Location, Spatial Price Discrimination and their interdependencies

An explorative approach to spatial competition theory through simulation

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Outline

1. Motivation, Objectives
2. Theoretical background
3. Methodological approach
4. Results
5. Summary

Motivation

- Spatial competition
  - Location theory
  - Spatial price theory
- Models of location theory: price strategy fix
- Models of spatial price competition: location fix
- From an agricultural economics perspective: less is done on input markets

Objectives

- analyze spatial input markets with regard to pricing **and** location through simulation
- consider a general pricing rule
- contrast theory with the outcome of simulations
- identify the impact of critical assumptions

Literature

Contribution	Models incorporate:[a] Lo	LP	Ol	2D	BE	El
Norman [1981]	–	■	□	–	–	–
Thisse and Vives [1988]	–	□[b,c]	–	–	–	□
Espinosa [1992]	–	■	–	–	–	–
Zhang and Sexton [2001]	–	□[b,c]	–	–	–	■
Hotelling [1929]	■	□[b]	–	–	■	–
Lerner and Singer [1937]	■	□[b]	–	–	■	–
Salop [1979]	■	□[b]	■	–	–[d]	■
Lederer and Hurter [1986]	■	–	–	■	■	–
Kats and Thisse [1993]	■	□[c]	–	–	–[d]	–
Economides [1993]	■	□[b]	■	–	■	■
Tabuchi [1994]	■	□[b]	–	■	■	–
Ansari et al. [1998]	■	□[b]	–	■	■	–
Irmen and Thisse [1998]	■	□[b]	–	■	■	–
Brenner [2005]	■	□[b]	■	–	■	–
This paper	■	■	■	■	■	■

■ = yes, □ = partial, – = no

[a] Lo=Location, LP= linear price strategies, Ol= more than two firms, 2D= two dimensional space, BE=border effects, El=elasticity of demand or supply

[b] Free on board pricing (fob)

[c] Uniform delivered pricing (udp)

[d] Circular market

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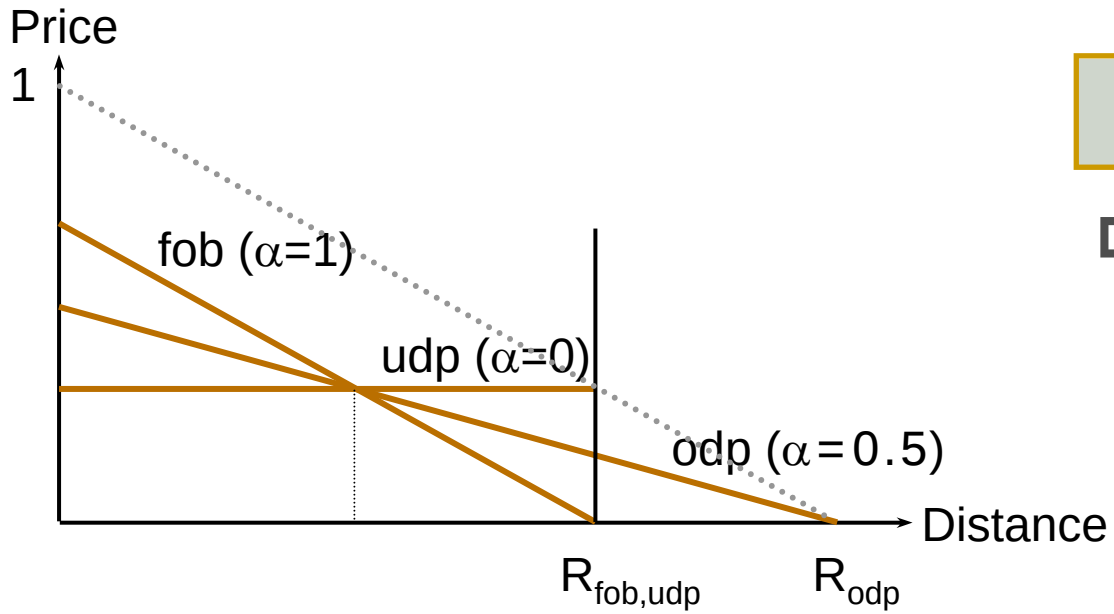
Spatial price theory



