# Phase Transitions in a 2D Ising Model of Agent Expectations in Financial Markets: Analytics in One- and Two-Dimensional Network Topologies

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## Abstract

Phase transitions between ordered and disordered states of interactive agents have been recognized as integral to dynamics in a range of economic and social processes. Several theorists in the study of financial markets have directly linked phase transitions between disordered and ordered states of agents to a critical point in the dynamics of market price. To date, phase transitions in the dynamics of price in financial markets have been demonstrated with numerical methods. In an application to a financial market, we propose a multicomponent in which a first component is in bounded rationality and a second component is in behavior that generates herding in financial markets. A transition function defines the relative weight of components. We extend conditions of Onsager (1944) for phase transitions in a 2D Ising model and analytically demonstrate that the proposed model evidences phase transitions. Generalizations of the results to other multi-component models are noted.

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`Phase transitions in financial markets_2D (6.01.2021).docx` available at https://authorea.com/users/432518/articles/536014-phase-transitions-in-a-2d-ising-model-of-agent-expectations-in-financial-markets-analytics-in-one-and-two-dimensional-network-topologies

*Market Price and "Fundamental"*    + Max    *value"*

B

Price > Fair value    $+\varepsilon_{max}$

A

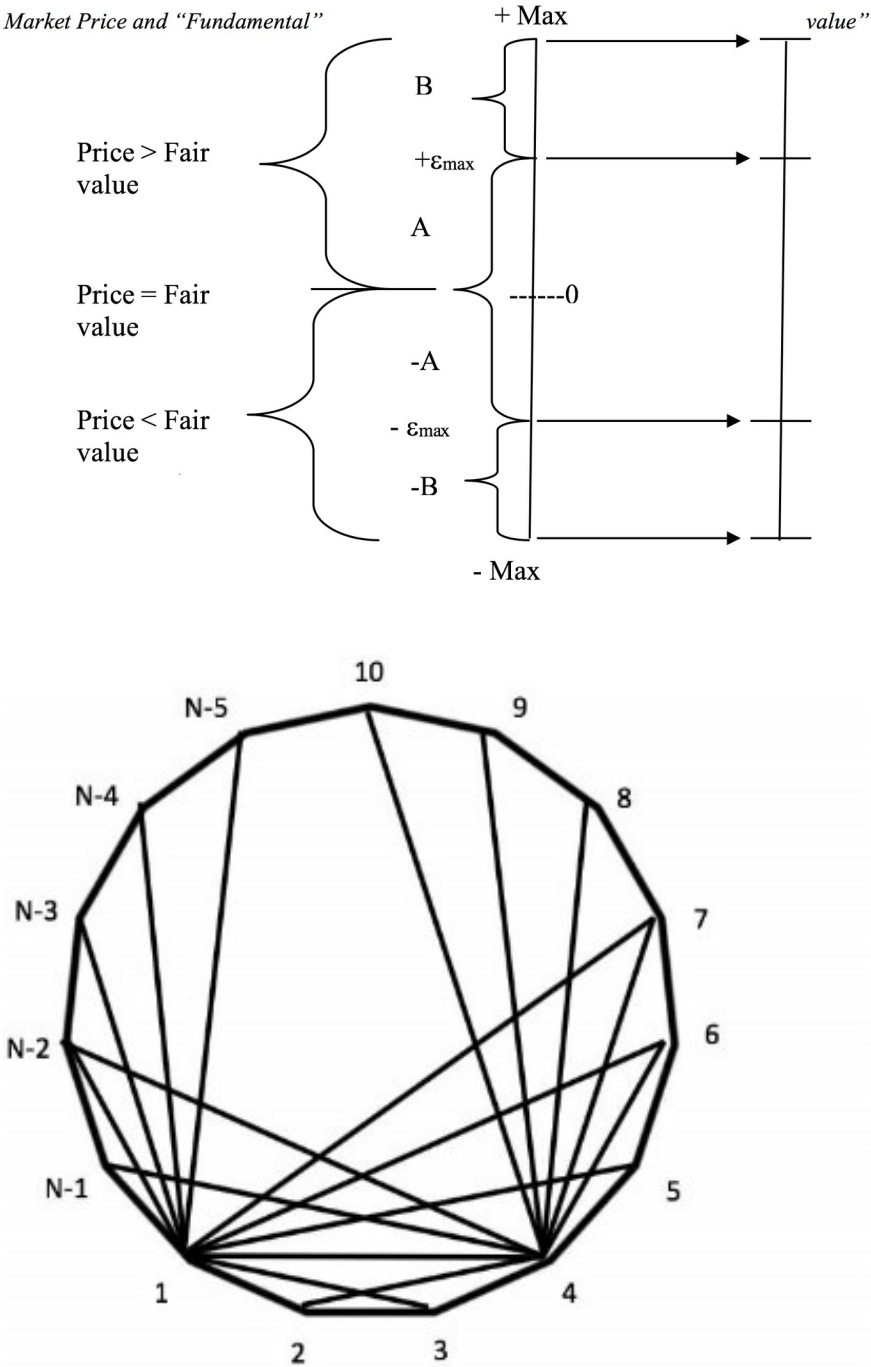Price = Fair value    ------0

-A

Price < Fair value    $-\varepsilon_{max}$

-B

- Max



Figure 2: Connectivity in a 2D Graph