E-Commerce:
Current Research and Areas for Future Exploration

NBER Digitization Tutorial
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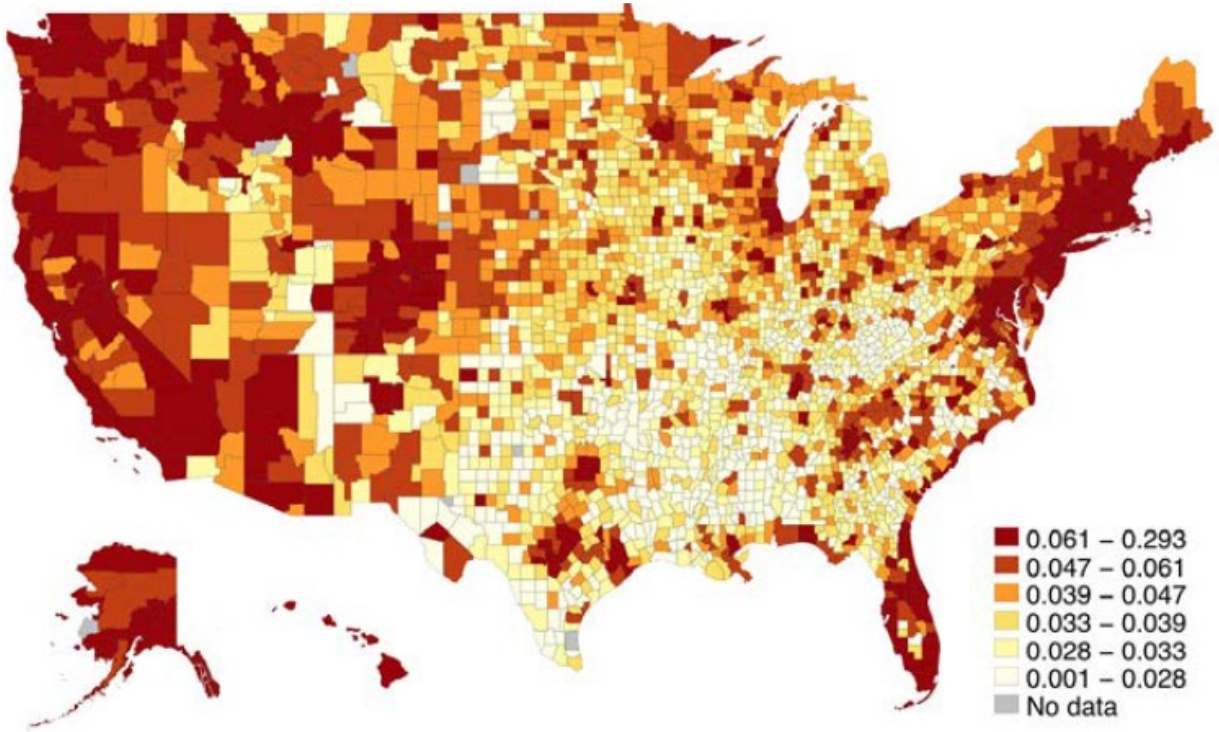
Motivating Facts

- Between 2007-2017, online spending grew from 5% to 8%; online retail spending from 3.5% to 5%.
- Significant spending heterogeneity:

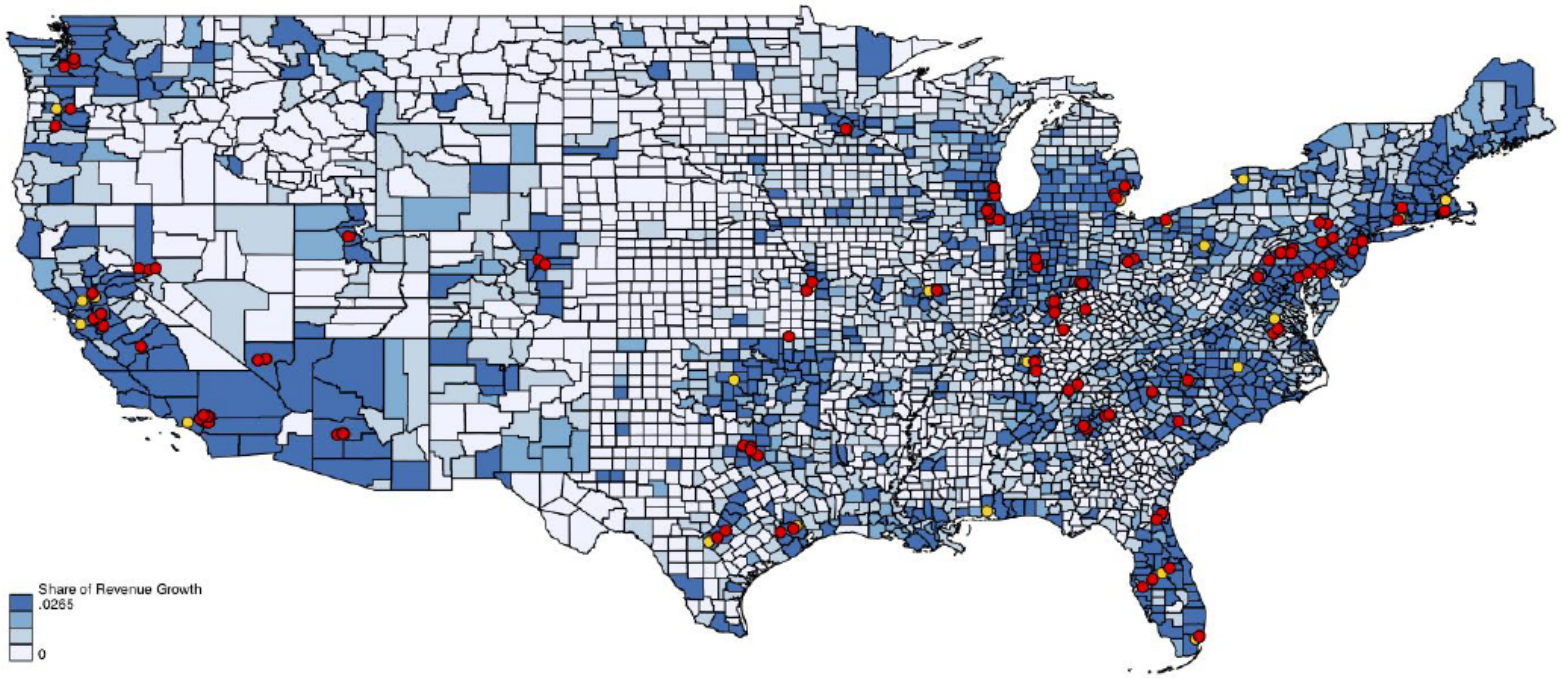


Online shares by county (2017)

Source: Dolfen et al (2019)

Motivating Facts, II

- Between 2007-2017, online spending grew from 5% to 8%; online retail spending from 3.5% to 5%.
- Significant heterogeneity in online take-up:

