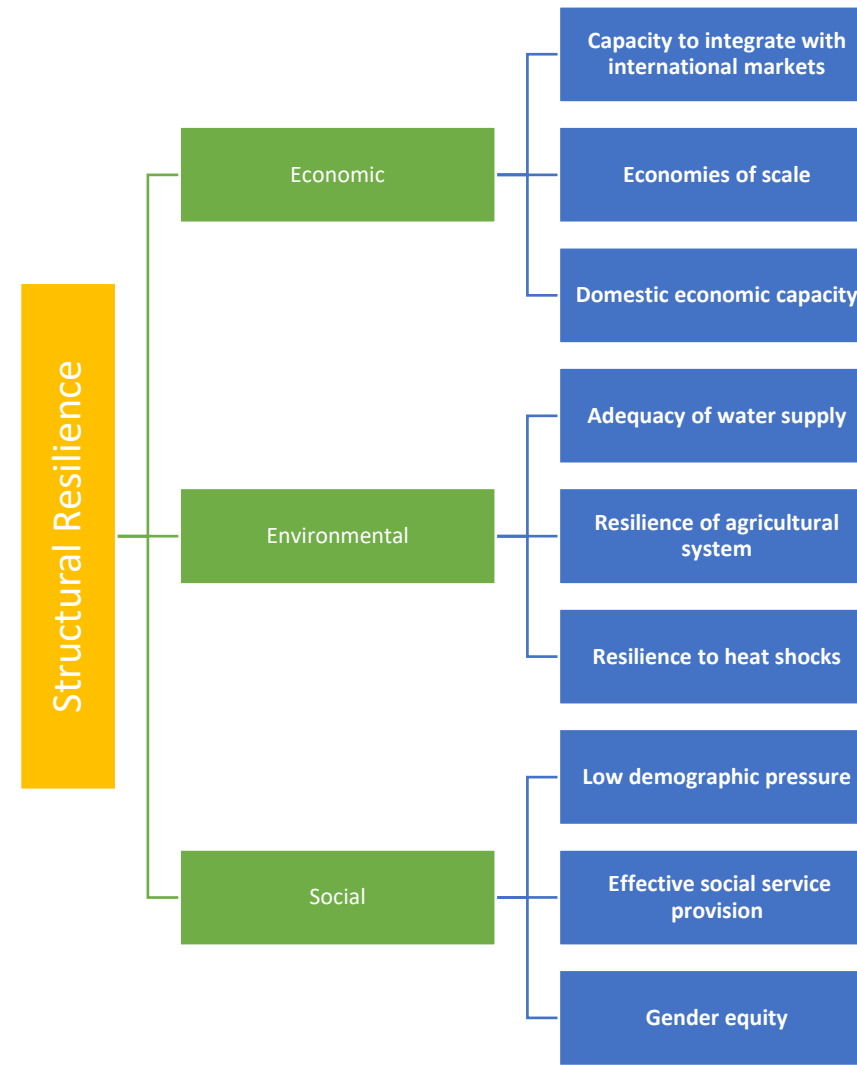
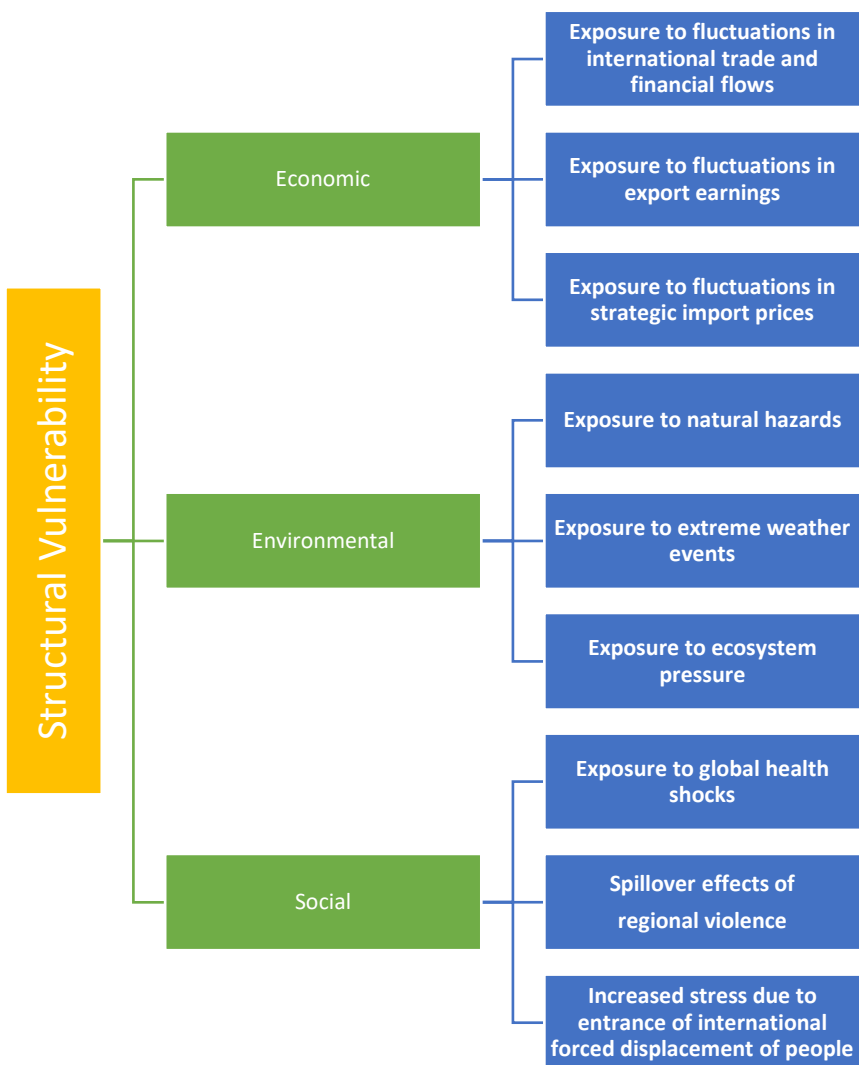
- Integrates 3 dimensions of sustainable development.
 - Dimensions could be used separately
- Dimensions defined by concepts shown to be related to exposure to external shocks and stressors (*vulnerability*), or structural factors that reduce loss in case risk materializes (*resilience*).
- Concepts measured by selected indicators.
 - Avoid long list of indicators





