What is Digital Freight Matching?

- DFM companies use web platforms to connect shippers with available trucking capacity
  - Think of Lyft for freight
- DFM replaces the traditional role of freight brokers
  - Real-time GPS tracking, instant proof of delivery, automated invoicing & payment…
What is Digital Freight Matching?

- There were 27 DFM startups as of 2016, including:
  - Cargomatic
  - Haulhound
  - Trucker Path
  - Load Express
  - Convoy
  - Haulme
  - uShip
  - Freight Rover
  - Uber
  - Transfix
  - FR8
  - Sleek Fleet

- Freight brokerage will generate $40 billion in 2017
  - DFM currently has a 5% market share ($35 billion)
Problem

Up to 50% of the shipments offered on DFM platforms are not accepted by carriers (i.e. not picked up)

Why should society care?

DFM usage could reduce truck traffic & pollution by:
- Reducing empty backhauls or “deadhead” trips
- Consolidating shipments and coordinating “milk runs”
Research Program

- Research Questions
  - What factors influence the probability that a given shipment will be accepted by a carrier?
  - How can greater usage be incentivized?
    - Rates paid to carriers?
    - Shipment timing?
Data & Methods

Data

- 125,723 individual shipments placed on DFM platforms from September 2015 through August 2017
- Only pallet shipments (<10,000 lbs.) are considered
- Highly confidential data from multiple DFM platforms serving two distinct urban markets
  - No summary statistics – sorry!
Data & Methods

- **Empirical Model**
  - **Dependent Variable:**
    - Whether or not a shipment was picked up by a carrier
  - **Independent Variables:**
    - Shipment weight & distance
    - Pickup & delivery timing characteristics
    - Payment offered per mile, ton, or ton-mile
Data & Methods

- Binary Logit Estimation Procedure
  - Estimates the probability that a shipment is picked up
  - Estimates how a change in one factor affects the probability that a shipment is picked up, holding all other factors constant

- This is a very preliminary analysis!
  - Please adjust your expectations accordingly
## Market A: Results

(n = 112,351)

<table>
<thead>
<tr>
<th>Delivery Time Variables</th>
<th>%-Point Effect</th>
<th>z-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup-By Time during Morning Peak Traffic (6a-9a)</td>
<td>13.2</td>
<td>29.8</td>
</tr>
<tr>
<td>Pickup-By Time during Evening Peak Traffic (3p-6p)</td>
<td>4.1</td>
<td>15.1</td>
</tr>
<tr>
<td>Deliver-By Time during Morning Peak Traffic (6a-9a)</td>
<td>-6.8</td>
<td>-5.6</td>
</tr>
<tr>
<td>Deliver-By Time during Evening Peak Traffic (3p-6p)</td>
<td>-3.2</td>
<td>-12.1</td>
</tr>
<tr>
<td>No Pickup Time Flexibility</td>
<td>-11.3</td>
<td>-23.0</td>
</tr>
<tr>
<td>Same-Day Delivery Required</td>
<td>-11.1</td>
<td>-10.9</td>
</tr>
<tr>
<td>Delivery Window (hours)</td>
<td>-0.0</td>
<td>-1.2</td>
</tr>
<tr>
<td>Pickup Window (hours)</td>
<td>-0.6</td>
<td>-11.0</td>
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## Market A: Results

\( n = 112,351 \)

<table>
<thead>
<tr>
<th>Pricing &amp; Shipment Variables</th>
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</thead>
<tbody>
<tr>
<td>Pay per Mile (Logarithm of $/mi.)</td>
<td>3.7</td>
<td>23.2</td>
</tr>
<tr>
<td>Pay per Pound (Logarithm of $/lb.)</td>
<td>2.9</td>
<td>22.3</td>
</tr>
<tr>
<td>Pay per Ton-Mile (Logarithm of $/tonmile)</td>
<td>2.4</td>
<td>22.3</td>
</tr>
<tr>
<td>Weight (tons)</td>
<td>5.4</td>
<td>24.5</td>
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<tr>
<td>Distance (miles)</td>
<td>0.2</td>
<td>26.2</td>
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<tr>
<td>Short-haul Move (&lt; 150 miles)</td>
<td>22.7</td>
<td>23.6</td>
</tr>
</tbody>
</table>
## Market B: Results

(n = 13,372)

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</thead>
<tbody>
<tr>
<td>Pickup-By Time during Morning Peak Traffic (6a-9a)</td>
<td>-16.6</td>
<td>-14.9</td>
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<tr>
<td>Pickup-By Time during Evening Peak Traffic (3p-6p)</td>
<td>9.6</td>
<td>3.9</td>
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<tr>
<td>Deliver-By Time during Morning Peak Traffic (6a-9a)</td>
<td>-38.5</td>
<td>-6.0</td>
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<tr>
<td>Deliver-By Time during Evening Peak Traffic (3p-6p)</td>
<td>-5.8</td>
<td>5.8</td>
</tr>
<tr>
<td>No Pickup Time Flexibility</td>
<td>-25.4</td>
<td>-16.9</td>
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<tr>
<td>Same-Day Delivery Required</td>
<td>-69.4</td>
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<tr>
<td>Delivery Window (hours)</td>
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<tr>
<td>Pickup Window (hours)</td>
<td>2.4</td>
<td>4.5</td>
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## Market B: Results

(n = 13,372)

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<tr>
<td>Pay per Ton-Mile (Logarithm of $/tonmile)</td>
<td>3.7</td>
<td>8.0</td>
</tr>
<tr>
<td>Weight (tons)</td>
<td>8.7</td>
<td>10.4</td>
</tr>
<tr>
<td>Distance (miles)</td>
<td>0.1</td>
<td>5.0</td>
</tr>
<tr>
<td>Short-haul Move (&lt; 150 miles)</td>
<td>46.8</td>
<td>33.0</td>
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</table>
Time of Day Effects

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Probability of Acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>5:00pm</td>
<td>Deliver</td>
</tr>
<tr>
<td>12:00pm</td>
<td>Pickup</td>
</tr>
</tbody>
</table>

- Deliver-By Time
- Pickup-By Time
Summary of Findings

- **Shipment Timing**
  - Shipments with rush-hour delivery deadlines are 3 to 39 \%\-points less likely to be picked up
  - Shipments with no pickup-time flexibility are 11 to 25 \%\-points less likely to be picked up
  - Shipments requiring same-day deliveries are 11 to 69 \%\-points less likely to be picked up
Summary of Findings

- Shipment Timing (continued)
  - Carriers prefer earlier pickup times
    - Longer pickup windows might improve pickup probabilities
  - Carriers prefer later delivery times
    - Longer delivery windows would have little effect
Summary of Findings

- Pricing
  - Each 1% increase in pay per mile improves pickup probabilities by 2.9 to 3.7 %-points
  - Each 1% increase in pay per ton improves pickup probabilities by 2.9 to 6.1 %-points
  - Each 1% increase in pay per ton-mile improves pickup probabilities by 2.4 to 3.7 %-points
Implications

- Peak-Period Pricing (c.f. “Surge Pricing”)
  - Higher pay is needed to incentivize acceptance of shipments delivered during rush-hour traffic

- Same-Day / Next-Day Pricing

- Pricing different degrees of pickup-time flexibility
  - e.g. a premium for narrow pickup windows
Going Forward

☐ Milk-Run Effects
  - How many shipments can be linked together?
  - How many shipments are available in delivery area?

☐ Shipper Adoption
  - How can more shippers be incentivized to use DFM services and technologies?
THANK YOU!  

QUESTIONS?