Introduction

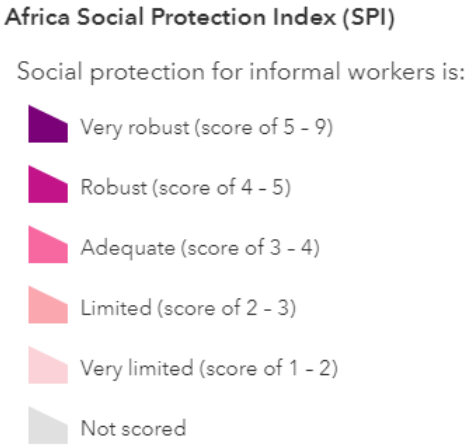
The Impacts of COVID-19 in Africa Project was created to explore and apply different GIS methods in order to address questions on the primary and secondary impacts of COVID-19 across Africa. A continent-wide GIS analysis approach was taken in order to compare countries and due to the lack and gaps in subnational data. The limitations of using national level data helped shape the methodology, but largely the methodology and analysis was driven by the analytic questions the team identified. The project focuses on two key areas: social protection for informal workers and the resiliency of health systems within the context of COVID-19. To address the analytic questions related to these two topics, the team used weighted linear combination to create the Social Protection Index (SPI) and Health Systems Resiliency Index (HSRI).

SPI Methodology

The Social Protection Index scores how well or robust African countries' systems, capacities, and responses to COVID-19 support and protect informal workers. The index scores countries on a scale from 1 to 9, with 9 being the most robust response to protect informal workers and 1 indicating a very limited response that is not protecting informal workers from the negative impacts of COVID-19.

Analytic Questions

- How robust and resilient are African countries' social protection systems and responses for informal workers during COVID-19?
- Which countries in Africa are doing a better job of supporting informal workers?



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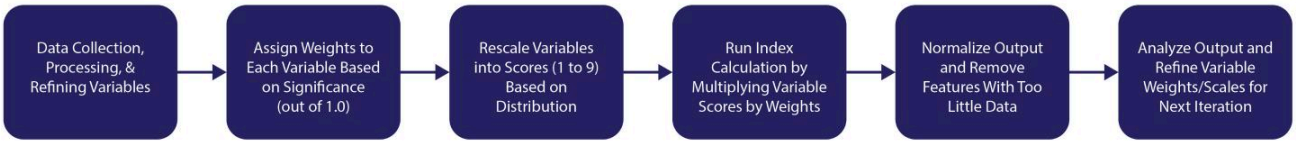

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databases that included national data for Africa. The variables were decided on after extensive quantitative and qualitative research on COVID-19 impacts in Africa, informal employment in Africa, and social protection systems in Africa.

SPI variables:

1. Social Protection Coverage
2. Social Protection Expenditure
3. Government Stringency
4. Direct Social Protection Measures
5. Indirect Social Protection Measures

Social Protection Coverage (SP Coverage)

This variable is the Social Assistance Coverage data downloaded from the World Bank Atlas of Social Protection Indicators of Resilience and Equity (ASPIRE). The variables notes the % of the total population covered by social assistance programs. Date of data is from 2004 - 2019. Website: https://www.worldbank.org/en/data/datatopics/aspire

Social Protection Expenditure (SP Expenditure)

This variable is the data downloaded from the International Labor Organization's World Social Protection Database. The variable provides the % GDP spent on social protection. Date of data is from 2005 - 2015. Website: https://www.social-protection.org/gimi/WSPDB.action?id=45

Government Stringency

This variable is the data downloaded from the University of Oxford's Coronavirus Government Response Tracker. The variable is the index score (0-100 with 100 being the strictest) from the Government Stringency Index, which records the strictness of lockdown style policies implemented by governments. The Government Stringency Index consists of containment and closure policies C1-C8 and one health system policy H1 (C1: School closing C2: Workplace closing C3: Cancel public events C4: Restrictions on gatherings C5: Close public transport C6: Stay at home requirements C7: Restrictions on internal movements C8: International travel controls H1: Public information campaigns). Data is temporal, date of data is from January 2020 until present. Website: https://github.com/OxCGRT/covid-policy-tracker

