Vertical Differentiation and Credence Goods: Harmonized Labeling and Gains from International Integration

Ian Sheldon and Brian Roe
(The Ohio State University)

Selected Paper Session: “Labeling Certification and International Trade”
AAEA Meetings, Orlando, FL, July 27-29, 2008
Motivation

- Goods increasingly differentiated by process attributes
- Consumers unable to verify claims about attributes, i.e., a form of *credence good* (Darby and Karni, 1973)
- Labeling possible, but there are implementation issues:
  - discrete vs. continuous labels
  - voluntary vs. mandatory
  - exclusive vs. non-exclusive
  - harmonized vs. mutual recognition
- Examine trade implications of choices in context of model of *vertical* product differentiation
Model

■ Consumers, firms and quality

- consumers have unit demand for quality-differentiated good, consumer utility, \( U = u(y - p) \), \( u \in [u, \infty] \) and \( u > 0 \)

- income uniformly distributed on interval \([a,b]\), size of population is \( s \)

- firms produce single differentiated good with zero production costs and a fixed, quality-dependent cost, \( F(u) \), sunk by firm after entry, \( F(u) = \varepsilon + \alpha(u - \bar{u})^2 \), \( \varepsilon \) and \( \alpha > 0 \)

■ Game structure

- 3-stage game: (1) entry/no-entry; (2) choice of quality; (3) price

- invoke sub-game perfection and Bertrand-Nash competition
Entry and number of firms

- assume \( 4a > b > 2a \) or \( b/4 < a < b/2 \), ensuring covered market of 2 firms with quality levels \( 0 < u \leq u_1 < u_2 \)

- if more than 2 firms enter, all firms produce top-quality at a zero price, earning zero profits, so with sunk costs \( \varepsilon \), only two firms can enter and make a profit in equilibrium

Labeling policy

- private and public certifiers perfectly monitor and communicate quality of individual firms \textit{ex ante}, continuous labeling more costly than discrete

Autarky equilibrium with perfect information

- equilibrium shown in Figure 1, firm 1 picks \( u \) and firm 2 picks \( u_2 \)
Figure 1: Autarky equilibrium with perfect information
North-North Integrated Equilibrium

- **Perfect information (PI)**
  - two economies with same distribution of income integrate, $a_1 = a_2$ and $b_1 = b_2$, although may be of differing sizes, i.e., $s^i = s_1 + s_2$
  - firms incur additional sunk costs to enter integrated market
  - economy supports 2 firms, i.e., 2 firms have to exit, figure 2
  - increase in quality of good 2, quality of good 1 remaining the same

- **Trade with no labeling (NL)**
  - sunk cost of entry combined with 3-stage game supports entry of single firm into integrated market producing lowest quality
  - price is monopoly outcome given linear demand structure due to assumptions on income distribution
Figure 2: North-North trade equilibrium – PI case
**Table 1: Labeling regimes – North/North trade**

<table>
<thead>
<tr>
<th></th>
<th>MNC</th>
<th>VND</th>
<th>MED</th>
<th>MND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmonized</td>
<td>Replicates PI</td>
<td>Replicates PI</td>
<td>May be NL (Figure 3)</td>
<td>Replicates PI</td>
</tr>
<tr>
<td>Mutual recognition</td>
<td>Replicates PI</td>
<td>Replicates PI</td>
<td>May replicate PI</td>
<td>Replicates PI</td>
</tr>
</tbody>
</table>

PI – perfect information  
NL – no labeling  
MNC – mandatory, non-exclusive, continuous  
VND – voluntary, non-exclusive, discrete  
MED – mandatory, exclusive, discrete  
MND – mandatory, non-exclusive, discrete
Figure 3: Harmonized – MED case

\[ F(u) \]

\[ s^i R_1(u, u^i_2) \]

\[ s^i R_1(u, u^g_2) \]

\[ \varepsilon \{ \]

\[ u \]

\[ u^g_2 \]

\[ u^i_2 \]

\[ F(u) \]

\[ s^i R_2(u^i_2, u) \]

\[ s^i R_2(u^g_2, u) \]

\[ u \]
North-South Integrated Equilibrium

- Trade equilibrium with overlapping income distributions
  - if two economies initially support two goods using same technology, but $a_1 > a_2$, and $b_1 > b_2$, there will be three goods in integrated equilibrium if, $a_1/2 < a_2 < a_1 < b_1/2 < b_2 < b_1$
  - gains from trade occur due to lower prices in equilibrium
  - NL generates monopoly outcome
  - harmonized/mutual recognition MNC, VND, MND, replicate PI
  - harmonized MED, one or two firms may be forced from market in equilibrium, but not necessarily with mutual recognition