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Comprendre pour changer
les équations sociétales,
leurs construction et
utilisations

27 & 28 JUIN 2024
BRUXELLES

The challenges of new practices of interdisciplinarity in the field of social intervention

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HETIS (LARIIS)

June 27, 2024

From Data to Impact: Assessing BRICS Countries, Social Performance with Green Finance Metrics

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HÉTIS
Haute école du travail
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What is green financing?

Why choose the BRICS countries?

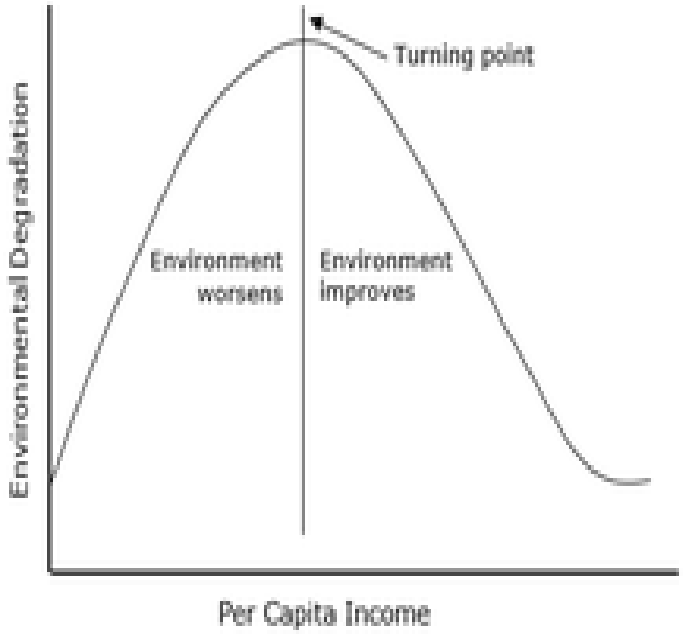
Many BRICS countries have taken initiatives to promote green finance, such as developing standards and certification labels for sustainable financial products, creating investment funds specializing in renewable energy and energy efficiency projects, and integrating Environmental criteria, Social and Governance (ESG) in investment decisions.

In summary, although the BRICS countries differ widely in terms of environmental challenges, political priorities and financial capacities, they can work together to promote a green finance approach tailored to their national and regional needs. As a result, help achieve the goals of sustainable development and combat climate change at the global level.

What is the difference between this study and previous studies?

- Existing studies have not investigated the impact of green financing on critical indicators of sustainable development such as environmental quality for BRICS countries under the Kuznets curve. Also, the above studies have not investigated the impact of green financing on social performance. We will examine the impact of green financing on sustainable development and social performance in this research.

What is the Kuznets curve?

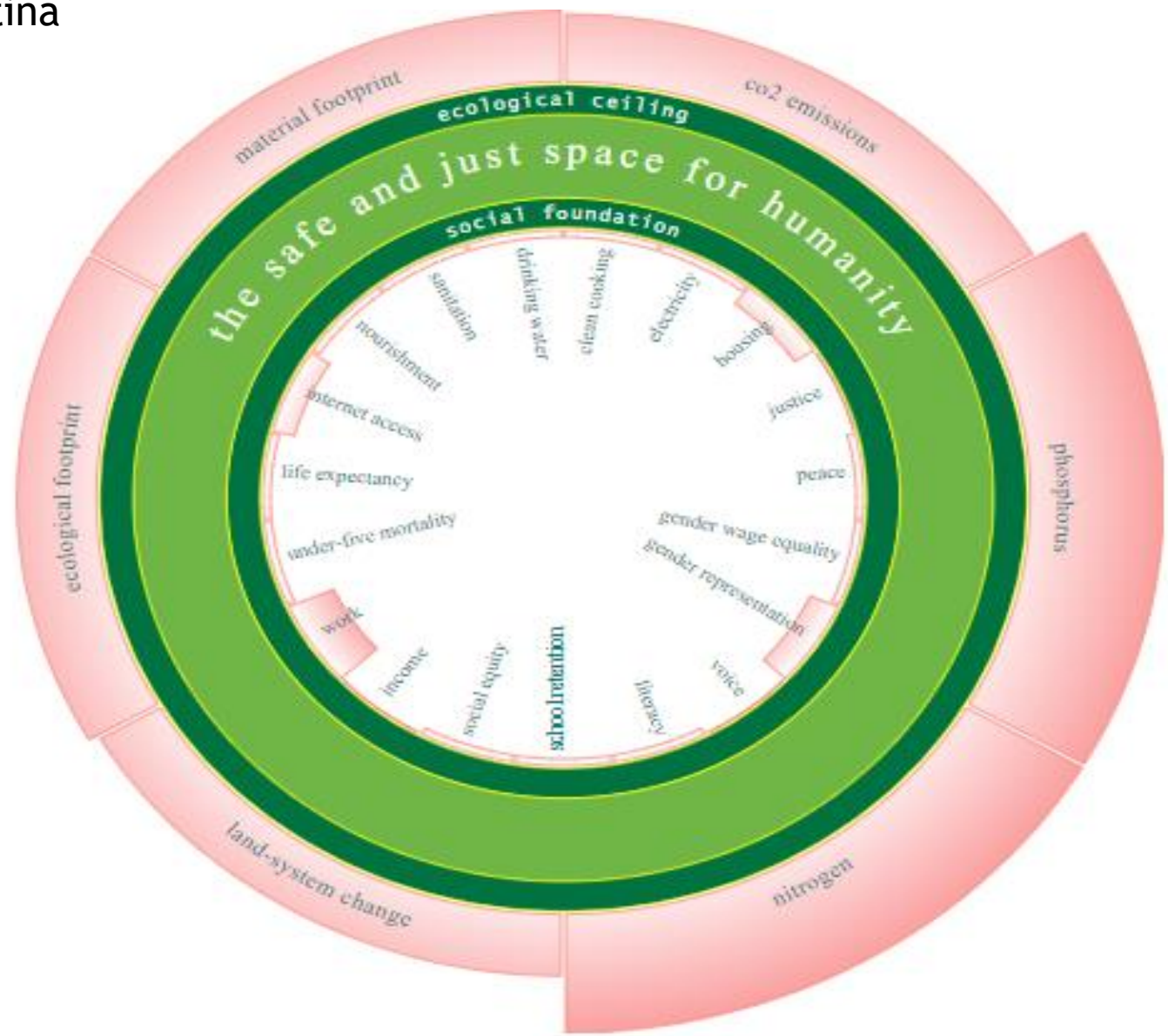


- Stage 1 - Increase in contamination: At the beginning of the economic development process, contamination increases with the increase in economic activity. Industries are releasing more pollutants into the air, water and soil to meet growing consumer and business demand.
- Stage 2 - Pollution reduction: After reaching a certain level of economic wealth, countries begin to implement stricter environmental policies and invest in cleaner technologies. This results in lower emissions per unit of production, even if economic activity continues to grow.
- Stage 3 - stabilization or reversibility of the trend: As the country reaches a higher level of economic development, the trend of pollution reduction stabilizes or may even reverse. This may be due to the increased consumption of environmentally friendly goods and services, unless specific policies are developed to counter this trend.

Doughnut for BRICS countries:

Visualize the doughnut of each country, and compare their social foundation and ecological ceiling performance relative to their boundaries. An ideal society falls within the green doughnut where ecological and social boundaries are respected. When nations exceed these boundaries, ecological and social issues are the result. The graph shows in red is the magnitude of ecological or social damage in each category.

Argentina


material footprint
co2 emissions
ecological ceiling
the safe and just space for humanity
social foundation
sanitation
drinking water
clean cooking
electricity
housing
nourishment
justice
internet access
peace
life expectancy
gender wage equality
under-five mortality
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work
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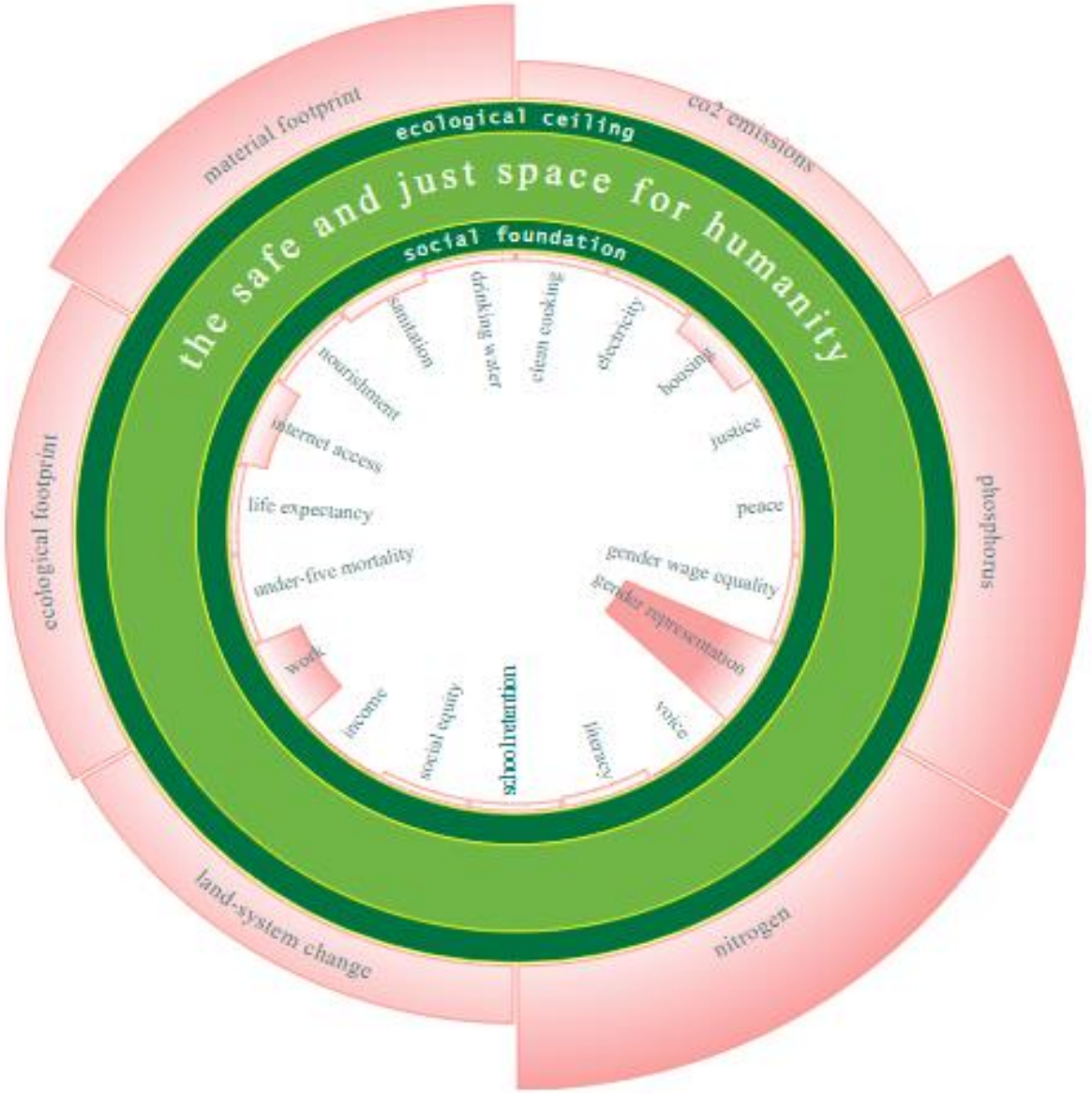
social equity
school retention
literacy
voice
ecological footprint
phosphorus
land-system change
nitrogen

