United Nations ESCAP
Open Seminar

Fostering Regional Integration: A Global Frontier Analysis of Untapped Potential

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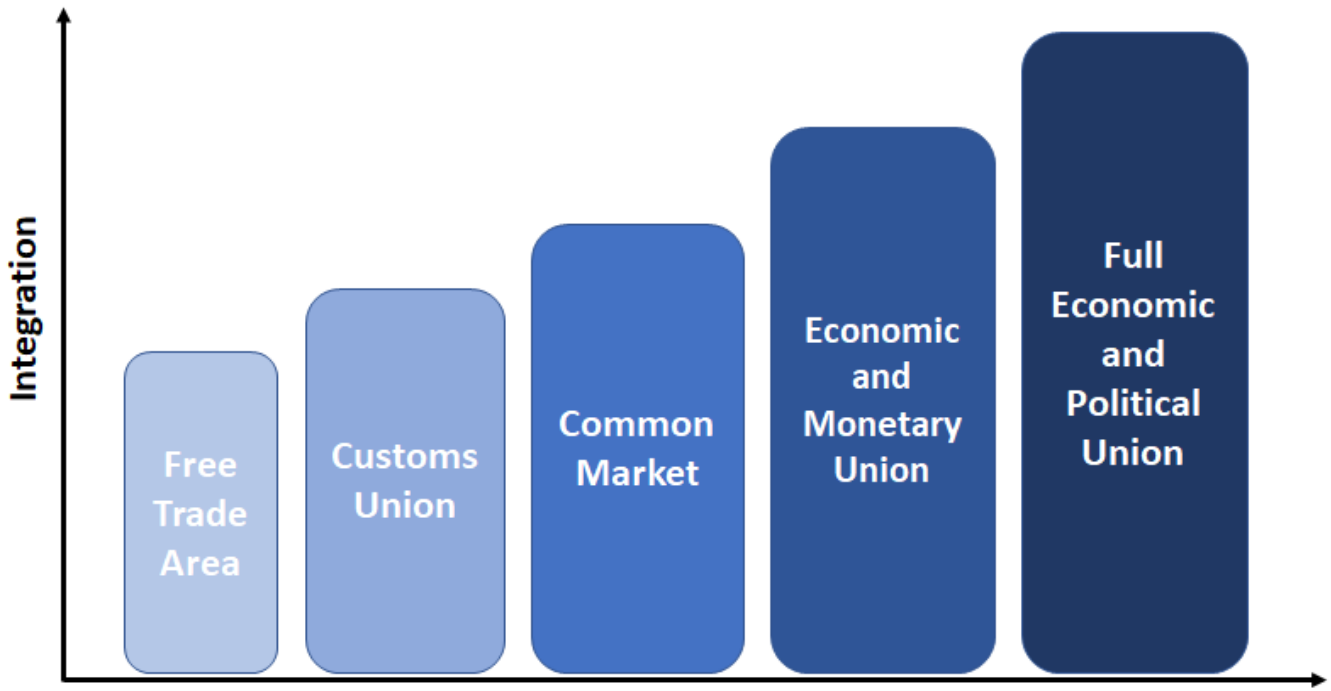
Motivation

- Evidence-based policymaking
  - How to measure levels of regional integration and compare them across different (sub)regions?
  - How to map achieved progress against stated goals?

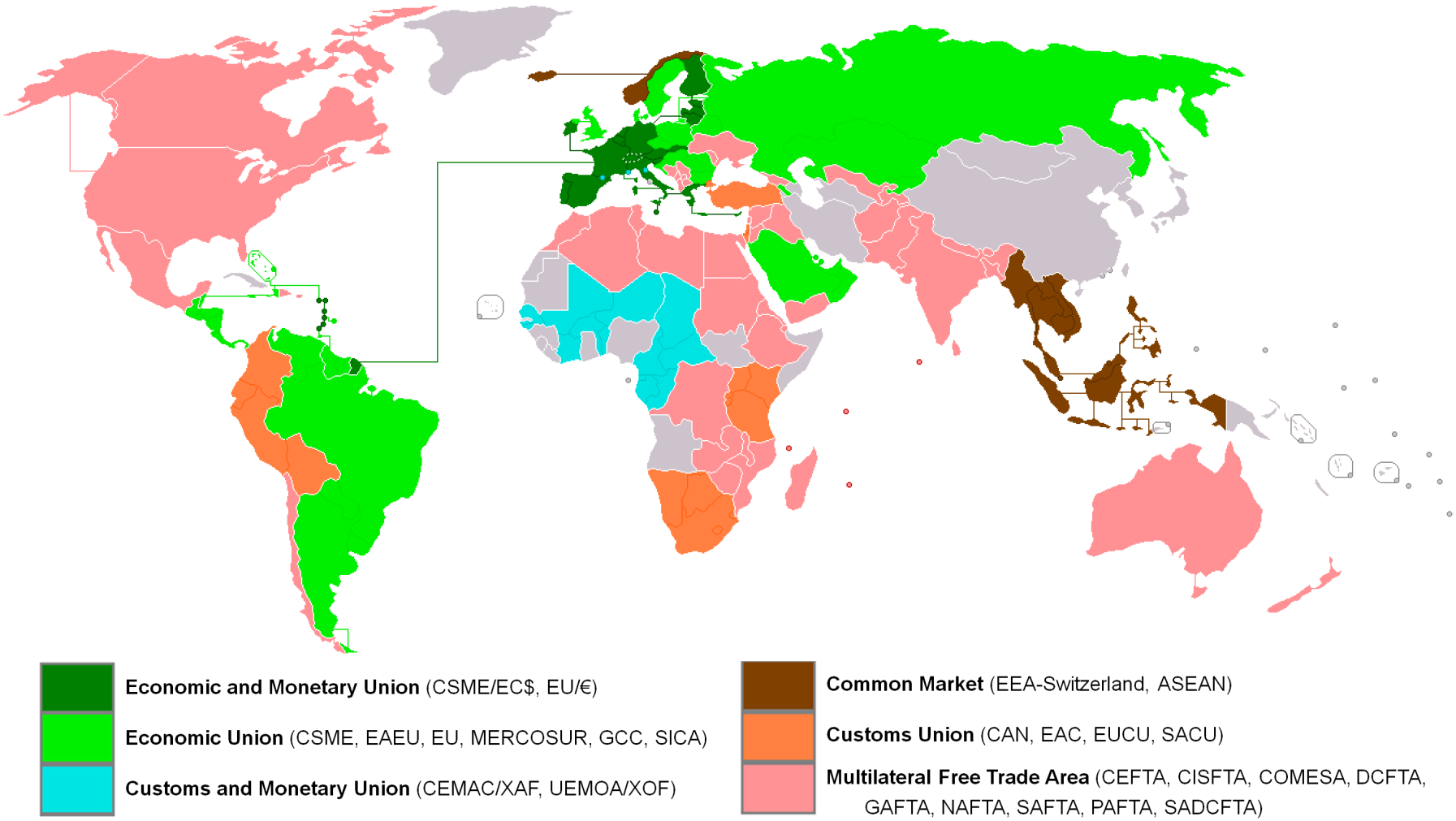
- Regional economic integration: *A process in which a group of countries in a geographic region enter into an agreement to reduce and ultimately remove (tariff and non-tariff) barriers to the free flow of goods, services, and factors of production between each other.*

