Commuting, Migration, and Local Employment Elasticities

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**Introduction**

- Many changes in the economic environment are local  
  - Climate, infrastructure, innovations, institutions, regulations
- The effect of these changes depends crucially on the ability of labor to move in response: **The elasticity of local employment**
- Two main sources for employment changes: Commuting and migration  
  - Workers spend 8% of their work-day commuting  
    - Seek balance between residential amenities, cost of living and wage
- We propose a quantitative spatial GE theory with goods trade that incorporates these two channels  
  - study the response of local outcomes to local shocks
**Introduction**

- We discipline our quantitative model to match
  - Gravity in goods trade
  - Gravity in commuting flows
  - Distribution of employment, residents and wages across counties

- The quantitative importance of these two channels varies across counties depending on their local characteristics
  - Leads to significant heterogeneity in the employment elasticity
  - Locations are not independent spatial units as often assumed in cross-section regressions
  - Underscores general equilibrium effects

- Affects the estimated effects of most local policies and shocks and their external validity
  - Heterogeneity is well accounted for by commuting links

- Provide empirical evidence for the importance of commuting
  - Shift-share analysis, Million Dollar Plants, China Shock

**Key Mechanisms**

- Productivity differences and home market effects
  - Forces for the concentration of economic activity

- Inelastic housing supply and heterogeneous preferences
  - Forces for the dispersion of economic activity

- Commuting allows workers to access high productivity locations without having to live there
  - Effectively reduces the congestion effect in high productivity areas

- Elasticity of employment with respect to local shocks (e.g. productivity, amenities, infrastructure) depends on
  - Ability to attract migrants
  - Ability to attract commuters from surrounding locations
The Extent of Commuting
- Counties become more open over time

![Graph showing the extent of commuting over time]

- Commuting links are sizeable and heterogeneous

<table>
<thead>
<tr>
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<th>Min</th>
<th>p5</th>
<th>p10</th>
<th>p25</th>
<th>p50</th>
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<tbody>
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<td>0.00</td>
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<td>1.00</td>
<td>1.01</td>
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<td>0.15</td>
<td>0.25</td>
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<td>CZ Employment/Residents</td>
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<td>0.91</td>
<td>0.97</td>
<td>1.00</td>
<td>1.01</td>
<td>1.03</td>
<td>1.04</td>
<td>1.12</td>
<td>0.98</td>
</tr>
</tbody>
</table>

Tabulations on 3,111 counties and 709 CZ after eliminating business trips (trips longer than 120km).

Related Literature

- Quantitative international trade literature on costly trade in goods
  - Eaton and Kortum (2002) and extensions

- Economic geography literature on goods trade and factor mobility

- Urban literature on costly trade in people (commuting)

- Local labor markets literature
Preferences and Amenities

- Utility of an agent $\omega$ that lives in $n$ and works in $i$ is

$$U_{ni\omega} = \frac{b_{ni\omega}}{\kappa_{ni}} \left( \frac{C_{n\omega}}{\alpha} \right)^\alpha \left( \frac{H_{n\omega}}{1 - \alpha} \right)^{1 - \alpha}$$

where $C_{n\omega}$ is the CES consumption basket with elasticity of substitution $\sigma$, and $H_{n\omega}$ housing consumption
- Utility cost of commuting are given $\kappa_{ni}$
- Amenities, $b_{ni\omega}$, drawn i.i.d. from Fréchet distribution

$$G_{ni}(b) = e^{-B_{ni} b^{-e}}, \quad B_{ni} > 0, e > 1$$

Production

- Horizontally differentiated varieties sold under monopolistic competition
- Labor required to produce $x_i(j)$ units of output in $i$ is

$$l_i(j) = F + \frac{x_i(j)}{A_i}$$

- Prices at $n$ are given by

$$p_{ni}(j) = \left( \frac{\sigma}{\sigma - 1} \right) \frac{d_{ni} w_i}{A_i},$$

where $d_{ni} \geq 1$ denotes iceberg transport costs between $i$ and $n$
- Constant equilibrium output $x_i(j) = A_i F (\sigma - 1)$ implies

$$M_i = \frac{L_{Mi}}{\sigma F}$$
Land Market

- There is an inelastic supply of land at $H_n$
- Price of land $Q_n$ determined from land market clearing
  
  \[ H_n Q_n = (1 - \alpha) v_n L_{Rn}, \]
  
  where $v_n$ is expected income of residents at $n$ and $L_{Rn}$ is the total number of residents