Brazil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ecological footprint
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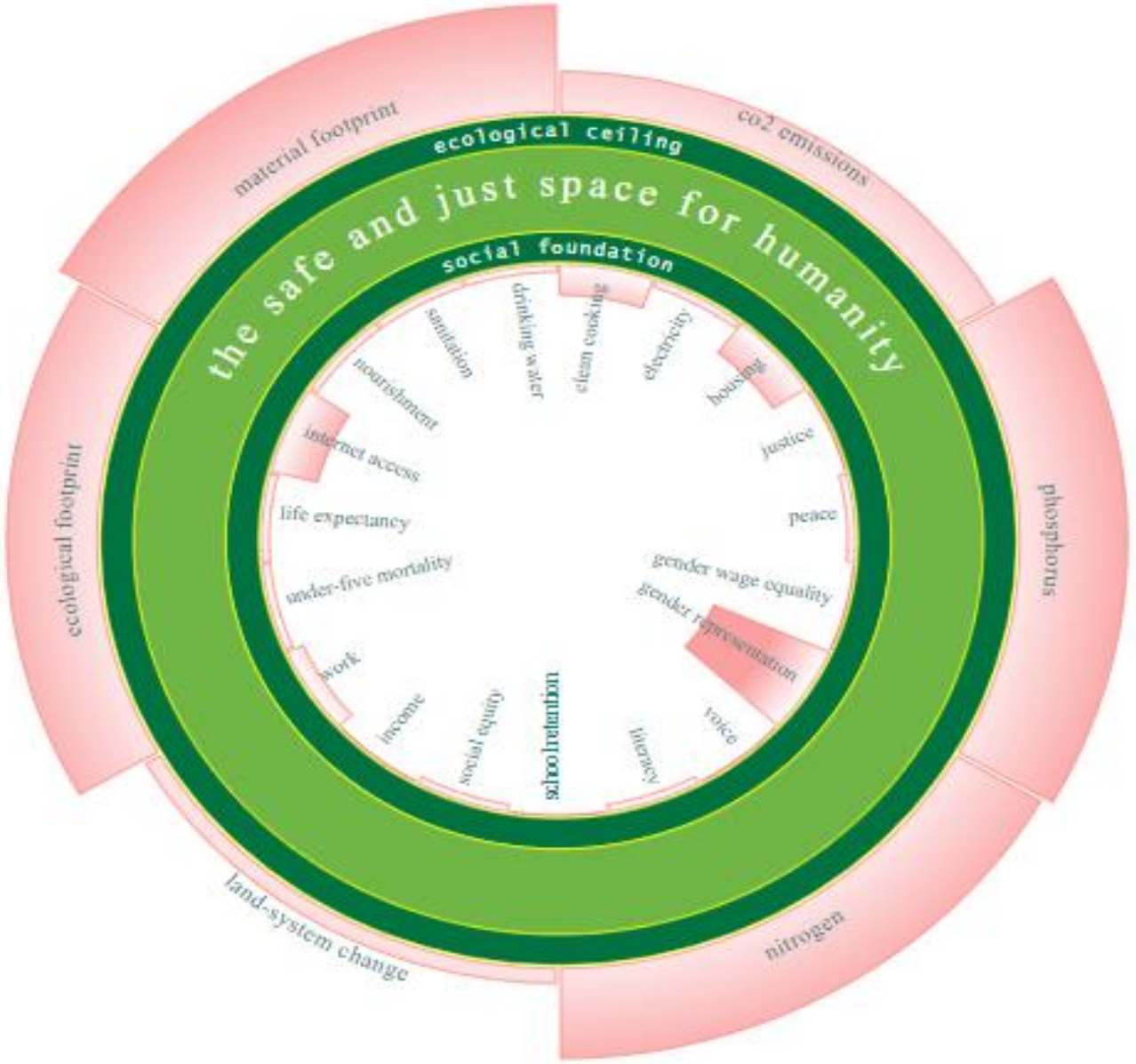
china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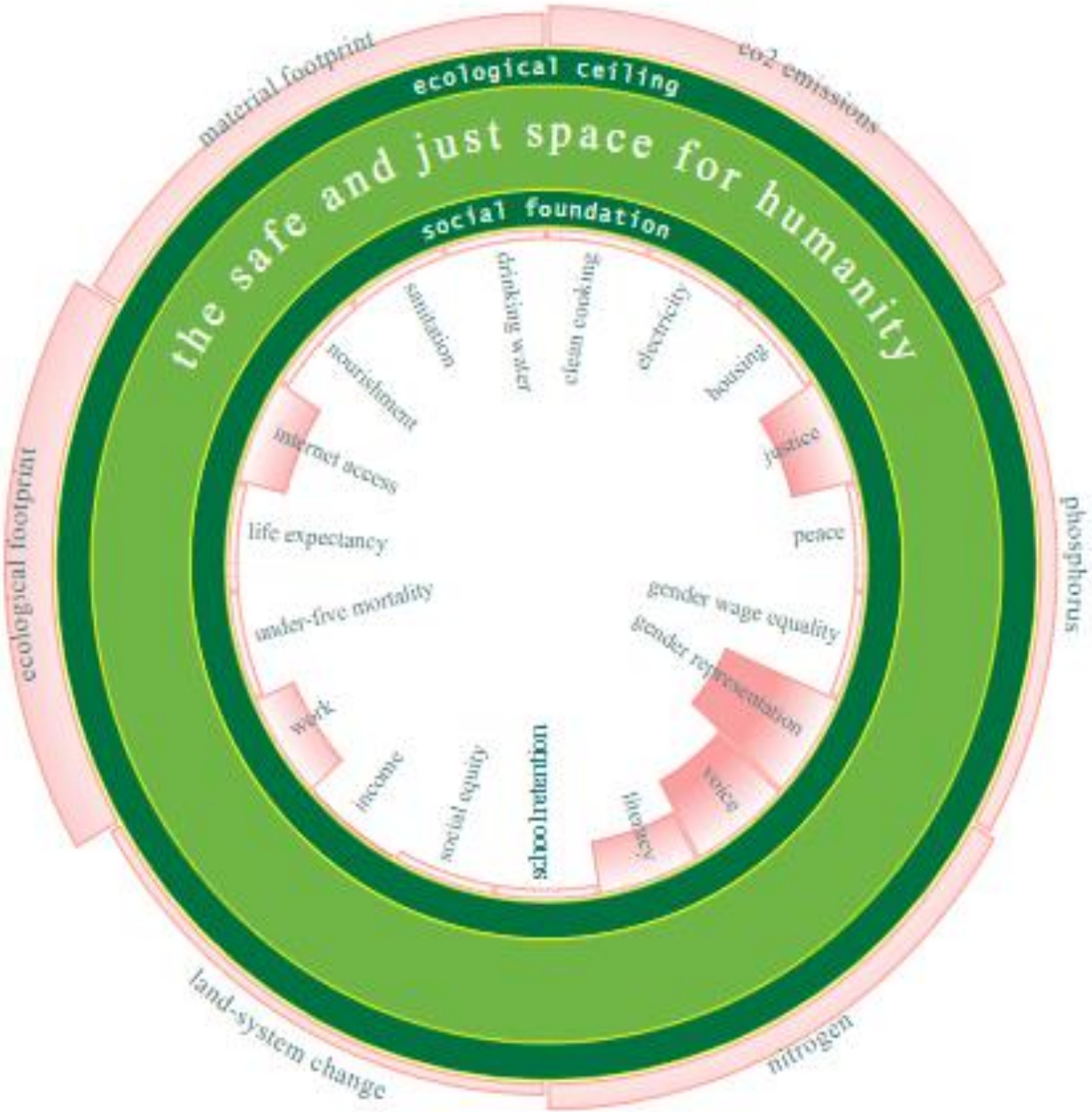
Egypt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social equity
school attention
literacy
voice
ecological footprint
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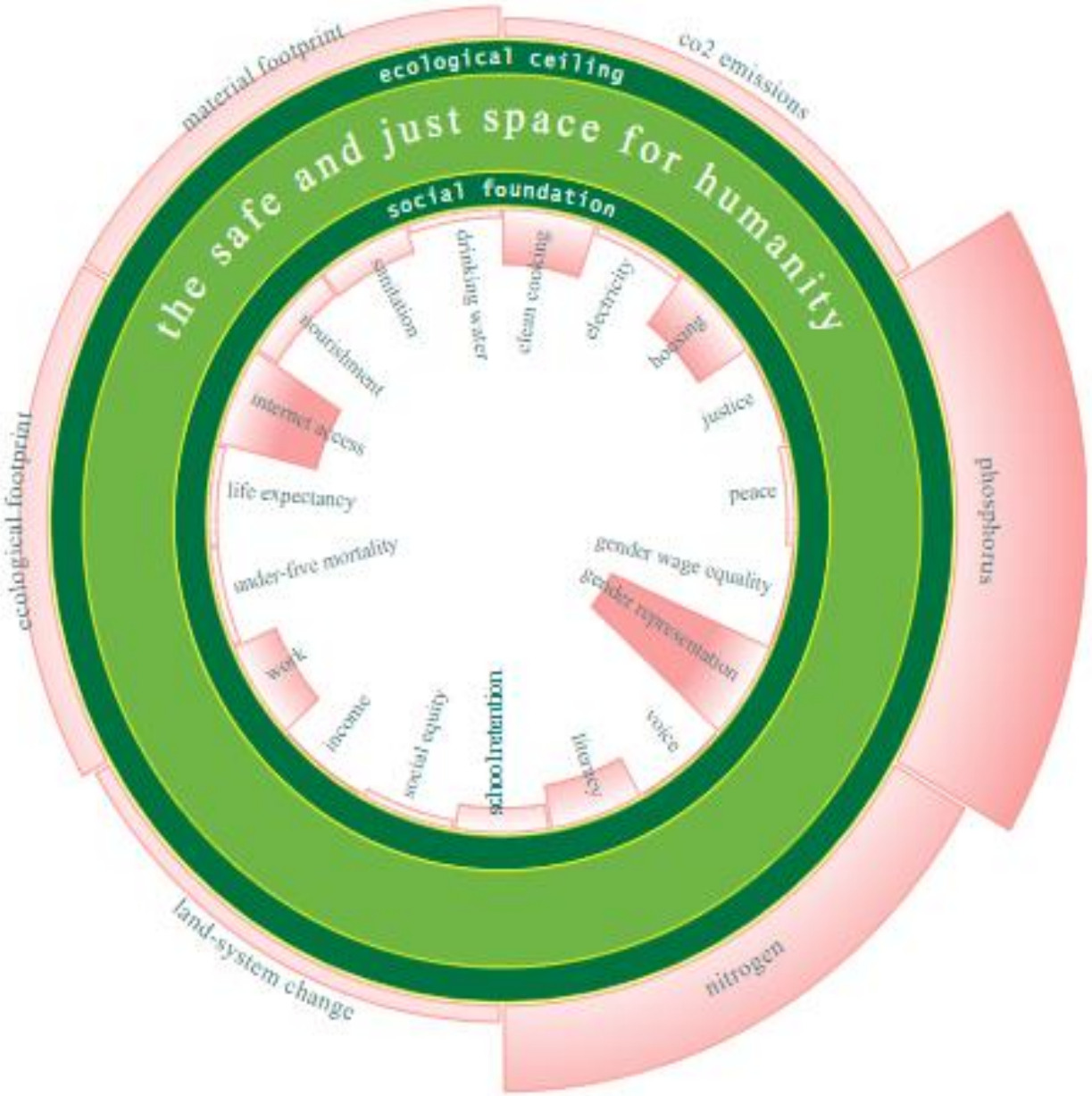
land-system change
nitrogen