Measuring Regional Integration: Approach 1

- Based on institutional arrangements
  - Harmonization of standards and rules
  - Preferential and free trade agreements
  - e.g., Balassa's (1961) five stages of economic integration



Stages of Regional Economic Integration



Measuring Regional Integration: Approach 2

- Based on actual economic outcomes
  - Cross-border flows of goods and services
  - Financial investments
  - Movement of people
  - ...

This Paper

- Approach
  - Measure and compare regional integration levels based on actual economic outcomes ('ultimate outcomes').
  - Institutional arrangements are considered as part of the 'enabling environment' needed to foster integration in each subregion.
- Research questions
  1. How integrated are subregions when looking at multiple key dimensions of economic integration?
  2. How well are subregions doing relative to others with similar enabling conditions?
  3. How large is the untapped potential for regional integration in each subregion, region, and globally?
- Methodology
  - Quantify regional economic integration using a composite index.
  - Construct a proxy of each subregion's enabling environment.
  - Estimate untapped potential using data envelopment analysis (DEA).

Related Literature

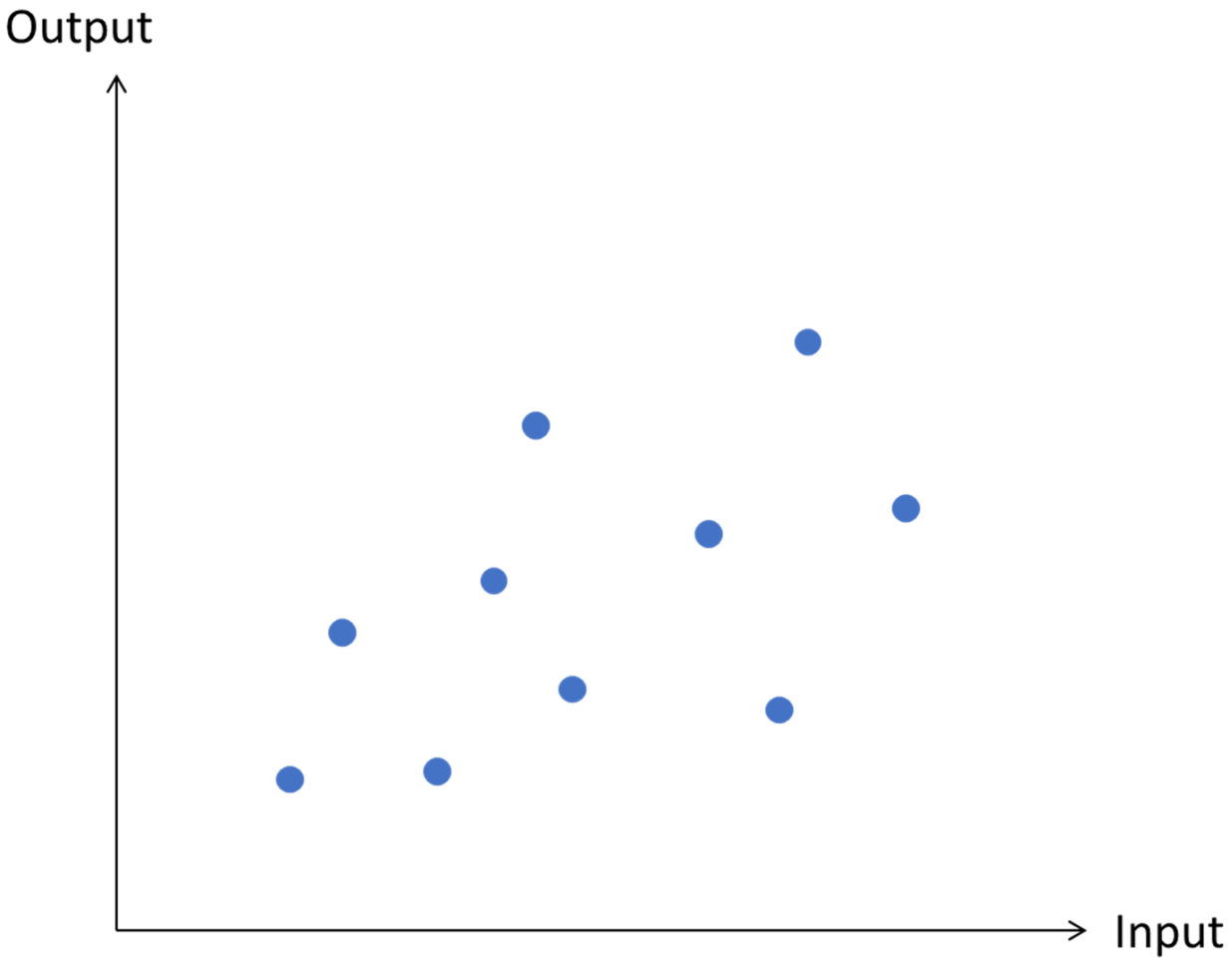
- Economic integration and regionalism
  - Many studies focusing either on institutional arrangements or on a single dimension of economic integration, e.g., trade or migration.
  - Few holistic (multidimensional) approaches.
- Composite measures of subregional integration levels
  - Africa Regional Integration Index (AfDB et al. 2016)
  - Asia-Pacific Regional Integration Index (ADB 2017; Huh and Park 2018)
  - Compare absolute levels of achieved integration, not accounting for different conditions faced by each subregion.
- Applications of DEA in economics
  - Public sector efficiency (Afonso et al. 2005; Gupta and Verhoeven 2001), health and education (Clements 2002, Herrera and Pang 2005), agricultural efficiency (Latruffe et al. 2004)
  - Regional economic integration in Asia (Naeher 2015)

