FDPE IO-THEORY PART 2 BY KULTTI

Bilateral relationships and hold-up: Hart & Moore 1988, Nöldeke & Schmidt 1995.

A buyer and a seller are locked to each other once they choose partners (each other).

They make relationship specific investments that are observable but not verifiable.

Or they are unable to specify the exact details of their relationship.

Or they live in a world of incomplete contracts.

This leads to renegotiation of contracts.

Renegotiation is bad: Whatever is realised after renegotiation can be anticipated, and without renegotiation a contract that specifies the renegotiation outcomes can be written.

Think of the current banking crises.

Some of the participants knew that they will be saved $=>$ renegotiation.

Hart-Moore-model

A buyer and seller make decisions sequentially.

At date 0 they write a contract.

Then they make investments β and σ.

At date 1 the valuation v and the cost c of one unit of indivisible good are realised.

At date 2 there may be trade.

After this payments are made and disputes are solved in a court.

Between date 1 and date 2 the parties can revise the contract.

Before contracting there is a competitive world where the seller's expected utility is $\overline{U}$.

There is uncertainty about valuations and costs - $= \{\omega_1, ..., \omega_n\}$.

At date 1

$$\begin{aligned} v &= v(\omega, \beta) \\ c &= c(\omega, \sigma) \end{aligned} \quad (1)$$

There is no asymmetric information: The state of the world is publicly observable, the investments are observed by the buyer and the seller, the valuation and the cost are observed by the buyer and the seller, their joint distribution is common knowledge at date 0.

But things are so complicated that state contingent contracts cannot be written.

The contracts cannot be conditional on v and c.

Trade takes place if and only if the seller delivers and the buyer accepts.

Trade can take place only at date 2.

After trade payments are made.

Aim is to figure out the optimal date-0-contract.

Let $q \in \{0, 1\}$ denote whether trade takes place or not.

Let investment costs be $h_b(\beta)$ and $h_s(\sigma)$.

Trade is efficient iff $q = 1 \Leftrightarrow v \geq c$.

Given investments total surplus is

$$W(\beta, \sigma) = E_{v,c}\left(\max\{v - c, 0\} \,|\beta, \sigma\right) - h_b(\beta) - h_s(\sigma)$$

Assume unique maximisers β^* and σ^*.

A contract can be made because there is a court that enforces it.

The court can observe:

1. whether trade occurred,
2. how much money was transferred between buyer and seller,
3. messages m exchanged between buyer and seller.

The contract specifies a price function $p(q, m) = (p_0(m), p_1(m))$.

Trade takes place, $q = 1$, if

$$v \geq p_1(m) - p_0(m) \geq c$$

Messages can be sent in d instances between dates 1 and 2.

At each instance there is collection and delivery by mail service.

A message takes one instance to arrive.

Message sent at instance d arrives before date 2.

Messages cannot be forged.

Two cases:

A. Messages cannot be publicly recorded.

B. Messages can be publicly recorded.

The parties can at any time ignore date-0-contract and write a new one.

Case A: Unverifiable messages

Objective is to design a revision (message) game such that it provides proper incentives for investment, and given v and c ensures efficient trade.

Two parts: 1. Sending messages,

2. Deciding which messages to reveal to the court (dispute game).

The parties cannot be forced to send messages and it is possible that $m = \varnothing$.

Denote $p_0 (\varnothing) \equiv \widehat{p}_0$ and $p_1 (\varnothing) \equiv \widehat{p}_1$.

Proposition 1 Fix $(\widehat{p}_0, \widehat{p}_1)$. The outcome of the message game and dispute game is the following:

1. If $v < c$, $q = 0$ and the buyer pays $\widehat{p}_0$.

2. If $v \geq \widehat{p}_1 - \widehat{p}_0 \geq c$, $q = 1$ and the buyer pays $\widehat{p}_1$.

3. If $v \geq c > \widehat{p}_1 - \widehat{p}_0$, $q = 1$ and the buyer pays $\widehat{p}_0 + c$.

4. If $\widehat{p}_1 - \widehat{p}_0 > v \geq c$, $q = 1$ and the buyer pays $\widehat{p}_0 + v$.

The idea of the proof Either party can always guarantee payment $\widehat{p}_0$. Any other price must be advantageous to both. In case-1 there are no gains from trade and maximum gains are realised when $q = 0$. Any other price would decrease the utility of one of the agents.

In case-2 maximum gains are realised when $q = 1$. If some messages resulted in a higher price than $\widehat{p}_1$ the buyer could reveal none of them and send no messages. Similarly, the seller can keep the price at $\widehat{p}_1$. Any strategy that tries to prevent gains from trade from realising is not credible (subgame perfect).

