Trading Away Wide Brands for Cheap Brands

Swati Dhingra

University of Wisconsin-Madison

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Motivation

- Gains from Trade through greater product variety and productivity.

- Large fractions of variety and productivity changes take place within firms.

- Trade liberalization affects firm investments in variety and productivity differently.
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- Trade liberalization affects firm investments in variety and productivity differently.
Motivation

- Why does trade liberalization affect investment in wide and cheap brands differently?

- Standard trade and innovation models do not address this tradeoff.
  - Trade $\implies$ economies of scale $\implies$ investment in cheap brands.
  - Product variety changes through entry and exit of firms.

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

- Firm behavior: Reorientation strategies.
- Trade, Competition and Innovation: New demand-based channel ("intra-firm cannibalization") through which trade affects innovation.
- Welfare: Across and Within firm changes.
Approach

- **Theory.** Krugman-type monopolistic competition model of product differentiation.
  - Linear demand system featuring brand differentiation.
  - Trade $\Rightarrow$ economies of scale $\Rightarrow$ cheap brands.
  - Trade $\Rightarrow$ tougher competition $\Rightarrow$ narrow brands.

- **Empirics.** How does product and process innovation respond to tariff cuts?
  - Innovation responses of Thai firms to home tariff cuts.
  - Direct measures of product and process innovation.
Theory: Brand Differentiation


- **Intra-firm Cannibalization:** Products are more substitutable within brands than across brands.
Theoretical Findings

Distinction

- Product innovation cannibalizes while process innovation does not.

Channel for innovation

- Firms lower product innovation to counteract the rise in competition after trade.

Explains wide-to-cheap effect of trade

Empirical Findings

- Thai manufacturing in 2002-2006.
- How does innovation of different Thai firms respond to home tariff cuts?

**Thai Tariff Cuts and Innovation:**

- Fall in process innovation of exporters through lower scale.
- Relative increase in product innovation of less export-oriented firms and vice-versa.

- Expected opposite findings for Malaysia w.r.t. Thai tariff cuts.
- Thai Demand for main product of an establishment is negatively related to demand for its other products.
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1. Related Work

2. Theory
   - Intra-firm Cannibalization
   - Trade Liberalization and Innovation

3. Testable Results and Empirics
   - Heterogeneous Firms
   - Innovation and Trade Policy in Thailand
   - The Impact of Thai Tariffs on Process Innovation
   - The Impact of Thai Tariffs on Product Innovation

4. Conclusion
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Related Work

Trade and Innovation


Multiproduct firms (Allanson and Montagna 2005)


- Trade liberalization has *no* impact on product and process innovation in a Krugman setting and on process innovation in a Melitz setting.

Multiproduct firms: Demand

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Theoretical Model

Melitz and Ottaviano (2008)

$L$ agents, each endowed with a unit of labor. $w = 1$. 

\begin{itemize}
\item Economy
\item Homogeneous goods
\item Differentiated goods
\item Brand
\item Variety
\end{itemize}
Consumers

Brand-wide consumption $= q_j = \int_0^{h_j} q_{ji} \, di$.
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 $q_{ji}^k$.
- $\alpha, \delta, \gamma, \eta > 0$. Brand consumption $= q_j^k$ and Industry consumption $= Q^k$.

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

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

\[
q_{ji} = \frac{L}{\delta} [\alpha - p_{ji} - \gamma q_j / L - \eta Q / L]
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Intra-firm Cannibalization

\[ q_{ji} = \frac{L}{\delta} \left[ \alpha - p_{ji} - \gamma q_j / L - \eta Q / L \right] \]

- Across-brand cross elasticity = \( \varepsilon_{ji,lk} = - \frac{dq_{ji}}{dq_{lk}} \frac{q_{lk}}{q_{ji}} = \eta (q_{lk} / \delta q_{ji}) \).
- Within-brand cross elasticity = \( \varepsilon_{ji,jk} = - \frac{dq_{ji}}{dq_{jk}} \frac{q_{jk}}{q_{ji}} = (\gamma + \eta) (q_{jk} / \delta q_{ji}) \).

