

Seminar IV

Problem 1.

This problem repeats the last part of Problem 3 of Seminar III.

- b) Due to difficulties with getting the funding he wants, Paul seeks the advice of a friend, who recommends splitting the development in two, with a first-phase project whose returns RI_1 is obtained from an investment I_1 , in case of success, before the decision to launch phase two, with returns RI_2 obtained from an investment I_2 in case of success. The two phases have the same success probabilities and the same moral-hazard problem as detailed above. Let us also assume that the two projects are statistically independent, and that long-term contracts are not available.
- ii. What would change if long-term contracts were available?
 - iii. How does the result hinge on the projects being statistically independent? To what extent is it reasonable to assume imperfect correlation in the particular case of Paul's property development?
- c) Paul realizes that there is a risk for a cost over-run in the project. In particular, there is a need, before the project is completed, for a reinvestment equal to ρI , where I is the initial investment, and ρ is distributed according to the probability distribution $F(\rho)$ on $[0, \infty)$, with density $f(\rho)$. The moral-hazard problem, in case of a reinvestment and completion of the project, is as detailed above. Discuss how this need for intermediate funds, in order to complete the project, can be dealt with in the initial contract. Explain, in particular, how the risk of a cost over-run calls for a smaller project than otherwise called for.

Problem 2.

This problem is a continuation of Problem 1.

Paul finds out that the liquidity problem raised by the prospects of a cost over-run could be mitigated if there would be a way to secure short-term returns from the project, which could be used to cover in part the cost over-run. In particular, he could sell part of the property before completion of the project, providing verifiable short-term returns rI , where again I is the initial investment, and the distribution of r is subject to a second moral-hazard problem, in addition to the one affecting the success probability of the completed project: If Paul works hard on getting high short-term returns, he would suffer a loss B_0I and r would be distributed according to the probability distribution $G(r)$, with density $g(r)$. If not, then r is distributed according to the probability distribution $\tilde{G}(r)$, with density $\tilde{g}(r)$. Assume that the likelihood ratio, $l(r) = [g(r) - \tilde{g}(r)]/g(r)$, is (weakly) increasing in r . Define a contract as a pair of functions $\{\rho^*(r), \Delta(r)\}$, where $\rho^*(r)$ is the cutoff reinvestment need when short-term returns are r , such that the project is abandoned if $\rho > \rho^*(r)$, and $\Delta(r)$ is Paul's per-unit-of-investment extra rent, for each realization of r , over and above what is required by the other moral-hazard problem if the project is completed, and a per-unit-of-investment cash compensation if it is abandoned.

- i. Explain the meaning of $l'(r) \geq 0$. Also, explain why we need the restriction $\Delta(r) \geq 0$.
- ii. Explain why the equilibrium contract has the property that $\rho^*(r)$ is (weakly) increasing in r , and discuss features of the project that determine whether the variation in the cutoff ρ^* , as the level of short-term return r varies, is large or small.
- iii. In cases where r is low, the cutoff ρ^* may be so low that a credibility problem arises, leading to a scope for renegotiation of the initial contract. This is called the problem of the *soft budget constraint*. Explain the nature of the problem and discuss how the contract needs to be amended in order to cope with this problem.

Problem 3.

Review Problem 4, parts (i)-(iii), in Tirole, pp. 627-628.