Is buying on Amazon like trading with a digital Atlantis?

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Why e-commerce?

• Volume of e-commerce is on a continuous growth path
• Share of e-commerce rises at the expense of traditional business
• Traditional business models face massive pressure
What is our contribution?

• Role of heterogenous firms in new markets (compare to Melitz 2003, Bernard et al. 2011, Helpman et al. 2004)
• E-commerce as more than just buyer-seller matching (compare to Freund and Weinhold 2004, Goldmanis et al. 2009)
• Non-linear effects in models of trade (Helpman & Redding 2010, Helpman et al. 2017)
This talk

- Stylized facts about e-commerce
- Theoretical approach
- Scenarios of e-commerce impacts
- Empirical approach & data
- Empirical results
- Conclusion
Stylized facts about e-commerce: 1/3

There is strong firm-level heterogeneity

![Bar chart showing the percentage of European enterprises that have done electronic sales in 2017 for different categories of enterprises (all enterprises, small enterprises, medium enterprises, and large enterprises) and different types of sales (within own country, to other EU countries, to the rest of the world). Eurostat 2019](image)
Stylized facts about e-commerce: 2/3

Consumer preferences for e-commerce versus traditional consumption differ across sectors

![Bar chart showing preferences to buy online versus in-store by product category.](chart.png)

PwC 2017
Stylized facts about e-commerce: 3/3

Multichannel-marketing: big e-commerce players heavily invest in traditional infrastructure
Theoretical approach: Melitz framework

E-commerce as a new technology

E-commerce products as a new variety
Firm side

Benchmark (Melitz 2003)

Production cost (fixed + iceberg trade, \( \varphi = \) firm productivity):

\[
l_{nij}^b = f_{nij} + \tau_{nij} \frac{q_{nij}}{\varphi}, \tau_{nij} \geq 1
\]

Variety price:

\[
p_{nij}^b(\varphi) & = \frac{\sigma}{\sigma - 1} \frac{\tau_{nij}}{\varphi}
\]

Firm profit:

\[
\pi_{nij}^b(\varphi) = B_{nj}^b \left( \frac{\tau_{nij}}{\varphi} \right)^{1-\sigma} - f_{nij}
\]

\[
B_{nj}^b = \frac{(\sigma - 1)^{\sigma - 1}}{\sigma^\sigma} A_{nj}^b, \quad A_{nj}^b = \beta_{nj} Y(P_{nj}^b)^{\sigma - 1}
\]

Twin varieties extension (TVO)

EC-cost (\( \varphi = \) firm productivity):

\[
l_{nij}^{ec} = f_{nij}^{ec} + \tau_{nij}^{ec} \frac{q_{nij}^{ec}}{\varphi}
\]

EC-variety price:

\[
p_{nij}^{ec}(\varphi) & = \frac{\sigma}{\sigma - 1} \frac{\tau_{nij}^{ec}}{\varphi}
\]

Firm EC-profit:

\[
\pi_{nij}^{ec}(\varphi) = B_{nj}^{ec} \left( \frac{\tau_{nij}^{ec}}{\varphi} \right)^{1-\sigma} - f_{nij}^{ec}
\]

\[
B_{nj}^{ec} = \frac{(\sigma - 1)^{\sigma - 1}}{\sigma^\sigma} A_{nj}^{ec}, \quad A_{nj}^{ec} = \beta_{nj} Y(P_{nj}^{ec})^{\sigma - 1}
\]

Traditional varieties: same as benchmark
Demand side & equilibrium

Benchmark (Melitz 2003)

Demand for firm variety:
\[ q_{nj}^b (\omega) = A_{nj} p_{nj}^b (\omega)^{-\sigma_{nj}} \]

Productivity cut-offs (zero-profit conditions):
\[ \phi_{nij}^b \]

Market-entry condition:
\[ \sum_{n} \int_{\phi_{nij}^b}^{\infty} \left[ B_{nj} \left( \frac{\tau_{nij}}{\phi} \right)^{1-\sigma} - f_{nij} \right] dG_i(\phi) = f_{Eij} \]

Twin varieties extension (TVO)

Demand for firm varieties:
\[ q_{nj}^{ec} (\omega) = A_{nj} p_{nj}^{ec} (\omega)^{-\sigma_{nj}} \quad \text{&} \quad q_{nj}^{tr} (\omega) = A_{nj} p_{nj}^{tr} (\omega)^{-\sigma_{nj}} \]

Productivity cut-offs (zero-profit conditions):
\[ \phi_{nij}^{ec}, \phi_{nij}^{tr} \]