India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literacy
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work
under-five mortality
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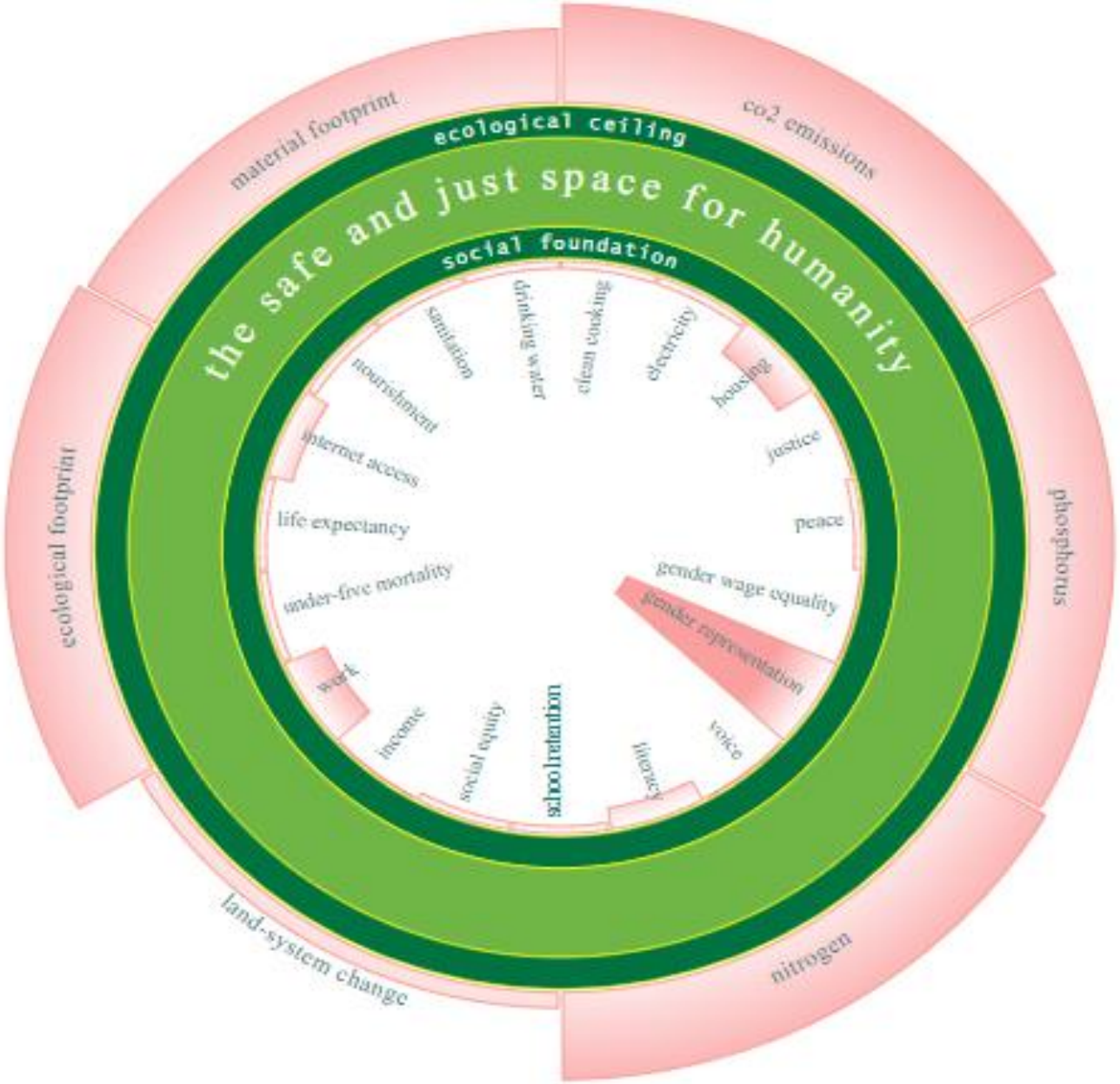
nourishment

