Using LEHD Data In Excess Commuting and Jobs-Housing Studies: Concepts, Methods, and Examples

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Presentation Structure

1. Introduction to issues in commuting and jobs-housing balance
2. Review of important concepts and studies from selected literature
3. Examples of statistics, metrics, and applications

Interest in Commuting

- Why urban commuting?
  - Commuting leads to a fundamental activity (i.e., employment)
  - Although only 20-25% of total travel
    - It is during peak periods that cities' roadways most congested
    - Reducing commuting could help alleviate congestion
- How does land use affect commuting?
  - A 'geographic' question
  - Does the spatial arrangement of cities shape travel patterns?
  - Commute lengths are longer when places are more distant from one another

Excess Commuting and Jobs-Housing Balance

- Excess commuting is
  - a benchmarking approach (Hamilton 1982)
  - the difference between *observed commuting* and a *theoretical minimum commute* (White 1988)
    - assumes people commute to job locations such that system travel costs are minimized (Buliung and Kanaroglou 2002)
    - useful for assessing the degree of regional *jobs-housing* balance (Giuliano and Small 1993)
- Jobs-housing balance is
  - the *relative proximity* or accessibility of residences to workplace in a given area (Shen 2000)

The Transportation Problem for finding the 'Minimum' Commute

$$T_r = \sum_{i=1}^{n} \sum_{j=1}^{m} c_{ij} x_{ij}$$ *(minimize total commuting costs)*

