

# Freight Establishment Survey Design

Yin Jin Lee, Lisa d'Ambrosio, Edgar Blanco & Christopher Zegras

Massachusetts Institute of Technology, Engineering Systems Division

## 1 Motivation

Freight establishment survey is an essential tool to understand freight transportation.

- Surveys are used to collect data on behaviors to predict freight transportation trips;
- data can be used to analyze policy effectiveness
- GPS data alone cannot reveal all the information needed for policy planning.

Current freight models are not accurate enough, and are too aggregated for detailed policy analysis. A new approach is needed:

- Responses should be specific to trading relationship, i.e. between supplier and retailer.
- Survey should emphasize on strategic and tactical decisions.  
(Strategic = 1-5 years, and tactical = 3 months – 1 year time frame)

## 2 Literature review

**Freight trip generation models** have depended on three types of variables, (1) area, (2) employment size and (3) industry type

The dependent variables usually aggregate deliveries over a period of time, such as peak periods of a day, or a week.

**Shipper type** was used in two freight models (Routhier & Toilier, 2007; Wisetjindawat, Sano, & Matsumoto, 2006)

- for estimating origin zones, and
- for its influence on total quantity flow.

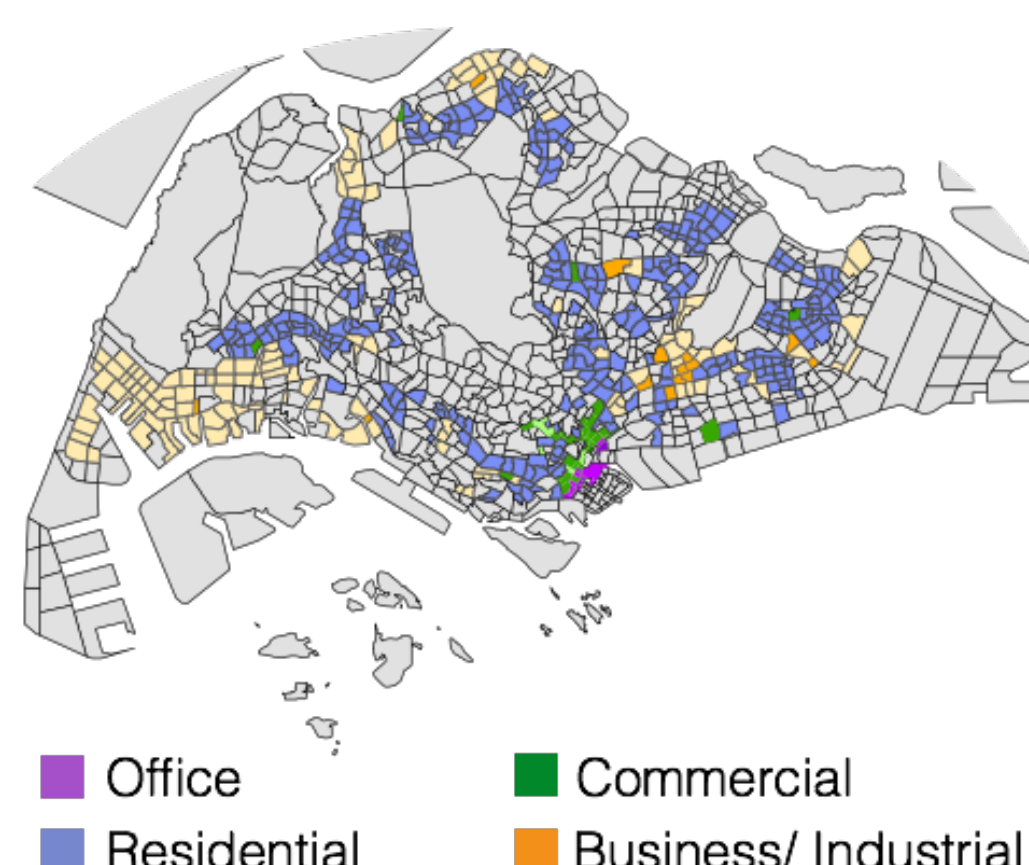
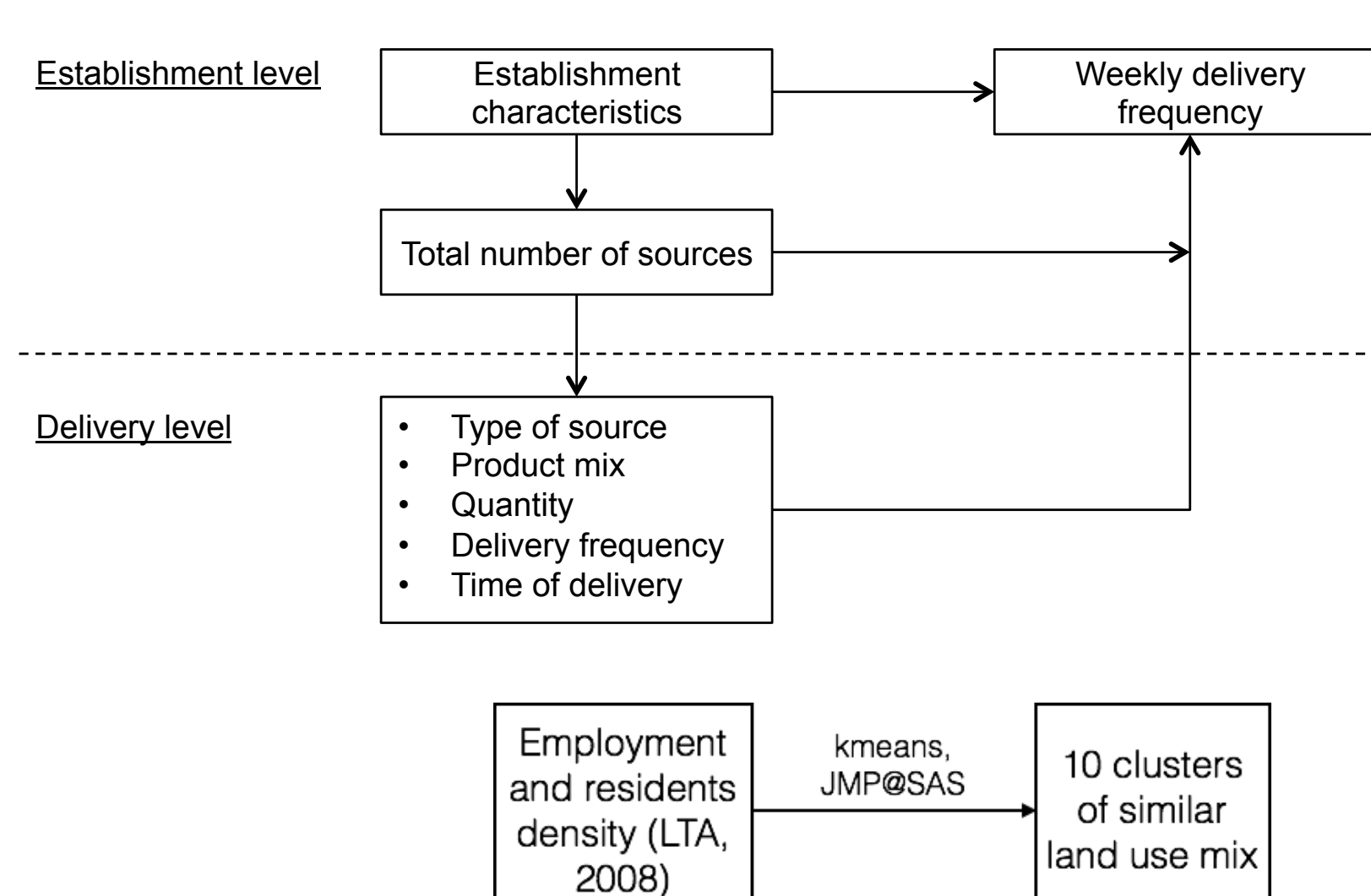
So far, studies including shipper-receiver relationship have modeled at zone level, and not at delivery level. Models at delivery level may reveal more underlying mechanism of delivery generation and also provide time of day estimates that can be used for traffic simulations.

## 3 Methodology

786 surveys were collected.  
(Response rate = 71%)

	Cosmetics	Accessory Store	Apparel Store	Food Court	Formal Food Service	Food retail	Pharmacy	Supermarket
Number of surveys	39	19	185	91	263	52	35	10

Interview surveys asked questions on two levels of observation.



