Chapter 7 – **Exchange: Contracts, Norms and Power**

Historical episodes of “silent trade”. How are they sustained ?
Community responsibility system can be an example (cheaters are punished by their own community, in order to defend reputation).

Exchange promoting devices are complete contracts enforceable by third parties at zero cost to the exchange parties. Unfortunately most economic transactions are not covered by these devices:
⇨ money lent in return for an unforceable promise to repay
⇨ managerial contracts
⇨ labour contracts do not mention that workers should work hard and well
⇨ rent contract does not mention the obligation to maintain the value of the property
⇨ insurance contracts cannot enforce prudent behaviour of the insured
⇨ purchase of health and education without knowing the exact quality
⇨ child rearing on the expectation of reciprocation in later years
⇨ labour division in the couple.

Contractual incompleteness is the rule rather than the exception.

Reasons:
* lack of appropriate information
* passage of time is required for the execution of the contracts
* lack of judicial power.

In the actual world
* contractual relationships are long-lasting
* trust and fairness matter in personal exchanges
* exercise of power
* limited capacity to process information
These features may compensate contractual incompleteness.

	player C	
Player R	cooperate	defect
cooperate	b,b	d,a
defect	a,d	c,c

This game is a Prisoners' Dilemma if $a > b > c > d$ and $a + d < 2b$ (to avoid agreement on alternating in cooperation and defection).

It is a game of incomplete property rights, where you may inflict damages to the other without liability.

(defect, defect) is a dominant strategy in one-shot game.
One may invoke **social norms** to achieve mutually beneficial transactions.

If social norms are recognised as beneficial, they may be reproduced in others' behaviours → the proliferation of the norm is due to the success of the groups in which the norm-adherence is common (*group selection*).

The clue of this approach is the repetition of the interaction, which makes cooperation sustainable even with self-interested players.

Model 1. **Repetition and retaliation**

If the interaction is to be repeated with substantial probability, cooperation may be supported by the threat of retaliation against defectors.

Two strategies are considered (but they are countless):
① nice tit-for-tat (offer cooperation and then copy the opponent behaviour)
② unconditional defect

If ρ is the probability of termination (and $1/\rho$ is the expected duration), the payoff under these two strategies are

	player C	
Player R	tit-for-tat	defect
tit-for-tat	b/ρ, b/ρ	$d+(1-\rho)c/\rho$, $a+(1-\rho)c/\rho$
defect	$a+(1-\rho)c/\rho$, $d+(1-\rho)c/\rho$	c/ρ, c/ρ

If the fraction of population adopting tit-for-tat is τ, then the expected payoff for the two strategies are

