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On the regulatory application of efficiency measures

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Abstract

The last decade has witnessed a change to more powerful incentive schemes and the adoption by a large number of regulators of some form of price cap regimes. The efficiency frontiers literature tackles the problem of measuring the *X* factor in a price cap regime with an RPI–*X* rule. However, that literature has by large focused solely on the theoretical aspects involved in the estimation of an efficient frontier. The empirical application of the theoretical concepts (which is the main interest of regulators) has not yet received equal attention. In this paper we address this issue and try to elaborate upon the applied aspects of efficiency measurement.
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1. Introduction

For decades, rate-of-return regulation has been the dominant practice in the regulation of utilities. This method, although allowing the firm to recover its costs and resulting in a lower cost of capital (due to the lower risk borne by the firms), provided little incentives for cost minimization among regulated firms. The last decade has witnessed a change to more powerful incentive schemes and the adoption by a large number of regulators of some form of price cap regimes[1]. The main purposes of a switch from rate-of-return regulation to price cap regulation have been to increase the incentives for firms to minimize their costs, and to ensure that, eventually, users benefit from these cost reductions — typically within 3–5 years after a regulatory price review. This objective requires the measurement of the expected efficiency gains that would lead to cost reductions at the firm level. The renewed attention given to productive efficiency is one of the main reasons for the increase in efforts to measure efficiency in regulated sectors. Efficiency measures are no longer a side show as they were under rate-of-return regulation.

Efficiency gains of a firm can come from two main sources: shifts in the frontier reflecting efficiency gains at the sectoral level, and efficiency gains at the firm level reflecting a catching up effect. The latter are the gains to be made by firms not yet on the frontier. These firms should be able to achieve not only the industry gain (the shift of the frontier) but also specific gains offsetting firm specific inefficiencies. A regulator should bear in mind this decomposition when carrying out an efficiency analysis.

The efficiency frontiers literature tackles the problem of measuring both components of the *X* factor in a price cap regime with an RPI–*X* rule. However, that literature has by large focused solely on the theoretical aspects involved in the estimation of an efficient frontier. The empirical application of the theoretical concepts (which is the main interest of regulators) has not yet received equal attention. In this paper we address this issue and try to elaborate upon the applied aspects of efficiency measurement in a regulatory context.

The paper outline is as follows. Section 2 deals with the choices faced by a regulator willing to evaluate regulated firms' performances. Section 3 presents the consistency conditions that should be met by the efficiency

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[1] See the discussion in Green and Rodríguez Pardina (1999).

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measures to be useful to regulators, and discusses how to apply them in a regulatory setting. Finally, in Section 4, conclusions to this work are made.

2. Regulatory choices

An efficiency measure is, broadly speaking, the distance of the observed practice to the efficient frontier. The regulatory task of measuring efficiency would be greatly simplified *if* this frontier were known. Unfortunately, the regulator has no knowledge of the efficient frontier and thus has to estimate it. This should constitute the main concern of the regulator when attempting to measure the efficiency of regulated firms, for different estimates of the frontier would lead to potentially distinct assessments (as would different distance concepts).

There are a number of choices a regulator has to make in order to be able to estimate an efficient frontier, and the options he/she makes will potentially give rise to different performance evaluations. It is important that the regulator can count on a sound set of arguments in favour of the choices made. The main goal of this study is to provide with the empirically relevant arguments that support each decision.

The first decision is how to construct the efficient frontier. There are basically two alternatives: (i) a theoretically defined function based on engineering knowledge of the process of the industry, or (ii) an empirical function constructed on estimates based on observed data. Next comes a decision about the relevant efficiency concept to be measured: (i) productive (or overall); (ii) technical[2]; or (iii) allocative. A choice related to the previous one has to do with the kind of relationship that is going to be estimated: (i) a cost function (productive efficiency estimates); or (ii) a production function (only technical efficiency measures).

There still remain other choices to be made. Is the frontier going to be estimated with parametric or non-parametric techniques? Is the distance to the frontier going to be attributed to inefficiency, or to random noise, or to some combination of both?

Having solved all the questions regarding the methodology to be employed, the regulator still has to decide upon the variables that should be included in the analysis. Which are the outputs of the industry? Which are the inputs? Are there variables beyond the firms' control?

The efficiency literature has dealt with these questions in depth, although in too much a theoretical way. Regulatory application has not been such an important issue. In the remainder of this section we discuss the pros and cons of all the preceding alternatives, not only from a theoretical point of view, but also from an empirical regulatory standpoint.

2.1. Theoretical function or best-observed practice

Modern regulatory regimes are focused on improving efficiency through incentive mechanisms. Among these, yardstick competition is a must. Yardstick competition, originally proposed by Shleifer (1985), requires the horizontal separation of some of the stages of a natural monopoly in order to obtain comparative information on relative efficiency levels of the firms. This information can then be used to set up tariffs for the regulated companies, allowing some efficiency gains to be passed on to consumers and preserving at the same time incentives for the firms to reduce their own costs. In other words, the regulator acting as the principal prefers to have several agents in order to reduce the existing asymmetry of information. In exchange for this superior knowledge some economies of scale and of scope are lost when the activity is separated into different units. If the firms were to be compared to a theoretically defined yardstick, however, the regulator would still be bearing the costs of lost scale economies, but it would not receive the benefits of increased information. In such a case, it would be better to compare the original natural monopoly (not divided) to that yardstick. Therefore, in those processes involving horizontal break-up of a natural monopoly, the best observed practice seems the natural choice.

Farrell (1957), in his path-breaking paper, argues in favour of using the best-observed practice:

> In a first place, it is very difficult to specify a theoretical efficient function […]. Thus, the more complex the process, the less accurate is the theoretical function likely to be. Also, partly because of this, and partly because the more complex the process, the more scope it allows to human frailty, the theoretical function is likely to be wildly optimistic. If the measures are to be used as some sort of yardstick for judging the success of individuals plants, firms, or industries, this is likely to have unfortunate psychological effects; it is far better to compare performances with the best actually achieved than with some unattainable level (Farrell, 1957, p. 255).

In accordance to Farrell's suggestion, the growing practice for regulatory purposes is to analyze individual performances in relation with best-observed practice. This, for example, is the approach used in UK for regulating the water utilities, in Costa Rica for setting transport tariffs, and in Hungary to regulate telecommunications companies. Furthermore, in Norway, where there are sixty transmission and two hundred distribution utilities, regulators have taken affirmative steps to employ this

[2] Technical efficiency can be further decomposed into "pure" technical efficiency, scale efficiency and congestion efficiency, as suggested in Färe et al. (1985), Pollitt (1995) and Coelli et al. (1998).

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