

# The Agglomeration Bonus in Small & Large Local Neighbourhoods: An Experimental Study

Simanti Banerjee  
Division of Economics  
University of Stirling



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# Road Map

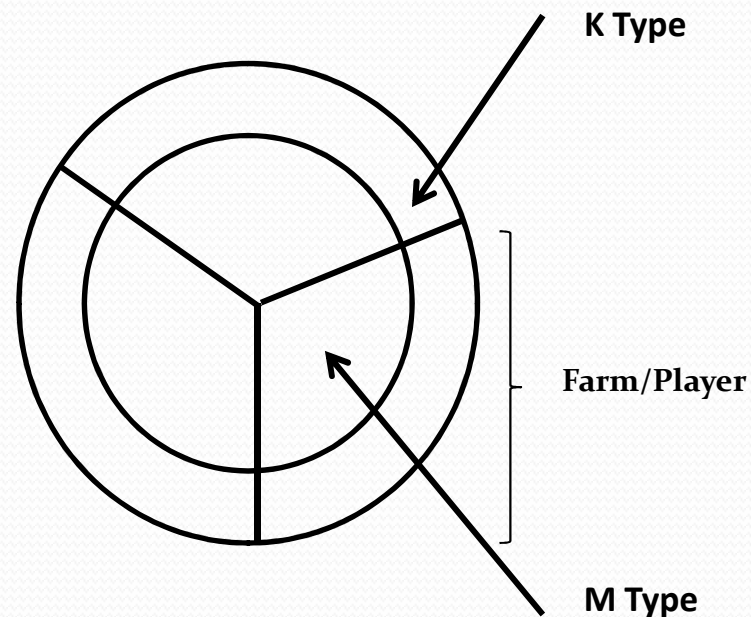
- Context
- New Directions
- My Study
- Results

# Agglomeration Bonus (AB)

- **PES** subsidy scheme to pay private landowners for pro-conservation land uses
- AB has
  - **Participatory payment** compensating for costs of changing land uses
  - **Bonus** incentivizing spatially coordinated land management
- Strategic interactions between agents is a spatial coordination game
- Spatially coordinated outcome is a Nash Equilibrium of AB coordination game

# An AB Coordination Game

- Coordination game has two strategies **M** & **K** indicating land uses on two parcel types
- Every player has **two** neighbours on a spatial grid
- AB payments for M are greater than for K
  - Pro-conservation land uses on M deliver more ES than on K



# An AB Coordination Game (contd.)

- Game has **Pareto Ranked Nash Equilibria (NE)**
- Payoff Dominant Nash Equilibrium (PDNE) & Risk Dominant Nash Equilibrium (RDNE) **same**
- Repeated interactions can lead to **Pareto Superior NE** i.e. a superior agglomeration outcome

**Payoff Table**  
Neighbors' Choices

| Own Choices | Both M | One M, other K | Both K |
|-------------|--------|----------------|--------|
| M           | 70     | 50             | 30     |
| K           | 15     | 25             | 35     |



# New Directions in Research

- Experimentally investigate spatial coordination
  - In the presence of **local interactions** between neighbours
  - When **Payoff Dominant NE** and **Risk Dominant NE** of the game are **different**
  - In **large** and **small** spatial grids representing different farming landscapes

# Local Interactions & Coordination

- Strategic interactions are local when
  - Players interact with their neighbors only and not everyone in the group
- Farmer interactions local given nature of geographical landscape
- Coordination to PDNE (Berninghaus et al. 2002)
  - Easier in standard global/closed setting
  - Harder in local/open neighborhoods



# New AB Game

- Participation payments for K **higher** than for M
  - K may be intensively managed land with some eco-delivery potential & high opportunity cost of land use conversion
- Bonus for M **higher** than for K
- PDNE (M) and RDNE (K) are **different**

## Payoff Table

### Neighbors' Choices

| Own Choices | Both M | One M, other K | Both K |
|-------------|--------|----------------|--------|
| M           | 55     | 35             | 15     |
| K           | 30     | 40             | 50     |

# Group Size & Coordination

- Strategic uncertainty about players' coordination propensity stronger in **bigger groups** than **smaller groups**
- Experimental evidence suggests that coordination failure more **common** in **big closed** groups than **small** ones
  - Van Huyck et al. (1990)
- **Same** result in **local** interaction settings with small and large grids
  - However different groups have different number of neighbours (Berninghaus et al. 2002)

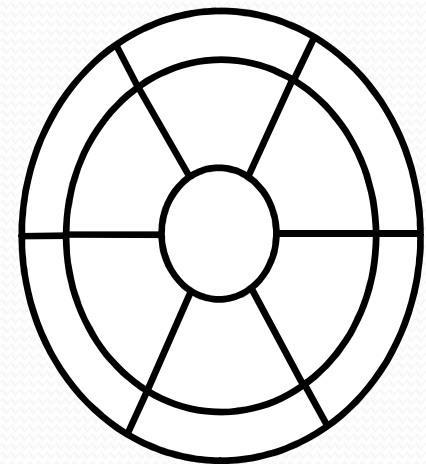
# Objectives

- What is the nature of spatial coordination in new AB game in **local** environment?
- Is coordination failure more frequent in **big** local groups than **small** ones
  - when number of neighbors **same**?
- What is the impact on agglomeration within a **cluster** or **local neighbourhood** in both groups?