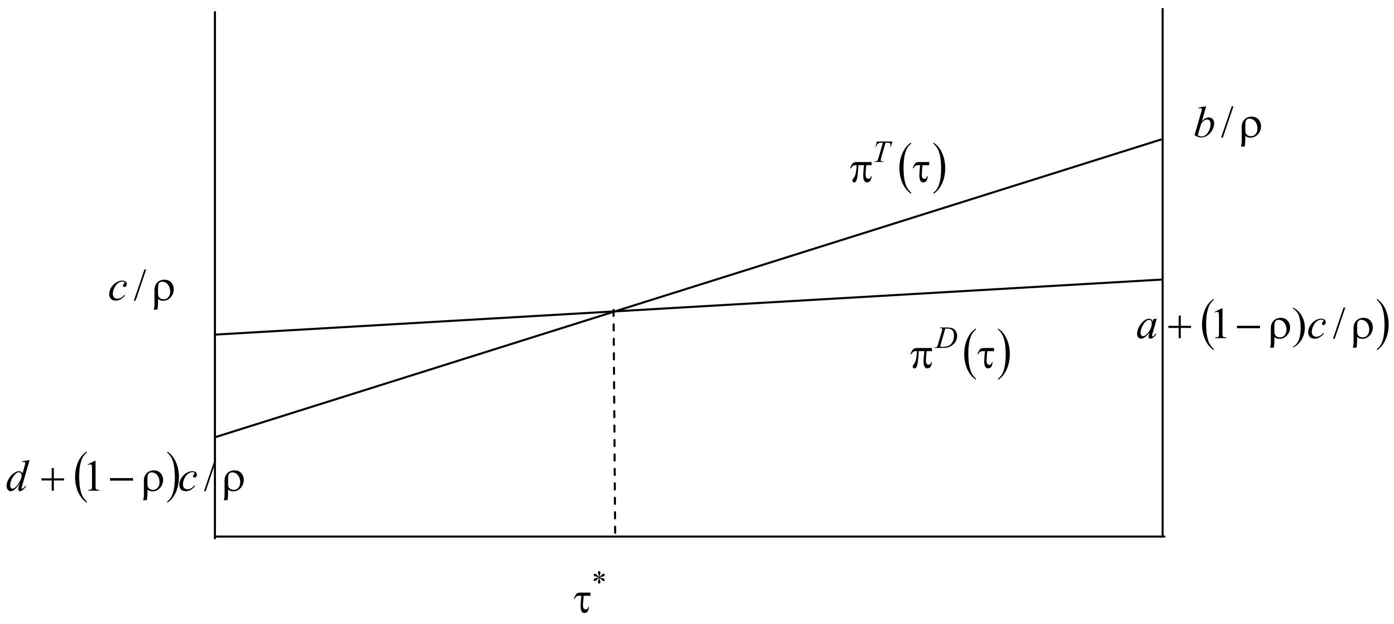
$$\pi^T(\tau) = \tau\frac{b}{\rho} + (1-\tau)\left\{d + \frac{(1-\rho)c}{\rho}\right\}$$
$$\pi^D(\tau) = \tau\left\{a + \frac{(1-\rho)c}{\rho}\right\} + (1-\tau)\frac{c}{\rho}$$

By equation these two expression, we find the population composition τ^* that make one agent indifferent between the two strategies

$$\tau^* = \frac{c-d}{2c-a-d+(b-c)/\rho}$$

τ^* is an equilibrium composition of the population, but it is unstable since

$$\frac{d\left(\pi^D(\tau)-\pi^T(\tau)\right)}{d\tau}<0$$



There are two stable equilibria, namely $\tau=0$ and $\tau=1$.

An increase in the probability of termination ρ reduces the expected cost of future retaliation for a defector, increases τ^* and diminishes the basin of attraction of the cooperative equilibrium $\tau=1$.

Tit-for-tat is an evolutionary stable strategy against unconditional defect, because for any fraction of invaders (playing "unconditional defect") lower than $\left(1-\tau^*\right)$, the process of differential replication of traits would lead to their elimination.

Implications: universal cooperation will be obtained for a sufficient low probability of termination.

Model 2. **Segmentation**

When pairing is non-random, the likelihood of meeting one's own type (one adopting the same strategy) is typically greater than the share in the population (*positive assortation*) $\rightarrow$ cooperation may be evolutionary stable even in one-shot interactions.

The segmentation (i.e. communities of identical types) has the effect of internalising the noncontractible benefits of both cooperation and defection. Suppose that people live in homogeneous villages and perform a fraction s of their interactions in the village, and the remaining fraction $(1-s)$ in the rest of the society, where the fraction of cooperators is α.

A cooperator will meet a cooperator with probability $s+(1-s)\alpha$.
A defector will meet a defector with probability $s+(1-s)(1-\alpha)$.
s is the degree of segmentation. $s=0$ pairing is random.

