Trading Away Wide Brands for Cheap Brands

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Motivation

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  - Half of new US products, 2/3rds of Spanish productivity.
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  • Half of new US products, 2/3rds of Spanish productivity.

• Trade liberalization affects firm investments in variety and productivity.
  • Canada, Argentina, Mexico.

• Standard trade models do not address the tradeoff of firm investments in variety and productivity.
  • Higher quantity (or better quality) at original production cost through economies of scale.
Unbundling Innovation

- I address this tradeoff by considering multiproduct firms with competing needs for product and process innovation.

- **Firm reorientation.** Product life cycle, firm and industry evolution, exporting.

- **Trade, competition and innovation.** Depends on dimension of innovation and firm.

- **Welfare and Policy.** Reveals new GFT from product innovation. Relates innovation policy to trade and competition.
Approach and Preview

- Krugman-type monopolistic competition model of product differentiation.
- Each firm chooses product variety and production processes.
- Linear demand system with brand differentiation, introduces cannibalization of products within firms.

- **Distinction.** Product innovation cannibalizes, Process innovation does not.
- **Channels for Innovation.** Economies of scale $\implies$ ↑ Process innovation. Tougher competition $+$ Cannibalization $\implies$ ↓ Product innovation.
- **Welfare and Policy.** ↓ Product innovation $\implies$ GFT from low elasticity varieties. Trade increases the need to encourage process vs product innovation.
Outline

1. Related Work

2. Benchmark Model
   - Cannibalization and Innovation
   - Trade Liberalization and Innovation
   - Welfare Gains and Innovation Policy

3. Within and Across-Brand Competition

4. Conclusion
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Related Work

Trade and Innovation


Multiproduct firms

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Benchmark Model

- Distinction between product and process; demand side.
Benchmark Model

- Distinction between product and process; demand side.
- \( L \) agents, each endowed with a unit of labor. \( w = 1. \)
Consumers

Brand-wide consumption: \( q_j = \int_0^{h_j} q_{ij} \, di \).

Industry-wide consumption: \( Q = \int_0^M q_j \, dj \).
Brand Differentiation and Demand

- Consumer $k$’s demand for brand $j$’s product $i$ is $q_{ij}^k$.
- $\alpha, \delta, \gamma, \eta > 0$. Brand consumption $= q_j^k$ and Industry consumption $= Q^k$.

$$U \equiv q_0^k + \alpha Q^k - \frac{\delta}{2} \int_j \int_i (q_{ij}^k)^2 di dj - \frac{\gamma}{2} \int_j (q_j^k)^2 dj - \frac{\eta}{2} (Q^k)^2$$

- Demand for brand $j$’s product $i$ is $q_{ij} = Lq_{ij}^k$.

$$p_{ij} = \alpha - \delta q_{ij} / L - \gamma q_j / L - \eta Q / L$$
Within-Brand Cannibalization

\[ p_{ij} = \alpha - \delta q_{ij}/L - \gamma q_j/L - \eta Q/L \]

- Across-brand demand effect = \( \frac{\partial p_{ij}}{\partial q_{i'j'}} = -\eta / L \).
- Within-brand demand effect = \( \frac{\partial p_{ij}}{\partial q_{ij}} = -(\gamma + \eta) / L \).

- Within-brand cannibalization: Fall in inverse demand due to brand differentiation.
  - \( \gamma > 0 \) implies Within-Brand Price Fall > Across-Brand Price Fall.
  - \( \gamma = 0 \): No cannibalization.
Differentiated goods industry: Pay entry cost $f$ to produce with unit cost $c$. 

**Firms**

- Product Range $n_j$
- Quantities $q_{ji}$
- Production Process $\omega_{ji}$
- Product R&D cost $r_h$
- Lowers unit cost $c(\omega_{ji})$
- Process R&D cost $r_\omega$
Firms

\[
\max_{\{\omega_{ij}, q_{ij}\}, h_j} \Pi_j = \int_0^{h_j} \left[ (p_{ij} - c(\omega_{ij}))q_{ij} - r\omega_{ij} - r_h \right] di - f
\]

