JÜLICH
FORSCHUNGSZENTRUM

Urban Structure and Demographic Development

11th October 2008 Dr. Joachim Geske

Introduction

- Introduction
- Dynamic Urban Structure Equilibrium – DUSE
- Spatial structure of the steady state
- Transitional dynamics
- Infrastructure
- Conclusion

Byproduct of:

Project Infradem – Infrastructure and demographic development

Introduction

Objective:

- Improving macroeconomic analysis of demographic change by adding microeconomic structures

1. is there the willingness to consume a good, that is produced with capital financed by a macroeconomic savings plan?
2. will an age class have enough income to consume the way before?

Method:

1. Overlapping Generations Model (OLG)
2. Microeconomic structure
   - sectoral structure
   - spatial structure

   } Urban Structure Model (Muth, Mills)
   - …

→ Combination: **Dynamic Urban Structure Equilibrium (DUSE)**

Introduction

Applications:

impact of demographic and energy price change on

1. housing structure (capital per flat, flatsize)
2. spatial population density distribution:
    1. commuting distance
    2. infrastructure demand (not only grid!)

→ energy demand
→ energy system models

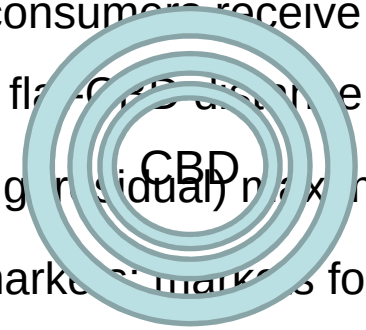
Research Program:

1. Prepare the static urban structure model to fit to spatial demographic data
   (4 german cities; folksy preferences; forthcoming with Claudia Nobis)
2. Combine the (demograpieless) static urban structure model
   and the OLG Model (DUSE, this paper)
3. Combine 1 + 2, Infrastructure supply, optimal dynamic infrastructure policy

Dynamic Urban Structure Equilibrium - DUSE

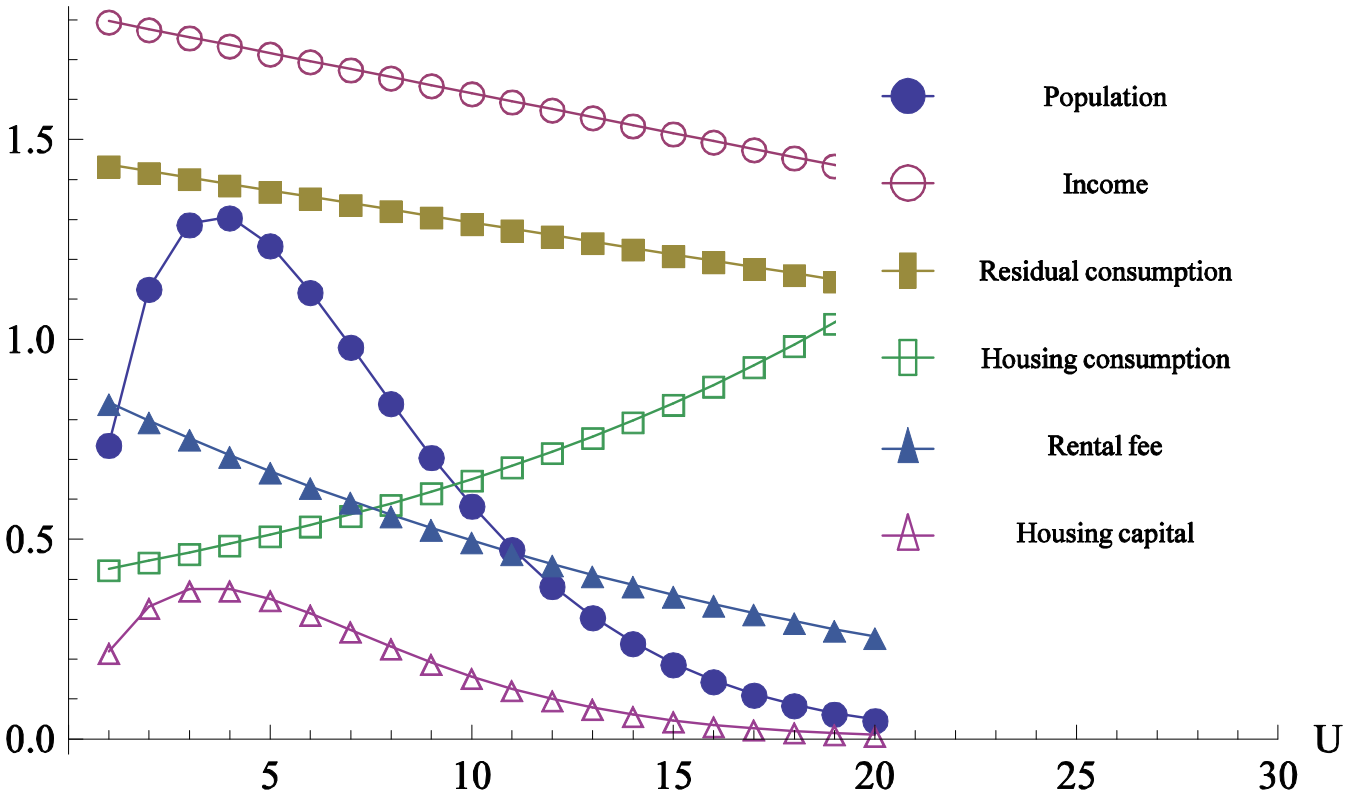
Model:

- cohort-representing agents maximise their lifetime utility s.t. their period budgets
- each cohort-representing agent consists of a continuum spatial differentiated consumers [n(u)]. They live on discrete rings u around a Central Business District and maximise their sub-utility U(cr,cw) s.t. w-tu = pr cr + pw cw
- No Movement Condition: consumers receive the same amount of utility independent of the of their fl[illegible]e
- producers (flats in each ring [illegible]idual) m[illegible]nise their profits,
- all markets clear (Factor marke[illegible] for goods).



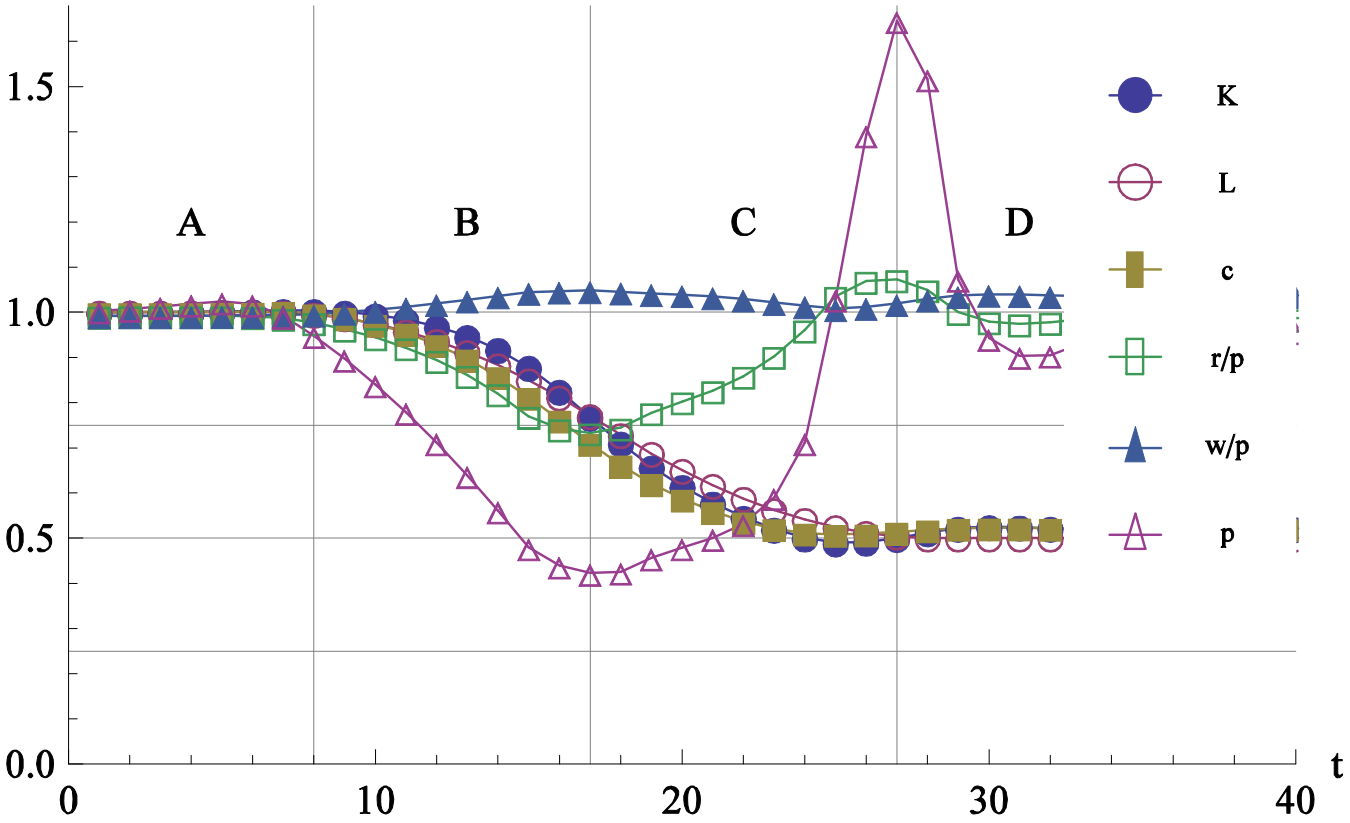
→ **D**ynamic **U**rban **S**tructure **E**quilibrium (**DUSE**)