# Strategic Environment of Experiments

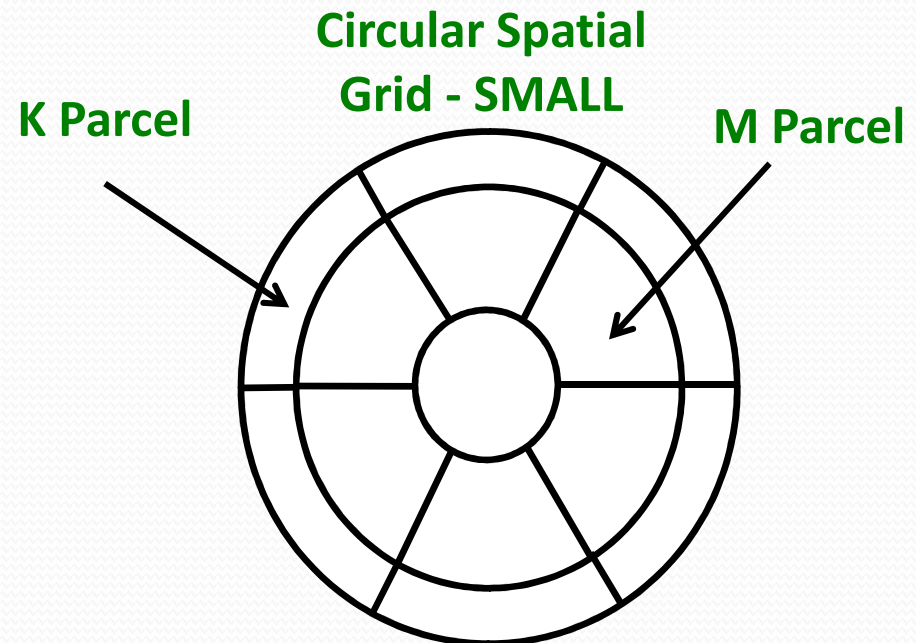
- Every player has
  - Two neighbors
  - Player & neighbors form **cluster** or **local neighborhood**
  - **Local NE** in cluster if all players choose same strategy
  - Diametrically opposite players not neighbours
- Local interactions on **open** circular grid
  - Small and Large group treatments

Circular Spatial  
Grid



# Experiments

- Treatment
  - SMALL : 6 players
  - LARGE : 12 players
- 8 sessions for each treatment
- Repeated interactions for 20 periods
- Neighbors of a player **same** across all periods
- Payoff table **same** for both treatments



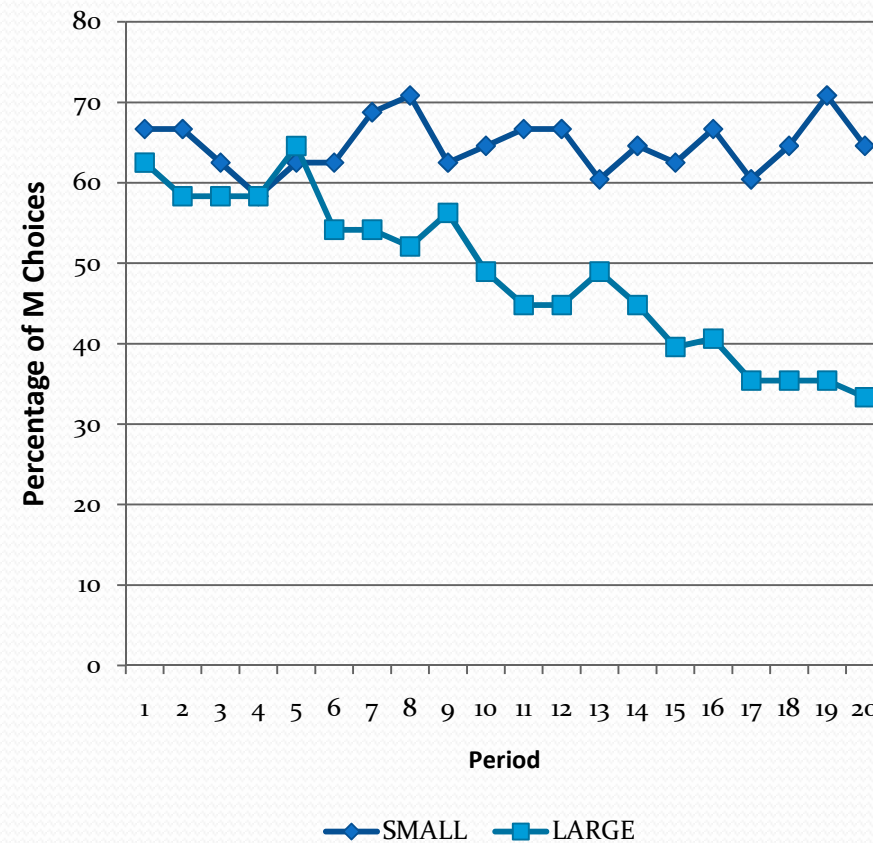
Payoff Table  
Neighbors' Choices

| Own Choices | Both M | One M, other K | Both K |
|-------------|--------|----------------|--------|
| M           | 36     | 18             | 0      |
| K           | 27     | 24             | 21     |

