New ideas and future research
Migration spatial structure

Colorado Conference on the Estimation of Migration
24 – 26 September 2004
Spatial interaction models

• Gravity model: distance function; cost function
• Entropy maximization
  – Maximize chaos; minimize structure
  – Minimize information content
• Log-linear model
  – Probability model based on probability theory
  – Statistical inference: maximum likelihood

Spatial interaction models

• Incomplete data
  – Prior information
    • Marginal totals
    • Preliminary estimates (guestimates)
  – Algorithms
    • Iterative proportional fitting; bi-proportional adjustment; RAS
  – Expectation-Maximization algorithm (EM)
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• Risk indicators: counts, probabilities, rates
• Generation and distribution component
  – Outmigration rate: $m_{i+}$
    • Transition rate models
  – OR: Probability of leaving region
  – Destination probability: $\xi_{ij}$ (direct transition; multiple destinations)
    • Logit models (multinomial) for each origin separately
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• Proportion: survivorship proportion $S_{kj}$
• $S_{kj}$ depends on covariate: region of birth
  – Native/non-Native

$$
\log \text{it}[S_{kj}] = \beta_{0kj} + \beta_{1kj} Y_k
$$

\(Y_k = 1\) if born in k

$$
\log \text{it}[S_{kj}] = \beta_{0j} + \beta_{1j} Y_1 + \beta_{2j} Y_2 + \beta_{3j} Y_3 +
\log \bar{S}_{kj}
\alpha_{kj}
\frac{i \bar{S}_{kj}}{k \bar{S}_{kj}}
\frac{\text{non-native}}{\text{native}}
\frac{\text{relative risk}}{i \alpha_{kj}}
\]
Migration spatial structure
Spatial interaction models

• Incomplete data: best use of prior information
  – Quantitative data
    • Historical migration patterns
    • Friction factors (e.g. cost, distance)
  – Qualitative data
    • Migration expectations (forecasting)
    • Expert opinions

• Bayesian modeling
Migration spatial structure
Spatial interaction models

• Basic research on spatial structure
  – What is structure?
    • A. Current spatial configuration (population distribution)
    • B. Spatial interaction: transaction, exchange, flow
  – How to model A and B?