Discussion of

Plants in Space

by Ezra Oberfield, Esteban Rossi-Hansberg, Pierre-Daniel Sarte, and Nicholas Trachter

Felix Tintelnot

University of Chicago and NBER

NBER ITI Summer-Online

July 9, 2020

Overall comments

- Great paper
  - Elegant and insightful analysis of plant location in continuous space

Overall comments

- Great paper
  - Elegant and insightful analysis of plant location in continuous space
- Contributions:
  - Derives a new special case in which the optimal plant location problem is tractable
  - Develops new predictions on firm sorting that can be confronted with the data

Main result #1

- In the limit, if ...
  - trade costs become very large,
  - fixed costs become very low,
  - and span of control costs become very low

  ... the firm's optimal plant location problem simplifies to:

$$\sup_{n:S\mapsto\mathbb{R}_+} \int_s \left[x_s z\left(q_j, N\right)^{\epsilon-1} n_s g(1/n_s) - R_s n_s \right] ds$$

A tractable discrete location model

- Consider a (unit continuum) multi-product firm with Frechet productivity draws for each product in every plant

A tractable discrete location model

- Consider a (unit continuum) multi-product firm with Frechet productivity draws for each product in every plant
- Fixed cost for each plant (which can produce multiple products at a time)

A tractable discrete location model

- Consider a (unit continuum) multi-product firm with Frechet productivity draws for each product in every plant
- Fixed cost for each plant (which can produce multiple products at a time)
- Denote firm HQ location by i

A tractable discrete location model

- Consider a (unit continuum) multi-product firm with Frechet productivity draws for each product in every plant
- Fixed cost for each plant (which can produce multiple products at a time)
- Denote firm HQ location by i

- The optimal plant location problem is (see Tintelnot 2017, QJE):

$$\max_{O_j} Z(q_j)^{\epsilon-1}\tilde{\epsilon}\kappa \sum_m \left(\sum_{o \in O_j} (\gamma_{io} w_o \tau_{om})^{-\theta} \right)^{\frac{\epsilon-1}{\theta}} \frac{Y_m}{P_m^{1-\epsilon}} - \sum_{o \in O_j} R_o \xi$$

A tractable discrete location model

- Consider a (unit continuum) multi-product firm with Frechet productivity draws for each product in every plant
- Fixed cost for each plant (which can produce multiple products at a time)
- Denote firm HQ location by i

- The optimal plant location problem is (see Tintelnot 2017, QJE):

$$\max_{O_j} Z(q_j)^{\epsilon-1}\tilde{\epsilon}\kappa \sum_m \left(\sum_{o \in O_j} (\gamma_{io} w_o \tau_{om})^{-\theta} \right)^{\frac{\epsilon-1}{\theta}} \frac{Y_m}{P_m^{1-\epsilon}} - \sum_{o \in O_j} R_o \xi$$

- Assume
  - $\tau_{om} \to \infty$
  - Allow multiple plants within the same location

The firm's problem simplifies to:

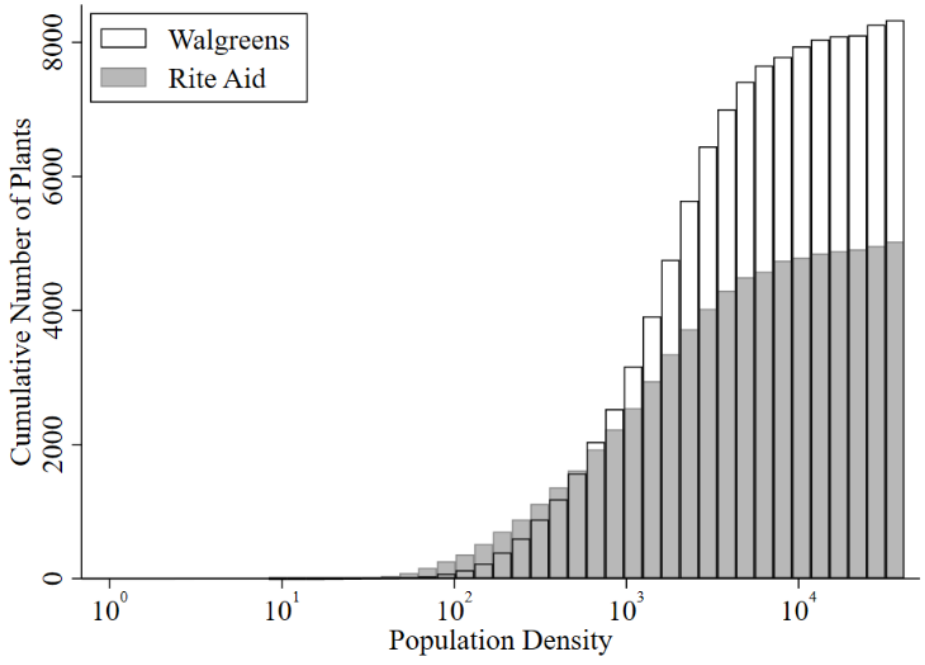
$$\max_{\{n_s\}} Z(q_j)^{\epsilon-1}\tilde{\epsilon}\kappa \sum_s \left(n_s(\gamma_{is}w_s)^{-\theta}\right)^{\frac{\epsilon-1}{\theta}} \frac{Y_s}{P_s^{1-\epsilon}} - \sum_s n_s R_s \xi$$

