Asymmetric information in finance

Financial contract

Is a contract agreed upon by a borrower and a lender.
The contract is signed *only if* both parties' participation constraint is fulfilled:

Participation constraint:
expected return from the contract $\geq$ expected return from best alternative course of action (**opportunity cost**)

Example

An entrepreneur (borrower) is considering the following investment project:

Risky Investment at time t: $I = 100$

Cash Flow at time $t+1$: if success $CF_s = 300$ if failure: $CF_f = 0$

Probabilities: $\alpha = 0.7$ $1 - \alpha = 0.3$

Expected value (cash flow) $EV(I) = \alpha\, CF_s + (1 - \alpha)\, CF_f = 210$

Loan contract $L = 100$ the investment I is fully financed by the loan L

Lender's opportunity cost: forgone opportunity to invest L = 100 in bonds at risk-free interest rate r

risk free interest rate r $= 10\%$.

Lender's opportunity cost = $(1 + r)L = 110$

Limited liability: contractual clause that, in case the investment fails, the borrower is not forced to pay the capital and interest owed by using personal assets. Under this clause, the financial contract is risky for the bank.

Lender's participation constraint: the interest rate r_L on the loan L fixed by the bank must be sufficient to yield:

expected revenue from loan $L \geq$ opportunity cost $(1 + r)L$

Bank's expected revenue from L:

$$\alpha(1 + r_L)L + (1 - \alpha)\min[(1 + r_L)L, CF_f] = \alpha(1 + r_L)L$$

borrower's repayment in case of failure

Lender's participation constraint: $\alpha(1 + r_L)L \geq (1 + r)L$

Minimum risk adjusted interest factor: $1 + r_L \geq \frac{1+r}{\alpha} = \frac{1+0.1}{0.7} = 1.57$

$$r_L \geq 0.57$$

Remark: whenever min $[(1 + r_L)L, CF_f] < (1 + r)L$, *we have* $r_L > r$

if the repayment in case of failure is lower than the lender's opportunity cost, the risk adjusted interest rate is higher than the risk-free interest rate

Assume $r_L = \min r_L = 0.57$

By fixing the minimum risk-adjusted interest rate, the lender is indifferent between the risky contract and the sure asset. Competition on the credit market drives banks to fix the lowest risk-adjusted interest rate.

Borrower expected profit: expected cash-flow (EV) - expected repayment

$E\pi = \alpha[CF_s - (1 + r_L)L]$= $EV - \alpha(1 + r_L)L$ = 210 – 0.7[1.57(100)] = 100.1 ≈ 100

Assumption: Borrower and lender are risk neutral

The financial contract is signed because participation constraint is fulfilled for both parties.

Borrower: $E\pi$ **> 0 and she has no other investment opportunity**

Lender: $\alpha(1 + r_L)L = (1 + r)L$

Forms of asymmetric information in financial contracts:

Hidden information: (pre-contractual opportunism)
The borrower overstates the true success probability α of the project, in the attempt of obtaining a lower risk adjusted interest rate r_L.

Hidden action: (post-contractual opportunism)

- the borrower mis-reports the true ex-post cash flow, in the attempt of avoiding the payment of $(1 + r_L)L$
- the borrower invests the money L received by the lender on a riskier investment project than was agreed with the bank (moral hazard).

Hidden information: adverse selection

Two types A, B of productive investment projects of size (cost) $L_A = L_B = L$

Frequency p_A, p_B with which projects of type A and B are selected is common information (A (B) projects selected by type A (B) entrepreneurs..)

$$EV_A = \alpha_A\, CF_{s,A} + (1 - \alpha_A)\, CF_{f,A} = \alpha_A\, CF_{s,A} \qquad CF_{f,A} = 0$$
$$EV_B = \alpha_B\, CF_{s,B} + (1 - \alpha_B)\, CF_{f,B} = \alpha_B\, CF_{s,B} \qquad CF_{f,B} = 0$$

Assume: $EV_A = EV_B$ and $CF_{s,B} > CF_{s,A}$ and $\alpha_A > \alpha_B$

⟶ **Project B is riskier than Project A**

The minimum risk adjusted interest rate is higher for the risky project:

$$\mathbf{1 + r_{L,A} = \frac{1+r}{\alpha_A} < \frac{1+r}{\alpha_B} = 1 + r_{L,B}}$$

The expected payment to the lender is the same $(1 + r)L$, under both types.

Hidden information:
Type B entrepreneurs hide their type to the bank, in the attempt of getting a lower interest charge. The bank is indeed unable to distinguish type A and B.

The bank charges the same risk adjusted interest factor ($1 + r_L$) to every borrower.

$(1 + r_L)$ is so fixed that:

$$(1 + r) = (p_A\,\alpha_A + p_B\,\alpha_B)(\mathbf{1} + \boldsymbol{r_L}) = \boldsymbol{p_s}(\mathbf{1} + \boldsymbol{r_L})$$

$\boldsymbol{p_s} = (p_A\,\alpha_A + p_B\,\alpha_B) =$ ***average probability of success***

$$(1 + r) = (\mathbf{1} + \boldsymbol{r_L})(\,p_A\,\alpha_A + p_B\,\alpha_B\,)$$

$$\mathbf{1} + \boldsymbol{r_L} = \frac{\mathbf{1}+\boldsymbol{r}}{\boldsymbol{p_A}\boldsymbol{\alpha_A}+\boldsymbol{p_B}\boldsymbol{\alpha_B}} = \frac{\mathbf{1}+\boldsymbol{r}}{\boldsymbol{p_s}}$$

By definition: $\boldsymbol{\alpha_A} > \boldsymbol{p_S} > \alpha_B$ ***which implies:*** $r_{L,A} < r_L < r_{L,B}$

hidden information implies:

low-risk (A), high-risk (B) projects are charged the same interest rate r_L.

in this example A and B yield the same expected cash flow $EV_A = EV_B$

This implies that if A and B pay the same interest rate r_L, the risky project B yields a higher expected profit than the safer project A.

This is because the probability of failure is higher for B, hence the expected repayment to the bank is lower, since in case of failure the payment is zero.

$$E\pi_A = \alpha_A\left[CF_{s,A} - (1 + r_L)L\right] = EV_A - \alpha_A(1 + r_L)L$$

$$E\pi_B = \alpha_B\left[CF_{s,B} - (1 + r_L)L\right] = EV_B - \alpha_B(1 + r_L)L$$

$$EV_A = EV_B \qquad and \quad \alpha_A > \alpha_B \longrightarrow \quad E\pi_A < E\pi_B \qquad at\ any\ r_L$$

Adverse selection: At interest rate $\boldsymbol{r_L > r_{L,A}}$ entrepreneurs have an incentive to select type B projects.

The outcome is that type A projects disappear from the market, that is there is an endogenous change in the frequencies of types A and B:

$$\boldsymbol{p_A = 0, \rightarrow\ p_B = 1} \text{ and } \boldsymbol{1 + r_L =\ 1 + r_{L,B}}$$

Remark:
Te previous example shows that:

- if the safe and the risky project yield the same expected cash flow,(simplifying assumption)
- if the project type is hidden information, so that a uniform 'average' risk adjusted interest rate is fixed by the lender (to meet its participation constraint),
- If the limited liability clause applies,

then:
the risky project yields a higher expected return than the safe one, to the effect that adverse selection will take place.