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Well-being productivity around the world: how well countries transform resources into subjective well-being

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Introduction

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- We apply non-parametric linear programming techniques to calculate well-being efficiency and well-being productivity;
- WB efficiency is the effectiveness with which a given set of resources is used to produce WB;
- WB productivity tracks changes over time and can be decomposed into changes in efficiency and technological change;
- WB efficiency $\longrightarrow$ Data Envelopment Analysis (DEA);
- WB productivity $\longrightarrow$ Malmquist Productivity Index (MPI).

Key messages

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1. Countries with few resources can be fully efficient. It is not about how much you possess, but how you use your resources;

2. Between 2006 and 2023, SWB has on average increased, but WB productivity stagnated:
    - The improvement in SWB required more resources over time.

3. Emphasis on WB productivity could:
    - Shift attention from more is always better;
    - Assess progress with respect to a country's past (not across countries);
    - Contribute to a more sustainable well-being.

Why is it important?

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- A high level of SWB does not mean efficient use of resources;
- Happy lives are not just a matter of quantity;
- Focus on how well resources are used, independently from the wealth of a country;
- It is a measure of progress that relates to:
  - Eudaimonia: the art of living a good life;
  - Sen's theory: ability to convert resources into capabilities.

Literature Review

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- Sarracino and O'Connor (2022): DEA analysis on cross-sectional data of 126 countries.
- Nikolova and Popova (2021), for a panel dataset of 91 countries, use income, education and health as inputs;
- Cordero et al., (2017) and Binder and Broekel (2012), use individual level data.

Our contribution

1. Large panel dataset;
2. We introduce the concept of WB productivity to make comparisons across years.

The intuition behind the method

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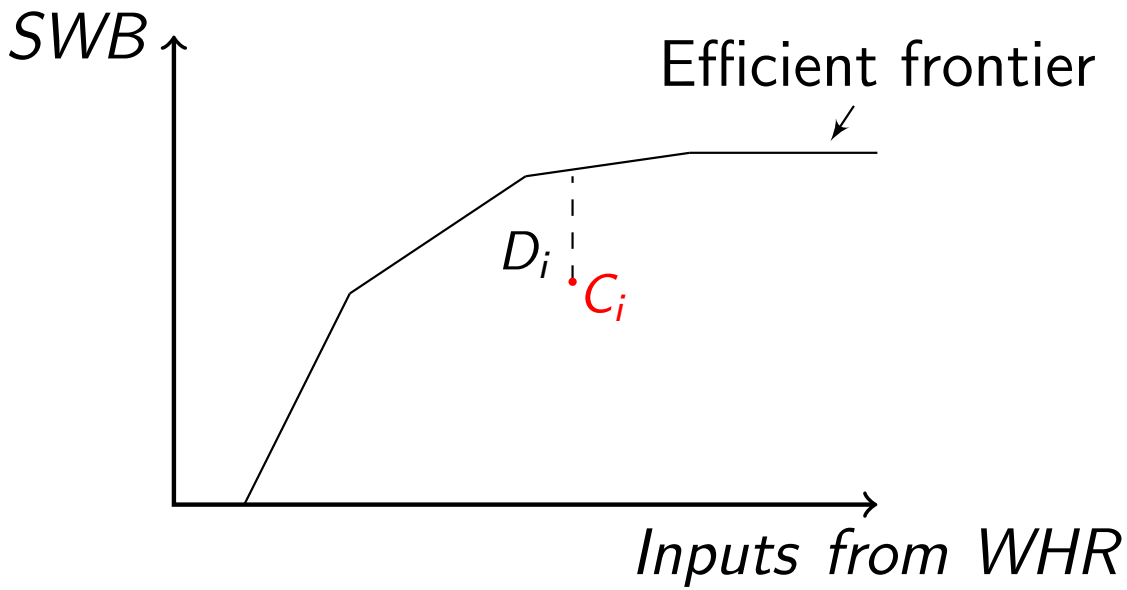

Subjective Well-being function

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$$\begin{aligned}\text{Subjective Well-being} &= f(\textit{lnGDPpc},\\ &\quad \textit{Healthy Life Expectancy},\\ &\quad \textit{Perceived Absence of Corruption},\\ &\quad \textit{Freedom of choice},\\ &\quad \textit{Social Support},\\ &\quad \textit{Generosity})\end{aligned}$$

Collectively, they explain 75% of the variation in cross-country SWB.

Which output?

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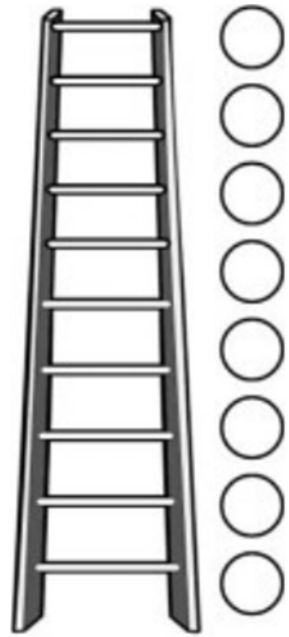
"Please imagine a ladder with steps numbered from zero at the bottom to 10 at the top.

The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you.

On which step of the ladder would you say you personally feel you stand at this time?"



Cantril Self-Anchoring Scale (Cantril, 1965)

Data

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World Happiness Report

- Aggregate data on *Subjective Well-being*;
- Healthy life expectancy at birth;
- Social Support;
- Freedom of Choice;
- Generosity;

World Bank

- GDP per capita

V-Dem

- Political corruption, reversed to represent absence of corruption

2006-2023 period

Efficiency vs. Cantril Ladder

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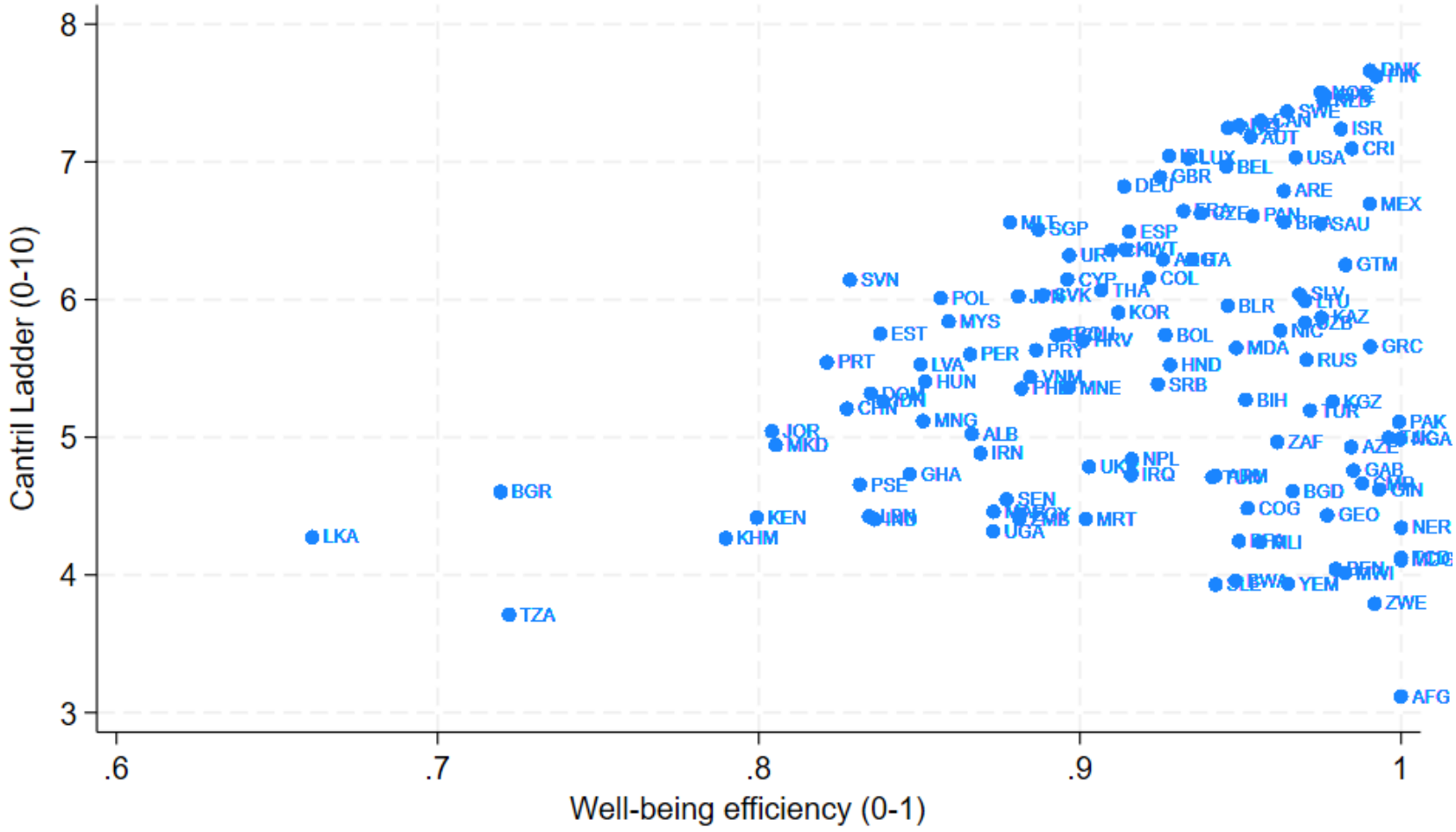

