# Incomplete Contract Approach to Financial Contracting

- Key word: "control"
- Modern financial contracting literature reconsiders the notions of debt, equity and other securities by focusing on CONTROL (decision) rights associated with securities, rather than cash-flow rights.
- Incomplete contracts framework (Grossman-Hart-Moore):
  - Some eventualities cannot be foreseen or described ex-ante
  - In the contract parties agree on certain actions under certain circumstances, AND they decide who has (residual) control when something not described in the contract happens
  - For example:
    - Who decides whether a firm should do this acquisition?
    - Who decides whether CEO should be fired?
    - Who decides whether a firm should be liquidated?
  - Who has decision rights ex-post matters for the *ex-ante* efficiency!

- Financial securities can be classified according to the control rights they bear
  - Equity comes with votes:
    - Electing directors (who have the right to make key decisions)
    - Approving certain transactions, charter amendments
  - Debt has no votes, but under certain circumstances debtholders can:
    - Foreclose the firm's assets
    - Initiate bankruptcy (then creditors also acquire some power of owners)
- Formal vs. Real control
  - Formal control does not imply real control
    - e.g. if the manager knows more than you you may prefer to let him choose what to do – he will have real control then

## Efficiency:

- Allocate control so as to maximize ex-ante social welfare. Ideally such that:
  - parties (mangement and investors) do ex-ante efficient investments
  - ex-post efficient decisions are made
- Note: Sometimes (but not always!) in order to induce ex-ante efficient investment some ex-post inefficiency is needed.
- Ex-post inefficiency creates ex-post incentives for renegotiation. If renegotiation is possible, it should be taken into account when designing the ex-ante optimal contract (renegotiation is not necessarily bad from the ex-ante point of view).

## Example (Based on Hart (JEL 2001))

**Setup:**

- Two parties: Entrepreneur (E) and Investor (I)
- Project yields:
  - security benefits (cash flow) $V$
  - pivate benefits $B$ for the entrepreneur
    - $B$ is non-contractible, non-transferable
- Entrepreneur is allocated fraction $\theta$ of $V$.
- At $t = 0$ the project is set up
- At $t = 1$ all decisions are taken and benefits earned
- Values of $V$ and $B$ are determined by the decisions taken at $t = 1$.

Entrepreneur: $\max B + \theta V$

Investor: $\max(1 - \theta)V \iff \max V$

Neither objective coincides with the social welfare maximization:

Social optimum: $\max B + V$

- Question: how to allocate decision rights efficiently?

Assume the only decision to be made: liquidate or continue

Assume for now no renegotiation at $t = 1$ is possible

**Case 1:**

Continuation: $B = 100,\ V = 0$

Liquidation: $B = 0,\ V = 200$

Assume (for now) $\theta = 0.1$

**Solution:**

Social optimum: liquidation (200 > 100)

Achieved by allocating control to I (he will always choose liquidation)

If E has control: $100 + 0.1 * 0 > 0 + 0.1 * 200 \Longrightarrow$ continuation, which is inefficient

**Case 2:**

Assume instead: under continuation $V = 120$ (and all the rest is the same)

**Solution:**

Social optimum: continuation (220 > 200)

Achieved by allocating control to E ($100 + 0.1 * 120 > 0.1 * 200$)

If I has control, he will choose liquidation ($200 > 120$), which would be inefficient.

In reality, $\theta$ is endogenous too, and the contract should define both $\theta$ and the allocation of control rights.

Then, in case 1 the optimum can be achieved even with E's control if $\theta > 1/2$ (incentives are substitute for control).

In case 2 only E's control achieves the optimum.

Looks like E's control can always achieve the social optimum. But. . . ▌

But assume, that in order for the project to be implemented the investor needs to invest $K$ at $t = 0$.

Now we cannot look only at the ex-post efficient decision.

