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Agenda

Advancing economics in business

When less is more: reducing regulatory judgement

The need for judgement is a key feature of many regulatory regimes; if a significant amount is required, this can increase regulatory risk, and therefore also the financing costs to the companies concerned. We examine how regulatory judgement can be reduced in one aspect of RPI – X regulation—the efficiency assessment—and investigate how better decisions can be made with less information, reducing both the regulatory burden and the requirement for maintaining independent comparators in an industry

Regulatory approaches to efficiency assessments

Under RPI – X regulation, regulators set network utility companies' allowed price levels for a fixed time period, to ensure that each utility company receives sufficient revenues to finance its operating expenditure (OPEX) and its capital investment programme, and thus enable the company to deliver the required outputs. To do this requires analysis of the expected efficient cost level for each company, which often involves undertaking benchmarking or comparative efficiency assessments.

This article reconsiders the regulatory 'toolkit' for comparative efficiency assessments, which is important for two key reasons. First, regulatory regimes often attempt to introduce quasi-competitive pressures by assessing comparative efficiency among regulated companies, and setting company-specific cost-reduction targets based on such comparisons. For example, Ofwat (the regulator of water services in England and Wales) has historically emphasised the importance of maintaining the number of independent companies in order to preserve the robustness of its efficiency modelling.[1] However, depending on the industry characteristics, over-reliance on independent comparators—indeed, over-reliance on comparative efficiency assessments for driving out efficiencies—has the potential to result in lost opportunities for economies of scale and scope, merger or synergy savings, and coordination improvements.

Second, following recent price control reviews, a number of regulators in different sectors across the EU are now taking a step back and reviewing their approaches to regulation, including reassessing their efficiency frameworks.[2]

As such, now seems an opportune time to examine alternative efficiency frameworks. This is itself a very broad topic, so this article focuses on just one element of an efficiency regime—the toolkit used to undertake comparative efficiency assessments. In particular, we examine the precision of comparative efficiency models, and suggest how such precision can be improved and what lessons can be learnt for future changes to regulatory regimes. The precision of the modelling is illustrated using a particular dataset (data on the water companies in England and Wales). However, many of the recommendations are also applicable in other settings.[3]

Improving precision by considering cross-links

To assess the potential for efficiency improvements, many regulators use econometric models to compare costs across companies.[4] For example, in order to compare companies' OPEX efficiencies for water services, Ofwat uses a suite of four econometric models across different service functions (Business Activities, Resources & Treatment, Distribution, and Power).[5] Each model is estimated using cross-sectional data (ie, looking at data for all companies at a given point in time) in order to predict an expected cost level for each water company given its associated cost drivers. These results are then aggregated to establish an expected level of OPEX for water services. Lastly, the aggregate results are compared across companies

This article is based on Kumbhakar, S. and Horncastle, A. (2010), 'Improving the Econometric Precision of Regulatory Models', *Journal of Regulatory Economics*, **38**:2, October.

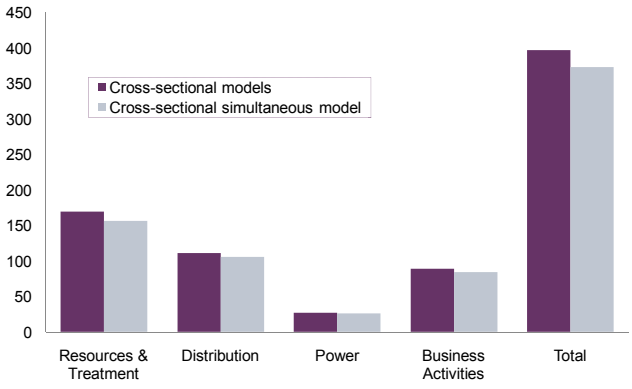
to ascertain the relative efficiency of each company with regard to water services.