  - Resulting price of land correlates well with house prices in the data

- Land owned by landlords, who receive income from residents’ expenditure on land, and consume goods where they live
  
  - Total expenditure on goods is the sum of expenditures by residents and landlords
  
  \[ P_n C_n = \alpha v_n L_{Rn} + (1 - \alpha) v_n L_{Rn} = v_n L_{Rn} \]

Trade in Goods

- Denote by $L_{Mi}$ the number of workers at $i$
- Then, as in many trade frameworks, expenditure shares are given by

  \[ \pi_{ni} = \frac{L_{Mi} (d_{ni} w_i / A_i)^{1-\sigma}}{\sum_{k \in N} L_{Mk} (d_{nk} w_k / A_k)^{1-\sigma}} \]

- And so the price of the consumption basket at $n$ is given by

  \[ P_n = \frac{\sigma}{\sigma - 1} \left( \frac{L_{Mn}}{\sigma F \pi_{nn}} \right)^{\frac{1}{1-\sigma}} \frac{w_n}{A_n} \]
Work-Residence Decision

- The indirect utility of an agent $\omega$ that lives in $n$ and works in $i$ is
  
  $$U_{ni\omega} = \frac{b_{ni\omega}w_i}{\kappa_{ni}P_n^\alpha Q_n^{1-\alpha}}$$

  which is drawn from

  $$G_{ni}(u) = e^{-\Psi_{ni}u^{-\epsilon}}, \text{ with } \Psi_{ni} = B_{ni}(\kappa_{ni}P_n^\alpha Q_n^{1-\alpha})^{-\epsilon} w_i^\epsilon$$

- So the unconditional probability that a worker chooses to live in region $n$ and work in location $i$ is
  
  $$\lambda_{ni} = \frac{B_{ni}(\kappa_{ni}P_n^\alpha Q_n^{1-\alpha})^{-\epsilon} w_i^\epsilon}{\sum_{r \in N} \sum_{s \in N} B_{rs}(\kappa_{rs}P_r^\alpha Q_r^{1-\alpha})^{-\epsilon} w_s^\epsilon}$$

- Free mobility implies that $\bar{U} = E[U_{ni\omega}]$ for all $ni$

Commuting

- Conditional probability that worker commutes to location $i$ conditional on living in location $n$ is
  
  $$\lambda_{ni|n} = \frac{B_{ni}(w_i / \kappa_{ni})^\epsilon}{\sum_{s \in N} B_{ns}(w_s / \kappa_{ns})^\epsilon}$$

- So labor market clearing implies that
  
  $$L_{Mi} = \sum_{n \in N} \lambda_{ni|n} L_{Rn}$$

- Expected residential income is then
  
  $$v_n = \sum_{i \in N} \lambda_{ni|n} w_i$$
General Equilibrium

- The general equilibrium is a vector of prices \( \{w_n, v_n, Q_n, P_n\} \) and allocations \( \{\pi_{ni}, \lambda_{ni}\} \) such that
  - Earnings equals expenditures (trade balance), \( w_i L_{Mi} = \sum_{n \in N} \pi_{ni} v_n L_{Rn} \)
  - Land markets clear
  - Agents move freely and labor markets clear, \( \bar{L} = \sum_{i \in N} L_{Mi} = \sum_{n \in N} L_{Rn} \)

- We formulate an isomorphic model using Armington or EK with external economies of scale, migration and commuting

- We provide sufficient conditions for equilibrium uniqueness and existence

Data for Calibration

- Commodity Flow Survey (CFS)
  - Bilateral trade between 123 CFS regions
  - Bilateral distance shipped

- American Community Survey (ACS)
  - Commuting probabilities between counties

- Bureau of Economic Analysis
  - Employment by workplace county
  - Wages by workplace county

- GIS data
  - County maps

- Parameters
  - Share of expenditure on consumption goods, \( \alpha = 0.6 \) (Davis and Ortalo-Magne, 2011)
  - Elasticity of substitution, \( \sigma = 4 \) (Bernard et al., 2003)
County Bilateral Trade and Productivities