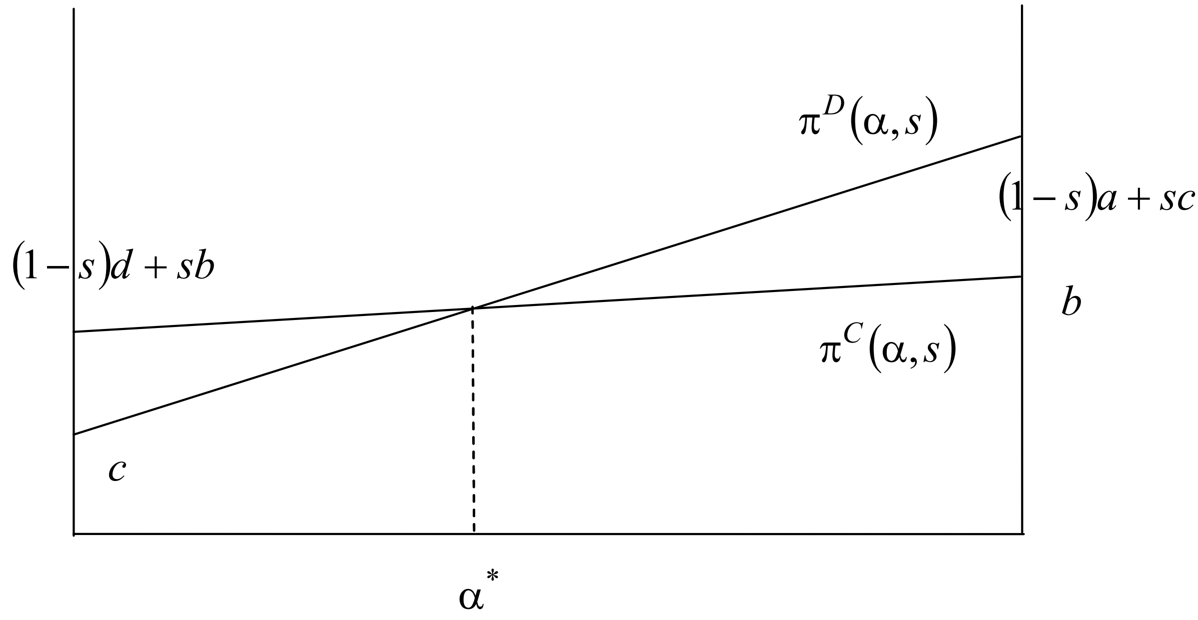
The expected payoff for the two types are

$$\pi^C(\alpha,s)=sb+(1-s)[\alpha b+(1-\alpha)d]$$
$$\pi^D(\alpha,s)=sc+(1-s)[\alpha a+(1-\alpha)c]$$

The equilibrium level of cooperation in this population is given by equating the two payoffs

$$\alpha^*=\frac{s(d-b)+c-d}{(1-s)(b-d-a+c)}$$

If $0\leq\alpha^*\leq 1$ it represents a stable equilibrium. This occurs when the reward from unilateral defection on a cooperator $(a-b)$ is larger than a penalty of cooperating against a defector $(c-d)$.



Implications:

① there is some value of $s<1$ such that $\alpha^*=1 \rightarrow$ universal cooperation is an equilibrium.

② there is some value of $s<1$ such that $\alpha^*=0 \rightarrow$ for s greater than this value some level of cooperation may be sustained as an equilibrium

③ if $\alpha^* \neq 0$ and is stable, an increase in the degree of segmentation will increase the frequency of cooperation in the population

④ if $\alpha^* \neq 0$ and is unstable, an increase in the degree of segmentation will enlarge the basin of attraction of universal cooperation.

Model 3. **Reputation**

If interaction are anonymous, but something is known about the past record of cooperation, then establishing a reputation of being conditionally cooperative may be an equilibrium strategy.

Suppose the fraction in the population of conditional cooperators is α. A conditional cooperator pays an inspecting cost $\delta>0$ and responds to a cooperative partner by cooperating and to a defector by defecting.

If there is an interior equilibrium $0 \leq \alpha^* \leq 1$, both strategies are present in equilibrium, and it must be the case that

$$\pi^I(\alpha) = \alpha(b - \delta) + (1 - \alpha)(c - \delta)$$
$$\pi^D(\alpha) = c$$

yielding $\alpha^* = \dfrac{\delta}{b - c}$. But at this equilibrium $\dfrac{d\left(\pi^I(\alpha) - \pi^D(\alpha)\right)}{d\alpha} > 0$ so α^* is unstable, and therefore $\alpha = 0$ or $\alpha = 1$ are basins of attraction.

Thus a low cost of knowing the true type of those with whom one interacts may make possible a population in which it pays to establish a reputation for conditional cooperation.

Summing up: institutions structuring the interactions may favour the evolution of seemingly other-regarding behaviours.

- ✓ long lasting interactions (ρ low)
- ✓ low cost of information (δ low)
- ✓ non-random pairing (s high)

ASYMMETRIC INFORMATION AND PRINCIPAL-AGENT RELATIONSHIP

Often agents know different things and can do different things.
In the labour exchange, the employer has the first-mover advantage (*strategic asymmetry*), while the employee has private information (for example on the level of effort – *information asymmetry*).