Efficiency vs. Cantril Ladder

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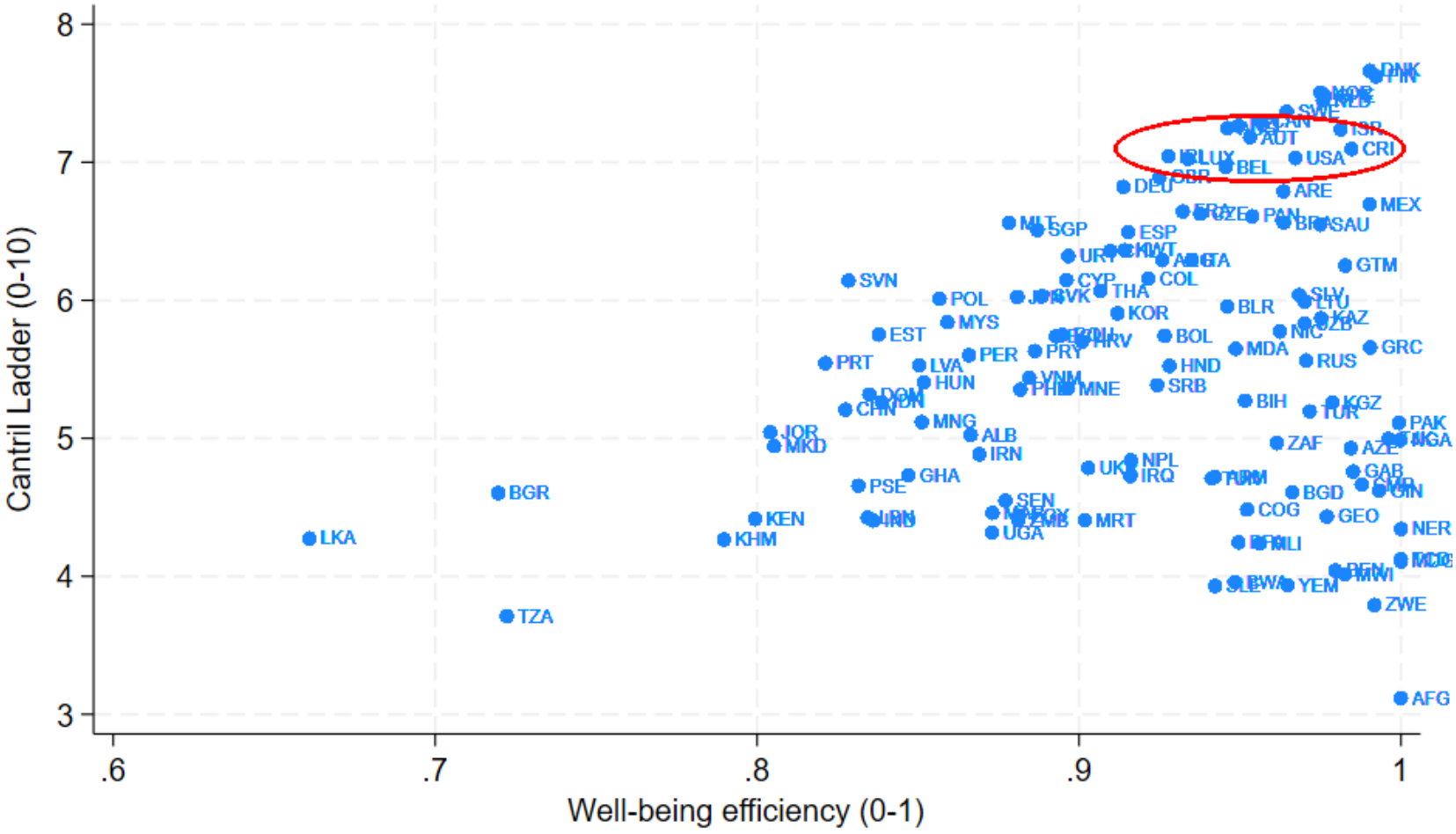