### Multistage sampling

**First stage:** Representative zones in the city.

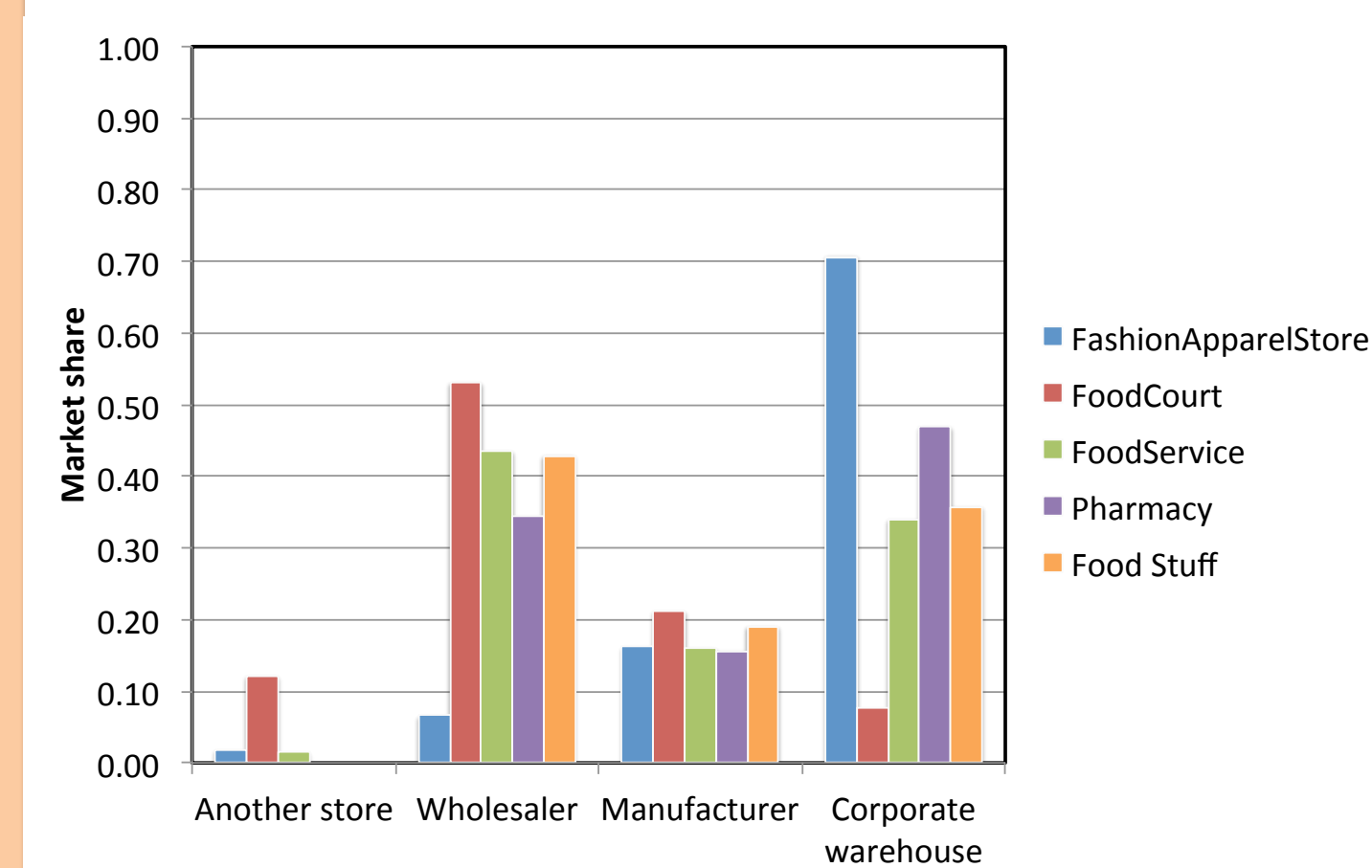
- Zones with the most retail and food service outlets in each cluster was selected.

