A Geopolitical Review of Definitions, Dimensions and Indicators of Energy Security

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[Energy is the] precondition of all commodities, a basic factor equal with air, water, and earth.

E. F. Schumacher, Nobel laureate economist (1911-1977)

It is even probable that the supremacy of nations may be determined by the possession of available petroleum and its products.

Calvin Coolidge, US President (1872-1933)

Without data, you're just another person with an opinion.

W. Edwards Deming (1900-1993)

Energy is an economic, ill-distributed and expensive good, subject to price fluctuations, with repercussions in many domains of life.

Energy security is paramount to human security, and has become an increasingly popular concept for policy makers, entrepreneurs and academics.

This presents a **review** of the energy security research literature from a geopolitical viewpoint, including:

- theoretical underpinnings
- definition
- conceptual dimensions
- selecting indicators and developing indexes.

Let's start by seeing how and when energy security became an issue.

In 1979, **oil** shared as much as **86%** of the world energy trade, and the **Middle East** supplied **58%** of the internationally traded oil.

In the **first oil crisis** of 1973, oil embargoes by the Organization of Arab Petroleum Countries (OAPEC) shook the oil-importing countries to the core; the **second oil crisis** shot up international oil prices above $30 per barrel (over $100/barrel in current values.)

How did the **international community** respond?

As a response, the **International Energy Agency** (IEA) was created in **1974** by the countries of the Organization for Economic Co-operation and Development (**OECD**), to promote energy security among its member countries, through collective response to **physical disruptions** of energy.

So you get that energy security back then meant continuous physical availability.

OK, but how may we define energy security now?

It’s not easy.

Energy security means different things to different **countries**, based on:

- geographical location
- natural resource endowment
- status of international relations
- political system
- economic disposition
- ideological views and perceptions of the world.

Approaches to energy security differ between countries also because of historical experiences, e.g.

- degree of reliance on Russian gas related to relationships during the **Cold War**.

According to the dominant strand of the **International Relations** (IR) theory in the study of security, energy resources are an intrinsic interest regarding the survival of states, ensuring *"**military** might, **economic** development and **social** stability".*

Energy security can be an instrument of state foreign policy (energy statecraft) by using energy resources to pursue foreign policy objective, so as to preserve *"energy **infrastructure**, resource **availability**, and stability of energy **demand**".*

I am complicating things, right?

Let me try to make IR theorists out of you in one slide.

There are distinct focal points of the international system:

- **Realism** focuses on the political-strategic aspect
- **Liberalism** focuses on economy and institutions
- **Constructivism** focuses on projection of power
- **Marxism** focuses on social aspects.

How to really fool others in parties with your knowledge of IR:

- **Realism** operates on **states**
- **Liberalism** operates on **individuals**
- **Constructivism** operates on **perceptions.**
- **Marxism** operates on **classes**.

I lied — I need a second slide to make you an IR expert.

Neoclassical realism is the sexiest approach to IR:

- focuses on the confrontational nature on IR ("**conflict**")
- which derives from the **anarchic** organizational principle of the international system
- international politics is all about the distribution of (relative) **power**.

All IR theoretical approaches relate energy security with interstate conflict and cooperation

- in **Game Theory**, we call this **co-opetition**.

What you start doing politics on a map, you get **geopolitics**!

And this is where I come in.

Are you confident enough as a budding IR theorist now?

Remember the movie scene with **John Nash** and his friends at the bar, when he was analyzing their optimal strategy to the blonde and her friends?

It was mentioned at this conference yesterday!

Well, the movie scene was all Hollywood and all wrong.

It was a **Prisoner's Dilemma**.

Enough flirting, let's get back to energy security.


RINCETON
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Energy security is a concept that is

- "***polysemic***"
- "***slippery***"
- multi-dimensional.

According to a seminal researcher, there are at least **45 different definitions of energy security** that share a great deal of similarity among them.

Another eminent paper identified **83 energy security definitions** in the literature.

Taking into consideration the absence of a clear definition, energy security has become an umbrella term for many different policy goals.

My favorite definition of energy security in this age of sustainability is the "***four As***" of:

- **Availability** (if not, what are we talking about?)
- **Affordability** (has to be cheap)
- **Accessibility** (to all, including the fuel poor)
- **Acceptability** (from an environmental standpoint).

The first two As (availability and affordability) constitute the classic approach to energy security (20th Century)

The latter two (accessibility and acceptability) reflect contemporary concerns relating to fuel poverty and global climate change (I MARK MYSELF AS A SKEPTIC).

Energy security encompasses a number of **dimensions**.

An eminent researcher listed seven salient energy security dimensions:

- environment
- technology
- demand management
- socio-cultural and political factors
- human security
- international elements like geopolitics
- formulation of energy security policy.

The same researcher made reference to **44 attributes** of energy security.

Another eminent group of researchers considered energy security to comprise five dimensions (and 20 components):

- **availability**, i.e. security of supply and production, dependency, and diversification
- **affordability**, i.e. low prices, price stability, access and equity, decentralization
- **technology development**, i.e. innovation and research, safety and reliability, resilience, energy efficiency, and investment
- **sustainability** (environmental component), i.e. land use, water, climate change, and air pollution
- **regulation**, i.e. governance, trade, competition, and knowledge of sound regulation.

This patient (that's an understatement) group of researcchers assembled **320 simple indicators** and **52 complex indexes** of energy security.

Some researchers argue that it is not possible to develop a unique methodology of assessing energy security because of resources that differ in:

- the type and intensity at different points of development
- climate
- geopolitical position
- demographic indicators
- economic growth
- strategic priorities (which depend on historical, social and political social conditions.)

The literature is replete with **simple indicators** and **composite indexes** of energy security. But it is plagued by the problem of "***proto game theory***".

Various studies have proposed a wide variety of energy security indexes, either to compare performance among countries or to track changes in a country's performance over time.

Usually, there is **data collection**, **normalization**, **weighting**, and **aggregation** of the chosen indicators to give one or more composite energy security indexes.

This is where my presentation of our paper finishes.

Because I am a nice guy, I have some extra slides for you.

Indicators used for constructing of Geo-economic Index of Energy Security.

Indicator	Source
Energy Intensity	Eurostat, database
Energy Dependence	Eurostat, database
Gross Domestic Product per capita	Eurostat, database
Final Energy Consumption per capita	Eurostat, database
Carbon Intensity	Eurostat, database
Electricity Prices	Eurostat, database
Electricity Consumption per capita	Eurostat, database
Production of energy from renewable sources	Eurostat, database
Sovereign Credit Rating	*Fitch Ratings* - Report

$$ESI = EI \times 20 + FEC \times 20 - ED \times 20 + GDPpc \times 10 - CI \times 10 + SRN \times 20$$

where:

EI – Energy Intensity
FEC – Final Energy Consumption
ED – Energy Dependency
GDP/pc – Gross Domestic Product per capita
CI – Carbon Intensity
SRN – Share of Renewable and Nuclear Energy

Coefficients (weights) are determined by

Principal Component Analysis

Specific energy security indexes have been developed.

