Ecommerce & Environmental Justice in Metro Seattle

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A quote to start us off...

Discriminatory practices [do] not require evil people intentionally making biased decisions, just well-trained experts following conventional procedures...

~ Ed Soja, UCLA (2010)
Logistics landuse: then and now

In 2018, U.S. warehouses surpassed office buildings as the dominant commercial & industrial land use

Representing 18 billion sq ft in floor space

PHOTO: FreightWaves 2020
Last-mile delivery stations are too sprawling

After a major spike in central city LMDS in 2015, LMDS suburbanized at \textit{twice the rate} they urbanized

Last-mile delivery stations built after 2020 5.0 km more dispersed from population centers*

*Welch's t-test, \( p < 0.05 \)

Ongoing research: What does UDC equity look like for suburbs v. urban areas at a national scale?
Disparate siting of ecommerce UDCs

- Warehousing disproportionately located in POC-majority populations
- The trend was decades-long and one-way
- But did not analyze environmental impacts

Waddell et al. 2021
Freight and air pollution

Toronto, ON: diesel exhaust represents 55% of all NOx emissions equating to 9,810 years lost per year

Source: Minet et al 2020. Photo: Jiffy Lube 2021
Race and Discriminatory Placement of Environmentally Hazardous Land Uses

4. That no building shall be left with paper exposure or with the exterior incomplete.
5. That the said land or buildings thereon shall never be rented, leased or sold, transferred or conveyed to, nor shall same be occupied exclusively by person or persons other than of the Caucasian Race.
6. The foregoing covenant and restriction shall run with the land and shall bind the grantee herein and the heirs, executors, administrators, successors and assigns of said grantee.

Racial covenant (Minneapolis, 1940)

- Early 20th century: Some practices shielded White homeowners from “Black and ethnic encroachment” and early industrial development
- Industrial zoning concentrated in predominantly black & immigrant communities
- Path dependency locked-in many of these land use patterns into modern day
Landuse lock-in

Neighborhoods with century-old covenants still segregated today
Research Question

> What are the distributional impacts of e-commerce, and what does it mean for equity and environmental justice?
Measuring ecommerce emissions in Seattle

- **Data**
  - Amazon UDC locations and package volumes (MWPVL 2021)
  - Demographic data from U.S. Census, ACS 5-year
  - Logit-based delivery assignment based on PSRC travel survey data
  - OSM network analysis & approx. travelling salesperson (TSP) distance
Logit-based delivery assignment

> Package demand derived using race:income, age, household size, and municipality

High income white populations ordered 2x more than middle and low income non-white
Lower incomes, higher POC % correlated with UDC location and VKT*

*Pearson's R coeff., p < 0.05
POC-majority tracts exposed to 3x more ecommerce-related traffic concentrations despite ordering 50% less online than white populations.
VKT, Emissions and Race

- Cargo van emissions comprised a majority of emissions: 95% NOx, 97% PM2.5
- POC-majority populations were more exposed than white populations, regardless of income*
- Middle-mile trucks had higher emission impact for middle-income POC pops, cargo vans had higher emission impact for low-income POC pops *

*Dunn’s test, p < 0.05
Race, highways and UDC proximity are stronger predictors for e-commerce VKT than income and package demand*

*OLS linear regression, $p < 0.05$
Future research direction

> Theorizing “freight justice”
  > What are guiding distributive principles?
    When is unequal unfair?
  > Where (i.e., what scale) are injustices (un)resolved?
  > Who’s (un)involved in the negotiations of outcomes?

> Longitudinal analysis: how do historic logistic land uses correlate to shifting demographics and today’s uses?

> Evaluating equity in urban cyclelogistics and microhub projects
  > Pilot studies in Seattle and Gothenburg
  > Food justice & accessibility - grassroots cyclelogistics in the Global North and South
Thank you!

