

## Appendix 2: Human Development Index and Index robustness

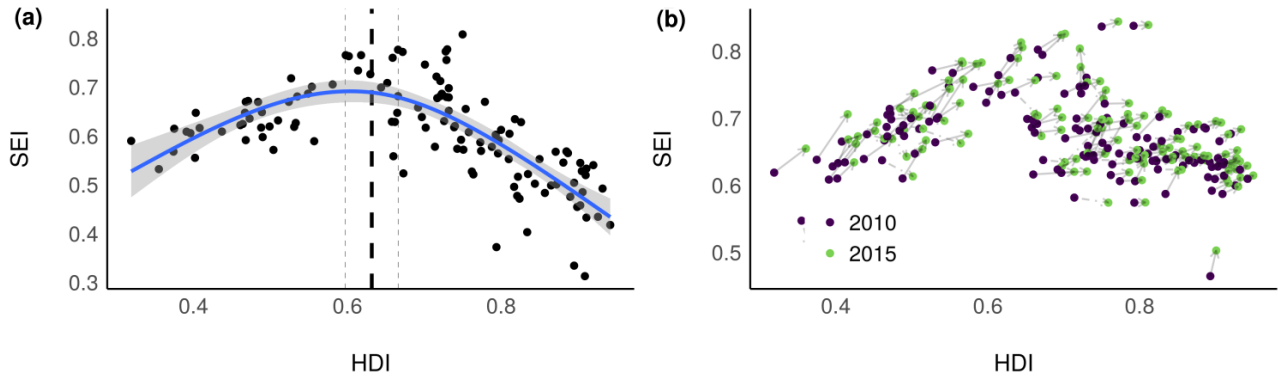


Figure A2.1: Relationships in space and time between SEI and HDI. (a) SEI values in 2011 related to HDI. The turning point is depicted by a black dashed line (with 95% CI). (b) Change in SEI values between 2010 and 2015 related to HDI.

HDI values come from United Nations Statistics (UN 2020). SEI showed a relationship with HDI in space very close to the one found with GDP (Fig. A2.1). SEI was positively related with HDI (slope = 0.70, sd = 0.09, pvalue <  $1.10^{-5}$ ,  $r^2 = 0.58$ ) before  $0.72 \pm 0.02$  and negatively above this threshold (slope = -2.17, sd = 0.17, pvalue <  $1.10^{-5}$ ,  $r^2 = 0.58$ ). Contrary to GDP, the threshold was not found in the temporal analysis (Fig. A2.1), meaning that changes in HDI and in SEI were not related.

There is an intrinsic link between HDI and GDP as GDP per capita is one of the measurements contained in HDI along with life expectancy and access to education. This explains the proximity in relationships found in space between SEI and HDI (Fig. A2.1) compared to SEI with GDP (Fig. 3a). Differences explained by the incorporation of life expectancy and access to education in the social standards are probably strong enough to shift away from patterns found with GDP in time but not in space. The negative relationship between SEI and HDI due to environmental and social degradation linked to GDP increases, seems to be compensated by the increase in social standards (life expectancy and access to education) in time (positive relationship between change in the social score and change in HDI: slope = 0.68, sd = 0.14, tvalue = 5, pvalue =  $5.10^{-6}$ ,  $r^2 = 0.51$ , non significant relationship between change in the biophysical score and change in HDI: slope = 0.13, sd = 0.17, tvalue = 1, pvalue = 0.46,  $r^2 = 0.06$ ). However, this was not true in space (negative relationship between change in the social score and spatial HDI: slope = -0.14, sd = 0.03, tvalue = -5, pvalue =  $2.10^{-6}$ ,  $r^2 = 0.51$ , positive relationship between change in the biophysical score and spatial HDI: slope = 0.09, sd = 0.08, tvalue = 3, pvalue = 0.007,  $r^2 = 0.06$ ), which explains the spatial pattern close to the relationship between SEI and GDP.

