Enabling vs. Controlling

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Enabling vs. Controlling (Employing)

Sale of products or services

Suppliers — Platform — Customers

“ENABLE”

Suppliers — Reseller — Customers

“BUY”

Suppliers — V.I. firm — Customers

vertical integration (employment)

“CONTROL (“MAKE”)
Integrated firms (employees)

Platforms (indep. contractors)

**Platforms**

- Infosys
- BCG (The Boston Consulting Group)
- WM (Waste Management)
- Raffles Hospital (Singapore)

**Integrated Firms**

- Yellow Cab Co.
- Uber
- Upwork (formerly oDesk)
- HourlyNerd
- Rubicon

**Extent of control by “agents”**

*(decisions not explicitly contracted upon)*
Goal of the paper

- Tradeoffs between two modes of organization: employment (E) mode vs. platform (P) mode
  - Agents hold more control rights in P-mode than in E-mode
  - Complete information & two-part tariffs in both modes

- Extension of “classic” theory of the firm to platforms => some novel & counter-intuitive results
Literature review

• Theory of firm: make vs. buy => make vs. enable
  + Incentive systems (Holmstrom and Milgrom, 1994)
  + Novel elements (2-sided moral hazard, transferable action, spillovers)

• Distortions due to revenue-sharing and linear contracts:

• Hagiu and Wright (2015a) and (2015b)

• Vertical integration in the platform literature:
Outline

1. Introduction and motivation

2. Baseline: 1 firm + 1 agent

3. 1 firm + N agents (spillovers)

4. Extensions

5. Conclusions
Baseline: 1 firm + 1 agent
Set-up

- 1 firm & 1 agent. Profits generated by the relationship:

\[ R(a, e, I) - c^a(a) - c^e(e) - c^I(I) \]

Two-sided moral hazard

- **E-mode** (employment): firm chooses \( a \) & incurs \( c^a \)
- **P-mode** (platform): agent chooses \( a \) & incurs \( c^a \)

non-contractible, transferable action:
- \( c^a > 0 \) (e.g. equipment)
- \( c^a = 0 \) (e.g. price)

firm’s non-contractible effort (non-transferable)

agent’s non-contractible effort (non-transferable)
## Examples

<table>
<thead>
<tr>
<th></th>
<th>Transferable decisions ($a$)</th>
<th>Non-transferable investments by agents ($e$)</th>
<th>Non-transferable investments by the firm ($I$)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upwork vs. Infosys; HourlyNerd vs. BCG</strong></td>
<td>training</td>
<td>service quality</td>
<td>quality of online system (monitoring, payment); advertising</td>
</tr>
<tr>
<td><strong>Uber/Lyft vs. taxi co’s</strong></td>
<td>car quality &amp; maintenance</td>
<td>service quality</td>
<td>quality of app &amp; back-end infrastructure; advertising</td>
</tr>
<tr>
<td><strong>Coursera vs. U of Phoenix</strong></td>
<td>curriculum design; advertising of individual &amp; courses</td>
<td>quality of content &amp; its delivery</td>
<td>quality of online infrastructure; advertising of the site</td>
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<td><strong>Hospitals &amp; their clinics</strong></td>
<td>medical equipment; support staff; advertising of individual clinics</td>
<td>service quality</td>
<td>quality &amp; maintenance of common facilities; advertising of hospital</td>
</tr>
<tr>
<td><strong>Franchising</strong></td>
<td>quality &amp; maintenance of outlets; staff benefits &amp; training</td>
<td>outlet manager’s effort</td>
<td>product quality (franchisor); national advertising</td>
</tr>
<tr>
<td><strong>Producers and sales agents</strong></td>
<td>training; promotion of individual agents</td>
<td>sales effort</td>
<td>quality of product/service; advertising</td>
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The example to remember!