$$p(r) = m - \alpha tr$$

- Local price p(r):
  - Constant mill price *m* less a portion α of the transport costs *tr*
  - $\Gamma = \Gamma(m, \alpha)$ is the spatial price strategy of a firm

t... Transport cost

r... Distance to processors location

R... Market Radius of the processor

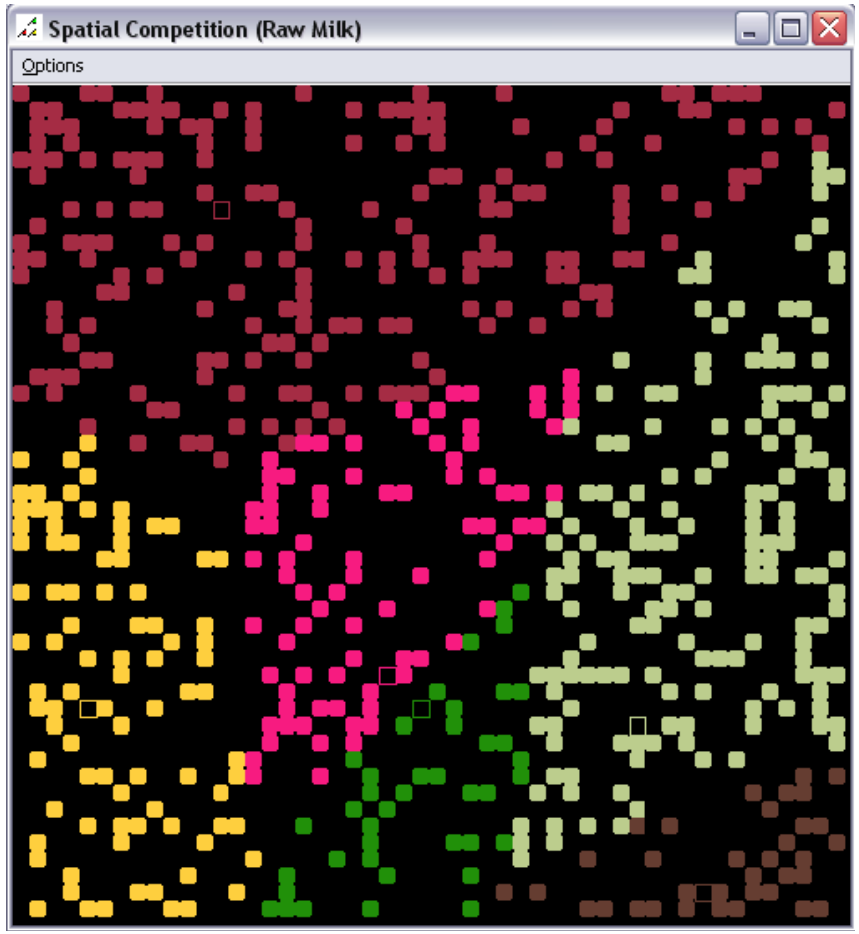
odp... Optimal dicriminatory pricing

udp... Uniform delivered pricing

fob... Free on board pricing

Methodology

- Agent-based Modeling (ABM)
  - interaction of many heterogeneous agents
  - explicit consideration of space
- Genetic Algorithm (GA)
  - heuristic search method for optimization
  - utilized as internal decision model of agents