- \( c'(\omega_{ij}) < 0 \) (and joint concavity). Higher \( \omega \) implies lower unit cost.
- Symmetric costs within firms \( \implies \omega_{ij} = \omega, \ q_{ij} = q \).
- Firms choose process \( \omega \), quantity per product \( q \) and product range \( h \).
- Assume Free entry of firms to determine equilibrium.
Optimal Process

\[-c'(\omega)q - r\omega = 0\]

Unit cost savings

- Economies of scale through \(q\).
- No direct cannibalization: \(\partial \omega(q, \gamma)/\partial \gamma = 0\).
- \(c(\omega) = c(1 - \omega^{1/2})\) for \(\omega \in [0, 1]\).
Optimal Quantities

Inverse Demand: $p = a - \delta q/L - \gamma h q/L$ where $a \equiv \alpha - \eta Q/L$.

$$[p - c(\omega)] - (\delta + \gamma h) q/L = 0$$
Optimal Products

- Profit from new product: \( \pi = [p - c(\omega)]q - r_\omega \omega - r_h. \)
- Cannibalization from new product: Price falls by \( \gamma q / L. \)

\[ \pi - h(\gamma q / L)q = 0 \]

- Direct Cannibalization: \( \partial h(q, \omega, \gamma) / \partial \gamma < 0. \)
Optimal Products

- Products $h$ enable firms to adjust price elasticity of demand $\varepsilon$.

$$\pi - h\pi'(\varepsilon)\frac{\partial\varepsilon}{\partial h} = 0$$

- New product $\uparrow h \implies \downarrow$ demand for existing products $\implies$ With linear demand, $\varepsilon \uparrow$ for existing products.

![Graph showing the demand curve and cannibalization effect.](image-url)
Brand Differentiation: Innovation and Welfare

Innovation

- *Product innovation cannibalizes while process innovation does not.*
  - $dh/d\gamma < 0$ and $d\omega/d\gamma = dq/d\gamma = 0$.
  - $q$ depends on $\text{MR} = \text{MC}$.
  - $h$ depends on $\pi =$Cannibalization and hence on $p$. 
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Innovation

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Welfare

• *Unbundling innovation shows welfare gains from product innovation.*

• Indirect utility is $V^k = 1 + Mh(\alpha - p)/2(\delta + \gamma h + \eta Mh)$.
  
  • Rises with Lower Prices $p = c(\omega) + $Markup.
  
  • Rises with Total Variety $Mh$.
  
  • Falls with Within-Brand Variety $\gamma h$, given total variety. *Access to low-elasticity varieties.*
Free Trade

- Think of two identical countries with segmented markets for differentiated goods and free trade in the homogeneous good.
- Free Trade acts like an increase in market size, from $L$ to $2L$.

Proposition

Moving from autarky to free trade increases process innovation but reduces product innovation.

- Gains from Lower Prices because $c(\omega)$ and markups fall.
- Gains from Variety because $Mh$ rises and $h$ falls.
Impact of Trade: Economies of Scale

Trade $\implies$ Market expansion ($q^x$ sold in foreign market) $\implies$ For any home quantity, Process innovation $\omega$ becomes more viable.

\[ \frac{1}{2} c(q + q^x)\omega^{-1/2} \]

Returns to Process Innovation shift up after an economy opens to trade.
Impact of Trade: Competition

Trade $\rightarrow$ Competition rises ($a$ falls) $\rightarrow$ Demand elasticities rise $\rightarrow$
Narrow product range $\rightarrow$ Ease within-brand cannibalization $\downarrow \gamma h/L$. 
Impact of Trade: Competition

Trade $\implies$ Competition rises ($a$ falls) $\implies$ Demand elasticities rise $\implies$ Narrow product range $\implies$ Ease within-brand cannibalization $\downarrow \gamma h/L$. 

\begin{align*}
D & : a \downarrow \\
D' & : a' \downarrow \\
\text{Slope of Demand Curve} & : -(\delta + \gamma h)/L
\end{align*}
Impact of Trade: Competition

Trade $\implies$ Competition rises ($a$ falls) $\implies$ Demand elasticities rise $\implies$ Narrow product range $\implies$ Ease within-brand cannibalization $\downarrow \gamma h/L$. 

\[ D \quad \text{Slope of Demand Curve is } -(\delta + \gamma h)/L \]

\[ D' \quad \text{Lower product innovation } h \]

\[ \alpha \quad \text{Intercept } a \text{ falls} \]

\[ \alpha' \]

Quantity
Welfare and Policy Effects of Unbundling Innovation

- *Gains from Product Innovation absent in models without within-brand cannibalization or process innovation.*
  - Differential impact of trade on returns to product and process.
Welfare and Policy Effects of Unbundling Innovation

- **Gains from Product Innovation absent in models without within-brand cannibalization or process innovation.**
  - Differential impact of trade on returns to product and process.

