Changes in the Retail and Distribution Landscape: Behavioral and Logistics Modeling Implications

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Outline

- Background
- Disruptions in the Retail & Distribution Landscape
  - Retail
  - Shopping Behaviors
- Examples in California
- Key Modeling Implications
Retailing and Distribution

Economic Transactions
(Purchasing & Selling)

Movement of People & Goods
E-commerce has grown almost 30% since 2009
Shopping

Any day…

40% of the population shop
(5-6% shop online) (ATUS, 2016)

Today…

55%-80% of the population shop online
79% of all shopping influenced by e-commerce (NHTS, 2017)
Retail and Behavioral Disruptions
Disruptions

Freight & Logistics
- Location of freight facilities
- Location of demand
- Retail landscape
- Inventory practices and distribution services

Shopping Practices
- Shopping process (search, purchase, transport)
- Tradeoff between individual’s travel and deliveries

E-commerce
Omni-channel distribution and consumer behaviors
Freight & Logistics
Changes in Recent Years

THE WALL STREET JOURNAL

Shopping-Mall Vacancies Are Highest in Seven Years After Big-Box Closings
The vacancy rate has risen despite the country's strong economic growth

Forbes

The Fall Of The Mall And How To Make Them Rise Again

odyssey

The Death Of The American Mall
Mall culture is dying, and here is why.

TIME

Why the Death of Malls Is About More Than Shopping

Vox

What the decline of American shopping malls means for social space
By Carlos Waters | carlos.waters@vox.com | Apr 11, 2018, 11:10am EDT

Vox

Get ready for the regional shopping mall apocalypse
Fragile ecosystems poorly suited to a changing world.
By Matthew Yglesias | @mattyglesias | matt@vox.com | May 4, 2017, 9:00am EDT
## Retailers are Closing Stores

<table>
<thead>
<tr>
<th>Retailer</th>
<th>Closing Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANN TAYLOR</td>
<td>268</td>
</tr>
<tr>
<td>BEST BUY</td>
<td>250</td>
</tr>
<tr>
<td>Brookstone</td>
<td>102</td>
</tr>
<tr>
<td>Foot Locker</td>
<td>110</td>
</tr>
<tr>
<td>GNC</td>
<td>200</td>
</tr>
<tr>
<td>GAP</td>
<td>200</td>
</tr>
<tr>
<td>BONTON</td>
<td>256</td>
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<tr>
<td>JCPenney</td>
<td>8</td>
</tr>
<tr>
<td>macy's</td>
<td>11</td>
</tr>
<tr>
<td>Toys R Us</td>
<td>~800</td>
</tr>
<tr>
<td>sears Kmart</td>
<td>~700</td>
</tr>
<tr>
<td>CHIPOTLE</td>
<td>65</td>
</tr>
<tr>
<td>SUBWAY</td>
<td>500</td>
</tr>
<tr>
<td>Starbucks</td>
<td>150</td>
</tr>
</tbody>
</table>

[1](https://www.forbes.com/sites/pamdanziger/2018/10/14/the-fall-of-the-mall-and-three-ways-to-make-them-rise-again/6f30d37b58ef)
Forecast

1/5 – 1/4 of all malls will close in the next 5 years

Credit Suisse

https://research-doc.credit-suisse.com/docView?language=ENG&format=PDF&sourceid=csplusresearchcp&document_id=1075851631&serialId=0H35FD75wQHBVu3x5lkvUaUWAN03QsD5MQWFvss5x4%3D
Cascading Effects

E-commerce will grow from 17% of industry sales to 35%+

Credit Suisse

https://research-doc.credit-suisse.com/docView?language=ENG&format=PDF&sourceid=csplusresearchcp&document_id=1075851631&serialid=0H35FD75wQHBUjm3x5lkvUaUWAN03QsDSMQWFvss5x4%3D
Shopping Behavior
How We Shop

Frequency of purchases by method

**38%** Multi-channel net
- Search in store, buy online: 8%
- Research online and in store, buy online: 8%
- Research online and in store, buy in store: 14%
- Search online, buy in store: 20%

**62%** Single-channel net
- Search and buy online: 42%
- Search and buy in store: 20%

Stores continue to play a major role even among avid online shoppers

Almost half (45%) of the avid online shoppers agree that shopping in store is still a major part of their shopping routine.