- Model is quantified for counties, but trade observed for CFS regions
- County trade balance implies

\[ w_i L_{Mi} = \sum_{n \in N} \tau_{ni} v_n L_{Rn} = \sum_{n \in N} \frac{L_{Mi}}{\sum_{k \in N} L_{Mk}} \left( \frac{d_{ni} w_i}{d_{nk} w_k} \right)^{1-\sigma} A_i^{\sigma-1} A_k^{-1} v_n L_{Rn}. \]

- We observe (or can compute) \( \{ w_i, L_{Mi}, L_{Ri}, \tau_{ni} \} \)
- Let \( d_{ni}^{1-\sigma} = (\text{distance}_{ni})^{-1.29} \), then we can solve uniquely for productivities, \( A_i \)
- Obtain predicted county bilateral trade flows, \( \tau_{ni} \)
- Aggregate to CFS level and compare with actual trade shares

Gravity in Goods Trade Across CFS Regions

- Slope: -1.29 (after removing origin and destination fixed-effects)
County Commuting Probabilities and Amenities

- Bilateral commuting probabilities are:

\[ \lambda_{ni} = \frac{B_{ni} \left( \kappa_{ni} P_n^\alpha Q_n^{1-\alpha} \right)^{-\epsilon} w_i^\epsilon}{\sum_{r \in N} \sum_{s \in N} B_{rs} \left( \kappa_{rs} P_r^\alpha Q_r^{1-\alpha} \right)^{-\epsilon} w_s^\epsilon}, \]

- We observe (or have solved for) \( \{ w_i, L_{Mi}, L_{Ri}, v_i, \pi_{ii}, A_i \} \) and so can calculate \( Q_n \) and \( P_n \).
- Use \( \kappa_{ni} = \) distance\(_{ni}^\phi \), find \( \phi \epsilon = 4.43 \), we can solve for the unique matrix of amenities \( B_{ni} \).
Gravity in Commuting Flows

- Slope: -4.43 (after removing origin and destination fixed-effects)

![Graph showing the relationship between log commuting flows and log distance. The dashed line represents the linear fit with a slope of -4.43.]

Separating $\phi$ and $\epsilon$

- Can rewrite the bilateral commuting probability in logs as
  \[
  \log \lambda_{ni} = -\log \left( \sum_{r \in N} \sum_{s \in N} B_{rs} (\kappa_{rs} P_r^\alpha Q_r^{1-\alpha})^{-\epsilon} w_i^\epsilon - \epsilon \log P_n^\alpha Q_n^{1-\alpha} \right)_{\text{constant}} - \epsilon \phi \log \text{dist}_{ni} + \epsilon \log w_i + \log u_{ni}
  \]

- To estimate $\epsilon$
  - Impose $\epsilon \phi = 4.43$
  - Instrument log $w_i$ with log $A_i$
    - F-stat from first stage: 822.1
  - We find $\epsilon = 3.30$ and $\phi = 1.34$
Quantitative Analysis

1 Shock to productivity of individual counties
   - We find substantial heterogeneity of local employment elasticity
   - Due in large part to commuting

2 The importance of commuting for local labor market outcomes
   - Shift-Share analysis
   - Million-Dollar plants
   - China Shock

3 Counterfactual exercises
   - Reduction in commuting costs
   - Shutting down commuting
   - Reducing trade costs in a world with or without commuting

Local Labor Demand Shocks

- Large empirical literature on local labor demand shocks
- “Differences-in-differences” specification across locations $i$ and time $t$

$$\Delta \ln Y_{it} = a_0 + a_1 I_{it} + a_2 X_{it} + u_{it}$$

$Y_{it}$ is outcome of interest and $I_{it}$ is demand shock (treatment), $X_{it}$ are controls and $u_{it}$ is a stochastic error

- Potential econometric concerns
  - Finding exogenous shocks to labor demand
  - Measuring the shock to local labor demand (interpreting $a_1$)
  - Heterogeneous treatment effects
  - Spatial linkages between counties and general equilibrium effects

- To what extent are heterogeneous treatment effects, spatial linkages and general equilibrium effects a concern?
- What if anything can be done to address these concerns?
Elasticity of Local Employment to Productivity

5% productivity shocks

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Local Employment Elasticities

Elasticity of Employment to Productivity

Eliminating bottom and top 0.5%; gray area: 95% bootstrapped CI

New Haven (CT)

d\ln L_A/dA: 1.47
Elasticity of Local Employment to Productivity
5% productivity shocks

Elasticity of Employment to Productivity
Eliminating bottom and top 0.5%; gray area: 95% boostrapped CI