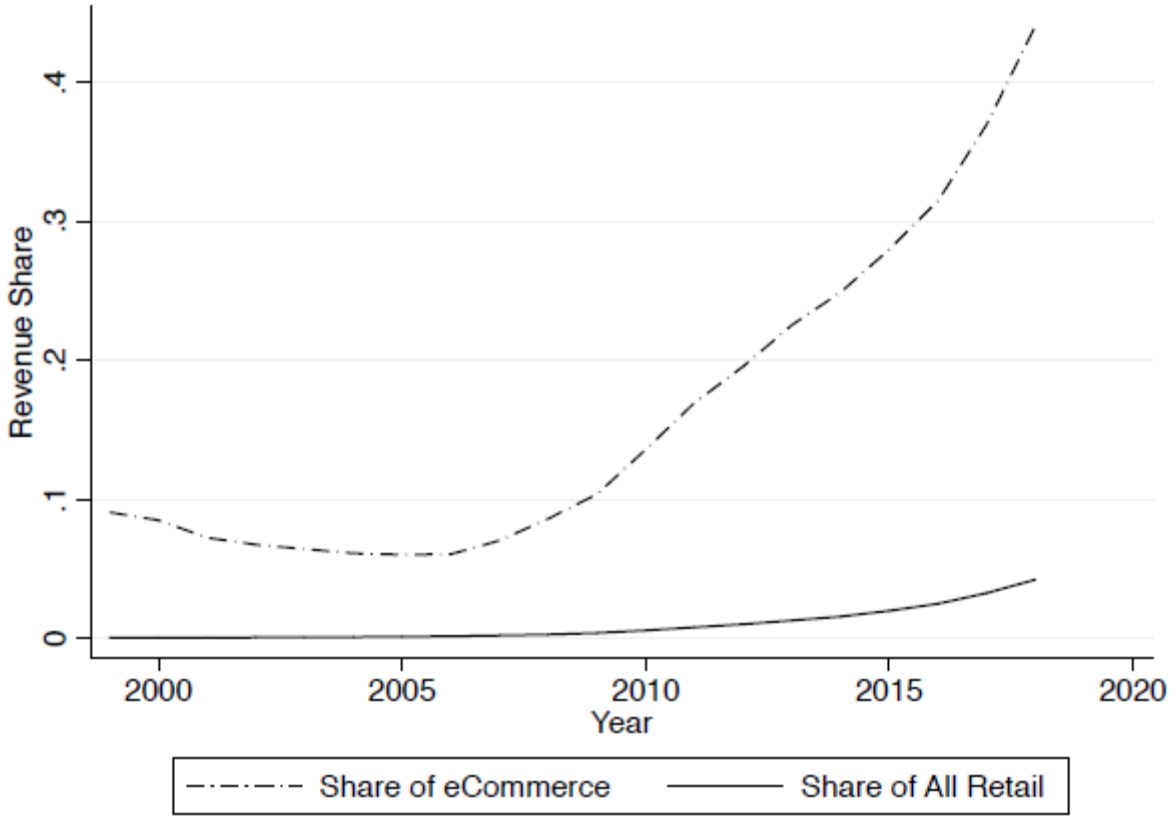


Distribution of Spending Growth, Amazon, 1999-2018

Source: Newberry et al (2021)

Motivating Facts, III

- Concentration of online retail: HHI of 400 to 1,900 (2006-2016).
- Amazon's sales growth: US revenue of $5.7bn to $80bn.



Questions

- What are the benefits to consumers from the rise of online shopping?
- Sources of these benefits
  - Variety
  - Convenience
  - Prices
- Competitive implications of increasing online concentration
  - Sophisticated algorithmic pricing
  - Platform market power, e.g., self-preferencing
- Broader policy implications of rise of e-commerce
- Highlight some examples, with focus on range of substantive question, methodological approach & data used.

Aggregate consumer benefits from e-commerce

- Dolfen et al (2019) estimate aggregate gains to e-commerce using universe of Visa transactions (~36 billion!) over 2007-2017.
  - Data: total transaction amount, merchant, merchant type & location; inferred consumer location & income (subset)
  - No price (or product) information. Welfare effects → monetize distance savings as "price" differences between channels.

- Sources of gains from e-commerce: Merchant variety
  - Ability to substitute to online retailer, given additional cost of offline option.
    - Welfare gains of online merchant options of ~14% of e-commerce spending; 1% of consumption, or ~$1,000
    - Distributional: larger for higher income consumers in denser counties

Aggregate consumer benefits from e-commerce

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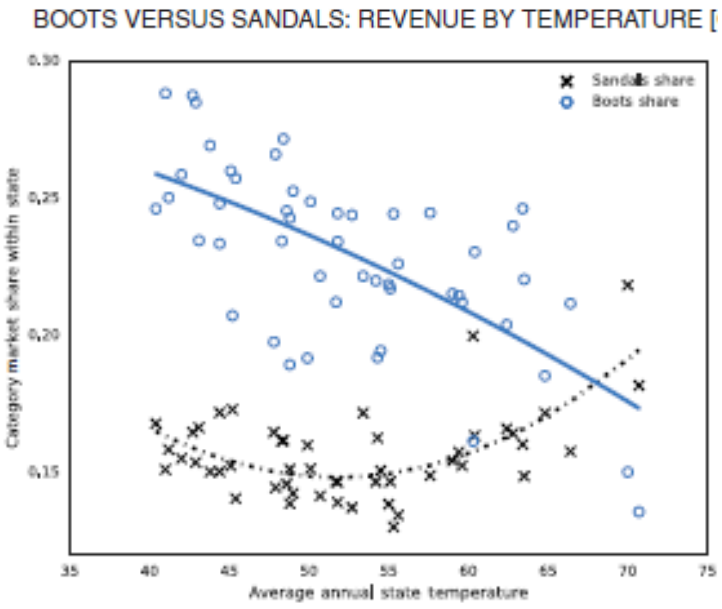
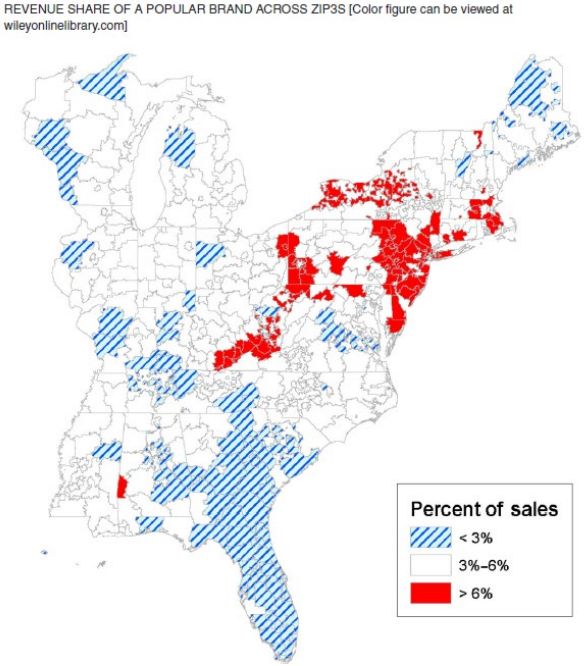
- Sources of gains from e-commerce: Convenience
  - Choice of online channel as fcn of distance to retailer's physical store.
    - Avg consumer gain equiv to reducing travel distance by ~11m
    - ~30% of value of consumer goods purchases; .5% of consumption
    - Distributional: larger for more remote consumers

Unpacking the Welfare Effects: Merchant Variety

- Merchant variety = product variety?
  - Long-tail literature (Anderson '04; Brynjolfsson, Hu & Smith, '03)
- Recent product variety evidence: Shoes (Quan & Williams 2018)