Outline

Data Envelopment Analysis (DEA)

- Non-parametric estimation method for efficiency analysis
  - Calculate empirical production possibility frontier: maximum amount of output that can be produced with any given set of inputs.
- Methodology
  1. Construct production possibility frontier based on a sample of comparable decision making units ('producers').
  2. Units located on the frontier are said to be efficient: no other unit produces more output with the same level of input.
  3. Relative efficiency gaps are calculated as the distance between a unit's performance and the estimated frontier.
- Outcomes
  - Normalized efficiency scores for each unit ranging between 0 and 1.
  - Interpret as 'untapped potential': how much more output should a unit be able to produce given its currently available inputs?

Graphical Illustration of DEA



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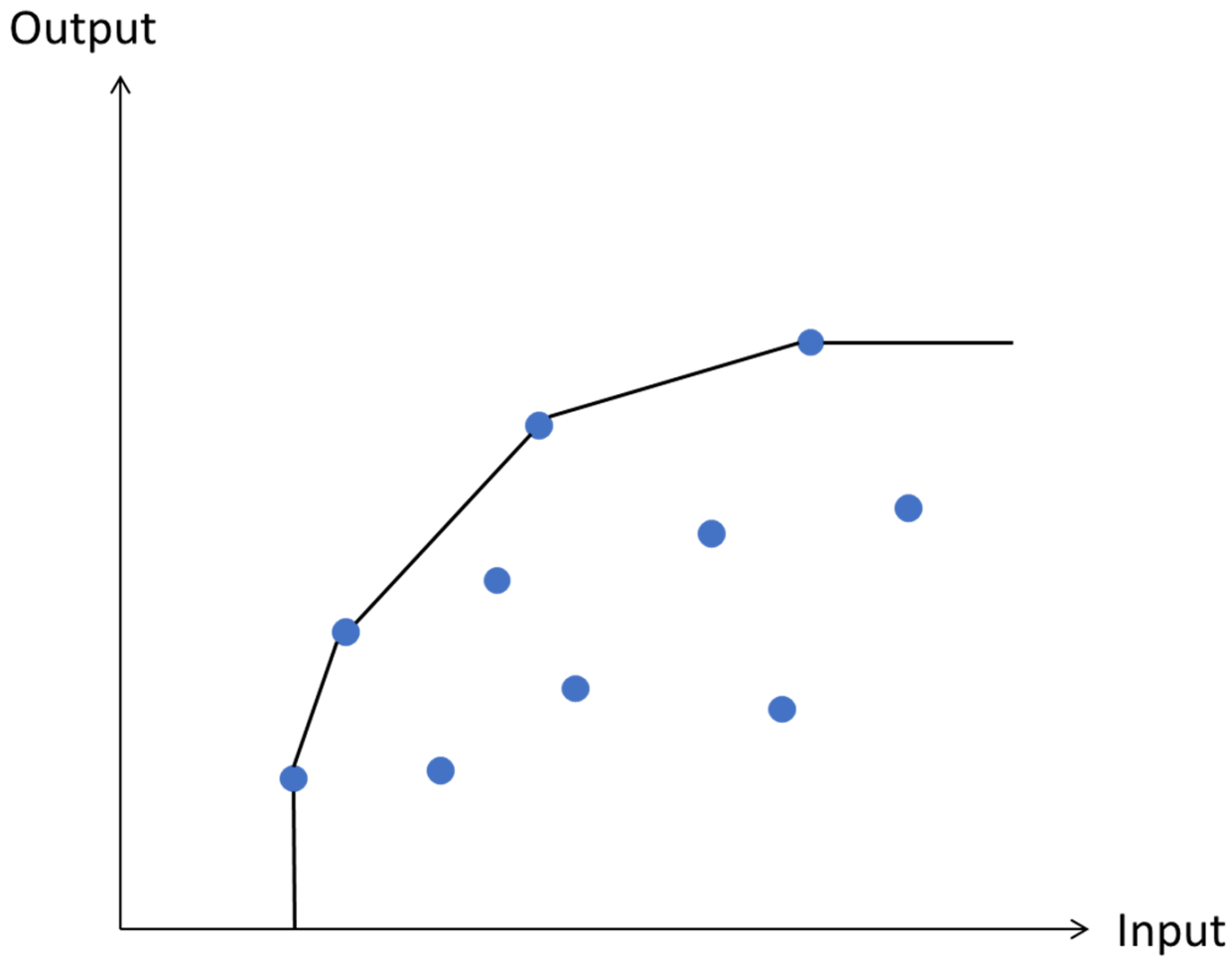

