Bundling as an Entry-Deterrent Strategy

**Study Objectives**

- To understand why bundling can possibly be a preferred pricing strategy for information goods.

- To understand why the bundling of information goods can be regarded as a profitable entry-deterrence tool.

- Come up with experiments that might help finding empirical evidence of bundling entry-deterrence effect.
Main Concepts

**Information good** – “something that can be digitized or encoded as a stream of bits” (Shapiro and Varian 1999), such as, software applications, books, movies, music, news stories, and research reports.

**Bundling** – a firm’s decision to sell its products (e.g., two or more information goods) in a package that is priced at a fixed amount.
The Market for Information Goods

The information goods production cost structure is often characterized in the literature as having:

- high fixed costs (most being sunk and not recoverable),

- low marginal costs (close to zero),

Because of this it is usually argued that information goods market tend to be more monopolistically competitive or “dominant firm” alike than perfectly competitive since if firms priced information goods at their marginal costs they would probably not be able to recover their high fixed costs.
Possible Pricing Strategies

Non-linear pricing schemes and bundling seem to be used quite often in the information goods market, mainly because they can be profitable while reducing the price dispersion in consumers’ ‘willingness-to-pay’, with the latter being unknown to producers.

Non-linear pricing – second and third-degree price discrimination seem to be largely used, with producers degrading the high quality version of a product to prevent ‘high willingness-to-pay’ consumers from buying the low quality version. Or grouping consumers, to price discriminate, by consumer type – business, and educational, for instance.

Bundling strategy – that seem most efficient when marginal costs are close to zero since for higher marginal costs some consumers might be buying the bundle valuing one of its information goods at below production costs, which makes bundling less attractive.
Some Bundling Examples

• Microsoft Office, and Microsoft Windows 98 and Explorer;

• Elsevier Science in PEAK (Pricing Electronic Access to Knowledge) field experiment—selling articles separately, bundles of user-defined articles, and the electronic version of their academic journals, on the Internet.
Reasons to Bundle

Bundling might:

1) Reduce the price dispersion in consumers’ willingness-to-pay, which might induce sellers to extract a higher surplus from all consumers with bundled sales than with separate sales of the same information goods.

Example: Table 1 shows two consumers willingness-to-pay for information goods A and B, produced by a monopolist.
Table 1 – Willingness to pay for information goods A and B

<table>
<thead>
<tr>
<th>Consumer</th>
<th>Good A</th>
<th>Good B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer 1</td>
<td>$120</td>
<td>$100</td>
</tr>
<tr>
<td>Consumer 2</td>
<td>$100</td>
<td>$120</td>
</tr>
</tbody>
</table>

- If the seller of these information goods decides to price each one at $120, it will only get Consumer 1 to buy good A and Consumer 2 to buy good B, earning $240.

- If it decides to charge $100 per information good it will get both consumers to buy goods A and B, which will render him an amount of $400.

- However, if it bundles both information goods and sells the bundle for $220, the seller will earn $440. Thus, it can be said that the willingness to pay for the bundle is less dispersed than the willingness to pay for its components.
(Reasons to Bundle) Bundling might:

2) Facilitate predation.

Example: Adding a substitute, for a one-product incumbent information good producer, to the bundle might induce the bundler to enter the one-product incumbent’s market capturing most of its market share, which could force it to exit.

3) Promote cost savings in production.

Example: It is cheaper for a software producer or music editor to include several applications or songs, in one CD disc and sell the package than selling those information goods separately.
(Reasons to Bundle) Bundling might:

4) Be used as an effective price discrimination tool under monopoly and oligopoly environments, if the incumbent firm faces a one-product competitor.
5) Discourage or foreclose potential one-product competitors’ entry – bundling entry-deterrent effect.

Example for items 4) and 5): Nalebuff (1999), assuming that consumer valuations were independent and uniformly distributed over [0, 1], showed that:

- Gains provided by the bundling entry-deterrent effect, under an oligopoly environment, can be higher than monopolist gains from unbundled sales.
- Bundling is able to reduce potential entrants’ profits.
- If entry occurs, incumbent’s post-entry profit loss is reduced when compared to the profit loss that would result from selling the same information goods separately.
Theoretical Support – Nalebuff (1999)’s Basic Model

Main Assumptions:

- non-repeated game of perfect information;
- two players: a two-product (e.g., goods A and B) incumbent and a one-product challenger;
- the two-product incumbent sets price(s) that will remain the same for the rest of the game;
- the challenger might produce and enter either good A or B market;
- marginal costs of producing both goods A and B are zero;
- consumers will purchase one unit of A and/or B;
- consumers valuations of goods A and B (i.e., $\alpha_A$ and $\alpha_B$, respectively) are independent and uniformly distributed over $[0, 1]$;
- total market is normalized to 1;
Independent pricing case: the incumbent decides to sell goods A and B separately.