In case 1:

- setting $\theta > 1/2$ and giving control to E can achieve the social optimum if and only if $K < 100$.
- If $K > 100$, then the only optimal solution is I's control, since E's control would be inconsistent with the investor's participation

In case 2:

- If $K < 120$, you can always pick $\theta$ such that $(1-\theta) * 120 > K$. E's control achieves both ex-post optimal decision and ex-ante investment. Investor's control would lead to an inefficient ex-post decision.
- Assume $K > 120$. E's control, though yielding the ex-post efficient decision, does not satisfy the investor's participation constraint (even for $\theta = 0$) Hence, in this case, investor's control is ex-ante efficient (even though ex-post inefficiency will occur)!

## Allowing for renegotiaion

Assume now at $t = 1$ parties can renegotiate, i.e. party who is not in control can pay (or offer higher share in $V$) to the other party in exchange for changing decision.

(Remember: $B$ is not transferable)

Renegotiation only can happen when it leads to an increase in efficiency.

- If we consider each case separately, renegotiation is of no use since we know in advance whose control would be optimal and can write a renegotiation-roof contract from the start:
  - For example, in case 1, renegotiation could help if $\theta < 1/2$ and E has control.
    Then E would want to implement inefficient continuation.
    At $t = 1$ I could offer E a greater share $\theta'$, such that $\theta' > 1/2$ and E then would implement A.
    Provided $(1 - \theta') * 200 > K$, I would break even.
    But if E's bargaining power is very large, E would agree only to a very large $\theta'$ (potentially 1). Then, I would not break even.
  - So it would be (weakly) better to set $\theta > 1/2$ such that $(1 - \theta) * 200 > K$ from the start (at $t = 0$). This would be renegotiation proof and I would break even.

- Renegotiation can be efficiency improving when we don't know at $t = 0$ which case we will be at $t = 1$.
  - Assume we can be equally likely in case 1 or case 2 at $t = 1$. Assume $K = 90$.
  - Under no possibility of renegotiation
    * investor's control would lead to inefficiency in case 2
    * enterpreneur's control would lead to efficiency in both cases only if $\theta > 1/2$.
      But then $\frac{1}{2}(1-\theta)*200+\frac{1}{2}(1-\theta)*120 < 90$ – investor would not break even
  - If allow for renegotiation, then under E's control and $\theta = 0$ we would always get efficiency and I would at least break even.
    * In case 1, I would offer E $\theta' = 1/2$ in exchange for implementing liquidation (assume E has all bargaining power)
    * In case 2, E would implement continuation
    * I would receive in expectation
      $\frac{1}{2}(1-\frac{1}{2})*200+\frac{1}{2}(1-0)*120 = 110 > 90$

## Theories:

- Optimal allocation of control between insiders and outsiders (mainly theories of debt)
- Optimal allocation of control between different outsiders
  - Debtholders and equityholders
  - Debtholders with different maturities
  - Several debtholders with the same maturity

## CONTROL ALLOCATION, DEBT, AND VENTURE CAPITAL CONTRACTS

Aghion and Bolton (1992), Tirole, ch. 10.

**Main idea:**

**(1) Control matters**

**(2) Securities differ in their allocation of control**

**(3) State-contingent control (and multiple control rights) is generally optimal.**

**Debt has such a feature: after a default, control shifts from the debtor to the creditor(s).**

**VC contracts also contain stage contingent allocation of control**

**e.g. after poor performance, control shifts to VC, after a successful IPO control shifts to entrepreneur...**

## Model

An entrepreneur with no funds has the following project:

- At $t = 0$: Financing
  - Need $I > 0$
- At $t = 1$: Decide on the use of the corporate assets
  - Choice between options A and B
- At $t = 2$:
  - Cash flow $X \in \{0, X^S\}$ is generated
  - Option $i$: $p_i \equiv \Pr[X = X^S]$, $Z_i$ – entrepreneur's private benefit, non-contractible, *non-transferable*
  - $\Delta p \equiv p_A - p_B > 0$
  - with $\Delta Z \equiv Z_B - Z_A > 0$

Implication of choice:

Option A leads to a higher expected cash flow, $p_A > p_B$, but to lower (certain) private benefits $Z_B > Z_A$

Option B – vice versa

Hence, there can be a conflict of interest

Ex-post efficiency: option A when $\Delta p X^S > \Delta Z$, otherwise – option B.

