

# *Optimal regulation of network expansion*

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## Overview

We model the optimal regulation of continuous, irreversible, capacity expansion, where a regulated firm has private information about capacity costs, investments are financed from the firm's cash flows, and demand is stochastic.

## Methods

In this article we have derived the optimal regulation of network expansion, by combining the real option and *principal-agent literature*:

In our model demand growth is not fully predictable (i.e. stochastic) and network investments are sunk. **Hence the firm** is continuously forecasting demand and balancing the benefits of expanding capacity now (and obtaining additional revenue) and delaying investments (and obtaining *superior information about future demand*). In other words, it needs to take into account the real option value of investments (Dixit and Pindyck, 1994).

In order to model the interaction between the regulator and the firm, we rely on the assumption that the **firm has superior information** about its own investment costs as in the seminal article by Baron and Myerson (1982).

Whereas most adverse selection types of models allow for lump-sum transfers to the agent, we impose a **self-financing constraint** which limits transfers.

## Results

We derive the optimal **direct mechanisms** in which the firm reports its cost type, and the regulator specifies the investment criterion, and which fraction of revenues the firm is allowed to keep.

By using Ito's lemma and the Bellman equation we derive how the firm's profits and social welfare depend on the investment criteria. The optimal investment criteria is derived from a dynamic optimization model which includes the incentive constraints, the participation constraints and the self-financing constraints.

## Conclusions

We show that the optimal mechanism can be implemented as a revenue tax that increases with the level of congestion. If the degree of asymmetric information is large, then the optimal mechanism consists of a laissez-faire regime for low-cost firms. That is, the firm delays investments as if it were an unregulated monopolist and it is not taxed. This 'maximal distortion at the top' is necessary to provide information rents, as direct subsidies are not feasible.

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