

**Forestry, Wildlife, and Fisheries Graduate Seminar**

**Market Equilibrium and Spatial Variability  
in the Value of Housing Attributes**

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**Introduction**

- Urban location theory
  - Alonso's (1964)
  - Rents diminish outward from the central of business district to offset both lower revenue and higher operating costs
- Criticism
  - Assumption that the value of housing attributes remains constant throughout an urban area.

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**Introduction (Contd.)**

- Market segmentation
  - Submarket
- Submarkets in equilibria
  - Minimized local variations in implicit prices of housing attributes by arbitrage

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## Literature Review

- Straszheim (1974)
  - First theory of distinctive submarkets
  - Market as a set of distinctive submarkets arising from structural and locational attributes
- Dunse and Jones (1998)
  - Submarket caused by preventing the adjustment of supply and demand
  - Least efficient property market

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## Motivation

- Lack of empirical attempt to test the stability of market equilibrium for housing attributes

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## Objective

- Empirical test the hypothesis that the market equilibrium for housing attributes are attained within distinctive submarket
- Investigate spatial variability in the values of housing attributes across submarkets

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## Empirical Model

- I. Submarket Identification
  - Two-step clustering
- II. Stability of market equilibria
  - Significance test for the spatial variability of parameter estimates of a hedonic housing price model
  - Monte Carlo procedure in a geographically weighted regression (GWR)

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## Empirical Model (Contd.)

- I. Submarket Identification
  - No universally accepted method of identifying the optimal number of housing submarkets
    - Bourassa et al. (1999), Bourassa, Hoesli, and Peng (2003), Goodman and Thibodeau (1998, 2003), Johnson (1982), Michaels and Smith (1990), and Schnare and Struyk (1976)
  - Two-step clustering
    - Without an *a priori* assumption about the initial number of clusters
    - Use continuous and categorical variables
    - Preferred to *k*-means clustering

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## Empirical Model (Contd.)

- Two-step clustering
  - First step
    - Cluster feature tree
      - Level, node
      - Entry: characterized by the mean and variance
    - Construct a likelihood function
    - Optimal number of clusters using Bayesian Information Criterion or AIC
  - Second step
    - Re-group by agglomerative hierarchical clustering
    - Structural, neighborhood, distance, and time

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## Empirical Model (Contd.)

### □ II. Hedonic Model in a GWR framework

$$\ln p_i = \sum_k \beta_k(u_i, v_i) x_{ik} + \varepsilon_i$$

- Bandwidth (Window size)
  - 25%, 50%, 75%, and 100% of observations
- Lagrange Multiplier (LM)
  - Test for spatial autocorrelation
- Monte Carlo procedure
  - Test for significance of spatial variability

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## Study Area and Data

- Knox County
  - Single family house 23,002 transactions (1998-2002)
- Data
  - Property parcel records from the Knoxville - Knox County - Knoxville Utilities Board (KUB) Geographic Information System (KGIS, 2006)
  - Data extracted from the 2000 US Census (GeoLytics, 2006)
  - Geographical information from the 2004 Environmental Systems Research Institute Maps and Data (ESRI, 2006)

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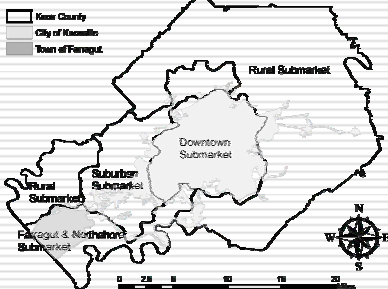
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## Study Area and Data (Contd.)



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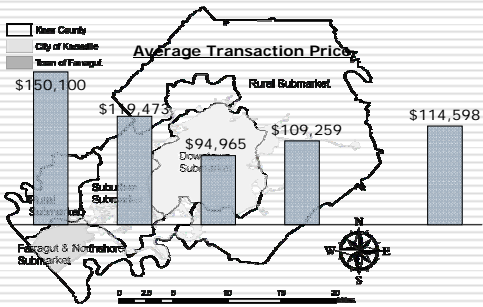
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### Study Area and Data (Contd.)



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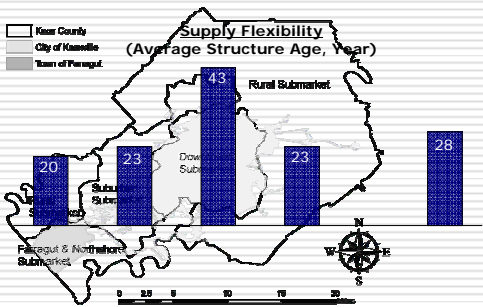
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### Study Area and Data (Contd.)



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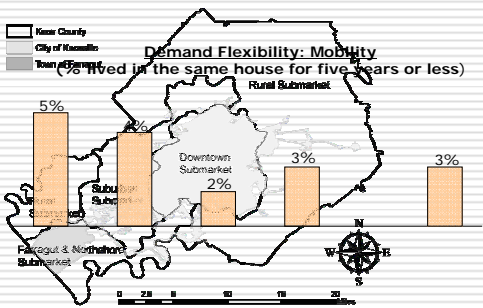
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### Study Area and Data (Contd.)



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## Empirical Results

- Likelihood-ratio (LR) test
  - Hypothesis that all parameters are equal among the four submarkets
  - Reject (LR=3757, df=120,  $p < 0.001$ )

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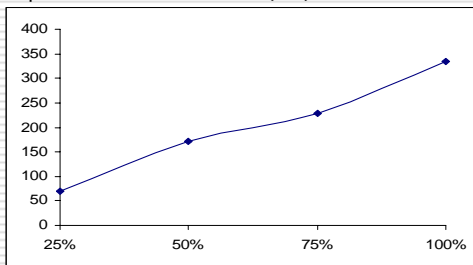
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## Empirical Results (Contd.)

- Spatial autocorrelation (LM)



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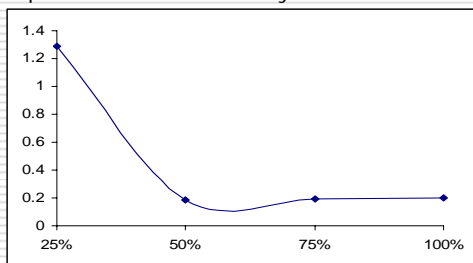
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## Empirical Results (Contd.)

- Spatial Heteroscedasticity



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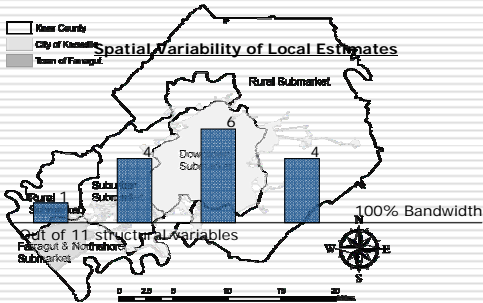
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## Empirical Results (Contd.)



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## Empirical Results (Contd.)

- Spatial Variability
  - Structural variables vs. neighborhood and distance variables
  - Time variables
    - Different degrees of supply flexibility

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## Conclusion

- Necessary conditions for market equilibria (Evans 1995)
  - Supply flexibility
  - Occupier mobility

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Any Question?

Thank you!!

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