Moral hazard and reputation on a two-sided platform

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Rise of electronic trading platform matching anonymous agents
- e-Bay: 54.7 Bn in market capitalisation (Oct. 2007)
- JDate: 75000 paying customers and 7.2M revenue (Q1 2007)
- Craigslist 10 million new ads each month

Differs from electronic stock exchanges (e.g. NASDAQ)
- Members are not licensed
- No financial commitment
- No regulatory powers (NASD, ASX)

Differs from standard intermediaries
- Do not take ownership
- Do not inspect the goods
- Do not set commodity prices

Object: How can such a platform address moral hazard?
Contributions

Preview of results

Overview of the analysis
To our understanding of two-sided markets:
- introduce moral hazard in a R and T framework, hence pricing distortions
- role of lump-sum payments and linear fees (equivalence R and T)
- role of subsidies (Caillaud and Jullien)

To the moral hazard problem
- participation on buyers’ side depends on sellers’ behaviour
- incentives of sellers depends on buyers’ behaviour
Preview of Results

• With linear prices only, downward pressure on both sides:
  – price decrease on the buyers’ side
  – price distortion on the sellers’ side

• With upfront fees and linear prices:
  – moral hazard entirely overcome
  – mimics contingent contracting

• Implications
A two-sided platform

Features:

- Complementarity on both side, but myopic behaviour
- Behaviour modified through equilibrium only

Examples:

- Stock exchanges, internet trading platforms (e-Bay)
• Monopoly platform, many buyers and sellers.

• Sellers
  – Seller type: $s \sim F(s), s \in [\underline{s}, \bar{s}], F(\cdot)$ log-concave
  – Action set: $a \in A \equiv \{a, \bar{a}\}$
  – Net utility: $v(s, a) - t^s = \begin{cases} s - t^s, & a = \bar{a}; \\
                                  s + d - t^s, & a = a \end{cases}$

• Buyers
  – Buyer type $b \sim G(b), b \in [\underline{b}, \overline{b}], G(\cdot)$ also log-concave
  – Net utility: $u(b, a) - t^b = \begin{cases} b + h - t^b, & a = \bar{a}; \\
                                  b - t^b, & a = a \end{cases}$

• $h > d$
Platform

- No private information, does not observe $a$
- Ex post signal: if $a = a$, probability $\alpha < 1$
- Punishment: exclusion
Moral hazard – Buyers

- Assume full population replacement.
- Let $r = \Pr(a = \bar{a})$

- Buyer’s net utility:
  $$\tilde{u}(b, t^b, r) = r(b + h) + (1 - r)b - t^b$$

- Buyers’ demand:
  $$D_b(t^b, r) = 1 - G(t^b - rh)$$
Moral hazard – Sellers

Seller’s acceptance: value of a transaction

\[ V(s) = \mu D_b \max \{ 0 + \delta V(s), s + d - t^s + (1 - \alpha)\delta V(s), s - t^s + \delta V(s) \} + (1 - \mu D_b)\delta V(s) \]
For
\[
\begin{cases}
  \geq t^s + \frac{1-\delta}{\delta} \frac{d}{\alpha \mu D_b} \equiv s^{**}, & \text{sellers choose to trade and play } \bar{a}; \\
  \in [s^*, s^{**}), & \text{sellers choose to trade and play } a; \\
  < t^s - d \equiv s^*, & \text{sellers do not trade.}
\end{cases}
\]

- Sellers’ demand: \( D_s(t^s) = 1 - F(s^*) \)
- Non-deviating sellers: \( 1 - F(s^{**}) \)

Let \( k(r) \equiv \frac{1-F(s^{**})}{1-F(s^*)} \), then
- equilibrium: \( r^* = k(r) \)
- properties
Suppose \( a = \bar{a} \) only, then \( D_s = 1 - F(t^s) \) and \( D_b = 1 - G(t^b - h) \) hence

\[
\max_{t^s, t^b} \Pi(t^s, t^b) = \sum_{\tau \geq 0} \delta^\tau \mu D^b(t^b) D^s(t^s)[t^s + t^b]
\]

therefore

\[
\bar{t}^s + \bar{t}^b = \frac{1 - F(t^s)}{f(t^s)} = \frac{1 - G(t^b - h)}{g(t^b - h)}
\]

Similarly if \( a = a \)

\[
\bar{t}^s + \bar{t}^b = \frac{1 - F(t^s - d)}{f(t^s - d)} = \frac{1 - G(t^b)}{g(t^b)}
\]

Identical result if solving

\[
\max_{t^s, t^b, r} \Pi(t^s, t^b, r) = \sum_{\tau \geq 0} \delta^\tau \mu D^b(t^b, r) D^s(t^s)[t^s + t^b]
\]

i.e \( r = 1 \).
Optimal linear fees

\[
\max_{t^s, t^b} \Pi(t^s, t^b, r) = \sum_{\tau \geq 0} \delta^{\tau} \mu D^b(t^b, r^*(t^s, t^b)) D^s(t^s)[t^s + t^b]
\]

therefore

\[
\hat{t}^s + \hat{t}^b = 1 - G(t^b - r^* h) \frac{g(.) (1 - \frac{\partial r^*}{\partial t^b})}{f(.)[1 - G(.)] - g(.) \frac{\partial r^*}{\partial t^s} [1 - F(.)]}
\]

where \( \frac{\partial r^*}{\partial t^b} < 0 \) and \( \frac{\partial r^*}{\partial t^s} < 0 \)

**Proposition 1 (Main result 1)** In equilibrium, \( \hat{t}^s < t^s \) and \( \hat{t}^b < t^b \)
Introduce $T^s$ to be paid in period 0, and $t^s$ at every match. Rework demands and reputation. Equivalence result on the buyers’ side, so $T^b = 0$.

**Proposition 2 (Main result 2)** *With registration fees, the platform implement the triplet* $\langle t^b_1, t^s_1, T^s_1 \rangle$ *such that*

\[
\begin{align*}
t^b_1 &= \bar{t}^b \\
T^s_1 &= d \\
t^s_1 &= s^* - \frac{(1-\delta)d}{\delta \mu D_b(t^b)} < \bar{t}^s
\end{align*}
\]

*and achieves the first-best.*
Why?

• $t^s, T^s$ substitutable at the participation decision, but

• $T^s$ irrelevant thereafter (sunk cost)

• with $t^s_1 < \bar{t}^s$, period surplus increases

$\Rightarrow$ higher incentives to cooperate, conditional on participation
Robustness

- Introduction of frictions (liquidity constraint)
  - Away from benchmark
  - Uniform improvement for any $T^s > 0$

- Incomplete replacement:
  - Introduce a “cleansing” effect: non stationary distribution
  - With a degree of exogenous replacement (prob. of “dying”), stationarity recovered
  - All results stand
Summary

• LT relationship between sellers and platform used to police ST trade between parties

• Break equivalence result (Rochet and Tirole (2005), Armstrong (2004))

• Registration fees preclude myopic behaviour from trading parties (Rochet and Tirole (2005), Armstrong (2004))

• Role of transaction and upfront fees (Caillaud and Jullien (2003))
  – Registration subsidies
  – Attract one side (upfront), extract from the other one (transactions)