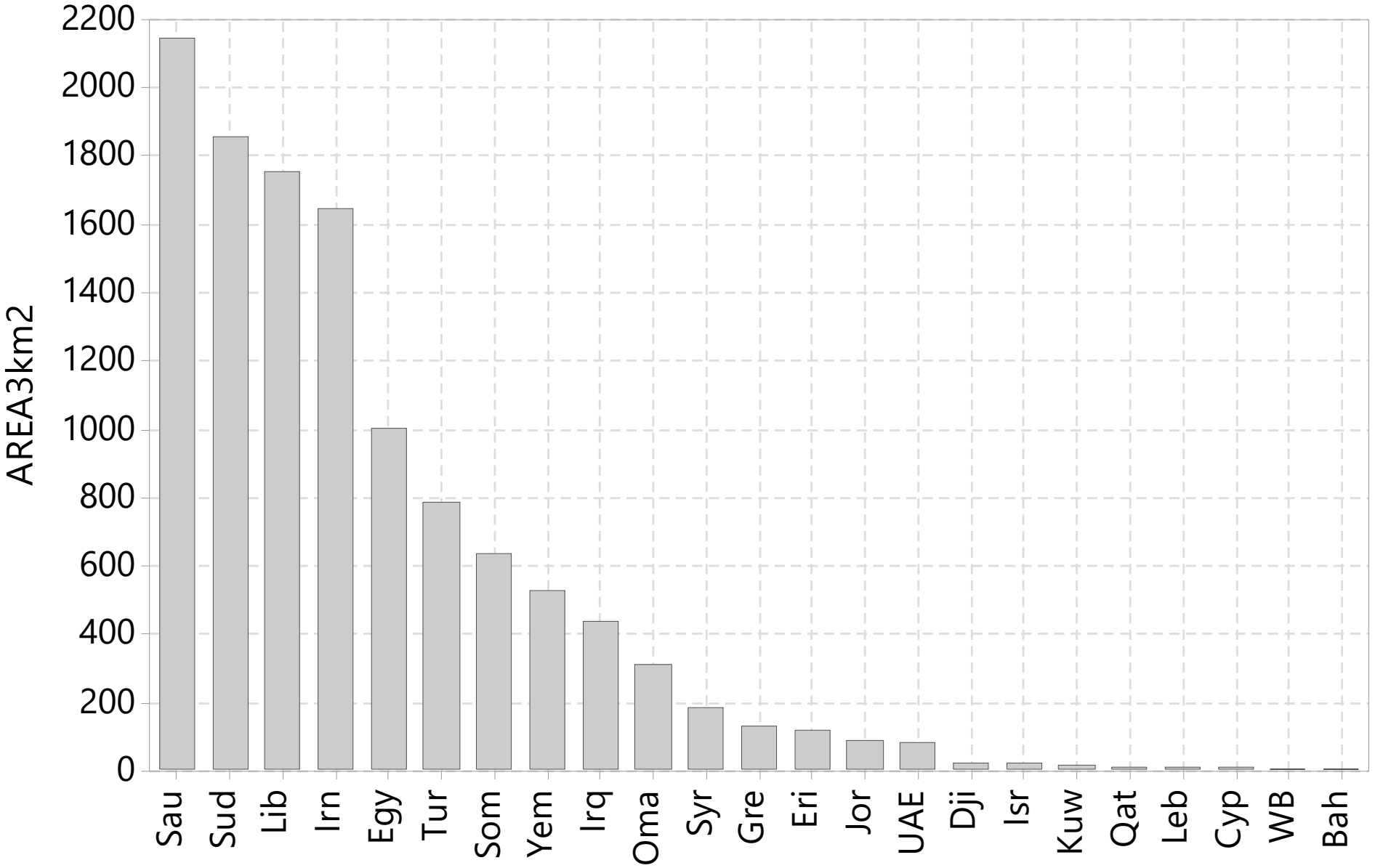
As an example, the **Energy Architecture Performance Index** (EAPI) was proposed in 2010 by the World Energy Forum (WEF).

EAPI is a composite index based on a set of indicators divided into three basic categories

- energy **security**
- energy **equity**
- environmental **sustainability**

the so-called Energy Trilemma.