Iran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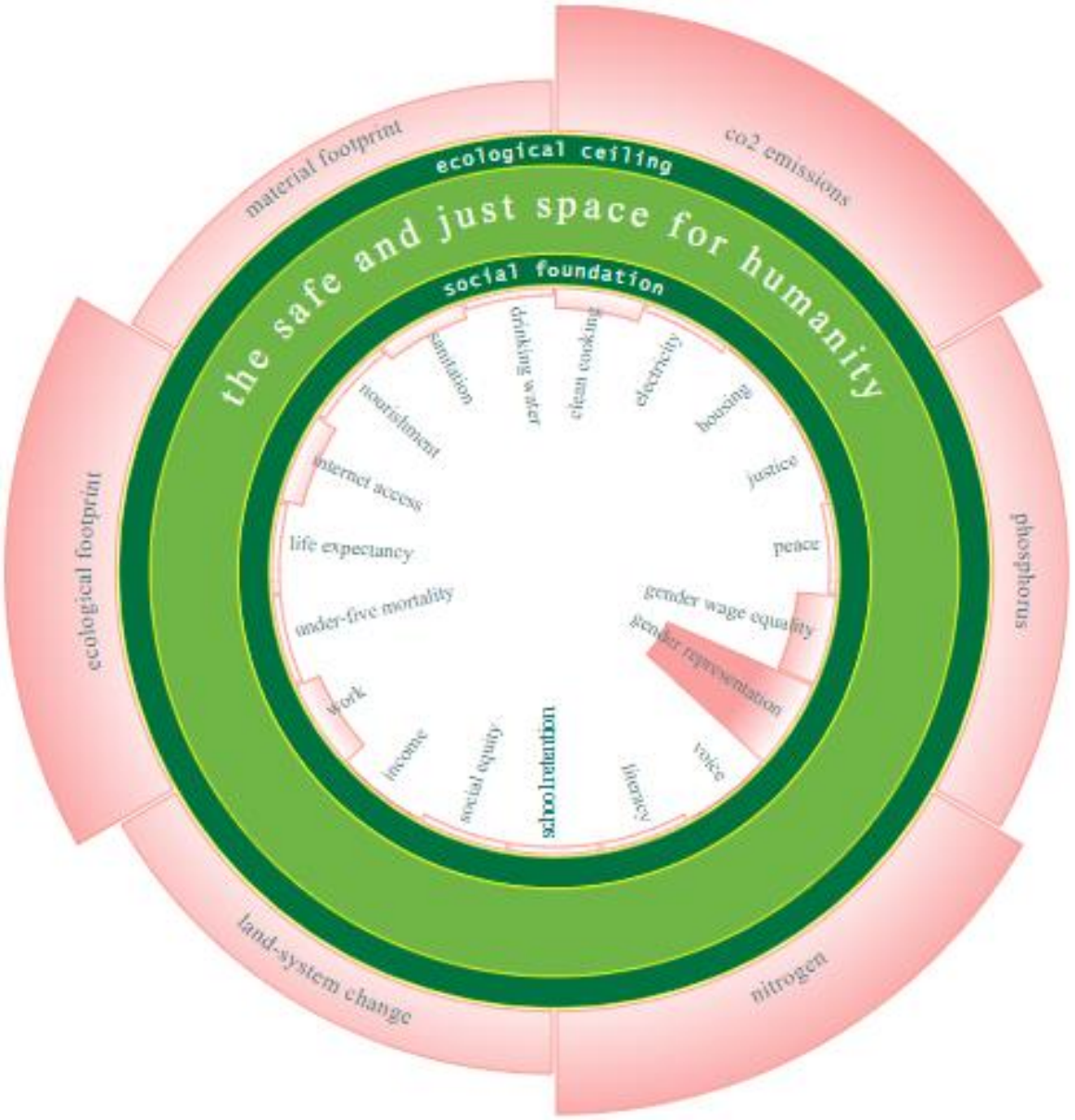
Russia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under-five mortality
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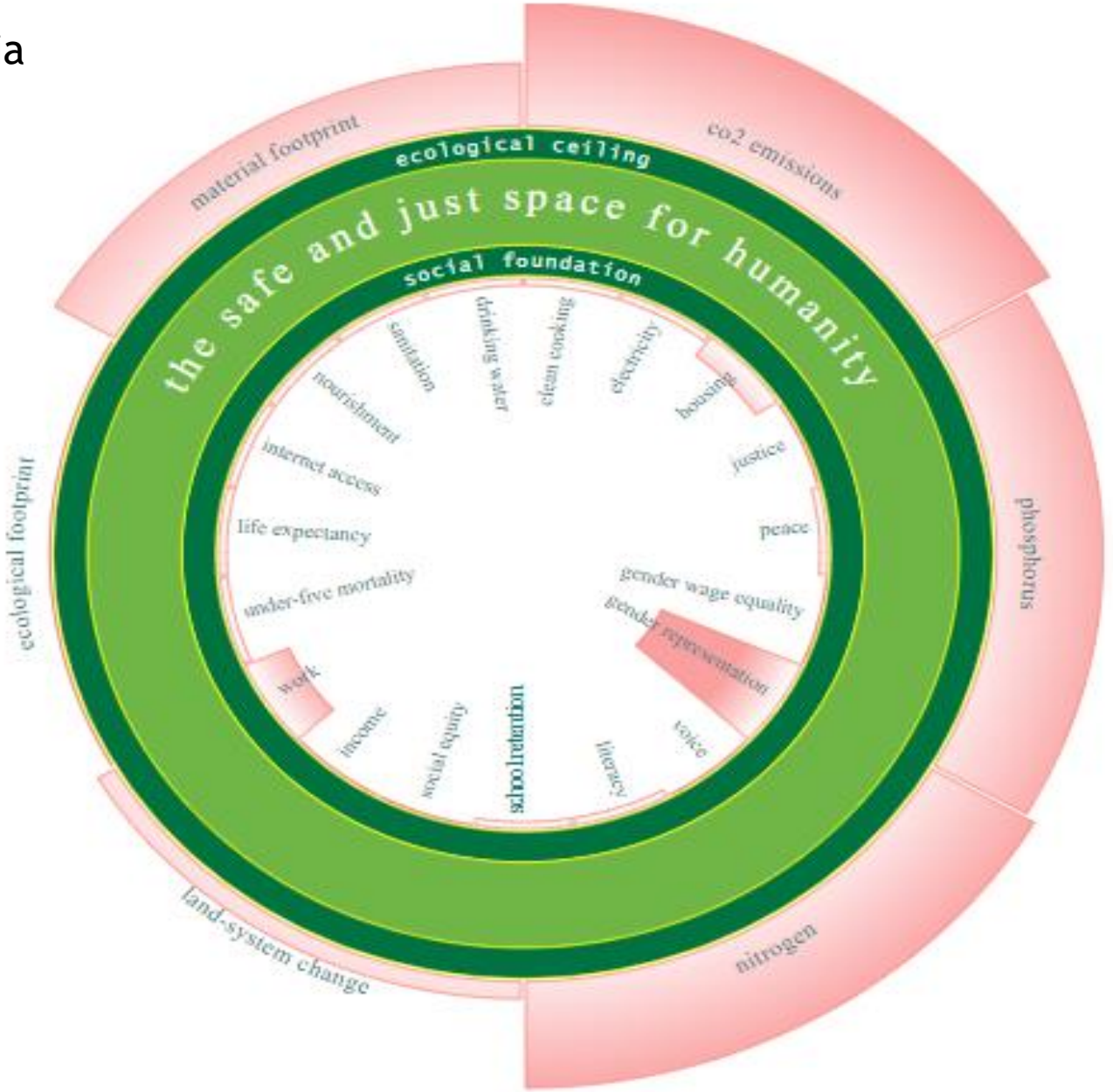
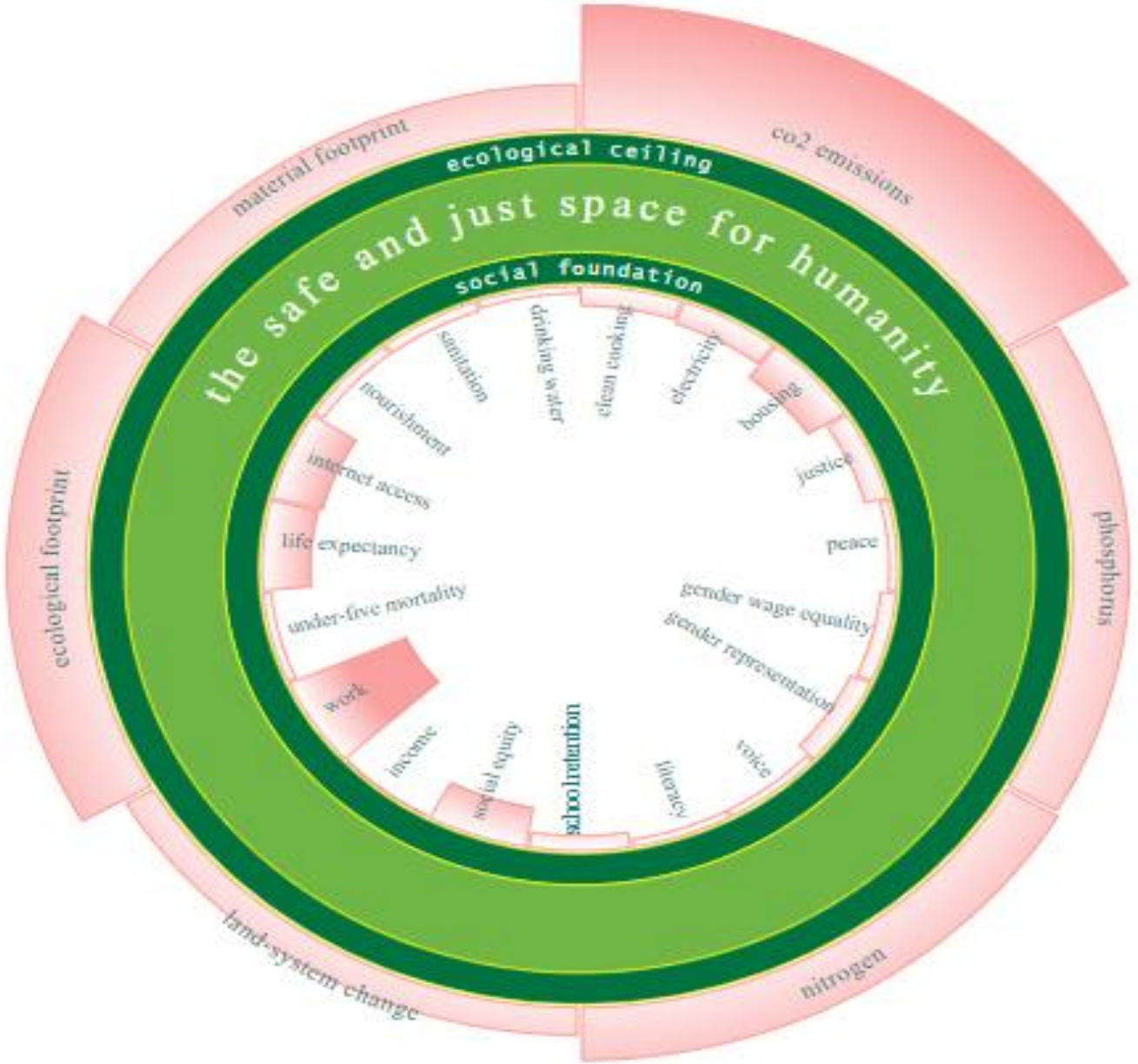
nourishment

Saudi Arabia



South Africa



MODEL

1. The effect of green financing on improving the quality of the environment:

The relationship between CO2 emissions and GDP growth and several additional variables in BRICS countries (Argentina, Brazil, China, India, Iran, Russia, Saudi Arabia and South Africa) during the period of 1994 to 2020 are used under premises of the new EKC method following the below mentioned equations from (Saleem et al, 2022):

$$CO_{2it} = \alpha_1 + \alpha_2 GDP_{it} + \alpha_3 (GDP_{it})^2 + \alpha_4 REW_{it} + \alpha_5 TECN_{it} + \alpha_6 ETX_{it} + \alpha_7 FND_{it} + \mu_{it}$$

$$CO_{2it} = \beta_1 + \beta_2 GEG_{it} + \beta_3 (GEG_{it})^2 + \beta_4 REW_{it} + \beta_5 TECN_{it} + \beta_6 ETX_{it} + \beta_7 FND_{it} + \varepsilon_{it}$$

Description of variables:

CO2: carbon emission in tons per capita

GEG: CO2 emissions based on green growth/production in percent

GDP: Gross domestic product Constant 2010 US$

FND: Domestic credit to the private sector as a percentage of GDP

REW: renewable energy consumption in terms of total final energy consumption in percentage

ETX: environmental taxes as a percentage of GDP

TECN: Environmentally clean technology and innovation as a percentage of all technologies

Data source: World Bank and statistics of Asian countries and Organization for Economic Development and Cooperation

Panel causality test:

Table 1: Test of residual cross section dependence

Test	statistic	p-value	Null hypotheses	Conclusion
Pesaran CD normal	0.8797	-0.151	NO CSD in residuals	Reject

Rejection means that the null hypothesis is rejected at a 1% and 5% significance level.

