1 Introduction

2 Responsiveness

3 Taxes
Trucks have various types and functions.
You may ask...

- Why do we need differentiated taxes?
  - Reduced form estimation
- What are the optimally differentiated taxes?
  - General equilibrium model
- What’s the impact?
  - Welfare analysis compared to optimal uniform tax
Introduction

- Data: Vehicle Inventory and Use Survey (1982-2002), cross-sectional time-series
- Truck classification
  - Combination trucks vs. Vocational vehicles
  - Gross Vehicle Weight Ratings (GVWR)
  - Business sectors
- Two trucking decisions
  - Vehicle-miles-traveled (VMT)
  - Payload distance (PD)
- Diesel fuel
Responsiveness to fuel costs
Elasticities of VMT with respect to fuel costs

- Reduced-form specification
  \[ \ln(VMT_i) = f\{\ln(\text{per-mile fuel costs}_i), \text{truck characteristics}, \text{business features, state FE, year FE} \} \]
- Coefficient of \( \ln(\text{per-mile fuel costs}) \): elasticity
- Robust Std. Error: two-way clustering
- Heterogeneity: \( \ln(\text{per-mile fuel costs}) \times \text{group id.} \)
Identification

Per-mile fuel cost$_i$ = \( \frac{\text{Fuel price}_i}{\text{MPG}_m} \)

IV for fuel price:

- Average fuel prices in non-neighboring states
- Alt.: global crude oil prices
Heterogeneous elasticities of VMT w.r.t. per-mile fuel cost

- Heavier trucks are less responsive to fuel cost changes
  - The elasticities for combination trucks GVWR 8 is -0.22, while for GVWR 7 is -0.38.
- Trucks in Business and personal services are quite responsive.
- Trucks in mining or quarrying are the least responsive.
Optimal taxes
A general equilibrium model

Model:

- Household’s utility, s.t. budget constraint & time constraint
- Production: price = production cost + shipping cost
- Freight:
  - cost = fuel cost + operational cost
  - cost minimization, s.t. shipping demand (ton-mile)
- Externalities: traffic congestion, road damage, air & noise pollution, energy insecurity
- Government: tax revenue = road repair + lump-sum transfer

Marginal welfare effect = 0 ⇒ Optimal taxes
⇒ Total welfare effects
Optimal taxes
Combination trucks

- Introduction
- Responsiveness
- Taxes

Jen He (UMD)
USAEE/IAEE
October 26, 2016
Optimal taxes
Vocational vehicles
Welfare effects of differentiated taxes by GVWR
Baseline: optimal uniform fuel tax
Welfare effects of differentiated taxes by business sectors
Baseline: optimal uniform fuel tax
Now you know...

- Why do we need differentiated taxes?
  - Reduced form estimation
- What are the optimally differentiated taxes?
  - General equilibrium model
- What’s the impact?
  - Welfare analysis compared to optimal uniform tax
  - 17.5 billion dollars per annum if differentiated by weight class
  - 32.5 billion dollars per annum if differentiated by business sector
Thank You!
## GVWR classification

<table>
<thead>
<tr>
<th>GVWR Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class One:</strong> 0,000 lbs. or less</td>
<td>Full Size Pickup, Mini Pickup, Minivan, SUV, Utility Van</td>
</tr>
<tr>
<td><strong>Class Two:</strong> 6,001 to 10,000 lbs.</td>
<td>Crew Size Pickup, Full Size Pickup, Mini Bus, Minivan, Step Van, Utility Van</td>
</tr>
<tr>
<td><strong>Class Three:</strong> 10,001 to 14,000 lbs.</td>
<td>City Delivery, Mini Bus, Walk In</td>
</tr>
<tr>
<td><strong>Class Four:</strong> 14,001 to 16,000 lbs.</td>
<td>City Delivery, Conventional Van, Landscape Utility, Large Walk In</td>
</tr>
<tr>
<td><strong>Class Five:</strong> 16,001 to 19,500 lbs.</td>
<td>Bucket, City Delivery, Large Walk In</td>
</tr>
<tr>
<td><strong>Class Six:</strong> 19,501 to 26,000 lbs.</td>
<td>Beverage, Rack, School Bus, Grain Axle Van, Stake Beds</td>
</tr>
<tr>
<td><strong>Class Seven:</strong> 26,001 to 33,000 lbs.</td>
<td>City Transit Bus, Furniture, High Profile Semi, Home Fuel, Medium Semi Tractor, Refuse, Tow</td>
</tr>
<tr>
<td><strong>Class Eight:</strong> 33,001 lbs. &amp; over</td>
<td>Cement Mixer, Dump, Fire Trucks, Fuel, Heavy Semi Tractor, Refrigerated Van, Semi Sleeper, Tour Bus</td>
</tr>
</tbody>
</table>
## Distribution of business sectors

**Table:** Distribution of business sectors in 2002

<table>
<thead>
<tr>
<th>Business sector</th>
<th>Combination trucks (1)</th>
<th>Vocational vehicles (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture or forestry</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>Business and personal service</td>
<td>1%</td>
<td>8%</td>
</tr>
<tr>
<td>Construction</td>
<td>8%</td>
<td>26%</td>
</tr>
<tr>
<td>For-hire transportation</td>
<td>56%</td>
<td>12%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Mining or quarrying</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Rental or contractor</td>
<td>1%</td>
<td>4%</td>
</tr>
<tr>
<td>Retail and wholesale trade</td>
<td>10%</td>
<td>18%</td>
</tr>
<tr>
<td>Other</td>
<td>5%</td>
<td>14%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Data source: VIUS 2002