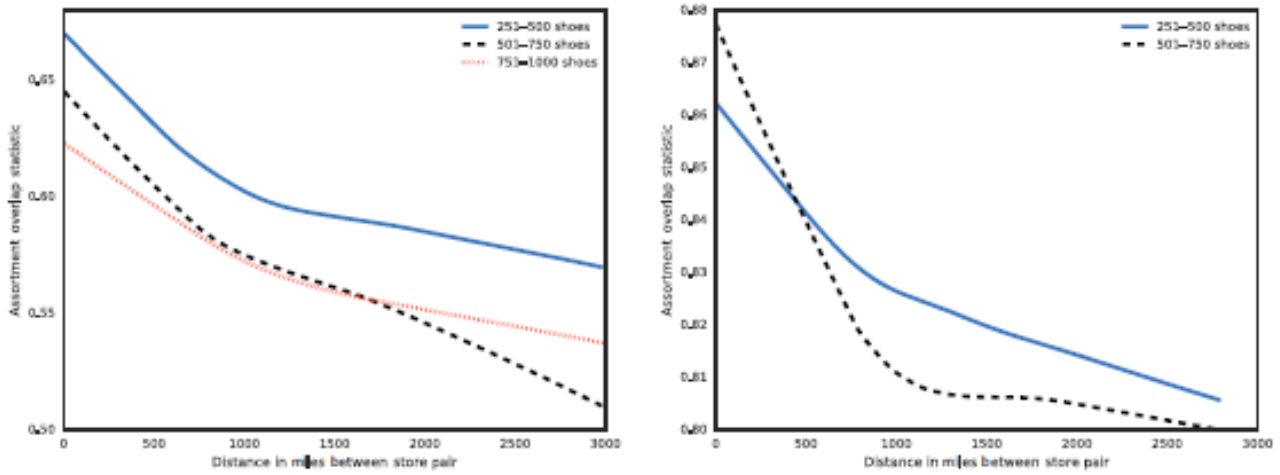


Local demand heterogeneity ⇒ heterogeneity in value of "long-tail" varieties

Tailoring of local assortments: offline retailers

- Offline retailers tailor assortments to local tastes
- Share of products available in a pair of stores, as a function of distance between stores

ASSORTMENT OVERLAP BY DISTANCE [Color figure can be viewed at wileyonlinelibrary.com]



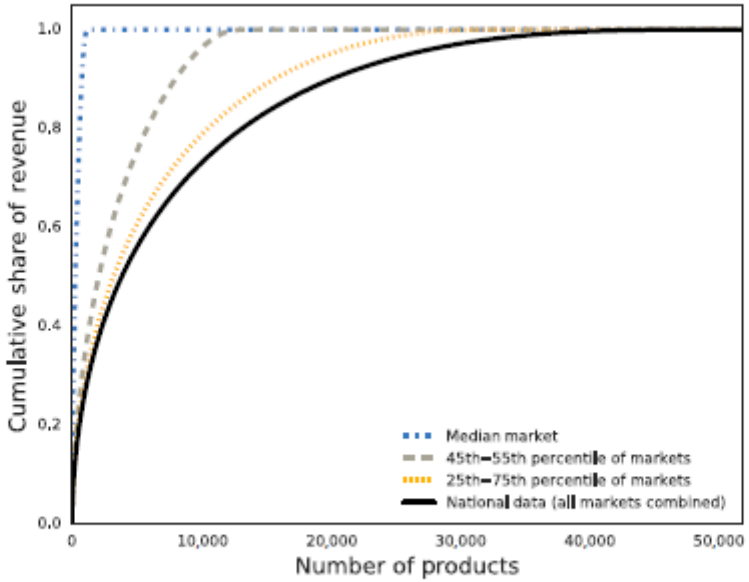
(a) Macy's (b) Payless

Notes: Lowess fitted values of assortment overlap across stores in the network. Analysis split across stores with similar assortment sizes.

Quantifying welfare gains to online variety

- Takeaways:
  - Sizable gains in consumer surplus from access to additional varieties. Equivalent to a 5% reduction in price.
  - More limited than previously thought: get tailored products locally in pre-Internet world. Limited value to long tail.

AGGREGATING TO THE LONG TAIL [Color figure can be viewed at wileyonlinelibrary.com]



Note: The cumulative revenue curve for the online retailer for different levels of data aggregation. The index of products corresponds to sales rank.

Follow-on questions

1. Distributional implications
   - Within market heterogeneity in preferences: online channel & preference externalities in small vs large markets

2. Response in local assortments to online variety
   - Beyond “retail apocalypse”: e.g., adaptation
   - Wu (2020) finds that a larger non-book revenue share dampens impact of online competition on sales and store survival

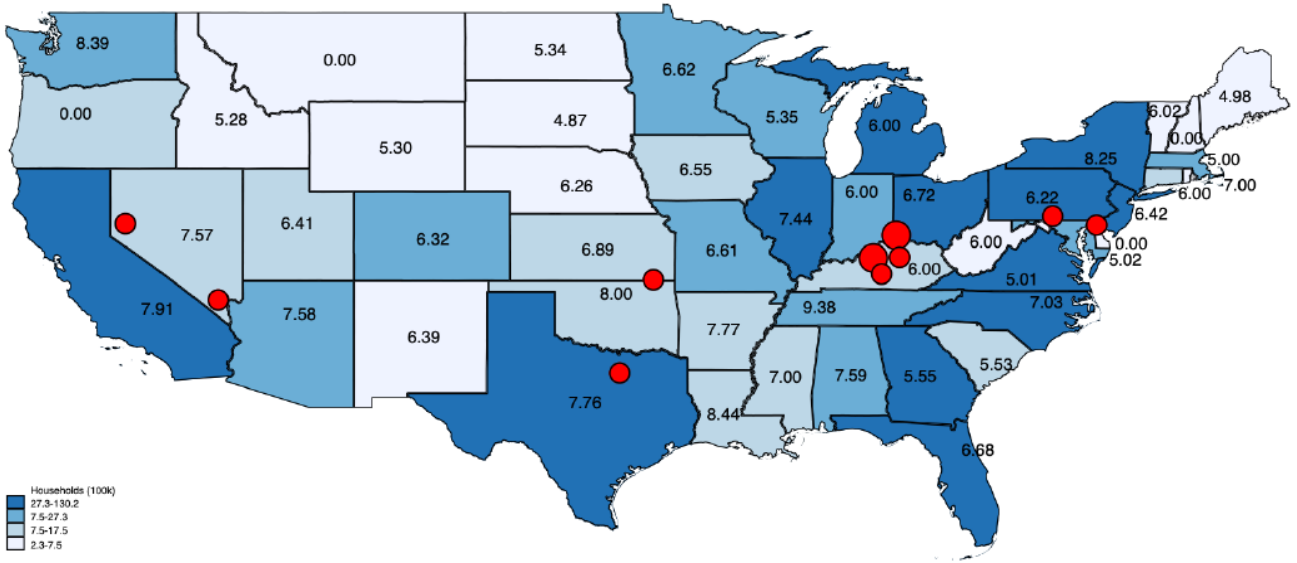
3. Online and offline variety as complements rather than substitutes
   - Chintala et al. (2021) find lower shopping basket variety and composition for online vs. offline grocery purchase trips