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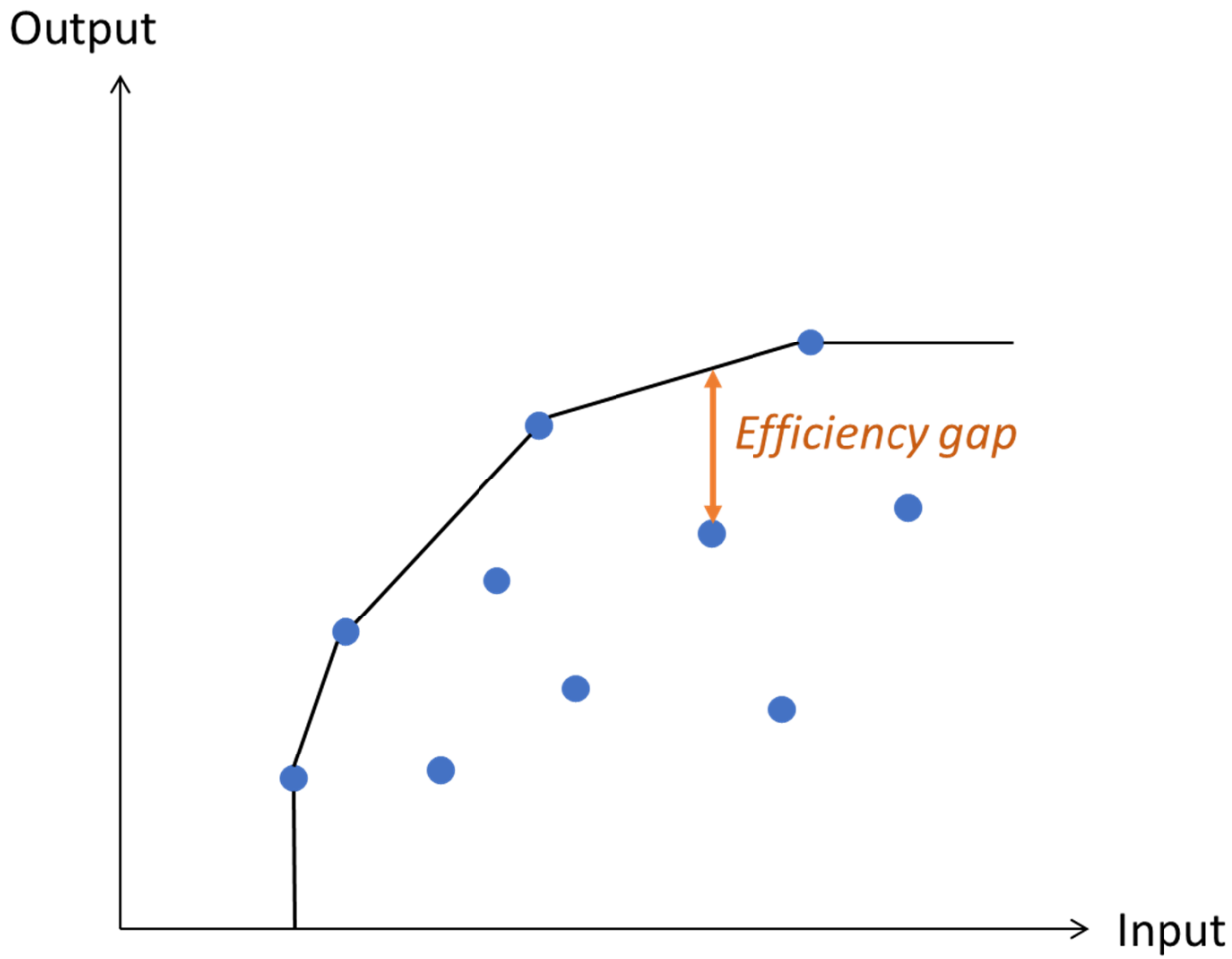


Parametric vs. Non-parametric Methods

- Different methods for efficiency analysis (Thanasoulis 1993; Sickles and Zelenyuk 2019)
  - Parametric/econometric: Regression analysis (OLS), Stochastic frontier analysis (SFA).
  - Semi-parametric: Neural network analysis.
  - Non-parametric/linear programming: Data envelopment analysis (DEA), Free disposal hull (FDH).
- Benefits of using DEA
  - No assumptions on the functional form of the production function.
  - Can handle multiple inputs/outputs measured in different units.
  - Efficiency estimates are based on immediate peers, not average producer.
- Limitations of DEA
  - "Black box": no information on root causes of inefficiency (causality).
  - No statistical significance tests.
  - Sensitive to selection of inputs/outputs, measurement error.