Direct Social Protection Measures (Direct SP Measures)

This variable is the data downloaded from the International Labor Organization's Social Protection Responses to COVID-19 Crisis around the World dashboard. The data counts new or expanded social protection measures in response to COVID-19. The data is organized by function; the Direct Social Protection Measures variable includes the following functions: Several Functions, Unemployment, Sickness, and Income/job protection, and Special allowances and grants. We assumed that these functions would have a more direct impact on informal workers than other functions. Data is temporal, date of data is from March 2020 - present. Website: https://www.social-protection.org/gimi/gess/ShowWiki.action?id=3417

Indirect Social Protection Measures (Indirect SP Measures)

This variable is the data downloaded from the International Labor Organization's Social Protection Responses to COVID-19 Crisis around the World dashboard. The data counts new or expanded social protection measures in response to COVID-19. The data is organized by function; the Indirect Social Protection Measures variable include the following functions: Health, Food and nutrition, Children and family, Housing and basic services, Pensions, and Access to education. We assumed that these functions would have some impact on informal workers, but not a direct impact compared to other functions. Data is temporal, date of data is from March 2020 - present. Website: https://www.social-protection.org/gimi/gess/ShowWiki.action?id=3417

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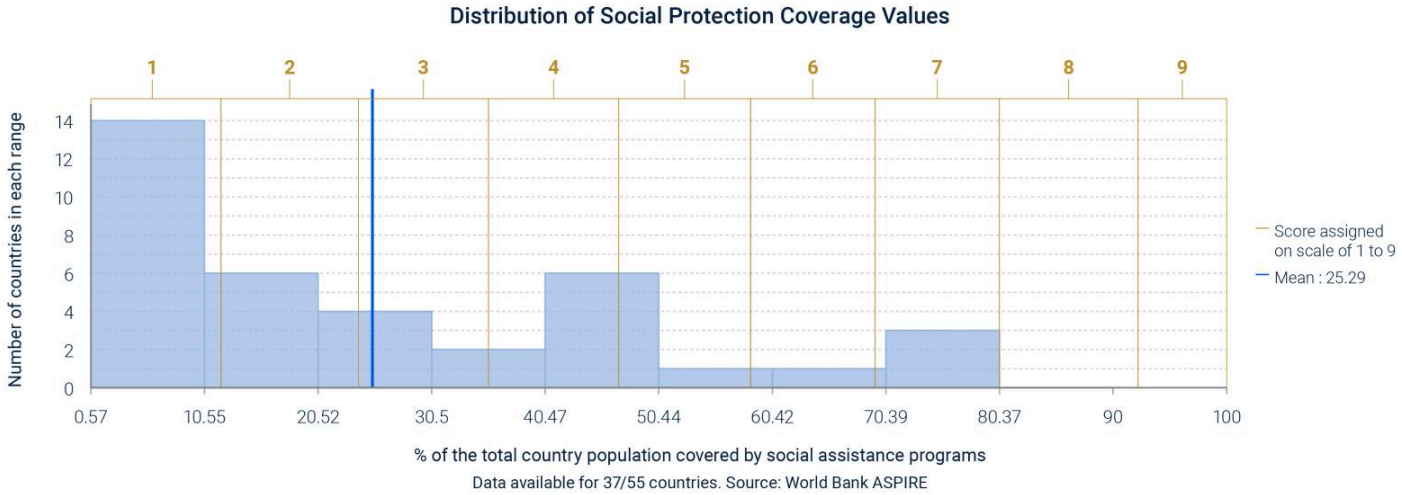
Variables were rescaled from original values to ensure a properly weighted model. Details on the scaling methods are included below for each variable. Additionally, variables were each weighed according to the analysts' assessment on how important the variable is to the index. A relative weighting scheme was used for this iteration.

Social Protection Coverage (SP Coverage)

Negative or Positive Variable: Positive

Weight: 35 - Given greatest relative weight because social assistance coverage notes the baseline and how well a country maybe able to respond to stressors and support their population.

Rescaling Method: Rescaling into 9 categories – 1 indicating lowest possible baseline coverage and 9 indicating highest. Rescaling based on global range for social assistance coverage is from 0-93, so 93 or higher would get a score of 9.