Table 2: Panel Levin-Lin-Chu Unit root test analysis

variables	statistics	p-value
CO_2	-3.2073	0.0007
GDP	-2.6875	0.0036
GDP^2	-2.6404	0.0041
GEG	-2.4903	0.0064
GEG^2	-2.4903	0.0064
REW	-1.9856	0.0235
ETX	-25.2579	0.0000
TECN	-1.6649	0.0480
FND	-2.0870	0.0184

Table 3. The heterogeneity and homogeneity F-Leamer testing of slope coefficient

Model 1

CO2t=f(f(GDPt,GDPt2,REWt,TECNt,ETXt,FNDt)

p-value 0.0000

Model 2

CO2t=f(GEGt,GEGt2,REWt,TECNt,ETXt,FNDt)

p-value 0.0000

Table 4. Hausman test

Model 1

CO2t=f(f(GDPt,GDPt2,REWt,TECNt,ETXt,FNDt)

Prob>Chi2 0.9999

Model 2

CO2t=f(GEGt,GEGt2,REWt,TECNt,ETXt,FNDt)

Prob>Chi2 0.1333

As a result, the panel has random effects

Table 5. Breusch and Pagan Lagrangian multiplier test for random effects

Model 1

CO2t=f(f(GDPt,GDPt2,REWt,TECNt,ETXt,FNDt)

Prob>Chibar2 0.0000

Model 2

CO2t=f(GEGt,GEGt2,REWt,TECNt,ETXt,FNDt)

Prob>Chibar2 0.0000

As a result, the panel has random effects

Table 6. Variance homogeneity or heterogeneity test

Model 1

CO2t=f(f(GDPt,GDPt2,REWt,TECNt,ETXt,FNDt)

Prob>Chi2 0.0000

Model 2

CO2t=f(GEGt,GEGt2,REWt,TECNt,ETXt,FNDt)

Prob>Chi2 0.0000

As a result, the heterogeneity of variance is confirmed

- We have used GLS method to estimate this model due to the existence of heterogeneity variance and autocorrelation.

Table 7. The result of GLS estimation for Model 1

Variables	Coefficients	P-Value
LNGDP	1.7369	0.000
$LNGDP^2$	-0.0207	0.000
LNREW	-0.06934	0.000
LNETX	-0.0019	0.000
d.LNTECN	0.0073	0.050
LNFND	-0.0304	0.000

We can be satisfied that increased technology does not necessarily cause CO2 emissions. The coefficients of GDP and technology are positive and significant, and this indicates the direct impact of these variables on CO2 emissions. You can see that the coefficient of GDP is much higher than other variables and this shows the importance of this variable among other variables. The coefficient of GDP2 has become negative, which is because U is the opposite of the Kuznets curve, the second derivative has become negative. Also, the coefficient of renewable energy variables, environmental tax and domestic credits to the private sector is negative and significant, and this indicates the negative effect of these variables on carbon emissions.

Table 8. The result of GLS estimation for Model 2

Variables	Coefficients	P-Value
LNGEG	2.9682	0.000
d.LNGEG^2	-0.4915	0.012
LNREW	0.2091	0.000
LNETX	0.7187	0.000
d.LNTECN	-0.1013	0.018
LNFND	-1.5091	0.000

The coefficients of CO2 emission with green growth, renewable energy and environmental tax are positive and significant, and this shows the direct effect of these variables on CO2 emission. You can see that the CO2 emission coefficient with green growth is much higher than other variables, and this issue is important. It shows this variable among other variables. The GEG2 coefficient has become negative, which is the reason for the inverted U of the Kuznets curve. Also, the coefficient of technology variables, internal credits to the private sector is negative and significant, and this indicates the negative effect of these variables on carbon emissions.

2. The impact of green financing on macroeconomic stability (social performance) from (saydaliev and chin, 2022):

$$lnCO_{2it} = \alpha_1 + \alpha_2 lnGDP_{it} + \alpha_3 lnLITER_{it} + \alpha_4 lnDEMO_{it} + \alpha_5 d.lnTECN_{it} + \alpha_6 lnETX_{it} + \alpha_7 lnFND_{it} + \alpha_8 lnWATER_{it} + \alpha_9 lnMISERY_{it} + \alpha_{10} lnHDI_{it} + \alpha_{11} lnGINI_{it} + \alpha_{12} lnLIFEEXP_{it} + \mu_{it}$$

Description of variables:

ETX: Environmental taxes as a percentage of GDP

TECN: Environmentally clean technology and innovation as a percentage of all technologies

FND: Domestic credit to the private sector as a percentage of GDP

CO2: Carbon emission in tons per capita

GDP: Gross domestic product according to the base year of 2010 of the United States

LITER: Literacy rate (% of people ages 15 and above)

DEMO: Democracy index

WATER: People using at least basic drinking water services (% of population)

MISERY INDEX: Inflation + Unemployment

HDI: Human Development Index (%)

GINI: GINI index

LIFEEXP: Life expectancy index (YEARS)

First, FMOLS method was used to estimate the model. The advantage of this estimate over OLS is that it corrects skewness and corrects endogeneity. Before estimation, the Kao cointegration test was performed, which showed the cointegration between the variables. After estimating the R^2, it became negative, which indicates the endogeneity of the variables and the existence of co-accumulation between them. Then we estimated the model with the VECM method to reach an equation in which there is no break and report the relationships of the variables in a long-term vector.

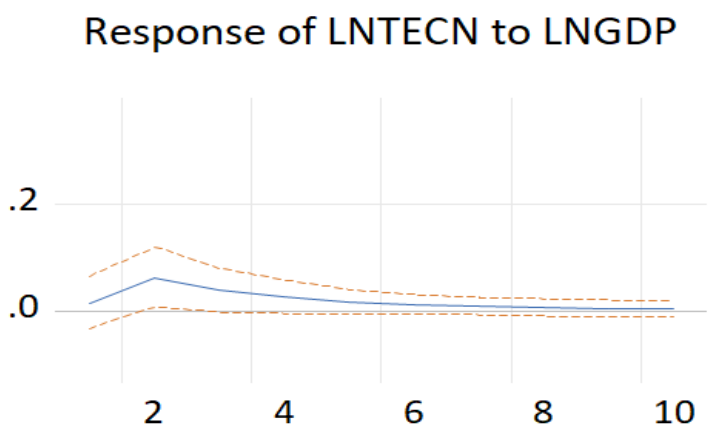
$$\begin{pmatrix} \Delta ln\,CO2 \\ \Delta \ln GDP \\ \Delta \ln ETX \\ \Delta \ln TECN \\ \Delta \ln DEMOC \\ \Delta \ln LIFEEXP \\ \Delta \ln WATER \\ \Delta \ln MISERY \\ \Delta \ln LITER \\ \Delta \ln GINI \\ \Delta \ln FND \\ \Delta \ln HDI \end{pmatrix} = \begin{pmatrix} \lambda 1 \\ \lambda 2 \\ \lambda 3 \\ \lambda 4 \\ \lambda 5 \\ \lambda 6 \\ \lambda 7 \\ \lambda 8 \\ \lambda 9 \\ \lambda 10 \\ \lambda 11 \\ \lambda 12 \end{pmatrix} + \sum_{m-1}^{n} \begin{pmatrix} \varphi 11 & \varphi 12 & \varphi 13 & \varphi 14 \\ \varphi 21 & \varphi 22 & \varphi 23 & \varphi 24 \\ \varphi 31 & \varphi 32 & \varphi 33 & \varphi 34 \end{pmatrix} * \begin{pmatrix} \Delta\, ln\, CO2it - m \\ \Delta \ln GDPit - m \\ \Delta \ln ETXit - m \\ \Delta \ln TECNit - m \\ \Delta \ln DEMOCit - m \\ \Delta \ln LIFEEXPit - m \\ \Delta \ln WATERit - m \\ \Delta \ln MISERYit - m \\ \Delta \ln LITERit - m \\ \Delta \ln GINIit - m \\ \Delta \ln FND\, it - m \\ \Delta \ln HDIit - m \end{pmatrix} + \begin{pmatrix} \vartheta 1 \\ \vartheta 2 \\ \vartheta 3 \\ \vartheta 4 \\ \vartheta 5 \\ \vartheta 6 \\ \vartheta 7 \\ \vartheta 8 \\ \vartheta 9 \\ \vartheta 10 \\ \vartheta 11 \\ \vartheta 12 \end{pmatrix} ECT_{t-1} + \begin{pmatrix} \varepsilon 1 \\ \varepsilon 2 \\ \varepsilon 3 \\ \varepsilon 4 \\ \varepsilon 5 \\ \varepsilon 6 \\ \varepsilon 7 \\ \varepsilon 8 \\ \varepsilon 9 \\ \varepsilon 10 \\ \varepsilon 11 \\ \varepsilon 12 \end{pmatrix}$$

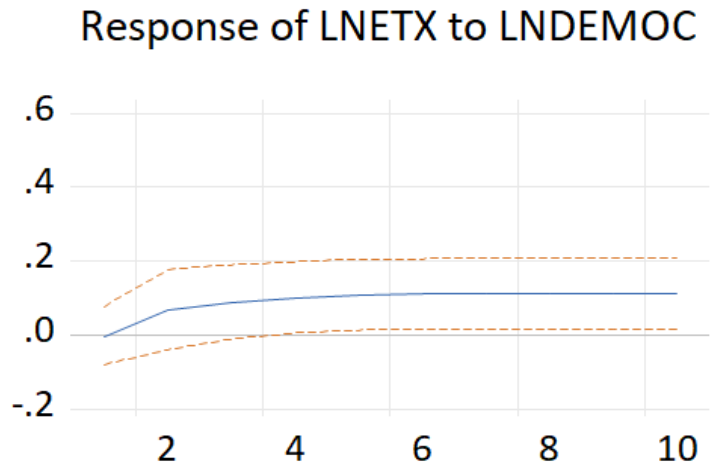
Panel causality test:

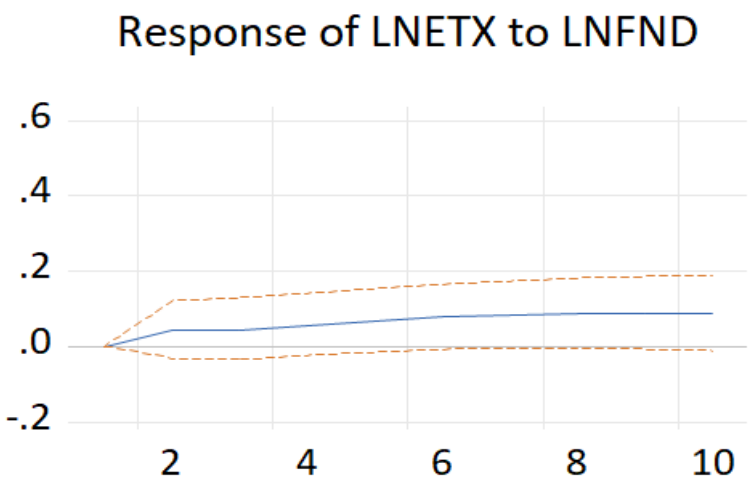
Table2: Panel Levin-Lin-Chu, Im, Pesaran and Shin W-stat, ADF - Fisher Chi-square Unit root test analysis