Simulation of price-location games

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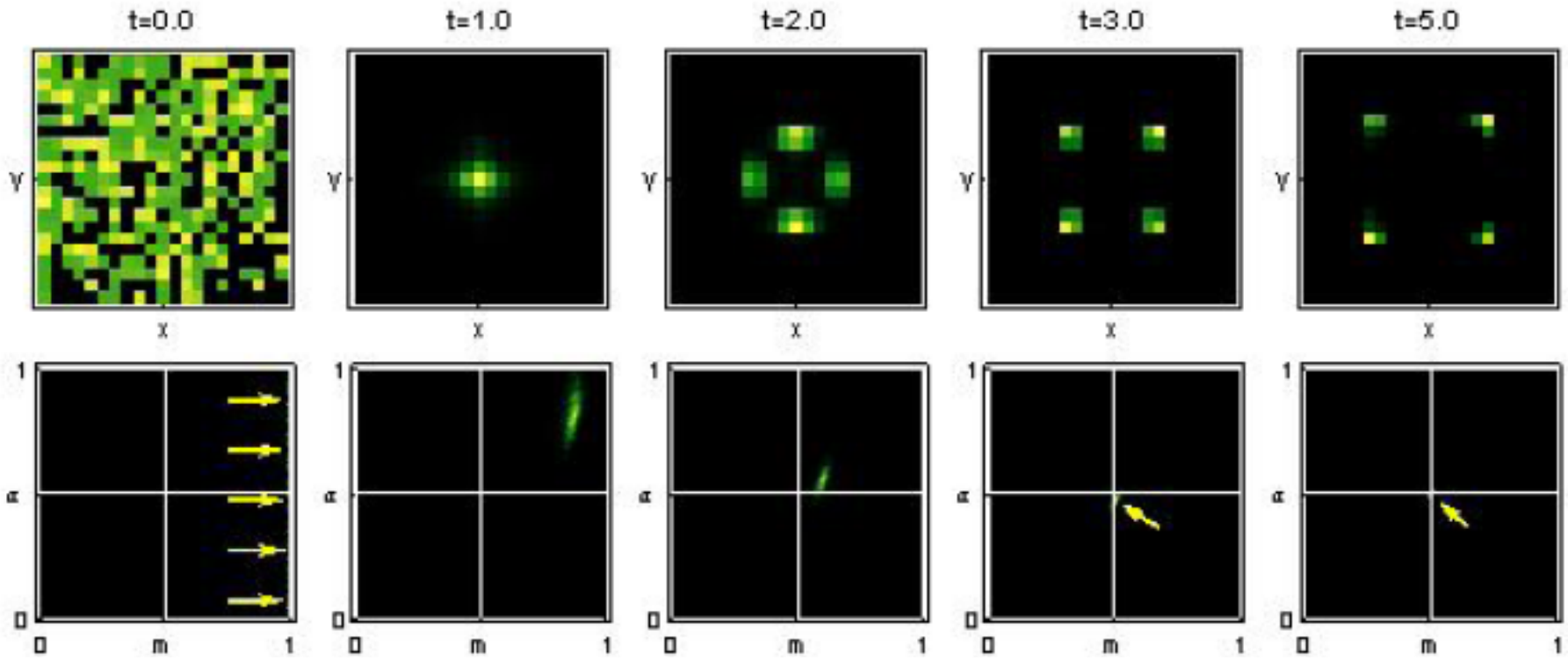
	Simulations			
Parameter	Duopsony	Oligopsony	Unbounded Space	Inelastic supply
i	2	3 . . . 6	2 . . . 6	2 . . . 6
j	400	400	400	400
t	0.0 . . . 5.0	2.0	2.0	2.0
φ	1.0	1.0	1.0	1.0
x, y	20	20	20	20
v	1.0	1.0	1.0	1.0
ω	1.0	1.0	1.0	0.0
space	plane	plane	torus	torus

Duopsony

For each figure the number of games is n=12500.

