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"Physics Meets Economics: Econophysics"

Abstract:

I shall briefly review the exciting development of econophysics as an interdisciplinary research, and then present a specific topic: the "invisible hand" in resource allocation. It is believed that the generalized "invisible hand" exists not only in economic markets, but also in many biological and social systems. However, the microscopic mechanism under the "invisible hand" is unclear, so far. In our recent study [PNAS 106, 8423 (2009)], we focused on the biasedly distributed resource allocation problem. First, we designed and conducted a series of behavioral economic experiments. We found that the allocation of a virtual resource could reach the efficient state in these experiments, even if direct negotiations among the participants, as well as the external instructions which might create a collaboration among them, were completely forbidden. In other words, we demonstrated the existence of the "invisible hand". Next, based on the minority game (MG), we constructed a model called market-directed resource allocation game (MDRAG). The new model can explain what we found in our experiments. In the mean time, through a large number of the MDRAG simulations, we are able to establish a possible mechanism for the "invisible hand". A more interesting discovery is related to a number of phase transitions found in the MDRAG simulations. Around the critical region of these phase transitions, the directing power of the "invisible hand" can be released completely, which could lead to an efficient, stable and unpredictable market.