Identification of concepts based on thorough literature search, theory of change

(See “Concepts and Indicators” table on website)





Indicators choice – the criteria

1. Data availability

- *The selected indicators must have data publicly available on all developing countries.*

2. Data quality

- *The MVI should be based on data of the highest quality.*

3. Indicator selection transparency

- *the relationship between vulnerability, resilience and the selection of indicators has to be based on clear and detailed rationales.*

4. Indicator acceptability

- *the selection of indicators has to lead to an acceptable MVI.*

The four **criteria** ensure the credibility of the index and well as its robustness and stability across time.

Application of principles and criteria related to data need clear **rules**.



Indicators choice - Rules

Rule #1: The use of UN data must be prioritized.

Rule #2: The MVI will not be based on variables that present too many missing values.

- Missing data will not be estimated at this stage.

Rule #3: The MVI will be computed for every country even those with a limited amount missing data.

Rule #4: The MVI scores and ranks will NOT be computed for countries with too many missing values.



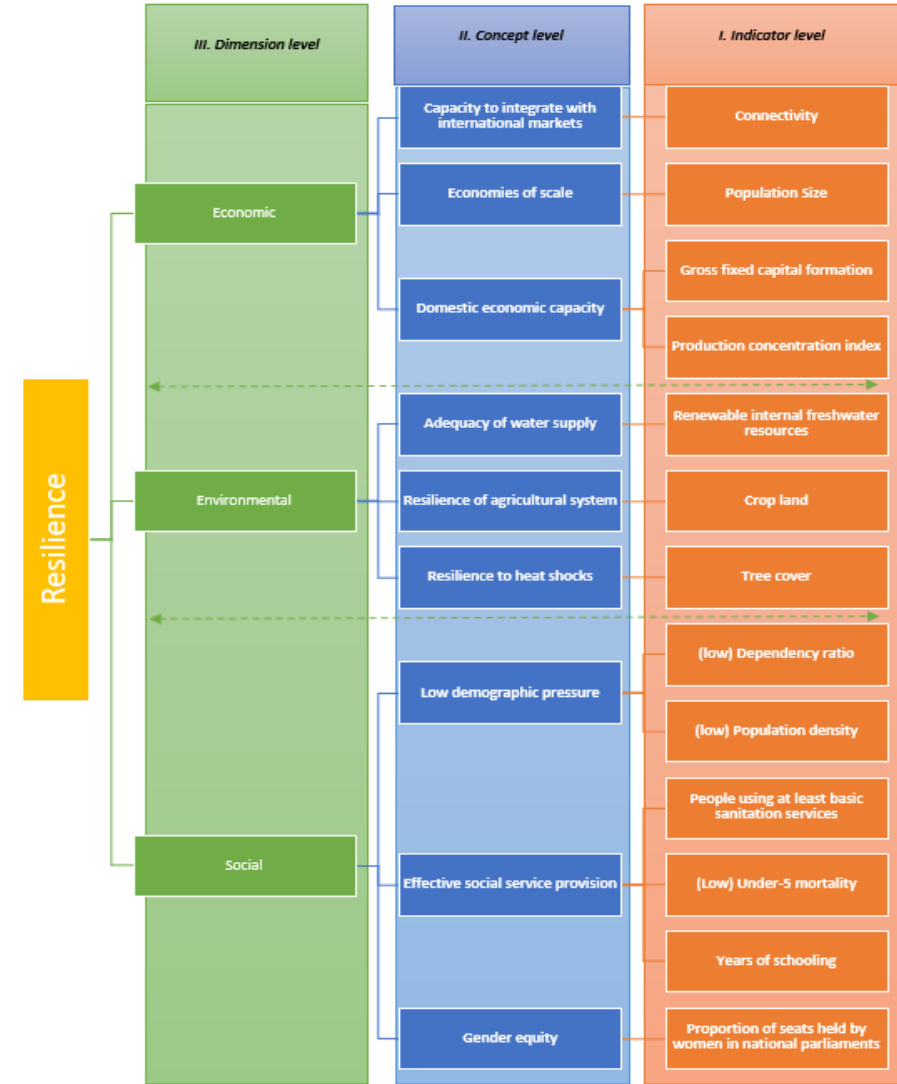
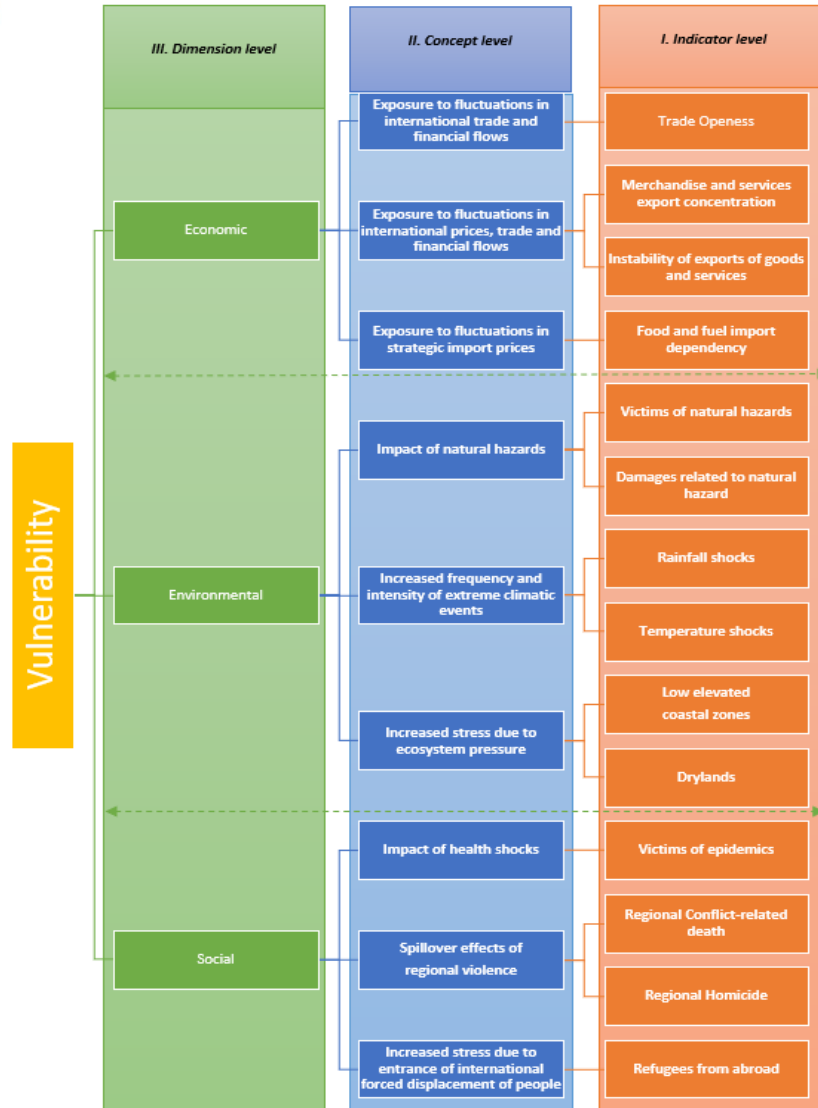
Examples of indicators excluded:

