Statistics of correlations and fluctuations in a stochastic model of wealth exchange

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In our recently proposed stochastic version of discretized kinetic theory, the exchange of wealth in a society is modelled through a large system of Langevin equations. The deterministic part of the equations is based on non-linear transition probabilities between income classes. The noise terms can be additive, multiplicative or mixed, both with white or Ornstein-Uhlenbeck spectrum. The most important measured correlations are those between Gini inequality index G and social mobility M, between total income and G, and between total income and M. We describe numerical results concerning these correlations and a quantity which gives average stochastic deviations from the equilibrium solutions in dependence on the noise amplitude.

The Gini index G is a widespread measure of income inequality in a society, expressed as a non-dimensional ratio of the relative mean absolute difference of income between two income classes to double their mean. The social mobility M can be identified with multiple definitions, but in essence it is defined as the probability for an individual to pass to the upper income class in a given unit time, averaged over all classes.

Empirical evidence shows a clear correlation between these two quantities, namely it is found that mobility reduces when inequality rises, thus implying a negative correlation between G and M. This correlation, nicknamed the "Great Gatsby Curve", is important since it means that the increase of inequality (as presently observed in several countries) tends to be a self-reinforcing phenomenon, unless it is complemented by suitable social policies. This holds for societies at near equilibrium.

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[2] M.L. Bertotti, et al., Int. J. D.N.E. to app. (2017).

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