Now some examples from countries of the **Southeast Mediterranean** and the **Middle East**.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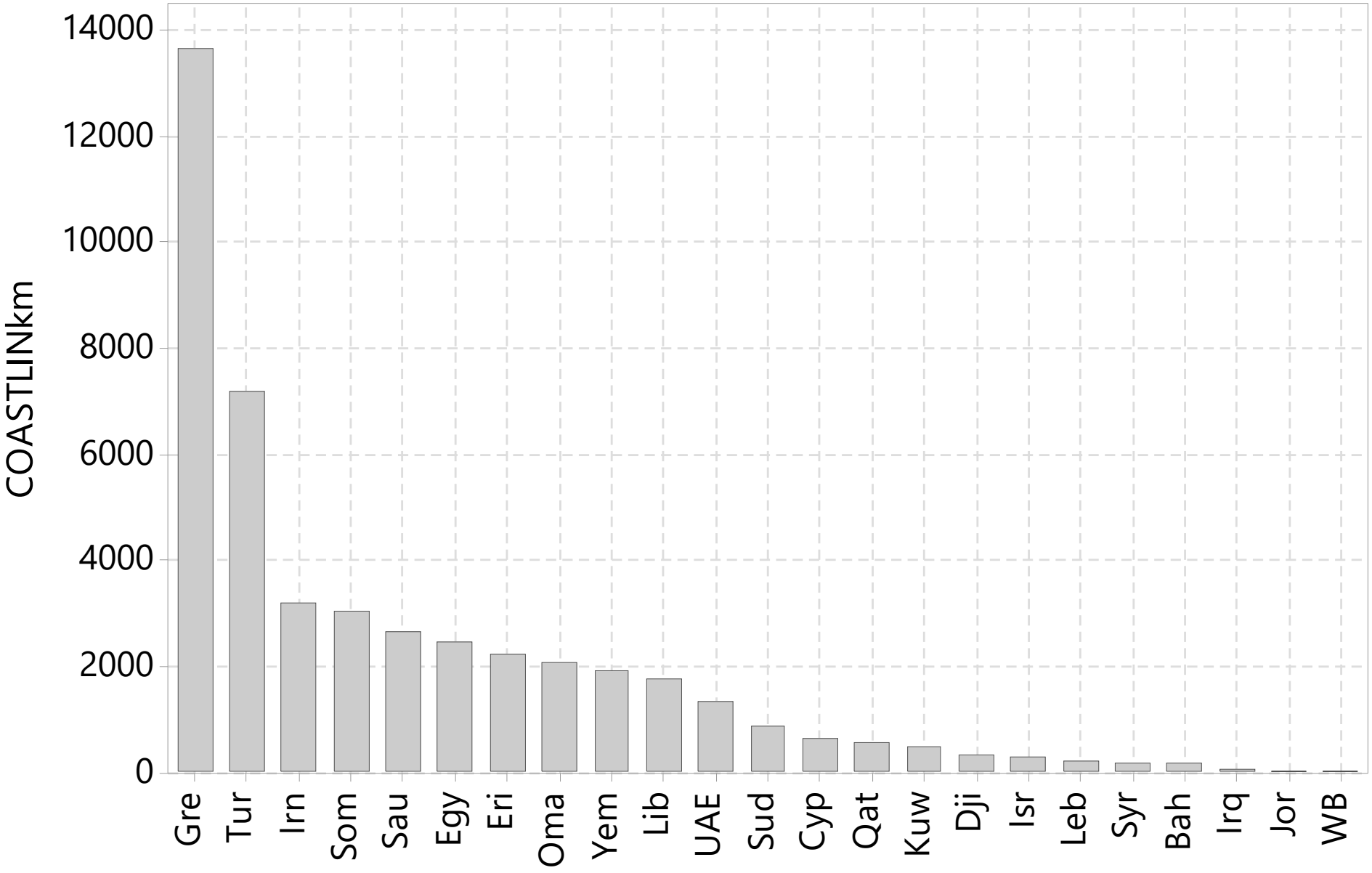
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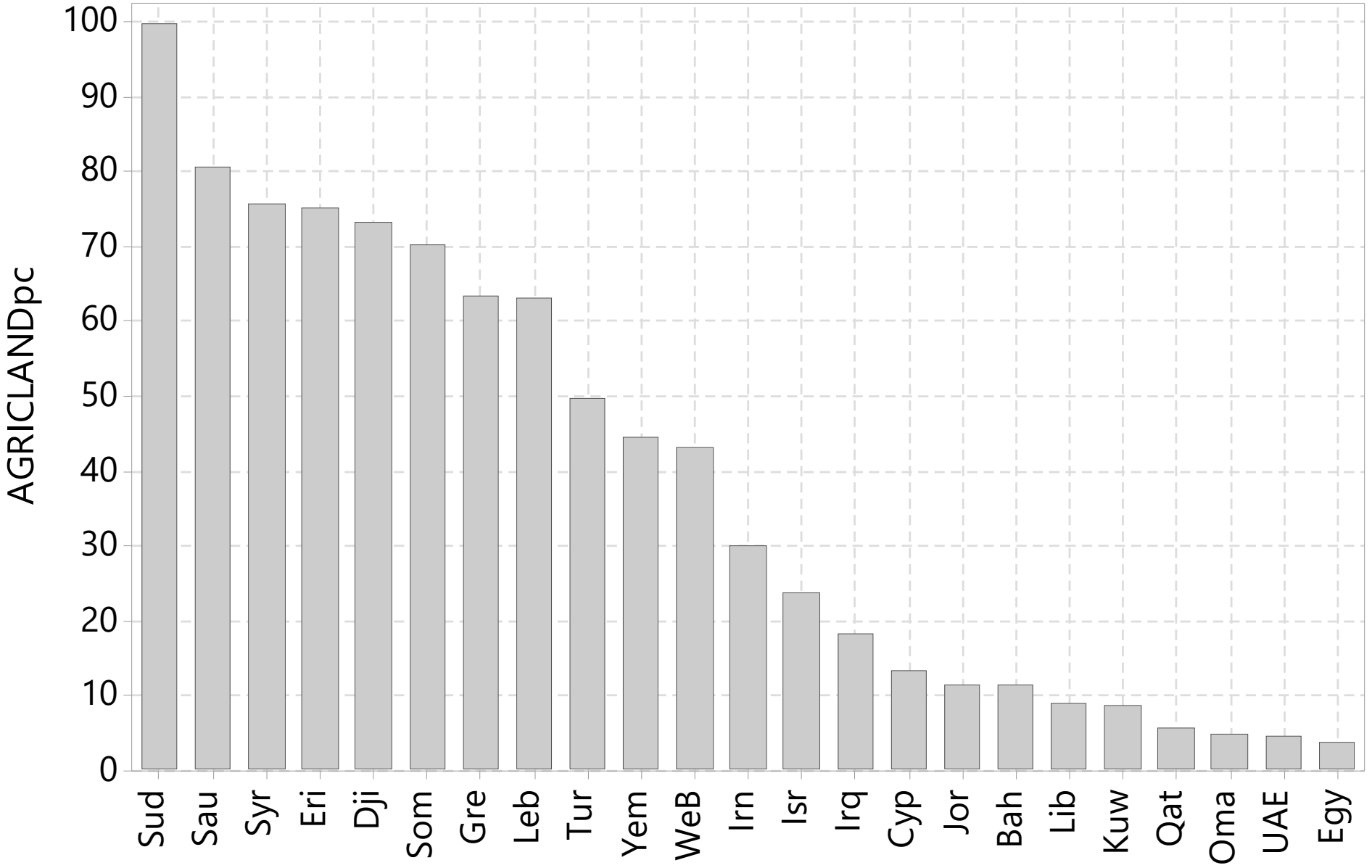
