STRATEGIC FORMATION OF CREDIT NETWORKS

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Credit Networks

• Abstraction of modeling trust

• Trust: One’s willingness to perform services for another without immediate compensation

• Agents keep track of levels of trust as credit balances

• Impetus for forming credit networks?
  • Why does anyone ever need or want one of these things…
    • Benefits to connected agents
    • Enable transactions among more people
Credit Networks
What networks occur in equilibrium?

Empty Network

Central Currency
Theoretical Approach

• Idea
  • Simplify the payoff model so it can be described analytically.
  • Restrict strategies accordingly.

• Example of theoretical reduction
  • Dichotomous risk
    • Only allow transactions between adjacent nodes
  • Really nice results
    • Best response converge to Pure-Strategy NE
    • Always maximizes social welfare
Problems with the Theoretical Model

- Oversimplification
- Restriction of strategies
- Dichotomous model: When you allow transactions between not just neighbors, “nice” results break down
## Theoretical vs. Simulation-Based

<table>
<thead>
<tr>
<th>Theoretical Model</th>
<th>Simulation Based</th>
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<tbody>
<tr>
<td>• Oversimplification</td>
<td>• Sample transaction sequences to compute average payoffs</td>
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<td>• Restriction of strategies</td>
<td>• Explore heuristic strategy for issuing credit</td>
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<td>• Dichotomous model: When you allow transactions between not just neighbors, “nice” results break down</td>
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Global Risk Model

- Publicly known probability of default
- Simulation leads to star like formation
- Leads to exploration of theoretical basis for star like structure
Credit Network Simulator

- Agents issue initial credit.
- Some agents default.
  - Update payoffs.
  - For a large number of rounds:
    - Select two agents.
    - If a path exists, they transact.
    - Update payoffs.
Defining Heuristic Strategy

• Strategy for evaluating other agents in network

• Pick the best q agents based on…
  • Likelihood of transactions
  • Probability of defaulting
  • Weighted combination of trade value/trade profit

• Issue them k units of credit
Key Strategies

• Default probability
  • Lowest known default for global risk
  • Pick the “best” agent to be center based on knowledge of other agents

• Index
  • Lowest node number
  • Arbitrarily pick an agent to be center of star
Qualitative Results

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<tr>
<th>Complete Information</th>
<th>Many Defaults</th>
<th>Few Defaults</th>
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<td><strong>High Value</strong></td>
<td><img src="red.png" alt="Red Circle" /> <img src="blue.png" alt="Blue Circle" /></td>
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Equilibrium Networks:
- **Empty**
- **Central**
- **Other**
Discussion Questions

• When you are reducing a complex system, at what point do you cross a line where the results from the model no longer apply to the original situation?

• Given the results of this paper, what aspects should be considered when implementing an actual credit network system?
  • Examples: Reputation System, Spam Reduction