

## CHAPTER 22

# POST-CONTRACT, PRE-DECISION INFORMATION

In this chapter we review a variation of the principal-agent model in which the agent (as opposed to the principal) receives private information *after a binding contract has been signed* but before he takes his action. In the following chapter, we consider the cases where the agent either is endowed with private information before signing the contract or can leave the firm after observing his private information.

Throughout this chapter we assume that the agent's utility is defined with respect to his terminal compensation. Chapters 25 and 26 considers settings in which the agent's utility is defined over consumption at more than one date and communication can affect both the amount and timing of the agent's compensation. Timing is not an issue in this chapter.

Private agent information is found in many business contexts. The information may, for example, pertain to cost of production, productivity of capital, and market conditions for the firm's products. It can be claimed that comparative advantage in information acquisition is one of the prime skills of successful managers. As we saw in Chapters 3, 4, and 8 additional pre-decision information may improve economic welfare through changes in production choices. The same phenomenon occurs in a principal-agent context. However, the agent's information about his performance measure also improves and, thus, the incentive problem may be more severe due to private information. The questions are whether the agent should be motivated to acquire private information, and whether economic welfare can be improved by letting the agent report his private information to the principal conditioning the agent's compensation on that report. In that case, the agent's information acquisition, actions and reports must be motivated by the principal through the compensation scheme.

### 22.1 THE BASIC MODEL AND THE REVELATION PRINCIPLE

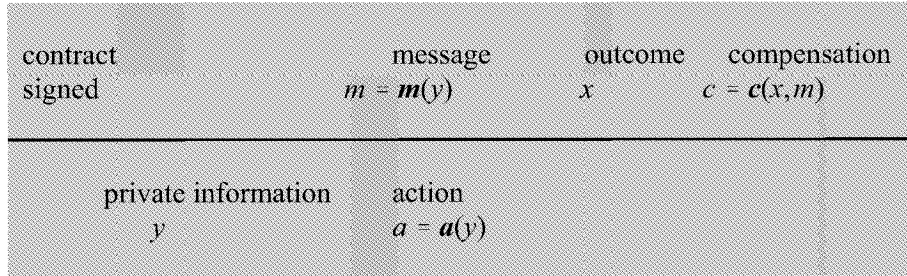
In this analysis, we generally assume that the outcome  $x \in X$  is contractible information and is the only *ex post* performance measure. The signal  $y \in Y$  from information system  $\eta$  is privately observed by the agent *after* he has signed the

contract with the principal, but before he takes his action. The contract, once accepted, is assumed to bind the agent to the firm so that he cannot leave after he has observed  $y$ . Since the agent observes  $y$  before he selects  $a \in A$ , his action choice may well depend on what he observes, i.e., the agent’s action strategy is a function  $\mathbf{a}: Y \rightarrow A$ . This is one of the key differences between this setting and those considered previously. A key issue is whether it is optimal to allow the agent to influence the contract based on his unverified report of the signal he has observed. That report, if made, is termed his message and is represented by  $m \in M$ , i.e., the message strategy is a function  $\mathbf{m}: Y \rightarrow M$ .<sup>1</sup> We assume, unless otherwise specified, that the message space  $M$  is the same as the signal space  $Y$  if there is agent communication. If there is no agent communication, then  $M = \emptyset$ . The basic notation is the same as in previous chapters.

$c: X \times M \rightarrow C$  is the compensation contract expressed as a function of the outcome  $x \in X$  and possibly of the agent’s message  $m \in M$ ,

$u^p(x - c) = x - c$  is the utility of a risk neutral principal,

$u^a(c, a) = u(c) - v(a)$  is the additively separable utility of the agent with  $u(\cdot)$  strictly increasing and strictly concave and  $v(\cdot)$  strictly increasing and convex (agent is risk and effort averse).



**Figure 22.1:** Timeline for incentive problem with post-contract, pre-decision information.

<sup>1</sup> Note that we can assume w.l.o.g. that the agent does not randomize over actions and messages since he (as the last mover in the sequential game) will only randomize over choices with equal conditional expected utilities. That is, action and message strategies can be represented as *functions* from the signal space to  $A$  and  $M$ , respectively. Of course, this does not rule out the possibility that it is optimal for the principal to induce randomization in the contract by including a contractible randomization variable in the compensation scheme. However, in formulating the incentive problems we generally assume that this is not optimal.