Contractual incompleteness does not depend on imperfect information, but also on verifiability.

Transaction between lender and borrower, or between employer and employee, belong to the class of principal-agent relationship (or *agency problem*): when the attributes/actions of one agent, which are not observed/verifiable, are relevant to the principal.

When there are *hidden attributes* we face a problem of *adverse selection*.
When there are *hidden actions* we face a problem of *moral hazard*.

Typical situation in principal-agent relationship:
a principal P is positively affected by an action a undertaken by an agent A; the action is costly to the agent (thus there is an inherent *conflict of interests*) and not subject to *costless enforceable* contract.

Example:
* the principal's revenue are $R(q), R' > 0$;
* the level of productivity q depends on the level of effort a, which is costly to the agent $U_A = U_A(a), U'_A < 0$;
* the level of productivity cannot be contracted upon, due to unforeseeable events $q = \alpha(a) + \mu, \qquad \mu \sim (0, \sigma^2)$.

Solution: the principal (which is residual claimant) offers a wage contract based on q such that $w = w(q), w'_q > 0$. The contract must satisfy
* <u>participation constraints</u> for both agents (each agent must find the expected value of accepting the contract at least as high as not taking it)
* <u>incentive compatibility</u> (each agent must act by maximising her objective function).

Alternative solutions to this type of situations (*endogenous enforcement*):

① transfer of control power to the principal (example: a banker entering the board of directors)
② bonds or collateral (example: project financing)
③ sharing of revenues (example: profit sharing)
In all cases the final object is to reduce the conflict of interests.

Alternatively
④ contingent renewal: paying to A something better than the next best alternative and then monitor A's action, promising to terminate the relationship in case of revealed low effort (example: efficiency wages).

Some of this devices are effective whenever the agent A is wealth constrained.

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EXAMPLE: buyer and sellers.

Each seller has to decide the quality $q \in [0,1]$ of the commodity supplied. Quality is costly to the seller, and is not costless verifiable ex-ante (but is revealed after the purchase). The price obtained when selling one unit of commodity is beneficial to the seller. Her utility function is given by

$$u = u\left(\underset{+}{p}, \underset{-}{q}\right), u_p > 0, u_q < 0, u_{pp} < 0, u_{qq} > 0$$

Faced with contractual incompleteness, the buyer offers the supplier a contingent renewal contract: "she announces a price p with a promise to continue the transactions in subsequent periods as long as the quality of the commodity is above a specified threshold $q > \overline{q}$. If the quality is inadequate, $q < \overline{q}$, the transaction will be terminated with probability $t(q), t_q < 0$".

Incentive compatibility: derive the Agent's best response function, varying the quality supplied as function of the announced price. It must satisfy

$$u_q = t_q(v - z)$$

where v is the expected utility and z the fall-back position. It suggests that the marginal cost of providing quality (LHS) must be equal to the marginal benefit in terms of the reduce probability of loosing the rent (associated to the difference between the current gain under transaction and the fall-back position).

Derivation: define the expected utility as

$$v = \frac{u(p,q)}{1+i} + (1 - t(q))\frac{v}{1+i} + t(q)\frac{z}{1+i} \quad \Leftrightarrow \quad v = \frac{u(p,q) + t(q)z}{i + t(q)}$$

where i is the discount rate.

Derive the best response function

$$\max_q v \quad \rightarrow \quad \frac{dv}{dq} = \frac{(u_q + t_q z)(i + t) - t_q(u + tz)}{(i+t)^2} = 0$$

which is equivalent to

$$u_q + t_q z = t_q \frac{u + tz}{i + t} = t_q v \quad \Leftrightarrow \quad u_q = t_q(v - z)$$

From the incentive compatibility, we derive the best response function

$$q = q(p), q_p > 0$$

The higher the price offered, the more valuable is the transaction to the sellers, the greater incentive to reduce the probability of termination.