4. Variety competition & one-stop shopping

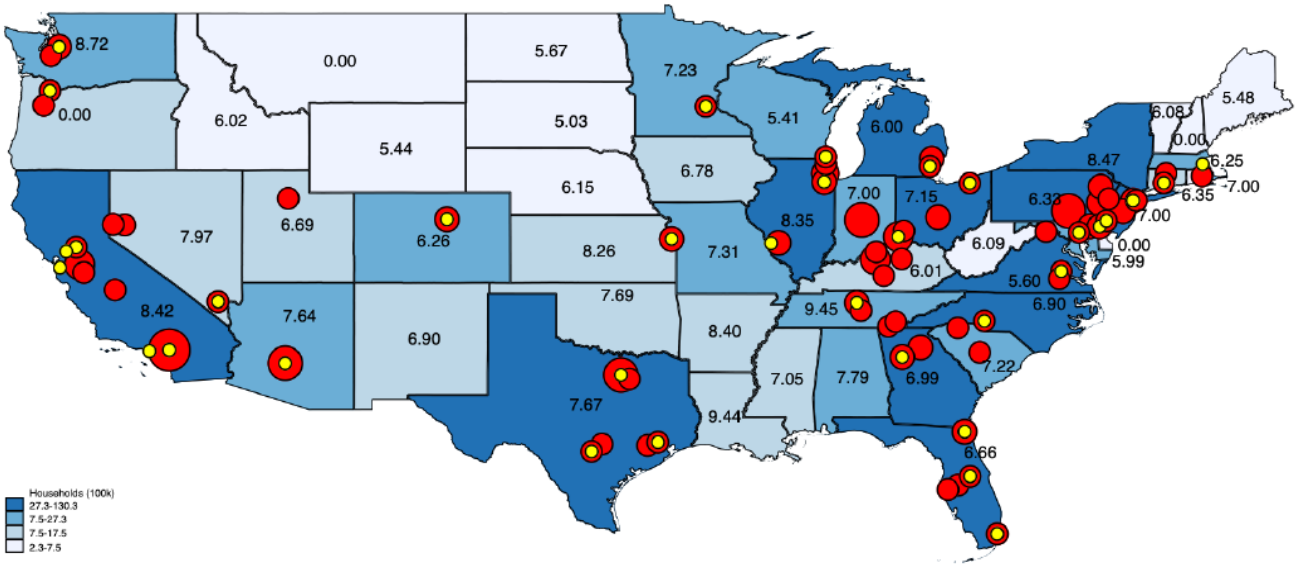
Unpacking the Welfare Effects: Convenience

- Dolfen et al focus on travel cost savings from online shopping.
- But also inconvenience: wait until package arrives; return package!
  - Response by online retailers: significant investment in distribution.
  - E.g., Amazon from 2011 to 2018:
    - Fullfilment Ctrs from 5 in 5 states to 100 in 32 states. Expansion into sortation: from 0 in 2011 to 40 sortation centers by 2018.
  - Expansion to be near demand ⇒ faster delivery?
  - Less relevant when Amazon offered uniform 2-day shipping speeds (Houde et al 2021)
    - Now one-day; same-day shipping
    - Likely benefits high-income consumers in dense markets more

(a) Amazon fulfillment center network, 2006



(b) Amazon fulfillment center (red) and sortation center (yellow) network, 2018



Unpacking the Welfare Effects: Prices??

Evidence from the Billion Price Project (Cavallo 2017, 2019)

1. Online offline prices
   - Large, multi-channel retailers in 10 countries charge the same price for a product online and offline 70% of the time.
   - Retailer & product heterogeneity [e.g., electronics vs. drugs stores]
   - For subset of products, online and offline prices match Amazon's in 38 and 31% of the time, w/ Amazon 5 and 6% lower on average.

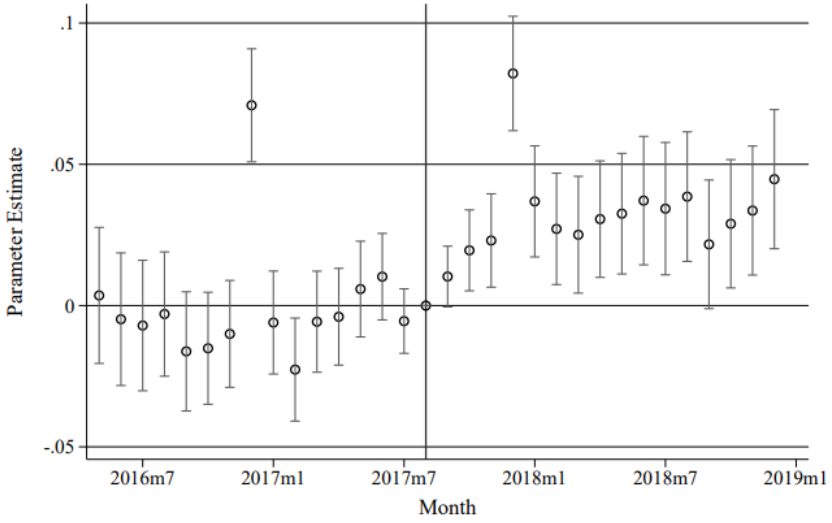
2. Price changes/discrimination:
   - Uniform prices across space for both online and offline retailers except in categories w/ limited online exposure (food & beverages)
   - More frequent changes in price (avg duration of pricing episode of 3.5m in 2017; 20% shorter for products also available on Amazon)

Unpacking the Welfare Effects: Prices

Limited evidence on the role of competition on price

1. [How much] has competition between online and traditional retailers reduced retail markups?
2. What is the effect of the growing concentration online on price?
   - Response in Amazon prices for toys to exit of Toys R Us (He, Reimers, Shiller 2021)

Figure 2: Monthly Effect of the Toys R Us Shutdown on Amazon Prices

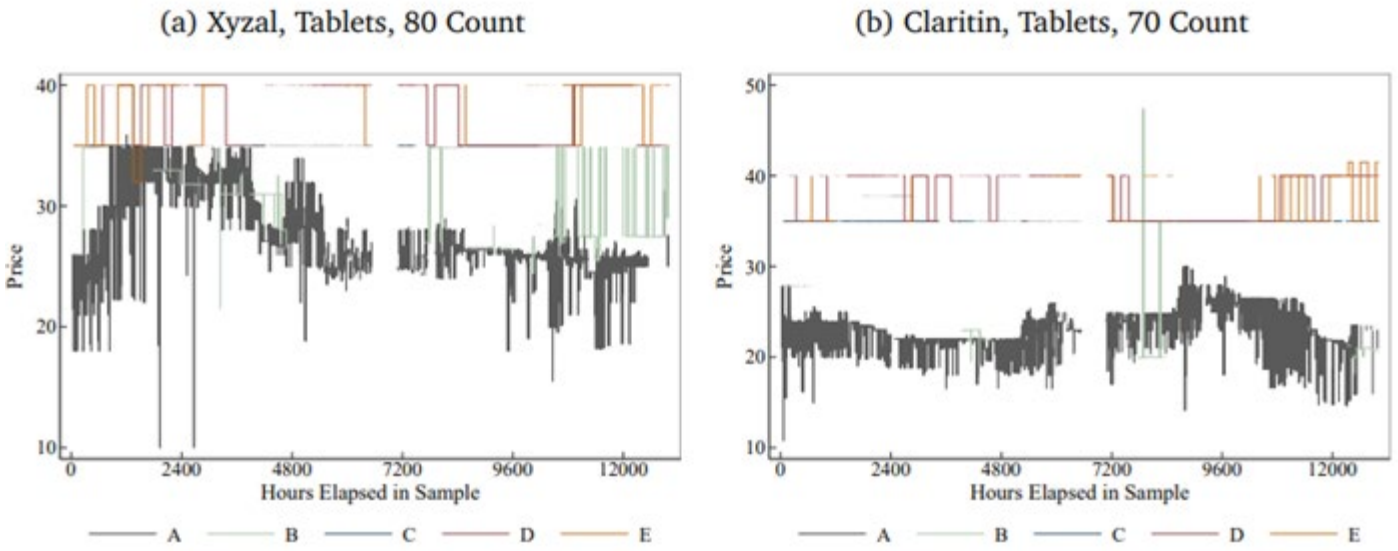


⇒ ~5% increase in price, relative to 10% price advantage over Toys R Us pre exit

Non-traditional market power concerns (I)