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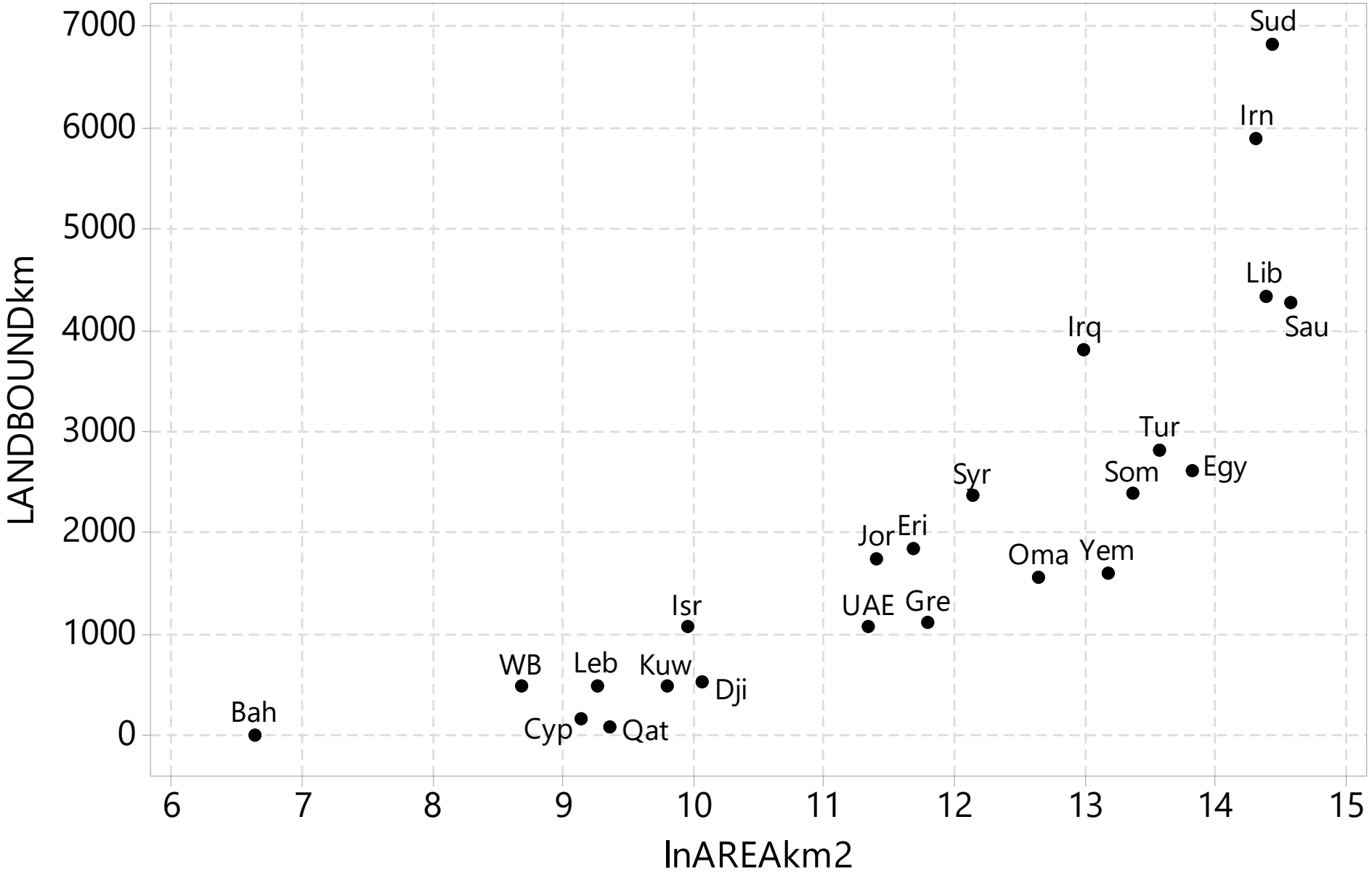
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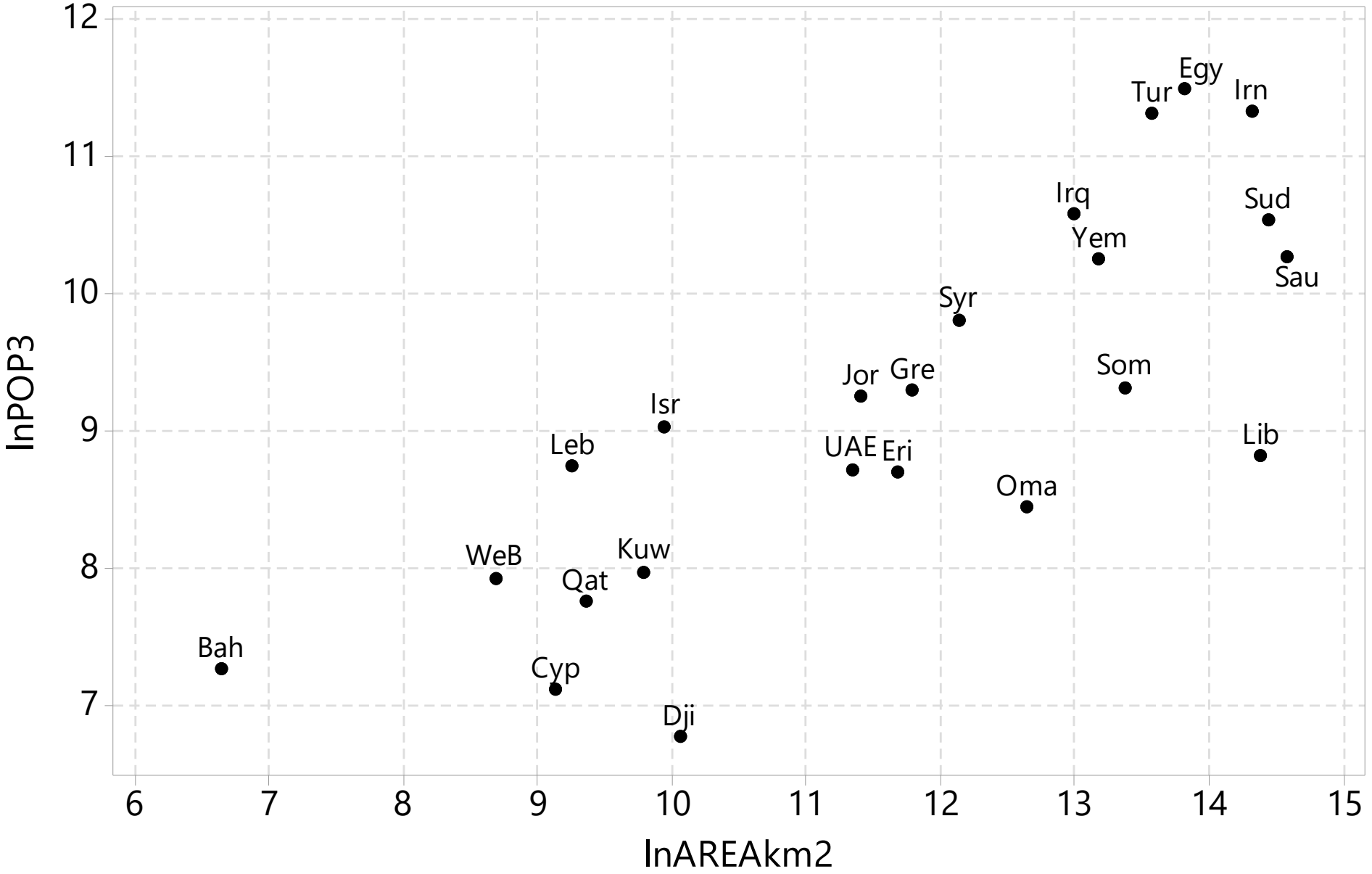
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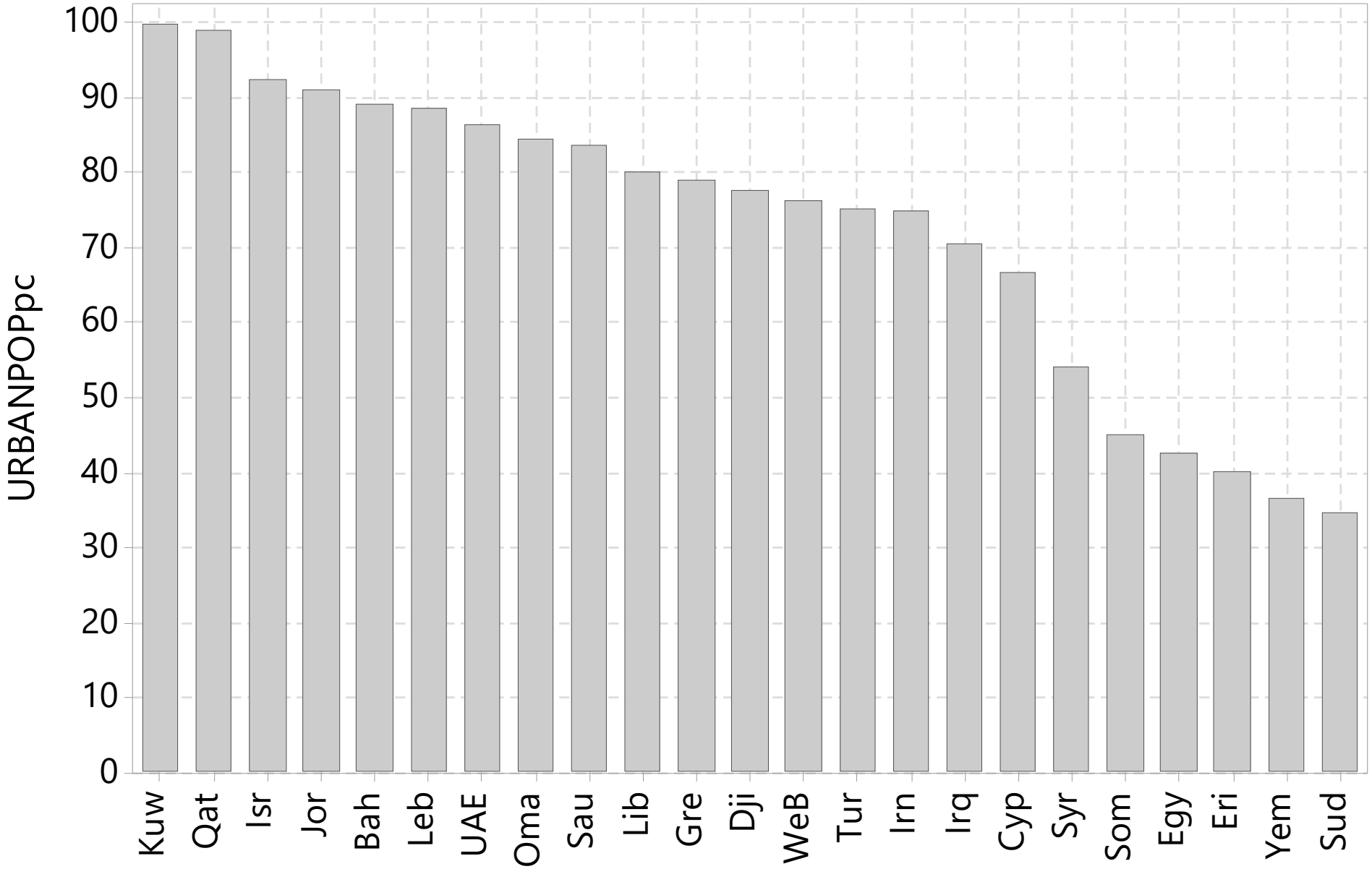
