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Application of Two-Ring Network and Ising Model to Agent-Based Dynamics in Financial Market

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We applied a two-ring network to study the dynamics of agents in a financial market. Two rings are randomly connected by coupling links. The Ising model is adopted to determine the state of each node, representing a financial agent. To relate the Ising network to a financial market, we mapped the (+1) state to the buying state and (-1) state to the selling state. The probability of changing states depends on the interaction between neighborhood nodes, coupling links, and the external field. Whenever the state of a node changes to (+1), the observed price variable increases by 1 unit and that agent buys 1 unit of stock with this price. Likewise, when a node changes state to (-1), the price decreases by 1 unit and this agent sells 1 unit of stock. Then the profit of individual nodes can be measured by the difference between its averaging cost and the current price. We vary the number of coupling links between two rings and the intensity of external magnetic field of each ring. We find that the magnetization strength of each ring depended on the number of coupling links. Consequently, the rate of change of the price depends on the network magnetization, and the profit grows as a quadratic function of magnetization. If two rings have opposite signs of magnetization, the less magnetized ring gets a loss in profit and the price moves in the direction of larger magnetized ring. But if both rings have the same sign of magnetization, most agents gain profits.

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