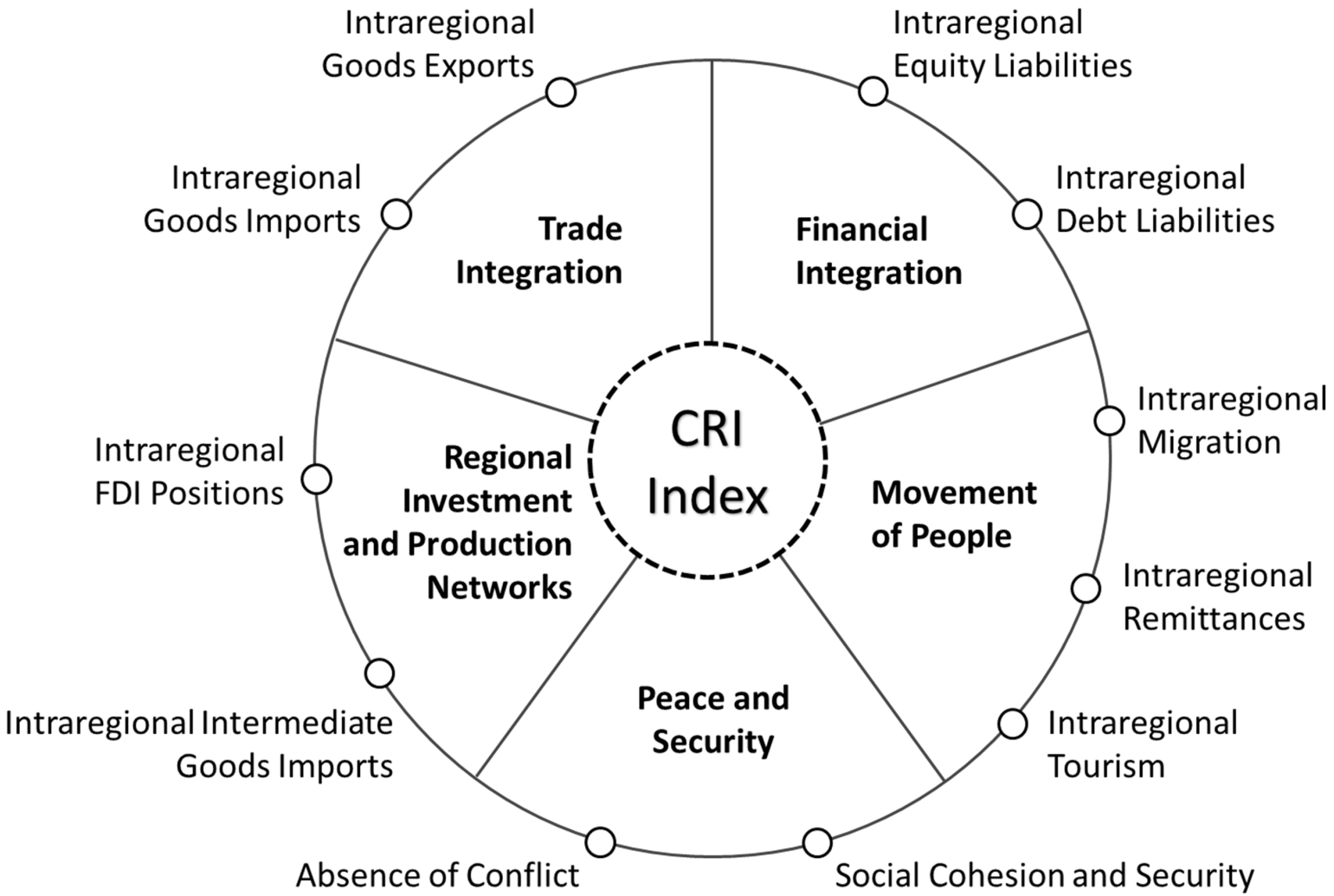
DEA Output Variable

- Composite regional integration (CRI) index
  1. Trade: *imports, exports*
  2. Financial integration: *equity, debt liabilities*
  3. Investment & production networks: *FDI, intermediate good imports*
  4. Human mobility: *tourism, migration, remittances*
  5. Peace and security: *social cohesion/security, risk of conflict*
- Intraregional shares of bilateral (dyadic) data
  - Country-by-country matrix of flows F_{ij} between country i and j
  - Intraregional shares:

$$\frac{F_{RR}}{F_{RW}} = \frac{\sum_{i \in R} \sum_{j \in R, j \neq i} F_{ij}}{\sum_{i \in R} \sum_{j \in W, j \neq i} F_{ij}}$$

  - Normalization via min-max rescaling
  - Equal weighting at each aggregation step
  - Robustness to alternative weights, principal component analysis