- **Principle: evidence-based**
 - ***Share of agriculture in GDP (Economic vulnerability)*** – Lack of convincing and recent evidence linking the indicator to vulnerability to shocks
 - ***Share of remittances in GDP (Economic vulnerability)*** – Lack of evidence relating this indicator to vulnerability to shocks; weak evidence relating it to resilience
- **Rule #1: UN data must be prioritized**
 - ***Victims and damages from natural hazard (Environmental vulnerability)*** – Sendai Framework Monitor data was replaced by the EM-DAT database as the alternative source which is also used by the UN.
- **Rules #2: too many missing values**
 - ***(low) Income inequality (Social resilience)*** – Countries without reliable income or consumption surveys do not have reliable data.



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The MVI framework – Concepts and indicators





Creating the Index

Min-Max rescaling

- Transforming the multiple units of the raw variables (e.g., people, dollars, etc.) into a common and comparable scale is a key technical first step to make the individual indicators aggregatable.
- Only indicators with comparable scales can be aggregated.
- Min-max is one of the most common ways to rescale data.
- For every indicator, all raw data were rescaled into a value between 0 and 100 depending on the distance to the Min and Max.
- Outliers were also detected and rescaled.



Creating the Index - Aggregation



- Countries are vulnerable in different ways.
- How to aggregate the indicators in a composite index which properly reflects these differences?
- Two simple options can be compared: the arithmetic and the quadratic mean.
 - The quadratic mean is computed in three steps as follows
 - Step 1: Each indicator is squared
 - Step 2: Calculate the arithmetic mean of the squared indicators
 - Step 3: Find the square root of the result obtained in step 2
- The MVI panel selected the **quadratic mean** as the appropriate method as it is better captures vulnerability by rewarding the largest differences in components.

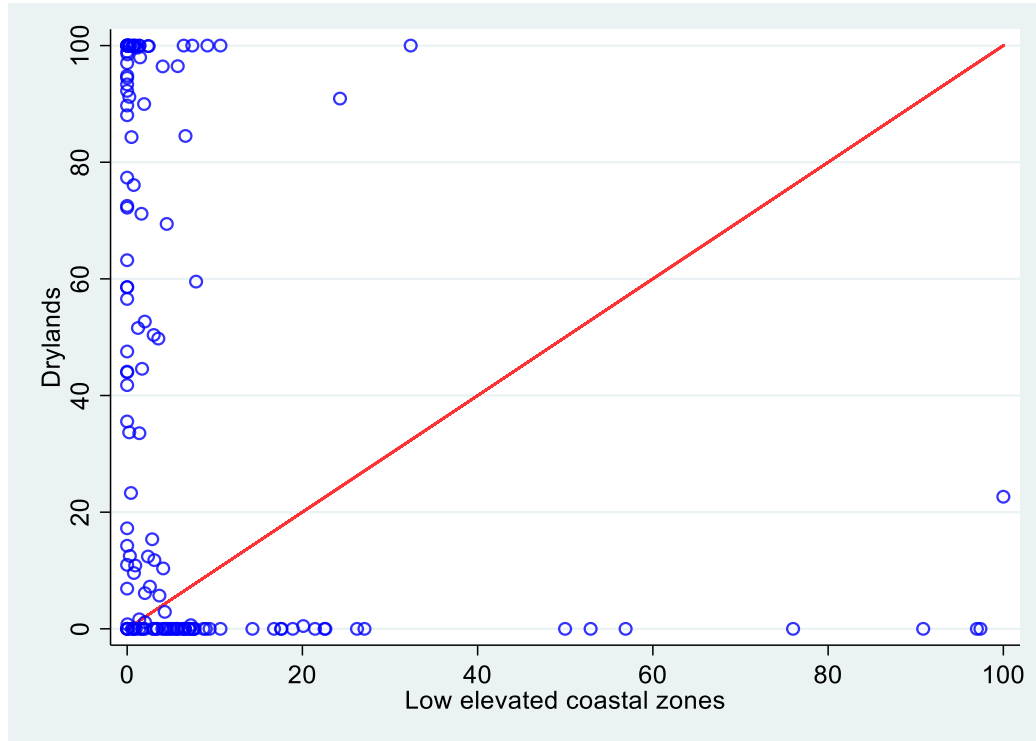
Example of arithmetic vs. quadratic aggregation