In case-3 the seller can guarantee $\widehat{p}_0$, and thus the buyer has to pay at least $\widehat{p}_0 + c$. Buyer pays exactly this by proposing, at the last instance, a contract $(\widehat{p}_0, \widehat{p}_0 + c)$, and this is accepted since $\widehat{p}_0 + c > \widehat{p}_1$. Seller cannot get more since the buyer just ignores such proposals.

In case-4 it is the seller to whom even the original contract is acceptable, and the buyer wants a new contract. Here the seller gets all the surplus (as the buyer did in case-3).

Case B: Sending messages is verifiable

The date-0 contract can specify that a buyer has to send one of the messages in $\{b_1, b_2, ..., b_m\}$ and the seller in $\{s_1, s_2, ..., s_n\}$.

Consider the message game in normal form, and let messages $\left(b_i, s_j\right)$ lead to revised prices $\left(p_0^{ij}, p_1^{ij}\right)$.

As long as $v > c$ it is in the interest of the parties to keep on sending messages until $v \geq p_1^{ij} - p_0^{ij} \geq c$.

Assume that final prices are determined as in Case-A

$$p_1^{ij}(v,c) = \begin{cases} p_1^{ij} \text{ if } v \geq p_1^{ij} - p_0^{ij} \geq c \\ p_0^{ij} + c \text{ if } v \geq c > p_1^{ij} - p_0^{ij} \\ p_0^{ij} + v \text{ if } p_1^{ij} - p_0^{ij} > v \geq c \end{cases} \tag{2}$$

and if $v < c$ there is no trade and transfer is p_0^{ij}. This means that bargaining power is still allocated as in Case-A.

Given v and c the renegotiation game will end efficiently. And it is a zero sum game. Thus, one can determine its values, for the two possible outcomes, as

$$p_0^* = \min_{\pi} \max_{\rho} \sum_{i=1}^{m} \sum_{j=1}^{n} \pi_i \rho_j p_0^{ij} \tag{3}$$

$$p_1^* (v, c) = \min_{\pi} \max_{\rho} \sum_{i=1}^{m} \sum_{j=1}^{n} \pi_i \rho_j p_1^{ij} (v, c) \tag{4}$$

where π and ρ are probabilities over $\{b_1, b_2, ..., b_m\}$ and $\{s_1, s_2, ..., s_n\}$.

Proposition 2. Let p_0^* and $p_1^*(v,c)$ be the values of the renegotiation game when $v < c$ and $v \geq c$. Now

1. for all $v \geq c$, $p_1^*(v,c)$ is non-decreasing in v and c.

2. if $v' \geq c'$, $v \geq c$, and $p_1^*(v',c') \geq p_1^*(v,c)$, then

   $p_1^*(v',c') - p_1^*(v,c) \leq \max\{v' - v,\ c' - c\}$.

3. for all $v \geq c$, $p_1^*(v,c) - v \leq p_0^* \leq p_1^*(v,c) - c$.

Propositions 1 and 2 show that ex-post efficiency is achieved. But the investments are not necessarily at the optimal level.

This happens rarely: When the valuation is always higher than cost, when only one party has an investment to make, or when the valuation and cost are not stochastic.

Proposition 4. Given investments β and σ assume that $v(.)$ and $c(.)$ are independent. Assume that β and σ can be scaled to lie in $[0, 1]$. If

1. for each $\beta \in (0, 1)$ the support of $v(., \beta)$ is $\{v_1 < v_2 < ... < v_I\}$, $I \geq 2$, and the probability of v_i is $\pi_i(\beta) = \beta\pi_i^+ + (1 - \beta)\pi_i^-$ where π_i^+ and π_i^- are probability distributions over $\{v_1 < v_2 < ... < v_I\}$ such that π_i^+/π_i^- increases in i.

2. for each $\sigma \in (0, 1)$ the support of $c(., \sigma)$ is $\{c_1 < c_2 < ... < c_J\}$, $J \geq 2$, and the probability of c_j is $\rho_j(\sigma) = \sigma\rho_j^+ + (1 - \sigma)\rho_j^-$ where ρ_j^+ and ρ_j^- are probability distributions over $\{c_1 < c_2 < ... < c_J\}$ such that ρ_j^+/ρ_j^- increases in i.

3. h_b and h_s are convex and increasing in $[0,1]$, $h_b'(0) = h_s'(0) = 0$, and $h_b'(1) = h_s'(1) = \infty$.

4. $\underline{v} < \overline{c}$ and $\underline{c} < \overline{v}$.

then the first best cannot be achieved. The second best can always be achieved, and the second best values of β and σ are less than β^* and σ^*.

Notice that the result most likely holds for many other assumptions; it is known that first best is achievable under very special circumstances.

It is not surprising that first best cannot be achieved; the point is that this is a consequence of non-verifiable, though, observable contingencies.