Duopsony



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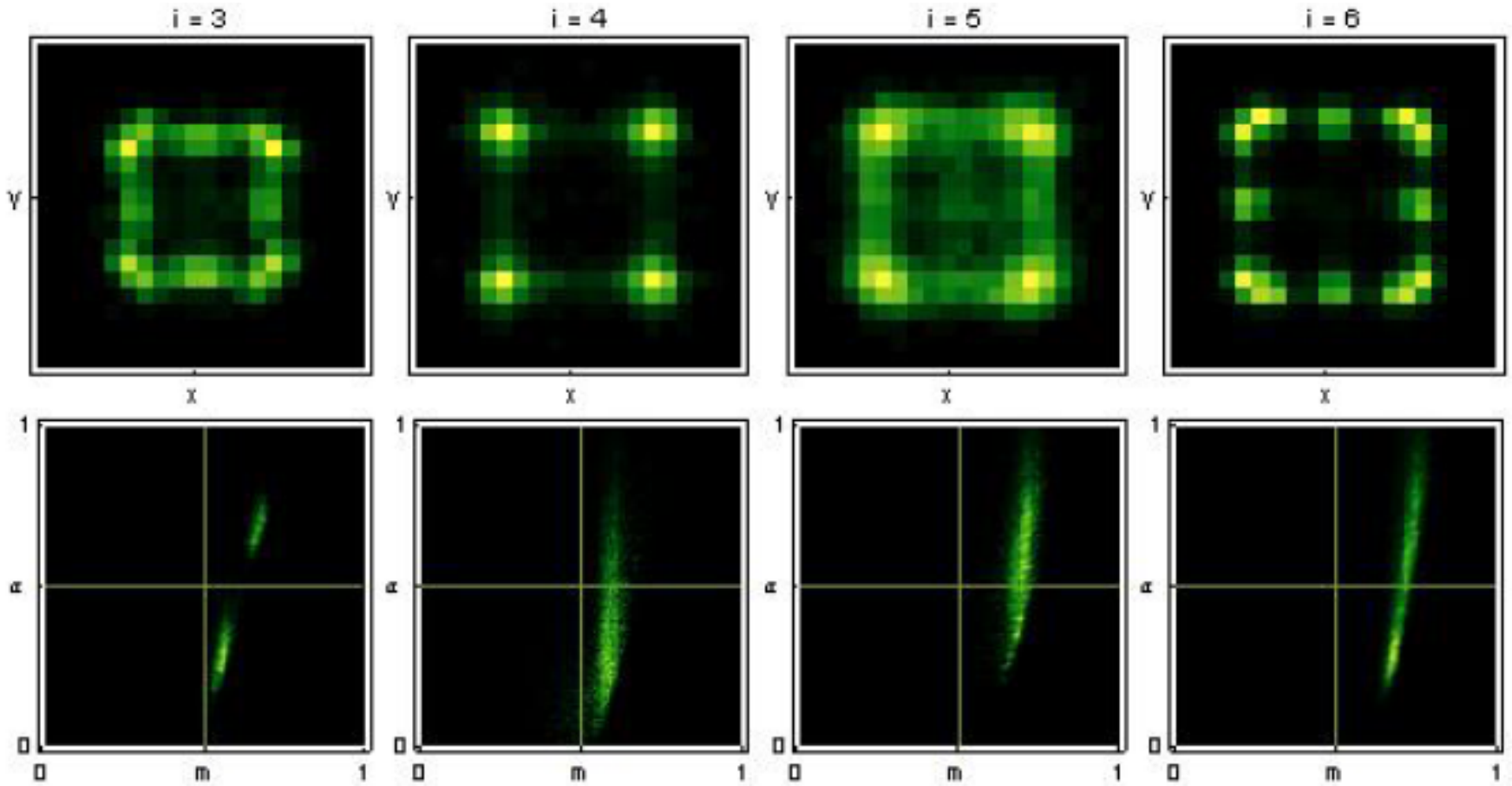
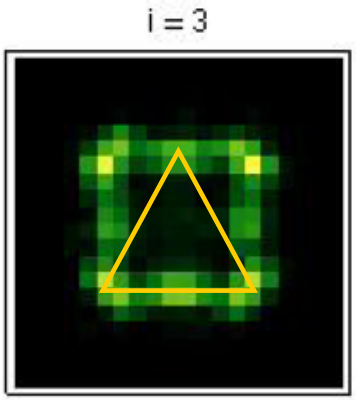
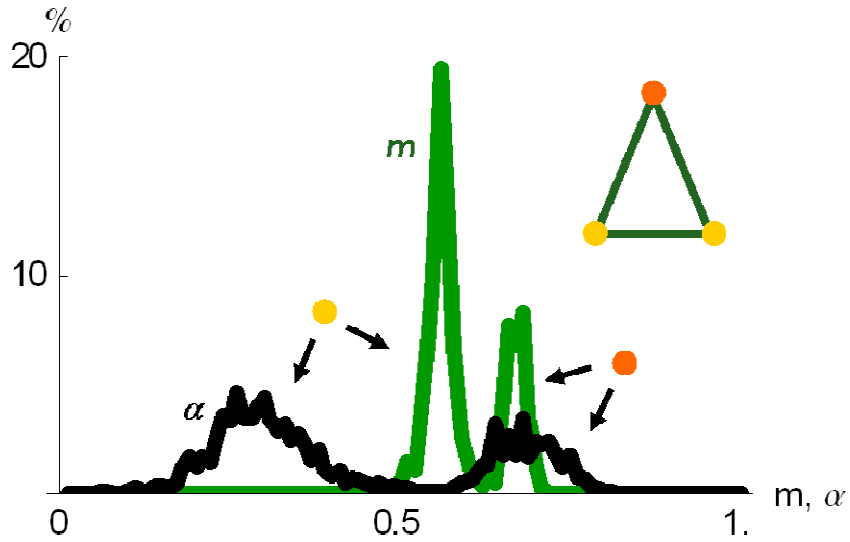
Oligopsony