Estimating exposure to ecosystem pressure:



How to combine drylands and low elevated coastal zones?

Figure 1: Scatter plot of Dryland and LECZ



The two indicators have a very low correlation. Countries are either exposed to one or the other (or neither) but never to both (no data close to the 45° line). Using a simple mean would blur their specific profiles.



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Example of arithmetic vs. quadratic mean aggregation

Exposure to ecosystem pressure



Figure 1: Distribution of scores using of arithmetic aggregation

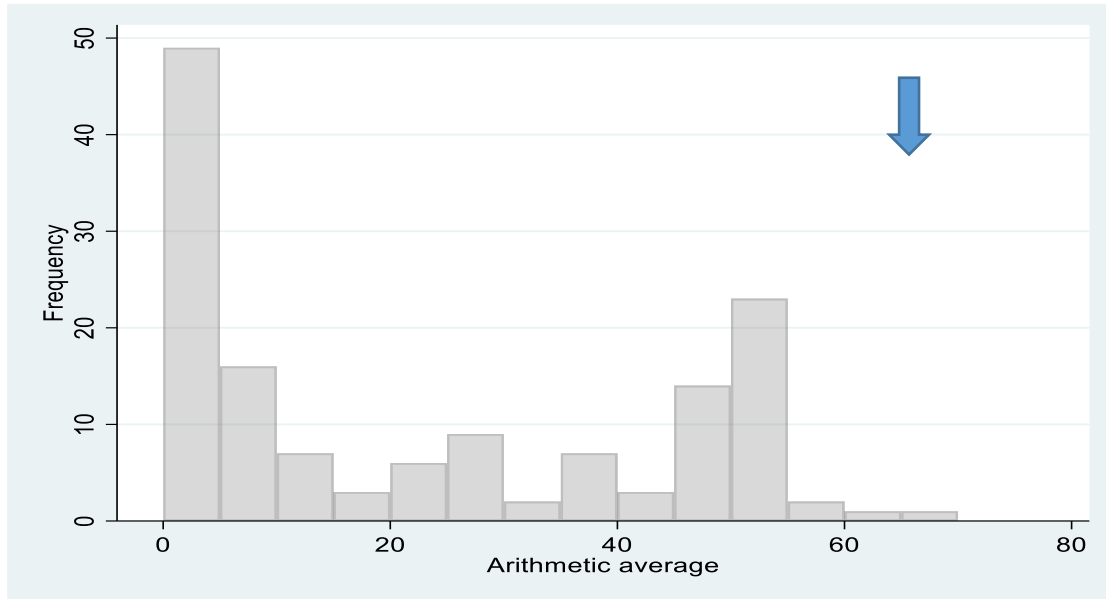
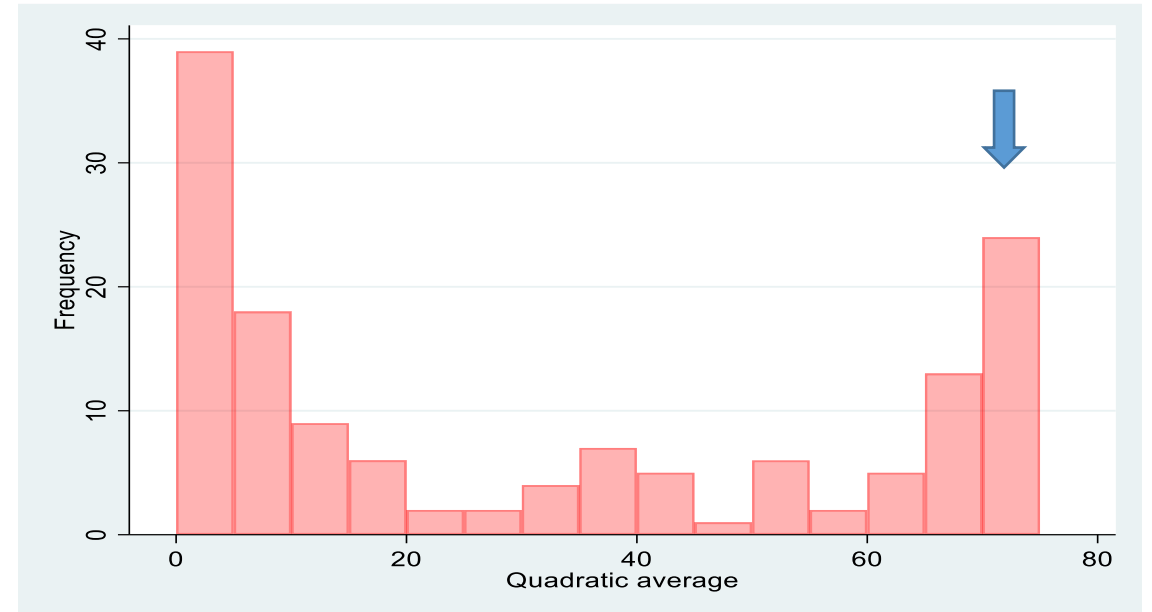


