Effect of savings on a gas-like model of economy with credit and debt

G. Chacón-Acosta[1], V. Angeles[2]

[1]Departamento de Matemáticas Aplicadas y Sistemas, Universidad Autónoma Metropolitana Cuajimalpa

[2]Escuela Superior de Economía, Instituto Politcnico Nacional

In order to model a simple economy, the models of exchange agents have been introduced, which present an analogy with the molecular models of gases formed by colliding particles from the statistical physics. In the same way that the particles of a gas exchange energy during the collisions, in these models agents exchange a fraction of their capital, which is determined by the fraction that they do not save. This analogy is possible given the conservation of total capital. The capital of the agents comes mainly from their income, however, such agents can increase their capital through a credit, which in the long run will generate a debt.

In this work we study the thermostatsical properties of kinetic models of exchange agents that describe a closed economy with income, savings, credit and debt. Debt and credit are introduced as a further variable different than income, so that the lower limit of it represents the debt. The economic system including credit and debt was first studied by Viaggiu and collaborators using the tools of the statistical assemblies. They adopt the Boltzmann-Gibbs distribution where energy is replaced by total money including income, credit and debt. On the other hand, the savings propensity is not introduced as usual in kinetic models, like in the paper by patriarca et al, where saving propencity was firts introduced. In such work was shown that this agents follow at equilibrium the so called Gamma distribution, this was done by numerical simulation. In this work we use an analytical geometrical formalism. The geometric model for distributions of agents that save money was first introduced by Lopez-Ruiz et al. In this work they consider that the interacting agents obey an additive constraint that defines an N-dimensional surface of equiprobability. In this case the Hamiltonian constraint contains the propensity of saving as an exponent of the monetary variable. We calculate the canonical partition function, the economic temperature and other relevant variables. In these quantities we observe that there is an interaction between the fraction of money that agents can save and the debt that they can acquire.

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