Efficiency vs. Cantril Ladder

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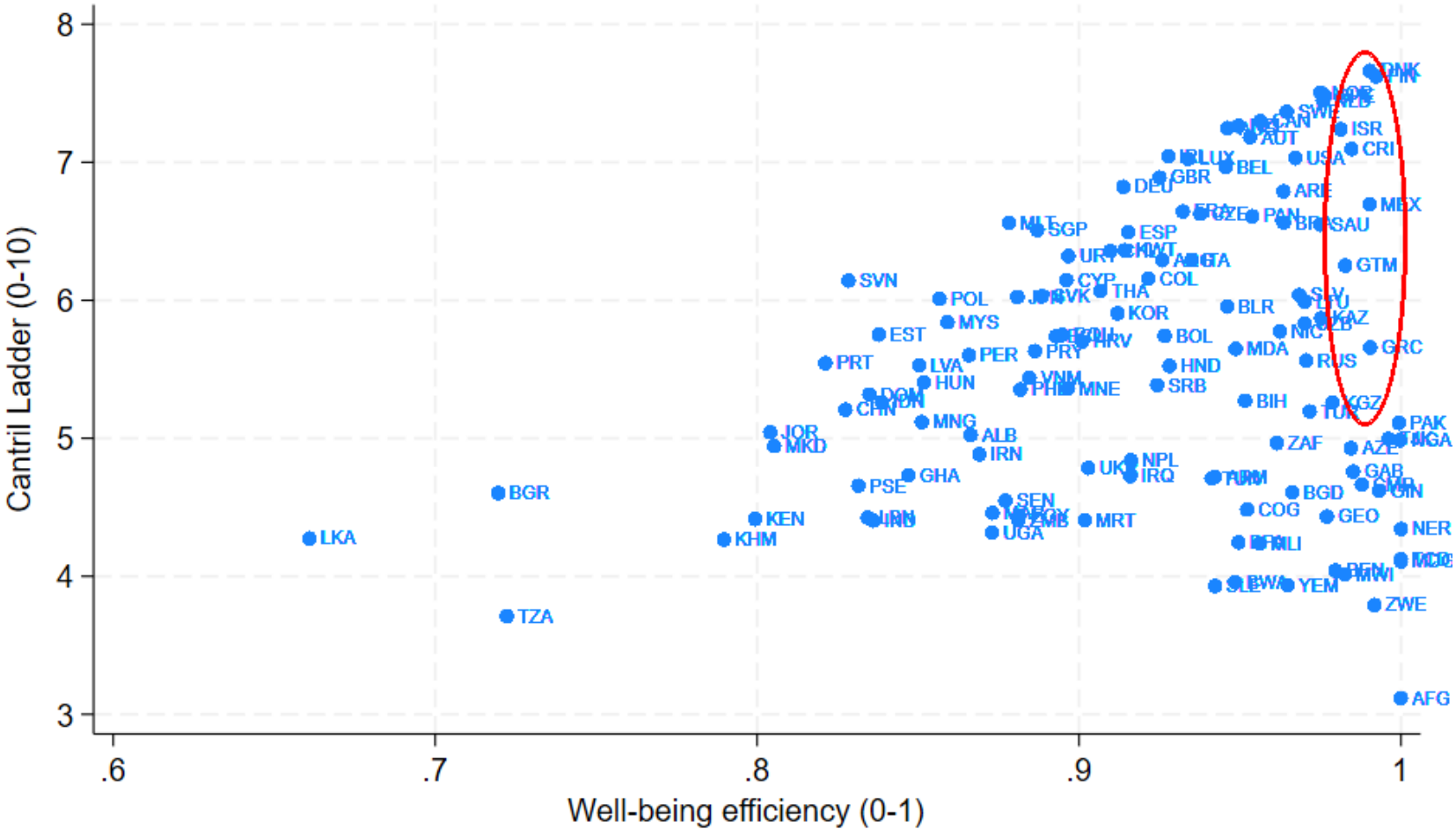

Actual vs Projected Well-being

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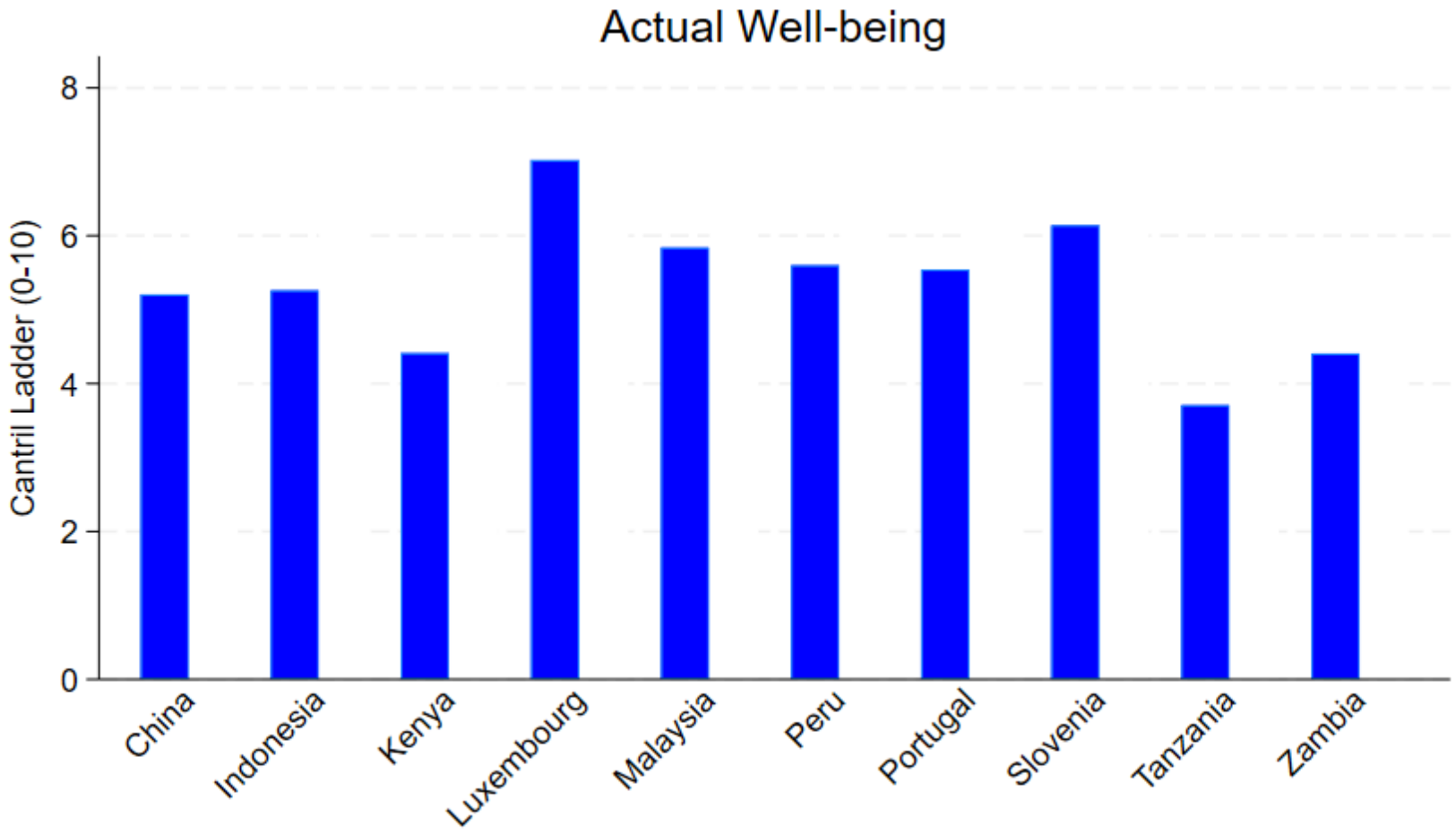