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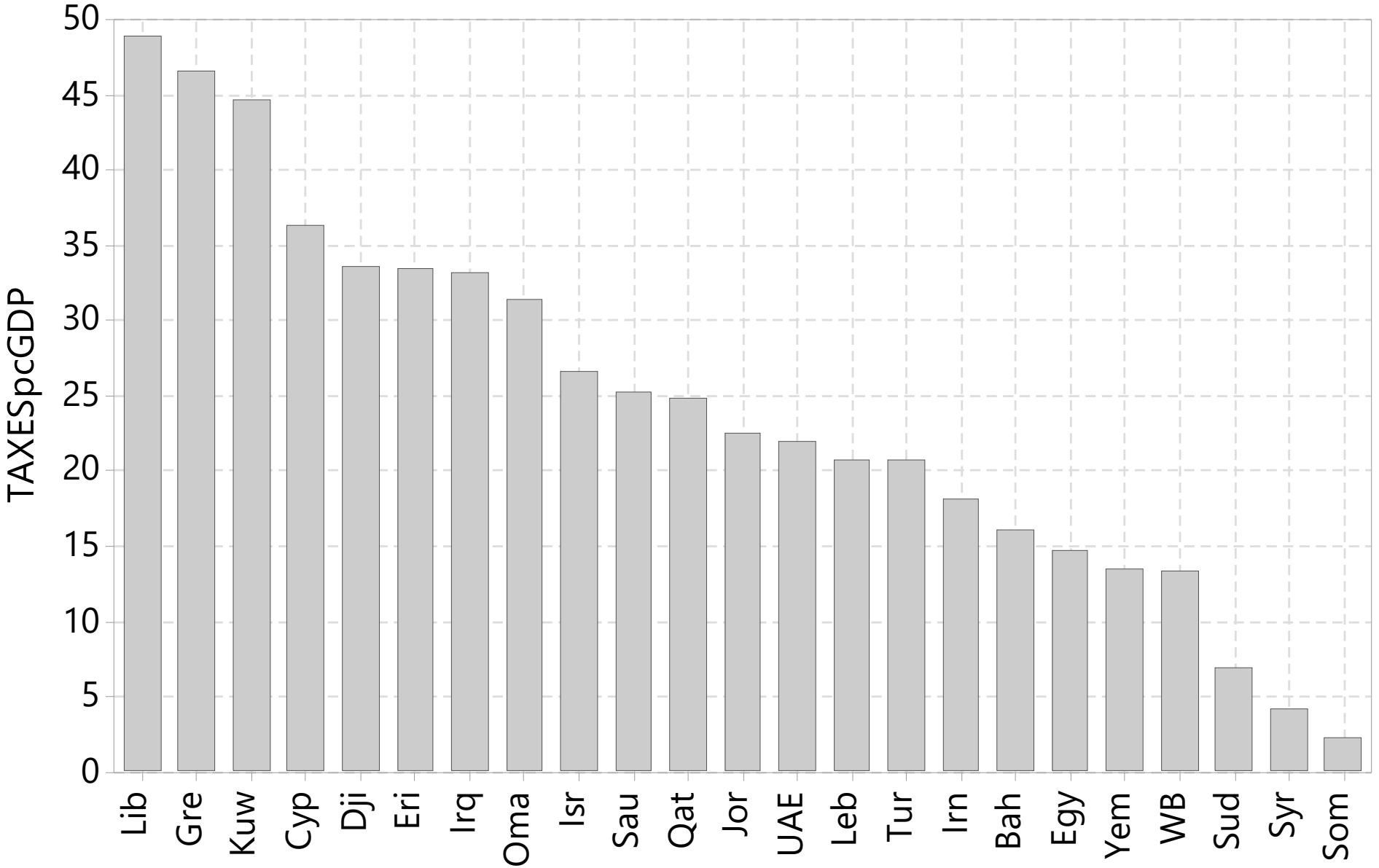
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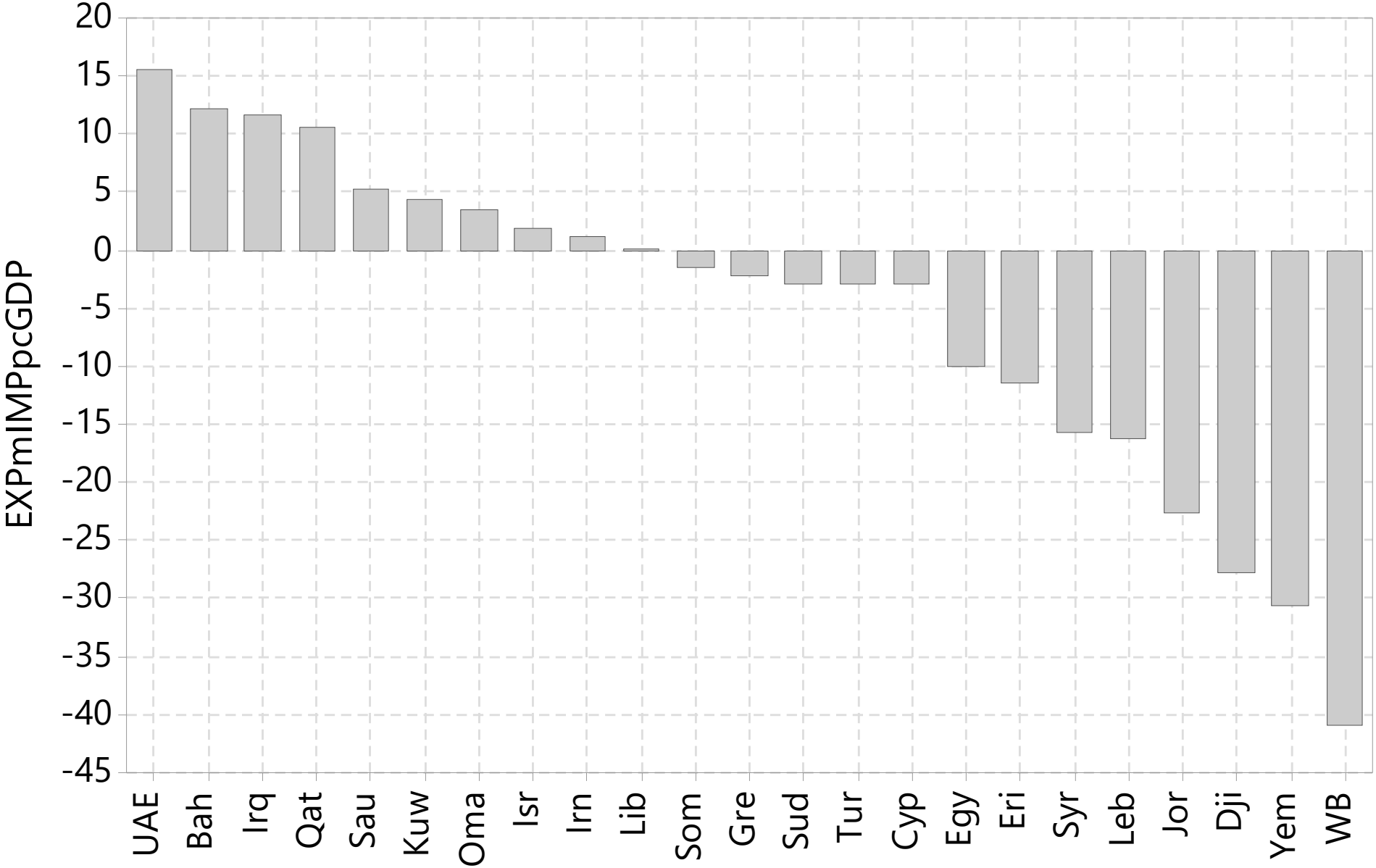
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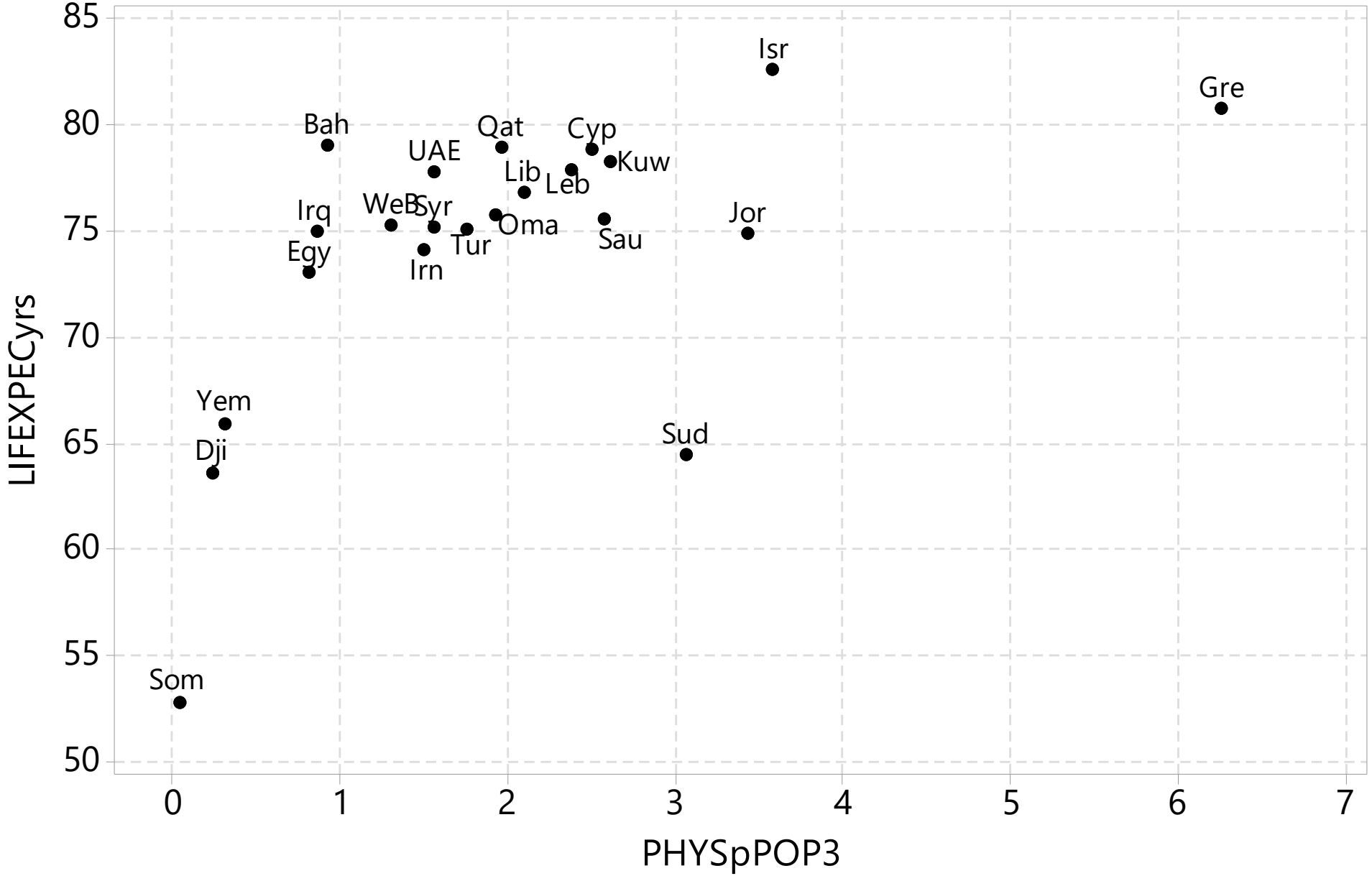