Subject to

$$\sum_{i=1}^{n} x_{ij} = D_j$$ *(jobs in each zone must be filled)*

$$\sum_{j=1}^{m} x_{ij} = O_i$$ *(workers living in each zone depart)*

$$x_{ij} \geq 0$$ *(no negative zonal worktrip flows)*

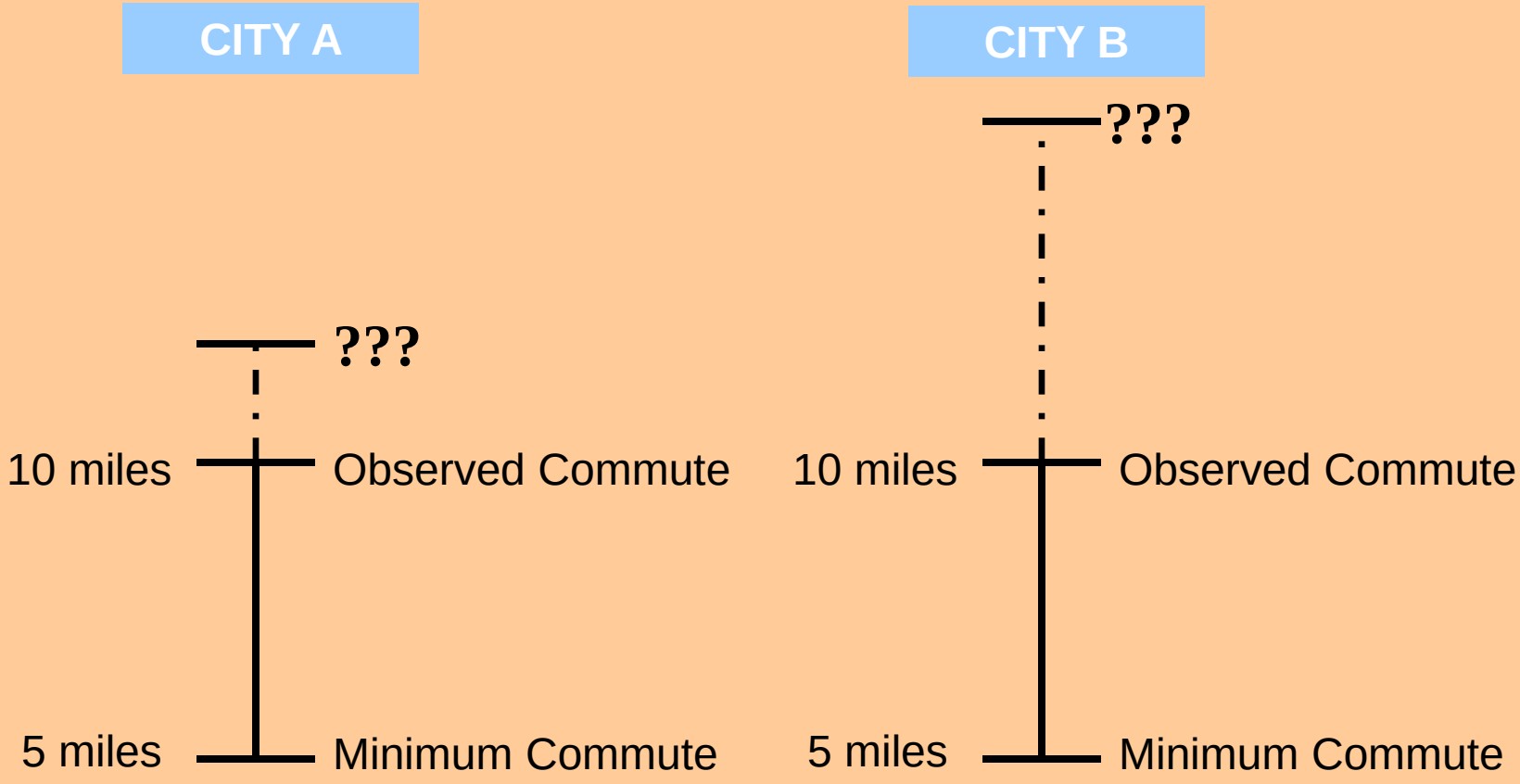
Where

T_r = Theoretical minimum journey to work commute
n = Number of origin TAZ locations
m = Number of destination TAZ locations
O_i = Number of workers living in zone i
D_j = Total employment in zone j
c_{ij} = Travel costs between zone i and zone j
x_{ij} = Journey to work trips from zone i to zone j

Introduction of a ‘Maximum’ Commute

- Integrate a ***maximum*** *commute* into excess commuting framework (Horner 2002)
  - Represents the most *inefficient* commuting scenario possible
  - Provides an upper bound on observed commuting
  - Extremes form a continuum
    - Analogies may be drawn with the concept of *carrying capacity*
  - Useful for comparative analysis

Why the Extremes Should be Considered:



Because we do not know how much commuting there actually *could be*.

Commuting Analysis for 26 Cities

Source: Horner (2002)

Findings

- Positive correlation found between theoretical minimum commute and observed commute (Horner 2002)
  - Minimum commute is rigorous indicator of jobs-housing balance (Giuliano and Small 1993)
  - Suggests ‘better’ jobs-housing balance could lead to reduced commuting (Horner 2002)
- Max. commute measures *polycentricity*

Theoretical Minimum Commute

- The *theoretical minimum commute* has emerged in the literature as a basic measure of jobs-housing balance (Layman and Horner 2010)
  - Predicated on the concept that the ‘quality’ of the optimality derived from reassigning workers to job-locations tells us something about urban structure
  - Quantified in ‘minutes’ or ‘miles’
  - In a comparative sense, lower theoretical minimum commutes mean greater jobs-housing balance

Trends towards policy-related analyes

- Literature reviews in Ma and Banister (2006), Charron (2007), Layman and Horner (2010)
- Increasing body of research discussing how excess commuting metrics can be used in more policy-oriented situations
  - Merriman et al. (1995)
  - Scott et al (1997)
  - Frost et al. (1998)
  - Horner and Murray (2003)
  - Yang (2008)
  - Horner (2007, 2009)
  - Murphy (2009)
  - Loo and Chow (2011)
  - Etc.

Residential and Job Locations (2000 CTPP)

Zooming in: How metrics help understand local change

- Source: Horner (2007)

Beyond Aggregate: Intraurban Analysis

- Extending to compare aggregate statistics at an interurban level (min, max, obs)
  - Analyze commute issues *within* urban areas
- Can compute simple jobs housing ratios
- Can compute each zone's min, obs, or max average commute (Horner 2007)
  - Can look at out-commutes (from residences)
  - Can look at in-commutes (incoming to employment centers)

Commute Metrics

Are These A Jobs-Housing Metric?

- Many commonly used measures are overly simplistic
  - simple ratio method of J/H ignores regional context
    - Myopic; measures assume zones do not interact with region
  - Buffering approaches/catchment areas are arbitrary
- May be appropriate to view average in and out commutes as proxies for jobs-housing balance (or accessibility)
  - e.g. minimum avg. out-commutes as a proxy for JHB

Past Challenges: Comparing ‘90 and ‘00 data

- Underlying difficulties in making intraurban comparisons that depend on matching spatial units
  - Number of spatial units increased from 1990 to 2000
  - Extents of MSAs widened to include more counties
  - Challenge is when spatial units compared across time
- Solution:

Conversion Example

Other Proposed Metrics

- Idea of ‘maximum commute’ sparked debate:
  - Is the maximum an appropriate upper bound on the observed commute?
- Other proposed approaches
  - Proportionally Matched Commute (Yang and Ferreira 2008)
  - Random Commute (Charron 2007; Murphy 2009)

Scale Issues?

- Input data are typically some form of zonation
  - e.g. census tracts, TAZs, etc.
- Past research has documented issues with respect to scale and unit definition (Modifiable Areal Unit Problem - MAUP)
  - e.g. Small and Song 1992, Giuliano and Small 1993, Horner and Murray 2002

Scale Figure

LEHD Data

- LODES
  - Commute flows of workers - census block scale
- Available for multiple years
- Can get counts of workers/jobs by zones
- Flows can be disaggregated by selected attributes (income, age, etc.)

Potential Interest

- Highly spatially disaggregate data
- Available for multiple places, times
  - Comparative studies of transportation, land use relations may be possible
- Flexibility to define study boundaries
  - Ability to look more at the ‘closed region’ issue
  - What are the consequences of choosing a particular boundary?

Example: Sedgwick County (KS)

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Summary

- Growing literature that looks at the relations between land use and transportation
  - Complimentary to individual level studies
  - Focus on commuting ‘outcomes’
- LEHD data could be increasingly used in this area

Thank You

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