# Strategic Certification and Provision of Quality

## Albano and Lizzeri (2001)

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# Summary of Findings

- Studies the link between the level of quality and the role of 3rd party intermediaries which verify quality
- Demonstrates there are a large number of disclosure and pricing rules for the intermediary which maximizes its profits
- Underproduction of quality relative to full disclosure setting
- Underproduction is due to sellers not fully capturing the marginal benefit of higher quality

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# Prior Literature

- Disclosure of prior literature starts with Grossman (1981) which shows the unraveling result
  - This assumes parties know others have possession of private information and statements can be verified
  - Assumes the information environment is exogenous
- Two extensions have arisen which "break" the unraveling result: adverse-selection (e.g. Biglaiser, 1993) or moral hazard (e.g. Biglaiser and Friedmen, 1994)
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# Assumptions of Model

- Four agents in the market: 1 informed seller who offers one prodct, two uninformed buys who bid for item, and an intermediary who can verify its quality
- Seller can produce the object according to a cost function $c(\theta, t)$, where:
  - $\theta$ is the quality of good
  - $t$ is the efficiency type that exogenously determined
  - $t \sim F(t)$ and has the support $[\underline{t}, \overline{t}]$ which is commonly known

$$\text{A1:} \quad \frac{\partial c}{\partial \theta} > 0 \qquad \text{A2:} \quad \frac{\partial^2 c}{\partial \theta^2} > 0$$

$$\text{A3:} \quad \frac{\partial c}{\partial t} < 0 \qquad \text{A4:} \quad \frac{\partial^2 c}{\partial t^2} < 0$$

$$\text{A5:} \quad \exists \theta : \theta - c(\cdot, \overline{t}) > 0$$

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# Timeline of Model

- *Stage 1:* Intermediary commits to a fee structure $P: \Theta \to \Re$ and disclosure rule $D: \Theta \to Q$
- *Stage 2:* Having observed $D \in \Psi$, $P \in \Gamma$ and $t \in T$, the seller chooses $\theta$ and whether to go with an intermediary. i.e., his strategy $\rho: \Gamma \times \Psi \times T \to \{0,1\} \times \Theta$
- *Stage 3:* If the intermediary is chosen, the product is tested and quality is observed
- *Stage 4:* Buyers observe disclosure rule ($D$), the fee ($P$), and the intermediary's report (if tested)
- *Stage 5:* Buyers bid for the product in a first price auction

# Roadmap to Through Results

1. Results under full information and a fixed price, $P$
2. Relax the full disclosure assumption, but keep a fixed price
3. Relax the fixed price assumption and show results with full information and nonlinear prices
4. Show the equivalence of this result with a noisy disclosure rule and a constant fee

Seller's profit function is:

$$\Pi = x - c(\theta, t) - P$$

# Full Information Results

## Lemma 1

If the seller does not go with the intermediary, she produces $\theta = 0$ and gets bids of 0 from the buyers

*Intuition*: Since $\theta$ is completely endogenous, there is no way the buyer can verify $\theta$. Hence, the buyer will not value $\theta$ and bid 0. From the sequential equilibrium, this causes the seller to set $\theta = 0$.

## Proposition 1

Suppose full disclosure. If $0 < P < \theta^{FD}(\overline{t}) - c\left(\theta^{FD}(\overline{t}), \overline{t}\right)$ then there is a $t^*$ such that for $t > t^*$, seller will use intermediary. For $t < t^*$, the seller will not use the certifier and sell nothing

# Threshold Quality

## Proposition 2

Suppose intermediary only reveals if $\theta > \theta^S$ and type $t^S$ is the type which is indifferent from using the certifier and not selling. Then for $t \geq t^S$, the seller goes with the intermediary and for $t < t^S$, the seller does not sell. If $\theta^S = \theta^{FD}(t^*)$ then the intermediary makes the same profit as full disclosure

- *Intuition*: Similar to Lizzeri (1999). Use the envelope theorem to show $\frac{\partial \pi}{\partial t} = -\frac{\partial c}{\partial t} > 0$ so profit is increasing in $t$ so those above $t^S$ will disclose
- *Implication*: Intermediary is indifferent from a Full Disclosure and a Threshold report assuming she properly adjusts $P$ (formalized in Lemma 2)

# Characterizing the Optimal Mechanism

Let $\kappa(t)$ be the payment to intermediary for type $t$. Then, the intermediary optimizes:

$$\max_{\kappa,\theta} \int_{\underline{t}}^{\overline{t}} \kappa(t) f(t)\, dt$$

$$\text{s.t.} \quad \begin{array}{c} \theta(t) - c(\theta(t), t) - \kappa(t) \geq 0 \\ \theta(t) - c(\theta(t), t) - \kappa(t) \geq \theta(\hat{t}) - c(\theta(\hat{t}), \hat{t}) - \kappa(\hat{t}) \end{array}$$

Imposing the single crossing property and a monotone hazard rate, this problem is equivalent to:

$$\max_{\theta} \int_{\underline{t}}^{\overline{t}} \left[ \theta(t) - c(\theta(t), t) + \frac{1 - F(t)}{f(t)} \frac{\partial c}{\partial t} \right] f(t)\, dt$$

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# Threshold Type

## Proposition 3

For $t < t^0$, the optimal mechanism sets $\theta(t) = 0$ and for $t > t^0$, $\theta(t)$ solves:

$$1 - \frac{\partial c}{\partial \theta} = -\frac{1 - F(t)}{f(t)} \frac{\partial^2 c}{\partial \theta \partial t}$$

- *Intuition*: $t^0$ is the threshold where the integrand is less than 0. Simply take the First Order Conditions of intermediary's problem
- *Implication*: All types (weakly) underproduce $\theta$ relative to the full disclosure setting but is weakly increasing as a function of type. Note that under FD the F.O.C. solves $1 - \frac{\partial c}{\partial \theta} = 0$