- Demand for each good is given by
  \[ q_j = 1 - p_j \] (with \( j = A, B \))

- As a monopolist, incumbent maximizes
  \[ \pi_i = \sum TR_j = \sum (q_j p_j) \]
  so that \( MR_j = MC_j \) and \( MC_j = 0 \),
  \[ \frac{\delta TR_j}{\delta p_j} = 0 \iff [(1 - p_j)p_j]' = 0 \iff p_j^* = 1/2, \text{ optimal monopoly independent price for both goods, absent entry, and thus } \pi_i^* = 1/2 \]

- If \( E \leq 1/8 \), the challenger comes in with \( p_j^* = 1/2 - \varepsilon \), stealing all the incumbent’s \( j \) market and making half of incumbent’s profits and thus \( \pi_c^* = \pi_i^*/2 = 1/4 \)
- Post entry, the incumbent should continue pricing $p_j^* = 1/2$ in the market that is left for it.

- Monopolist’s best entry deterrence strategy would be to charge prices for both goods such that $\pi_i^* = 2E$ (with $E$ being the value of challenger’s entry costs); thus, the incumbent will only try to deter entry if $E > 1/8$.

**Table 2 – A summary of Independent Pricing case optimal results**

<table>
<thead>
<tr>
<th>Entry costs ($E$)</th>
<th>Incumbent charges</th>
<th>Incumbent’s profits</th>
<th>Challenger’s price</th>
<th>Challenger’s profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\leq 1/8$ (entry occurs)</td>
<td>$p_j^* = 1/2$</td>
<td>1/4</td>
<td>$p_j^* - \varepsilon$</td>
<td>1/4</td>
</tr>
<tr>
<td>$1/8 &lt; E \leq 1/4$</td>
<td>$p_j^<em>$, such that, $\pi_i^</em> = 2E$</td>
<td>2E</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>(limit pricing)</td>
<td></td>
<td>entry deterred</td>
<td>entry deterred</td>
<td></td>
</tr>
<tr>
<td>$&gt; 1/4$ (monopoly)</td>
<td>$p_j^* = 1/2$</td>
<td>1/2</td>
<td>«</td>
<td>«</td>
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**Pure bundling case:** the incumbent decides to sell goods A and B as part of a package, charging a fixed price for it.

- By charging \( p_t = p_A^* + p_B^* = 1/2 + 1/2 = 1 \) the incumbent would get the same profits as with unbundled sales.

- By marginally lowering the price of the bundle the incumbent can get more marginal consumers to buy it, which will raise its profits and lower challenger’s profits making entry less attractive.
Absent entry (e.g., for $E > 0.1$):
- Demand for the bundle is given by $q_t = 1 - p_t^2/2$
- As a monopolist, incumbent maximizes \( \pi_t = p_t(1 - p_t^2/2) \)

so that its f.o.c. is given by \( 3p_t^2 - 2 = 0 \),

the optimal monopoly bundled price is \( p_t^* \approx 0.8 \), and \( \pi_t^* \approx 0.54 \)

Entry occurs on, e.g., B market (for \( E \leq 0.035 \)):

- Demand for the bundle is given by \( q_{pt} = 1 - p_t + p_B - p_B^2/2 \)

- Demand for challenger’s good B is given by \( q_B = (1 - p_B)(p_t - p_B) \)
Figure 5

Market for the Bundle

Market for Good B only

\( \alpha_A \)

\( p_t - p_B \)

\( p_B \)

\( \alpha_B \)
The incumbent maximizes
\[
\pi_{pt} = p_t(1 - p_t + p_B - p_B^2/2)
\]
so that its f.o.c. is given by
\[
2p_t + 1 + (1 - p_B/2)p_B = 0,
\]
the optimal bundled price is \( p_t^* \approx 0.66 \), and \( \pi_{pt}^* \approx 0.38 \).