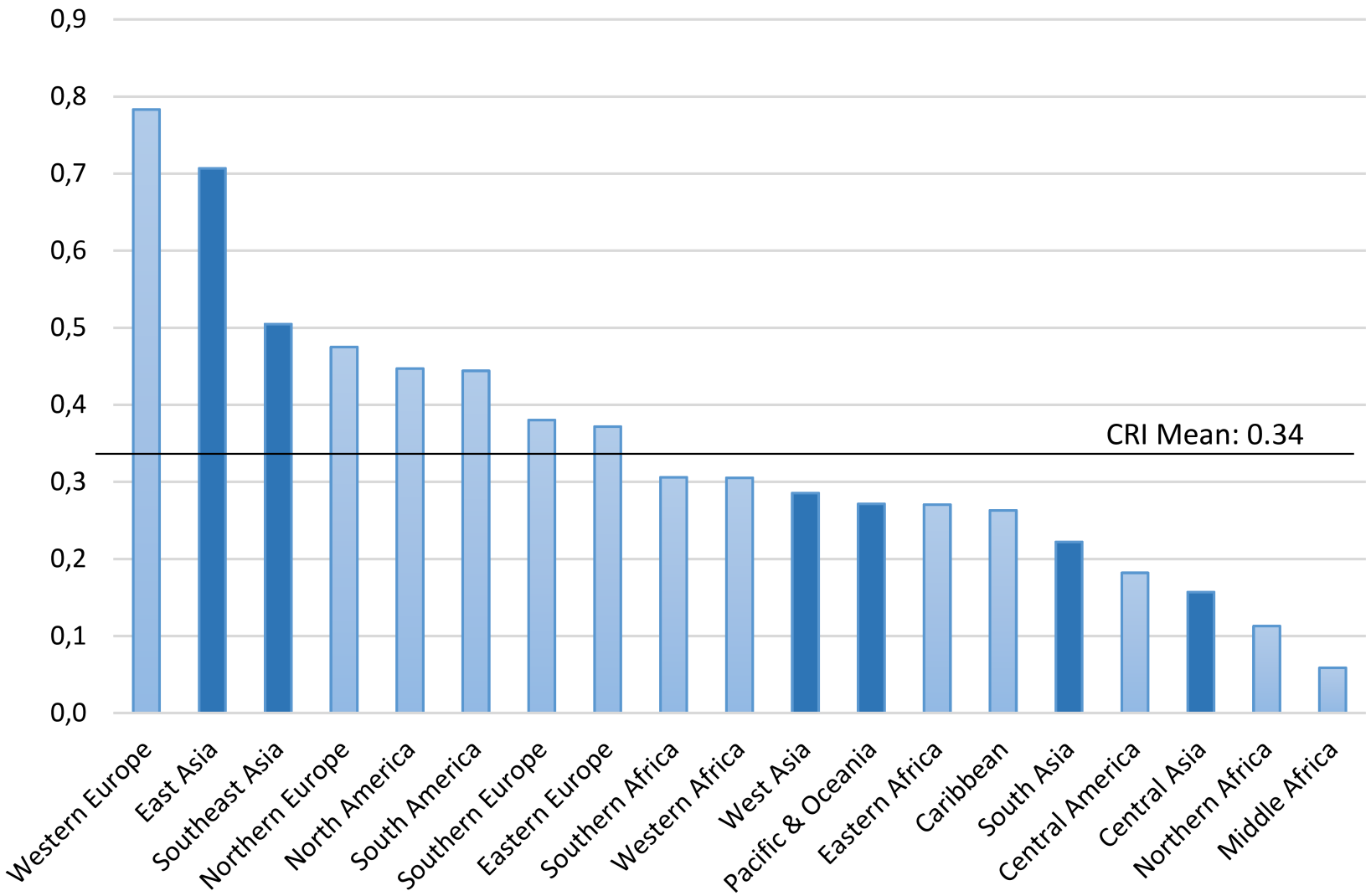
Composite Regional Integration Index



DEA Input Variable

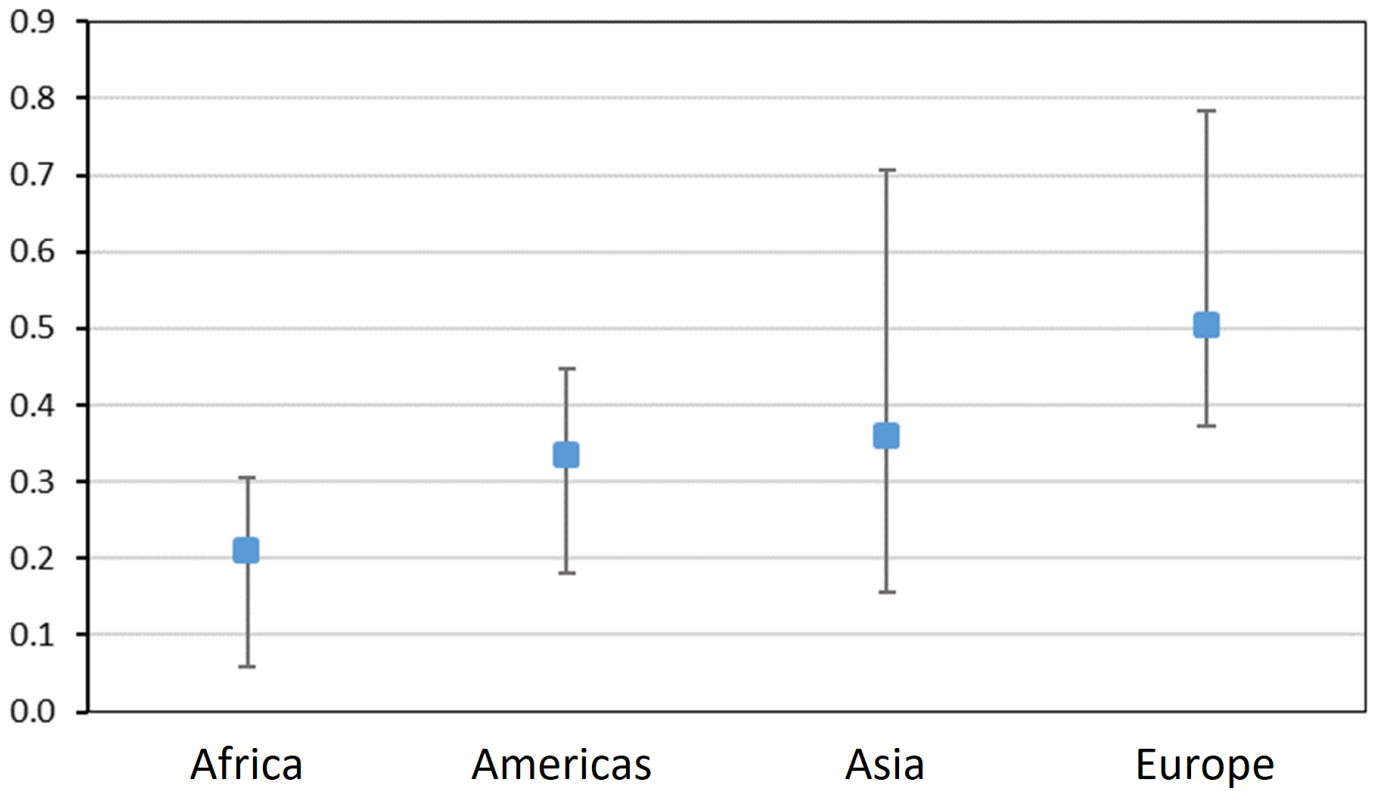
- Proxy of the enabling environment
  1. Trade openness: *percentage of country pairs with trade agreement*
  2. Cross-border infrastructure: *subregional mean of the World Bank's Logistics Performance Index*
  3. Business regulation environment: *subregional mean of the Doing Business Index*
- Three drivers of regional integration identified in the literature
  1. Institution-led processes
  2. Market-led processes
  3. Private sector-led processes
- Other potential factors
  - Geographical features (distance, natural characteristics), cultural background (common language), etc.
  - Here: focus on factors that are more directly controllable by governments and international policymakers.