# Impact of Group Size with Local Interactions

- With local interactions in final period
  - **Inability** to coordinate to PDNE in both groups
  - **Mis-coordination** with players choosing both M & K in SMALL & LARGE
  - Percentage of M decisions **significantly different** across treatments in final period
    - SMALL – 64.58%
    - LARGE – 33.33 %

Percentage of M Choices



# Random Effects Dynamic Probit Regression of M Choices

$$y_{it} = D + \gamma y_{i(t-1)} + \beta_1 \text{Period} + \beta_2 \text{Period} * y_{i(t-1)} + \alpha_i + u_{it}$$

| Constant            | Size<br>Dummy      | Own Action<br>In<br>Past Period | Period              | Own Action ×<br>Period | # of Obs | # of<br>Groups |
|---------------------|--------------------|---------------------------------|---------------------|------------------------|----------|----------------|
| -0.245**<br>(0.102) | -0.248*<br>(0.062) | 1.231*<br>(0.1254)              | -0.048*<br>(0.0079) | 0.064*<br>(0.0107)     | 2736     | 144            |

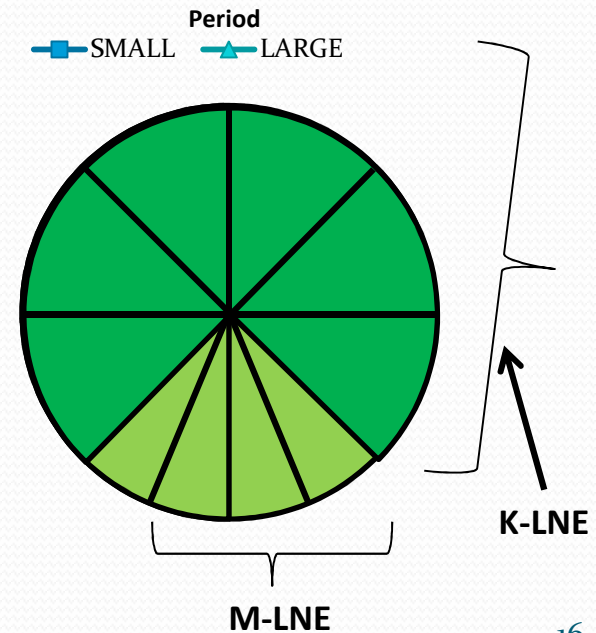
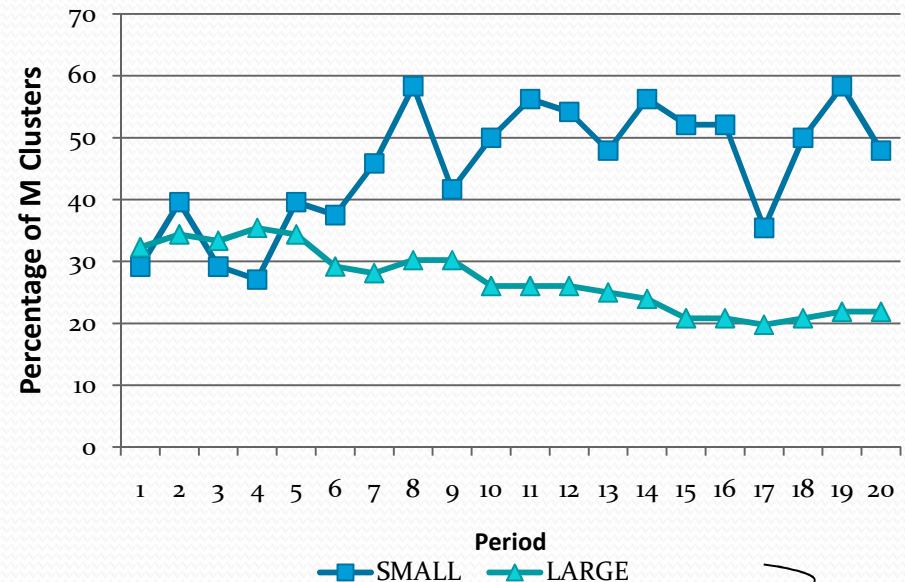
\* Represents significant at 1%

\*\* Represents significant at 5%

# Impact of Local Neighborhood

- In **Period 20**
  - Percentage of M-LNE significantly different across treatments
    - SMALL – 47.91%
    - LARGE – 22.91%
  - In LARGE, localized M choices by 3 or more players
- Subjects don't follow **Best-Response Behavior**
- AB **partially effective** in LARGE

Percentage of M-LNE





# Conclusions

- Impact of **Local Interactions**
  - Spatial coordination failure in both SMALL and LARGE
- Impact of **Overall Group Size**
  - Instances of coordination failure more in LARGE
- Impact of immediate **Local Neighborhood**
  - Localized areas of coordinated management (M-choices) in LARGE

# Thank you

Questions!