ENTROPY MODELING OF THE GLOBAL INCOME DISTRIBUTION

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This proof-of-concept study demonstrates the application of entropy models to the study of the global income distribution. The broad outlines of the global income distribution have been remarkably stable for over 100 years. Thus study focuses in particular on the degree to which the global income distribution has been structured along regional, world-systemic, and colonial-heritage lines using a constant sample of 100 countries over the period 1972-2007. Contrary to the expectations of classical economics, the entropy of the world-economy did not increase substantively over this period. Instead, entropy is either decreasing (existing patterns are strengthening) or increasing only very slowly. Brownian motion models indicate that in a random-walk sequence of growth rates existing patterns in the world-economy would be unrecognizable in 30-50 years. In light of this, the fact that early 20th century structures in the world-economy survive today is evidence of the existence of strong pro-systemic forces -- e.g., dependency, hegemony, and other forms of global economic policing.

The literature on income inequality has to date focused exclusively on the study of summary measures of inequality (such as the Gini coefficient), which have remained extraordinarily high since the turn of the twentieth century. Summary inequality, however, is only one of many relevant facts about the global distribution of income. The structure of global inequality is much more interesting -- and much less studied -- than the summary level of global

inequality. Incomes differ systematically by region, by world-system zone, and by many other factors (latitude, cultural heritage, post-colonial status, etc.). Some of these patterns may be accidents of history, while others may be actively maintained by systemic forces of repression and redistribution. In the absence of such systemic forces, and given the myriad of factors that influence national growth rates, normal theory would predict that over time the historical patterns of income distribution should dissipate.

Applied to countries' levels of national income per capita, the second law of thermodynamics implies that incomes should equalize across categories of countries over time. In other words, the entropy of the global income distribution should rise. Some countries might have more or less income than others, but these variations should be random and transient, not systematic and permanent. To the extent that structures of income distribution persist, structure-building and structure-maintaining forces must be at work. This claim is proved by the contrapositive: in the absence of such forces, entropy must rise, meaning incomes must equalize across categories. The most visible force of structural maintenance is the enforcement of borders between countries, but of course many others exist. For example, dependency theorists have long claimed that peripheral countries have been underdeveloped by the same forces that have developed core countries.

In this proof-of-concept study, illustrative entropy models of the country-level global income distribution are presented for a constant sample of 100 countries over the period 1972 - 2007. Data are taken from the World Bank's

World Development Indicators 2009 dataset. National income per capita is operationalized using the log base 10 of series NY.GNP.PCAP.CD (GNI per capita, Atlas method, current US$). The study period was chosen to maximize the achievable sample size. Missing data were linearly interpolated for Mali (1989) and for South Korea (2000-2001). The 100 countries included in the sample account for over 80% of the world's population today; the post-Soviet states, the sometimes-divided countries of central Europe, and several poor African countries make up the majority of the missing cases by population.

The salience of structure is operationalized as the percentage of total variability in the country-level global income distribution that can be accounted for by countries' categorical group memberships. Three categorical variables are tested: world region, world-system stratum, and historical colonial status. In each model, national income per capita is regressed on categorical status, with structure represented by the resulting R^2 score. More formal entropy-based measures of structure using the negative of the Akaike (1974) Information Criterion (AIC) produced identical substantive results. The salience of world-system and colonial statuses decreased marginally over the study period, while the salience of world region actually increased. Monte Carlo Brownian motion simulations indicate that is extraordinarily unlikely that such structures could have been maintained by chance.

The results therefore indicate that pro-systemic forces are almost certainly working to maintain the structural status quo of the world-economy.