Analysis of Firm Location and Relocation Around Maryland and Washington, DC Metro Rail Stations

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Introduction

- Washington DC Metropolitan Region continues to grow.
  - Population: 6.6 million in 2010 ➔ 8.8 million in 2040
  - Households: 2.5 million in 2010 ➔ 3.4 million in 2040
  - Employment: 3.9 million in 2010 ➔ 5.6 million in 2040
  - Metropolitan Washington Council of Governments (MWCOG) Round 8.3 Cooperative Forecasting

- Many challenges associated with this growth:
  - accessibility, sustainability, prosperity, and livability
  - Economic development, environment, housing, transportation, and social equity

- The Greater Washington 2050 Coalition
  - Established in 2008 to address these challenges in a collaborative manner involving many stakeholders
  - Identification of regional activity centers: many include rail transit stations
Introduction

• Transit Oriented Development (TOD) as a catalyst for:
  – Economic growth, economic development, and formation of employment centers
  – Sustainable land use patterns and travel behavior, integrating transportation and land use
  – Livability and pedestrian-friendly communities

• The objective of this paper:
  – Conduct an analysis of firm location data, using statistical, economic, and spatial analysis methods, to describe the distribution of firms
    (1) across the DC metro region
    (2) in relation to WMATA Metro stations
Outline

• Introduction
• Literature review of Transit-oriented Development (TOD)
• Three research questions
• Data and Methodology
• Analysis Results
• Summary Findings and future research agenda
Literature Review: Transit Oriented Development (TOD)

- Increasing accessibility through transit
- An increasing number of studies show TOD’s positive effects on property values
  - More on residential properties than commercial properties
- Effects on commercial properties up to 0.8 - 0.9 miles
- Mixed results in terms of firms/jobs densification effects
  - Little research by industry
  - A few studies show higher concentration of firms in professional, scientific and technical services, and the financial and investment industries.
  - A question about TOD’s net effects within a region
Three Research Questions

1. What industries, if any, are more likely to locate near transit stations?
2. What is the overall distribution of firms in relation to metro station locations?
3. Does a new transit station result in a net gain of firms within the station proximity and for the region or does it merely redistribute existing firms?
Data and Methodology

• The National Establishment Time Series (NETS) data
  – Based on Dun and Bradstreet’s data
  – Washington DC and Maryland datasets
  – Longitudinal and cross-sectional firm-level data from 1990 to 2010: location, employment, and sales
  – National American Industry Classification System (NAICS)
  – A total of 148,464 records for DC and 869,574 for Maryland
  – Firm-level relocation information: every firm move to, from, or within Washington, DC or Maryland – origins and destinations

• A caveat
  – Missing Virginia data due to limited resources
Study Area

- The Washington DC region comprising DC, Montgomery and Prince George’s Counties in MD.
- This area covers the 66 stations of Washington Metropolitan Area Transit Authority (WMATA) Metro service.
Data and Methodology

• Descriptive analysis using, statistical, economic, and spatial analysis methods

• Station buffers: a walking distance of 0.5 miles on the street network
  – 1) individual stations and 2) the aggregate
  – Substantial overlaps of buffers in downtown DC

• Firm relocation analysis
  (1) the aggregated station buffer
  (2) the MWCOG planning area
  (3) Maryland exclusive of (2)
  (4) outside MD and (2)
  – All industries, and
  – finance, insurance, and real estate (FIRE) industries
Analysis Results: Location Quotients for All Industries, for year 2010

- Firms with a high level of growth within station areas
- LQ higher than 1.00

LQ = \[
\frac{\left\{\frac{\text{(total # of jobs/firms)area}}{\text{(total # of jobs/firms)region}}\right\}}{\left\{\frac{\text{(total # of jobs/firms)area}}{\text{(total # of jobs/firms)region}}\right\}}
\]

: measures a industrial specialization in the station area relative to the study area