Social Protection Expenditure (SP Expenditure)

Negative or Positive Variable: Positive

Weight: 15 – %GDP spent on social protection indicates certain level of investment, prioritization, and resources by government on social protection issues. Coverage weighted more since the variable is more extensive and directly notes the % of the population that is covered, which could include informal workers.

Rescaling Method: Rescaling into 9 categories – 1 indicating a country's lowest % social protection expenditure and 9 indicating the highest % social protection expenditure. Rescaling based on global %GDP expenditure range with 23% or higher being a 9.

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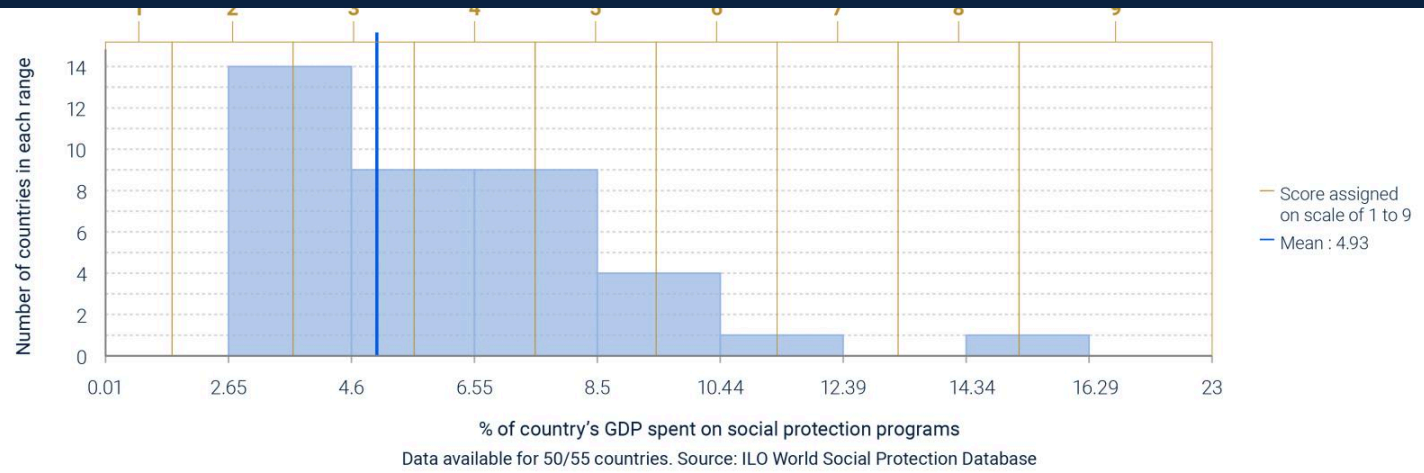

Government Stringency

Negative or Positive Variable: Negative

Weight: 10 – Given the least amount of weight because it is only meant to account for COVID-19 responses that negatively impact informal workers. But weighted less than social protection measures, because restrictive measures didn't fully stop informal employment for continuing. Also given lower weight to account for countries that might not have good social protection measures and a low stringency score, which would cause the country to score higher on the index when it is not a country with good social protection measures for informal workers.

Rescaling Method: Rescaling into 9 categories – 1 indicating the highest stringency index score and 9 indicating a lower stringency score. Range for Government Stringency Index is 0 – 100.

Direct Social Protection Measures (Direct SP Measures)*

Negative or Positive Variable: Positive

Weight: 25 – Direct measures were given more weight than indirect measures because they are directly supporting informal workers and making them more resilient to negative COVID-19 impacts.

Rescaling Method: Rescaling into 9 categories – 1 indicating the least number of direct social protection responses and 9 indicating the most number of direct social protection responses. The 9 categories were created by dividing each country's total number of social protection