- Intra-firm cannibalization: Fall in demand due to brand differentiation.
  - \( \gamma > 0 \) implies \( \varepsilon_{ji,jk} > \varepsilon_{ji,lk} \).
  - \( \gamma = 0 \): No Intra-firm cannibalization.
**Firms**

Differentiated goods industry: Pay entry cost $f$ to produce with unit cost $c$. 

![Diagram](image-url)
Firms

\[
\max_{\{\omega_{ji}, q_{ji}\}, h_j} \Pi_j = \int_0^{h_j} [(p_{ji} - c(\omega_{ji}))q_{ji} - r_\omega \omega_{ji} - r_h] di - f
\]

- \( c'(\omega_{ji}) < 0 \). Higher \( \omega \) implies lower unit cost.

- Symmetric costs within firms \( \implies \) Same process and quantity for each product \( i \).

- \( q_{ji} \equiv q, q_j = h q \)

\[
\max_{\omega, q, h} \Pi_j = h [(p - c(\omega))q - r_\omega \omega - r_h] - f \equiv h \pi - f
\]
Firms

\[
\max_{\{\omega_{ji}, q_{ji}\}, h_j} \Pi_j = \int_0^{h_j} \left[ (p_{ji} - c(\omega_{ji}))q_{ji} - r_\omega \omega_{ji} - r_h \right] di - f
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\]
Optimal Process

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

Unit cost savings

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

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 \( h \uparrow \) \( \rightarrow \) \( \downarrow \) demand for existing products \( \rightarrow \) With linear demand, \( \varepsilon \uparrow \) for existing products.
Autarky Equilibrium

Profit from new product: \( \pi = [p - c(\omega)]q - r_\omega \omega - r_h. \)
Markup: \( p - c(\omega) = (\delta + \gamma h)q/L. \)

**ZPC:** Zero-profit condition
Net profit from new product = 0.
\( \pi - h(\gamma q/L)q = (\delta/L - c^2/4r_\omega)q^2 - r_h = 0. \)

**FE:** Free entry condition
Total profit = 0. \( h\pi - f = \gamma (hq)^2/L - f = 0. \)
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Product and Process Innovation

- \( q = r_h^{1/2} / (\delta / L - c^2 / 4r_\omega)^{1/2} \). \( q \) is invariant to \( \gamma \) and rises with \( L \).
- \( \omega = (cq / 2r_\omega)^2 \). \( \omega \) is invariant to \( \gamma \) and rises with \( L \).
- \( h = (Lf / \gamma q^2)^{1/2} \). \( h \) falls with \( \gamma \) and \( L \).

Proposition

Product innovation cannibalizes directly and indirectly while process innovation does not. Formally, \( \partial h / \partial \gamma < 0 \) and \( dh / d\gamma < 0 \) while \( \partial \omega / \partial \gamma = 0 \) and \( d\omega / d\gamma = 0 \).
Product and Process Innovation

- \( q = \frac{r_1^{1/2}}{h/\left(\frac{\delta}{L} - \frac{c^2}{4r_\omega}\right)^{1/2}} \). \( q \) is invariant to \( \gamma \) and rises with \( L \).
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Free Trade: Firms

- Identical countries.
- Home and foreign markets for differentiated goods are segmented.

\[
\max_{\omega,q,q^x,h} \Pi_j = h[(p - c(\omega))q + (p^x - c(\omega))q^x - r_\omega \omega - r_h] - f
\]

- \( q = q^x \) and Total quantity per product = 2q.
- Same product range supplied to each market: \( h = h^x \).
Free Trade: Equilibrium

- **ZPC':** \( \pi - \gamma h q^2 / L - \gamma h (q^x)^2 / L = (\delta / 2L - c^2 / 4r\omega)(2q)^2 - r_h = 0. \)
- **FE':** \( h\pi - f = \gamma h^2 (2q)^2 / 2L - f = 0. \)

- Total quantity per product \( 2q \) increases after trade.
- Process \( \omega \) rises.
- Product range \( h \) falls.
Impact of Trade

Proposition

Moving from autarky to free trade increases process innovation but reduces product innovation. Gains from Lower Prices and Gains from Variety are both positive.