n = 7500

Oligopsony (i=3)





- the “top”-firm discriminates less than the “bottom ” firms
- Market border may be closer to the location of the “top” firm, but there is a better adjustment to supply elasticity in the backyard

Simulation of price-location games

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x, y	20	20	20	20
v	1.0	1.0	1.0	1.0
ω	1.0	1.0	1.0	0.0
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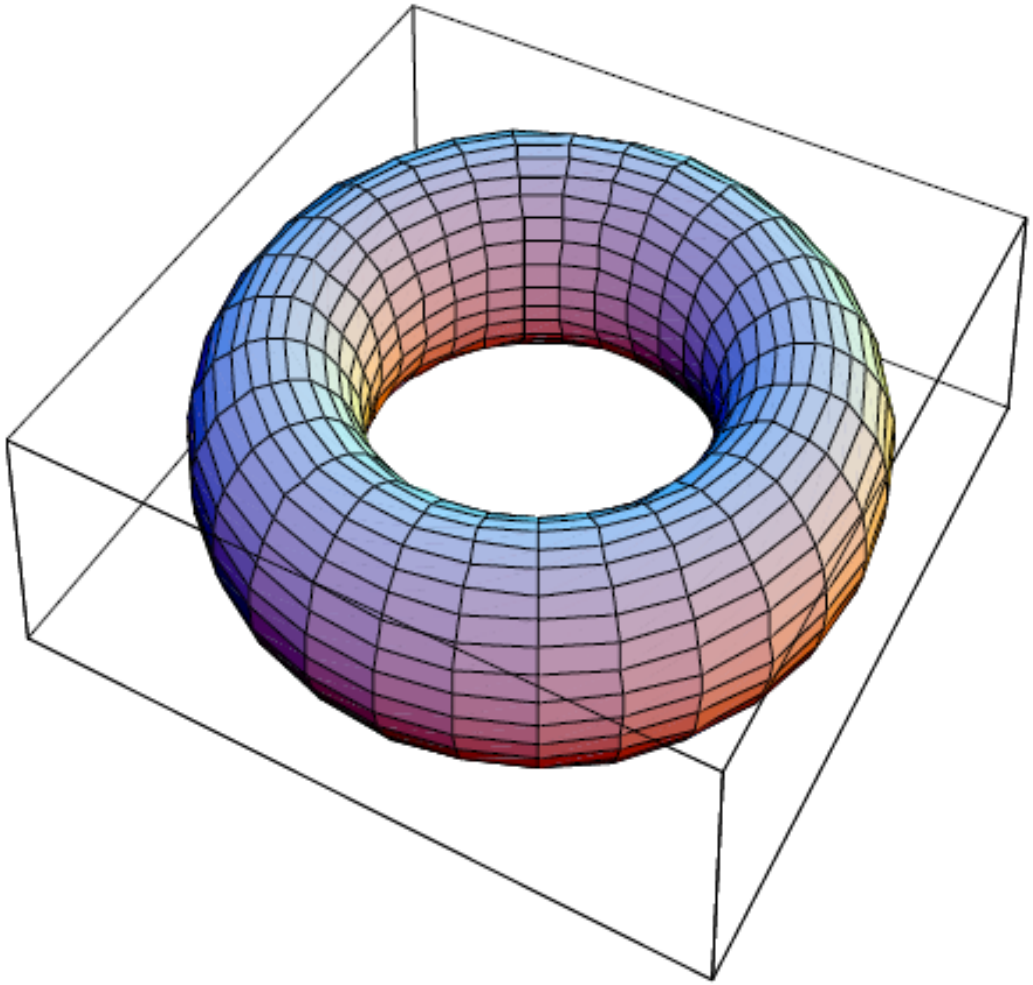
Torus