<table>
<thead>
<tr>
<th>Industry</th>
<th>FIRMS</th>
<th>LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>6</td>
<td>0.27</td>
</tr>
<tr>
<td>Agriculture</td>
<td>65</td>
<td>0.40</td>
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<tr>
<td>Mining</td>
<td>19</td>
<td>1.04</td>
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<td>Utilities</td>
<td>53</td>
<td>1.97</td>
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<tr>
<td>Construction</td>
<td>1,543</td>
<td>0.47</td>
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<tr>
<td>Manufacturing</td>
<td>217</td>
<td>1.03</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>317</td>
<td>1.04</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>338</td>
<td>0.73</td>
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<tr>
<td>Wholesale</td>
<td>898</td>
<td>0.73</td>
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<td>Retail</td>
<td>2,118</td>
<td>0.91</td>
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<tr>
<td>Retail</td>
<td>931</td>
<td>0.87</td>
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<tr>
<td>Transportation and Warehousing</td>
<td>370</td>
<td>0.48</td>
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<tr>
<td>Transportation and Warehousing</td>
<td>121</td>
<td>0.87</td>
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<tr>
<td>Information</td>
<td>1,630</td>
<td>1.23</td>
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<tr>
<td>Finance, Insurance, Real Estate</td>
<td>4,430</td>
<td>1.11</td>
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<tr>
<td>Rentals</td>
<td>160</td>
<td>0.79</td>
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<tr>
<td>Professional</td>
<td>12,980</td>
<td>1.34</td>
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<tr>
<td>Management of Companies</td>
<td>152</td>
<td>0.97</td>
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<tr>
<td>Admin/Waste Services</td>
<td>5,251</td>
<td>0.59</td>
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<tr>
<td>Educational</td>
<td>1,163</td>
<td>1.11</td>
</tr>
<tr>
<td>Healthcare</td>
<td>4,199</td>
<td>1.05</td>
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<tr>
<td>Arts and Entertainment</td>
<td>995</td>
<td>1.01</td>
</tr>
<tr>
<td>Accommodation and Food</td>
<td>1,694</td>
<td>1.47</td>
</tr>
<tr>
<td>Other Services (not public)</td>
<td>5,848</td>
<td>1.22</td>
</tr>
<tr>
<td>Public Admin</td>
<td>1,359</td>
<td>1.98</td>
</tr>
<tr>
<td>Unknown</td>
<td>116</td>
<td>1.70</td>
</tr>
</tbody>
</table>
Analysis Results:

(1) Industries with Strong Presence in Station Proximity

- All five industries show a greater propensity to locate within station areas
- Professional Services and Food & Accommodation show the greatest disparities

<table>
<thead>
<tr>
<th></th>
<th>Outside of Station LQ</th>
<th>Within Station Area LQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRE</td>
<td>0.94</td>
<td>0.97</td>
</tr>
<tr>
<td>Professional Services</td>
<td>0.87</td>
<td>0.86</td>
</tr>
<tr>
<td>Health Care</td>
<td>1.04</td>
<td>1.03</td>
</tr>
<tr>
<td>Arts and Entertainment</td>
<td>1.03</td>
<td>1.05</td>
</tr>
<tr>
<td>Food and Accommodation</td>
<td>0.91</td>
<td>0.91</td>
</tr>
<tr>
<td>FIRE</td>
<td>1.14</td>
<td>1.06</td>
</tr>
<tr>
<td>Professional Services</td>
<td>1.30</td>
<td>1.33</td>
</tr>
<tr>
<td>Health Care</td>
<td>1.00</td>
<td>0.98</td>
</tr>
<tr>
<td>Arts and Entertainment</td>
<td>0.94</td>
<td>0.88</td>
</tr>
<tr>
<td>Food and Accommodation</td>
<td>1.21</td>
<td>1.20</td>
</tr>
</tbody>
</table>
Analysis Results:
Industry Specific Firm Growth

a) Outside the Station Areas
   - Professional services shows consistent growth
   - All 5 industries show growth faster than within the station areas

b) Within the Station Areas
   - Professional services growth is more variable
   - FIRE firm growth of 59% is slower than outside the station areas (139%)
Analysis Results:
The Number of FIRE firms by Number of Employees

a) Outside the Station Areas
- Small firms (2 to 10) grew by 132%
- Sole proprietors grew by 426%
- Medium-sized (11 to 50) firms grew slowly in the later years

b) Within the Station Areas
- Large firm growth is relatively stagnant
- Small firms grew by 70%
Analysis Results: Location Quotients of the FIRE Industries in the WMATA Metro Station Areas in 2010

- LQs over 1.00 on all lines
- Concentration along the western Red Line
  - Bethesda, Friendship Heights, Twinbrook, White Flint.
- Low values (<0.70) also dispersed widely
  - Anacostia, Brookland, Waterfront, Forest Glen, Chevery, Greenbelt
- L’Enfant has lowest downtown LQ (0.81)
• The geographic mean of firm locations
  – Nearby Takoma station
  – Shifting to the north over years
  – South of the center of the study area ➔ dominance of downtown DC