The benefit of modelling these functions separately is that appropriate cost drivers for each function can be considered separately. Aggregating the results into an overall target mitigates the potential for cherry-picking the best performance on each individual function and setting a hypothetical target that is unachievable (in that the target might not currently be achieved by any of the regulated companies). Several other regulators also follow a similar approach.[6]

This approach, however, might not make the best use of the information available. Taking into account the operational and accounting trade-offs, or the links between functions, might improve the precision of the modelling, and hence the understanding of the scope for efficiency improvements. An alternative approach is examined below, in which all four sub-models are estimated simultaneously. This results in some precision gains compared with the approach of modelling each function separately—precision is improved if the confidence intervals around estimated costs are smaller. As shown in Figure 1 below, the simultaneous modelling approach results in smaller bars.

Figure 1 also shows that, even if a regulator wants to restrict the analysis at the cross-sectional level, alternative modelling procedures that reduce the uncertainty of the results might be worth exploring. However, further improvements are also possible. Including data on the companies over time might provide additional information that could make the modelling more precise. For this, the benefits of using a panel dataset (ie, data on the same company at several points in time) are now considered.

Figure 1 Comparison of model accuracy, 2007/08 (£m)



Note: The figure compares, across companies, the sums of the confidence widths around the predicted costs in each model. While only the 2007/08 results are reported here, the results are similar for every year from 1997/98 to 2007/08—ie, the cross-sectional models using a simultaneous approach produce smaller confidence widths than when the models are estimated separately.
Source: Kumbakhar and Horncastle (2010).

Improving precision by considering data across companies and over time

In contrast to the cross-sectional modelling approach, pooled or panel data approaches employ data on companies both across the industry and over time, enabling more observations to be used in the regressions.[7] Thus, with N companies and T years of data, N×T observations would be available in a panel data framework. This increase in the number of observations can reduce the uncertainty in the parameter estimates and increase the precision of the predicted costs (in much the same way as the simultaneous approach discussed above).

Another advantage of panel data is that company-specific and/or industry time trends can be included in order to capture any changes in technology over time (technical change). This enables past rates of efficiency frontier shift (technological change), and past rates of catch-up to best practice, to be estimated. Such information is useful when attempting to estimate the rates of catch-up and frontier shift that are possible or achievable for companies going forward. Furthermore, particular panel data techniques can control for 'unobservable' effects, which might include company-specific or regional factors.

Given these potential advantages of panel data analysis, its validity in this context and its impact on modelling precision are considered next.

Validity and precision of using panel data

When deciding whether to use panel data, one important factor is whether the cost function is stable over time. In other words, have there been significant technological developments over the time period concerned such that the relationship between costs and cost drivers has altered?

Kumbhakar and Horncastle (2010) demonstrate that the cost functions used in the water industry in England and Wales are stable over a reasonably long period of time (between seven and ten years), and that models using data over time are therefore appropriate in this context. Such tests should always be undertaken when applying these approaches in this context, although it is not clear that regulators have always followed this critical step.

As noted, one of the benefits of using panel data arises from the increase in the number of observations and

the resulting improvement in modelling precision. Kumbhakar and Horncastle (2010) also demonstrated that the model fit is better in most of the models using panel data than in the cross-sectional models. Although the estimated parameters are fairly similar in value between the cross-sectional and pooled models, the precision of their estimation is improved. This increase in precision when using pooled models compared with the cross-sectional models is demonstrated in Figure 2.

The increase in precision is even more noticeable in this context than the improvement in precision achieved through simultaneous modelling (as shown in Figure 1).[8]

It is also of interest to consider the impact of such an approach on regulators' merger regimes; the main question being whether fewer comparators can still provide reliable enough information for regulatory decision-making. Kumbhakar and Horncastle (2010) show that, when removing two specific water companies from the dataset of 22 companies and replacing them with a company representing the merged entity, the model precision was not significantly affected within the panel framework. Critically, the model precision remained considerably higher, even with one fewer company in the panel data framework, than when the current (cross-sectional) approach was used with all 22 companies.