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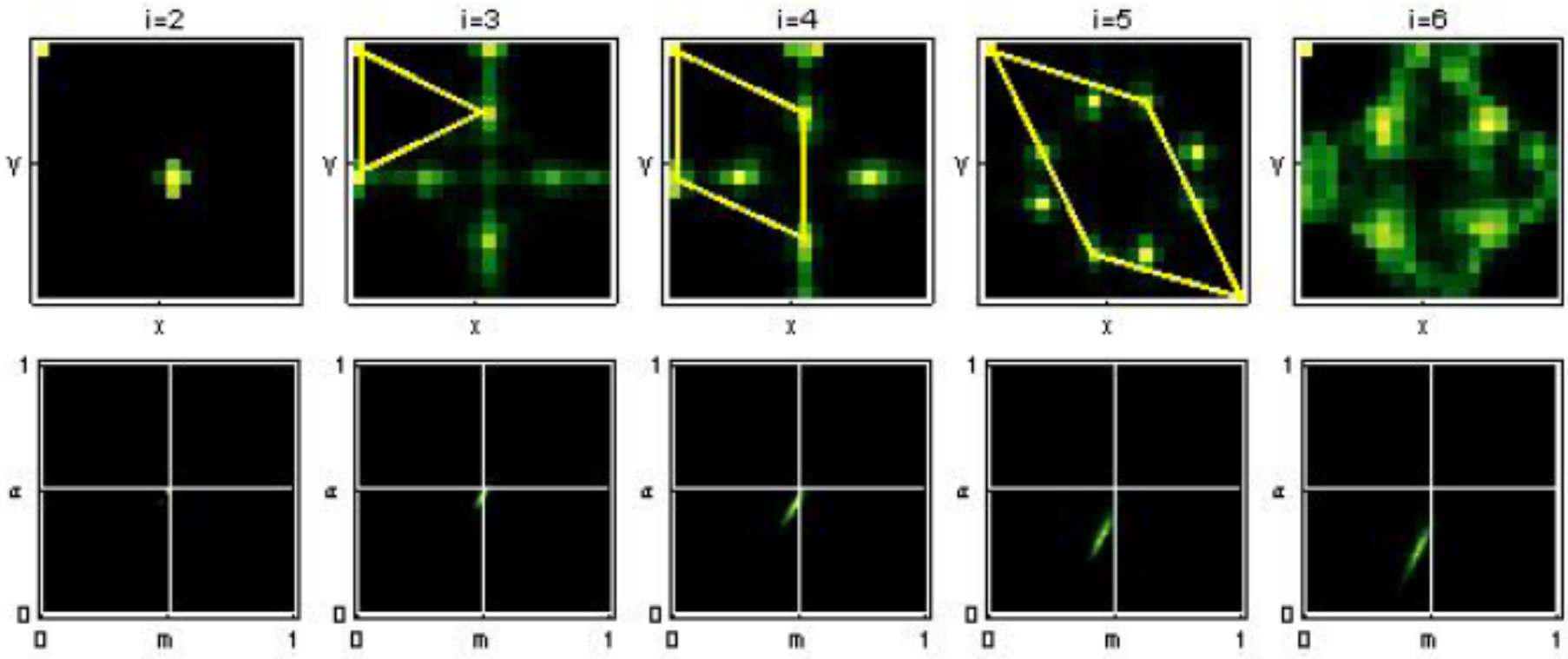
Unbounded space



