Outside Options and the Failure of the Coase Conjecture

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The Coase Conjecture

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- A canonical example of the problem of commitment
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Coase conjecture has been shown to be remarkably robust:

Kahn (1986) (nonlinear costs)
Bond and Samuelson (1984) (depreciation)
Sobel (1991) (entry of new buyers)
Fuchs and Skrzypacz (2010) (seller's outside option)

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- Coase conjecture fails if buyers have an outside option they can choose to exercise

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> In the essentially unique PBE the seller is then able to maintain the static monopoly price

• Foundation for the search literature which commonly assumes that sellers do not haggle (Wolinsky 1986)

Model: Agents

A monopolistic seller of a durable good; the seller's cost is 0, and is commonly known.

The buyer privately knows:

- his value for the good $v \in V \subset [0, \overline{v}]$, and
- the value of his outside option $w \in W \subset [\underline{w}, \overline{w}]$ where $\underline{w} > 0$.

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Let: $u = v - w$ be the *net value* of the buyer, and

$F(u)$ be the probability the buyer's net value is strictly below u

Model: Timing and Strategies

At the start of any period $t = 1, 2, 3, \ldots$:

i) the seller chooses price $p_t \geq 0$, and then
ii) the buyer chooses whether to buy the good, exercise his outside option, or wait.

The game continues only if the buyer chooses to wait.

Actions are publicly observable and we allow for mixed strategies.

A *history* of the game is any finite sequence of the seller's and buyer's consecutive actions, starting with the first price decision of the seller.

Model: Payoffs

• If the buyer buys the good in period t then:
buyer's payoff is $\delta^t (v - p_t)$ and seller's payoff is $\delta^t p_t$.

• If the buyer exercises the outside option in period t then:
buyer's payoff is $\delta^t w$ and seller's payoff is 0.

• If the buyer waits forever, both the seller and buyer obtain 0.

Model: Equilibrium

A *Perfect Bayesian Equilibrium (PBE)* is a history-contingent sequence of the seller's offers p_t, the buyer's acceptance and exercise decisions, and of updated beliefs about the buyer's values (v, w) such that:

• actions are optimal given beliefs;

• beliefs are derived from actions from Bayes' rule whenever possible, including off the equilibrium path; and the seller's actions, even zero-probability actions, do not change its belief about the buyer's type.

Main Result

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Proposition. *There is a PBE in which in every period:*

- *the seller charges p^m such that $p^m \in \text{argmax } p(1 - F(p))$;*

- *the buyer buys the good if $u \geq p$, and otherwise exercises his outside option.*

If there is a unique monopoly price $p^m \in \text{argmax } p(1 - F(p))$, then all equilibria are payoff-equivalent.

Proof of the Essential Uniqueness of PBE

Step 1. Suppose there is a PBE and a price p_1 (on-path or off-path) such that some positive measure of buyer types waits till $t = 2$; let $\underline{u}(h_2) =$ min of the support of their net values.

Then: for small $\epsilon > 0$ a positive measure of types $u < \underline{u}(h_2) + \epsilon$ buys in some period $t \geq 2$

We can show $p(h_t) \geq \underline{u}(h_2)$, and for $u < \underline{u}(h_2) + \epsilon$,

$$\delta^{t-1}(v - p(h_t)) \leq \delta^{t-1}(v - \underline{u}(h_2)) < \delta^{t-1}(v - u + \epsilon) = \delta^{t-1}(w + \epsilon) \leq w$$

This contradicts the assumption that a positive mass delays.

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Step 2. PBE incentive compatibility for the buyer implies that the buyer buys if $v - p_1 > w$ and exercises his outside option if $v - p_1 < w$. Incentive compatibility for the seller requires that if there is an atom of types $v - p_1 = w$ then these types buy with probability 1.

The seller thus maximizes $p_1 (1 - F(p_1))$.

Implications

• Sellers may offer a range of heterogeneous products in order to commit to high prices.

• In merger cases, a requirement that merging firms license their product to a competitor may affect buyers' outside options and the merged firm's commitment power.

• In monopolization cases, the result makes one skeptical of firms using Coasian logic to argue that they face competition from their past selves.

Related Literature

Diamond Paradox: Diamond (1971)

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Two-sided bargaining: Perry (1986), Cramton (1991), Rubinstein (1985), Bikchandani (1992)

Comments on Assumptions

Reversible Exit

The result remains true if the buyer can return to the seller after receiving flow payoff from the outside option for some number of periods.

Reversible Exit and Many Buyers

The result remains true if the buyer can return to the seller after receiving flow payoff from the outside option for some number of periods.

An analogue of the result obtains when the seller sells a continuum of goods to a continuum of buyers with different values and outside options.

Types with No Outside Option

Suppose there is a finite number of buyer types, and prices come from a sufficiently fine price grid.

Proposition. *As the mass of types with zero outside option shrinks to* 0*, the PBE payoffs of the buyer and seller converge pointwise to the unique PBE payoff profile of the main result.*

Search

The Non-Haggling Assumption in Search

A standard assumption in search: if a buyer rejects a seller's offer, the interaction with the seller is over.

What happens if the buyer waits for the next offer of the same seller?

Model of Sequential Search: Agents

Mass 1 of ex-ante identical sellers, each with zero marginal cost.

Mass 1 of buyers, each buyer has private value at seller i, denoted v_i; these values are constant across time and iid across sellers with continuous density $f(\cdot)$ and distribution $F(\cdot)$ on $[0, \overline{v}]$.

Model of Sequential Search: Timing

Each period proceeds as follows:

1. A buyer chooses to stay with his current seller or picks a new one at random

2. If a buyer arrives at a new seller, he observes his value v_i at that seller

3. The seller quotes a price to the buyer

We can either assume that seller i observes the entire history of the market or just the history at seller i.

Proposition on Sequential Search

Suppose the hazard rate $f(v)/[1 - F(v)]$ is increasing in v. Then there is an essentially unique equilibrium in which each seller charges a constant price

$$p = \frac{1 - F(v^*)}{f(v^*)}$$

A buyer purchases if $v \geq v^*$ and otherwise moves onto another seller. The cutoff v^* satisfies

$$v^* - p = \delta E_v \big[\max\{v - p, v^* - p\} \big].$$