**Second stage:** Proportional sampling of establishments by industry types.

## 4 Results

### General findings

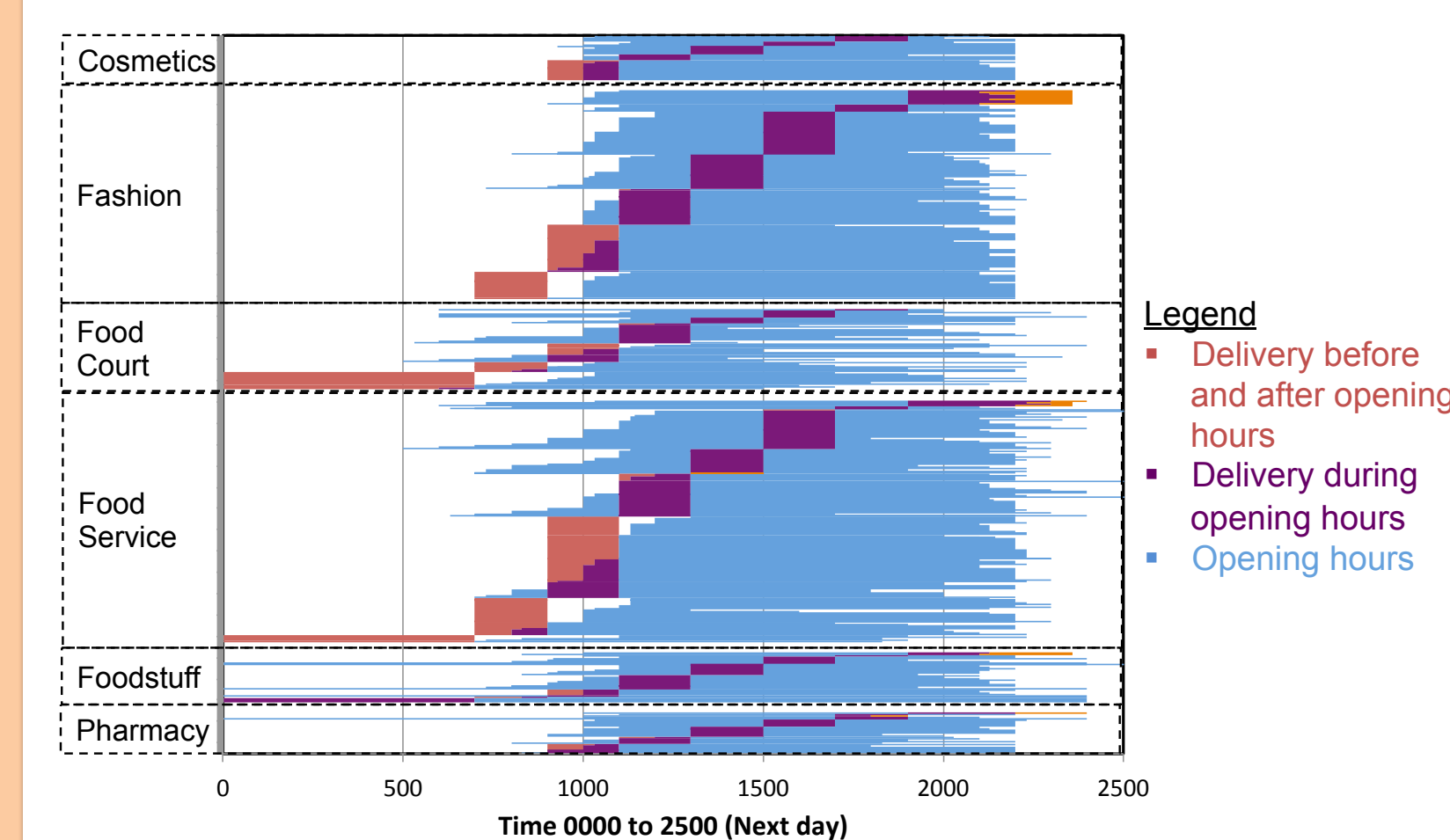
1. **Food service and fashion establishments** have high chances of being supplied by corporate warehouse. The chances are 34% and 71% respectively, compared to 8% for food courts.



