

Demand steering through the smokescreen of stockouts: Evidence from cigarette vending machines

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Motivation

- ▶ stockouts are widespread and frequent in many retail environments
 - ▶ Gruen, Corsten, and Bharadwaj (2002): 8% of retail groceries and drugstore items stocked out at any given moment (average developed countries)

mistakes? low effort?

costs?

→ *Stockouts to steer demand from (out of stock) low margin products towards high margin products*

Relevance of smoking out the steering motive behind stockouts

1. In many markets, demand steering can raise antitrust concerns due to possible exclusionary effects
 - ▶ Ex: self-preferencing in digital platforms, Amazon Buy Box
 - ▶ Challenging to detect: unintentional vs strategic stockouts to steer demand
2. Conflict of interest between manufacturers and retailers – loss of manufacturer surplus (downstream moral-hazard)
 - ▶ Hard to measure/identify because of vertical agreements to soften conflict

Context

cigarette vending machines in major metropolitan area in EU

- ▶ placed in bars, restaurants, hotels, newsstands
- ▶ managed and stocked by local tobacco shop
- ▶ cigarettes can only be kept inside machine (no stocks under the counter)
- ▶ frequent stockouts: 75% probability at least one product is out of stock in machine \times day



Demand steering in unique setting

usual profit maximizing tools are unavailable to retailers due to heavy regulation:

manufacturers set prices nationally

+

the product line is fixed in the medium run

+

promotions not allowed

+

vertical contracts between manufacturers and retailers are prohibited

also: retail margins fixed at 8.5%

Data

- ▶ sales, prices, **lost sales**, recharge per day x brand x machine in a major metropolitan area in Europe
- ▶ density of machines and tobacco stores
- ▶ years 2016, 2017, 2018, 2019
- ▶ subsample with 261 machines with most frequent sales

*Uniqueness of these data
(and very convenient for our project)*

we observe latent demand!

Model and implications

- ▶ Parsimonious model of strategic stockout with search

- ▶ Implications – the retail profit maximizing probability of stockout:
 1. > 0 if products have different retail margins
necessary but could be true absent demand steering motives

 2. is higher for lower margin products, conditional on demand
necessary but could be true absent demand steering motives

 3. \nearrow with consumers' transportation cost to visit another machine
higher transportation costs \rightarrow less sales lost to outside option; not true in standard stockout

Empirical evidence I: stockouts and retailer revenues

Implication 1

Retail profit maximizing probability of stockout > 0

Empirical test: *Is machine revenue higher when there are stockouts, controlling for total sales?* ✓

stronger than model implication because cost of re-stocking > 0

Empirical evidence II : stockouts & recharges and margins

Implication 2

Retail profit maximizing probability of stockout is higher for lower margin products

Empirical tests:

- ▶ *Probability of product stocking-out \searrow with its margin, controlling for total demand (sales + latent)? ✓*
- ▶ Conditional on machine recharge, probability of product recharge \nearrow with margins?
- ▶ Time length between product recharges \searrow with margins, controlling for total demand?

Empirical evidence: stockouts and competition

Implication 3

Retail profit maximizing probability of stockout ↗ with transportation costs

Empirical test:

Do machines with a higher density of competitors around have less stockouts, controlling for total demand? ✓

Cost to consumers and manufacturers

Counterfactual of no stockouts

preferences estimates from demand model allowing for full unobserved consumer heterogeneity across machines

+ model of manufacturer price setting

→ simulation of counterfactual scenario of no stockouts

Consumers

$$\Delta CS = 3.2\%$$

~ 240€ more per year for a heavy smoker (1 pack a day)

Manufacturers

$$\Delta MS = 5.7\%$$

Conclusion

What's behind the frequent and ubiquitous stockouts in retailing?

What are the costs of stockouts for manufacturers and consumers?

- ▶ we show evidence consistent with retailers strategically stocking out to benefit from demand diversion to higher margin products
- ▶ we quantify the cost of stockouts for consumers and manufacturers in a setting without vertical agreements to alleviate agency problems
- ▶ costs are non negligible even in situation where retailer profit gain from strategic stockouts appear to be small