

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

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Road Map

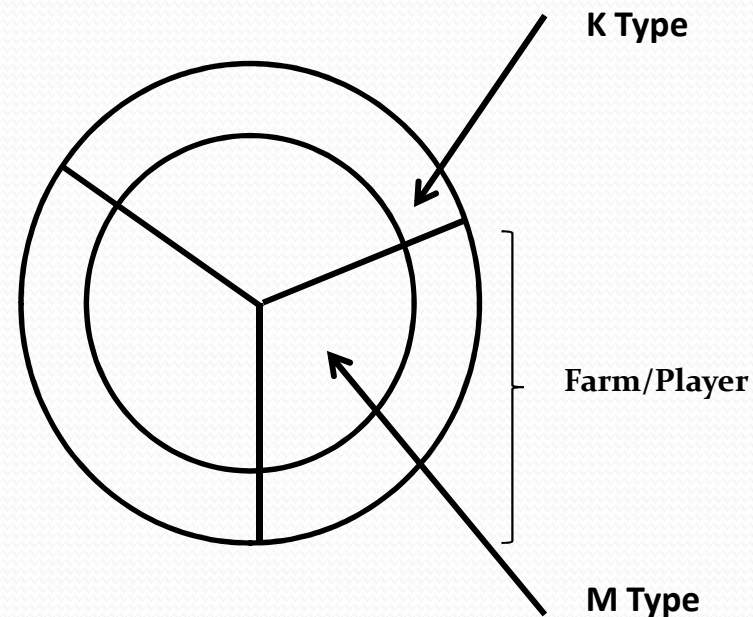
- Context
- New Directions
- My Study
- Results

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)

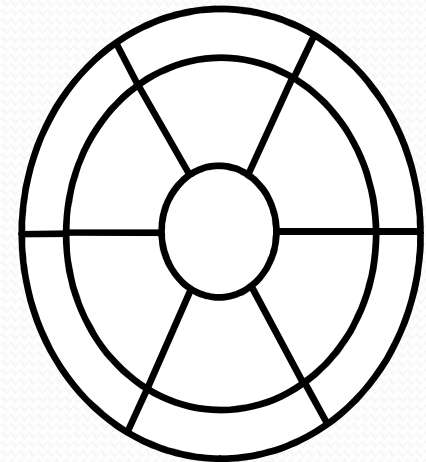
Objectives

- 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

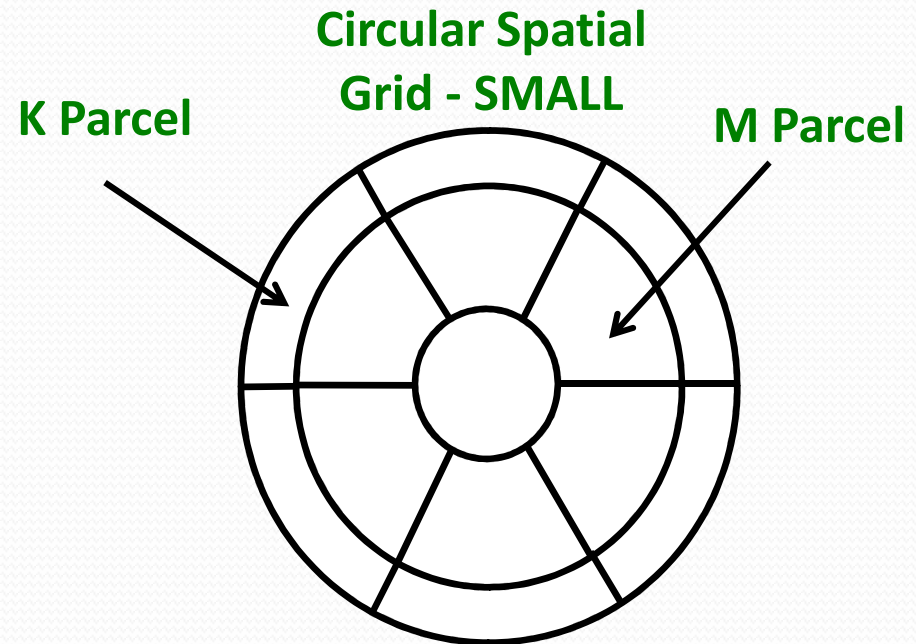
- Every player has
 - Two neighbors
 - Player & neighbors form **cluster** or **local neighborhood**
 - **Local NE** in cluster if all players choose same strategy
 - Diametrically opposite players not neighbours
- Local interactions on **open** circular grid
 - Small and Large group treatments