- Do new pricing technologies (algorithmic pricing) raise prices?
  - Automated pricing decisions allow for frequent price changes and commitment to condition price changes on competitor prices
- Brown & MacKay (2021) provide new evidence on algorithmic pricing of allergy drugs sold by Amazon, Walmart, Target, CVS, and Walgreens

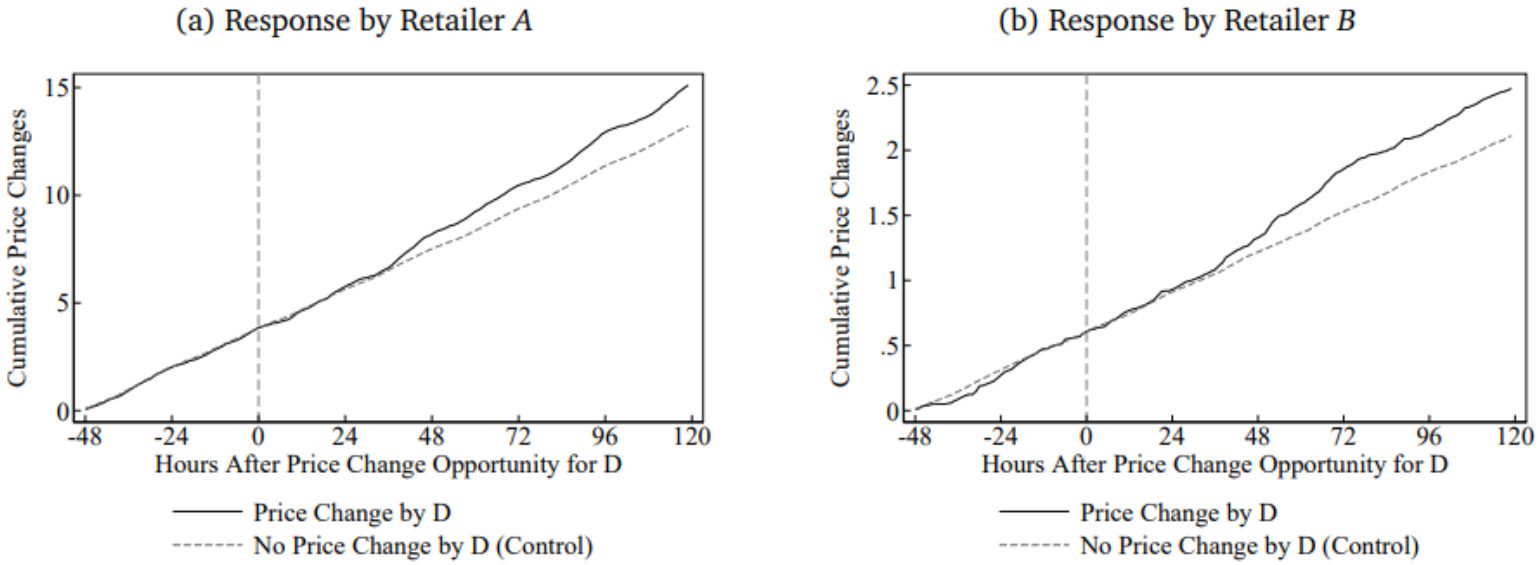
Figure 1: Example Time Series of Prices for Identical Products Across Retailers



⇒ regular price changes. Frequency and detailed timing varies across retailers

Algorithmic pricing

- Algorithmic pricing:



  - Firms with frequent price changes (A is best)
    - respond quickly to price change by slow rivals
    - charge between 10-30% lower prices (not due to distribution or asymmetric preferences)

Algorithmic pricing - Implications

- Calibrate model of price competition with different pricing frequencies and commitment to a pricing strategy that depends on rivals' prices.
- Comparison of predicted prices to simultaneous move pricing

Table 5: Counterfactual Effects on Markups and Profits

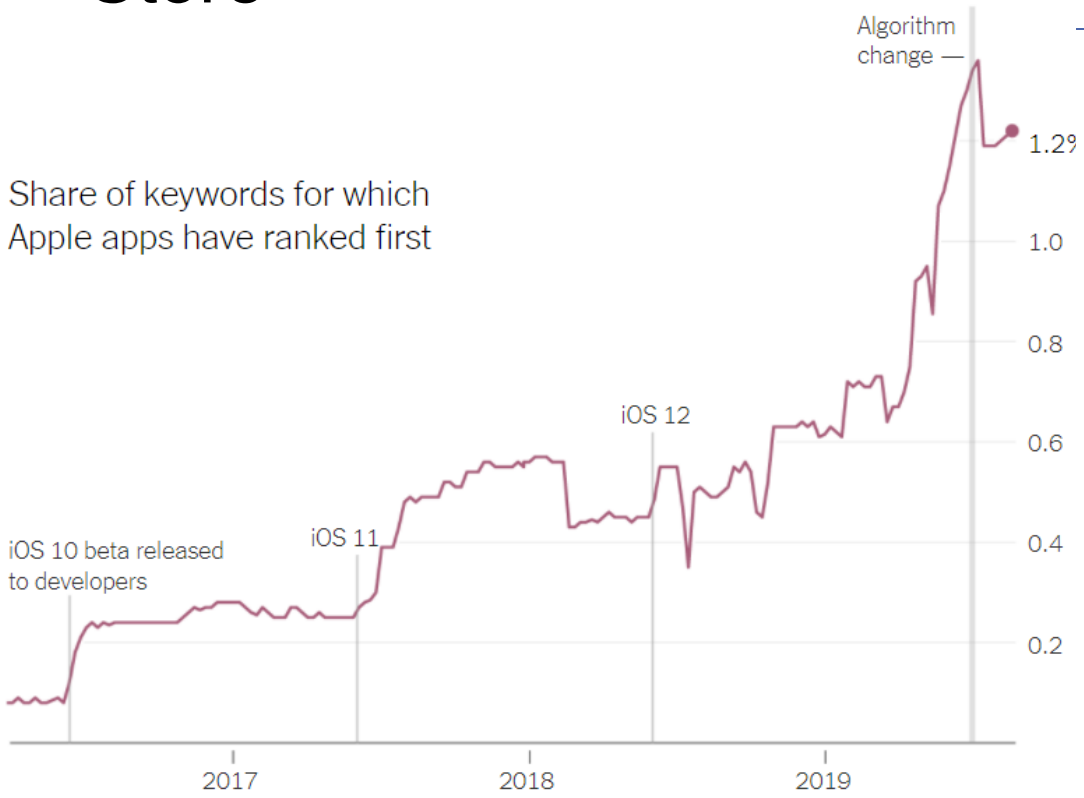
	Simultaneous Bertrand			Algorithmic Competition			Percent Change		
Firm	Markup	Share	Profit	Markup	Share	Profit	Markup	Share	Profit
A	1.77	0.282	6.5	1.85	0.314	7.9	4.5	11.4	22.0
B	1.81	0.314	7.6	2.00	0.275	8.1	10.1	-12.4	6.4
C	1.92	0.136	3.8	2.02	0.138	4.2	5.1	1.3	11.1
D	2.33	0.121	4.8	2.37	0.124	5.0	1.9	2.0	4.5
E	2.41	0.147	6.2	2.45	0.150	6.4	1.7	1.8	3.8
Aggregate	1.97	1	28.9	2.07	1	31.7	5.2	0	9.6

