Corporate finance and product markets

- Profit destruction
- Relative performance / benchmarking
- Effects of competition on corporate governance and financial structure

Profit destruction

- A project's profitability may depend on how many other firms succeed with similar projects.
  - There is a *strategic uncertainty*.
  - Investors have to take into account the scope for other firms' success.
- Two firms, each with own funds A.
- One firm's return in case of success is: M if the other firm fails; $D \leq M$ if the other firm succeeds.
- Success probabilitites p_H or $p_L = p_H - \Delta p$, depending on whether the entrepreneur works or not.
- The fixed-investment model, with $A < I < p_H M$.
- The two firms' projects are independent.
  - No scope for relative-performance evaluation.

- If both firms get funding, then a firm's expected return is:

$$p_H[(1 - p_H)M + p_H D]$$

  - Investors' breakeven constraint defines $\overline{A}$:

$$p_H[(1 - p_H)(M - \frac{B}{\Delta p}) + p_H(D - \frac{B}{\Delta p})] = I - \overline{A}$$

- If only one firm gets funding, then this firm's expected return is:

$$p_H M$$

  - Investors' breakeven constraint defines $\underline{A} < \overline{A}$:

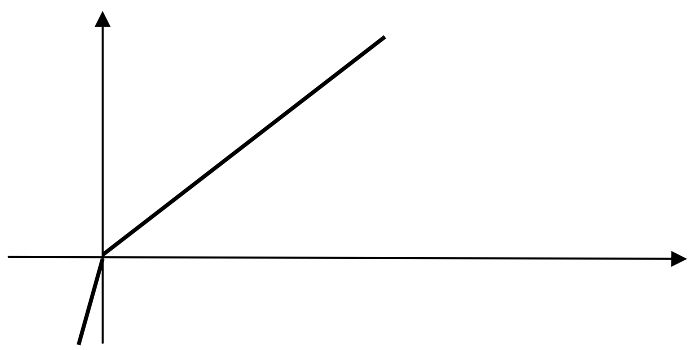
$$p_H(M - \frac{B}{\Delta p})] = I - \underline{A}$$

- If $A < \underline{A}$, then no firm enters. If $A \geq \overline{A}$, then both firms enter.
- If $\underline{A} \leq A < \overline{A}$, then one firm enters. But which?
  - There are two asymmetric equilibria in pure strategies. There also exists a symmetric mixed-strategy equilibrium.

Benchmarking

- Suppose now the two projects are perfectly correlated.
  - A random variable ω is distributed uniformly on [0, 1].
  - A project always succeeds if $\omega < p_L$, always fails if $\omega > p_H$, and succeeds only with good behavior if $p_L < \omega < p_H$.
  - Because of the uniform distribution, the probability of success is p_H with good behavior, p_L otherwise.
  - Perfect correlation means the two firms have the same ω.

- Risk neutrality and limited liability: there is nothing to gain from relative performance.
  - Shirking will be discovered whenever $p_L < \omega < p_H$, but cannot be punished with more than 0, which is the return for the entrepreneur even without benchmarking.
- Alternative assumption: the entrepreneur is not protected by limited liability but is risk averse.
  - No limited liability: contracts with $R_b < 0$ are feasible.
  - Risk aversion: $u'(R) > 0$, $u''(R) < 0$: more important to increase returns in bad times than to increase then in good times.
  - Simple special case: entrepreneur locally risk neutral for any $R > 0$: $u(R) = R$; but $u'(R) > 1$ for $R \leq 0$.
    - Say, $u(R) = (1 + \theta)R$ for $R \leq 0$, where $\theta > 1$.



- Now, we can have relative-performance contracts such as:

$$R_b = \begin{cases} a, & \text{if the firm does at least as well as the other firm;} \\ -b, & \text{if the firm does worse than the other firm.} \end{cases}$$

- Good behavior ensures the return a, misbehavior means a probability Δp that the return is $-b$. As θ increases, this threat gets very effective and ensures, as $\theta \to \infty$, that the moral-hazard problem disappears.

