

DISINCENTIVE REGULATION: EVIDENCE FOR RATCHET EFFECT AMONG GERMAN ELECTRICITY DISTRIBUTION SYSTEM OPERATORS

Michael Hellwig, ZEW Centre for European Economic Research, +49 621 1235-233, hellwig@zew.de
Dominik Schober, ZEW Centre for European Economic Research, +49 621 1235-385, schober@zew.de

Overview

We exploit a legal discrimination between electricity distribution system operators (DSOs) in the German price-based incentive regulation which results in the coexistence of two incentive-based regulatory regimes: yardstick and revenue cap regulation. Using data on 111 DSOs for 2010-2013 and drawing on a difference-in-differences framework we find that DSOs in the revenue cap regime pile up more expenditures than their counterparts in the yardstick regime in the base year. Moreover, highly cost efficient DSOs in the revenue cap regime also invest more in the base year, but their (cost) efficiency worsens from 2010 to 2013 compared to all other DSOs. This suggests the occurrence of a ratchet effect¹ in revenue cap regulation, which is even stronger when productivity targets are too ambitious and risk the profitability of firms. Efficient DSOs inflate their cost basis by inefficient investment allowing them to respect their participation constraint, or in other words, to avoid bankruptcy. Hence, we find that incentive regulation setting uniform sector-wide efficiency targets and thereby ignoring heterogeneity in firm efficiency may – against its primary objective – create the perverse incentive to invest inefficiently. This leads the case of light-handed regulation applying a general productivity target *ad absurdum*, which is meant to exploit heterogeneous firm efficiency by granting information rents. This evidence makes a strong point for yardstick regulation.

Our paper focusses on both the ratchet effect and the incentive compatibility of different forms of incentive regulation. Whereas earlier literature has thoroughly analysed the switch from cost-based to incentive regulation,² we provide a comparison of yardstick and revenue cap regulation with respect to the effects of accounting for heterogeneity in firm efficiency. Since DSOs in one regulatory regime provide a counterfactual to the other DSOs, we can also causally identify a ratchet effect, whose presence was only suggested in a non-causal manner by earlier empirical studies.³

Methodology

We exploit a unique natural experiment: the legal discrimination between DSOs in the German incentive regulation introduced in 2009 by the Incentive Regulation Ordinance, which sorts more than 800 DSOs in two different incentive-based regulatory regimes. In both regimes, DSOs are given sinking revenue caps for regulatory periods of five years. The descending path is subject to an efficiency score derived from benchmarking. Aiming for a convergence to the most efficient DSOs, this yardstick element prevails the whole regulatory period and, thus, coins the default regime. The German regulator Bundesnetzagentur has, however, foreseen exemptions for DSOs with less than 30.000 connected customers. Due to lower reporting requirements, small DSOs are exempted from efficiency analyses. They are, instead, given a preset, homogenous efficiency score resulting in a genuine revenue cap regulation with additional cost-reducing targets that neglect any heterogeneity in firm efficiency. As the preset efficiency score is independent of the actual cost structure (in contrast to the yardstick regime), DSOs in the revenue cap regime retain the possibility to influence their future revenue caps through (inefficient) expenditures in the base year, in which the official cost audit is conducted.⁴

The very distinction of DSOs in a common jurisdiction is useful for a comparison between regulatory regimes permitting causal interpretation. As DSOs in both regimes face the same trend and as regulation only differs in the base year we draw on a difference-in-differences approach implemented in a fixed effects OLS estimation. Besides comparing the spending behaviour in both regimes, we also distinguish between DSOs in the revenue cap regime that

¹ The ratchet effect usually refers to firms abstaining from cost reductions as they anticipate that the observable reduced costs might prompt the regulator to set tougher future targets, see, e.g., Weitzman (1980) or Laffont and Tirole (1993).

² See Newbery and Pollitt (1997), Domah and Pollitt (2001), Greenstein et al. (1995), Ai and Sappington (2002), Majumdar (1997) or, more recently, Cambini and Rondi (2010).

³ See Casarin (2014), Bottasso and Conti (2009) or Di Tella and Dyck (2008).

