CHAPTER 23

PRE-CONTRACT INFORMATION – UNINFORMED PRINCIPAL MOVES FIRST

The analysis in the preceding chapters has already demonstrated that differences in the timing and contractibility of information can have a significant impact on the optimal contract between a principal and his agent. The preceding chapter assumed that the agent obtained private information after he had signed a contract with the principal and the agent could not break that contract after he observed his private signal. We now consider the case in which the principal contracts with an agent who has already received private information. The principal is fully aware (i.e., it is *common knowledge*) that the agent has private pre-contract information, but the principal does not know which signal the agent has received.

In this setting we assume the principal offers a contract (or a menu of contracts) to the agent. That is, this is a game in which the uninformed player moves first and *commits* to a contract. This permits us to invoke the Revelation Principle, as we did in the previous chapter (which considered post-contract/pre-decision information). In some settings, such as an initial public offering (IPO), the informed player moves first, i.e., the agent offers a contract to the principal. This is a radically different game – the Revelation Principle does not (necessarily) apply here and it is frequently referred to as a signaling game. We examined signaling games in Chapter 13.

23.1 BASIC MODEL

Two basic models are considered. In the first, a single contract is offered, i.e., there is no communication of the agent's private information. In the second, a menu of contracts is offered and the agent's choice from that menu reveals his private information.

The notation is the same as in the setting with post-contract/pre-decision information considered in Chapter 22. However, the timeline is different, with the key difference being that the agent observes his private information before accepting a contract offered by the principal. We depict contract acceptance and communication of message m as two distinct steps in the process so that it

encompasses both no communication ($M = \emptyset$) and communication in the form of selecting one of the elements from the menu of contracts.

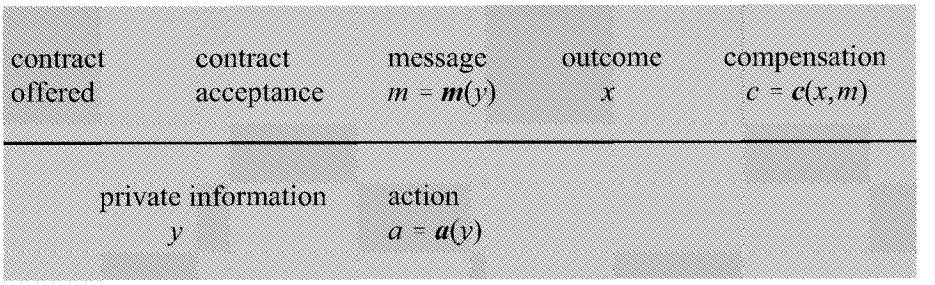

Figure 23.1: Timeline for incentive problem with pre-contract information.

In the formulation of the communication program we directly appeal to the Revelation Principle, which has the same formulation and proof as in Chapter 22.

Proposition 23.1 *The Revelation Principle*
For any optimal contract $\boldsymbol{z} = (\boldsymbol{c}, \boldsymbol{a}, \boldsymbol{m})$ based on communication by the agent, there is an equivalent contract $\boldsymbol{z}'$ that (weakly) induces full and truthful disclosure of the agent's private information, i.e., $\boldsymbol{m}'(y) = y$ for all $y \in Y$.

The programs defining the Pareto optimal contracts with and without agent communication can be formulated as follows.

Principal's Decision Problem without Agent Communication:

$$\underset{\boldsymbol{c},\boldsymbol{a}}{\text{maximize}} \quad U^p(\boldsymbol{c},\boldsymbol{a},\eta) = \int_Y \int_X [x - \boldsymbol{c}(x)]\, d\Phi(x|y,\boldsymbol{a}(y))\, d\Phi(y), \tag{23.1}$$

$$\text{subject to} \quad U^a(\boldsymbol{c},\boldsymbol{a}(y)|y,\eta) = \int_X u(\boldsymbol{c}(x))\, d\Phi(x|y,\boldsymbol{a}(y)) - v(\boldsymbol{a}(y)) \geq \bar{U}, \quad \forall\ y \in Y, \tag{23.2}$$

$$U^a(\boldsymbol{c},\boldsymbol{a}(y)|y,\eta) \geq U^a(\boldsymbol{c},a|y,\eta), \quad \forall\ a \in A,\ y \in Y. \tag{23.3}$$