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## Temporal fluctuation scaling and thermostatistical study of the per capita gross domestic products of 105 countries of the world during the period 1960-2023

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We perform an econophysics study of the gross domestic product per capita (GDPP) data from  $N = 105$  countries worldwide, which have annual records in the World Bank database for every year between 1960 and 2023.

Starting from the time series of annual values of the average GDPP per country and the variance of the GDPP for the period 1960-2023, we find that the variance presents a power law relationship with respect to the average, that is, the existence of the scaling of the temporal fluctuation in this economic system is verified. Subsequently, after verifying that there is also scaling of the time fluctuation for 15-year observation windows, we studied the annual evolution of the values of the proportionality constant and the exponent of the scaling of the time fluctuation during the period 1974-2023, observing the existence of anticorrelated cycles for these two quantities.

Finally, defining the economic temperature ( $T_e$ ) as the first absolute moment of the 105 GDPP values with respect to the average GDPP per country, the economic entropy ( $S_e$ ) as the average Shannon entropy per country multiplied by  $N$ , and the economic chemical potential ( $P_e$ ) by establishing an analogy with the first law of thermodynamics, we study the temporal evolution of the macroscopic variables  $T_e$ ,  $S_e$ , and  $P_e$  over the period 1960–2023.

We find that, in terms of these macroscopic variables, it is possible to identify historical periods in which different economic factors led to growth or decline dynamics in the annual values of both the average GDPP per country and the variance of GDPP.

**Primary author:** RIASCOS OCHOA, Alejandro (Universidad Nacional de Colombia)

**Co-author:** QUIMBAY HERRERA, Carlos José (Universidad Nacional de Colombia)

**Presenter:** RIASCOS OCHOA, Alejandro (Universidad Nacional de Colombia)

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