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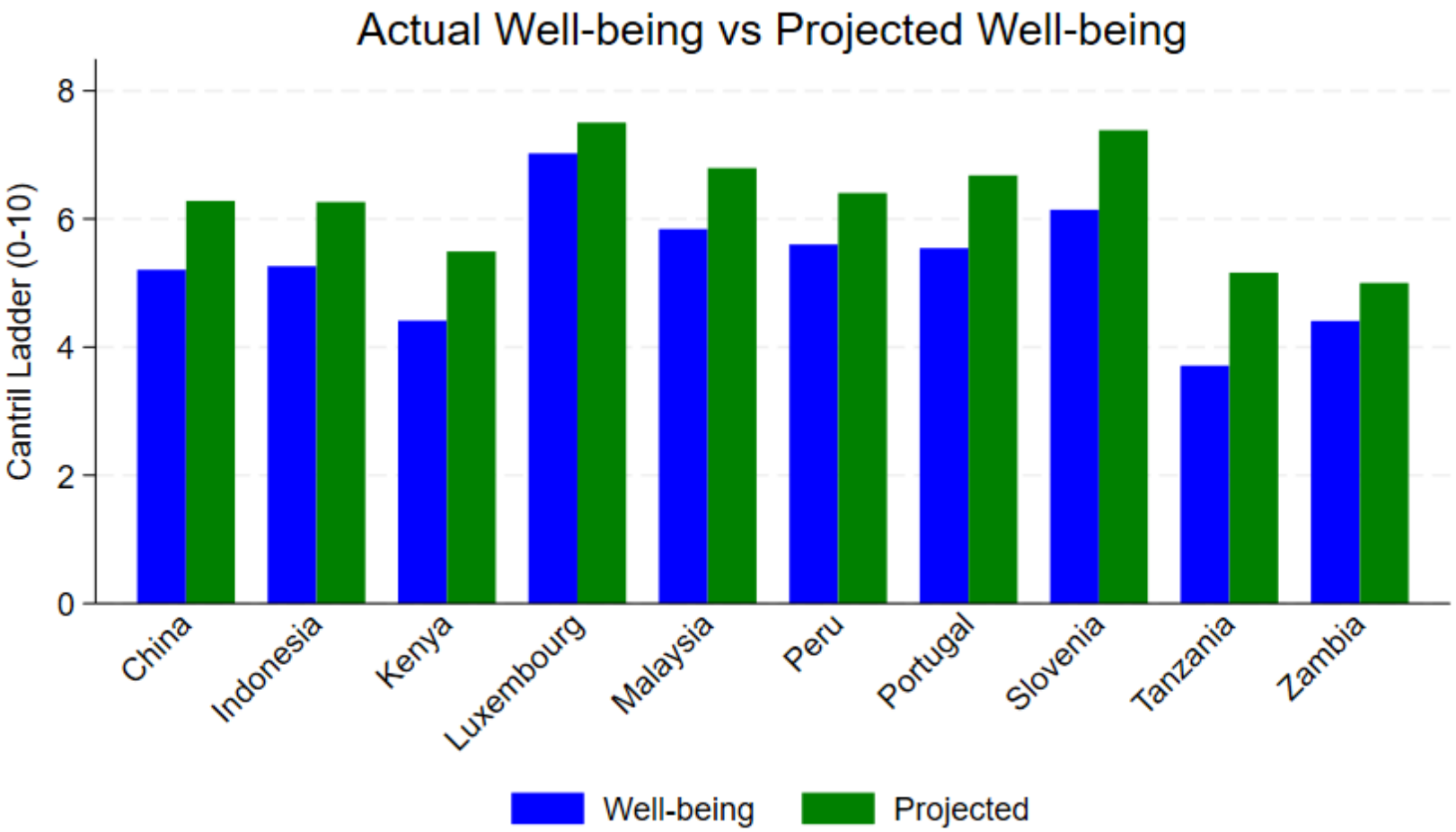

Cantril Ladder & Efficiency by Region

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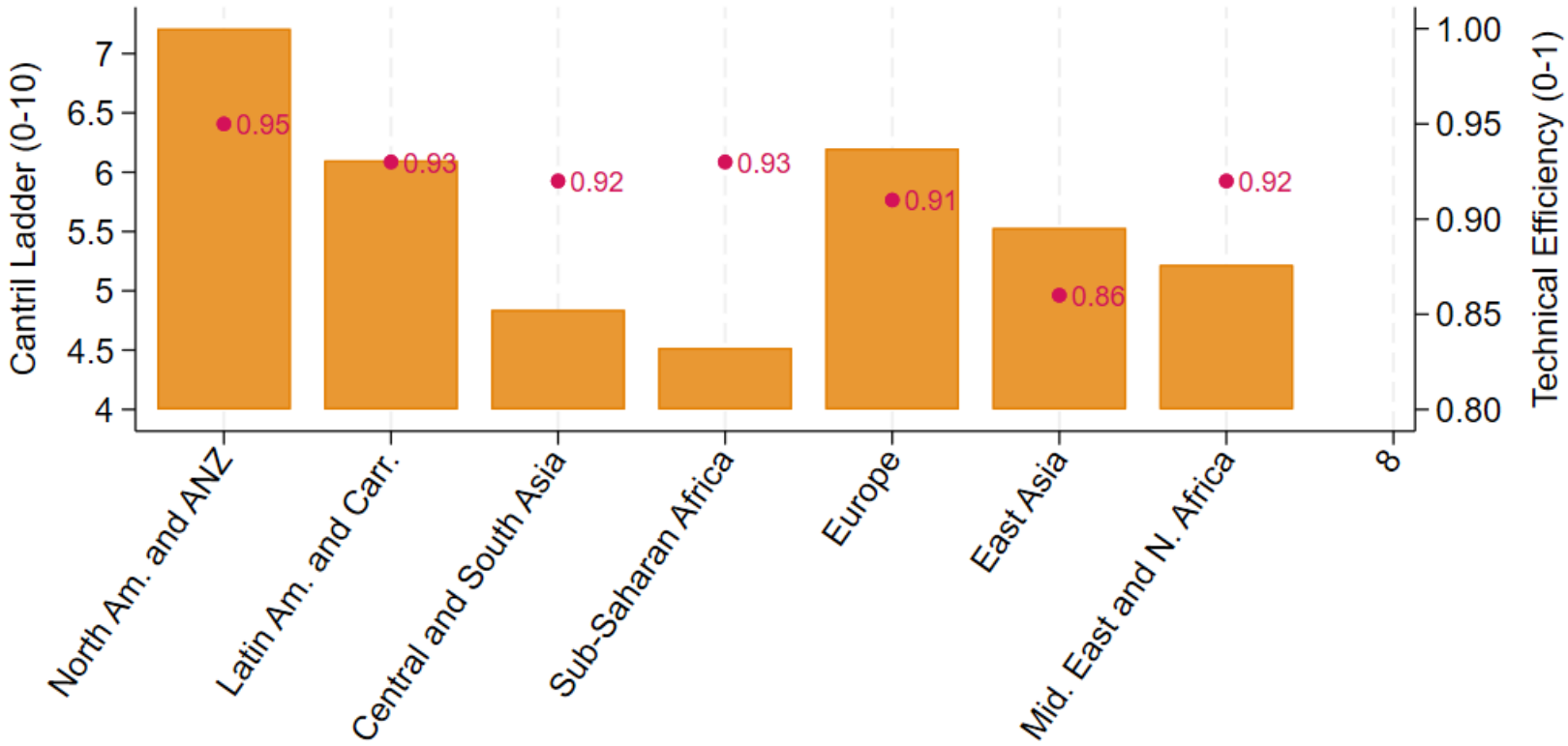

Robustness tests (1/2)

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- Excluding resources
  - **Test 1** excludes healthy life expectancy and absence of corruption.
  - **Test 2** excludes healthy life expectancy and GDPpc.
  - **Test 3** excludes social support and generosity.
  - **Test 4** excludes healthy life expectancy, absence of corruption, and GDPpc.
  - **Test 5** excludes social support, freedom of choice, and generosity.

Robustness tests (1/2)

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Validity Test	Correlation Spearman	Correlation Pearson	Observations
	Excluding resources		
Test 1	0.7540	0.7824	2178
Test 2	0.7374	0.7293	2178
Test 3	0.7184	0.7561	2178
Test 4	0.4810	0.5574	2178
Test 5	0.6107	0.6571	2178

Table: All scores are significant at 1% level.

Robustness tests (2/2)

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- Accounting for outliers
  1. Drop countries above and below the top and bottom 1% for each of the 6 resources and Life Ladder.
  2. Drop countries above and below the top and bottom 1% for healthy life expectancy, GDPpc and absence of corruption.
  3. Drop countries above and below the top and bottom 1% for social support, generosity and freedom to make life choices.
  4. Drop countries above and below the top and bottom 1% for GDPpc and corruption.

Robustness tests (2/2)

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Validity Test	Correlation Spearman	Correlation Pearson	Observations
	Accounting for outliers		
Outlier Test 1	0.958	0.949	1944
Outlier Test 2	0.949	0.941	1854
Outlier Test 3	0.919	0.935	1548
Outlier Test 4	0.958	0.927	1998

Table: All scores are significant at 1% level.