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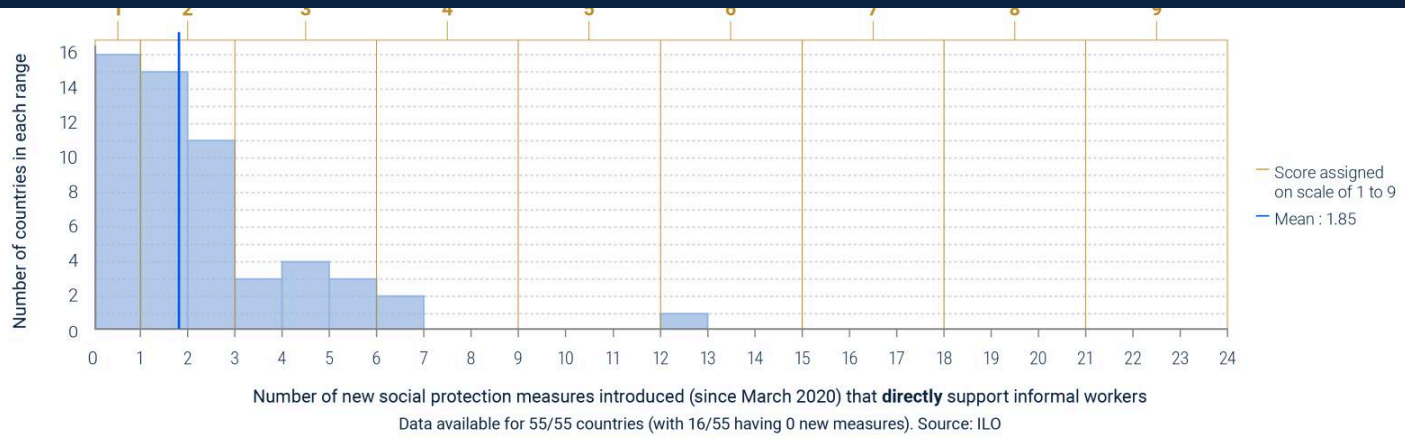
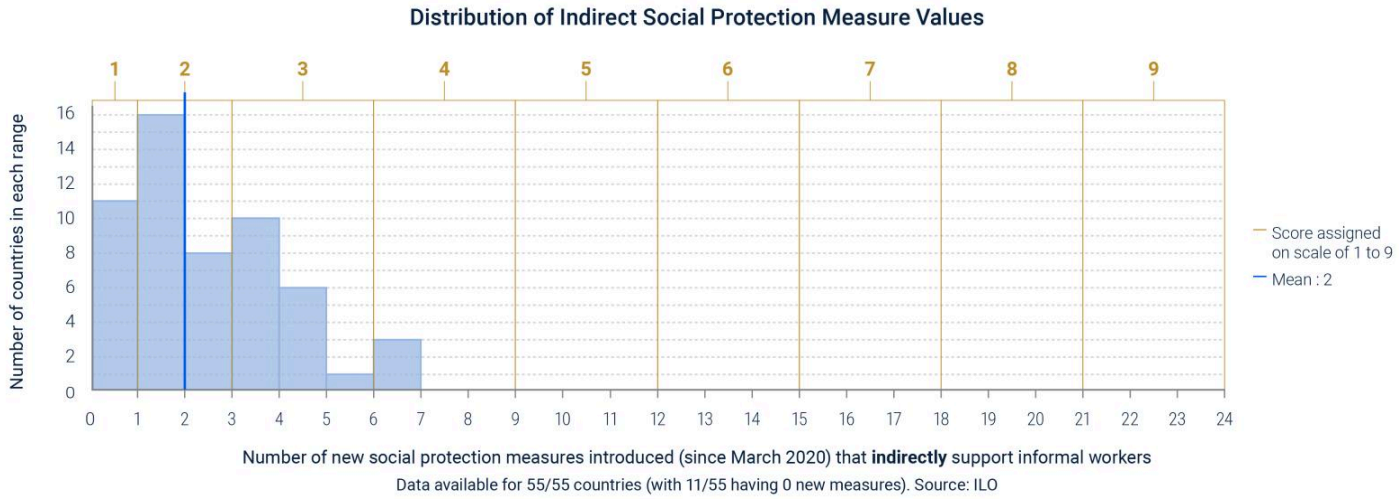


Indirect Social Protection Measures (Indirect SP Measures)*

Negative or Positive Variable: Positive

Weight: 15 – Indirect measures weighted less than direct measures but still included because they still most likely would have a positive impact on informal workers.