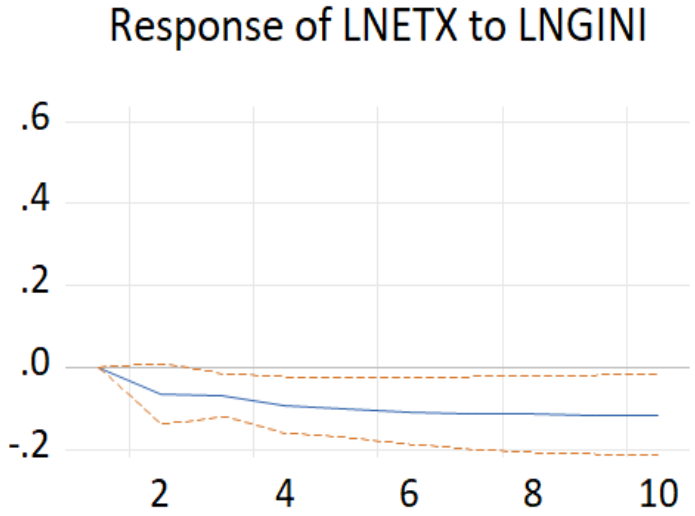
variables	statistics	p-value
D(LNCO$_2$)	-6.7239	0.0000
D(LNGDP)	-2.2272	0.0130
D(LNHDI)	-9.0913	0.0000
D(LNDEMO)	-6.5729	0.0000
D(LNLIFEEXP)	-6.1964	0.0000
D(LNLITER)	-14.1739	0.0000
D(LNETX)	-11.8849	0.0000
D(LNTECN)	-15.9527	0.0480
D(LNFND)	-7.7266	0.0000
D(LNWATER)	-7.8785	0.0000
D(LNMISERY)	-14.3229	0.0000
D(LNGINI)	-9.7050	0.0000

Long-term relationship between variables:

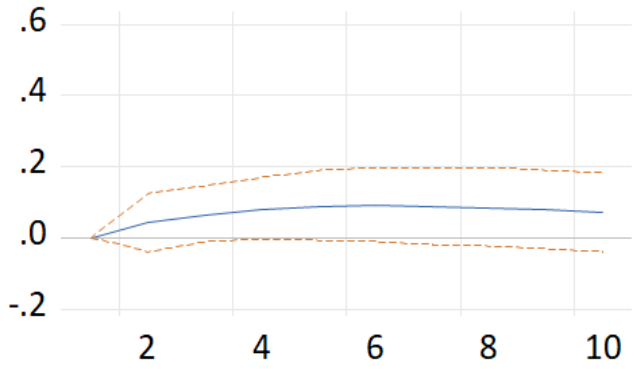




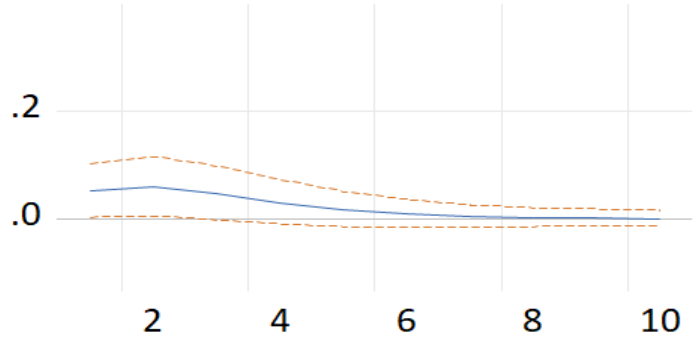




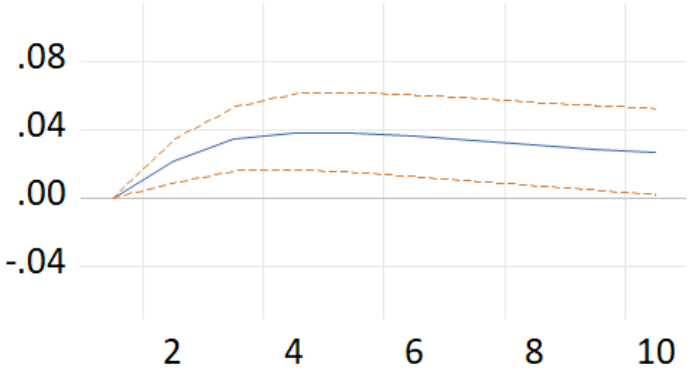
Response of LNETX to LNLITER



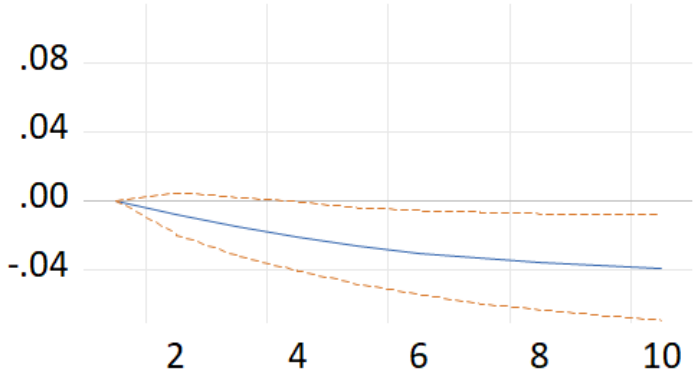
Response of LNTECN to LNMISERY



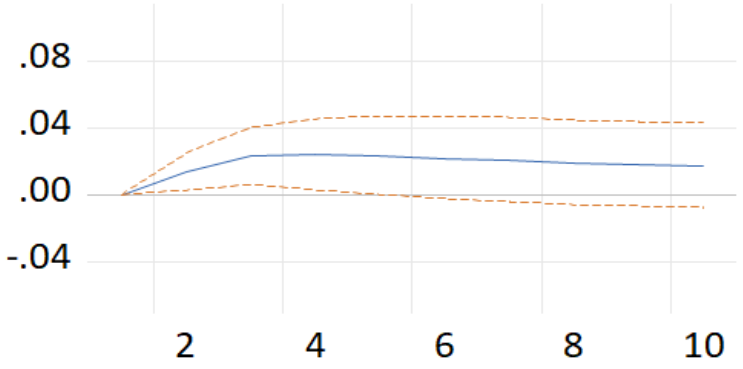
Response of LNFND to LNGDP



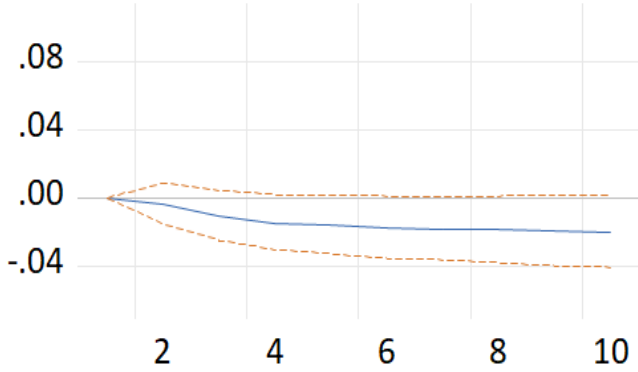
Response of LNFND to LNLIFEEXP



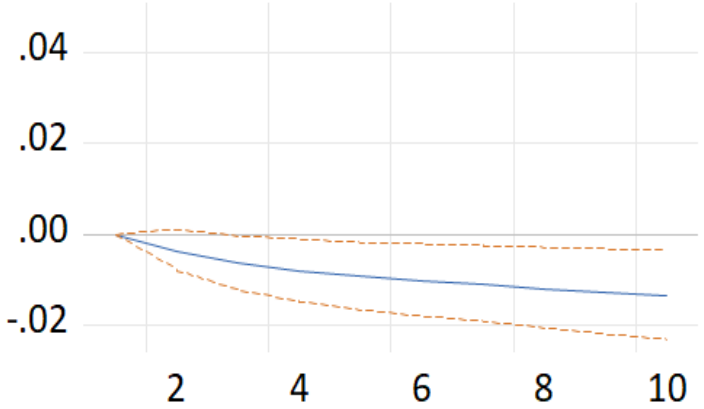
Response of LNFND to LNTECN



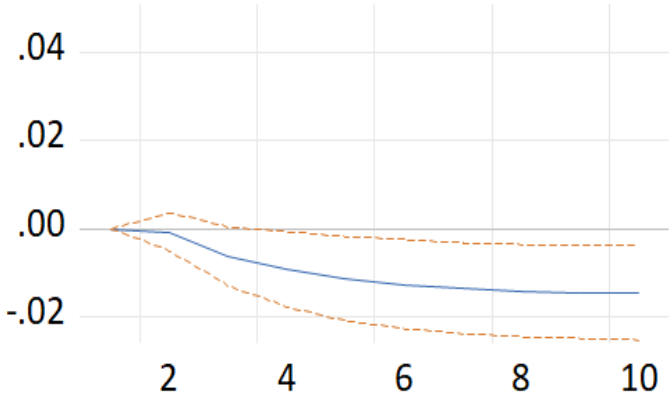
Response of LNFND to LNWATER



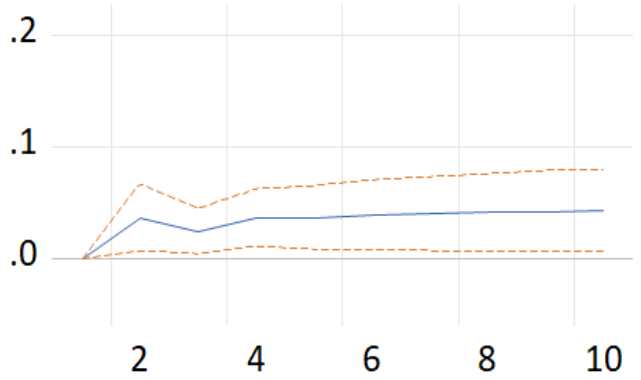
Response of LNGDP to LNHDI



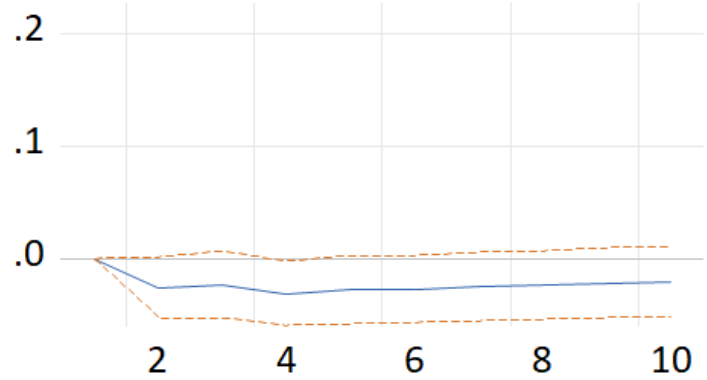
Response of LNGDP to LNTECN



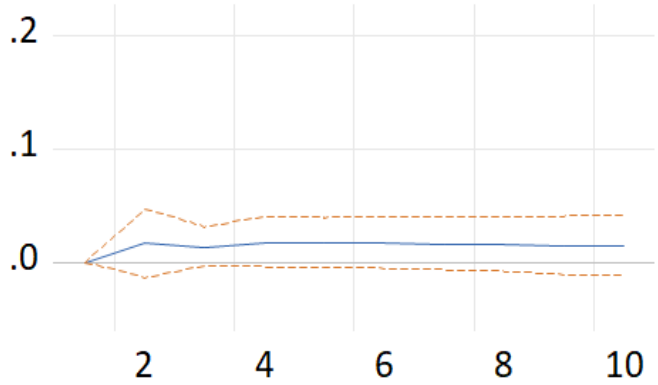
Response of LNGINI to LNLITER



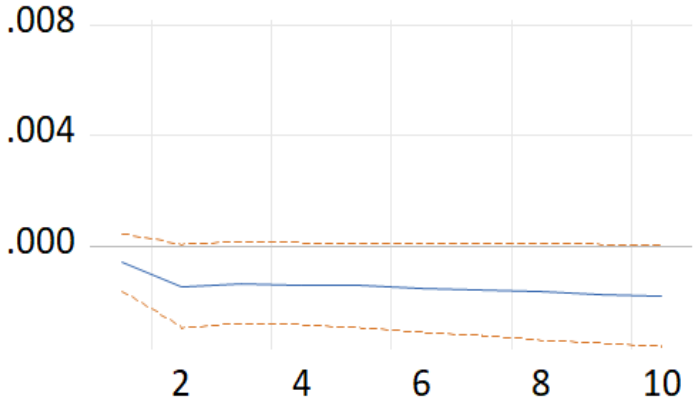
Response of LNGINI to LNTECN

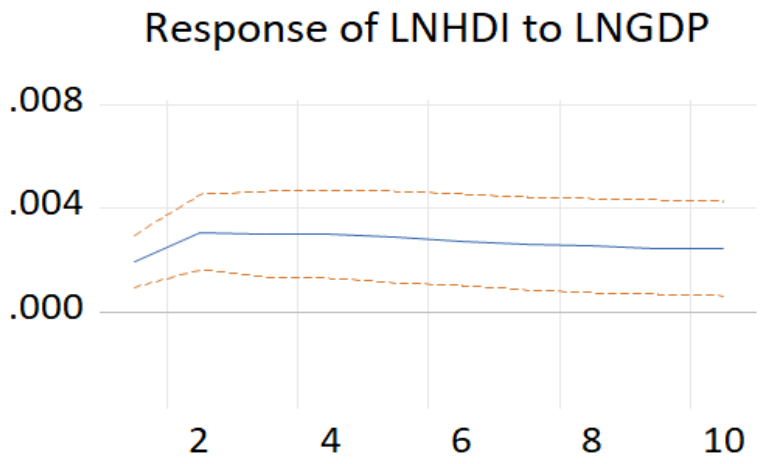


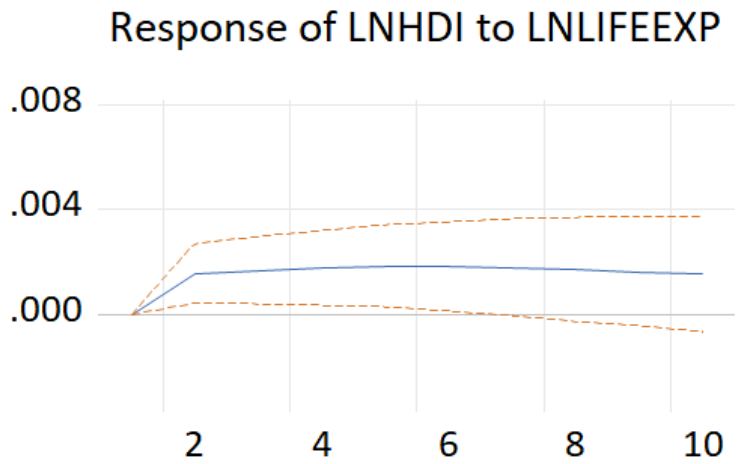
Response of LNGINI to LNWATER



Response of LNHDI to LNDEMOC




Response of LNHDI to LNGDP
.008
.004
.000
2
4
6
8
10


Response of LNHDI to LNLIFEEXP
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.004
.000
2
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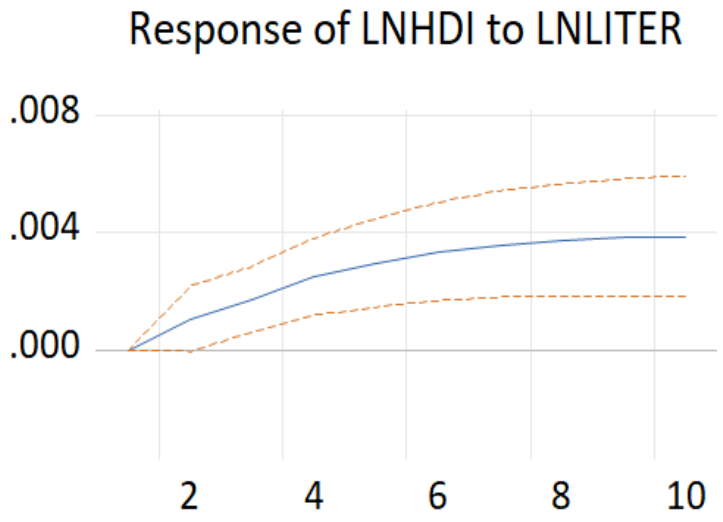
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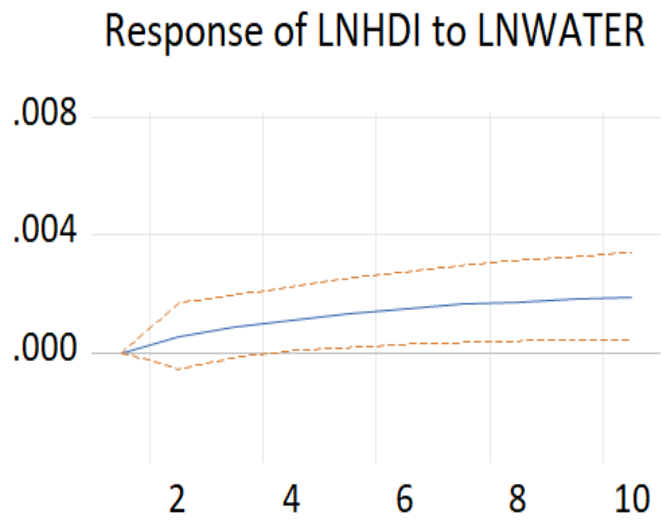
Response of LNHDI to LNWATER
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.004
.000
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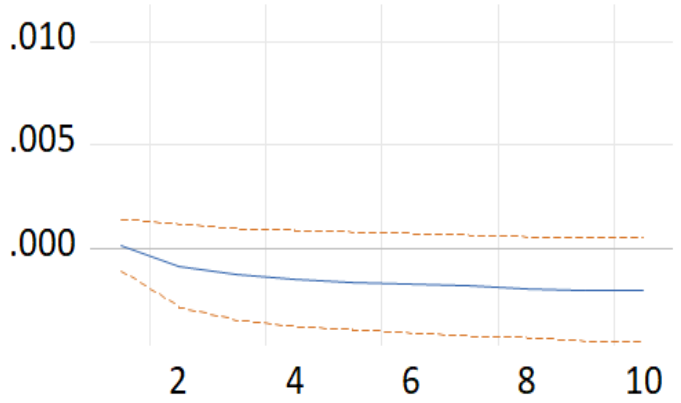
Response of LNLIFEEXP to LNDEMOC



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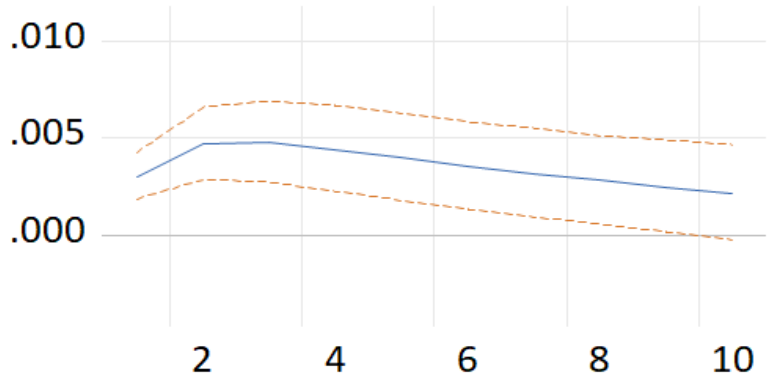