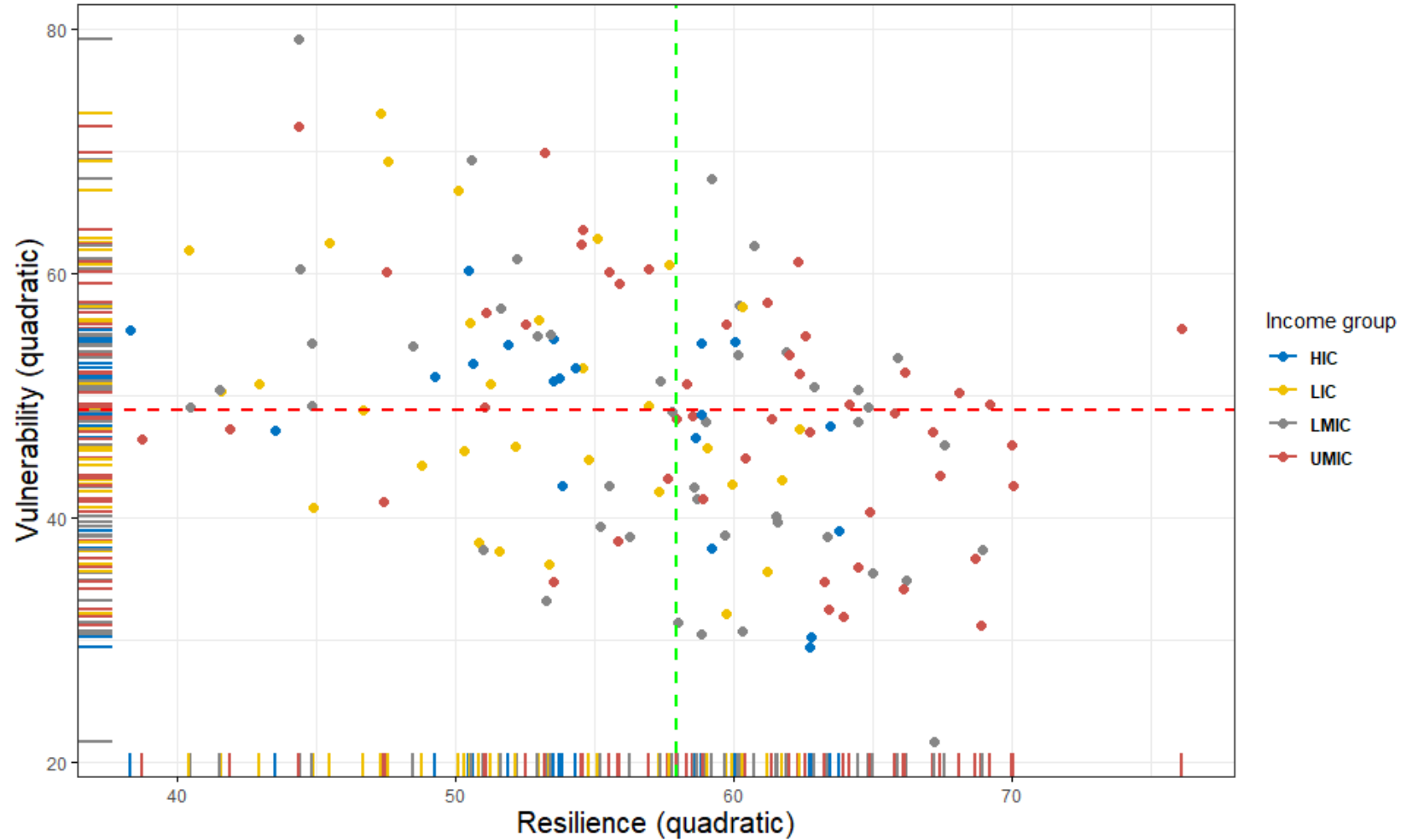
Figure 2: Distribution of scores using quadratic aggregation



The quadratic mean (in orange, on the right) results in high vulnerability scores for countries with just one of the two types of vulnerabilities, compared to the arithmetic mean (in grey, on the left), where almost no countries are scored as vulnerable.

Aggregating vulnerability and resilience

Scatter plot of vulnerability and resilience





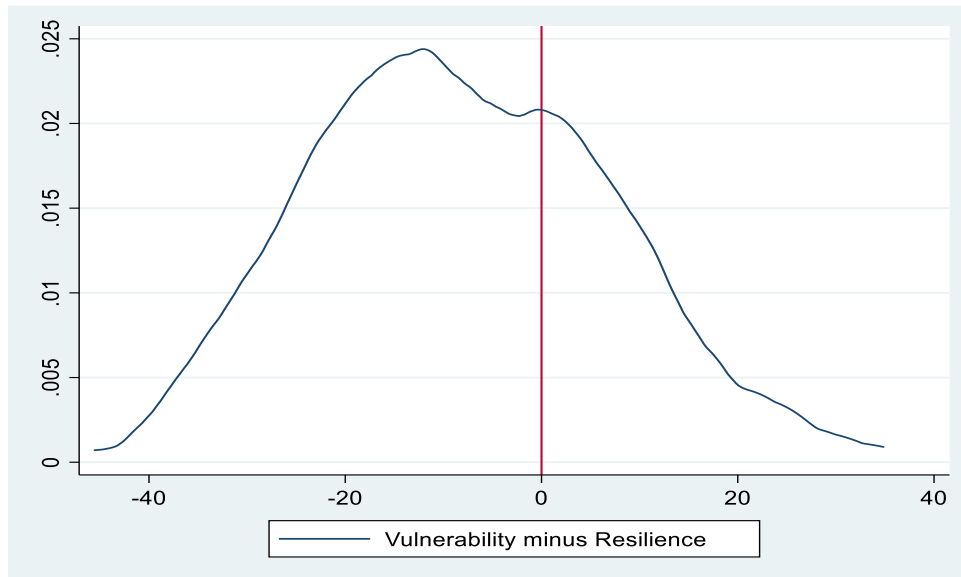
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Aggregating vulnerability and resilience