- Looks a lot like the main result #1 (except for span of control and discreteness). Similar predictions:
  - Cannibalization within a location
  - Pecking order for firms with same HQ location i: $q_j \geq q_{j'} \implies n_s(j) \geq n_s(j')$
  - If low productivity firms have HQ location in low density areas and γ_{is} is rising in distance: firm sorting by location density
  - Can further enrich model by firms choosing a distribution setup in an outer nest problem
- Advantage of ORHST setup: Differentiability (requires also sending fixed cost and span of control terms to zero), one dimension of firm heterogeneity gives their sorting prediction

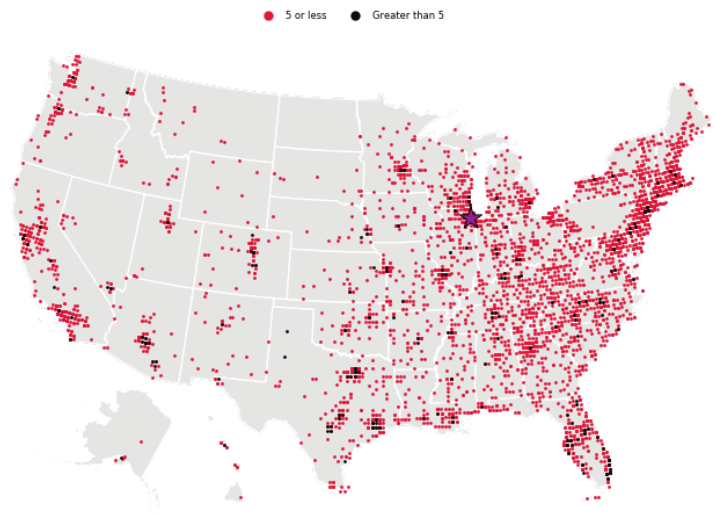
Main result #2

- Theoretical predictions on firm sorting:
  - Large and productive firms sort into high density (high rent, high payoff) locations
  - Smaller and less productive firms open plants in low density locations that large firms don't serve
- Supporting evidence from NETS data

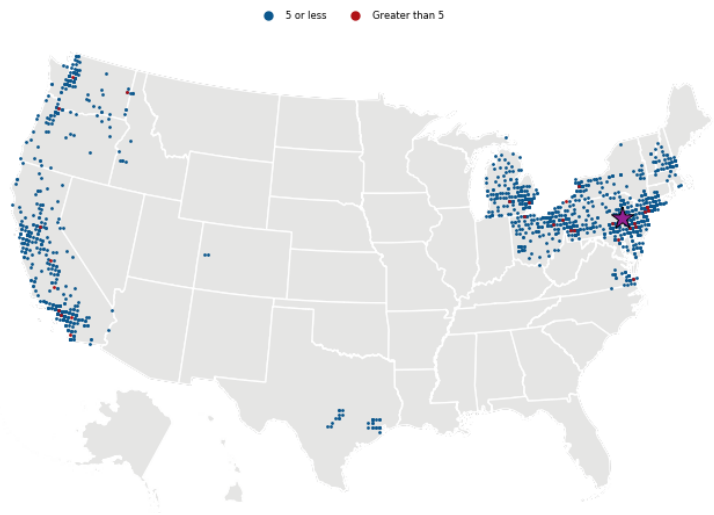
Figure 2: Sorting: Walgreens vs. Rite Aid



A closer look at Walgreens vs Rite Aid



Walgreens (HQ in Deerfield, IL)



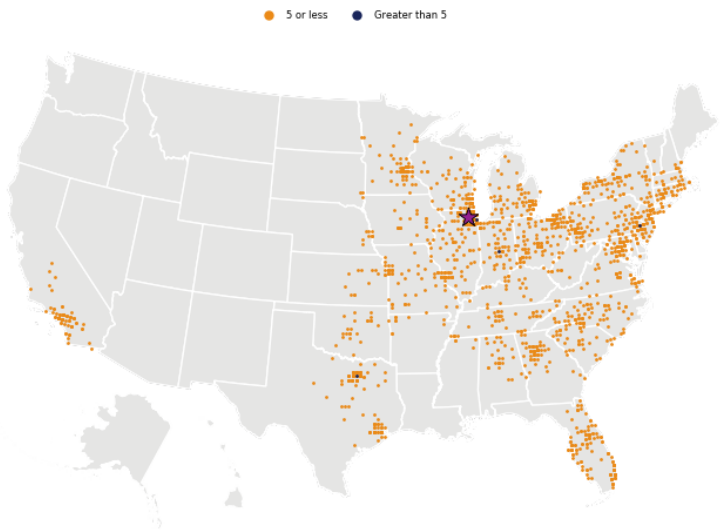
Rite Aid (HQ in Camp Hill, PA)