<table>
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<th>Hair salons</th>
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<th>Non-transferable investments by the firm ((l))</th>
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<td>price ((c^a = 0)); hair products; promotion of individual hair dressers ((c^a &gt; 0))</td>
<td>service quality</td>
<td>maintenance &amp; advertising of salon</td>
</tr>
</tbody>
</table>
Set-up & timing

1 firm & 1 agent. Profits generated by the relationship:

\[ R(a, e, I) - c^a(a) - c^e(e) - c^I(I) \]

1. Firm chooses **E-mode** or **P-mode** & offers contract \((t, T)\):
   - agent will get \((1 - t)R(a, e, I) - T\)
   - firm will get \(tR(a, e, I) + T\)

2. **E-mode**: firm chooses \(a\) and \(I\), agent chooses \(e\)
   - **P-mode**: firm chooses \(I\), agent chooses \(a\) and \(e\)

3. Revenues are realized
Optimal profits

- E-mode:
  \[ \Pi^E = \max_{t,a,e,I} \{ R(a, e, I) - c^a(a) - c^e(e) - c^l(I) \} \]
  subject to:
  \[
  \begin{align*}
  tr_{a}(a, e, I) &= c^a_{a}(a) \\
  (1 - t)r_{e}(a, e, I) &= c^e_{e}(e) \\
  tR_{l}(a, e, I) &= c^l_{l}(I)
  \end{align*}
  \]

- P-mode:
  \[ \Pi^P = \max_{t,a,e,I} \{ R(a, e, I) - c^a(a) - c^e(e) - c^l(I) \} \]
  subject to:
  \[
  \begin{align*}
  (1 - t)r_{a}(a, e, I) &= c^a_{a}(a) \\
  (1 - t)r_{e}(a, e, I) &= c^e_{e}(e) \\
  tR_{l}(a, e, I) &= c^l_{l}(I)
  \end{align*}
  \]
Optimal profits

• E-mode:
\[
\Pi^E_* = \max_{t,a,e,I} \{R(a, e, I) - c^a(a) - c^e(e) - c^I(I)\}
\]
subject to:
\[
\begin{align*}
tr_a(a, e, I) &= c^a_a(a) \\
(1 - t)r_e(a, e, I) &= c^e_e(e) \\
tr_l(a, e, I) &= c^I_l(I)
\end{align*}
\]

• P-mode:
\[
\Pi^P_* = \max_{t,a,e,I} \{R(a, e, I) - c^a(a) - c^e(e) - c^I(I)\}
\]
subject to:
\[
\begin{align*}
(1 - t)r_a(a, e, I) &= c^a_a(a) \\
(1 - t)r_e(a, e, I) &= c^e_e(e) \\
tr_l(a, e, I) &= c^I_l(I)
\end{align*}
\]

• Two-sided moral hazard \((e, l)\) + distortion of \(a\)
General results

- **Proposition 1:** In both modes, linear contract is optimal.
  
- **Proposition 2:**
  - If $a$ is contractible or costless (e.g. price) then $\Pi^E = \Pi^P$
  - If $e$ is contractible or $R_e = 0$ then $\Pi^E > \Pi^P$
  - If $l$ is contractible or $R_l = 0$ then $\Pi^P > \Pi^E$

- **Proposition 3:** Suppose $R(a, e, E)$ is super-modular.
  - If $t^E < 1/2$ then $\Pi^E < \Pi^P$
  - If $t^P > 1/2$ then $\Pi^P < \Pi^E$
Linear example

• Suppose
  – \( R(a, e, E) = \theta a + \gamma e + \delta I \)
  – \( c^a(a) = \frac{1}{2} a^2, c^e(e) = \frac{1}{2} e^2 \) and \( c^I(I) = \frac{1}{2} I^2 \)

• Proposition 4: Firm prefers P-mode to E-mode iff \( \gamma > \delta \)

• i.e. agent’s moral hazard > firm’s moral hazard
1 firm + N agents
Set-up and timing

• 1 firm & \( N \) agents (symmetric). Total profits generated:

\[
\sum_{i=1}^{N} (R(a_i, a_{-i}, e_i, I) - c^a(a_i) - c^e(e_i)) - c^I(I)
\]

Spillovers across transferable actions
=> services can be complements or substitutes

• E-mode – firm chooses all \( a_i \)'s
• P-mode – agent \( i \) chooses \( a_i \) for \( i = 1, \ldots, N \)
General results

• Proposition 7: *In both modes, linear contract is optimal.*

• Proposition 8:
  – If $a_i$’s are contractible then $\Pi^E^* = \Pi^P^*$
  – If $a_i$’s are costless (e.g. price) then $\Pi^E^* \neq \Pi^P^*$ due to spillovers
    • If $R(a_i, a_{-i}, e_i, I)$ is additively separable then $\Pi^E^* > \Pi^P^*$
  – If $I$ is contractible or $R_I = 0$ then $\Pi^P^* \neq \Pi^E^*$ due to spillovers