The buyer maximises the benefit from the transaction

$$\max_p r(q(p)) - p \rightarrow \quad \frac{d\pi}{dp} = r_q q_p - 1 = 0 \quad \rightarrow \quad q_p = \frac{1}{r_q} = \frac{1}{\frac{p}{q}} = \frac{q}{p}$$

which identifies a preferred couple of values (p^*, q^*) which ensures $v(p^*, q^*) > z$: each seller would like to participate to the transaction, but some of them may be excluded (*rationing*). Any promise to provide higher quality for lower price is non credible, given the best-response function.

Implications:
1) Pareto inefficient outcome (there are unexploited opportunities to increase price and quality)
2) equilibrium rent $(v > z)$
3) equilibrium without market clearing (short side of the market - the buyer rations the sellers)
4) dyadic transactions (buyer and sellers interact over many periods)
5) price making (due to the perception that quality is related to the price)
6) endogenous claim enforcement through the exercise of power (of terminating the relationship, which force the agent to act in the interest of the buyer delivering more quality)
7) endogenous preferences (the buyer has an interest in the psychological makeup of the supplier, trying to reduce the disutility of effort).

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CONTRACTS AND BEHAVIOURS

The object of the contract defines its completeness/incompleteness, and therefore the length of the market, the frequency of interactions.

"An interesting implication is that traders in markets with incomplete contracts will exhibit different behaviours than those in complete contracting markets. The reason is that the types of contracts in use influence the structure of economic interactions, and these in turns affect the equilibrium distribution of behaviours."

Experimental evidence that markets with goods of variable quality are characterised by rents received by experimental subjects, which do not disappear even in competitive environment → contractual incompleteness induces reciprocal behaviours, and this has durable effects on competitive equilibrium.

structure of interactions	*complete contracts*	*incomplete contracts*
DURATION	one shot	contingent renewal
OFFERS	public	private
PRICE DETERMINANTION	haggling, offers rejected	price setting by short sider
TRADERS' RELATIONSHIP	anonymous	trust, retaliation for cheating
MARKET NETWORKS	many weak links	bilateral trading islands

The underlying process jointly determines the distribution of contracts and the distribution of behavioural norms in the population (*coevolution of institutions and preferences*).

Example: purchase under imperfect information

Buyer and seller randomly paired. The quality (High or Low) is determined by the seller and is costly to determined ex ante by the buyer.

Two possible types of transactions
⇨ a complete contract corresponds to the cost of providing L-quality goods (C-type buyer)
⇨ an incomplete contract where the buyer pays the cost of producing L-quality goods plus half of the net profit resulting from the transaction (I-type buyer).

Two types of sellers
⇨ R-type interpret the I-contract as a sign of trust, and reciprocate by producing H-quality goods, with an additional cost of δ. On the contrary, when offered a C-contract feel mistrusted, experiencing a psychological cost δ, and retaliate providing L-quality.
⇨ S-type always offer L-quality goods

Define π^H the buyer's profit (net of compensating the seller for producing L-quality goods) from obtaining H-quality goods, and π^L the corresponding case for L-quality transactions.

	seller	
buyer	Reciprocator (R)	Selfish (S)
Incomplete contracts (I)	$\pi^H/2$, $\pi^H/2-\delta$	$\pi^L/2$, $\pi^L/2$
Complete contracts (C)	$\pi^L, -\delta$	$\pi^L, 0$

Assume $\pi^H > 2\pi^L$ and $\pi^H - \pi^L > 2\delta$. There is no dominat strategy, but two Nash equilibria.

The fraction of reciprocators in the population is ω. Therefore, the expected pay-off to buyers offering I or C contracts are

$$\nu^I = \omega\frac{\pi^H}{2} + (1-\omega)\frac{\pi^L}{2}$$
$$\nu^C = \omega\pi^L + (1-\omega)\pi^L = \pi^L$$

Similarly, if the fraction of buyers offering incomplete contracts is φ, the payoff to R or S-sellers is