**Assumption:** $p_A$, $Z_B$ and $Z_B$ are known at $t = 0$, while $p_B$ is unknown at $t = 0$ but observed at $t = 1$ *prior* to taking a decision. $\Delta p$ is distributed over $[\underline{\Delta}p, \overline{\Delta}p]$.

Hence: if $\overline{\Delta}pX^S > \Delta Z$ option A is sometimes ex-post efficient; $\underline{\Delta}pX^S < \Delta Z$ option B is sometimes ex-post efficient.

**Assumption:** Decision at $t = 1$ is not contractible at $t = 0$

- Too hard/costly to describe an unforeseen contingency

**Note:** Requires that $Z$ is non-verifiable

**Assumption**: The controlling party takes the decision at $t = 1$

- The controlling party has residual control rights, i.e., the right to take decisions when the initial contract is silent.
- Given these assumptions, contract can only specify
  - who takes decision at $t = 1$ (control allocation rule)
  - repayment $R^S$ to investor at $t = 2$ in case $X = X^S$.
- Payoffs after $p_B$ is realized and *after* action $i$ is chosen:
  - Entrepreneur receives $Z_i + p_i(X^S - R^S)$
  - Investor receives $p_i R^S$

- Since investor cares only about cash flows, investor's control $\Rightarrow$ Decision A is chosen, even if $\Delta p X^S < \Delta Z$

**Assumption:** $\overline{\Delta} p \left( X^S - \frac{I}{p_A} \right) < \Delta Z$

- Due to this assumption: financing under entrepreneur's control $\Rightarrow$ decision B is chosen, even if $\Delta p X^S > \Delta Z$

This means that the entrepreneur cannot be induced to choose A by means of an incentive scheme.

Indeed, the assumption implies that for any $R^S \geq \frac{I}{p_A}$:

$p_A \left( X^S - R^S \right) + Z_A < p_B \left( X^S - R^S \right) + Z_B$, i.e. the entrepreneur chooses B.

Hence, it should matter which party has control rights

**Assumption:** $p_A X^S - I > 0$

- Provided decision A is chosen, project has positive NPV
  - Investor control $\Rightarrow$ Project can be financed

## Optimal Contract

- **Problem**: How to choose financial instruments such that the resulting governance structure, i.e., allocation of control, leads to the ex-post efficient action and ensures funding? This may be problematic:
  - For instance, allocate control always to investor (e.g. voting equity).
    - Ensures that investor breaks even (in expected terms). However, he wants to implement A even if B is more efficient ex-post.
  - If control is allocated to entrepreneur, he wants to implement B. Then two problems:
    - A can be more efficient ex-post
    - Even if B is more efficient, it may be inconsistent with the investor's break-even condition

## Case 1: Project A is always efficient, i.e., $\underline{\Delta} p X^S > \Delta Z$

### Investor's control:

The efficient outcome is reached, i.e., A is chosen

The investor's maximum payoff (for $R^S = X^S$) is $p_A X^S$

Hence, the project can be financed as $p_A X^S > I$

### Entrepreneur's control:

The entrepreneur would choose B while A is efficient

However, the investor can pay him to buy the control right at $t = 1 \Rightarrow$ The efficient outcome is restored.