n=7500

Simulation of price-location games

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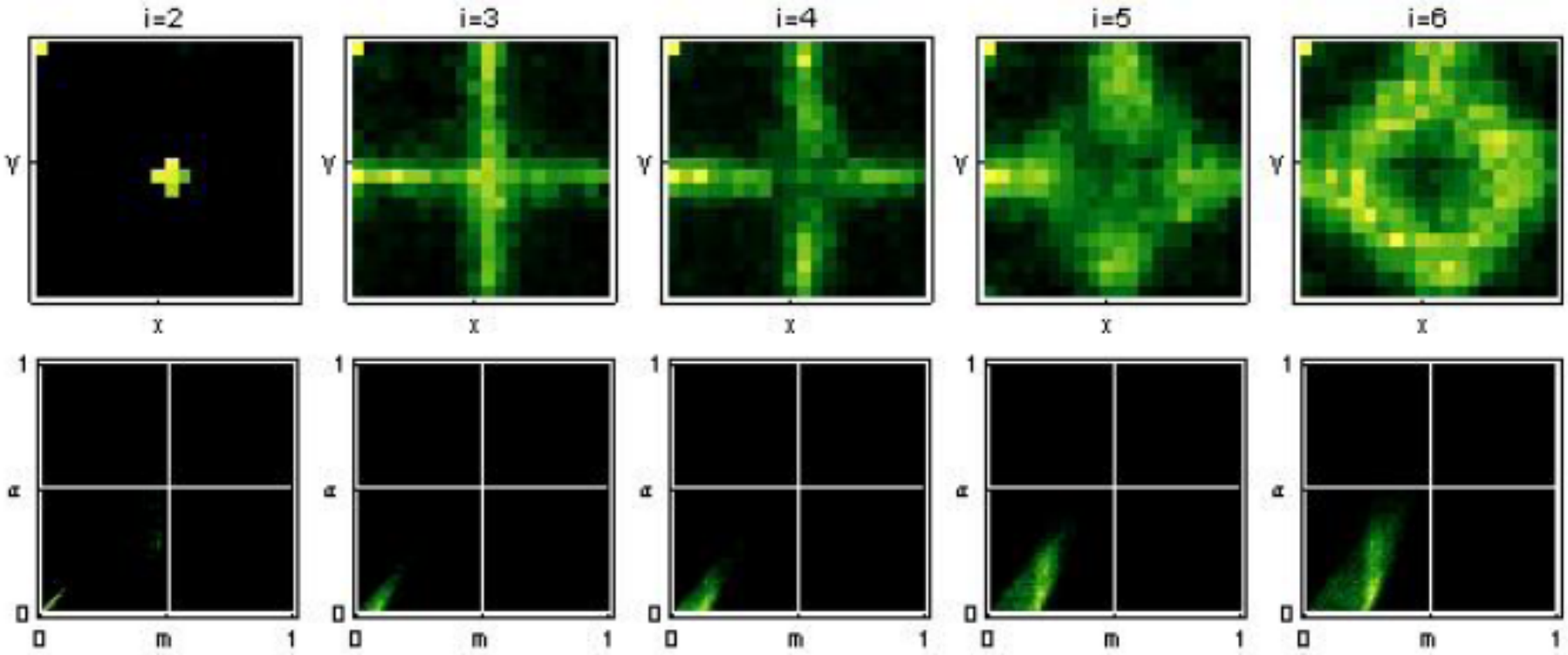
Perfectly inelastic supply



n = 7500

Results

Variable:	Simulation[a]			
	Duopsony	Oligopsony	Unbounded space	Inelastic supply
	transport costs	number of firms	number of firms	number of firms
m	▼	□	▼	▲
α	▲	□	▼	▲
β	▼	□	▲	▼
$\overline{d}$	▲	▼	▼	▼

[a] Du = duopsony, Ol = oligopsony, US = unbounded space, IS = (perfectly) inelastic supply, $\overline{d}$ = average distance between all processors, ▼ = decreasing, ▲ = increasing, □ = indeterminate

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Summary

- First investigation of both: location and pricing in terms of a non-cooperative game
- Simulation enables to consider
  - two-dimensional markets
  - multi-firm competition
  - elastic supply functions
- Results considerably differ from prior studies, e.g.:
  - Minimum differentiation with low price discrimination
  - Deviation from regular location patterns
  - differentiation with respect to location **and** price discrimination
- General relation between spatial price discrimination and spatial differentiation of firms locations hinges on the model's specification

Thank you!

Questions?

- Yes!
- No!
- Maybe?