⁴ The major rationale behind the ratchet effect is that DSOs can increase future profits by inflating their cost basis in the base year.

either benefit or suffer from neglected heterogeneity in efficiency. The distinction is based on efficiency analyses performed among all DSOs in our sample. We employ Stochastic Frontier Analysis (SFA) complemented by Data Envelopment Analysis (DEA) for robustness. In addition, we conduct a decomposition of the total factor productivity to gauge the DSOs' individual efficiency changes.

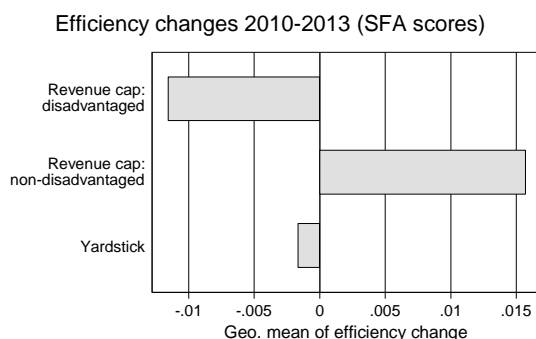
Our data on 111 German DSOs is derived from annual statements and other legal reporting requirements for the years 2010 to 2013. As all DSOs in the revenue cap regime have necessarily less than 30.000 connected customers, we restrict our attention to DSOs in the yardstick regime with at most 100.000 connected customers in order to keep the DSOs' supply obligations comparable. For our cost efficiency analyses, we follow the official guidelines set by the regulatory authority. Concretely, we use standardized total expenditures as input and the total number of exit points, annual energy delivered, area served, the length of underground and overhead lines, and the total installed capacity for renewable electricity as outputs. For our central estimation, we regress investment ratios (and differentials of yearly capital, operational and total expenditures) on difference-in-differences dummies, the number of exit points, energy delivered, network length, installed capacity for renewable electricity, the current and lagged growth rate of installed capacity for solar power electricity generation, and a dummy for grid acquisitions. This choice is motivated to restore comparability and to account for the assumptions of the difference-in-differences approach.

Results

When comparing investment ratios of DSOs in the yardstick to those of all DSOs in the revenue cap regime we do not find significant differences in the base year (compared to other years). When expanding this difference-in-differences approach into the distinction between disadvantaged and non-disadvantaged DSOs in the revenue cap regime we, however, find that the disadvantaged DSOs significantly invested more than both the non-disadvantaged DSOs and the DSOs in the yardstick regime in the base year. This augmented spending behaviour is also evident when regarding differentials of yearly capital, operational or total expenditures.⁵

Decomposing total factor productivity into technical and efficiency change reveals that the disadvantaged DSOs in the revenue cap regime significantly worsened their individual efficiency from 2010 to 2013 whereas the non-disadvantaged DSOs could significantly improve and DSOs in the yardstick regime could at least maintain their efficiency.

We have checked the robustness of our results by employing both SFA and DEA efficiency scores and also by conducting and altered efficiency analysis with outputs on a more aggregated level. Our findings remain comparable and significant.



Conclusions

The first aspect of this paper is the comparison of incentive regulation regimes of different incentive power regarding the occurrence of a ratchet effect. The degree of exogeneity of revenues is stronger for yardstick regulation than for revenue cap regulation: the latter allows for own revenue inflation by cost increases in the base year whereas the former does not. The ratchet effect is shown to occur to a significantly larger extent in the revenue cap regulation regimes.

The second aspect sheds more light on the problematic issue of setting uniform productivity targets when firms have heterogeneous efficiency. In addition to relatively increasing the ratchet effect compared to all other subgroups, efficient firms being exposed to an overly ambitious efficiency target are found to significantly reduce their efficiency to achieve the zero profit constraint.

This appears somewhat paradox: Incentive regulation is designed to exploit heterogeneous efficiency potentials of firms, to leave information rents to the firms and thereby to set incentives to increase efficiency. In contrast, incentive regulation in its light-handed version with only one uniform productivity target achieves the opposite. This leads revenue (and price) cap regulation *ad absurdum* and makes a case for yardstick regulation whenever a regulator wants to exploit dynamic efficiency. The alternative of lowering general efficiency target sticking to a revenue cap does not appear too seducing.

⁵ For operational and total expenditures we also find significant higher expenditures in the revenue cap regime as a whole.