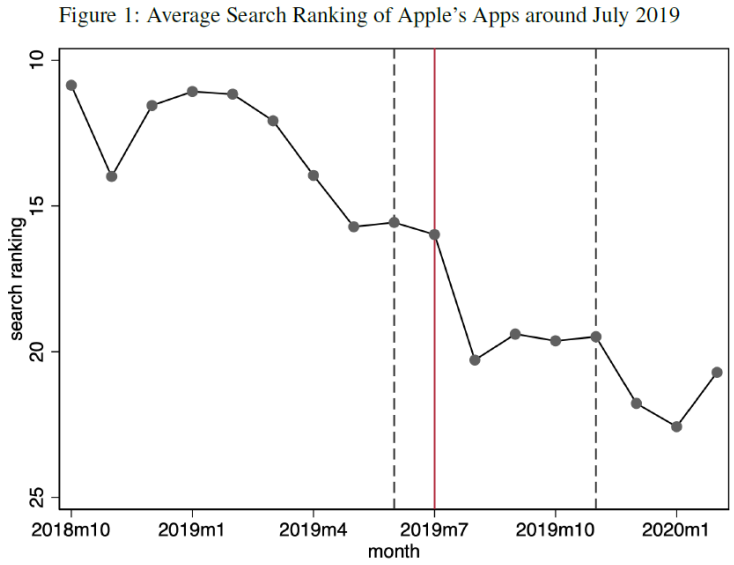
- Prices rise for all firms, but gains accrue disproportionately to firm with best pricing technology
- [Biggest shortcoming of paper is lack of quantity data]

Non-traditional market power concerns (II)

- Should platforms be allowed to sell on their own marketplaces?
- Increasing number of e-commerce players acting as marketplaces and sellers
  - Amazon, Flipkart (in India), JD.com (China), Target, Walmart
  - Apple's App Store, Google's Play Store, MS Windows Apps
- Anticompetitive behavior concerns
  - steering consumers towards own offerings might limit effective competition, quality investments by merchants, entry
  - using data to imitate popular 3rd-party products could reduce innovation incentives
- Policymakers grappling with this question
  - European Digital Markets Act

Self-preferencing: Evidence from Apple's App Store



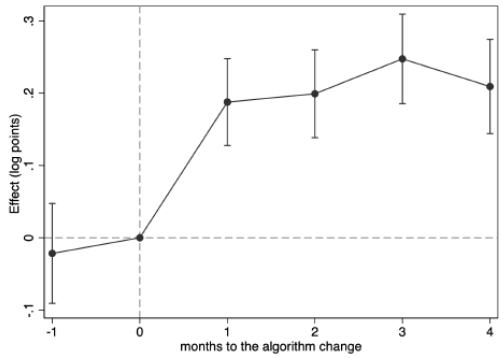


July 2019: Apple changes search ranking algorithm: tweaks "a feature of the App Store search engine that sometimes grouped apps by maker" so that "Apple apps would no longer look as if they were receiving special treatment."

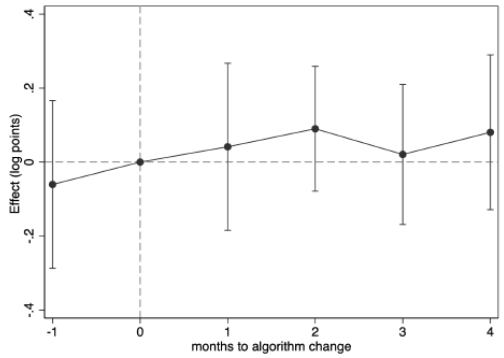
Self-preferencing: Evidence from Apple's App Store

Effect on Competing Apps (Relative to Apps in Categories w/o Apple Products)

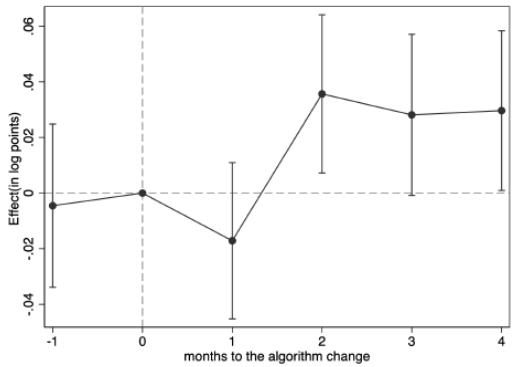
Panel A. Download



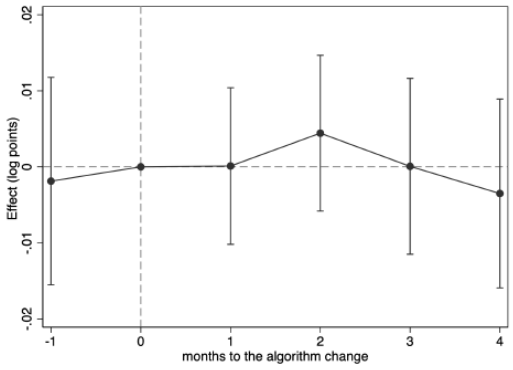
Panel B. Conversion Rate



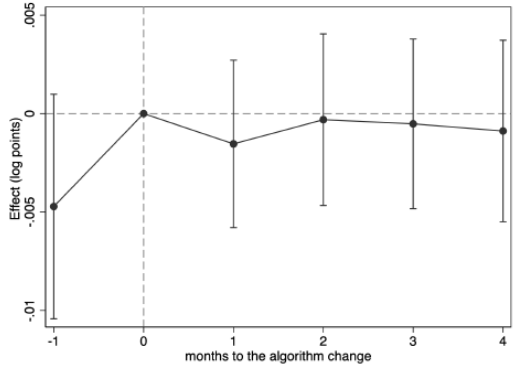
Panel A. Update Frequency



Panel B. Price



Panel C. Average Rating



Source: Teng (2021)

22% increase in downloads and 2% increase in update frequency (i.e., small quality improvement). No effect on conversion, price, ratings.
⇒ any welfare gains due to improved match to app consumer prefers.

Self-preferencing: Evidence from Amazon

- Recall Lee & Musolff's paper from yesterday. Different aspect to self-preferencing: of the sellers of a particular product, which one does the recommendation algorithm elevate?
- Interesting facts about buy-box recommendations:

  - One quarter of consumers consider only recommended offer
  - Recommended offer is cheapest in 50% of cases, FBA prevalence
  - Conditional on Amazon being present, recommended 40% of time

	1st	99th	Effect
Is FBA?	0	1	12.56% [11.74%,13.37%]
Is Amazon?	0	1	9.17% [8.84%,9.51%]
Feedback Count	1	179,594	2.51% [2.29%,2.73%]
Pos. Feedback %	50	100	1.61% [1.36%,1.86%]
Shipping Time	0	192	-20.86% [-22.02%,-19.70%]