Market-entry condition:
\[ \sum_{n} \int_{\phi_{nij}^{ec}}^{\infty} \left[ B_{nj} \left( \frac{\tau_{nij}^{ec} \tau_{nij}^{tr}}{\phi} \right)^{1-\sigma} - f_{nij}^{ec} \right] dG_i(\phi) \\
\quad + \sum_{n} \int_{\phi_{nij}^{tr}}^{\infty} \left[ B_{nj} \left( \frac{\tau_{nij}^{tr}}{\phi} \right)^{1-\sigma} - f_{nij}^{tr} \right] dG_i(\phi) \\
\quad = f_{Eij} \]

\[ \leftrightarrow \phi_{nij}^{tr} > \phi_{nij}^b; B_{nj} < B_{nj}^b, P_{nj} < P_{nj}^b \]
Scenarios of e-commerce impacts: 1/3

E-commerce is only attractive as a second channel for highly productive firms
Scenarios of e-commerce impacts: 2/3

Switching to e-commerce will allow medium companies to stay in business
Scenarios of e-commerce impacts: 3/3

E-commerce will allow many small unproductive companies to enter business
Empirical hypotheses

Scenario I: Markets with very high e-commerce costs are characterized by higher concentration and very large size of companies trading online.

Scenario II: Decreasing e-commerce costs lead to lower average productivity in ecommerce, thus, to smaller average firm size.

Scenario III: Markets with very low e-commerce costs are characterized by a large number of online-only firms and overall lower market concentration.
Empirical approach (1/2)

Step 1: Determine proxies for e-commerce adoption

\[ ec_{ijt} = \beta X_{ijt} + \alpha_{ij} + u_{ijt} \]

- \( ec_{ijt} \) — e-commerce adoption
- \( X_{ijt} \) — proxies of e-commerce costs
- \( \alpha_{ij} \) — country-sector fixed effects
- \( u_{ijt} \) — error term

Potential proxies:

- consumers’ ICT usage and online shopping behavior
- logistics and postal services
- sector characteristics (durability, complexity, bulkiness)
- income level, institutions (payment systems, contract enforcement, etc.)
Empirical approach (2/2)

Step 2: Relate e-commerce adoption to market concentration

\[ mc_{ijt} = \beta_1 ec_{ijt} + \beta_2 ec_{ijt}^2 + \gamma Z_{ijt} + \alpha_{ij} + u_{ijt} \]

- \( mc_{ijt} \) — market concentration,
- \( ec_{ijt} \) — e-commerce adoption,
- \( Z_{ijt} \) — controls,
- \( \alpha_{ij} \) — country-sector fixed effects,
- \( u_{ijt} \) — error term

Step 3: Relate proxies from step 1 to market concentration

\[ mc_{ijt} = \beta_1 X_{ijt} + \beta_2 X_{ijt}^2 + \gamma Z_{ijt} + \alpha_{ij} + u_{ijt} \]

- \( mc_{ijt} \) — market concentration,
- \( X_{ijt} \) — proxies of e-commerce costs,
- \( Z_{ijt} \) — controls,
- \( \alpha_{ij} \) — country-sector fixed effects,
- \( u_{ijt} \) — error term
Data

“ec-extra” sample

• 35 countries in EU & (potential) EU accession candidates

• 22 NACE Rev. 2 sector groups in manufacturing, trade & services (based on 2-digit classification)

• Data on e-commerce proxies, e-commerce adoption & market structure


• Steps 1-3

“full” sample

• 35 countries in EU & (potential) EU accession candidates

• 649 NACE Rev. 2 sectors in mining, manufacturing, trade & services (based on 2- to 4-digit classification)

• Data on e-commerce proxies & market structure

• 2005-2017

• Step 3
Results: Step 1

Best proxies for e-commerce:

- Online shopping behavior
  - Share of population buying online (+)
  - Online-shoppers reporting problems with fraud (-)
- Logistics
  - Number of post offices & daily urban deliveries (+)
  - Share of population not covered by post (-)
- Institutions
  - Time to build a warehouse (-)
  - Amount of card payments (+)
- Sector characteristics (enterprise side)
  - Capital R&D expenditure (-)
  - Share of foreign-owned enterprises (-)
Results: Step 2

Hump-shaped relationship between e-commerce adoption & market concentration → hypothesis 1+3
Results: Step 3

Hump-shaped relationship between e-commerce costs & market concentration → hypothesis 1+3
Conclusion

• Theory prediction:
  • E-commerce, like trade liberalization, increases competitive pressure but also opens opportunities for some firms to expand through access to new markets
  • Large, most productive firms will use e-commerce as a second channel
  • Unlike trade liberalization, depending on e-commerce costs, e-commerce can profit small & medium firms too
  • There are three potential scenarios of e-commerce impact on market structure

• Empirical result:
  • Relation between e-commerce costs is non-linear (hump-shaped)
  • In high-cost markets, large firms profit from e-commerce → market concentration rises
  • In low-cost markets, small firms can survive / enter the market → market concentration falls