Malmquist Productivity Index

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- DEA provides efficiency estimates under the assumption that technology is fixed;
- Malmquist Productivity Index allows technology to change. It can be used to measure productivity over time;
- Efficiency change refers to the movement of a DMU relative to the frontier from one year to the other;
- Technological change refers to the movement of the frontier itself.

$$MI(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D^{t+1}(x^{t+1}, y^{t+1})}{D^t(x^t, y^t)} \left[\left(\frac{D^t(x^{t+1}, y^{t+1})}{D^{t+1}(x^{t+1}, y^{t+1})} \right) \left(\frac{D^t(x^t, y^t)}{D^{t+1}(x^t, y^t)} \right) \right]^{1/2}$$

WB Productivity changes across years

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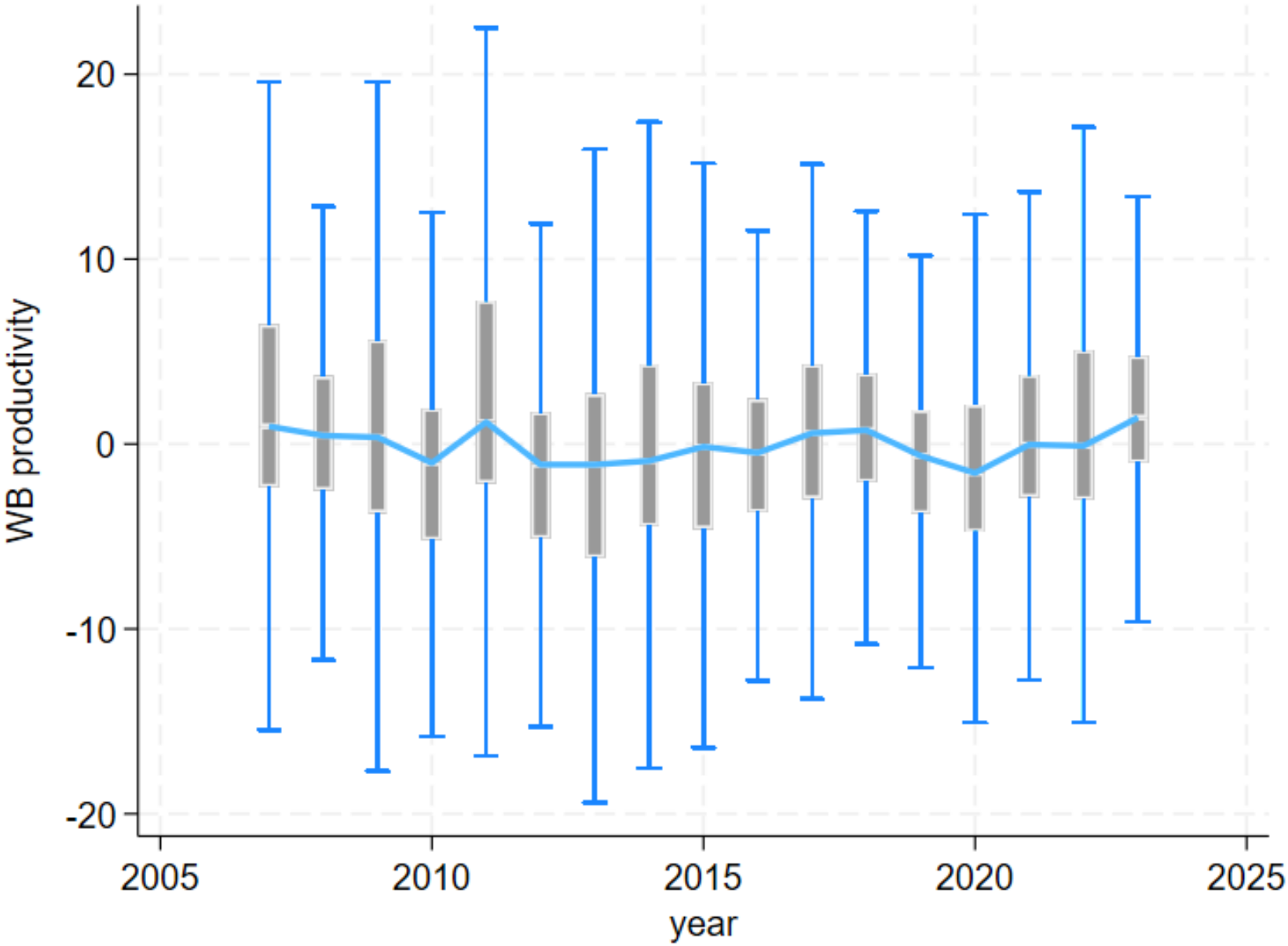

WB productivity trends (2007-2023)

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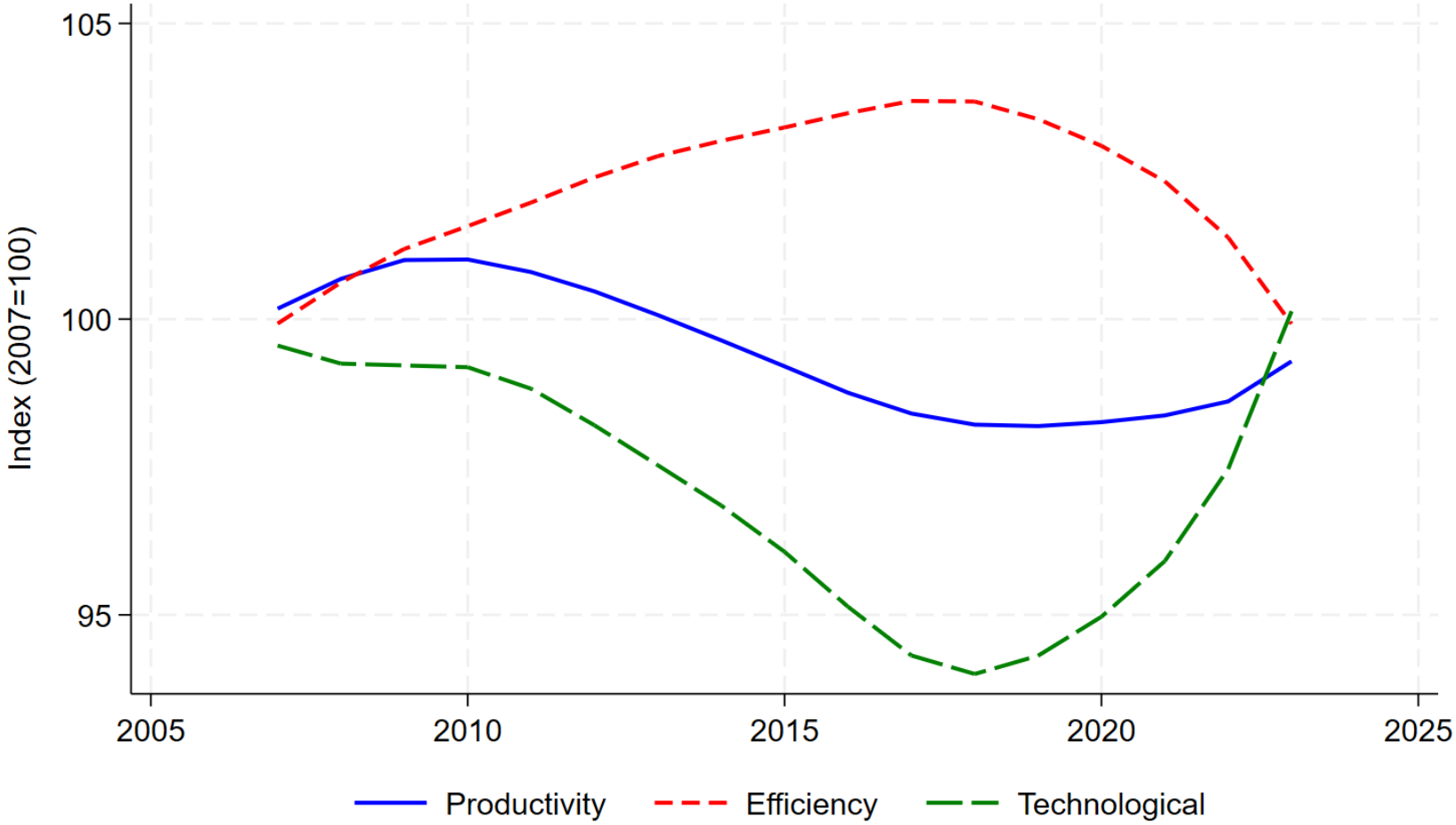