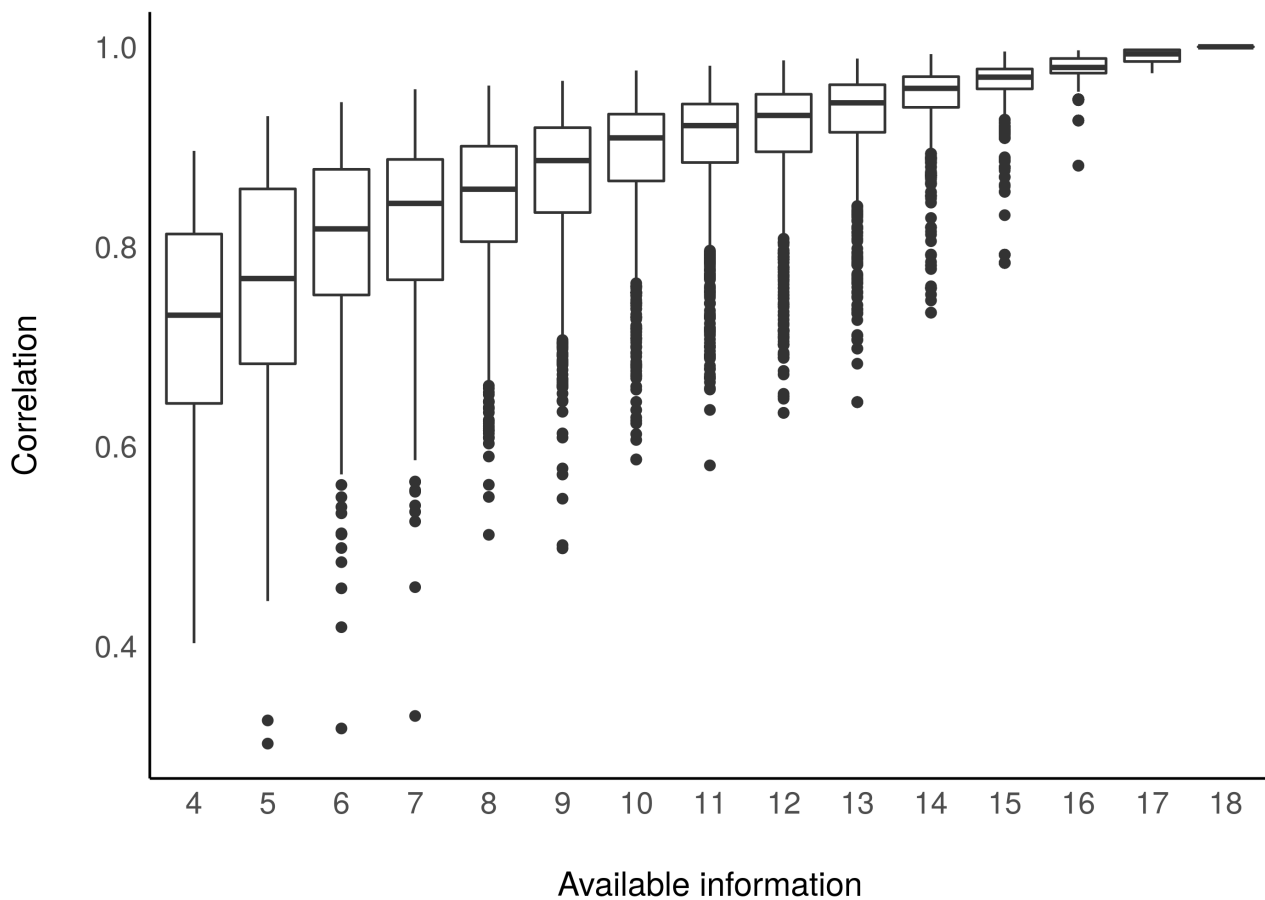


Figure A2.2: Robustness analysis. SEI was computed after removing at least one social or biophysical indicator and the correlation between the recalculated index and the original SEI was assessed. Available information corresponds to the number of social and biophysical indicators kept for index calculation and ranges from 4 (2 social indicators required to compute the social score and two biophysical indicators required to compute the biophysical score, needed for index calculation) to 18 (all the 7 biophysical indicators kept and all the 11 social indicators kept).

Supplementary reference:

UN. 2020. United Nations Statistics. Human development trends.