Competition may affect corporate governance and financial structure

- A key topic in the theory of industrial organization: A firm can improve its competitive position by
  - looking tough, when that is called for; and
  - looking soft, when that is called for.
- Looking tough is often good in order to *deter other firms' entry*.
  - If a firm, in case of other firms' entering its industry, produces a high quantity, then prices will be low and profits low, and entry is less attractive.
  - Looking tough can also help in securing a firm a large market share: If a firm produces a high quantity, other firms are less interested themselves in producing a high quantity.
- Looking soft is sometimes good in order to dampen competition among the firms in an industry – particularly under price competition.
  - If a firm sets a high price, other firms will be induced to do the same, and profits will be high.
- There is an issue of credibility here.
  - When actually faced with a new entry, a firm may not be so interested in producing a high quantity after all.
  - In order for *looking tough* to work as an entry deterrent, it is necessary to have a commitment device.
- Corporate finance may work as *committing* the firm to looking tough or looking soft.

- Strategic complements and strategic substitutes
    - Two firms' decision variables are *strategic complements* if one firm's increasing its variable induces the other firm to also increase: $\frac{\partial^2 \pi}{\partial x_i \partial x_j} > 0$.
    - Two firms' decision variables are *strategic substitutes* if one firm's increasing its variable induces the other firm to decrease: $\frac{\partial^2 \pi}{\partial x_i \partial x_j} < 0$.
- Corporate governance: allocation of control rights (ch. 10)
- Suppose that intermediate actions can be taken before completion of the firm's project that enhance project returns but which nevertheless reduce the entrepreneur's utility.
    - firing workers, selling off a division of the firm, etc.
- Since they entail a loss of entrepreneurial utility, these decisions will not be taken as long as the entrepreneur has control
    - If the firm does not need to take these actions in order to secure funds, they will not be taken.
    - If, on the other hand, they are necessary, an allocation of control rights from entrepreneur to investors need to be made.
- A firm with allocation of control rights to investors is *looking tough*.
- Competition in the product market may affect firms' incentives to look tough and therefore to allocate control rights to investors.
    - Entry deterrence: Give control to investors in order to keep other entrepreneurs out of the market.
        - If they enter, they may need to do the same.

Predation and corporate finance

- Predation: inducing rival firms to exit, for example through aggressive competition.
- In order to succeed, predation requires the predating firm to be stronger than the prey.
    - the *long-purse story* of predation (or deep-pocket story)
- A model of predation
    - Two dates: 0 and 1. Duopoly. Firms identical, except their wealths: Firm 1 financially strong, the predator; firm 2 financially weak, the prey.
    - An investment needs at both dates. But both firms have available own funds for date 0. Profit at date 0 determines available firm 2's own funds at date 1 – retained earnings.
    - Date 0: Firm 1 may take a predatory action reducing both firms' date-0 profit. In particular, firm 2's profit falls from A to a.
    - Date 1: Expected profit when both firms compete is

$$C = (1 - p_H)M + p_H D$$

    - Assume that whether pledgeable income is enough for firm 2 to secure outside funding depends on firm 1's decision on predation at date 0

$$I - A < p_H\left(C - \frac{B}{\Delta p}\right) < I - a.$$

- Predation by firm 1 at date 0 triggers firm 2's exit. But is predation profitable?
  - Gain from predation: elimination of a rival in the event that both firms would have succeeded

$$p_H^2(M-D)$$

  - Cost of predation: k
  - If both firms suffer the same cost of predation, then

$$k = A - a.$$

- Predation at date 0 occurs if: $k < p_H^2(M-D)$

- But what if the weak firm foresees all this and secures funding already at date 0 for the investment needed at date 1?
- Assume now that firm 2 can sign a *long-term contract* with outside investors at date 0. Will this help against predation?
  - Let $p_H = 1$.
  - Let private benefits of misbehavior be lower at date 0 than at date 1: $B_0 < B$.
  - Predation at date 0 results in profit 0 for both firms in that period.
  - Investors of firm 2 cannot observe the other firm's profit at date 0
    - They cannot tell whether zero profit is due to misbehavior or due to predation

