

# The minimum heterogeneous agent configuration to realize the future price time series in the AI market experiment: an updated version 2020

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**Abstract.** With the advent of the new era of Artificial Intelligence, we need to update our inferential methods in economics and the social sciences accordingly. The implementation of a slightly realistic consideration will easily reveal to us a very large domain. In this article, we employ the AI market simulation system called U-Mart to model the efficiency of a realistic futures market. In the actual market, participating agents send orders either randomly or non-intelligently, even though they depend on their own unambiguous strategies. It has been noted that purely random orders often result in the best performance in the market. Thus, the market system may have many redundancies. Although we cannot know an optimal solution in advance, we may form a winning strategy. In a sense different from efficiency market hypothesis, we can thus affirm a certain statement on the efficiency of the market. This kind of analysis is essentially similar to the idea of Fully Random, Rule-Based Interactive Cellular Automata (ICA), which is based on Alan Turing's rule selection. This may be a hint, because a consecutive application of a different rule of CA randomly selected gives a various behavioral pattern represented by Class properties from fixed, periodic, chaotic and complex one (Carvalho 2011 [3]). Interactive randomness and heterogeneity must be essential for the pattern formations. Based on this hint, we can now find the Nakajima- Mori agent configuration of the so-called traditional technical analytical agents (behavioral rules) to realize the future price time series similar to any given spot price time series in the AI market experiment. <sup>4</sup>

In the following, we will derive the next propositions:

1. As the bodies of each strategy are simultaneously increased, the possibility to match current orders to settle them may be much bigger;
2. The discovery of **the minimum agent configuration** brings a scale free property to the Nakajima- Mori agent configuration in the AI market experiment. In this sense, we will be able to employ this special configuration as a gravitational mediator to identify what kind of agent configuration dominates a current future price formation;

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<sup>4</sup> This abstract is an integrated version of the next two articles of Aruka et.al(2019a)[1] and Aruka et.al(2020)[2]

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3. The earning property is also scale free from the absolute number of agents. The Nakajima-Mori special agent configuration usually provides us with an almost fixed mixture also of the earning structure, irrespective of the absolute number of participating agents.

**Keywords:** Interactive CA, Turing's rule selection, Minimum agent configuration, U-Mart system, Acceleration experiment, Self-correlation to lag, Moving average strategy, Earning distribution

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universal behavior of rule 110, for instance.