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# Optimal Nonlinear Price

## Proposition 4

The optimal policy can be implemented with a full disclosure rule and the following nonlinear price, $P^*$:

$$P^*(\theta) = \begin{cases} \int_0^\theta 1 - \frac{\partial c\left(u, \theta^{-1}(u)\right)}{\partial u} du & ; \theta \geq \theta^* \\ +\infty & \theta < \theta^* \end{cases}$$

where $\frac{dP^*}{d\theta} < 1$ and $\frac{d^2P}{d\theta^2} < 0$

- *Intuition*: Maximize the producer's first order condition. Note that $u = \theta^*(t)$ for $t > t^0$
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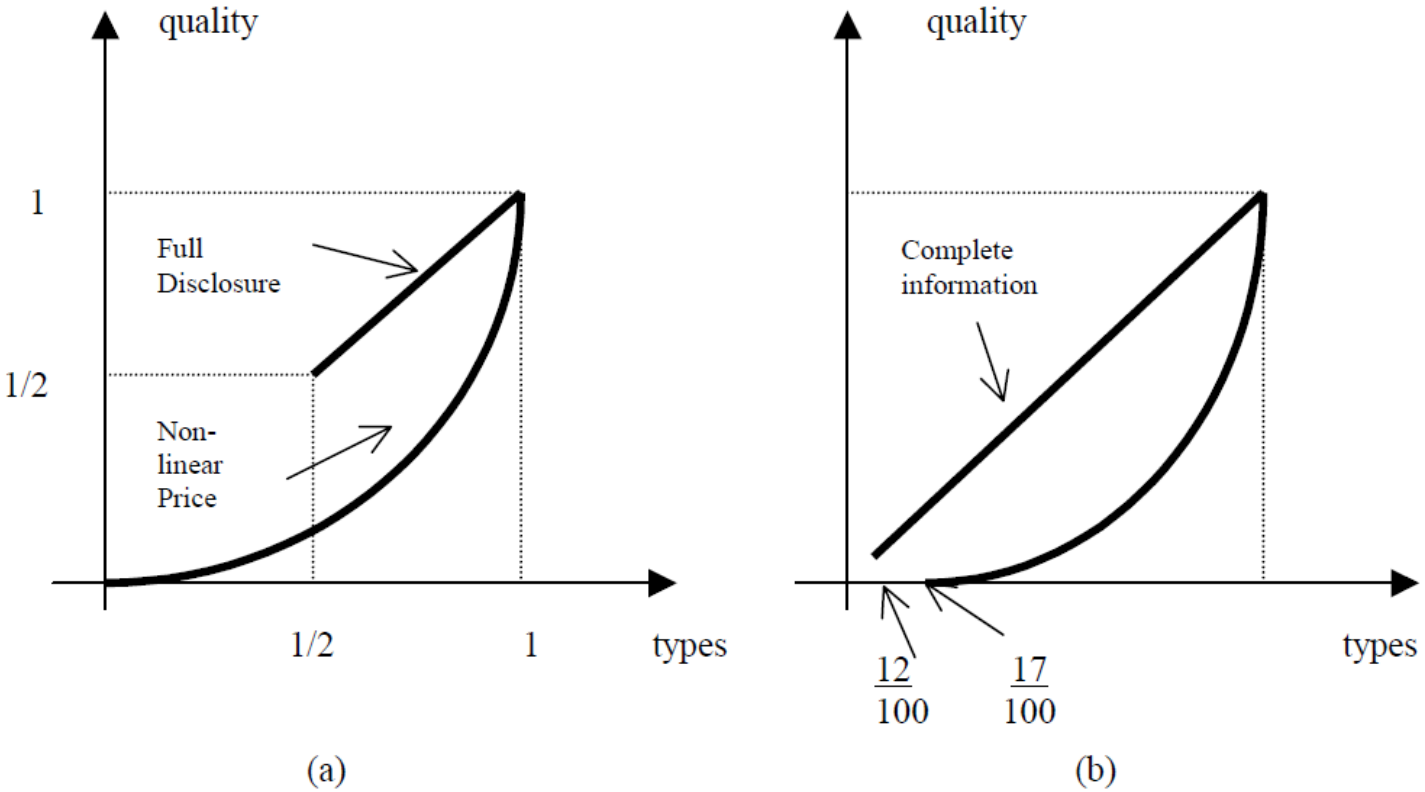
# Distribution of Quality



# Equivalence with a Fixed P and Noisy Disclosure

Demonstrate how the intermediary can earn the same profits using a constant price a noisy disclosure

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The optimal policy can be implemented by charging $\mathbf{P}^*$ $(\equiv E(P^*(\theta)))$ and the following disclosure rule, $D^*$: $\theta$ is fully revealed with probability $q(\theta) = 1 - \frac{\mathbf{P}^* - P^*}{\hat{\theta} - \theta}$ for $\theta \neq \hat{\theta}$ and $q\left(\hat{\theta}\right) = 1$. With probability $1 - q(\cdot)$, reveal nothing informative. Then types $t \geq t^0$ use the intermediary and for $t < t^0$ do not

- *Intuition*: The expected payoff to the producer must be the same as full disclosure. Then, using sequential equilibrium, show that the buyers' beliefs when $\theta = \hat{\theta}$ must follow Bayes' rule

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# Implications of Proposition 5

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- The probability that quality is revealed increases in quality, i.e. $q'(\theta) > 0$ (Corollary 1)

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# Conclusion

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- There is a deadweight loss associated with information asymetries which is only partially mitigated with intermediaries
  - The partial resolution is due to seller only receiving a portion of the marginal benefit from disclosing

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