• Two cases of interest:
  – Costly $a_i$’s and additively separable $R(a_i, a_{-i}, e_i, I)$ (investments)
  – Costless $a_i$’s and non-additively separable $R(a_i, a_{-i}, e_i, I)$ (prices)
Costly $a_i$’s and additively separable $R$

- Suppose
  $$R(a_i, a_{-i}, e_i, I) = \theta a_i + x(\bar{a}_{-i} - a_i) + \gamma e_i + \delta I$$
  
  $$c^a(a) = \frac{1}{2} a^2, c^e(e) = \frac{1}{2} e^2 \text{ and } c^l(I) = \frac{1}{2} I^2$$

- **Proposition 9:** Firm prefers $P$-mode over $E$-mode iff
  $$\left| x \frac{\gamma^2}{\theta} + \theta^2 + N\delta^2 \right| < \sqrt{\theta^2(\theta^2 + \gamma^2 + N\delta^2)} + \gamma^4$$

- **Proposition 10:** A larger $\gamma$ (resp. $\delta$) shifts the tradeoff in favor of the $P$-mode (resp. $E$-mode) iff $t^E_* > t^P_*$. 
Costly $a_i$’s and additively separable $R$

Counter-intuitive results (opposite of “classic” theory of firm):

• Moderately negative $x =⇒$ larger $|x|$ shifts trade-off towards P-mode
  — negative spillovers $⇒$ over-invest in $a_i$ in P-mode $⇒$ offset under-investment due to revenue-sharing $⇒$ closer to first-best

• Very negative $x =⇒$ agents’ (resp. firm’s) moral hazard shifts tradeoff towards E-mode (resp. P-mode)
  — offsetting effect $⇒ t^{P*} > t^{E*} =⇒$ agents’ incentives less distorted in E-mode
Costless $a_i$’s and non-additively separable $R$

- Suppose

$$R(a_i, a_{-i}, e_i, I) = p_i(d + \theta p_i + x(\bar{p}_{-i} - p_i) + \gamma e_i + \delta I)$$

$$c^e(e) = \frac{1}{2} e^2 \text{ and } c^I(I) = \frac{1}{2} I^2$$

- **Proposition 9**: Firm prefers $P$-mode over $E$-mode iff

$$- \frac{4k(k + \theta)}{k + 2\theta} < x < 0$$

where $k \equiv \frac{N\delta^2\gamma^2}{N\delta^2 + \gamma^2}$ (combined importance of moral hazard)
Costless $a_i$’s and non-additively separable $R$

- Substitutes or strong complements $\Rightarrow \Pi^{E^*} > \Pi^{P^*}$
  - E-mode internalizes spillovers

- Weak complements $\Rightarrow \Pi^{P^*} > \Pi^{E^*}$
  - Complements $\Rightarrow$ prices too high in P-mode $\Rightarrow$ offset 2-sided moral hazard (strategic complementarity btw. prices and efforts)

- Agents’ and firm’s moral hazard have same effect on $E$ vs. $P$ tradeoff
  - Revenue-sharing does not distort price $\Rightarrow$ both modes balance 2-sided moral hazard in the same way
Extensions

• Private benefits

• Timing
  – Ex-ante commitment to I (e.g. infrastructure) => shift in favor of P-mode

• Cost asymmetries

• Hybrid modes:
  – Across services/agents
    • Can be optimal
  – Across transferable actions
    • Cannot be optimal when revenue function is super-modular
Conclusions

• Important strategic choices: positioning between platform (independent agents) and traditional firm (employees)

• Control rights over non-contractible decisions => extend theory of the firm to incorporate platforms
Enabling vs. Controlling (Employing)

- **Enable**
  - Suppliers → Platform → Customers
  - Sale of products or services

- **Buy**
  - Suppliers → Reseller → Customers
  - Sale of products

- **Control ("Make")**
  - Suppliers → V.I. firm → Customers
  - Vertical integration (employment)
  - Sale of products or services
Conclusions

• Important strategic choices: positioning between platform and integrated firm

• Control rights over non-contractible decisions => extend theory of the firm to incorporate platforms

• New “style of modeling” (multi-sided) platforms => novel economic tradeoffs + empirical predictions

• Current/future work:
  – Partial delegation as intermediate mode between P-mode and E-mode
  – Competition between different modes
Thank you for your attention.