Regulation under Imperfect Observability: The Dynamics of Incentive Contracts Revisited

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Extended Abstract:

In a string of seminal contributions Laffont and Tirole (1986, 1987, 1988, 1990, 1993) lay the foundations for the way that modern economic theory looks at regulation and procurement. Starting with a static model they show how agency schemes are used to regulate firms on the basis of the data that becomes available in the course of the operation of the firm (i.e., costs). They demonstrate that for these schemes to work, data need not be observed perfectly, that is, even if costs are affected by zero-mean unobservable noise, the optimal incentive scheme yields the same results as under perfect observation.

In their latter works, regulation is analyzed in a dynamic setting in which the regulator cannot commit to long-term contracts. These papers lead to an exploration of the celebrated 'ratchet effect.' The critical insight from this work is that it is hard to obtain separating contracts.
Indeed, separation is not possible unless future payoffs are discounted sufficiently strongly. If separation is possible, efficient firms operate at ‘first best’ levels, and other types of firms’ costs are subject to distortions above ‘first best’ levels.

In contrast to the static model, the dynamic analysis is conducted only in a deterministic setting with perfect cost observations. We revisit Laffont and Tirole’s classic work with imperfect observability, and consider a dynamic version of their static analysis. Adding noise to cost observations may be more appropriate than considering deterministic models in many settings, and the resulting analysis differs substantially, both qualitatively and quantitatively, from deterministic models on the ratchet effect.

It is shown that contracts based solely on cost observations deviate from their deterministic counter-parts, due to imperfect inferences that result from stochastic costs. Consider first the event that the ratchet effect can be circumvented (e.g., a discount factor of zero for the regulated firm; or, equivalently, the possibility of replacing management between periods). Then the first period contract is affected by the regulator’s desire to improve the inference he draws from the first period imperfect cost observation and, thus, the regulator alters the contract in order to obtain better information about the cost structure. That is, the regulator uses contract design in order to experiment. Experimentation leads to greater distortions away from first best cost levels for inefficient firms, and — more importantly — experimentation results in excessive cost reductions, below first-best levels, for the most efficient type of firm.

The added distortions caused by experimentation are due to the (possibly restrictive) assumption that regulatory contracts are based solely on imperfect cost observations. Indeed, such costly distortions can be avoided if the regulator uses additional messages between the firm and the regulatory agency as the basis for regulatory contracts. Specifically,
the firm can be asked to give a deterministic message about its type to the regulator, and payoffs of the firm can be conditioned on this message in addition to the cost observations. This results in a contract whose economic implications are analogous to a deterministic setting — thus, obviating the need for costly distortions due to experimentation.

While imperfect observability has no impact on real variables in expectation in multi-period settings, provided that the ratchet effect can be circumvented and contracts are based on more than just the cost observation, imperfect cost observations do affect equilibrium actions when the ratchet effect becomes a concern.

Again, consider first contracts based solely on imperfectly observed costs. When the ratchet effect is present, imperfect cost observations have two informational effects between periods. First, the aforementioned experimentation effect that is used to reduce deviations from first-best actions in the second period. Second, the ratchet effect that necessitates additional high upfront rents to the most efficient type of firm, that are designed to compensate for reductions in future information rents due to learning. In deterministic settings this latter effect leads to the potential for the ‘take-the-money-and-run’ strategy, which makes separation of firm types difficult. However, under imperfect observability, learning is impeded. This preserves future information rents, on the one hand, and makes current deception less effective, on the other hand. As a consequence, the additional upfront rents to the most efficient firm are reduced so that separation is more likely to occur under imperfect observability than in deterministic settings. Thus, in contrast to deterministic settings with ‘much pooling,’ separation of firm’s actions is readily supported in stochastic settings.

Since the upfront rents to the efficient firm are, thus, functions of the imperfect observability of costs, the regulator can manipulate contract terms in order to further reduce upfront rents to the most efficient firm.
This is termed 'signal dampening,' as a reduction in the informativeness of the cost observation (i.e., the signal) preserves future rents and reduces payoffs from deception. While signal dampening (reducing the flow of information) runs counter to experimentation (increasing the amount of learning), the former is a dominant effect. Consequently, costs of inefficient firms are closer to first-best levels, and — more importantly — the most efficient firm is induced to produce above the first-best level.

The distortions resulting from experimentation and signal dampening are, in a sense, costly. And, to some degree, these distortions can be avoided when contracts are not only based on imperfect cost observations, but also on additional messages. However, unlike the case of pure experimentation, when the ratchet effect is of concern, additional messages are not used, even when available. That is, the contract based solely on cost observations is optimal, despite the distortions implied by experimentation and signal dampening. The intuition is that learning (i.e., obtaining information) is costly to the regulator — this is crux of the incentive implications of the ratchet effect — so an environment with imperfect cost observations is to the benefit of the regulator, who can manipulate contract terms in such an environment in order to obtain the optimal degree of information dissemination between periods.

The paper concludes with a discussion of long-term commitment and renegotiation in stochastic settings. It is shown that short-term contracts and long-term renegotiation-proof contracts are more similar to one-another in stochastic settings when compared to deterministic settings. That is, some of the insights from the analysis of short-term contracts in stochastic settings carry over to renegotiation-proof long-term contracts.

Keywords: Dynamic Contracts, Dynamic Agency, Ratchet Effect, Experimentation, Signal Dampening, Renegotiation, Regulation

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