Table 3: *Recommendation Equivalent Price Effects.*

Self-preferencing: Evidence from Amazon

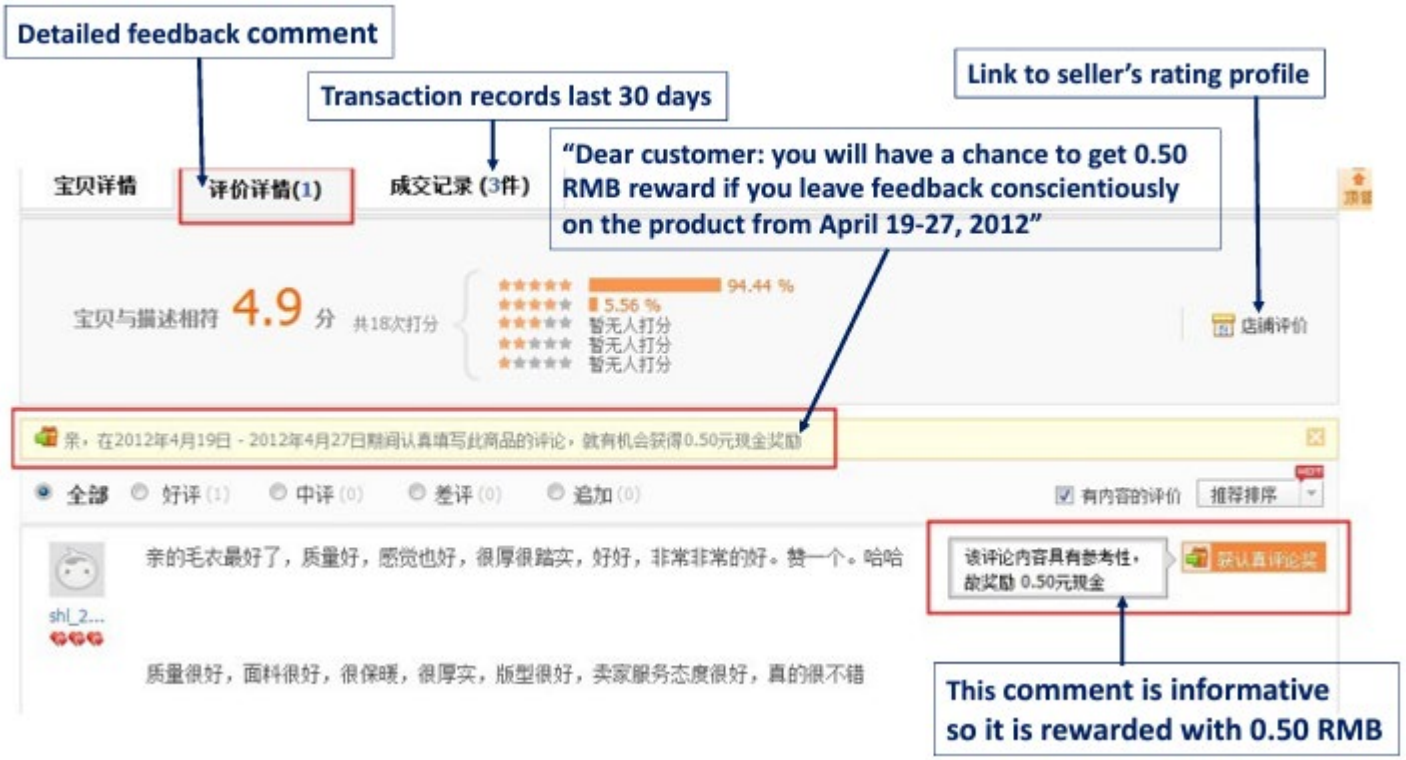
- Implications of self-preferencing:
  - Short-run – no price response; only change recommendation algorithm
    - Naïve consumers gain: Prefer Amazon and benefit from steering.
  - Medium-run – price response: small price increase
    - Sophisticated consumers – harmed
    - Naïve consumers gain more – why? Steered away from more expensive offers.
  - Long-run – entry response: limited due to competitiveness of price

- Follow-on questions:
  - Self preferencing and broader platform strategy
    - Role of FBA – does recommendation algorithm "force" sellers to buy FBA?
    - Effect of self preferencing on commissions, platform value, and competition

Seller reputation

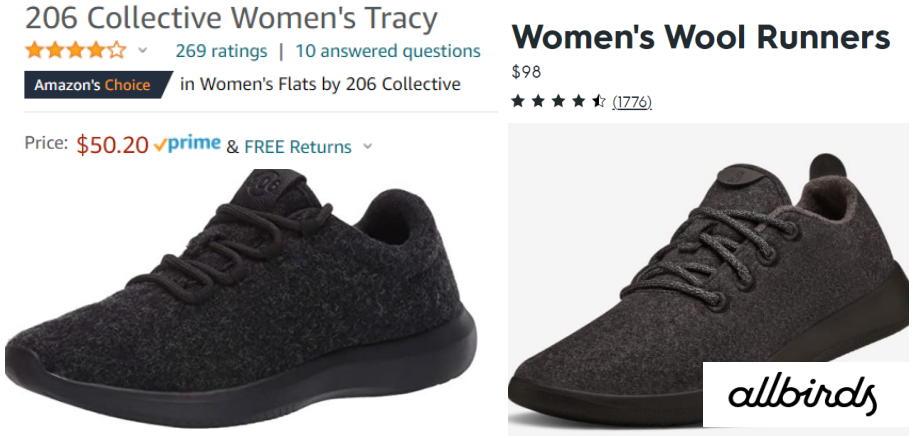
- Sources of strong Amazon preference?
  - Why doesn't Amazon limit imitation on the platform?
  - Should it facilitate seller reputation building?
    - Platform benefit: established reputations of existing sellers may be barrier of entry for new sellers

- Evidence from Taobao:
  - One way of building reputation: strong offline presence
    - National retailers do not need reputation (Newberry, Zhou 2019).
  - Another way of building reputation: buy feedback
    - Signaling theory: only sellers that expect positive feedback pay for feedback. Marketplace acts as enforcer.
    - Example: Taobao's "Rebate-for-Feedback" mechanism for informative feedback (Li, Tadelis, Zhou 2020).



- Sellers more likely to adopt RFF for
  - products with a high measure of quality (cumulative positive reviews).
  - "cold start" products
- Sales respond strongly to RFF (36% increase)
  - 1/3rd due to quality signal of RFF: buyers that leave "ineffective" feedback

Outstanding: Imitation & Innovation



Does this deter investments in product innovations?

- Store brands as cheaper (pretty good) alternatives.
- Plus price competition benefits