- **Trade makes inadequate process innovation more costly.**
  - Innovation policy: \( (1 - \tau_\omega)r_\omega \) vs. \( (1 - \tau_h)r_h \).
  - Relative Benefit of Process vs. Product: \( RB_{\omega h} = \frac{dU/d\tau_\omega}{Mhr_\omega \omega} - \frac{dU/d\tau_h}{Mhr_h} \).

- Encourage process innovation. Even more after trade.
  - Same effect of \( \tau_\omega \) and \( \tau_h \) on prices.
  - Process also reduces \( c \) so direct impact on fall in markups.
  - Economies of scale in reducing \( c \) so higher \( \tau_\omega \) after trade.
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Within-Brand and Across-Brand Competition

- Assumed Within-brand price fall > Across-brand price fall.
- Interaction between within-brand and across-brand competition.

\[ p_{ij} = \alpha - \frac{\delta}{L} q_{ij} - \frac{\gamma}{L} q_j - \frac{\eta}{L} Q_i - \frac{\kappa}{L} q_j Q_i \]

- Within-brand price effect = \( \frac{\partial p_{ij}}{\partial q_j} = -\left(\gamma + \kappa Q_i\right) / L < 0 \).
- Across-brand price effect = \( \frac{\partial p_{ij}}{\partial Q_i} = -\left(\eta + \kappa q_j\right) / L < 0 \).
- Product characteristics: \( i \) competes with similar products \( Q_i \).
  Within > Across if \( Q_i = Q \).

- \( \kappa \geq 0 \): Benchmark model. \( \kappa < 0 \): Prefer market visibility of variety.
Innovation and Across-Brand Competition

- High Visibility: Process innovation same as earlier. Trade $\implies$ ↑Process innovation.
- But now Trade $\implies$ ↑Product innovation.
Innovation and Across-Brand Competition

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- But now Trade $\implies \uparrow$ Product innovation.
- Why? Visibility effect $>\text{Cannibalization effect.}$

Trade provides welfare gains from higher variety, lower prices and product innovation (given total variety).
  - Within-brand cross-elasticity falls.
Innovation and Across-Brand Competition

• High Visibility: Process innovation same as earlier. Trade $\implies$ ↑Process innovation.
• But now Trade $\implies$ ↑Product innovation.
• Why? Visibility effect $>$ Cannibalization effect.

• Trade provides welfare gains from higher variety, lower prices and product innovation (given total variety).
  • Within-brand cross-elasticity falls.
• Policy: Process vs. Product innovation similar.
  • Need to encourage entry vs. product innovation with trade.
  • Trade increases brand size so lowers need for entry subsidy.
Heterogeneous Firms

- Single cost draw per firm. $c \sim G(c)$ on $[0, c_{\text{max}}]$.
- Discrete Process Choice: Can upgrade process from $c$ to $c - \omega(c)$ by paying $r_\omega$. Assume $\omega'(c) < 0$. 
Heterogeneous Firms

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- Discrete Process Choice: Can upgrade process from $c$ to $c - \omega(c)$ by paying $r_\omega$. Assume $\omega'(c) < 0$.

- Bilateral trade liberalization:
  - Exporters are more likely to undertake process innovation.
  - Low-productivity exporters and non-exporters reduce product innovation.
  - High-productivity exporters engage in higher product innovation.

- Opposite effects with unilateral home tariff liberalization.
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Tybout and Westbrook (1995): “bulk of production gains” within firms. Initial steps to unbundle the relationship between trade and innovation.

1. Distinguishes product and process innovation.
2. Explains how trade and competition affect product and process innovation.
3. New channel for the effect of trade on innovation.
4. Innovation policy related to trade and nature of competition.

Future work: New Innovation surveys.
Thank you!