- Long-term financial contract for firm 2: $\{z^S, z^F, R_b^S, R_b^F\}$
  - z^i – probability of reinvestment at date 1 if outcome is i at date 0, $i \in \{S, F\} = \{\text{Success, Failure}\}$
  - R_b^i – firm's return at date 1 in case of reinvestment and success, if outcome is i at date 0, $i \in \{S, F\}$.
- *Date-1 incentive constraint*: $R_b^i \geq \dfrac{B}{\Delta p}$.
- Positive NPV without predation: $D - I > 0$.
- Without date-0 profit, firm 2 would not have enough own funds to finance the date-1 investment: $(D - \dfrac{B}{\Delta p}) - I < 0$.
- *Predation deterrence constraint*: Firm 2 must choose its financial contract such that firm 1's costs of predation exceed the gains

$$D \geq (z^S - z^F)(M - D) \Leftrightarrow z^S - z^F \leq \frac{D}{M - D}$$

- *Date-0 incentive constraint*: Entrepreneur's compensation is delayed to date 1.

$$z^S R_b^S - z^F R_b^F \geq \frac{B_0}{\Delta p}$$

- *Benchmark: No predation.*
  - Disregard the PD constraint. Clearly, failure at date 0 means misbehavior (since no predation, and $p_H = 1$).
  - Borrower's net utility – NPV – depends on z^S:

$$U_b(z^S) = D - I + z^S(D - I) = (1 + z^S)(D - I)$$

  - Investors' breakeven constraint

$$(1 + z^S)D - z^S R_b^S \geq (1 + z^S)I - A$$

  - Firm 2 is *strong* if A is so high that $z^S = 1$ is feasible. In particular, this requires

$$2D - \frac{B}{\Delta p} \geq 2I - A \Leftrightarrow A \geq \frac{B}{\Delta p} - 2(D - I)$$

    - But also the date-0 incentive constraint must be satisfied. It can be shown that it is if z^F is sufficiently low.
  - Firm 2 is *weak* if $A < \frac{B}{\Delta p} - 2(D - I)$. Now, it is necessary to have $z^S < 1$, and $R_b^S = \frac{B}{\Delta p}$. The continuation probability in case of date-0 success, $z^S = \bar{z}^S$, is found by solving

$$(1 + \bar{z}^S)D - \bar{z}^S \frac{B}{\Delta p} = (1 + \bar{z}^S)I - A$$

- *Predation feasible.* Introducing the predation-deterrence constraint.
  - *Weak firm*: without predation, we have $z^S < 1$ and $R_b^S = \frac{B}{\Delta p}$. Date-0 incentives require

    $$(z^S - z^F)\,\frac{B}{\Delta p} \geq \frac{B_0}{\Delta p},$$

    while the predation constraint is:

    $$z^S - z^F \leq \frac{D}{M - D}$$

    In combination:

    $$\frac{B_0}{B} \leq z^S - z^F \leq \frac{D}{M - D}$$

  - If $\frac{B_0}{B} \leq \frac{D}{M-D}$, then the possibility of predation does not alter the contracts.
  - What if $\frac{B_0}{B} > \frac{D}{M-D}$?
    - The gain from predation is large relative to its costs, or the date-0 moral-hazard problem is almost as large as the date-1 one.
    - Firm 2 cannot escape predation totally. It needs to make date-1 investment less sensitive to the date-0 outcome, which means decreasing z^S below $\bar{z}^S$, so that $z^S - z^F$ is reduced.
    - A *shallow-pocket* strategy: low probability of continuation, in order to counter the threat of predation
  - Strong firm: Similarly, we find $z^S < 1$.
- Empirical work: Indebted firms seem to be easier prey.