Monte, Redding, Rossi-Hansberg
Local Employment Elasticities

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Local Employment vs. Resident Elasticity to Productivity

5% productivity shocks

Elasticity of Employment and Residents to Productivity

Density

Elasticity of Employment and Residents to Productivity

Employment
Residents

Eliminating bottom and top 0.5%; gray area: 95% bootstrapped CI

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Local Employment Elasticities
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Local Employment vs. Resident Elasticity to Productivity

5% productivity shocks

Elasticity of Employment and Residents to Productivity

Density

Arlington (VA)

\[ \frac{d\ln L}{dA} : 2.35 \]

\[ \lambda_{\text{emp}} : .310 \]

Eliminating bottom and top 0.5%; gray area: 95% bootstrapped CI

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Local Employment Elasticities
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Local Employment vs. Resident Elasticity to Productivity

5% productivity shocks

S. Diego (CA)
\( \frac{d \ln L}{d \lambda} \): 0.63
\( \lambda_{\text{res}} \): .996

Arlington (VA)
\( \frac{d \ln L}{d \lambda} \): 2.35
\( \lambda_{\text{res}} \): .310

New Haven (CT)
\( \frac{d \ln L}{d \lambda} \): 1.47
\( \lambda_{\text{res}} \): .746

Eliminating bottom and top 0.5%; gray area: 95% bootstrapped CI

Monte, Redding, Rossi-Hansberg

Local Employment Elasticities

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Explaining The Elasticity of Employment

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Elasticity of Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \log L_i )</td>
<td>-0.003 (0.014) 0.009 (0.012) -0.054** (0.006) 0.037** (0.004) 0.033** (0.004)</td>
</tr>
<tr>
<td>( \log w_i )</td>
<td>-0.201** (0.015) -0.158** (0.012) -0.054** (0.006) -0.263** (0.004)</td>
</tr>
<tr>
<td>( \log T_i )</td>
<td>-0.054** (0.015) -0.172** (0.012) 0.003 (0.009) 0.009 (0.009)</td>
</tr>
<tr>
<td>( \log L_{i-1} )</td>
<td>0.118** (0.017) 0.027** (0.009) 0.027** (0.009)</td>
</tr>
<tr>
<td>( \log w_{i-1} )</td>
<td>0.204* (0.083) 0.163** (0.037) 0.207** (0.038)</td>
</tr>
<tr>
<td>( \lambda^0_{ij} )</td>
<td>-2.047** (0.042)</td>
</tr>
<tr>
<td>( \sum_{n \neq j} (1 - \lambda_{n,i}) \phi_{w,i} )</td>
<td>2.784** (0.192) 2.559** (0.178)</td>
</tr>
<tr>
<td>( \phi_i \left( \frac{1}{\lambda_i} - \lambda_i \right) )</td>
<td>0.915** (0.210) 0.605** (0.175)</td>
</tr>
<tr>
<td>( \frac{\partial}{\partial A_i} \sum_{n \neq j} (1 - \lambda_{n,i}) \phi_{m,n} )</td>
<td>-1.009** (0.123) -0.825** (0.150)</td>
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<tr>
<td>( \frac{\partial}{\partial A_i} \phi_i \left( \frac{1}{\lambda_i} - \lambda_i \right) )</td>
<td>1.038** (0.090) 1.100** (0.091)</td>
</tr>
<tr>
<td>Constant</td>
<td>1.515** (0.034) 1.545** (0.158) 5.683** (0.632) 1.245 (0.797) 2.975** (0.022) 0.840** (0.201) 1.553** (0.087) 1.861** (0.404) 2.064** (0.352)</td>
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<td>( R^2 )</td>
<td>0.90 0.90 0.90 0.90</td>
</tr>
<tr>
<td>( N )</td>
<td>3,111 3,111 3,111 3,081 3,111 3,111 3,081 3,081</td>
</tr>
</tbody>
</table>

Standard errors are clustered by state. * p-value ≤ 0.05; ** p-value ≤ 0.01.