Questions? Email: tfried3@uw.edu
> Higher UDC intensity correlated with low incomes and high POC concentrations
> Middle-mile trucks an important pain-point
> POCs were more exposed to emissions than White populations, regardless of income and total packages ordered
> In line with past EJ research: racial makeup may affect disparate industrial siting more than socio-economic status. Also:

  – Opportunistic suburban municipalities encourage more UDC development, possibly exposing middle-class POCs
Vehicle utilization and sensitivity analysis

> Discrepancies between race-income groupings more sensitive to fluctuations in truck utilization
Implications for urban freight solutions

> Commonly proposed urban freight solutions seek to improve efficiency for last-mile deliveries in **dense urban centers**
> How would this address equity outcomes?
Considerations moving forward

Companies:

> Emphasize **up-chain** environmental mitigations
> Consider UDC **placement** -> human health impacts

Government:

> Provide guidance, best practices, coordination to municipalities
> Municipalities evaluate industrial land use/permits
> Consider localized environmental & economic effect
> UDC-targeted air quality regulations (SOCAL and NY introduced policies, 2022)

Advocates:

> Warehouse siting is an **environmental justice** issue
> Don’t forget about externalities for adjacent communities!
Logistics “Sprawl”

- Dablanc (2008): Warehouses leaving the inner city for the ‘burbs
- Conceptually rooted in urban sprawl and economics: firm polarization/dispersion
- Tons of reasons. To oversimplify: highways and land prices
- What’s the impact?

Resulting sprawl added 15,000 tons CO₂ per year

Paris, 1974-2008
“Can’t ecommerce coming to town be a good thing? What’s the trade-off?”

- **The Good:**
  - Lots of people benefit from online shopping
  - UDCs create some jobs
  - Some UDCs are replacing unproductive commercial landuse (e.g., abandoned shopping malls and car dealerships); property/utility tax benefit

- **The Bad:**
  - Warehouse jobs are low density. Often they displace jobs rather than net-create.
  - Most UDCs are greenfield since retrofitting commercial real estate is costly

- **The Ugly:**
  - Jobs are low quality: wages and benefit are low, worker protections are flimsy
  - UDCs are more automated, leaving workers vulnerable to negative automation effects
Logit model

<table>
<thead>
<tr>
<th>Daily package received (binary logit)</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td><strong>Model 1</strong></td>
</tr>
<tr>
<td><strong>Model 2</strong> (w/o interaction)</td>
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<tr>
<td><strong>Model 3</strong> (w/ interaction)</td>
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<td></td>
</tr>
<tr>
<td><strong>Variable</strong></td>
</tr>
<tr>
<td>intercept</td>
</tr>
<tr>
<td>age [25-54]</td>
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<tr>
<td>children [yes]</td>
</tr>
<tr>
<td>hh size</td>
</tr>
<tr>
<td>race [white]</td>
</tr>
<tr>
<td>income [mid]</td>
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<tr>
<td>income [high]</td>
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<tr>
<td>num. trips education [graduate degree]</td>
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<tr>
<td>education [HS or less] renter [yes]</td>
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<tr>
<td>lives in Seattle [yes] race [white]: income [mid]: race [white]: income [high]</td>
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<tr>
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## OLS Model

### OLS Linear Regression

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<th>Coef.</th>
<th>Std. e</th>
<th>Coef.</th>
<th>Std. e</th>
<th>Coef.</th>
<th>Std. e</th>
<th>Coef.</th>
<th>Std. e</th>
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<tbody>
<tr>
<td>Intercept</td>
<td>3.75*</td>
<td>1.98</td>
<td>2.83</td>
<td>2.39</td>
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<td>0.87</td>
<td>5.69***</td>
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<td>Log(POC)</td>
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<td>0.11</td>
<td>0.39***</td>
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<td>0.53***</td>
<td>0.05</td>
<td>0.19***</td>
<td>0.08</td>
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<td>Log(income)</td>
<td>-0.01</td>
<td>0.19</td>
<td>-0.08</td>
<td>0.23</td>
<td>-0.02</td>
<td>0.08</td>
<td>-0.33**</td>
<td>0.13</td>
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<tr>
<td>Log(pkg demand)</td>
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<td>0.14</td>
<td>0.34**</td>
<td>0.16</td>
<td>0.28***</td>
<td>0.06</td>
<td>-0.29***</td>
<td>0.10</td>
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<tr>
<td>Log(highway length/sakm)</td>
<td>0.82***</td>
<td>0.06</td>
<td>0.93***</td>
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<td>0.02</td>
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<td>Log(km from UDC)</td>
<td>-0.92***</td>
<td>0.09</td>
<td>-1.00***</td>
<td>0.11</td>
<td>-0.08</td>
<td>0.04</td>
<td>-0.28***</td>
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