

Innovation incentive for regulated network industries

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1. Background

The capital intensive network industries such as electricity and gas delivery infrastructures exhibit natural monopoly characteristics because of their high economy of scale relative to the size of market. Due to absence of direct competition in these regulated industries, the infrastructure providers hardly undertake the appropriate level of innovation activities to optimise their operation and improve continuity and quality of their services.

The relationship between market structure and innovation behaviour of a firm has been long a point of contention among economists. On the one hand, Adam Smith view of laissez fair economy in which monopoly power needs to be restrained, and on the other hand Schumpeterian economy, in which momentary monopoly power is functional for innovation (Loury, 1979). In the first view, competition is the main driver of innovation, and thus policies that promote competition have also a positive impact on innovation. In the second view, possibility of achieving monopoly power and the rent associated with it is necessary to incentivise firms for innovation activities. Furthermore, according to Schumpeter, over time the monopoly power will be eroded through new entry, imitation and innovation. However, the network-based industries are an exception in this context because their “natural” monopoly characteristics make direct competition (competition in the market) and new entry (network duplication) infeasible. Moreover, the relation between market structure and innovation is not clear cut as it depends on different dimensions such as market concentration, the extent of entry barriers, the composition of firm size within the industry, and the overall importance of innovation activity (Acs and Audretsch, 1987). However, the common point of every innovation process is that it is risky and costly and it generally has benefits for society. Thus a market with monopoly firms like network companies is subject to a myriad of economic regulations which influences their short run operation as well as investment decisions and innovative activities.

The importance of innovation becomes more pronounced when considering that electricity networks around the world are expected to undertake significant investment and innovation over the coming decades in order to address the challenges of decarbonisation. As innovation activities are costly and risky undertakings, a

relevant query is how to incentivise innovation through economic regulation. Specifically, in this paper, we try to understand (i) how innovation cost needs to be treated (i.e., as other regulated costs or differently?) (ii) how the risk of innovation activities need to be shared between firm and its customers and (iii) how effective is competitive innovation fund in rewarding the innovation projects with highest potential value?

2. Methodology

The model adopted in this paper to investigate aforementioned questions is based on the standard contract theory and game theory. It is inspired by similar problems in different contexts that have been investigated in the literature. For example, we used models of moral hazard in contracts (e.g., Bolton and Dewatripont, 2005; Holmström and Milgrom, 1990; Itoh, 1993), and competition among players for obtaining resources (Cornes and Hartley, 2003; Skaperdas and Gan, 1995; Sahn, 2010; Bresnahan, 1997) to shed light on behaviour of firm under individual incentive contracts and competitive innovation funds. In the individual incentive contract regulator incentivises regulated network utilities to undertake risky and costly innovation activity in return for a payoff. The contract is designed in a way to address the problem of moral hazard and risk sharing given the risk attitude of the firm. The competitive model is a rent seeking contest game in which companies compete for innovation fund by submitting proposal for innovation projects to the regulator.

3. Results and conclusion

The results of our analysis show that treating innovation costs like any other regulatory cost leads to reduction of innovation activities. This because innovation is often riskier compared with business as usual activities of the firm hence, when innovation costs are subject to same regulatory restrictions as other expenses, the attention of the firm will be diverted to conventional efficiency gain. This implies specific innovation incentive is required which takes into account the risk profile of these uncertain undertakings.

Since regulator cannot observe the effort of firm but only performance which is a noisy function of effort, and as regulated firms are often risk averse, the optimal model of innovation incentive requires the firm to bear some degree of risk for its activities. This means that compensation need to be linked (partially) to the performance of the firm in order to incentivise the firm to exert the optimal effort. Additionally, full insurance to the firm for its innovation costs kills the incentive of firm (there is a fundamental trade-off between incentive and insurance).

Competitive innovation schemes in which firms put forward innovative proposal can potentially lead to optimal effort among the competing firms, however, contest among the firms can also dissipate parts of resources. Also, in these kind of contests, the risk attitude of firm plays a pivotal role. When firm are similar in their risk attitude, projects of higher value potential have a higher chance of winning the contest. However, when the owner of higher value innovation project is also more risk averse compared with its rivals (with lower potential value projects), the winning probability of higher value project can be lower. This means that competitive innovation funds does not necessarily lead to the selection of most valuable innovation projects. The competitive schemes are more likely to be effective when firms are not very heterogeneous in their degree of risk aversion.

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