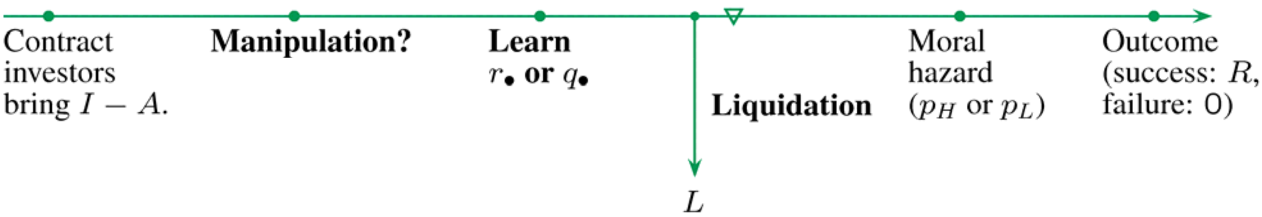
Earnings manipulations

- Solving one incentive problem may create others
    - High-powered incentive schemes (where compensation is highly dependent on the firm's outcome) increase the manager's interest in
        - manipulating the timing of income recognition: moving income forward or backward in time, if this serves her interests
        - taking actions that affect the firm's risk
- *Multitasking:* It is difficult to enhance behavior along one dimension without also affecting behavior in other dimensions.
- Accounting manipulation techniques (cooking the books)
    - Moving loss provisions forward, so that today's accounts look better than they actually are;
    - Choosing between capitalization and expensing of maintenance and investment costs; and so on
- Manipulating the firm's operations
    - Delaying maintenance
    - Running sales in December, rather than in January
    - Giving customers favourable terms in order to obtain particularly early or late delivery.

A model of managerial myopia

- *Posturing*: Pretending to be something else.
- Management may have incentives to *boost short-term profit* at the cost of long-term loss.
- Fixed-investment model. Probability of success depends on both ability and behavior.
    - o High ability: success probability is r_H or r_L, depending on whether the manager puts in effort or not, where $r_H > r_L$.
    - o Low ability: success probability is q_H or q_L, where $q_H < r_H$, $q_L < r_L$, and $q_H - q_L = r_H - r_L = \Delta p$.
        - ▪ Whatever the ability, shirking has the same effect.
- At the funding stage, *no-one* knows the manager's ability; the prior probability of the manager being able is α.

$$p_H = \alpha r_H + (1 - \alpha)q_H;\ \ p_L = \alpha r_L + (1 - \alpha)q_L;\ \ p_H - p_L = \Delta p.$$



- After contracts are signed, ability becomes publicly observable and verifiable.
- Contract specifies whether, after ability is known, management is allowed to continue or not: $\{z^r, z^q\}$ – where z^i s the probability of continuation if ability turns out to be i.
    - o In principle, also other items should be contracted upon. More on this later.

- In case of termination, there is a value L to share between investors and incumbent management.

- Benchmark: no manipulation

  - Assumption: $q_H R > L$. – Even a low-ability manager would prefer keeping her job.

  - Furthermore, guaranteed tenure or guaranteed termination does not generate enough expected pledgeable income,

    $$\max\{ p_H(R - \frac{B}{\Delta p}), L\} < I - A,$$

    while there is enough pledgeable income if there is termination only when ability is low, as long as outside investors get the liquidation value in case of termination:

    $$\alpha r_H(R - \frac{B}{\Delta p}) + (1 - \alpha)L > I - A.$$

  - The entrepreneur's net utility equals the NPV, given the contract's probabilities of continuation z^r and z^q.

    $$U_b = \alpha[z^r r_H R + (1 - z^r)L] + (1 - \alpha)[z^q q_H R + (1 - z^q)L] - I$$

  - NPV would have been maximized at guaranteed tenure, $z^r = z^q = 1$. But this fails in attracting outside investors.