CRI Index: Global Comparison

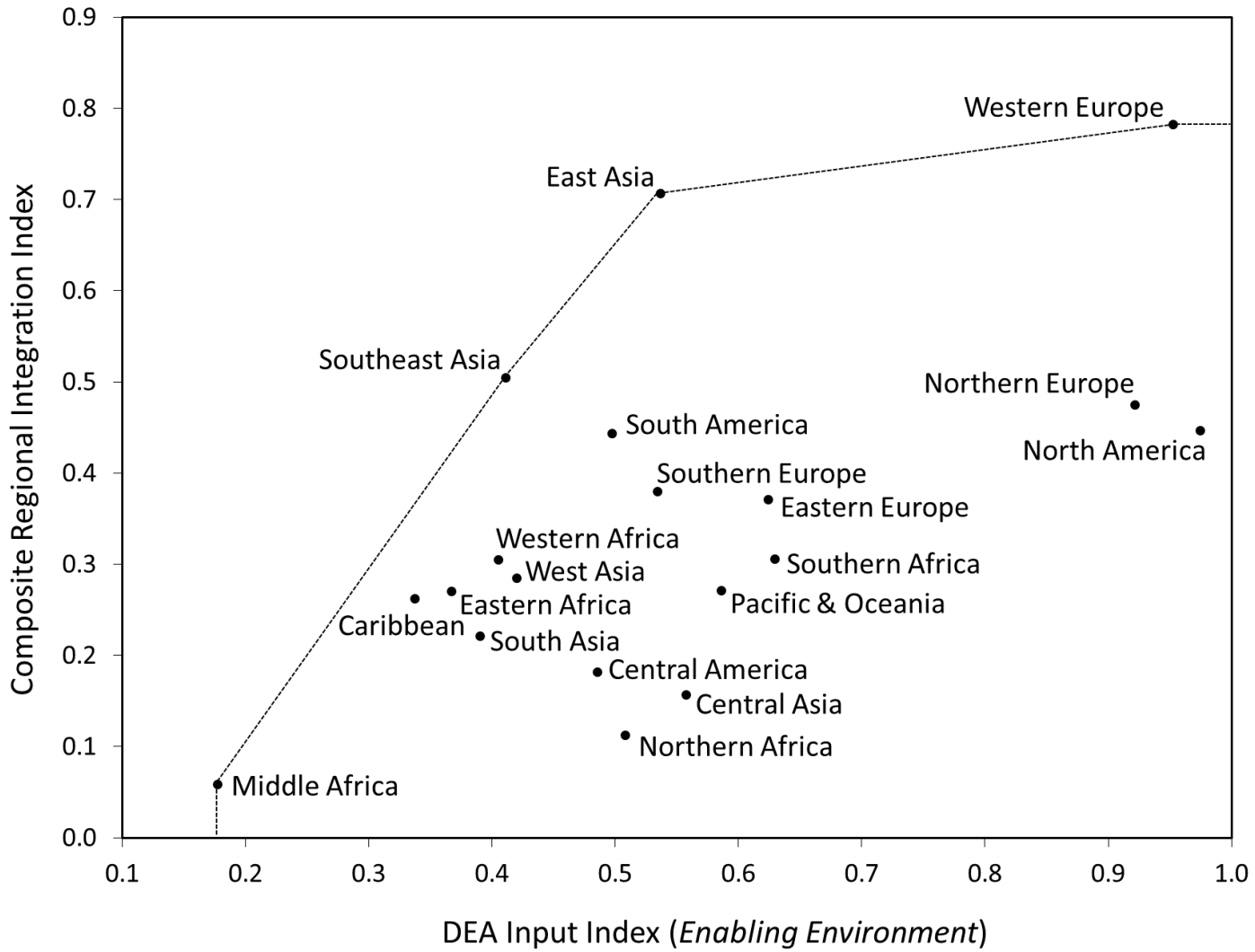


Subregions Disaggregated results

CRI Index: Ranges for Geographical Regions



DEA: Regional Integration Frontier



DEA: Untapped Integration Potential

Subregion	DEA Score	Rank	CRI Index	Input Index
Western Europe	1.00	1	0.78	0.95
East Asia	1.00	1	0.71	0.54
Southeast Asia	1.00	1	0.50	0.41
Northern Europe	0.61	6	0.47	0.92
North America	0.57	7	0.45	0.97
South America	0.69	3	0.44	0.50
Southern Europe	0.54	9	0.38	0.53
Eastern Europe	0.51	10	0.37	0.62
Southern Africa	0.42	12	0.31	0.63
Western Africa	0.62	5	0.31	0.41
West Asia	0.55	8	0.29	0.42
Pacific & Oceania	0.38	13	0.27	0.59
Eastern Africa	0.64	4	0.27	0.37
Caribbean	0.72	2	0.26	0.34
South Asia	0.48	11	0.22	0.39
Central America	0.29	14	0.18	0.49
Central Asia	0.22	15	0.16	0.56
Northern Africa	0.17	16	0.11	0.51
Middle Africa	1.00	1	0.06	0.18
Regional Averages:				
Africa	0.57		0.21	0.42
Americas	0.57		0.33	0.57
Asia	0.60		0.36	0.48
Europe	0.67		0.50	0.76
Global Average	0.60		0.34	0.54

Robustness

- Main results are robust to moderate changes in the used aggregation methodology.
- Different weighting schemes:
  - Double weights for any single dimension.
  - Weights based on principal component analysis (PCA).
- Handling of missing values:
  - Missings imputed based on past values and alternative data sources.
  - Results not driven by dimension with lowest data coverage (dropping dimension V).