- The way structural vulnerability and resilience should be combined wasn't specified in UN resolution or TOR
- **Is Net Vulnerability = Vulnerability-Resilience?**
- Problem: Negative values. What does negative vulnerability mean?
 - *Negative values result in part from min-max scaling, not from lack of vulnerability*

Distribution of Vulnerability minus Resilience



98 out of 143 countries have negative values under this aggregation method

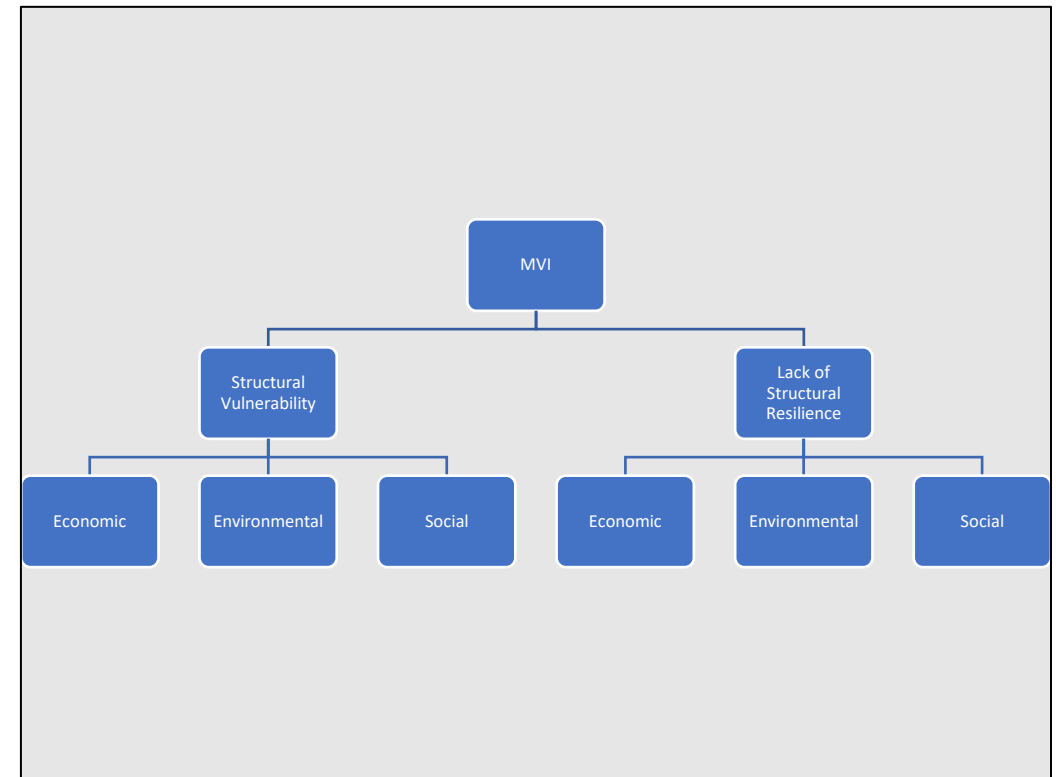
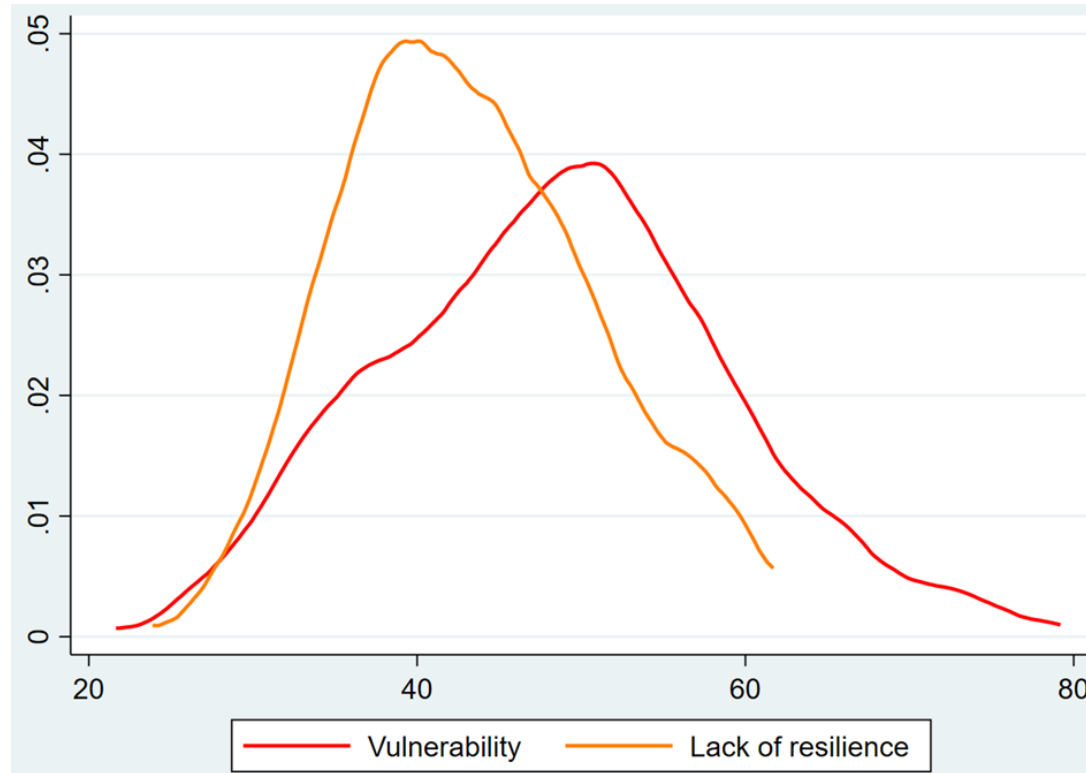
Total Vulnerability = Vulnerability + Lack of Resilience*