- Trade $\implies$ Market Expansion $\implies$ Increase product and process innovation.

- Trade $\implies$ Product market competition rises $\implies$ Lower product innovation to ease intra-firm cannibalization.
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Impact of Trade

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

![Graph showing the relationship between $a$, $a'$, and quantity.](image-url)
Impact of Trade

Trade \implies \text{Competition rises (}a\text{ falls}) \implies \text{Demand elasticities rise} \implies 
\text{Narrow product range} \implies \text{Ease intra-firm cannibalization } \downarrow \gamma h / L.
Impact of Trade

Trade \implies Competition rises (a falls) \implies Demand elasticities rise \implies Narrow product range \implies Ease intra-firm cannibalization \downarrow \gamma h/L.
Impact of Trade Liberalization

Home firms pay $t^*$ per unit of exports $\implies c(\omega) + t^*$. 
Foreign firms pay $t$ per unit of exports $\implies c(\omega) + t$.

- Bilateral tariff liberalization or Unilateral foreign tariff cut $\implies$ Relative $\uparrow$ in market size for home firms $\implies \uparrow \omega$ and $\downarrow h$.

- Unilateral home tariff cut $\implies$ Relative $\downarrow$ in market size for home firms $\implies \downarrow \omega$ and $\uparrow h$. 
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Heterogeneous Firms

- Single cost draw per firm.
- **Process Choice.** Discrete: Can upgrade process from $c$ to $c - \omega(c)$ by paying $r_\omega$. 
Innovation and Trade Policy

Proposition
When an economy opens to trade, process innovation increases among exporters but is unaffected for non-exporters. Product innovation increases for firms above the economy-wide export orientation and falls for firms below it.

A home tariff cut has the opposite effects.

- ↓ market size for exporters ➞ ↓ Process innovation of exporters.
- ↑ competition abroad ➞ ↓ Product innovation of more export-oriented firms and vice-versa.
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- $\downarrow$ market size for exporters $\implies\downarrow$ Process innovation of exporters.
- $\uparrow$ competition abroad $\implies\downarrow$ Product innovation of more export-oriented firms and vice-versa.
Innovation and Trade Policy

- **Process Innovation.** Compare with non-exporters.

\[ \Delta \omega = \beta_1 \Delta t + \beta_2 \cdot E \cdot \Delta t + Z'_{\omega} \zeta_{\omega} + \epsilon_{\omega} \]

- Exporters lower process innovation. \( \beta_2 < 0 \).

- **Product innovation.** Compare with unbranded firms \( (B = 0) \).

\[ \Delta h = \beta_1 \Delta t + \beta_2 (ES \cdot \Delta t) + \beta_3 (B \cdot \Delta t) + \beta_4 (B \cdot ES \cdot \Delta t) + Z'_{h} \zeta_{h} + \epsilon_{h} \]

- \( B = 1 \): Less export-oriented firms increase product innovation and vice-versa. \( \beta_3 > 0 \) and \( \beta_4 < 0 \).
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Data: Innovation

- PICS 2007: 944 Thai manufacturing establishments spanning 28 different ISIC 4-digit industries.
- PICS 2004: 426 incumbents.
- **Process Innovation** $\Delta \omega$: Value of New Machinery & Equipment of the firm in 2005-2006 (% of market value of M&E).
- **Product Innovation** $\Delta h$: 1 if firm increased product range (through product additions or plant openings) in 2005-2006 and 0 otherwise.

<table>
<thead>
<tr>
<th>Percentage of Incumbents by Innovation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product &amp; Process</td>
</tr>
<tr>
<td>28.1</td>
</tr>
</tbody>
</table>
Data: Thai Trade Policy

TRAINS: % Fall in effectively applied tariff rates from 2003 to 2005-2006.