Under Nash bargaining, the investor's payoff is

$$\underbrace{p_B R^S}_{\text{Investor's Outside Option}} + \underbrace{\gamma}_{\text{Investor's Bargaining Power}} \times \underbrace{\left[\Delta p X^S - \Delta Z\right]}_{\text{Surplus from renegotiation}}$$

But the investror may not break-even anymore. The investor's maximum expected payoff (for $R^S = X^S$) is only

$$p_A X^S - \left[(1-\gamma)E[\Delta p]X^S + \gamma \Delta Z\right] < p_A X^S$$

Hence, under entrepreneur's control, ex-post efiicient decision is always taken thanks to renegotiation, but the hold-up problem may lead to credit rationing, i.e., project not funded

### Conclusion for Case 1:

Investor control is optimal;

Security: Voting equity

## Case 2: Project B is always efficient, i.e., $\overline{\Delta} p X^S < \Delta Z$

**Case 2.1:** $E[p_B]X^S \geq I$

**Entrepreneur control:**

The efficient outcome is reached, i.e., B is chosen.

The investor's maximum payoff (for $R^S = X^S$) is $E[p_B]X^S \geq I$.

Hence, the project is undertaken.

**Investor control:**

The investor would choose A while B is efficient.

However, the entrepreneur could pay him to pick B (equivalently, pay him to buy the control right at $t = 1$).

The investor's outside option in renegotiation is $p_A R^S$.

Assume $\gamma = 0$, and, hence, the investor expects to get the same $p_A R^S$. It means he contributes exactly $p_A R^S$ (It must be that $p_A R^S \geq I$)

The entrepreneur can pay up to $p_A R^S - I$ in cash and promice maximum $R^S = X^S$ in exchange for option B. Thus, renegotiation would occur iff

$$p_A R^S - I + p_B X^S \geq p_A R^S \quad \text{or} \quad p_B X^S \geq I$$

$\Rightarrow$ Investor control will lead to inefficiencies whenever $p_B X^S < I$.

**Conclusion for Case 2.1:**

Entrepreneur control is optimal;

Security: Non-voting equity.

**Case 2.2:** $E[p_B]X^S < I$

We continue to assume $\gamma = 0$

B is efficient, but Investor needs some control to break even.

Optimal contract should minimize probability of inefficient decision at $t = 1$ (i.e. "maximize" the Entrepreneur control), subject to the break-even condition:

This is achieved by setting $R^S = X^S$ and Investor's control with probability $\nu$ such that

$$(1 - \nu)E[p_B]X^S + \nu p_A X^S = I$$

or

$$(E[p_B] + \nu E[\Delta p])X^S = I$$

Note: due to $\gamma = 0$, the investor always gets $p_A X^S$ whenever he obtains control.

Security: allocates decision rights at $t = 1$ to either party with positive probability.

**Conclusion for Case 2.2:**

Random control is optimal;

Interpretation? See below...

## Case 3: $\underline{\Delta}pX^S < \Delta Z < \overline{\Delta}pX^S$

We continue to assume $\gamma = 0$

The logic is the same as in Case 2.2: you should give as much control *as possible* to Entrepreneur since his control is ex-post efficient

The optimal contract: $R^S = X^S$ and Investor's control with probability $\nu$ such that

$$(E[p_B] + \nu E[\Delta p])X^S = I.$$

Unless $E[p_B]X^S > \dot{I}$. Then $\nu = 0$ and $R^S$ can be $< X^S$.

Note: when $\Delta pX^S > \Delta Z$ enterpreneur control (which happens with prob. $(1-\nu)$) may seem to yield inefficient choice (B instead of A). But as we saw in Case 1, there will always be ex-post renegotiation so that A is chosen. The break-even condition above ensures that the hold-up problem does not preclude investment. Hence, as in Case 2.2, the optimal contract minimizes probability of inefficient decision at $t = 1$, subject to the break-even condition.

**Conclusion for Case 3:**

Random control is optimal;

Interpretation? See below...

Interpretation of Cases 2.2 and 3?

- Multiple control rights (Tirole 10.2.2)
  - Assume that at $t = 1$ there are many rather than a single choice (decision) to be made. Allocate control to investors over decisions:
    * for which the investor's choice is ex-post optimal
    * which matter a lot for their payoff and/or do not harm entrepreneur too much (i.e. do not create too big ex-post inefficiency)
- State contingent control (below, and Tirole 10.2.3). Theory of debt and VC contracts

## State Contingent Control Allocation

(Cases 2 and 3)

Which contract has the feature that the control right can shift from one party to another?

