LOCAL SALES TAX, CROSS-BORDER SHOPPING, and TRAVEL COST

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Disclaimers
The views and opinions expressed herein are those of the author and do not necessarily represent the views of the Nebraska Department of Revenue. All errors and omissions are my own.
Background

• Cross-border shopping (CBS) is a well known phenomenon

• Previous studies found significant effects of CBS on demand, but focused on specific areas

However,

• It can occur everywhere

• Travel cost (i.e. driving time) is a crucial factor in deciding to engage in cross-border shopping
Nebraska: Land of Opportunity

- Cities levy local sales taxes,
- Counties **do not** exercise local sales tax options

- **Point To point Travel cost** between cities
Goal and Strategy

• Estimating the magnitude of CBS effect in response to a travel cost

1. Finding evidences of CBS
   – Constructing a demand function, in which separating impacts of state and local sales taxes

2. Evaluating the impact of CBS in terms of a travel cost
   – Explicitly incorporating traveling cost into the demand function
Data

• 44 mid-sized cities in Nebraska except Omaha and Lincoln
• Quarterly Data over 1994:1 to 2014:4

• Dependent Variables
  – Net taxable sales by city as demand

• Independent Variables
  – Changes in state sales tax rates: 3 times
  – Changes in local sales tax rates: 66 times
  – Price Index from CPI
  – Driving time between a home city and a neighboring city

• Control variables
  – Per capita Income
  – Unemployment rate
  – Population
  – The number of filing
Simple Demand Function

• Demand Function $x(p, \tau^{s}, \tau^{l})$
  - $\ln x_{jt} = a_{j} + \beta \ln(1 + \tau^{t^{s}}) + \theta c \beta \ln (1 + \tau^{jt^{l}}) + \gamma \ln p_{t}^{l} + \delta x_{jt}^{l} + \varepsilon_{jt}$

• The null Hypothesis
  - Consumers do not have an incentives to cross a city border to shop when a local sales tax changes
  - $\theta c = \frac{\partial \ln x}{\partial \ln (1 + \tau^{l})} / \frac{\partial \ln x}{\partial \ln (1 + \tau^{s})} = \varepsilon_{l^{x}}, 1 + \tau^{l} / \varepsilon_{l^{x}}, 1 + \tau^{s} = 1$

• Estimation
  - $AR(4)$ with GLS: $\varepsilon_{jt} = \rho \varepsilon_{jt} - 4 + u_{jt}$
## Effect of Sales Taxes on the Demand of Taxable Goods

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Regional Trend</th>
<th>Demographic Changes</th>
<th>Business Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln(1+State sales tax)</td>
<td>-1.969**</td>
<td>-1.688**</td>
<td>-1.724**</td>
<td>-1.689**</td>
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<tr>
<td></td>
<td>(0.765)</td>
<td>(0.761)</td>
<td>(0.769)</td>
<td>(0.765)</td>
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<tr>
<td>Ln(1+Local sales taxes)</td>
<td>-4.490***</td>
<td>-4.421***</td>
<td>-4.394***</td>
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<tr>
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<td>(0.667)</td>
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<tr>
<td>The Effect of Cross-border Shopping</td>
<td>-2.521</td>
<td>-2.733</td>
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<td>-2.527</td>
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<tr>
<td>Ln(Price)</td>
<td>-0.0438***</td>
<td>-0.528***</td>
<td>-0.395**</td>
<td>-0.103</td>
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<tr>
<td>Ln(Population)</td>
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<td></td>
<td>0.325***</td>
<td>0.528***</td>
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<tr>
<td>Ln(Filing)</td>
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<td></td>
<td>0.203***</td>
<td>0.231***</td>
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<tr>
<td>Ln(Per Capita Income)</td>
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<td></td>
<td>0.273***</td>
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</tr>
<tr>
<td>Ln(Unemployment)</td>
<td></td>
<td></td>
<td>-</td>
<td>-0.051***</td>
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<tr>
<td>( \rho ) (4)</td>
<td>1.002</td>
<td>0.931</td>
<td>0.896</td>
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<td>Wald Test</td>
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<tr>
<td>Adjusted R(^2)</td>
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<td>0.994</td>
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<td>Observations</td>
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<td>3,520</td>
<td>3,520</td>
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</tbody>
</table>
Travel Cost Function

• Demand function
  
  \[ \ln x_{jt} = \alpha + \beta \ln (1 + \tau_{jt}s) + g(d, D_{jt}) \ln (1 + \tau_{jt}l) + \gamma p_{jt} + \delta X_{jt} + \epsilon_{jt} \]

• Travel Distance Function

  \[ g(d, D_{jt}) = d_0 + d_1 D_{jt} + d_2 D_{jt}^2 \]
  
  \[ g^\prime = (d, D_{jt}) > 0 \text{ and } g^\prime = (d, D_{jt}) < 0; \]

• Estimating Equation: AR(4) with GLS

  \[ \ln x_{jt} = \alpha + \beta \ln (1 + \tau_{jt}s) + d_0 \ln (1 + \tau_{jt}l) + d_1 D_{jt} \ln (1 + \tau_{jt}l) + d_2 D_{jt}^2 \ln (1 + \tau_{jt}l) + \gamma p_{jt} + \delta X_{jt} + \epsilon_{jt}. \]
### Effect of Sales Tax on the Demand

<table>
<thead>
<tr>
<th>Term</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Ln(1+Local sales taxes)</td>
<td>-7.588***</td>
<td>(2.282)</td>
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<tr>
<td>Ln(1+Local sales taxes)*Travel cost</td>
<td>0.181**</td>
<td>(0.076)</td>
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<tr>
<td>Ln(1+Local sales taxes)*travel cost$^2$</td>
<td>-0.002***</td>
<td>(0.000)</td>
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<tr>
<td>Ln(1+State sales tax)</td>
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<td>Ln(Price)</td>
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<tr>
<td>Ln(Population)</td>
<td>0.524***</td>
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<tr>
<td>Ln(Filing)</td>
<td>0.235***</td>
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<tr>
<td>Ln(Per Capita Income)</td>
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<tr>
<td>Ln(Unemployment)</td>
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<tr>
<td>$\rho$ (4)</td>
<td>0.825</td>
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<tr>
<td>Wald Test</td>
<td>0.002</td>
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<td>Adjusted $R^2$</td>
<td>0.994</td>
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<td></td>
</tr>
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</table>
What Happen When Local Sales Tax Increase 1%

The elasticity of a state sales tax

The elasticity of a local sales tax
The Case of County Sales Tax

Panel A. City-County Rate

Panel B. Weighted Rate
• Findings: *The elasticity of cross-border shopping*
  – 4.81% *at the border*
  – 1.87% *when a city is 20 minutes away*
  – *No incentive when a city is 53 minutes away*

• Contributions
  – General understanding about Cross-border Shopping
  – A guideline for local policy makers

• Limitations and Future Study
  – The impact of Internet Sales
  – The impact of firm’s behavior
  – The case of a large discrete change
Questions?

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The Paper is posting on SSRN
Previous Work: Unaccomplished Mission

\[ S_{it} = A_i Y_{it}^{a} P_{It}^{b} C_{it}^{c} \]

\[ P_{It} = P_{it} \frac{(1 + T_{it})}{P_{at} (1 + T_{at})} \]
\[ = \frac{(1 + T_{it})}{(1 + T_{at})} \]

\[ \ln S_{it} = \ln A + a \ln Y_{it} + b \ln (1 + T_{it}) \]
\[ + c \ln C_{it} + u_{it} \]