  - In order to keep z^r and z^q, and therefore NPV, as high as possible, the contract will leave as much as possible to investors in case of liquidation, and in case of continuation and success:

    $$L^r = L^q = L, \text{ and } R_b^r = R_b^q = \frac{B}{\Delta p}.$$

  - It is more to gain from keeping z^r high than from keeping z^q high. Therefore, the contract will have $z^q = z^*$ and $z^r = 1$, where z^* is the highest one that satisfies investors' breakeven constraint:

    $$\alpha r_H(R - \frac{B}{\Delta p}) + (1 - \alpha)[z^* q_H(R - \frac{B}{\Delta p}) + (1 - z^*)L] = I - A$$

- *Manipulation*: The entrepreneur can, at a cost, alter the information received by the outside investors.
    - The act of manipulation: the entrepreneur boosts short-term performance by generating information that indicates high ability, r.
    - The cost of manipulation: a (uniform) reduction τ in the probability of success.
- Two forms of manipulation
    - *Uninformed manipulation*: When deciding whether to manipulate information, the entrepreneur still does not know her ability.
    - *Informed manipulation*: Before deciding whether to manipulate information – but after the contract is signed – the entrepreneur gets to know her ability.
        - If she knows her ability already when the contract is signed, then she could use dissipative signals, such as distorted continuation rules in the contract, to reveal her type to outside investors.
- Let now the contract also include a return $R_b \geq \frac{B}{\Delta p}$ in case of continuation and success.

- Uninformed manipulation:
  - The *no-manipulation constraint*: the entrepreneur's gain from manipulation must be less than what she gets from abstaining from manipulation

$$z^r(p_H - \tau)R_b \leq [\alpha z^r r_H + (1 - \alpha)z^q q_H]R_b \Leftrightarrow$$

$$\frac{z^r}{z^q} \leq \frac{1}{1 - \frac{\tau}{(1-\alpha)q_H}}$$

  - The continuation probability at high ability cannot be too much different from that at low ability.
    - The lower the cost of manipulation τ is, the closer the two probabilities need to be.
- Informed manipulation: The interest in manipulation occurs only when the entrepreneur learns that she has low ability.
  - The no-manipulation constraint:

$$z^r(q_H - \tau)R_b \leq z^q q_H R_b \Leftrightarrow$$

$$\frac{z^r}{z^q} \leq \frac{1}{1 - \frac{\tau}{q_H}}$$

  - This constraint is harder to satisfy than when manipulation is uninformed, which is natural.

- In the case of uninformed manipulation: is the no-manipulation constraint binding? – Yes, if

$$\frac{1}{z^*} > \frac{1}{1 - \frac{\tau}{(1-\alpha)q_H}} \Leftrightarrow 1 - z^* > \frac{\tau}{(1-\alpha)q_H}$$

  - Increasing z^q above z^* is not possible, since this reduces pledgeable income, and so the breakeven constraint would fail to hold. Reducing z^r below 1 also reduces pledgeable income, and so z^q needs to be reduced even more. In the end, it may not be possible to find a pair $\{z^r, z^q\}$ satisfying both the breakeven constraint and the no-manipulation constraint.
  - The ability to cook the books later on may jeopardize the firm's possibility to obtain funding in the first place. And even when funding is feasible, this ability reduces project NPV and therefore firm value.
- *Golden parachute* – making the entrepreneur more interested in liquidation when ability is low. Could it be useful here?
  - It would relax the no-manipulation constraint.
  - It means giving away some of the liquidation value: $L^q < L$.
  - Unless L is very low, it is better to reduce z^q than L^q.
- *Career concerns*
  - Explicit vs implicit incentives
  - Suppose the manager is driven solely by career concerns – monetary compensation plays no role, but there is a value to keeping the job.
  - Impossible to keep manager from manipulating earnings – the loss in profit that follows does not affect a manager who does not care about money.