Spatial structure of the Steady State



Transition Dynamics - population decline

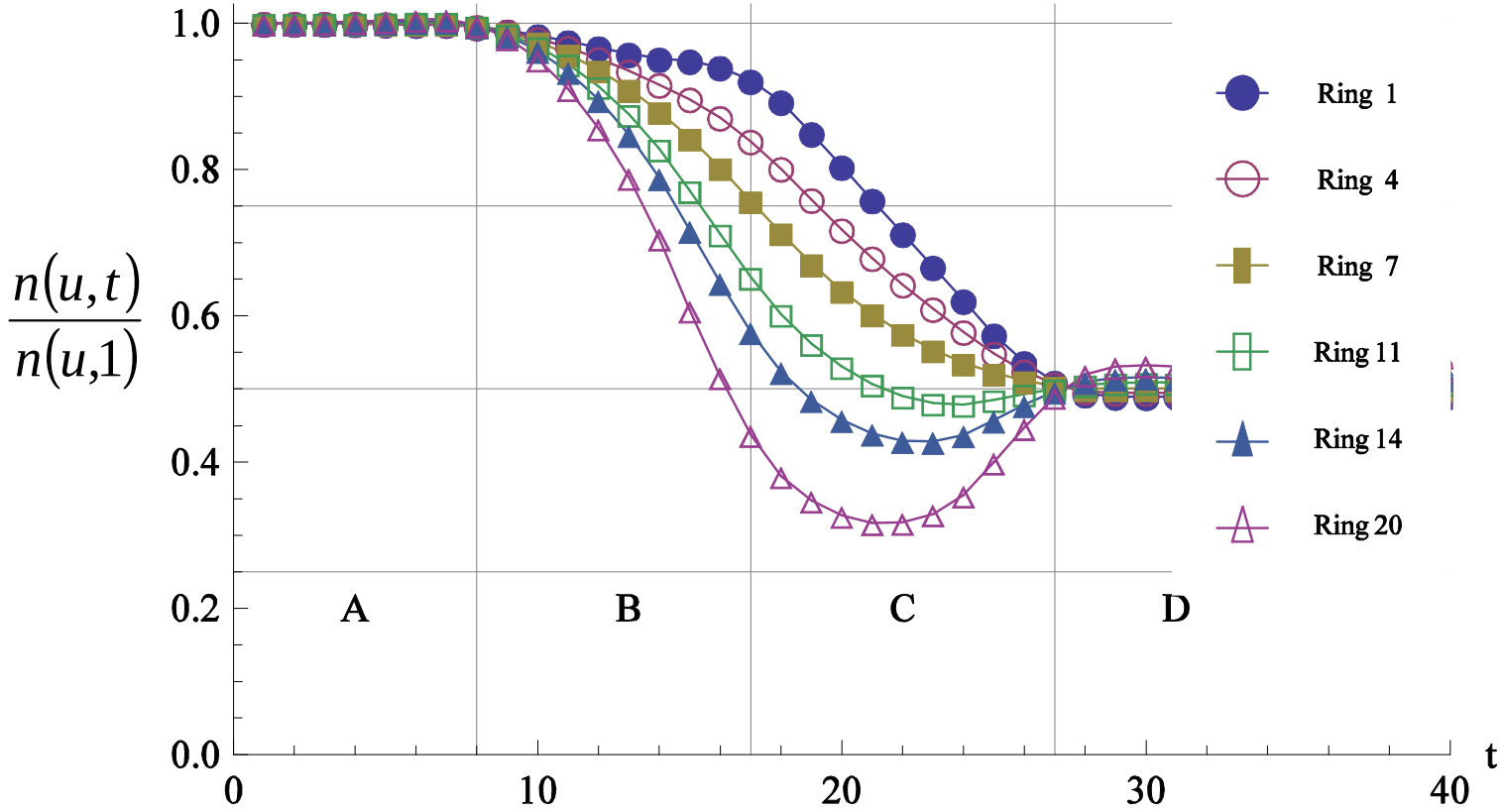
Development of key indicators relative to their initial value