<table>
<thead>
<tr>
<th></th>
<th>Obs.</th>
<th>Mean</th>
<th>S.D.</th>
<th>Min</th>
<th>Max</th>
<th>&lt;10%</th>
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<tbody>
<tr>
<td>Home tariffs $\Delta t$</td>
<td>944</td>
<td>42.3</td>
<td>53</td>
<td>-40</td>
<td>195</td>
<td>5/28</td>
</tr>
<tr>
<td>Foreign tariffs $\Delta t^*$</td>
<td>944</td>
<td>2.6</td>
<td>25</td>
<td>-87</td>
<td>90</td>
<td>17/28</td>
</tr>
</tbody>
</table>
Process Innovation

- Exporters ↓ process innovation compared to non-exporters.
- Is this driven by economies of scale through exports per product?

<table>
<thead>
<tr>
<th>New M&amp;E in Exp.</th>
<th>(1) Coef.</th>
</tr>
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<tbody>
<tr>
<td>2005-2006</td>
<td>(S.E.)</td>
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<thead>
<tr>
<th>Thai tariff cut $\Delta t$</th>
<th>-0.515</th>
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<tr>
<td>('0.728)</td>
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<tr>
<th>Exporter $\cdot \Delta t$</th>
<th>$\beta_2 &lt; 0$</th>
</tr>
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<tr>
<td>-0.284*</td>
<td>(0.139)</td>
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<tr>
<th>Exporter</th>
<th>1.126**</th>
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<tr>
<th>Industry dummies</th>
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<th>N</th>
<th>914</th>
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<tr>
<th>Log-likelihood</th>
<th>-1875.678</th>
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Notes: ** and * denote 1 and 5 per cent significance levels.
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<tbody>
<tr>
<td>Thai tariff cut Δt</td>
<td>-0.515</td>
<td>(0.728)</td>
<td>ΔExport per pdt βω &gt; 0</td>
<td>0.410**</td>
<td>(0.022)</td>
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<tr>
<td>Exporter·Δt</td>
<td>-0.284*</td>
<td>(0.139)</td>
<td>Initial process yes</td>
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<tr>
<td>Exporter</td>
<td>1.126**</td>
<td>(0.348)</td>
<td>Industry dummies yes</td>
<td></td>
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<tr>
<td>Industry dummies</td>
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<td>First-stage: ΔExport per product βt &lt; 0</td>
<td>-0.874**</td>
<td>(0.236)</td>
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<td>N</td>
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<td>Log-likelihood</td>
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Product Innovation


<table>
<thead>
<tr>
<th>Product Innovation</th>
<th>Exp.</th>
<th>(1) Coef.</th>
<th>(2) Coef.</th>
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<tbody>
<tr>
<td>Thai tariff cut $\Delta t$</td>
<td>-0.455**</td>
<td>-0.478*</td>
<td></td>
</tr>
<tr>
<td>Export share $\cdot \Delta t$</td>
<td>0.626**</td>
<td>0.527**</td>
<td></td>
</tr>
<tr>
<td>Brand $\cdot \Delta t$</td>
<td>$\beta_3 &gt; 0$</td>
<td>0.870**</td>
<td>0.728**</td>
</tr>
<tr>
<td>Export share $\cdot$ Brand $\cdot \Delta t$</td>
<td>$\beta_4 &lt; 0$</td>
<td>-0.659*</td>
<td>-0.641*</td>
</tr>
</tbody>
</table>

Export share, Brand, Industry dummies: yes

N: 416
Log-likelihood: -262.182, -264.726

Notes: ** and * denote 1 and 5 per cent significance levels.
Robustness Checks

- **Innovation variables:**
  - New process for main product, Change in value of new M&E between 2002 to 2006.
  - Promotion expenditure, exclusive design workers.

- **Explanatory variables:**
  - Import duties on intermediates and capital goods, Domestic tax and innovation policy, MNC relationship.
  - Initial characteristics: firm size, innovation, credit constraints.

- **Policy variables:**
  - Endogeneity of trade policy: Lobbying behavior as instruments.
  - Foreign tariffs of major trade partners.
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4 Conclusion
## Conclusion

- Initial steps to unbundle the relationship between trade and innovation.
  - Intra-firm cannibalization from brand differentiation

  1. Distinguishes product and process innovation.
  2. New channel for the effect of trade on innovation.

  1. Confirm the predicted impact of Thai tariff liberalization on product and process innovation.
  2. Direct support for intra-firm cannibalization within Thai brands.