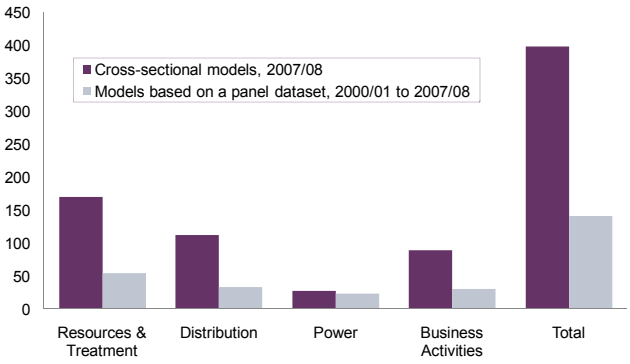
It can therefore be concluded that using a panel dataset can substantially improve the precision of the estimated models, such that the models remain more precise than those under the cross-sectional approach, even with one fewer independent company in the dataset. Indeed, given the order of magnitude of the difference in precision, in order to achieve the level of precision with which the regulator (as well as the Competition Commission[9]) has historically been comfortable for the purpose of setting efficiency targets in the regulatory regime, panel data analysis would allow a far smaller dataset of independent companies to be used.

Concluding remarks

Comparative efficiency analysis can be an essential part of a regulator's toolkit, and many regulators are currently reviewing their toolkit in this area. However, many regulators' comparative efficiency analyses are based on econometric modelling using cross-sectional data from a given year, and/or separately modelling different activities or functions. This approach often ignores the rich historical information that is available, and the links between functions that exist within companies.

In contrast, simultaneous modelling of functions accounts for these links, while pooled or panel

Figure 2 Comparison of model accuracy using cross-sectional data and panel data (£m)



Source: Kumbakhar and Horncastle (2010).

modelling techniques employ data on companies both across the industry and over time, enabling more observations to be used in estimation, and potentially improving the robustness of the results. A key advantage of using simultaneous modelling and/or panel data is therefore that a more precise estimation of the models is achievable (which, in turn, strengthens the power of the test applied to the models). This is critical for several reasons.

- The regulator uses such modelling to set cost-reduction targets for companies, and therefore price limits. Getting these targets wrong can therefore have adverse consequences on companies' abilities to finance their functions.

- The reliance of regulators on cross-sectional estimation of separate cost functions has historically resulted in proposed mergers not being allowed to proceed due to the loss of information for comparative purposes. By using information across functions simultaneously and/or over time, any possible detriment to the comparative regime can be significantly mitigated, reducing the need to maintain a large number of independent companies. This is essential from an efficiency perspective since the reduced possibility of takeover eases the pressure on company management to improve their performance.[10]

- The approach could reduce the resources spent in this area. With panel data and/or simultaneous modelling, the increase in the number of observations would allow more factors to be incorporated into the modelling and thus reduce the need for separate consideration of additional non-modelled factors (such as regional or special factors). Again, if the modelling were accepted as being more precise and capturing more of the external factors then, in theory, this should reduce the need for companies and regulators to spend significant time and resources

examining regional factors, or for companies to re-examine the regulator's modelling or the need for regulatory judgement.

- Using panel data models can mitigate many modelling issues, removing the need to assess efficiency separately for different activities.[11] This could be important because modelling OPEX using functional models for different cost areas requires costs to be separable across the different activities; it also requires cost allocation across the companies to be consistent. It might be that neither of these conditions holds. If the regulator were to use panel or pooled data, company-level assessment could be carried out.[12]

- By using information over time, there is a reduced need to collate more detailed cross-sectional data. As such, the regulatory burden, in terms of collating and auditing the data, might be lessened.

- Using panel data models would allow direct estimation of past rates of catch-up and frontier shift. Such information is key to assessing what cost reductions could be made in future.

