# Theory of Phase Transition in the Evolutionary Minority Game

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We discover the mechanism for the phase transition from self-segregation (into opposing groups) to clustering (towards cautious behaviors) in the evolutionary minority game (EMG). The mechanism is illustrated with an analytical solution of a simplified EMG with three groups: two groups of opposing agents and one group of cautious agents. Two key factors affect the population distribution of the agents. One is the market impact (the self-interaction), which has been identified previously. The other is the market inefficiency due to the short-time imbalance in the number of agents using opposite strategies. Large market impact favors "extreme" players who choose fixed strategies, while large market inefficiency favors cautious players. The phase transition depends on the number of agents ($N$), the reward-to-fine ratio ($R$), as well as the wealth reduction threshold ($d$) for switching strategy. When the rate for switching strategy is large we have strong clustering of cautious agents. On the other hand, when $N$ is small, the market impact is large, and the extreme behavior is favored.