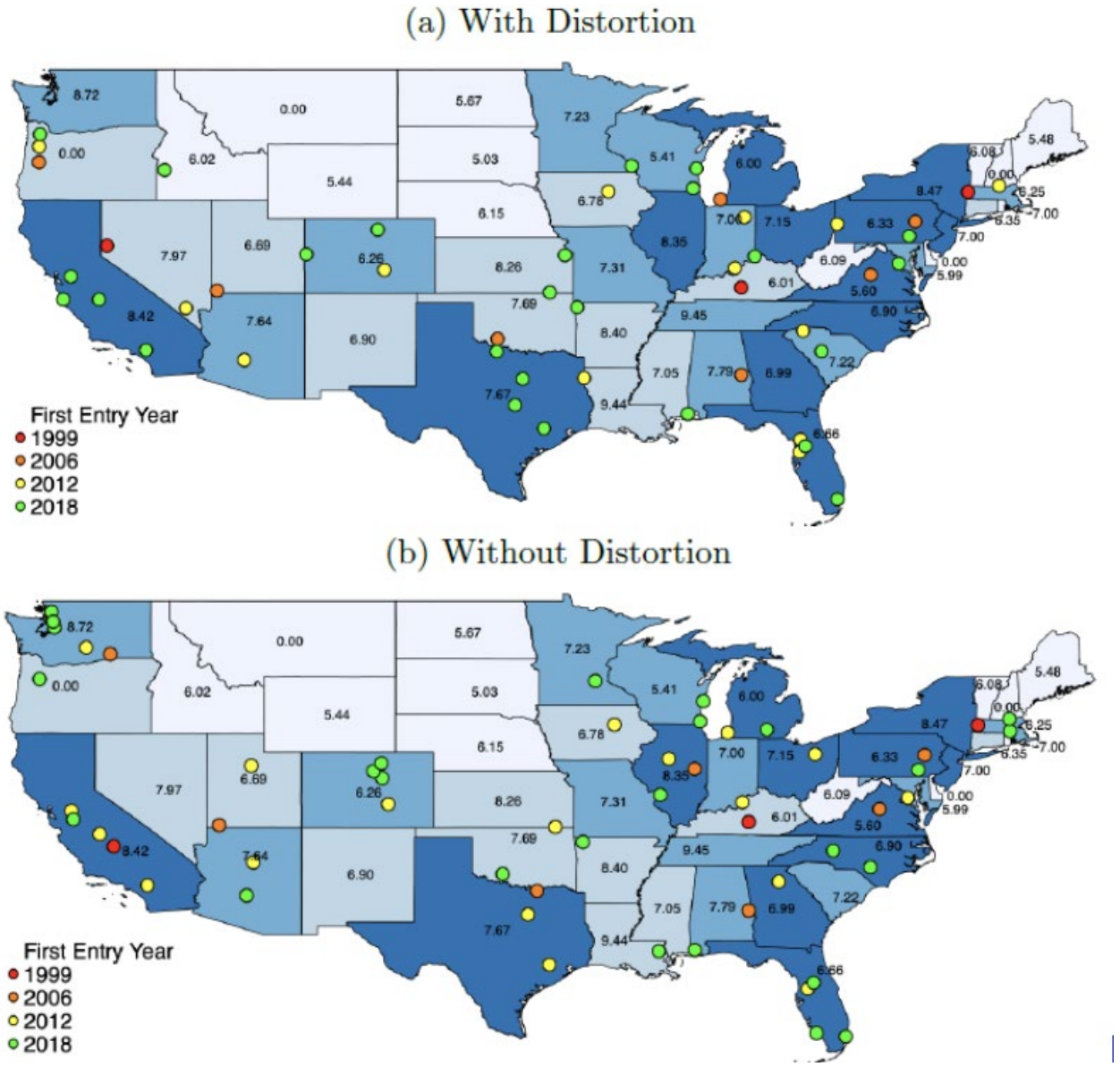
Does this deter investments in product innovations?

- Drastic and costly innovation
- (allbirds does not sell on Amazon)

Broader Implications of E-Commerce

- E-Commerce ⇒ replace storefronts with distribution centers
- Choice of distribution center location depends on local policy environment and has broad implications for local economy
  - Tax policy: Nexus Laws
  - Subsidy competition between states in attracting facilities
  - Local Economic development
    - Amazon as second largest US employer
  - Environmental implications of moving from store visits to package delivery

Broader Implications of E-Commerce: Tax Policy



- Initial exemption of online retail from sales tax collection
- locate in facilities in low-tax states in close proximity to high-demand areas
- reduces economies of density in distribution: higher shipping cost.

Broader Implications of E-Commerce: Subsidies

- Place-based policies: is competition over e.g., Amazon HQ2 warranted?
- Slattery (2020) studies subsidy competition between states for new firms, broadly
  - Allocation of rents between states and firms depend on variation in valuations for firms and the substitutability of locations
  - Bidding behavior reveals valuations
  - Findings: Efficiency gains because firms get matched to locations that value them more, but firms extract most of the gains

Broader Implications of E-Commerce: Economic Dev

- Direct evidence on local benefits to Amazon presence limited

United States

Mar 26th 2022 edition ›

The United States of Amazon

What happens when Amazon comes to town

The e-commerce giant is expanding at a rapid pace. How might that change America?

Broader Implications of E-Commerce: Economic Dev

- Direct evidence on local benefits to Amazon presence limited
- Anecdotally:

The Economist

- Warehouse workers in counties w/ Amazon made about $41,000 a year in 2017, 10% less than those in counties w/ Amazon.
- Similar gap after adoption of minimum wage in 2018

Spillovers: Derencourt et al (2021) find local spillovers of adoption of minimum wage by Amazon on other local retailers

Broader Implications of E-Commerce: Environmental

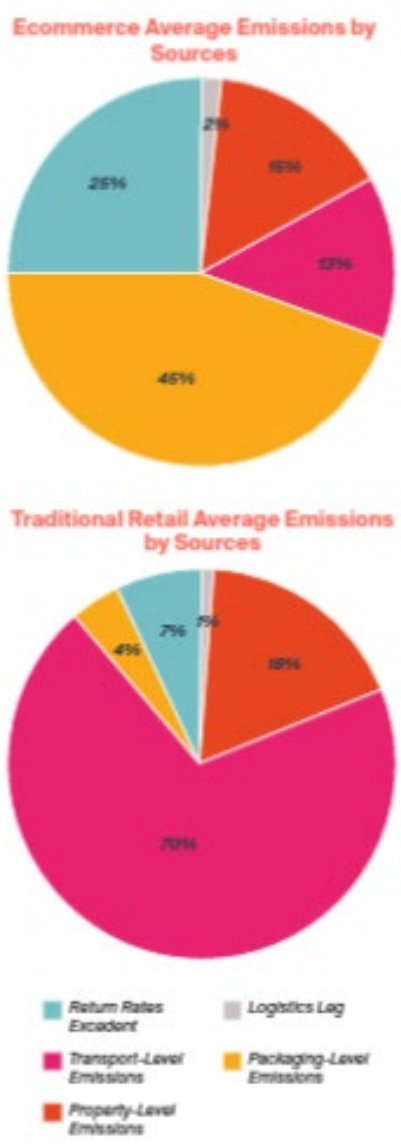


Fig 4. GHG emissions Breakdown by Sources.

Traditional and online shopping have very different carbon footprints that translate into different total emissions

Estimates from Fernandez-Briseno et al (2020)

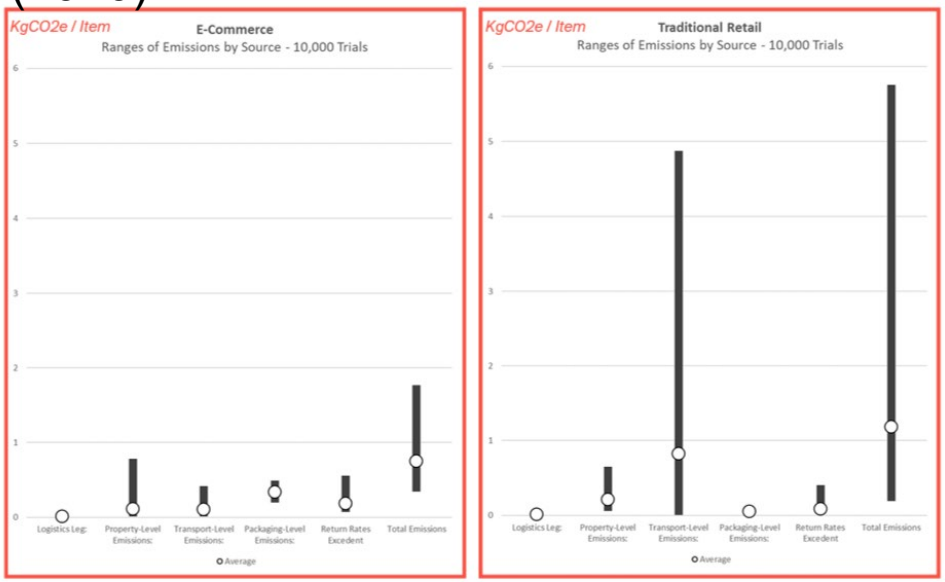


Fig 5. Breakdown of Carbon Footprints by Ecommerce and Brick-and-Mortar Retail.

Questions?