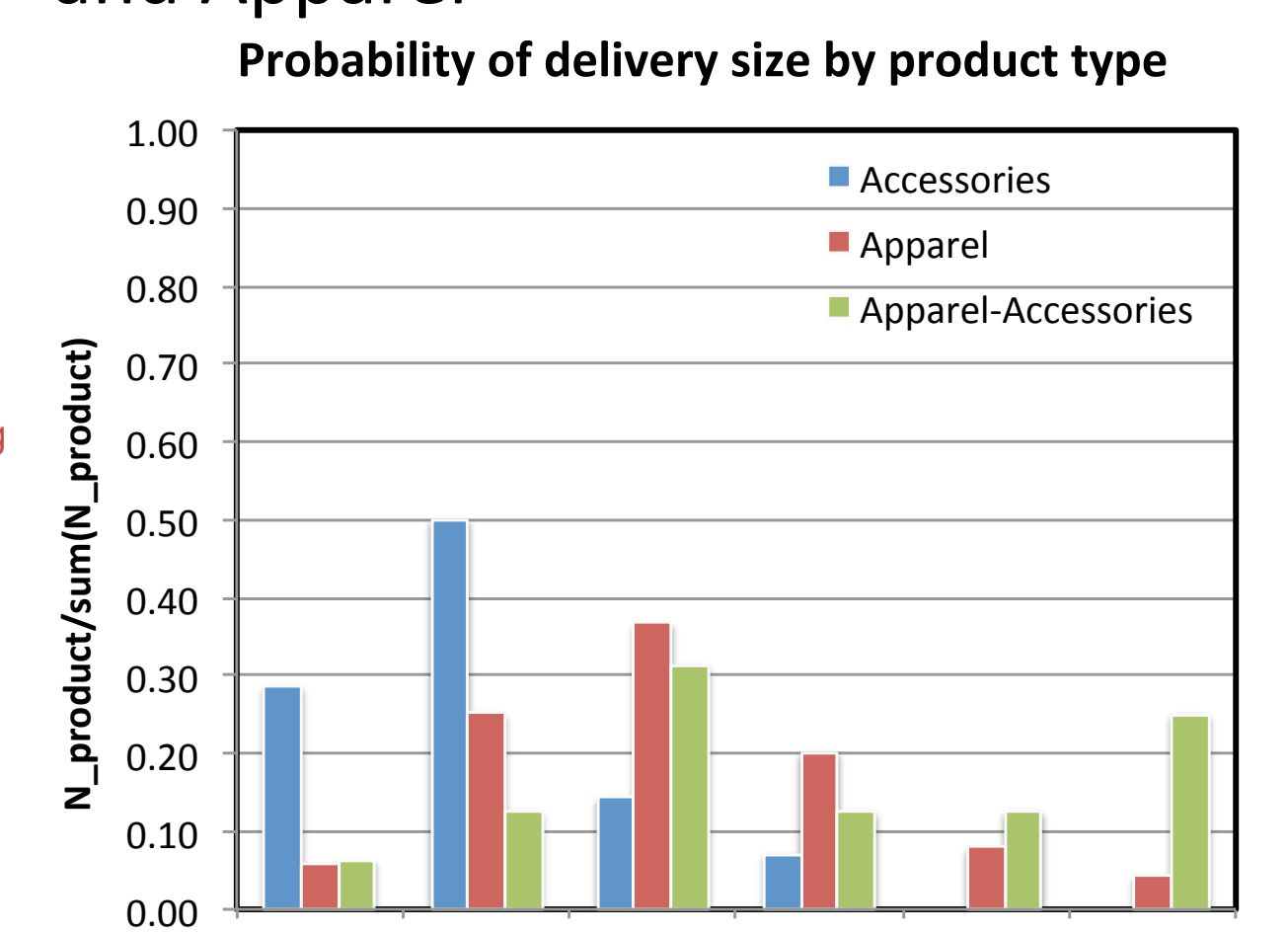
2. **Perishability of food** is a strong determining factor to delivery frequency.

Goods	Delivery frequencies
Prepared	5.01±2.76
Fresh food	4.40±2.23
Mix food	4.14±2.25
Frozen	3.39±2.42
Cosmetics	2.29±2.05
Dry food	2.28±2.09
Apparel-Accessories	2.26±2.61
Pharmaceutical	2.24±2.40
Apparel	2.11±1.77
Accessories	1.75±1.14

3. **Most deliveries** took place from 11am to 3pm. However food deliveries can take place before 7am.



4. **Package sizes** increase with the variety of products. e.g. Accessories < Apparel < Accessories and Apparel



### Retail-supplier relationship

**Food services.** Formal food services has more shipping sources and one of the sources is often a corporate warehouse. Food court has fewer shipping sources.

**Pharmacies** usually receive multiple deliveries from their corporate warehouse once a week. The deliveries from the corporate warehouse are large and frequent, and the deliveries from other sources are small, and at varying frequencies.

**Fashion and Cosmetic stores** in the sample are mainly franchise of a corporate company and receive deliveries mainly from the corporate warehouse. The delivery frequencies are low. The only difference between Fashion and Cosmetics deliveries is that the delivery size is larger in the former case because the items are larger.

### The Role of Corporate Warehouse

Establishments of the same industry can differ a lot in their delivery characteristics depending on if they have a corporate warehouse.

- It reduces the total deliveries to store by increasing delivery volume.
- Fashion establishments tend to only receive deliveries from corporate warehouse
- Food service, pharmacy or supermarkets consolidated some goods with corporate warehouse, but still have many other deliveries.

## 5 Conclusion

- Delivery-based questions linked with receiver-shipper relationship help explain heterogeneous delivery patterns.
- The challenge in scaling this model up to city level is the lack of data on receiver-shipper relationship in public records.
- Including more company characteristics can improve the model explanation power, and application in policy analysis.