The challenger maximizes
\[
\pi_e = p_B(1 - p_B)(p_t - p_B)
\]
so that its f.o.c. is given by
\[
3p_B^2 - 2(1 + p_t)p_B + p_t = 0,
\]
the optimal price for the good is
\[
p_B^* = (1 + p_t)/3 - 1/3 \sqrt{(1 - p_t + p_t^2)} \approx 0.26, \text{ and } \pi_e^* \approx 0.08.
Limit pricing (for $0.035 < E \leq 0.1$):

- The incumbent attempts to deter entry only if it can get profits above $0.38$

- Therefore, the incumbent’s optimal bundled price $p_l^*$ will be such that

$$\pi_e = p_B(1 - p_B)(p_l - p_B) = 0$$

<table>
<thead>
<tr>
<th>Entry costs ($E$)</th>
<th>Incumbent charges ($p_l^*$)</th>
<th>Incumbent’s profits</th>
<th>Challenger’s price</th>
<th>Challenger’s profits</th>
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</thead>
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<tr>
<td>$\leq 0.035$</td>
<td></td>
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<td>0.8</td>
<td>0.54</td>
<td>«</td>
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</tbody>
</table>
Independent pricing vs. pure bundling cases:

- If \( E \leq 0.035 \), incumbent’s optimal behavior is to accommodate entry on both independent pricing and pure bundling cases, however, bundling:

  - Can be used to deter entry since entry occurs if \( E \leq 0.035 \) opposed to \( 0.125 \) of independent pricing;

  - Reduces challenger’s profits to \( \pi_e (\approx 0.08) \) opposed to \( \pi_c (=0.25) \) of independent pricing;

  - Makes entry less costly for the incumbent since \( \pi_{pt} (\approx 0.38) > \pi_i (=0.25) \);
• If \( 0.035 < E \leq 0.1 \), incumbent bundler optimal behavior is to start limit pricing in order to prevent entry; if not bundling, incumbent’s optimal behavior is to accommodate entry, thus bundling:

- Is an efficient way to deter entry since incumbent bundler’s profits rise rapidly;

- Makes the challenger earn non-positive profits;

- Makes entry less costly for the incumbent since, and, for \( E = 0.1 \),

\[
\pi_r \approx 0.54 > \pi_i \approx 0.25;
\]
• If $0.125 \leq E \leq 0.25$, incumbent bundler optimal behavior is to act like a monopolist; if not bundling, incumbent’s optimal behavior is use limit pricing to prevent entry. Thus, bundling:

- Is an efficient way to deter entry since $\pi_i (\approx 0.54) > \pi_i (0.25 \leq \pi_i \leq 0.5)$;

- Makes the challenger earn non-positive profits;

• If $E > 0.25$, incumbent’s optimal behavior is to act like a monopolist since challenger’s best response is to stay out of the market.

- Bundling can also be used as a price discrimination tool since

$$\pi_i (\approx 0.54) > \pi_i (= 0.5)$$
Table 4 – Incumbent’s bundled versus independent prices and profits (before and after entry), and challenger’s potential profits

<table>
<thead>
<tr>
<th>Incumbent charges</th>
<th>Incumbent’s profits with entry</th>
<th>Incumbent’s profits without entry</th>
<th>Challenger’s potential profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (bundle)</td>
<td>0.278</td>
<td>0.5</td>
<td>0.148</td>
</tr>
<tr>
<td>0.8 (bundle)</td>
<td>0.361</td>
<td>0.544</td>
<td>0.105</td>
</tr>
<tr>
<td>0.66 (bundle)</td>
<td>0.374</td>
<td>0.516</td>
<td>0.077</td>
</tr>
<tr>
<td>0.5 (each good)</td>
<td>0.25</td>
<td>0.5</td>
<td>0.25</td>
</tr>
</tbody>
</table>
The Experimental Design

- Having Nalebuff’s basic model as theoretical support:

  - Three two-person non-cooperative games were designed, and they are ‘independent pricing’, ‘pure bundling’, and ‘independent pricing or pure bundling’;

  - Two experimental sessions will be conducted per game, one featuring ‘high’ and another featuring ‘low’ entry costs in order to incorporated entry cost change effects in each game;
- Each experimental session will have, at most, 20 periods with each player being assigned the same role for 10 periods after which the roles are switched in order to make subjects learn the game; thus, all subjects will get to play both Incumbent and Challenger player roles;

- Each period every Incumbent player will be matched to a different unknown Challenger player in order to keep the players from the repeated game effects that might occur;