Rescaling Method: Rescaling into 9 categories – 1 indicating the least number of indirect social protection responses and 9 indicating the most number of indirect social protection responses. The 9 categories were created by dividing each country's total number of social protection responses by the maximum number of total social protection responses globally, and splitting into even categories.



***The Direct and Indirect Social Protection Measures data was regrouped based on the "function of measures" which was an assigned category in ILO's dataset.** Regrouping allowed us to create a direct and indirect variable for the social protection responses. We presupposed that some functions would have a more direct, positive impact on informal workers' economic security than other measures, but that all identified social protection measures would provide informal workers with some level of protection from possible negative economic impacts of the COVID-19 pandemic and response measures. Countries without a measure in the dataset were given a "1" for no measures vs a "0" as a null.

Social Protection Measures Regrouped by Function

Direct Function
Several Functions
Unemployment
Sickness

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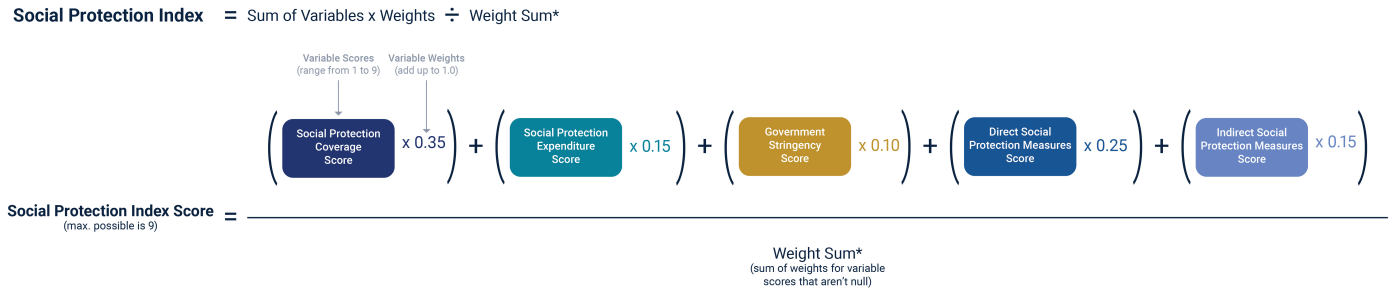
Health
Food and nutrition
Children and family
Housing and basic services
Pensions
Access to education

See ILO's Social Protection Monitor methodology for definitions of intended functions: https://www.social-protection.org/gimi/ShowWiki.action?id=3417

Calculations for the Model



***Normalization of Data**

During previous iterations of the analysis, we identified a bias towards countries with more data available (fewer null values). To address this issue of some countries having higher SPI scores simply because they had data for 5/5 variables instead of 4/5, we developed an algorithm to normalize the data. This consisted of dividing the interim "Sum of Values x Weights" by the "Weight Sum", or the sum of weights for all variables that are not null.

For example, Mali had data available for 4/5 variables analyzed and was missing data for the Social Protection Coverage, which is weighted the highest in the index. Mali's "Sum of Variables x Weights" came out to be 1.85. Mali's "Weight Sum" was 0.65, which is equal to the sum of the weight for the four variables it did have values for (Social Protection Expenditure, Government Stringency, and Direct and Indirect Social Protection Measures), or 0.15 + 0.1 + 0.25 + 0.15. By dividing Mali's Sum of Variables x Weights, 1.85, by the Weight Sum, 0.65, we arrived at Mali's normalized SPI Score of 2.85. For countries with all data for all 5 variables available, the Weight Sum would equal 1.0, and dividing the Sum of Variables x Weights by this would have no impact on the resulting SPI Score.

Once a Weight Sum for each country was generated, any country with a Weight Sum of less than 0.5 was removed from the analysis, because it was deemed to have data available for less than half of the variables analyzed. As of the latest update *(December 30, 2020)*, all countries had a Weight Sum of 0.5 or higher, so none currently appear under the category of "Not scored" on the map.