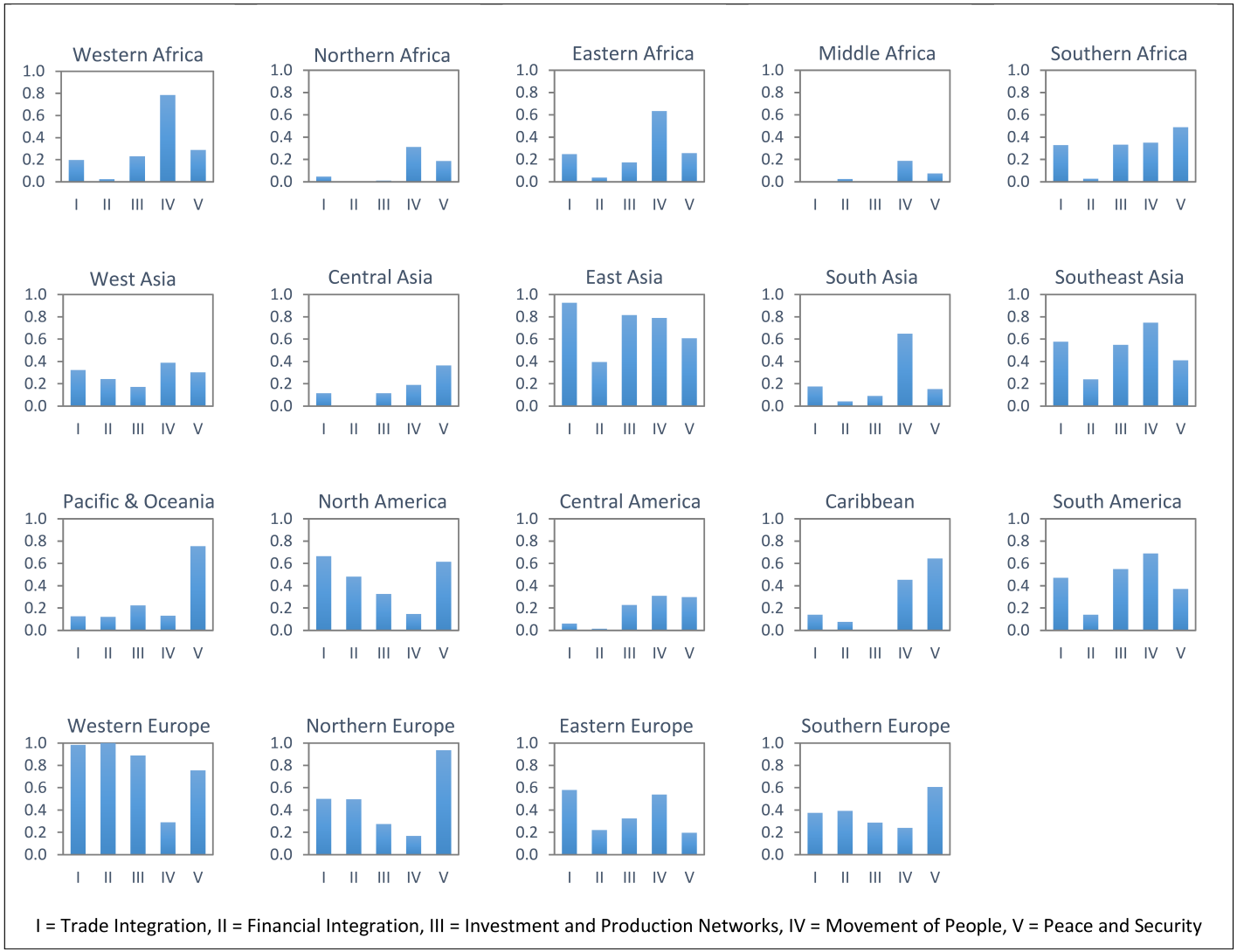
Limitations

- Non-parametric design
  - Based on currently available resources and conditions (no forecasting)
  - No assessment of the tradeoff between regional vs. global integration.
  - No direct implications for welfare and growth effects (see Baldwin and Venables 1995; Sapir 2011).
- General shortcomings of 'mash-up indices' (Stiglitz et al. 2009, Ravallion 2010)
  - Report disaggregated results for individual dimensions.
  - Verify robustness to different weighting schemes.
- Sensitivity to underlying classification of subregions (UN 2017)
  - Geographical subregions provide complete set of country groupings: each country is mapped to exactly one subregion (unlike RECs).
  - But not always fully in line with political objectives.
  - **Ongoing research**: identify 'regional integration clusters' endogenously as data-driven classification.

Conclusion

- New method to quantify untapped regional integration potential
  - Combine composite index with non-parametric frontier analysis.
  - Account for differences in enabling factors across subregions.
  - Not specific to design of our CRI Index: can be applied to any quantitative measure of regional integration.
- Main empirical findings
  - Globally, subregional integration levels are at 60% of the estimated potential (based on current conditions).
  - Subregions with large untapped integration potential are spread across all geographical parts of the world.
  - For most subregions, East Asia and SE Asia are better benchmarks than Western Europe (high integration despite similar conditions).
- More insights from disaggregated results
  - Identify the largest obstacles to integration faced by each subregion.
  - Inform interventions aimed at fostering higher integration.

CRI Index: Dissagregated by Subregion



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Subregional Groupings (1/2)

Africa (52)

- Eastern Africa (17): Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Malawi, Mozambique, Rwanda, Seychelles, Somalia, South Sudan, Tanzania, Uganda, Zambia, Zimbabwe
- Middle Africa (8): Angola, Cameroon, Central African Republic, Chad, Dem. Rep. of the Congo, Congo, Equatorial Guinea, Gabon
- Northern Africa (6): Algeria, Egypt, Libya, Morocco, Sudan, Tunisia
- Southern Africa (5): Botswana, Lesotho, Namibia, South Africa, Swaziland
- Western Africa (16): Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, The Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo

Americas (37)

- Caribbean (15): Antigua and Barbuda, Aruba, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Puerto Rico, Saint Lucia, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Trinidad and Tobago
- Central America (8): Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama
- North America (2): Canada, United States
- South America (12): Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela

Subregional Groupings (2/2)

Asia (65)

- Central Asia (6): *Azerbaijan*, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan
- East Asia (8): China, China Hong Kong SAR, China Macau SAR, DPR Korea, Japan, Mongolia, South Korea, Taiwan
- South Asia (9): Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, Sri Lanka
- Pacific and Oceania (15): Australia, Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia, Nauru, New Zealand, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu
- Southeast Asia (11): Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, Vietnam
- West Asia (16): Armenia, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Turkey, UAE, Yemen

Europe (39)

- Eastern Europe (10): Belarus, Bulgaria, Czechia, Hungary, Moldova, Poland, Romania, Russia, Slovakia, Ukraine
- Northern Europe (10): Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Lithuania, Norway, Sweden, United Kingdom
- Southeastern Europe (12): Albania, Bosnia and Herzegovina, Croatia, Greece, Italy, Macedonia, Malta, Montenegro, Portugal, Serbia, Slovenia, Spain
- Western Europe (7): Austria, Belgium, France, Germany, Luxembourg, Netherlands, Switzerland