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



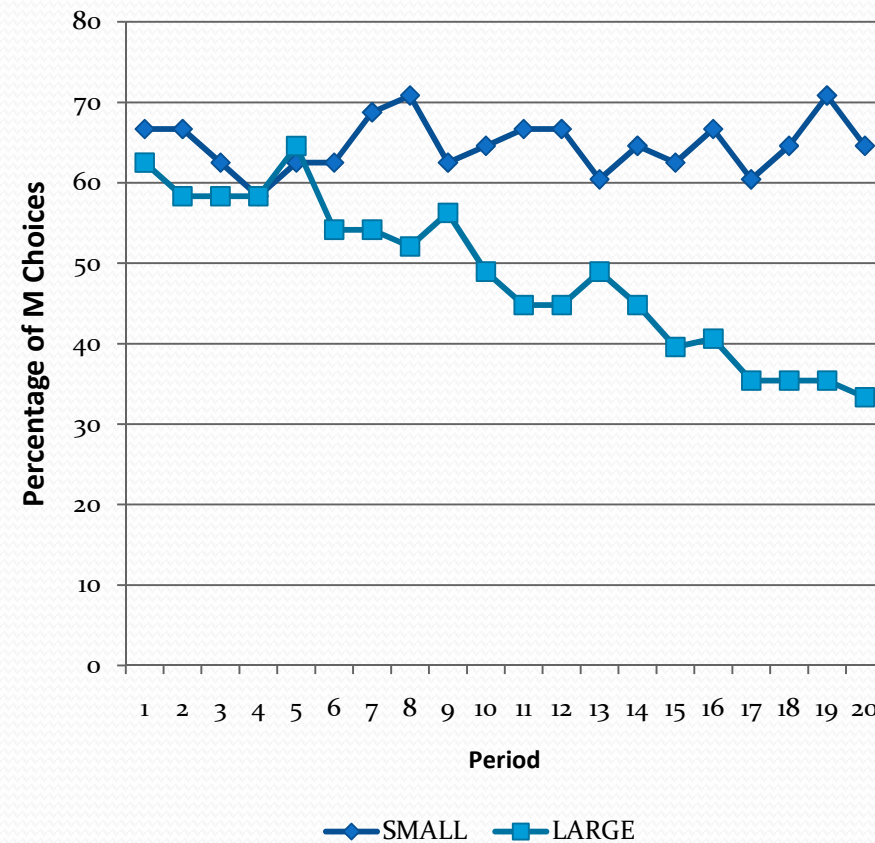
Payoff Table
Neighbors' Choices

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

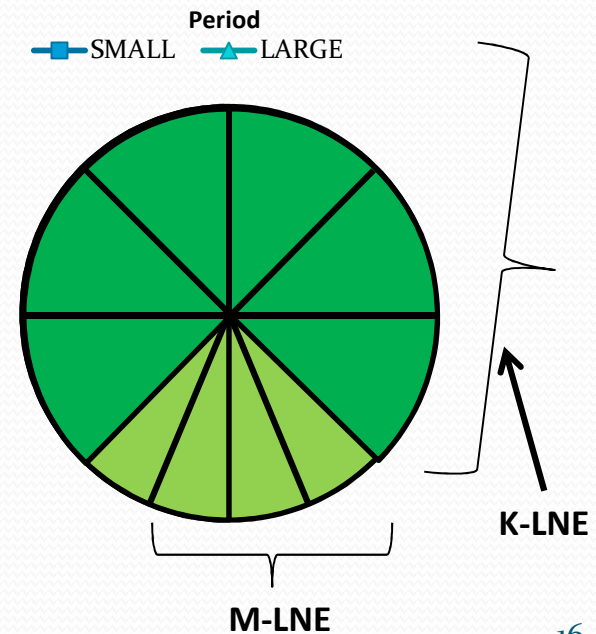
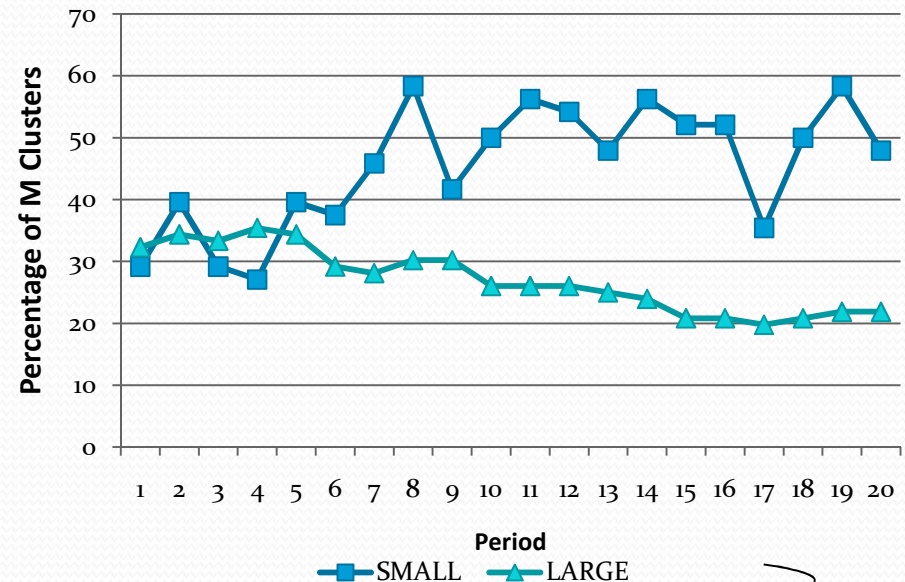
* Represents significant at 1%

** 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!