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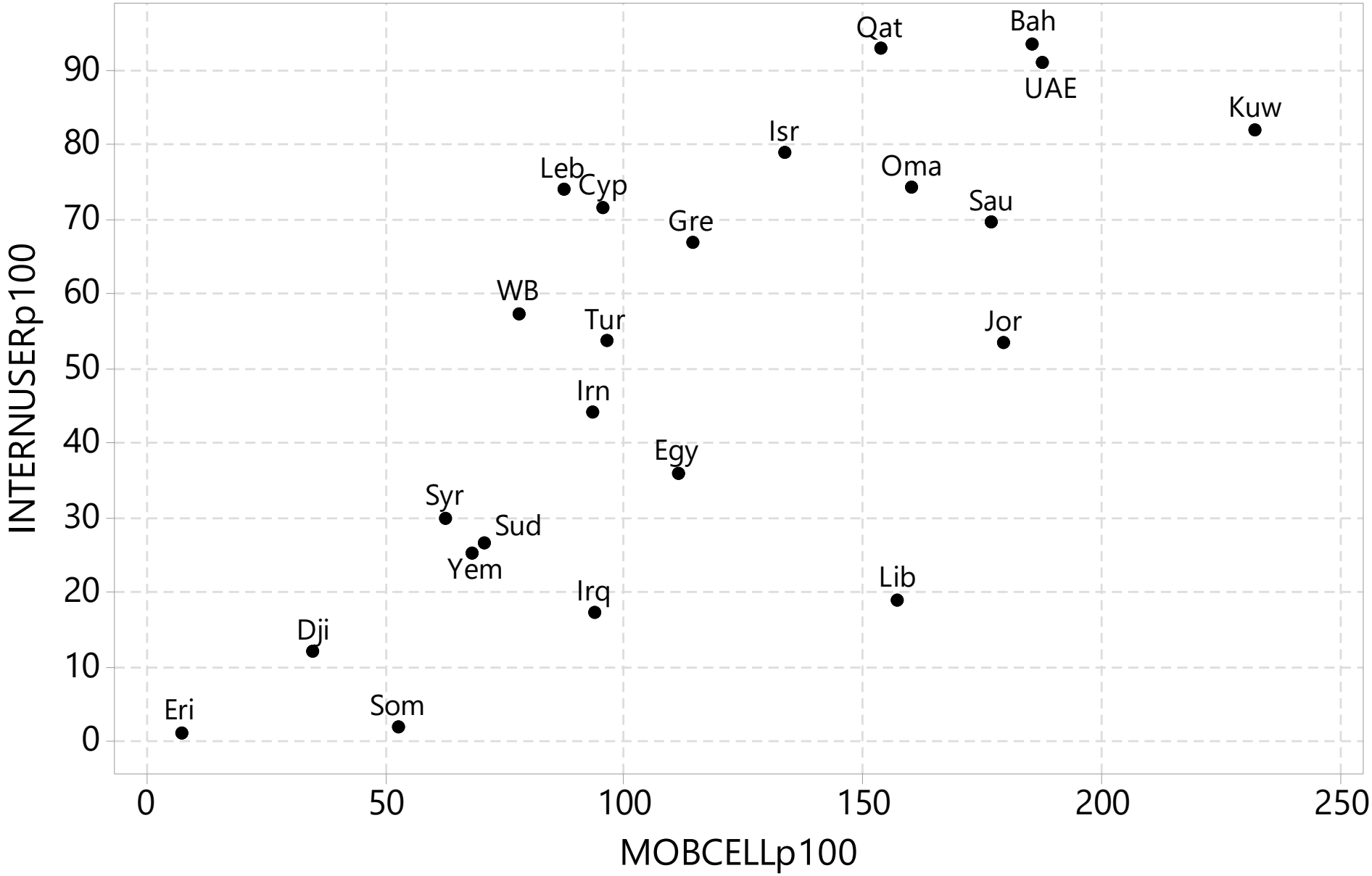
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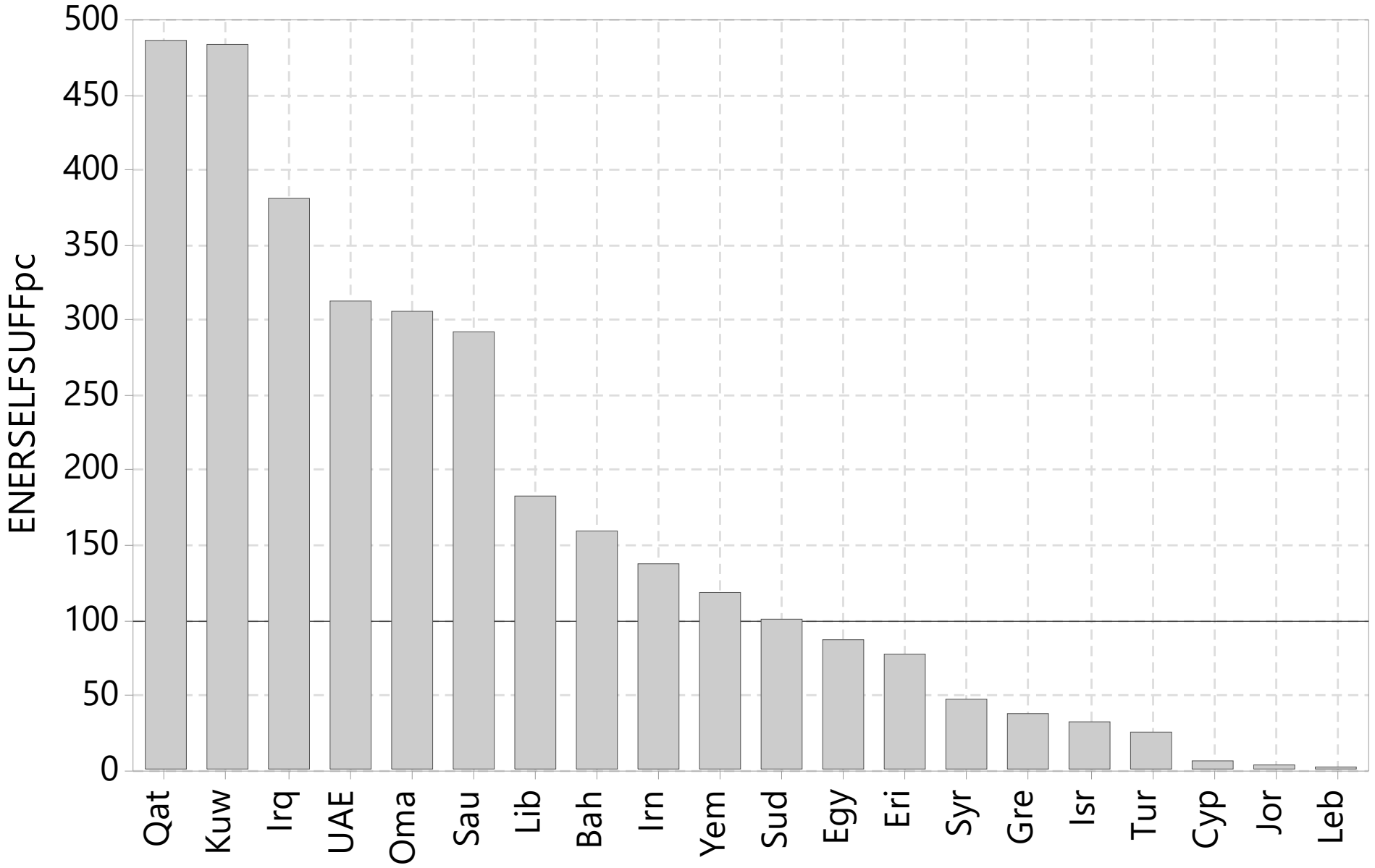
Type of government in countries of the Southeast Mediterranean and the Middle East