*Lack of Resilience = (100-Resilience)

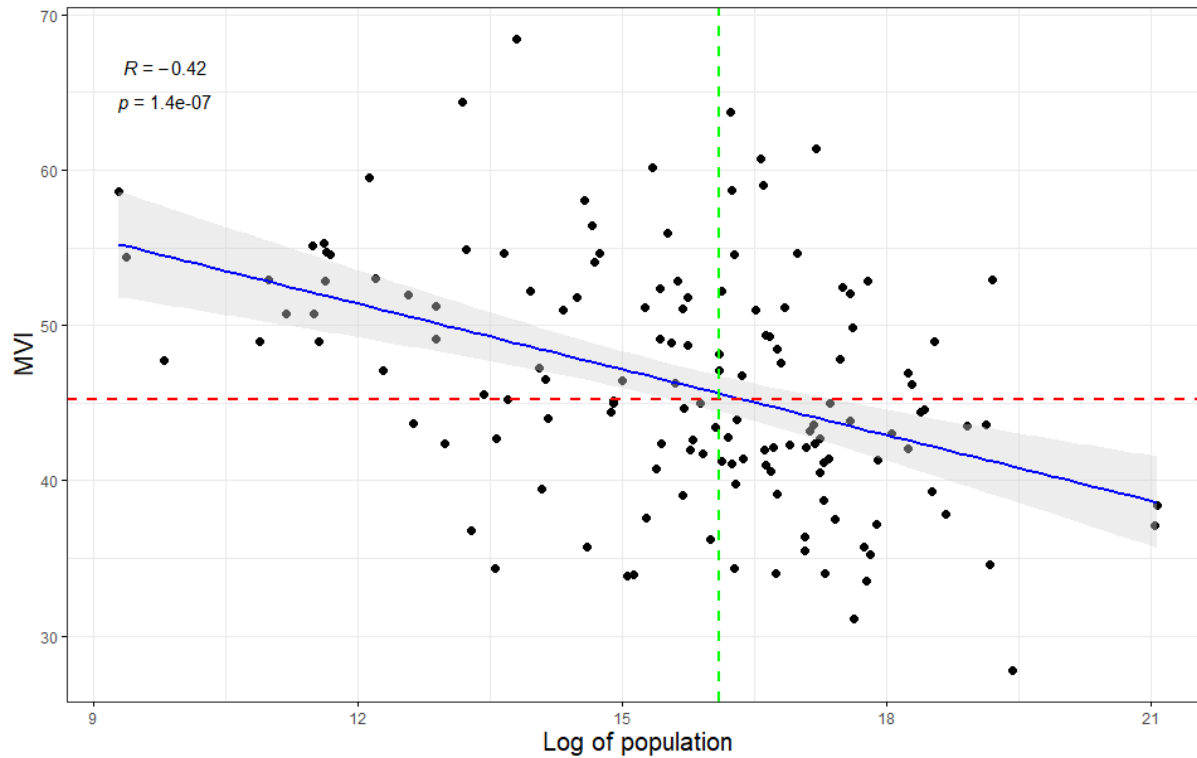
* Aggregation of two pillars by quadratic mean