### Deviation in Diff-in-Diff Estimates

- We estimate
  \[
  \Delta \ln L_{Mi} = a_0 + a_1 I_i + a_2 X_i + a_3 (I_i \times X_i) + u_i
  \]

- Using different comparison sets of “control counties”
  - Closest county, random county, neighbors, non neighbors, all counties

- Using two sets of controls
  - Reduced-form controls: land, employment, residents, workplace wages, employment and wages in neighboring areas
  - Model-suggested controls: partial equilibrium elasticities for commuting, migration, and goods market linkages

- Compute the deviation as
  \[
  \hat{\beta}_i = \frac{(a_1 + a_3 X_i)}{dA_i} - \frac{dL_{Mi}}{dA_i L_{Mi}}
  \]
Distribution of Deviations in Diff-in-Diff Estimates

Using “closest county” and “all observations” control groups

![Graph showing distribution of deviations](image)

Eliminating bottom and top 0.5%; M.S.: model-suggested controls; R.F.: reduced-form controls

Other Control Groups

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Commuting Role in Accounting for Employment Variability

Time-series analysis: variation w.r.t. employment in 1990

- Let \( \Delta^{T} L_{it} = L_{i2007} - L_{i1990} \); then,

\[
\Delta^{T} L_{it} = \left( \lambda_{ii|it}^{R} \Delta^{T} R_{it} \right)_{(i) \text{ own residents}} + \left( R_{it-1}^{\Delta^{T}} \lambda_{ii|it}^{R} \right)_{(ii) \text{ own commuting shares}} + \sum_{n \neq i} \lambda_{ni|nt}^{R} \Delta^{T} R_{nt} + \sum_{n \neq i} R_{nt-1}^{\Delta^{T}} \lambda_{ni|nt}^{R} \left( \begin{array}{l}
(iii) \text{ other residents} \\
(iv) \text{ other commuting shares}
\end{array} \right)
\]

<table>
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<tr>
<th>1990 to 2006-10</th>
<th>(i) Changes Own Residents, Constant Commuting</th>
<th>(ii) Changes Own Commuting, Constant Own Residents</th>
<th>(iii) Changes Other Residents, Constant Other Commuting</th>
<th>(iv) Changes Other Commuting, Constant Other Residents</th>
<th>Sum (i)-(iv)</th>
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<td>10th percentile</td>
<td>17.2</td>
<td>2.2</td>
<td>3.1</td>
<td>1.8</td>
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<tr>
<td>25th percentile</td>
<td>33.7</td>
<td>6.3</td>
<td>7.3</td>
<td>5.9</td>
<td>-</td>
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<tr>
<td>50th percentile</td>
<td>50.0</td>
<td>16.0</td>
<td>12.3</td>
<td>13.1</td>
<td>-</td>
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<tr>
<td>75th percentile</td>
<td>66.0</td>
<td>30.4</td>
<td>18.6</td>
<td>22.8</td>
<td>-</td>
</tr>
<tr>
<td>90th percentile</td>
<td>80.2</td>
<td>46.3</td>
<td>26.8</td>
<td>34.1</td>
<td>-</td>
</tr>
<tr>
<td>Mean</td>
<td>49.7</td>
<td>20.4</td>
<td>14.0</td>
<td>15.8</td>
<td>100</td>
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The Role of Commuting in Local Labor Demand Shocks

- Announcements of Million Dollar Plants (MDP)
  - Compare winning county where new firm locates to runner-up counties
- 82 MDP announcements from Greenstone and Moretti (2004)
  - GHM(2010) use subset of 47 MDP openings in (confidential) Census data
- We generalize GHM(2010) with commuting interactions

\[
\ln L_{it} = \kappa I_{jt} + \theta (I_{jt} \cdot W_i) + \beta (I_{jt} \cdot \lambda_{rij}^R) + \gamma (I_{jt} \cdot W_i \cdot \lambda_{rij}^R) + \\
+ \alpha_i + \eta_j + \mu_t + \epsilon_{it}
\]

- \(i\): counties; \(j\): cases; \(t\): calendar year; \(\tau\): treatment year index;
- \(L_{it}\): employment in county \(i\), \(t\) years after announcement;
- \(I_{jt}\): indicator for case \(j\) starting in treatment year;
- \(W_i\): indicator for winner county;
- \(\lambda_{rij}^R\): residence own-commuting share in 1990 (experiment with more);
- \(\alpha_i, \eta_j, \mu_t\): counties, cases, calendar years fixed effects.