Transition Dynamics - population decline

Development of spatial structure realtive to its initial value

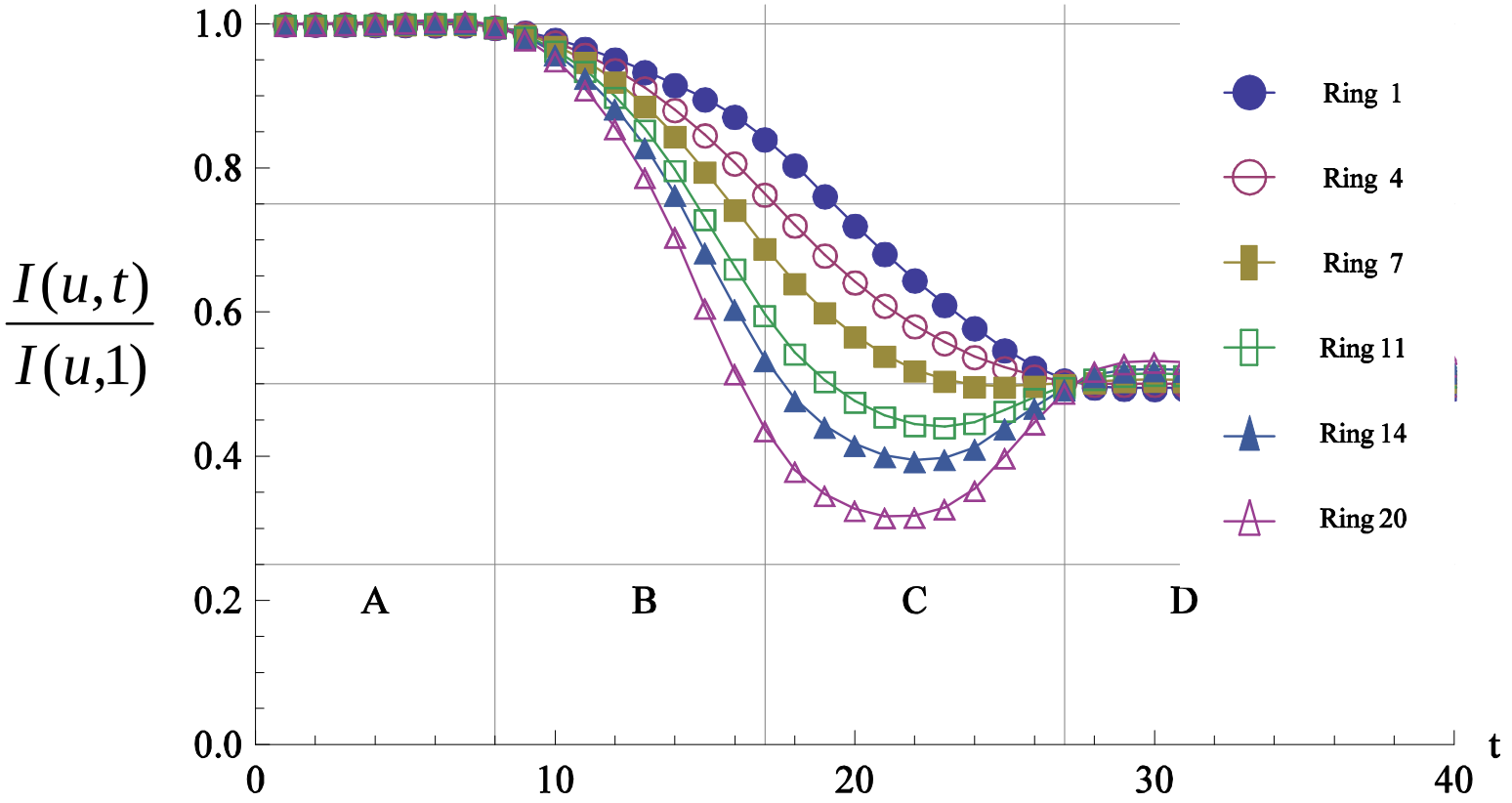
n(u,t) : Population in ring u, time t



Infrastructure - population decline

Development of road infrastructure demand $I(u,t) = \sum_{u^*=u+1}^{U} \frac{n(u^*,t)}{2\pi u^*}$

- other types of infrastructure derived from density possible



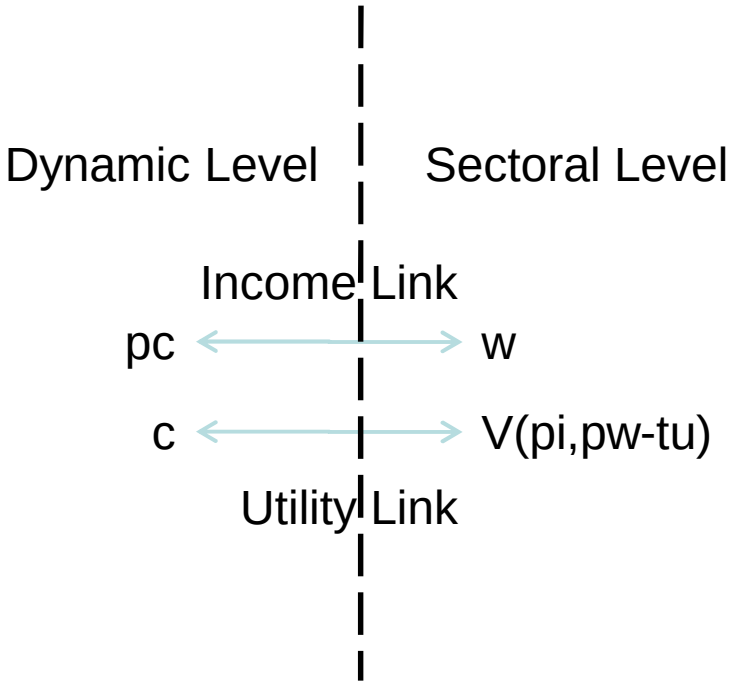
Conclusion

- Infrastructure demand developes with substantial spatial heterogeniety
- peripherial areas are more sensitive to demographic change and they show non monotonicity
- Requirements to infrastructure development: adaptability!

Thank you for your attention!

Dynamic Urban Structure Equilibrium - DUSE

Linking:



1. klassischer Utility Link:
$c = pc\ (p^c)^{\mu}\ (p^w)^{1-\mu}$
→ Preisgleichung : $1 = p\ (p^c)^{\mu}\ (p^w)^{1-\mu}$

2. Übertragung
$c\text{-}tu = (pc\text{-}ptu)\ (p^c)^{\mu}\ (p^w(u))^{1-\mu}$
→ $const = p^w(u)$

3. Lösung 1
Verzicht auf den Utility Link

4. Lösung 2
$c = (pc\text{-}tu)\ (p^c)^{\mu}\ (p^w(u))^{1-\mu}$
→ p