Shopping Travel

(a) Shopping tours per person
(b) Stops per shopping tour
(c) Tour length vs Stops
(d) Share of in-store activities in a shopping tour
Delivery Preferences

Circumstances under which shoppers are willing to pay a premium for faster shipping

- 50% If I needed it faster due to personal reasons (e.g., travel, holidays, birthdays)
- 30% If I waited until the last minute so I didn’t have other options
- 23% If I was purchasing perishable items
- 22% If I was purchasing a high-value product
- 16% If I needed to ensure a high-demand product will still be available
- 8% I generally prefer earlier deliveries despite the cost
- 22% None of the above

Preference in delivery location

- 65% To my home/residence
- 35% Alternative delivery location

Convenience of Returns

55% prefer dropping their returns off at carrier locations

- 21% Leave it in my mailbox or by my front door
- 13% Schedule a pickup from my home or office, so I can hand it to a driver (a pickup fee may apply)
- 6% Hand the package to the carrier's driver when I see them
- 5% Bring it to my office to include in my company's regularly scheduled pickup

36% Bring it to the carrier's retail store (UPS Store, etc.)
10% Bring it to the carrier’s drop box
9% Bring it to a local business near my home that accepts packages (i.e., independent pack-and-ship stores)

Examples from California
Distribution Landscape

Warehouses and Distribution Centers in Southern California
Serving Los Angeles
Fast delivery services come at cost
Proximity to Customers

Costs

Fixed: warehouse, fleet

Operational: driver, maintenance, fuel

Externalities: GHGs and criteria

Time windows: 1, 1.5, and 3 hours
Market Share

Retailer’s market share
Large: 47%
Small: 6%

Crowdsourcing: Flex vehicles
Serving Sacramento
Amazon Facilities

“SMF1” Amazon Fulfillment Center

“DSM1” Amazon Delivery Station

“UCA9” Amazon Prime Now Hub in East Sacramento
Distribution Patterns

Average Number of Departures per Day by Vehicle Type

- Delivery Station: 795
- Prime Now Hub: 20
- Fulfillment Center: 157

- Heavy Trucks
- Vans
- Flex Cars
Estimated Impacts

1 mile radius from the facility
Efficiency per Delivery Option

![Bar chart showing emissions per package by vehicle type: Flex Car = 7.1 g CO₂ per package per mile, Delivery Van = 4.4 g CO₂ per package per mile, Heavy Truck = 0.9 g CO₂ per package per mile.](attachment:bar_chart.png)
Key Implications
Location and Distribution

Need to be located closer to the customer
- At the expense of facility cost
- Smaller facilities
- Higher delivery frequencies

Time windows:
- Increase the overall cost significantly
- Decrease the distribution efficiency
- Require more vehicles
- Locate even closer to customer
Use of crowdsourced deliveries

- Reduce capital expenditures
- Increase freight activity due to smaller vehicles
- Less efficient than vans or trucks
- Allow contending with demand fluctuation
- Trade-offs with other costs

Distribution structure

- Smaller facilities for distribution, require sortation, and fed by larger facilities
- Last few feet could use alternate distribution modes
Questions!

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Shopping Malls in the US

(2012-2017)
19% drop in:
Regional and Super-regional Shopping Centers

Source: International Council of Shopping Centers
Shared Delivery Services
Delivery Tours

- **Delivery tour length (miles)**
  - Weibull Distribution
    - Shape: 3.66
    - Scale: 45.85

- **Stops in a tour**
  - Triangular Distribution
    - Min: 15
    - Max: 75
    - Mean: 35
Proximity Costs

Fast delivery services come at cost

Warehouse sales price ($/sq.ft.) vs. distance from downtown L.A.

\[ y = 356.37x^{0.231} \]

\[ R^2 = 0.1442 \]
Externalities

Time windows have a negative effect on the externalities from the delivery operation.
Example from San Francisco and Dallas
Omni-channel vs. in-Store
Online vs. in-Store
Shopping Behaviors

In-store vs. online

- Online increasing very rapidly
- In-store still dominates
- Store closures increasing
- Less availability in-store
- Customers willing to pay a premium for fast and reliable shipments
- Click-and-pick and option but may not be attractive

Demographics

- Differences among shoppers and geographic locations
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Shopping Behaviors

Shopping includes:
- Pre-purchase: searching/comparison
- Purchasing: channel location and delivery method
- Post-purchase: returns
- Basket size: items per purchase/order
- An related travel
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