- Geographic clustering around HQ
- Walgreens avoids competition with Rite Aid in PA
- Acquisitions play a major role of growth and shrinkage of retailers:
  - Rite Aid acquired Thrifty Pay Less in 1996
  - Walgreens acquired 2186 Rite Aid stores in 2017
  - Walgreens closed around 600 Rite Aid stores that were proximite to its own stores

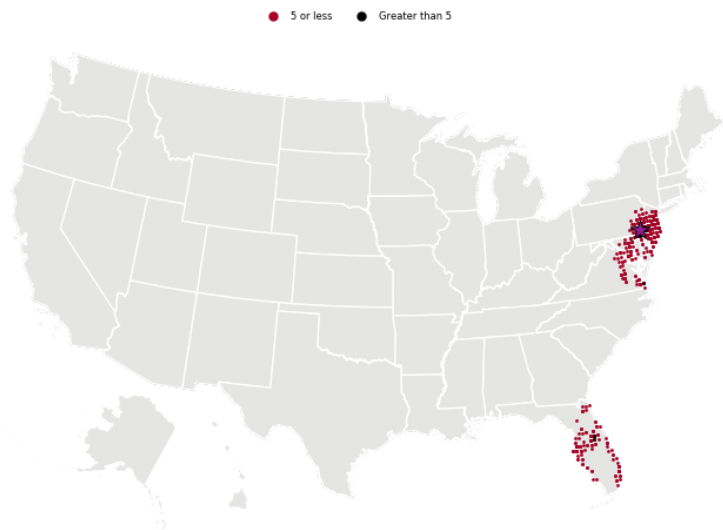
Other drivers of firm sorting by location density

- Distribution: Retail chains are radiating out from their HQ location (Holmes, 2011)
  - Chains headquartered in low density areas tend to have stores in low density areas
- Market segmentation: Firms avoid overlap in competition (Bresnahan and Reiss, 1991)
- Chain customization by income or education group paired with a national strategy (DellaVigna and Gentzkow, 2019)
- Local brand loyalty (Bronnenberg, Dube, and Gentzkow, 2012)

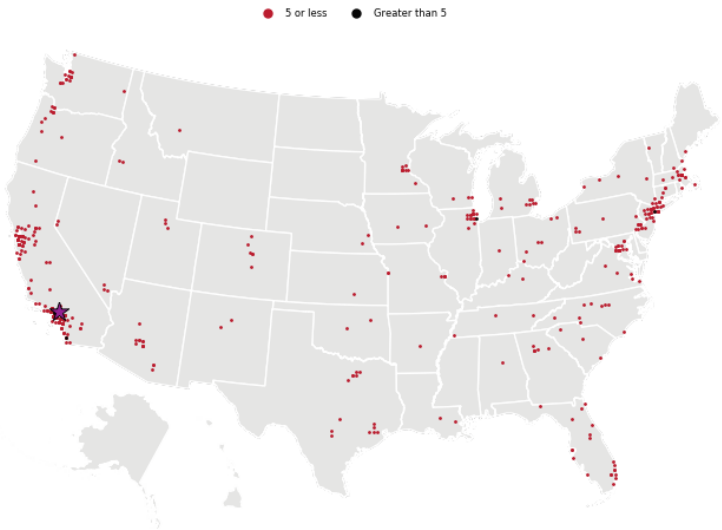
More data on the geographic spread of retail chains



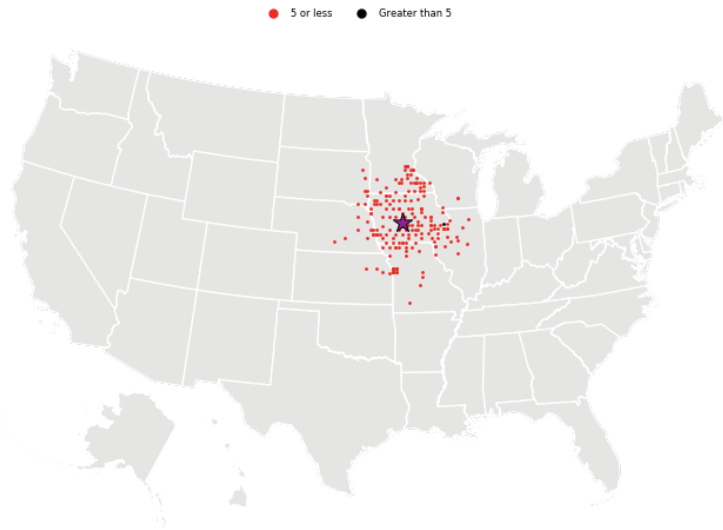
Aldi (HQ in Batavia, IL)



Wawa (HQ in Wawa, PA)



Trader Joes (HQ in Monrovia, CA)



Hy Vee (HQ in West Des Moines, IA)

Summary

- Great and thought-provoking paper
- Interesting theoretical results that suggest to look at the establishments data in a different dimension (population density)
- This strikes me as a tractable model of retail stores
  - Less convinced it describes well the problem of choosing manufacturing plant locations
  - Could be improved by incorporating geography into the span of control considerations
- I look forward to the next version.