Debt allocates control on a state-contingent basis but so far in our model control allocation was purely random

Extension:

**Assumption**: At $t = 1$,

- A random variable $\sigma \in (\underline{\sigma}, \bar{\sigma})$ with density $h$ realizes
- $\sigma$ is verifiable

Hence, parties can write contract on it. In particular, it can be used to randomize the allocation of control rights.

**Remark**: So far, no improvement relative to pure uncontingent randomization.

**Assumption**: $\Delta p$ is perfectly determined by the realization of $\sigma$, and $\Delta p(\sigma)$ is decreasing.

**Optimal contract:** The investor should,

- Get control when this is efficient, i.e. $\Delta p(\sigma)X^S > \Delta Z$
  Denote $\sigma^*$ the solution of $\Delta p(\sigma)X^S = \Delta Z$
- Get control in enough states so as to break even (at least)
- If necessary, get control when this is least inefficient (i.e. for lowest $\sigma$ among all $\sigma$'s such that $\Delta p(\sigma)X^S < \Delta Z$)
  Define $\sigma^{**}$ by

$$\left(E[p_B] + \int_{\underline{\sigma}}^{\sigma^{**}} \Delta p(\sigma)h(\sigma)d\sigma\right) X^S = I$$

- Optimal contract:
  - Investor's control for all $\sigma \leq \max\{\sigma^*; \sigma^{**}\}$
  - Entrepreneur's control otherwise
- The optimal contract minimizes the probability of inefficient investor control.
- Remark: if $\sigma$ is a noisy (verifiable) signal of $\Delta p$, then in some states of the world there will be renegotiation, just as in the situation when we had no signal. However, the optimal contingent contract will have the same form.

## Debt contract?

So far $\sigma$ is merely verifiable signal at interim date $t = 1$.

Suppose $\sigma$ is short-term cash flow. Then, one may give following interpretation. In bad times,

- Cash flows are low ($\sigma$ low) – default
- Pursuing the entrepreneur's private goals is most inefficient, i.e., investor's control is most valuable ($\Delta p(\sigma)$ decreasing), hence the control shifts to the investor

However, no inherent reason why $\sigma$ should be short-term cash flow, $\sigma$ may be any verifiable signal.

**Conclusion:**

- Despite renegotiation, investor control yields inefficiencies. Why?
  Because the entrepreneur's wealth constraint does not permit renegotiation when it is efficient.
- Entrepreneur control may not be feasible even though renegotiation restores ex-post efficiency.

  Indeed, the entrepreneur's control rights allow him to extract too much rent from the investor ex-post, which may prevent financing ex-ante

  He cannot commit not to extract this rent

$\rightarrow$ State-contingent control allocation is optimal

**Remark:** Optimal contract can involve renegotiation in equilibrium.

With incomplete contracts, renegotiation can occur in equilibrium and even increase ex-ante efficiency

## Comments

### Incomplete Contract Approach

Aghion-Bolton (1992) features characteristics common to this literature:

Incomplete contract typically allocates residual control rights to one of the party contingent on the realization of a verifiable signal.

Verifiable signal is (usually) not perfectly correlated with non-verifiable states of nature

→ party with control rights may not choose the most efficient action

→ scope for renegotiation and/or inefficiencies

Design of contract should be such as to limit tendency of agents to behave inefficiently.

### Theory of Debt and VC financing

- This theory explains the optimality of one feature of debt: control is allocated on a state-contingent basis
- However, in debt contract, control shifts following default or violation of a covenant. Why should signal $\sigma$ be any of these?
- There are also other contracts that feature state-contingent allocation of control rights, e.g. **venture capital arrangements** (Kaplan and Stromberg (2003))