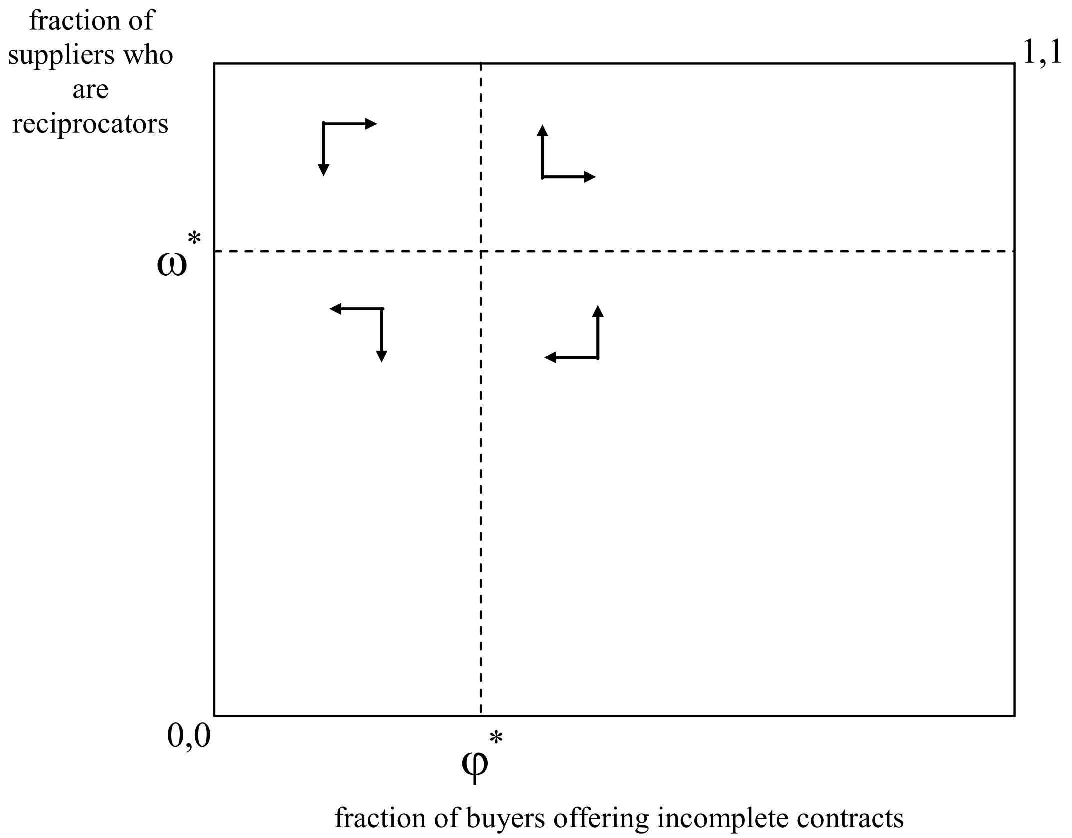
$$\nu^R = \varphi\left(\frac{\pi^H}{2} - \delta\right) + (1-\varphi)(-\delta)$$
$$\nu^S = \varphi\frac{\pi^2}{2} + (1-\varphi)0 = \frac{\varphi\pi^L}{2}$$

By equating $\nu^I = \nu^C$ and $\nu^R = \nu^S$ we obtain the sustainable equilibrium fraction in the population $\omega^* = \frac{\pi^L}{\pi^H - \pi^L}$ and $\varphi^* = \frac{2\delta}{\pi^H - \pi^L}$.

What kind of contracts and behaviours we expect to observe in the population ? Suppose that both suppliers and buyers periodically update their strategies by switching to strategies with higher payoffs according to replicator dynamic equation

$$\frac{d\varphi}{dt} = \varphi(1-\varphi)\left(\nu^I - \nu^C\right)$$
$$\frac{d\omega}{dt} = \omega(1-\omega)\left(\nu^R - \nu^S\right)$$

There are three possible equilibria: $\varphi = 0, \omega = 0$, $\varphi = 1, \omega = 1$ and φ^*, ω^*. The intermediate equilibrium is unstable (saddle-path stable), while the two extremes are stable.



Conclusions

① where contracts are incomplete, traders discriminate in favour of "insiders" (parochialism)
② norms concerning exchange evolve under the existing distribution of contracts, as well as institutions and contracts evolve according the presence of norms in the population
③ when exogenous enforcement of contracts is absent, exchange is often facilitated by the exercise of power → exchange is a political process.
④ politics (power) and culture (preferences) cannot be excluded by economic theory, because they affect the way in which incomplete contracts are implemented.