

# ***Dynamic Efficiency and Incentive Regulation: An Application to Electricity Distribution Networks***

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## **1. Overview**

Efficiency and productivity analysis is a central concept in incentive-based regulation of network utilities. However, the efficiency measures obtained from benchmarking predominantly reflect short term performance and hence, provide only a snapshot of the firm's path towards its long run equilibrium. On the other hand, the factors affecting the short run behaviour of firms may not adjust instantaneously when firms undertake investment. In these instances, short run inefficiency caused by investments will be transmitted to subsequent periods. This effect, which arises from costs associated with the adjustment of capital stock or production capacity, is problematic under incentive regulation with ex-post regulatory treatment of investment. This is because it adversely affects the firms' short term efficiency and, consequently, regulated revenue.

This paper introduces the concept of dynamic efficiency under incentive regulation with ex-post regulatory treatment of investments using the case of electricity distribution networks in Norway.

## **2. Methodology and data**

This paper has a theoretical as well as an empirical part. In theoretical section we develop a framework to describe the process of capital stock adjustment of the firm and its effect on evolution of inefficiency under incentive regulation with ex-post regulatory treatment of investment. Then we present a parametric method, in a Bayesian framework, to estimate the two components of inefficiency and the rate of inefficiency transmission, across periods.

The dataset used for the application is a balanced panel of 128 Norwegian electricity distribution networks observed from 2004 to 2010.

## **3. Results**

The results demonstrate that, in a given period, cost inefficiency of regulated utilities is a combination of period-specific effects (shocks) and a carry-over component from previous periods. The results also show that, at the sector level, around 72% of the efficiency to inefficiency ratio is transferred from one period to another. At the level of individual companies, however, the variation is significant. There are firms with very low or very high elasticity of inefficiency transmission. The high magnitude of elasticity causes the effect of the shocks to die out over a longer period. The distribution of inefficiency decomposition shows that the share of carry-over effects, in the observed level of firms' inefficiency, is considerable. The results also demonstrate that investment is positively associated with period-specific inefficiency shocks and also inefficiency transmission rate across periods. Therefore, those firms with higher investment share have experienced higher inefficiency persistence

## **4. Conclusions**

The results of this study suggest that incentive regulatory models based on the total cost benchmarking are problematic for investment and optimal inter-temporal accumulation of capital of regulated firms. This is because they induce an autoregressive process in the level of cost efficiency and exposes the firms to financial loss following investment and capital stock adjustment. The current form of incentives regulation with ex-post

regulatory treatment of investment employed by many European regulators does not take this effect into account and, hence, there is a risk of financial loss for regulated companies when undertaking investment. Therefore, the simultaneous incentives for investment and static cost efficiency can send inconsistent signals to regulated firms. This potentially limits the companies' incentives for investment and innovation.

## **5. References**

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