Validation:
- Balance Table
- Event Study

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1_{jt} \times W_i)</td>
<td>(\theta)</td>
<td>0.067**</td>
<td>0.250***</td>
<td>0.191***</td>
<td>0.244***</td>
<td>0.260***</td>
<td>0.223***</td>
<td>0.160***</td>
<td>0.159***</td>
</tr>
<tr>
<td>(1_{jt} \times W_i \times \lambda_{rij}^R)</td>
<td>(\gamma)</td>
<td>-0.242**</td>
<td>(0.096)</td>
<td>-0.219**</td>
<td>(0.096)</td>
<td>-0.190**</td>
<td>(0.077)</td>
<td>-0.195**</td>
<td>(0.066)</td>
</tr>
<tr>
<td>(1_{jt} \times W_i \times \lambda_{rij}^MRL)</td>
<td>(\gamma)</td>
<td>-0.241***</td>
<td>(0.088)</td>
<td>-0.281**</td>
<td>(0.110)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(1_{jt} \times \lambda_{rij}^R)</td>
<td>(\beta)</td>
<td>0.012</td>
<td>(0.135)</td>
<td>-0.048</td>
<td>(0.108)</td>
<td>-0.203***</td>
<td>(0.075)</td>
<td>-0.213**</td>
<td>(0.082)</td>
</tr>
<tr>
<td>(1_{jt} \times \lambda_{rij}^MRL)</td>
<td>(\beta)</td>
<td>0.243*</td>
<td>(0.129)</td>
<td>0.124</td>
<td>(0.160)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1_{jt} \times \lambda_{rij}^{L&amp;MRL})</td>
<td>(\beta)</td>
<td>0.133</td>
<td>(0.145)</td>
<td>0.107</td>
<td>(0.086)</td>
<td>0.160**</td>
<td>(0.066)</td>
<td>0.159**</td>
<td>(0.066)</td>
</tr>
<tr>
<td>(1_{jt})</td>
<td>(\kappa)</td>
<td>-0.015*</td>
<td>-0.024</td>
<td>-0.200**</td>
<td>-0.113</td>
<td>-0.113</td>
<td>0.021</td>
<td>0.160**</td>
<td>0.159**</td>
</tr>
</tbody>
</table>

County observations are weighted by population at the beginning of the sample period. Standard errors are clustered by state. * p-value ≤ 0.1; ** p-value ≤ 0.05; *** p-value ≤ 0.01.
Changes in Commuting Costs

- We use observed commuting flows to back out implied values of 
  $B_{ni} = B_{nj}k_{ni}^{-\varepsilon}$, using

  $$\tilde{B}_{ni} = \left( \frac{B_{ni}B_{in}}{B_{nn}B_{ii}} \right)^{1/2} = \left( \frac{L_{ni}L_{in}}{L_{nn}L_{ii}} \right)^{1/2}$$

- Compute this measure for both 1990 and 2007
  - We find a reduction in commuting costs of 4% at the 25th percentile, 12% at the median, and 21% at the 75 percentile

- Associated welfare changes:

<table>
<thead>
<tr>
<th>Change in Commuting Costs</th>
<th>Decrease by p75</th>
<th>Decrease by p50</th>
<th>Decrease by p25</th>
<th>Increase by p50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welfare Change</td>
<td>-21%</td>
<td>-12%</td>
<td>-4%</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>6.89%</td>
<td>3.26%</td>
<td>0.89%</td>
<td>-2.33%</td>
</tr>
</tbody>
</table>

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Changes in Commuting Costs

- Employment response of reductions in commuting cost by median change between 1990 and 2007

![Graph showing the percentage change in employment and the employment/residents ratio.](image-url)
More Exercises

- Shutting down commuting between counties
  - Large effects on the spatial distribution of economic activities
    - Areas using the commuting technology more intensively lose attractiveness
  - The welfare cost is 7.2%

- Reducing trade costs in a world with or without commuting
  - Commuting and trade are
    - complements in terms of employment
    - substitutes in terms of real income

Conclusions

- Study changes in local employment in response to local shocks
  - To do so we introduced migration and commuting into a spatial GE model

- Found that local employment elasticities are very heterogenous
  - Puts into question the external validity of empirical estimates of any single local employment elasticity

- Heterogeneity in commuting patterns important in generating the heterogeneity in employment elasticities
  - The model suggests simple controls to recover such heterogeneity
  - Underscores the importance of GE effects
  - Commuting links are empirically very important

- Emphasize the role of commuting to determine
  - the spatial distribution of economic activity
  - the consequences of reduction in trade costs