- Lastly, it would allow approaches to be implemented that explicitly account for modelling errors, again reducing the need for regulatory judgement.[13]

Based on the advantages discussed above, regulators could consider extending their toolkit to include the use of panel data analysis and the modelling of different cost areas jointly, alongside considering other approaches, in order to minimise the use of subjective judgements in the regulatory regime. Moreover, this would allow stronger management incentives to improve companies' efficiency, given the potential increased threat of takeovers.

[1] Since 2004, the Office of Fair Trading has been obliged to refer to the Competition Commission any merger of two or more water companies where one of the merging companies has a turnover of at least £10m. The Commission's remit includes assessing whether the merger affects Ofwat's ability to make comparisons between water companies. Given the existing size of the companies in the industry, such a threshold implies that any proposed merger between the companies used by Ofwat for comparative purposes would be referred. (Cholderton Water is the exception, being below this threshold limit, but is not used by Ofwat for comparative purposes.) This special merger regime is currently being reconsidered. See Ofwat (2010), 'Beyond Limits: How Should Prices for Monopoly Water and Sewerage Services be Controlled?'. In addition, in its recent consultation on merger policy, Ofgem (the GB energy regulator) emphasised the impact on its ability to undertake cost assessments. See Ofgem (2010), 'Public Statement on Ofgem's Network Company Merger Policy', May.
[2] For example, see Algemene Rekenkamer (2009), 'Tariff Regulation Energy Transport'; Ofgem (2010), 'Regulating Energy Networks for the Future: RPI-X@20 Recommendations: Implementing Sustainable Network Regulation', July 26th; Oxera (2009), 'Recommendations on How to Model Efficiency for Future Price Reviews', report prepared for Office of Rail Regulation, November, and Ofwat (2010), op. cit.
[3] Although note that Kumbhakar and Horncastle (2010) demonstrate that it is not possible to use theoretical arguments to draw any conclusions about the impact of a particular merger between two regulated companies on the precision of the modelling, and that, instead, the issue has to be examined empirically.
[4] In this context, an econometric model seeks to explain variations in costs between companies through variations in cost drivers such as scale, topography or customer characteristics.
[5] Ofwat (2009), 'Relative Efficiency Assessments 2008–09—Supporting Information', December.
[6] For example, see Ofgem (2007), 'Gas Distribution Price Control Review: Final Proposals', December.
[7] See Baltagi, B. (2008), *Econometric Analysis of Panel Data*, fourth edition, Cambridge: Wiley and Sons; or Hsiao, C. (2003), *Analysis of Panel Data*, second edition, New York: Cambridge University Press.
[8] In fact, a joint approach could be adopted whereby simultaneous modelling is undertaken using a panel dataset. Other models are also possible in the panel data context. These were examined, and the results compared, in Kumbhakar and Horncastle (2010).
[9] Competition Commission (2007), 'South East Water Limited and Mid Kent Water Limited: A Report on the Completed Water Merger of South East Water and Mid Kent Water Limited', May.
[10] See, for example, Martin, K.J. and McConnell, J. (1991), 'Corporate Performance, Corporate Takeovers, and Management Turnover', *Journal of Finance*, **46**, pp. 671–87.
[11] For example, see Oxera (2010), 'Bristol Water's Efficiency: An Assessment of Relative Operating Expenditure Efficiency for Water Services'.
[12] In the case of the water industry in England and Wales, for example, the use of panel data means that Ofwat does not need to be confined to the modelling structures created in 1994, when Ofwat was limited to using cross-sectional ordinary least squares.
[13] Such approaches include stochastic frontier analysis. For examples of the use of such an approach, see Oxera (2010), op. cit. and Oxera (2009), op. cit.

If you have any questions regarding the issues raised in this article, please contact the editor, Dr Gunnar Niels: tel +44 (0) 1865 253 000 or email g_niels@oxera.com

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