Distribution of Vulnerability and Lack of Resilience

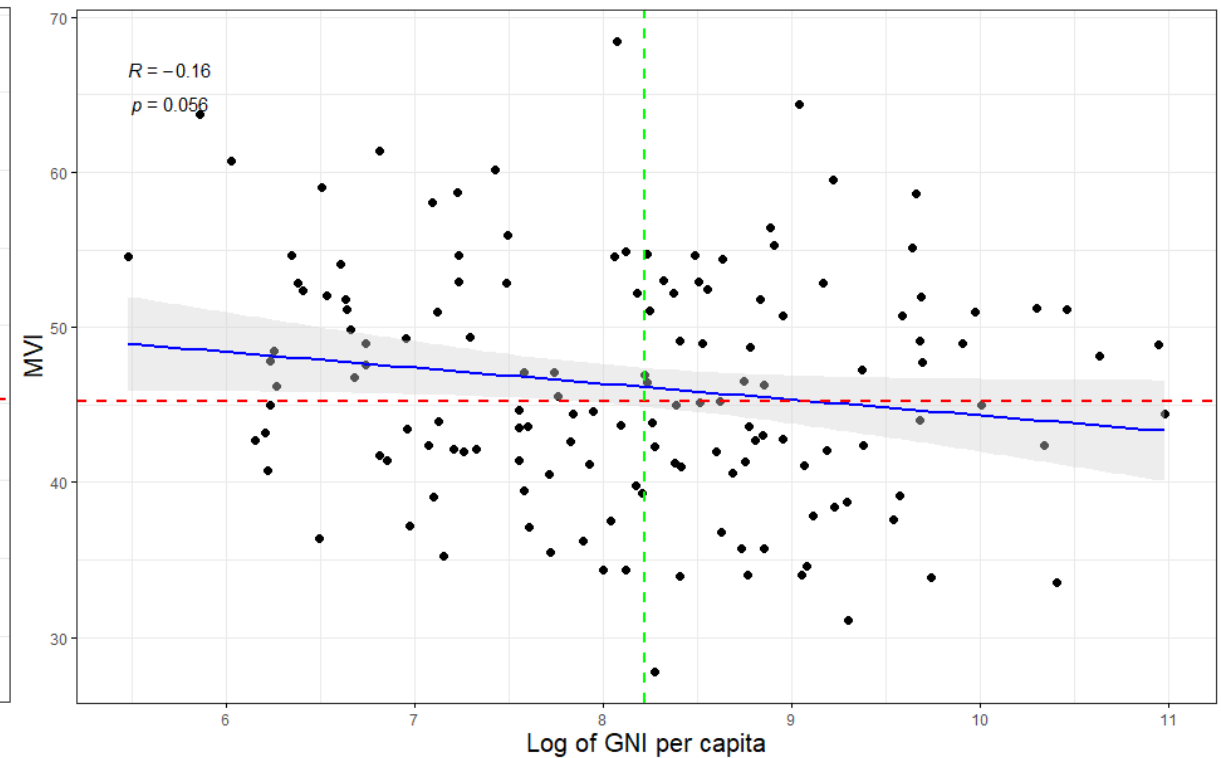


MVI – SENSITIVITY ANALYSIS

Scatter plot of MVI and population (log)

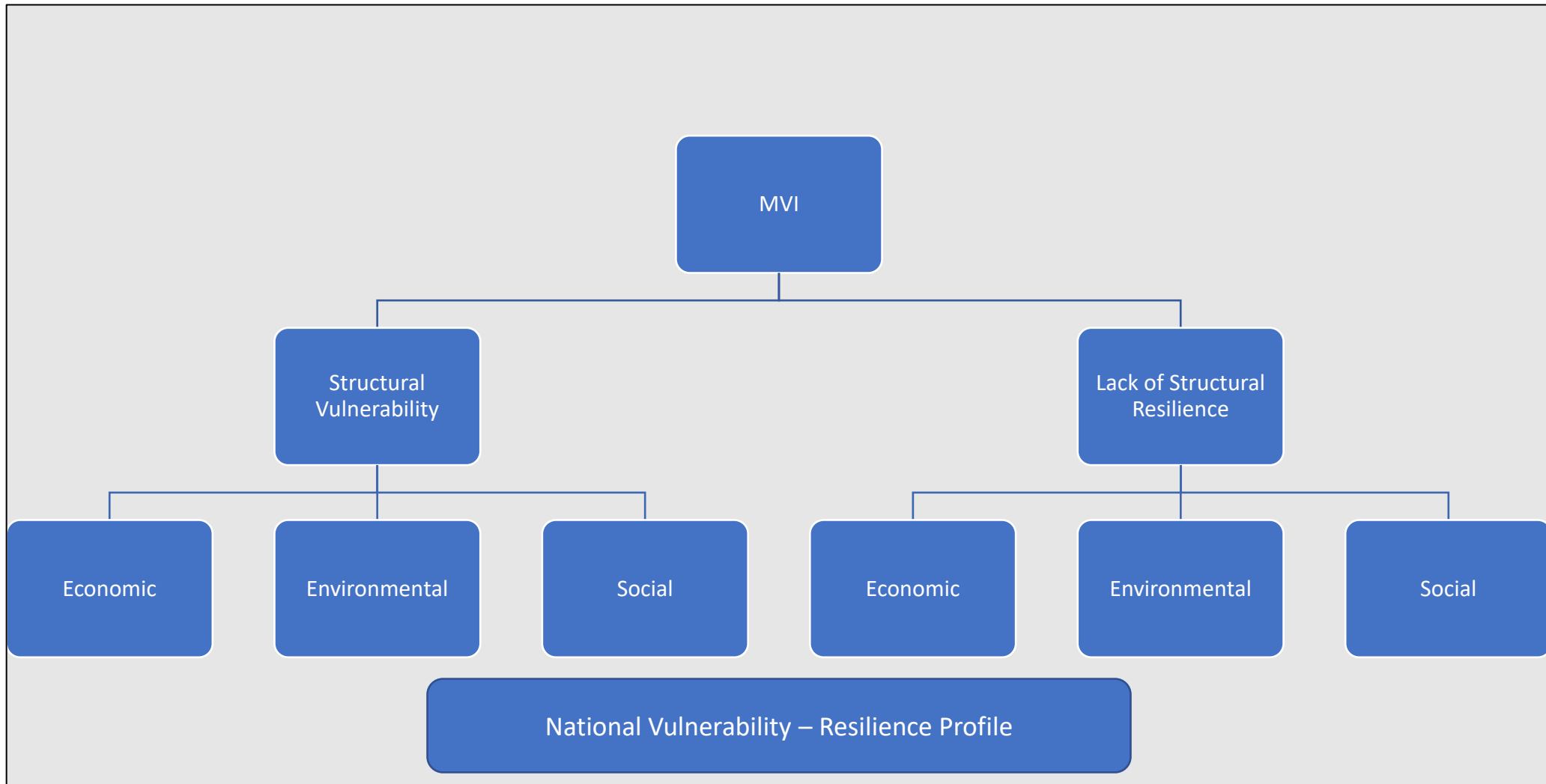


Scatter plot of MVI and GNI PC





THE FULL MVI FRAMEWORK





Thank you for your attention

- Written comments may be sent to:
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