Other forms of posturing

- *Risk taking*
  - o Suppose again that only career concerns matter.
  - o Two periods, two projects: Each project has a return in period t equal to R_t if success, equal to 0 if failure
  - o No moral hazard. Funding is certain.
  - o Manager obtains a benefit B per period in the job.
  - o Manager's ability unknown to everyone. Initially, probability of high ability (with success probability for a project equal to r) is α, and probability of low ability (success probability $q < r$) is $(1 - \alpha)$.
  - o Before the two periods, the manager chooses the correlation between the two projects – for simplicity: either independence (*hedging*) or perfect correlation (*gambling*).
  - o After the first period, investors observe outcomes and choose whether or not to fire the manager. An alternative manager is available whose expected ability is $\hat{\alpha}$.
  - o Hedging equilibrium: manager chooses independence, and investors rationally anticipate this. Can this be an equilibrium?
    - ▪ Suppose investors believe manager chooses independence – would manager prefer to deviate?
  - o The probability that manager has high ability given success in one project in the first period:

$$\alpha_1^H = \frac{\alpha r(1-r)}{\alpha r(1-r)+(1-\alpha)q(1-q)}$$

  - o If $\hat{\alpha} < \alpha_1^H$, then one success is enough for keeping the job.
    - ▪ Gambling would increase the probability of two failures, and therefore of losing the job.
  - o If $\hat{\alpha} > \alpha_1^H$, then two successes are needed for keeping the job. Gambling would increase the probability of two successes.

- In summary: the manager is conservative and chooses uncorrelated projects if her position is secure ($\hat{\alpha}$ low), and gambles if her position is threatened ($\hat{\alpha}$ high).
- Empirical analysis: mutual-fund managers – very important for them to be among top performers.
  - Poor performance in first three quarters: gamble for resurrection.
  - Good performance in first three quarters: conservative.

- Herding: doing what others do.
  - *Statistical* herding: Observing other people's action reveals something about the information they have. In the end, when making up one's own mind, more weight is put on others' choices than the information one has collected oneself. This may lead to everybody choosing the wrong action.
  - *Reputational herding*: Managers' job is to collect information for the investors. But only smart managers receive (the same) informative signals. By doing what others do, you keep up the possibility that you have the same information as others, and therefore that you are smart.

"... it is the long-term investor, he who most promotes the public interest, who will in practice come in for most criticism, wherever investment funds are managed by committees or boards or banks. For it is in the essence of his behavior that he should be eccentric, unconventional, and rash in the eyes of average opinion. If he is successful, that will only confirm the general belief in his rashness; and if in the short-run he is unsuccessful, which is very likely, he will not receive much mercy. *Worldly wisdom teaches that it is better for reputation to fail conventionally than to succeed unconventionally*" – J.M. Keynes, *General Theory* ch. 12, my emphasis.

Effort and risk taking

- Managers – through their decisions – do not only affect project quality, but also project riskiness.
- Would incentives to work hard on quality also lead the manager to take too high risks?
- A simple way to model the issues: three possible outcomes – success, middle, and failure – with returns R^S, R^M, and R^F.
- A *two-dimensional* moral-hazard problem
    - *Effort* increases the probability of success and reduces the probability of failure, but makes the manager incur a loss of private benefit.
    - *Risk taking* increases the probabilities of success and failure, and reduces the probability of the middle outcome.
- Otherwise, the fixed-investment model. Investment required: I. Entrepreneur is risk neutral and has cash $A < I$. Limited liability.
- Without efforts by the entrepreneur, all three outcomes are equally likely, that is, have a probability 1/3 each, and the investment is not profitable:

$$\frac{1}{3}(R^S + R^M + R^F) + B < I.$$

- Efforts raise the probability of success, and lowers the probability of failure, by $\theta > 0$, making the investment profitable:

$$(\frac{1}{3} + \theta)R^S + \frac{1}{3}R^M + (\frac{1}{3} - \theta)R^F > I.$$

- Risk taking, which can be done with or without efforts, increases the probability of success by α, increases the probability of failure by β, and lowers the probability of the middle outcome by $\alpha+\beta$. Risk taking lowers the project's profitability:

$$\alpha R^S + \beta R^F < (\alpha + \beta) R^M \iff$$

$$\alpha(R^S - R^M) < \beta(R^M - R^F)$$

- Contract $\{R_b^S, R_b^M, R_b^F\}$. Put $R_b^F = 0$.