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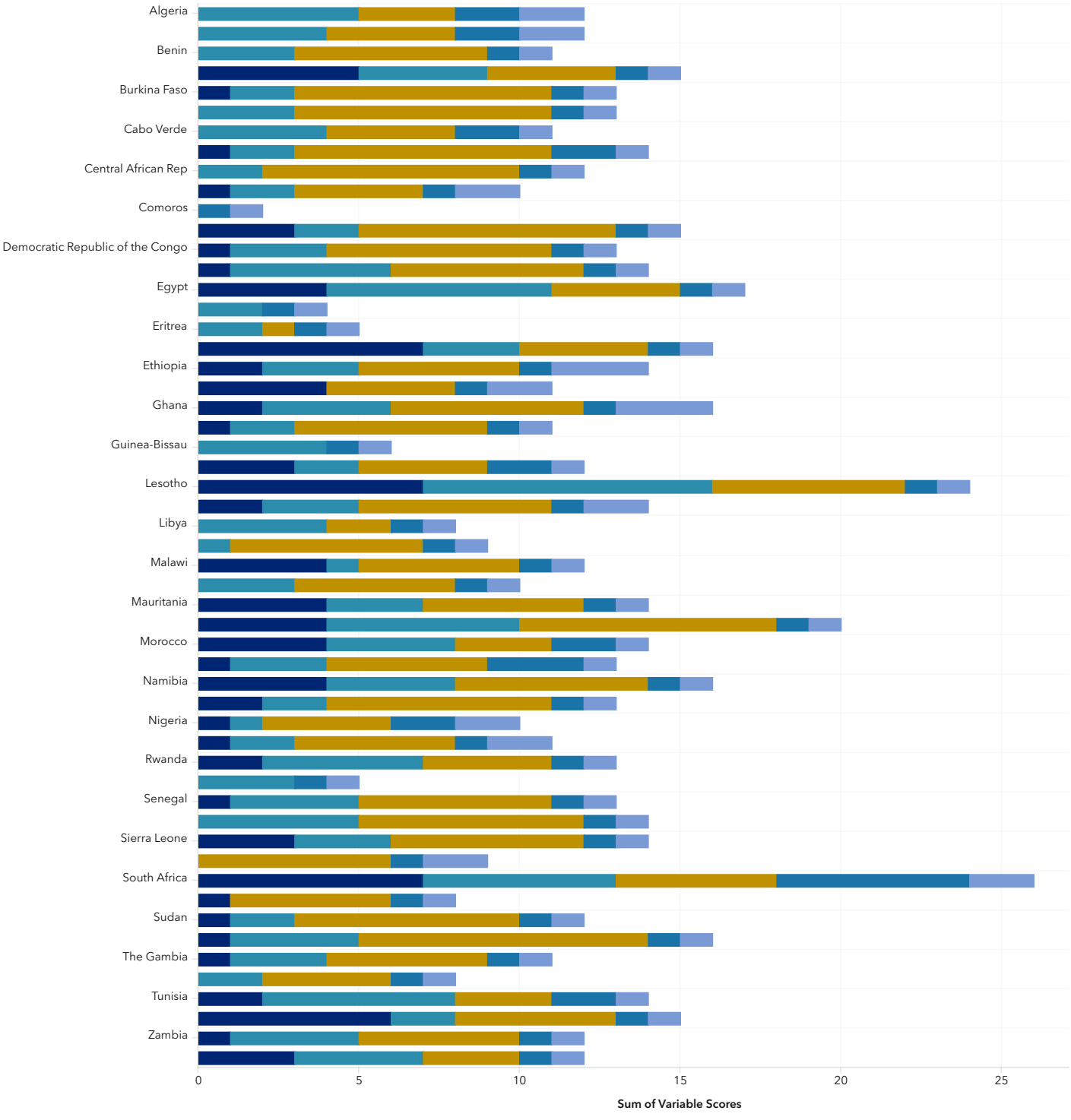
Scores for Each SPI Variable

Each country received a score for each of the five variables examined, ranging from 1 (worst) to 9 (best). A score of 0 indicates no data. These scores were use the final Social Protection Index (SPI) score.



Constraints and Assumptions:

- Data was available for different time scales and frequencies. We used the latest available data for each variable.
- For the Social Protection Responses to COVID-19 Direct and Indirect, we assumed that some functions would have a more direct impact on informal workers than other measures.

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variables with data. Once this was done, any countries missing data for 3 or more variables were removed and are listed under the category of "Not scored".