WB productivity trends - Luxembourg

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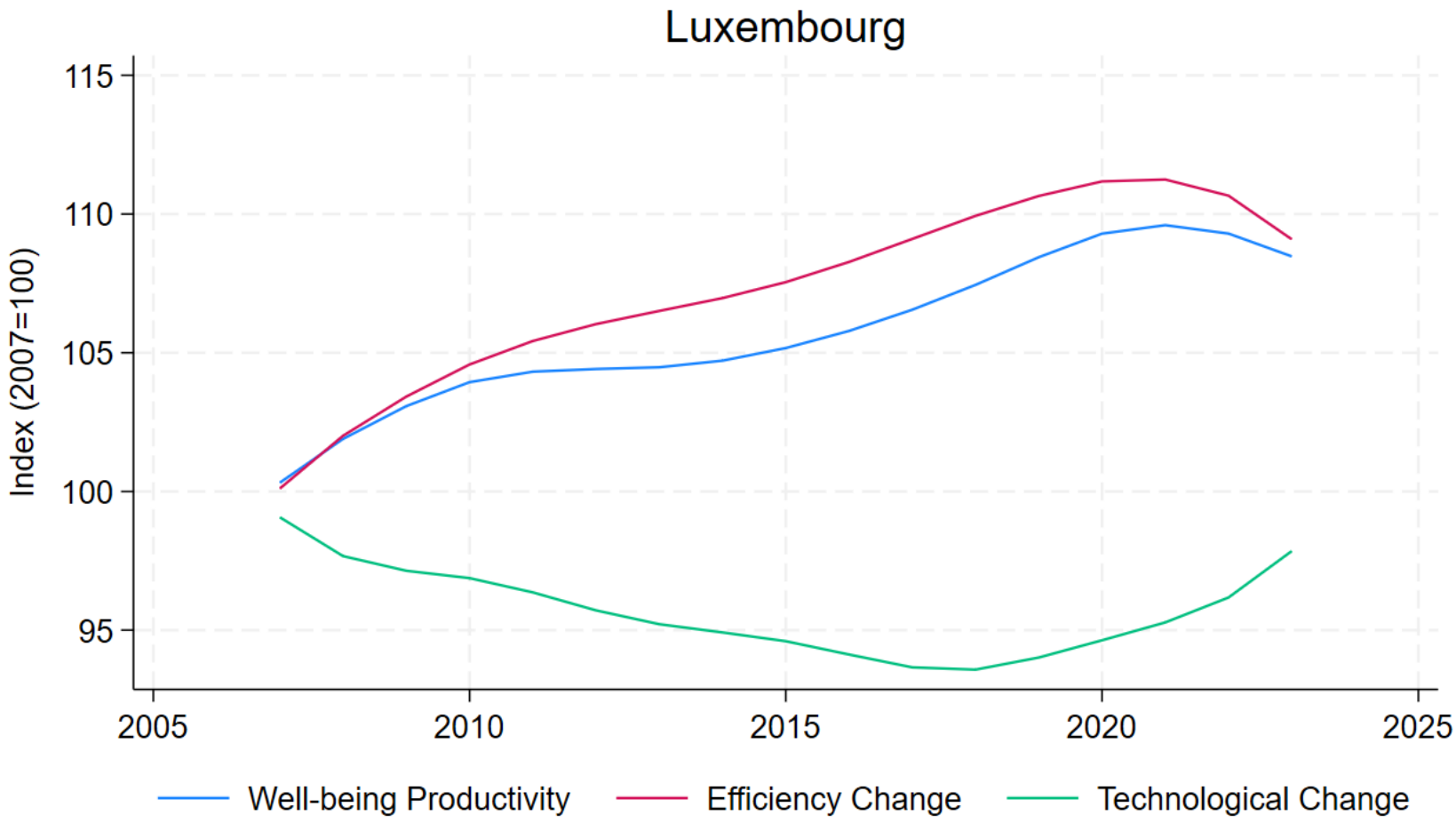

WB productivity comparison - 4 countries

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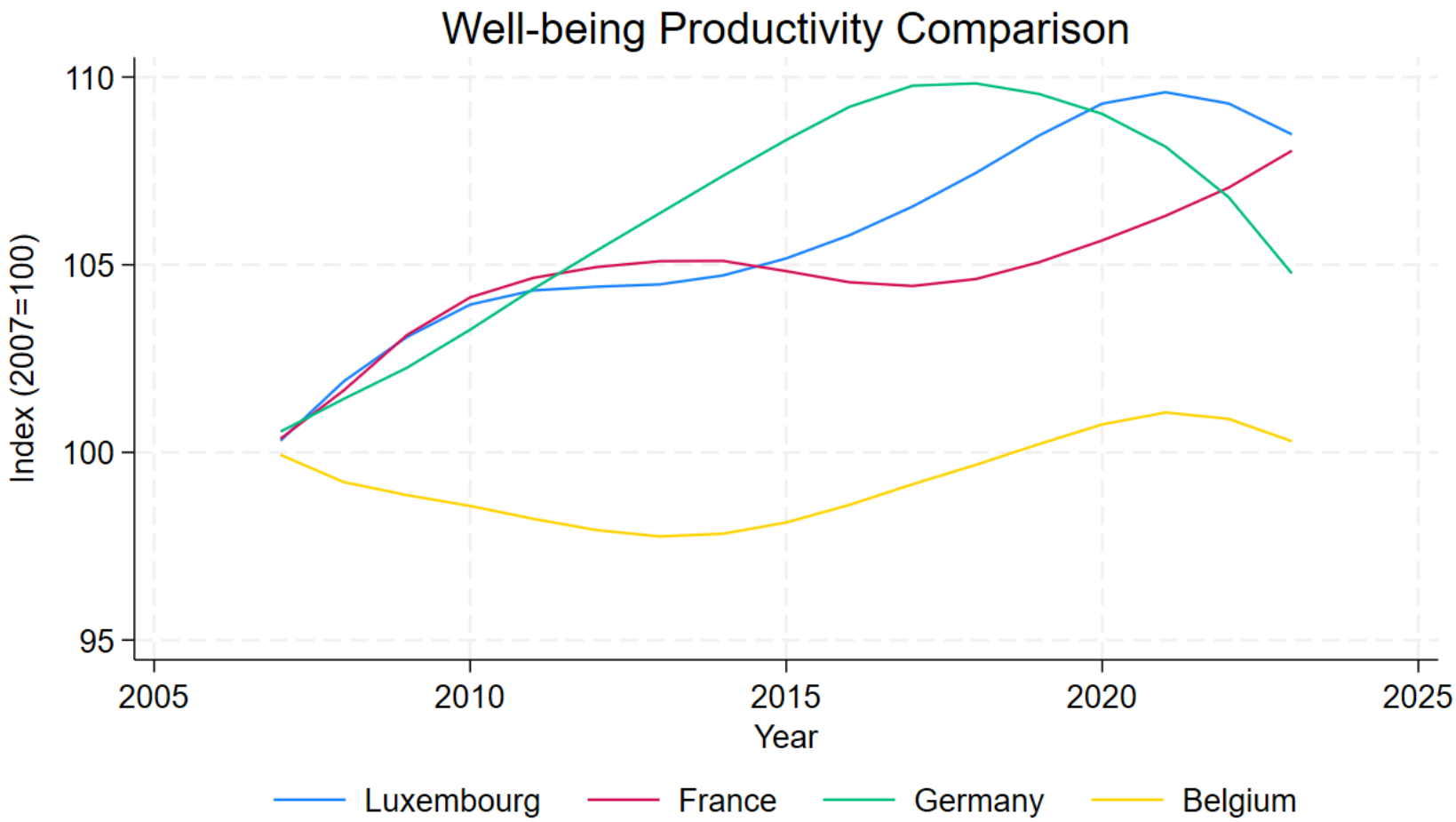