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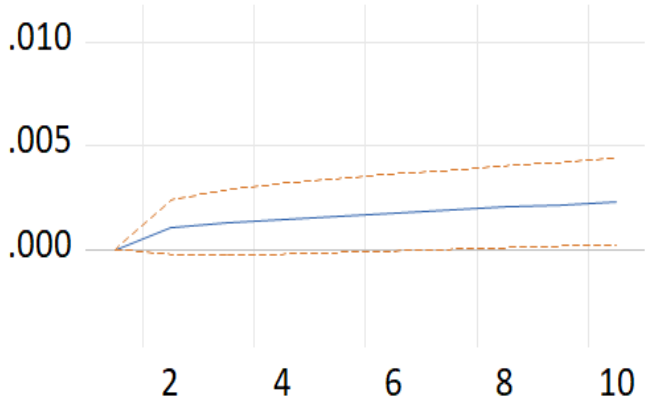
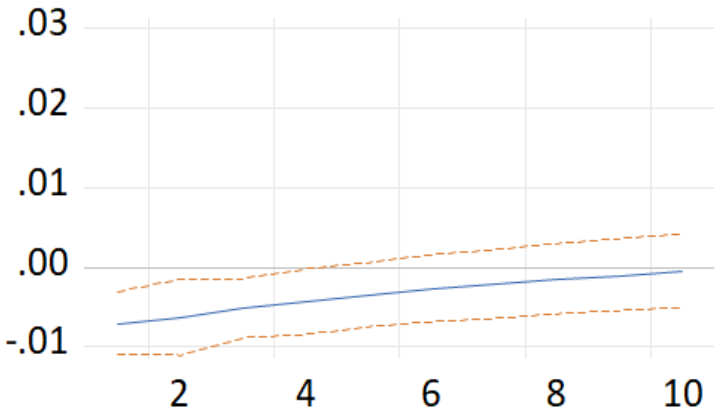
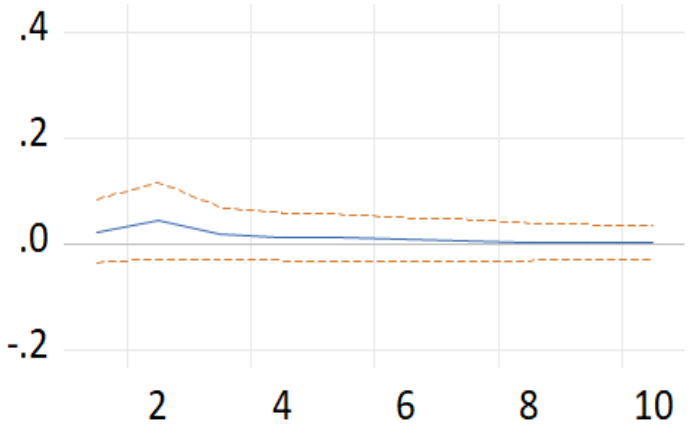


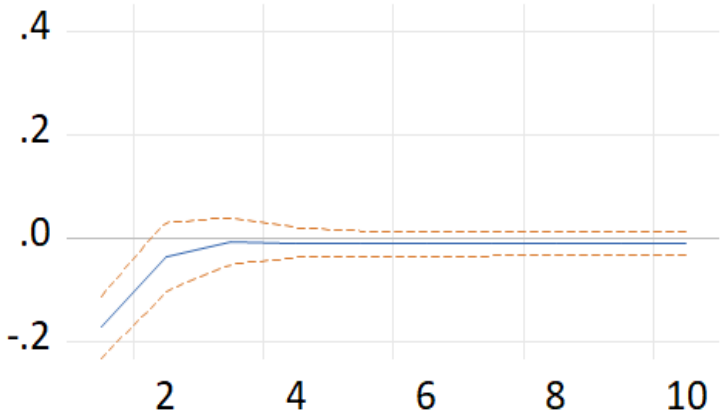
Response of LNLITER to LNGINI



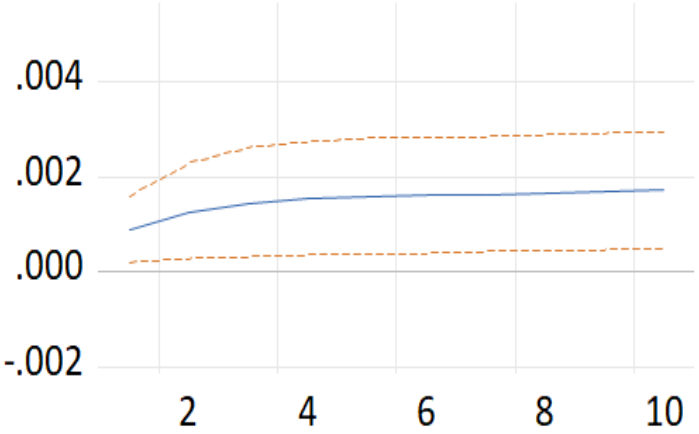
Response of LNMISERY to LNETX



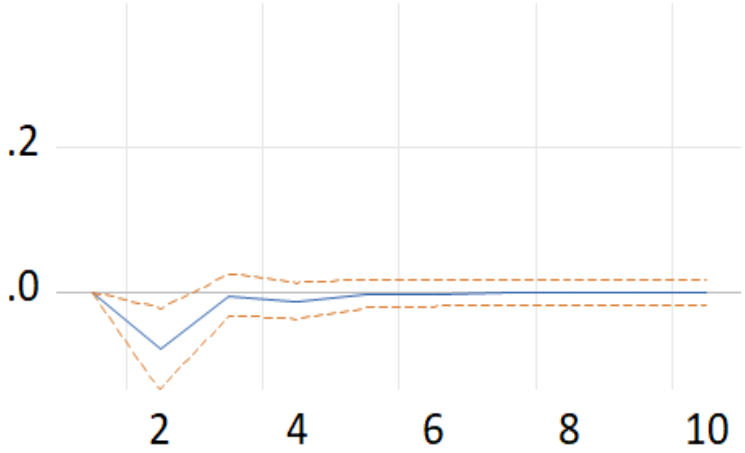
Response of LNMISERY to LNFND



Response of LNWATER to LNGDP



Response of LNTECN to LNWATER



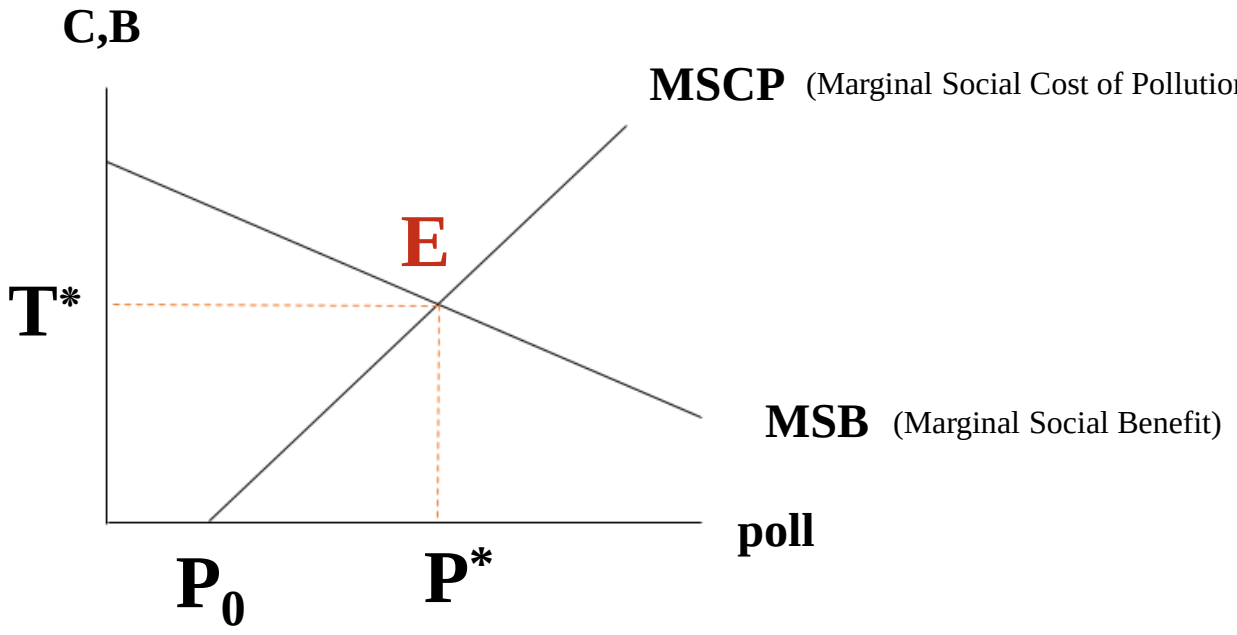
Discussion and conclusion

- Numerous BRICS countries are top emitter countries of the world; thus, green growth, eco-friendly technology, and environmental tax revenue are indispensable for these economies in decreasing the level of CO2 emission. The achievement of sustainable economic growth is difficult for policymakers, owing to paradoxical and conflicting links among growth, energy use, and CO2 emission. Policy-making in light of this conflicting relationship is crucial; for sound sustainable economic policies, the main objective of this study is to provide better solutions for policymakers. Based on comprehensive analysis, in protecting the environment in BRICS countries, it is crucial to adopt the sustainable development goal by implementing environmental taxes as an institutional policy. Although, for BRICS countries, economic growth will be hampered by implementing environmental taxes because the cost of production of manufacturing goods will also increase. Thus, in this regard, a two-tiered approach should be followed by these economies: where environmental taxes must complement economic strategies as it will endure the cost (economic) to help the moving towards renewable energy use. Thus, we also suggested that policymakers pay attention to sustainable and green opportunities to apply energy-efficient technologies at the manufacturing level.

- Furthermore, various economic activities that cause environmental pollution can be discouraged through carbon taxes; then, the investors will start environmental-friendly production and projects. Overall, technological innovation and renewable energy sources see greater capacities due to the support of the public and environmentalists should focus on eliminating regulatory barriers for eco-friendly renewable technologies. A unidirectional causality was found between financial development and CO2 emission, so financial assistance can be provided to technological innovation which can significantly improve the environmental quality.

- The finance of green technologies requires green money to meet sustainable development objectives. It is envisaged that the present financial markets would allocate the savings to initiatives using cutting-edge green technology that will assist in slowing the rate of environmental damage. Despite the rapid deterioration of the environment and the various attempts, it can be observed that the pool of funding is still matched with projects that are ecologically damaging and worsen present situations. Even though green financing is essential for the progress of green technology, investments in these technologies still do not attract enough investors. Many governments lack the enormous financial requirements, necessitating the involvement of the private sector, given the massive investment requirements of green businesses. However, private sector investment in green technology is very restricted due to the significant costs and risks involved with early investments in green technologies, making the rate of return significantly very tiny. Since green investments are so hazardous, the banking industry is unwilling to offer to fund green technology, creating the need for new types of finance. More substantial financial system involvement has also been a possible solution to the funding restrictions encountered by clean energy and green technology initiatives.

Policy Implication



It is better for each of the countries to define the optimal point of existence and removal of pollution based on the production structure, different levels of technology, environmental conditions, geographical location and population and social performance, and determine the optimal average environmental tax rate based on that.


Thank You