Economic inequality from a statistical physics point of view

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Inequality is an important and seemingly inevitable aspect of the human society. Various manifestations of inequality can be derived from the concept of entropy in statistical physics. In a stylized model of monetary economy, with a constrained money supply implicitly reflecting constrained resources, the probability distribution of money among the agents converges to the exponential Boltzmann-Gibbs law due to entropy maximization. Our empirical data analysis [1] shows that income distributions in the USA and other countries exhibit a well-defined two-class structure. The majority of the population (about 97%) belongs to the lower class characterized by the exponential ("thermal") distribution, which we observed in the data for 67 countries around the world [2]. In contrast, the upper class (about 3% of the population) is characterized by the Pareto power-law ("superthermal") distribution, and its share of the total income expands and contracts dramatically during booms and busts in financial markets [1]. In Ref. [3], we found that global inequality in energy consumption and CO2 emissions per capita around the world has been steadily decreasing in 1980-2010, and the corresponding distributions became approximately exponential by 2010. We attributed this outcome to globalization of the world economy, which mixes the world and brings it closer to the state of maximal entropy. In Ref. [3], we predicted that global inequality will soon stop decreasing and will saturate at the Gini coefficient G=0.5 corresponding to the exponential distribution. This prediction has been remarkably confirmed in Ref. [4] after the more recent data up to 2017 became available, as shown in the Figure. The black circles for 1980-2010, analyzed in Ref. [3], manifest a decreasing trend and no sign of saturation yet. But the new data points for 2011-2017, shown by red squares, exhibit the predicted saturation at G=0.5. The Figure demonstrates that the decrease of global inequality has stopped once the exponential distribution, corresponding to maximal entropy, had been reached. This observation has profound consequences for strategies and scenarios dealing with the climate change [4].

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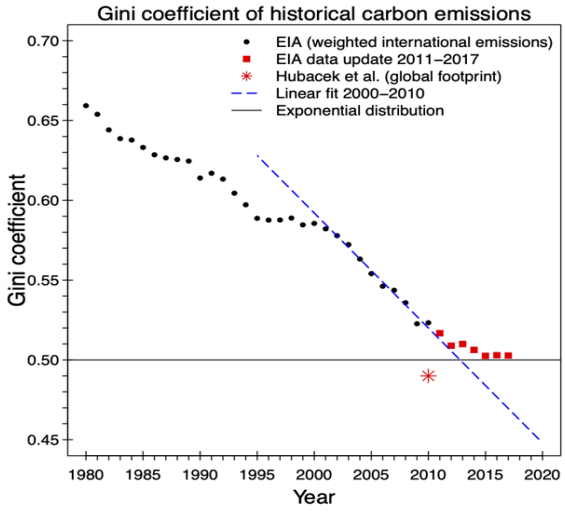

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