Type of government	*Number of countries*	*Average years independent*
Absolute monarchy	3	168
Parliamentary republic	3	120.3
Presidential republic	3	62
Federal parliamentary republic	2	73
In transition	2	48.5
Constitutional monarchy	1	48
Constitutional monarchy (emirate)	1	58
Federation of monarchies	1	48
Parliamentary constitutional monarchy	1	73

Type of government	*Number of countries*	*Average years independent*
Parliamentary democracy	1	71
Presidential republic (highly authoritarian)	1	73
Semi-presidential republic	1	42
Theocratic republic	1	40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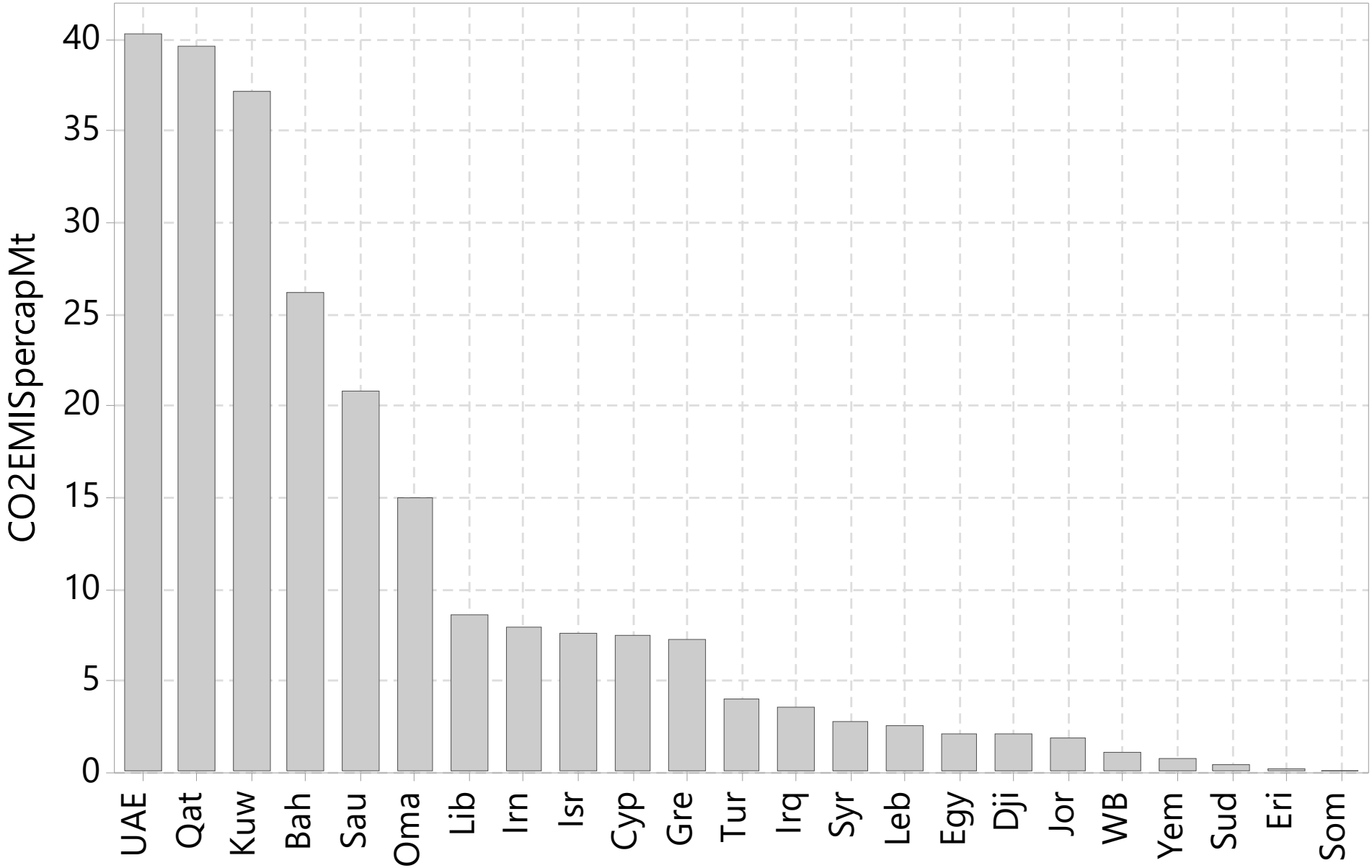
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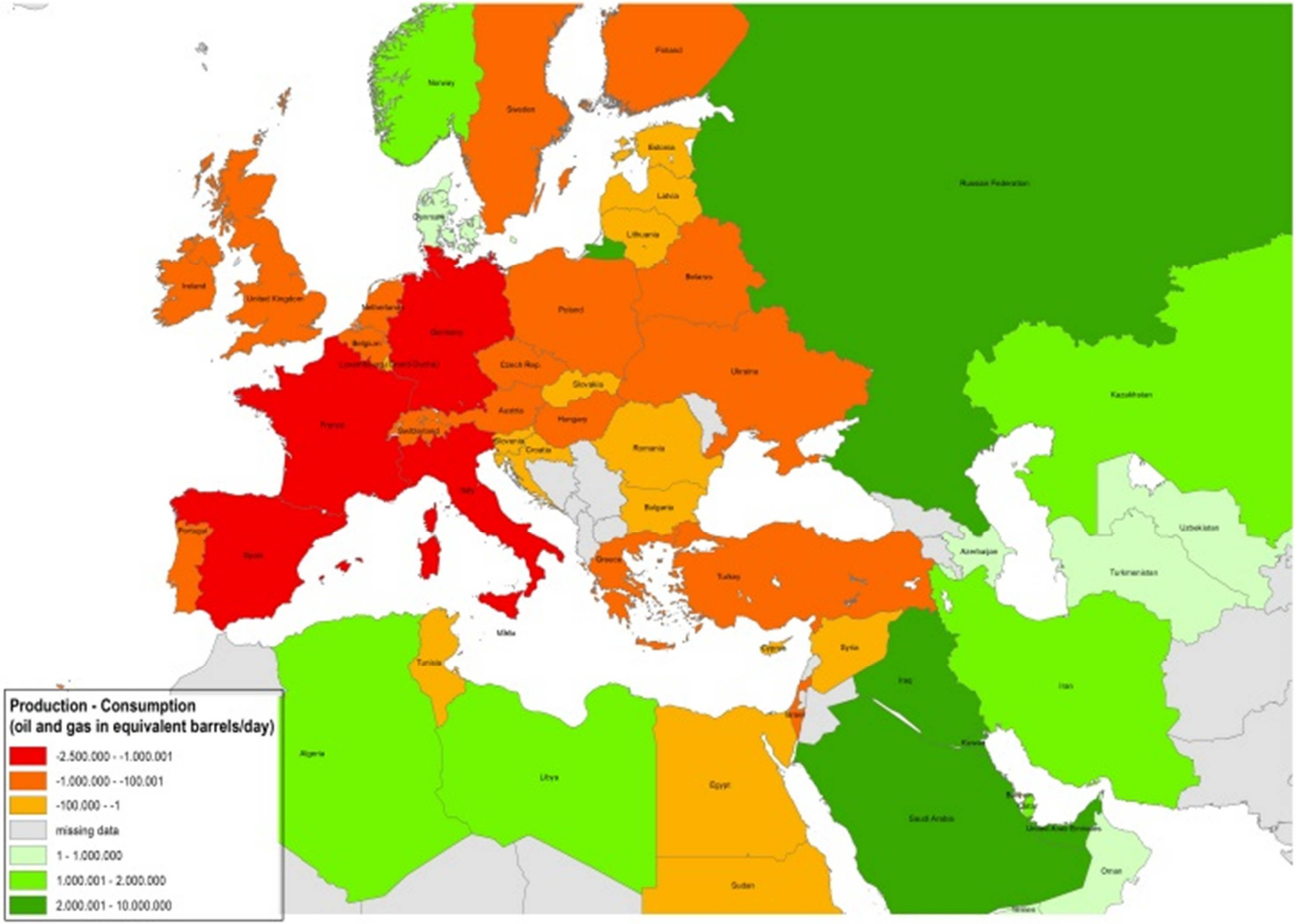
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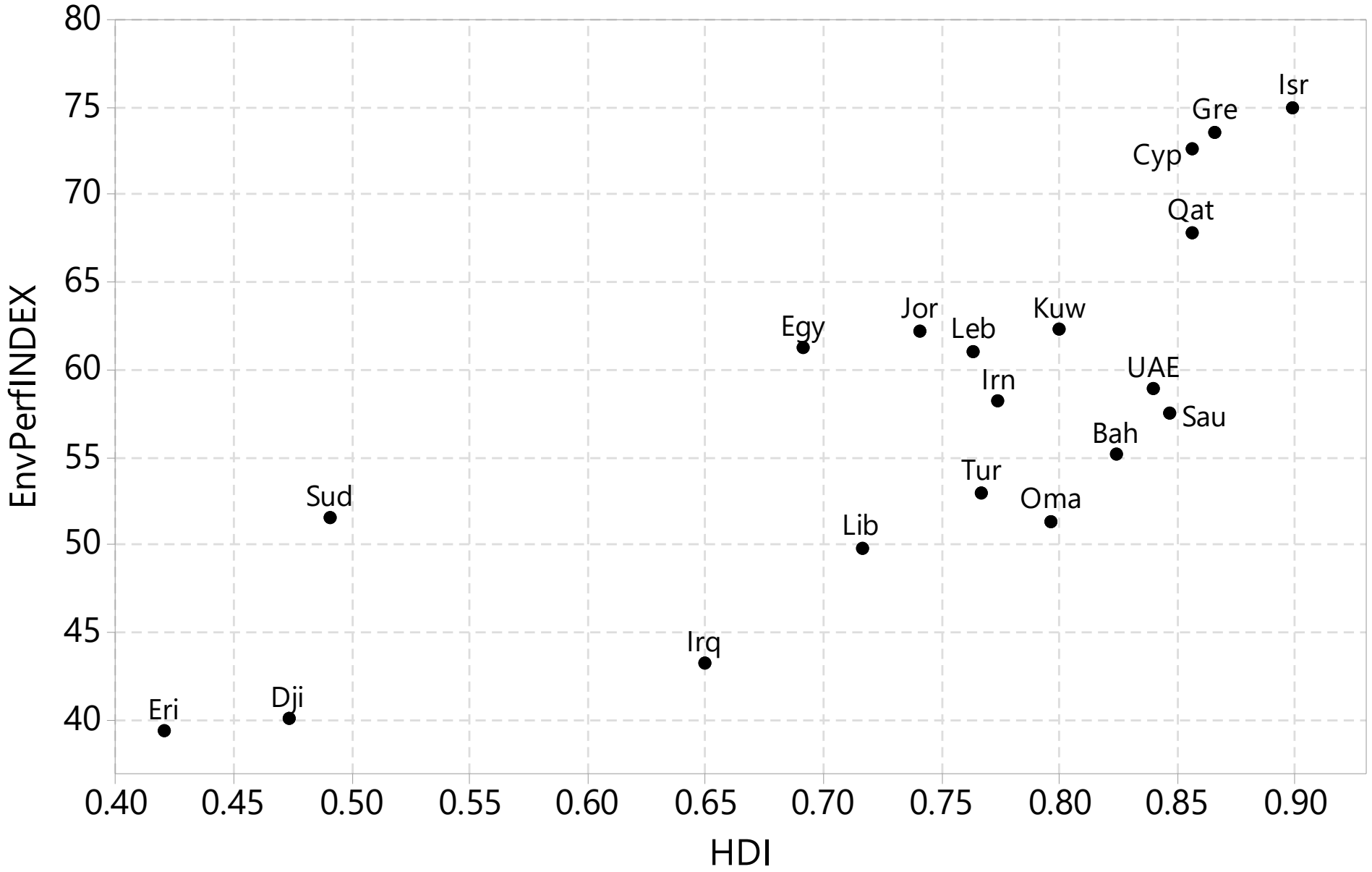
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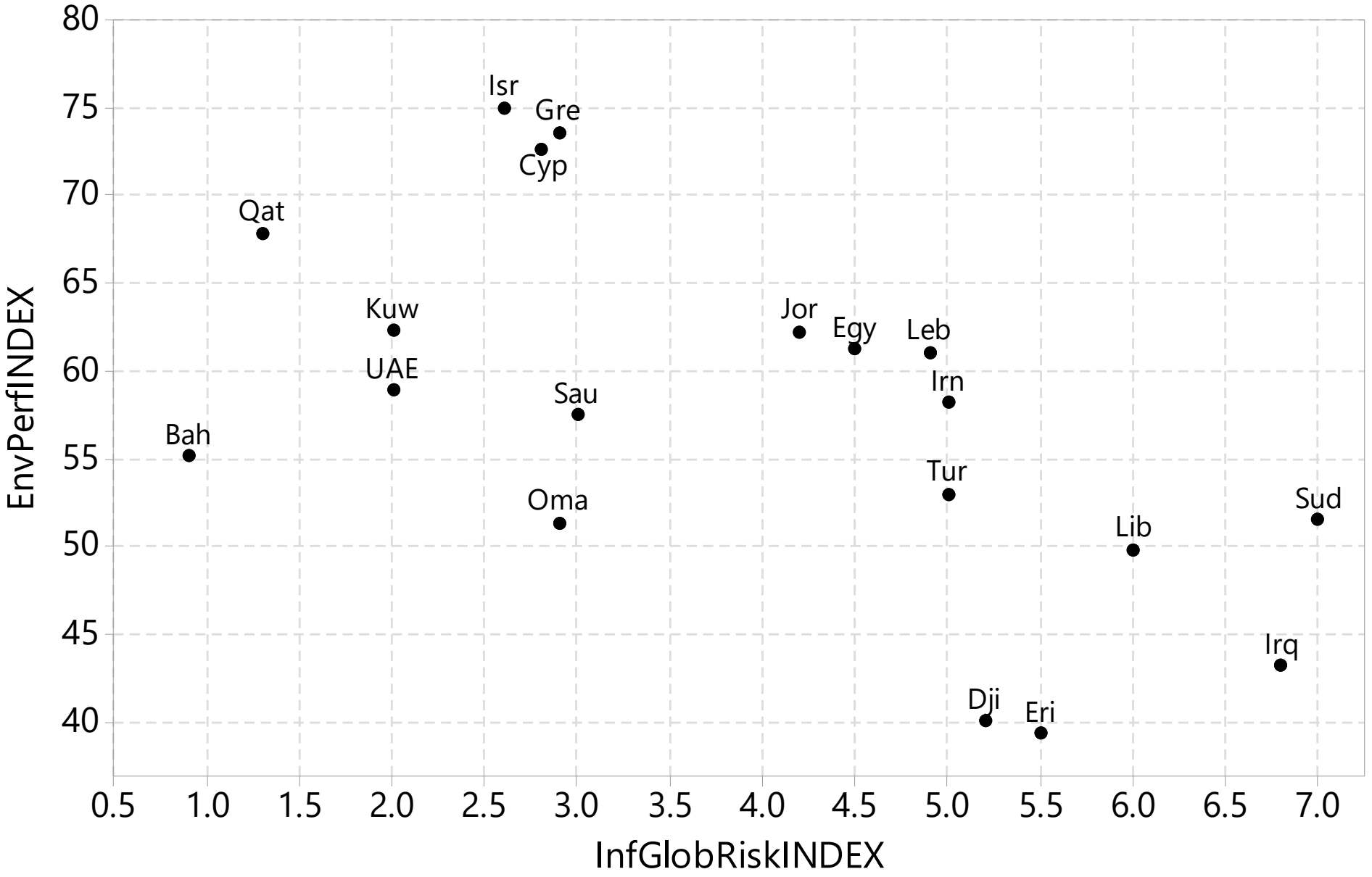
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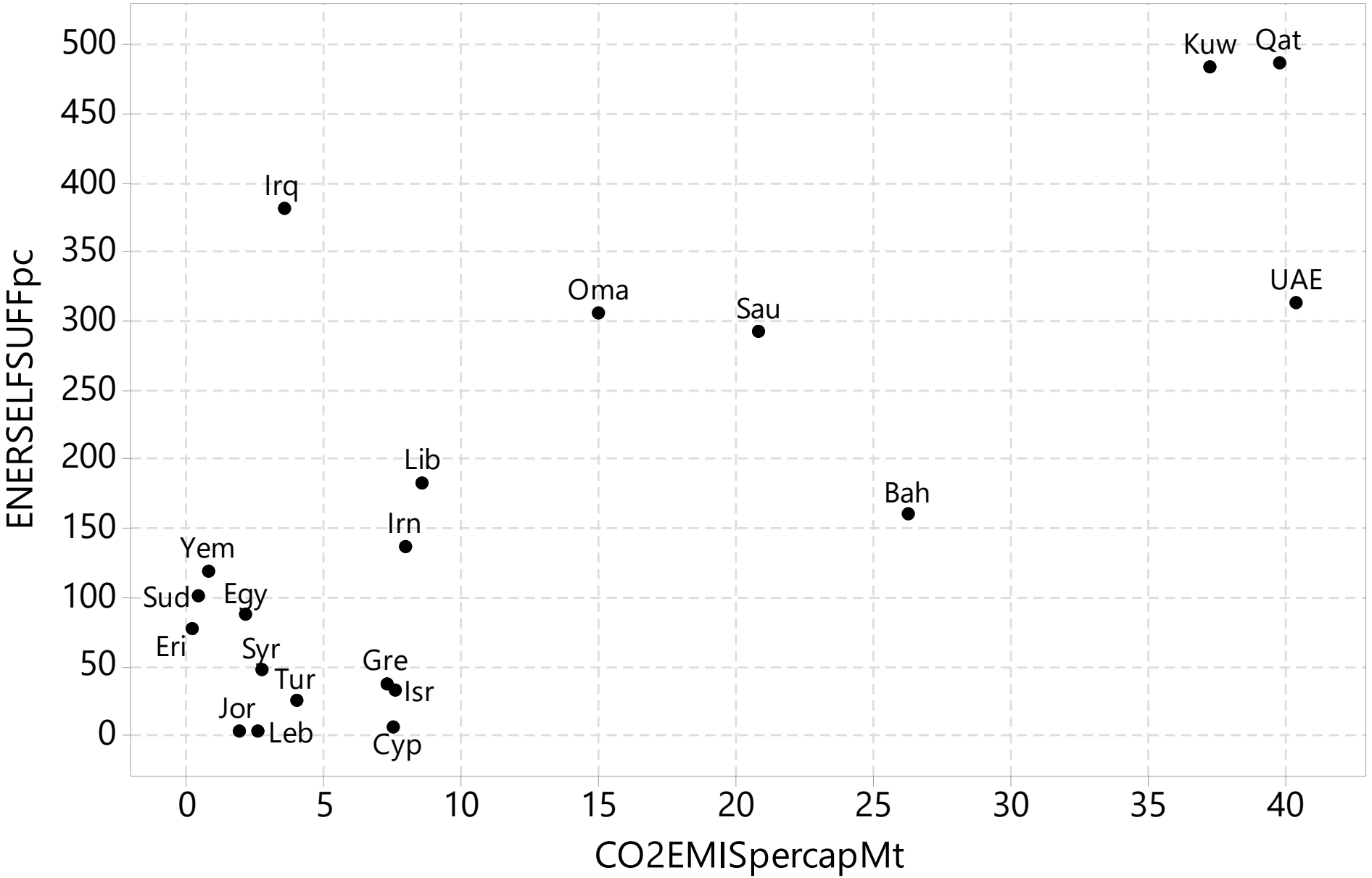
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All things must pass

George Harrison (of the Beatles)