• The geographic distribution of firm locations became slightly more dispersed over years
  – North-North-west direction
  – North-east direction
Hot Spots of Firm Distribution using Getis-Ord Gi* Z-scores

a) 1990

b) 2000
Hot Spots of Firm Distribution using Getis-Ord Gi* Z-scores

b) 2000

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c) 2010
Analysis Results:
Spatial-temporal Analysis of Firm Growth in the DC Region

a) Downtown DC
Analysis Results:
Spatial-temporal Analysis of Firm Growth in the DC Region

b) Bethesda

- Negative Growth
- Positive Growth

Map showing growth patterns in Bethesda area.
Analysis Results:
Spatial-temporal Analysis of Firm Growth in the DC Region
c) Largo Town Center
Analysis Results:
Spatial-temporal Analysis of Firm Growth in the DC Region

d) White Flint
Analysis Results:
(3) Firm Relocation

[ Net gain or loss of firms in the aggregated station buffer (SB) ]
= [ the number of firms moved from (X area) to SB ]
- [ the number of firms moved from SB to (X area) ]

- Gained firms from outside of DC/Maryland, but lost in all other areas in most cases
- Largest loss is to the MWCOG region
- Relocations represent a small fraction of total firms at any time
### Analysis Results: (3) Firm Relocation

#### Gained firms from outside of DC/Maryland, but lost in all other areas in most cases

#### Largest loss is to the MWCOG region

#### Relocations represent a small fraction of total firms at any time

<table>
<thead>
<tr>
<th>Industry</th>
<th>Relocations</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Industries</td>
<td>(-2277)</td>
</tr>
<tr>
<td>FIRE</td>
<td>(-85)</td>
</tr>
<tr>
<td>Professional Service</td>
<td>(-676)</td>
</tr>
<tr>
<td>Health Care &amp; Social Assistance</td>
<td>(-133)</td>
</tr>
<tr>
<td>Arts and Entertainment</td>
<td>(-48)</td>
</tr>
<tr>
<td>Accomodation &amp; Food Services</td>
<td>(-62)</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Accomodation &amp; Food Services (-62)</th>
<th>Arts and Entertainment (-48)</th>
<th>Health Care &amp; Social Assistance (-133)</th>
<th>Professional Service (-676)</th>
<th>FIRE (-85)</th>
<th>All Industries (-2277)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station</td>
<td>-7</td>
<td>-15</td>
<td>-27</td>
<td>25</td>
<td>-26</td>
</tr>
<tr>
<td>MWCOG</td>
<td>-46</td>
<td>-29</td>
<td>-109</td>
<td>-638</td>
<td>-78</td>
</tr>
<tr>
<td>MD</td>
<td>-4</td>
<td>-6</td>
<td>-3</td>
<td>-60</td>
<td>-25</td>
</tr>
<tr>
<td>External</td>
<td>-5</td>
<td>2</td>
<td>6</td>
<td>-3</td>
<td>44</td>
</tr>
</tbody>
</table>
Net Moves by Metro Station:
15 Net Loss Stations and 10 Net Gain Stations

The western portion of downtown DC

The eastern portion of downtown DC
Summary of Findings

1. What industries, if any, are more likely to locate near transit stations?
   - FIRE, Professional Services, Health Care, Arts and Entertainment, Food and Accommodation

2. What is the overall distribution of firms in relation to metro station locations?
   - Downtown DC retains the dominance.
   - In Montgomery County, high concentrations of firms can be found along Red Line – in particular, its western portion, which also has good access to I-270.
   - In Prince George County, high concentrations of firms can be found outside of the I-495 (Belt way) more than in the station proximity.
Summary of Findings

1. What industries, if any, are more likely to locate near transit stations?

2. What is the overall distribution of firms in relation to metro station locations?

3. Does a new transit station result in a net gain of firms within the station proximity and for the region or does it merely redistribute existing firms?
   - In terms of relocation, the station areas as a whole attract firms mostly from the outside of MD and DC, and lose them to other areas, especially for the MWCOG region. But need to consider births and deaths of firms.
Future Research Agenda

• The importance of effects of highway proximity
  – The relative importance of transit accessibility and highway accessibility may differ by industry and by jurisdiction.
• The distance of the effect of transit access
• The effects of station openings – time lag?
• How do incorporate spatial-temporal analysis?
• What agglomeration effects can possibly explain for attracting firms in the five industries?
Acknowledgement

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