- Suppose first that *risk taking should be discouraged*.
  - Incentive constraint with respect to effort:

$$(\frac{1}{3} + \theta) R_b^S + \frac{1}{3} R_b^M \geq \frac{1}{3} R_b^S + \frac{1}{3} R_b^M + B \iff$$

$$\theta R_b^S \geq B$$

  - Incentive constraint with respect to risk taking:

$$(\frac{1}{3} + \theta) R_b^S + \frac{1}{3} R_b^M \geq (\frac{1}{3} + \theta + \alpha) R_b^S + (\frac{1}{3} - \alpha - \beta) R_b^M \iff$$

$$(\alpha + \beta) R_b^M \geq \alpha R_b^S$$

  - Combining the two incentive constraints:

$$\frac{\alpha + \beta}{\alpha} R_b^M \geq R_b^S \geq \frac{B}{\theta}$$

    - The entrepreneur should be paid in case of success, in order to provide incentives for effort, but not too much, in order to discourage risk taking.
  - The third incentive constraint, making efforts and no risk taking preferable to no effort and risk taking, is redundant:

$$(\frac{1}{3} + \theta) R_b^S + \frac{1}{3} R_b^M \geq (\frac{1}{3} + \alpha) R_b^S + (\frac{1}{3} - \alpha - \beta) R_b^M + B \iff$$

$$[\theta R_b^S - B] + [(\alpha + \beta) R_b^M - \alpha R_b^S] \geq 0$$

- In case of funding, the entrepreneur retains the NPV for the project, which without risk taking is:

$$U_b^1 = (\frac{1}{3} + \theta)R^S + \frac{1}{3}R^M + (\frac{1}{3} - \theta)R^F - I.$$

- Pledgeable income with no risk taking:

$$(\frac{1}{3} + \theta)(R^S - \frac{B}{\theta}) + \frac{1}{3}(R^M - \frac{\alpha+\beta}{\alpha}\frac{B}{\theta}) + (\frac{1}{3} - \theta)R^F$$

- Suppose, alternatively, that *risk taking is not to be avoided*.
  - Now, returns to the entrepreneur are only if success:

$$R_b^M = R_b^F = 0.$$

  - A single incentive constraint, with respect to effort:

$$\theta R_b^S \geq B.$$

  - The entrepreneur again retains the NPV, which now is smaller than without risk taking:

$$U_b^2 = U_b^1 + [\alpha(R^S - R^M) - \beta(R^M - R^F)] < U_b^1$$

  - Pledgeable income with risk taking:

$$(\frac{1}{3} + \theta + \alpha)(R^S - \frac{B}{\theta}) + (\frac{1}{3} - \alpha - \beta)R^M + (\frac{1}{3} - \theta + \beta)R^F$$

- Of course, the entrepreneur prefers a contract that does not induce risk taking, since risk taking here lowers value.
  - This requires sufficient own cash:

$$(\frac{1}{3} + \theta)(R^S - \frac{B}{\theta}) + \frac{1}{3}(R^M - \frac{\alpha+\beta}{\alpha}\frac{B}{\theta}) + (\frac{1}{3} - \theta)R^F \geq I - A \Leftrightarrow$$

$$A \geq (\frac{1}{3} + \theta)\frac{B}{\theta} + \frac{1}{3}\frac{\alpha+\beta}{\alpha}\frac{B}{\theta} - U_b^1$$

  - If not, funding may still be possible, if risk taking increases pledgeable income and is not too costly in terms of NPV.
    - In fact, risk taking does increase pledgeable income if $U_b^2 \approx U_b^1$.