Average WB Productivity by Region

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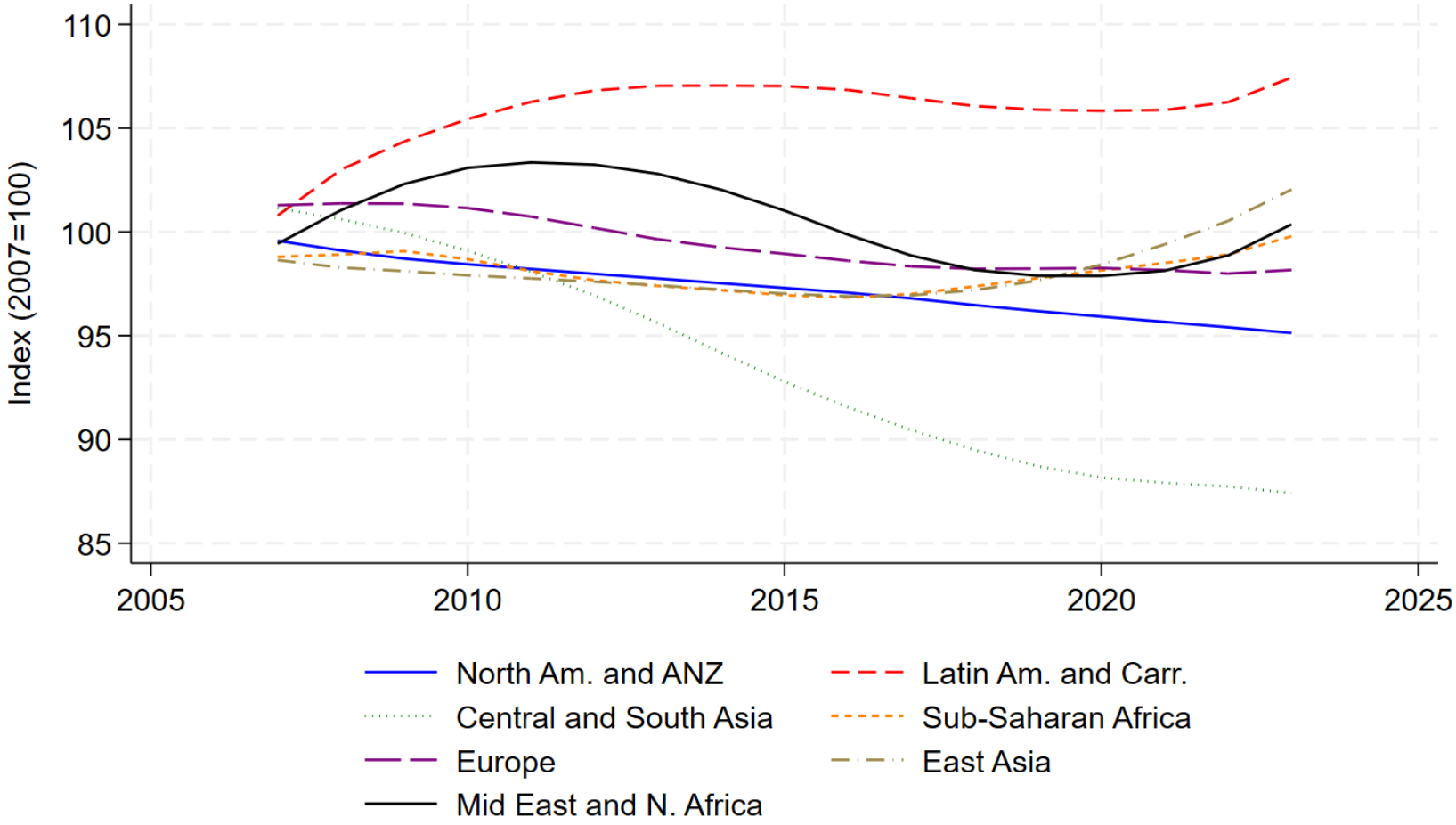

WB productivity regressions

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We regress well-being productivity on a host of potential explanatory variables to find what correlates with WB productivity

Economic

- Unemployment
- Gini index
- TFP
- Gov. health exp.
- Inflation
- Trade openness
- Labor force particip.
- Poverty pop. share

Socio-demographic

- Old age dependency
- ICT use
- Religiosity
- Years of education
- Quality of governance
- Optimism

Environmental

- CO_2 emissions
- $PM2.5$ emissions

WB productivity regressions

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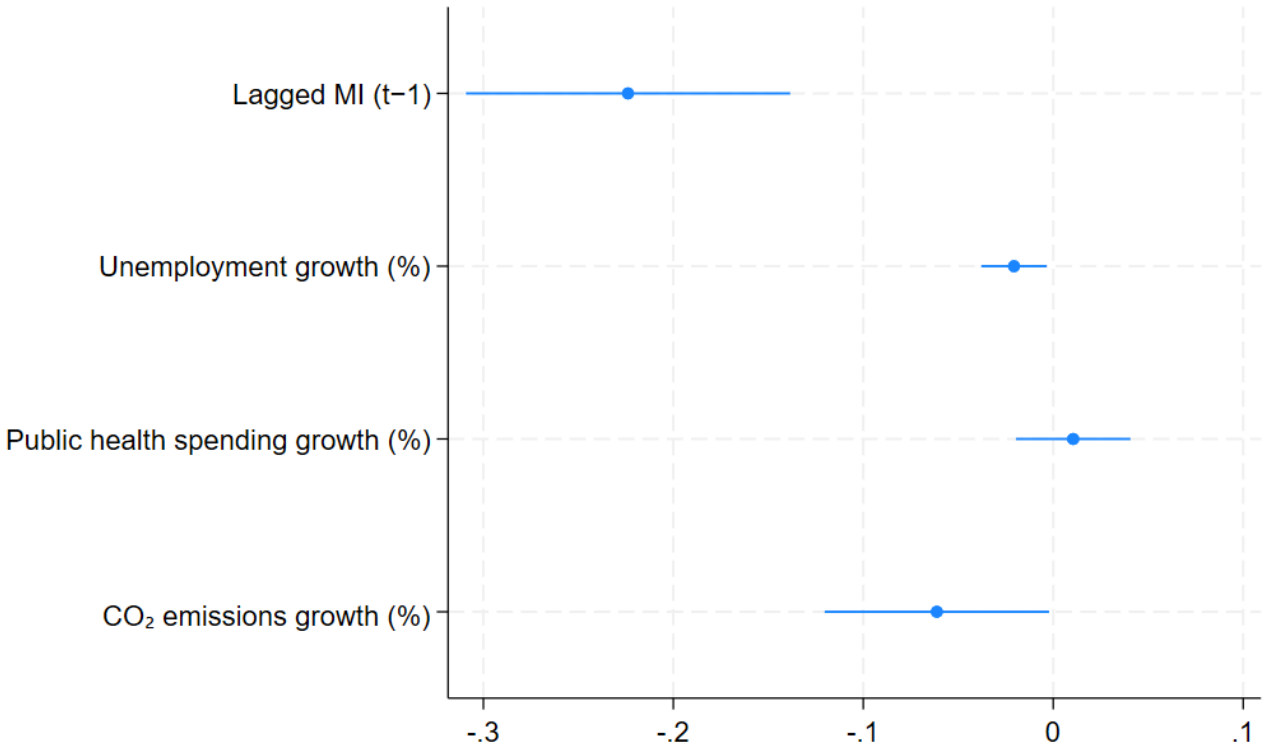

Conclusions

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- We use DEA and MPI to estimate well-being efficiency and well-being productivity for 121 countries over 18 years;
- Well-being efficiency reveals that countries with few endowments can be efficient. This is important when resources are constrained;
- Over 2006-2023, SWB has on average gone up, but SWB productivity has somehow remained stagnant;
- Emphasizing productivity could shift attention from more is always better and contribute to a more sustainable well-being.

Thank you!

2024 World Happiness Report

Rank	Country	Subjective Well-being
1	Finland	7.736
2	Denmark	7.521
3	Iceland	7.515
4	Sweden	7.345
5	Netherlands	7.306
6	Costa Rica	7.274
7	Norway	7.262
8	Israel	7.234
9	Luxembourg	7.122
10	Mexico	6.979

Rank	Country	Subjective Well-being
81	Greece	5.776
86	North Macedonia	5.503
89	Albania	5.411
106	Azerbaijan	4.875
109	Pakistan	4.768
111	Ukraine	4.680
125	Ghana	4.340
126	Myanmar	4.321
140	Yemen	3.561
147	Afghanistan	3.364

Efficiency 1/2

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Efficiency is:

$$TE_k = \frac{\sum_{r=1}^{s} u_r y_{rk}}{\sum_{i=1}^{m} v_i x_{ik}} \tag{1}$$

where:

- TE_k is the technical efficiency of country k using m resources to produce s outputs;
- y_{rk} is the quantity of output r produced by country k;
- x_{ik} is the quantity of input i used by country k;

Efficiency of country k is maximized subject to the following constraints:

$$\frac{\sum_{r=1}^{s} u_r y_{rk}}{\sum_{i=1}^{m} v_i x_{ik}} \leq 1 \qquad j = 1, \ldots, n \tag{2}$$

$$u_r, v_i > 0 \quad \forall r = 1, \ldots, s; i = 1, \ldots, m. \tag{3}$$

Efficiency 2/2

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Output orientated DEA model with variable returns to scale (Banker et al., 1984)):

$$\textit{Minimize} \qquad \sum_{i=1}^{m} v_i x_{ik} - c_k \tag{4}$$

where x_{ik} is the quantity of input i used by country k; m is the number of resources; c_k is a measure of returns to scale for country k.

Subject to:

$$\sum_{i=1}^{m} v_i x_{ij} - \sum_{r=1}^{s} u_r y_{rj} - c_k \geq 0 \qquad j = 1, \ldots, n \tag{5}$$

$$\sum_{r=1}^{s} u_r y_{rk} = 1 \tag{6}$$

$$u_r, v_i, c_k > 0 \qquad \forall r = 1, \ldots, s; i = 1, \ldots, m. \tag{7}$$

Projected well-being

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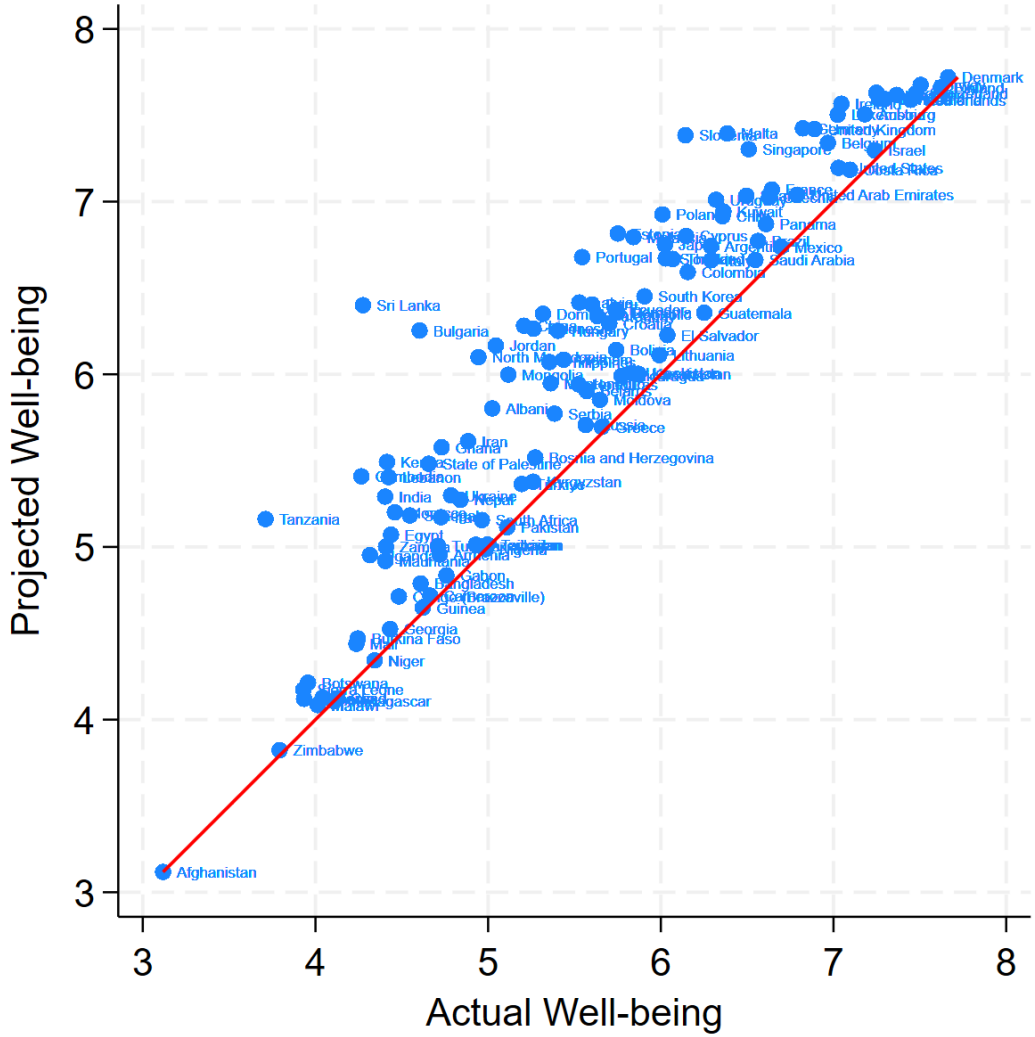

Regression results

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Dependent variable: *Well-being Productivity*			
	Coefficient	**Std. Error**	**p-value**
lag of Well-being Prod.	-0.2239	0.0431	0.000
Share of Unemployment	-0.0206	0.0087	0.019
Gov. Health Expenditures	0.0105	0.0152	0.491
CO_2 Emissions	-0.0612	0.0298	0.042
Constant	0.9512	0.8161	0.246
Observations		1,807	
R-squared		0.072	
Clusters (dmu)		121	