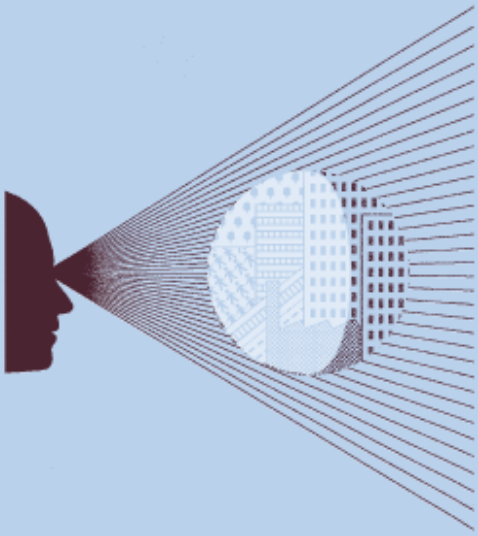
Oxera

# Encouraging efficiency in regulated sectors

## Lessons from 20 years of RPI – X

**Report prepared for BT**

**December 2011**



Oxera Consulting Ltd is registered in England No. 2589629 and in Belgium No. 0883.432.547. Registered offices at Park Central, 40/41 Park End Street, Oxford, OX1 1JD, UK, and Stephanie Square Centre, Avenue Louise 65, Box 11, 1050 Brussels, Belgium. Although every effort has been made to ensure the accuracy of the material and the integrity of the analysis presented herein, the Company accepts no liability for any actions taken on the basis of its contents.

Oxera Consulting Ltd is not licensed in the conduct of investment business as defined in the Financial Services and Markets Act 2000. Anyone considering a specific investment should consult their own broker or other investment adviser. The Company accepts no liability for any specific investment decision, which must be at the investor's own risk.

© Oxera, 2011. All rights reserved. Except for the quotation of short passages for the purposes of criticism or review, no part may be used or reproduced without permission.

# Executive summary

Utility regulators aim to ensure that markets with natural monopoly characteristics function as much as possible in the same way as competitive markets. To achieve this, regulators have adopted various approaches to regulation, including RPI – X, where prices are fixed and independent of costs for a period of time; rate of return (RoR) or cost-plus regulation, where if costs change, prices change; and hybrids of RPI – X and RoR. Of these approaches, RPI – X regulation, or one of its various hybrids, has been the option of choice for regulating utilities in the UK and many other countries over the past 20 years, due to its incentive properties.

The key feature of RPI – X regulation and its hybrids is that, by offering companies the possibility to outperform the regulatory settlement and thus earn a higher return than assumed by the regulator, it provides them with high-powered incentives to achieve efficiency gains, which in turn leads to benefits to customers in the form of lower prices at future price control reviews.

BT commissioned Oxera to explore how regulators encourage efficiency gains. In this report, this question has been approached first from the high-level perspective of the incentives of the RPI – X regulatory regime, and then from the more detailed perspective of how regulators set the efficiency target. The assessment is based on a review of the experience in UK price-regulated sectors and of the academic literature, and has been used to draw out regulatory best-practice principles.

**The first principle identified is that, in general, regulators seek to ensure that the RPI – X regulatory framework provides companies with high-powered incentives to achieve efficiency**. This is done in order to obtain the full potential of the regime, in terms of a long-term reduction in prices resulting from efficiency gains.

Regulators have a number of ways to help to ensure that high-powered efficiency incentives are provided, including the following.

– **Set efficiency targets using tools that rely, as much as possible, on exogenous data** (ie, data that is external to the regulated company: if the prices of one company are set on the basis of efficiency targets calculated using that company's data only (eg, costs of the same company as disclosed in its business plan), the company may have less incentive to outperform. This is because it knows that reductions in its own cost base will lead directly to the regulator setting it lower cost allowances, and hence lower prices. This would undermine the strength of the incentives of the RPI – X regime. Given the asymmetry of information in relation to a company's potential for making cost reductions—ie, the company is better informed about what it can achieve than the regulator is—a moral hazard problem arises. If only endogenous information is used, the regulated company has an incentive not to inform the regulator of the full potential for cost reductions. In the long run (ie, over successive price control periods), using endogenous information only would be akin to RoR or cost-plus regulation with minimal incentives for improved performance. To prevent this, and to ensure that efficiency incentives remain effective, the tools used by regulators to set efficiency targets need to include, as far as possible, approaches based on data that comes from outside the

company for which the target is being set.[1] Even if a regulated company's business plan is being used as part of the evidence base, a well-justified business plan is expected to contain external benchmarking evidence. In this way, RPI – X, combined with comparative efficiency, seeks to mimic the competitive dynamic, whereby companies aim to outperform their competitors (ie, to produce goods at costs below the costs of their competitors) in order to gain market share and higher returns until their competitors catch up to, or leapfrog, their performance.

– **Set efficiency targets using a methodology that is consistently and transparently implemented and applied**: ideally, efficiency targets should be set using a methodology that is predictable (in terms of the tools and sources of information used) and that has been consulted on and agreed with the regulated industry. This has the positive effect of securing trust in the regulatory regime and regulatory commitment, both of which are essential for companies and investors to decide confidently to undertake the managerial effort and investment necessary to achieve further efficiency gains.

– **Consider implementing additional incentive schemes to encourage innovation**: to make sure that the incentives in the regulatory system mimic as far as possible the incentives that could be provided by competitive markets, regulators have implemented additional incentive mechanisms aimed at rewarding frontier companies over and above the built-in rewards of the RPI – X system. Failure to implement such mechanisms might have the unintended consequence of discouraging further innovation in the price-regulated industry.

**The second principle identified is that efficiency targets set by regulators are, in general, balanced**: as noted, under RPI – X regulation, companies are encouraged to achieve efficiency gains through the possibility of outperforming the targets, and thereby earning higher returns than assumed by the regulator at the price control review. Targets that are too demanding will not offer such a reward and might undermine the financing of the regulated company, jeopardising key desired outcomes such as quality of service or future investment. In other words, regulators tend to set efficiency targets at a level that offers companies a 'carrot' (the possibility of outperforming targets) as well as a 'stick' (the actual target). To achieve balanced efficiency targets, in addition to ensuring that 'carrots' are offered, the following need to be considered.

– **Developing an efficiency target within a clear overall framework**: this includes identifying the potential for catch-up to best practice and the potential for frontier shift or technological progress. The former requires an assessment of each regulated company's efficiency relative to its peers.

– **Economy-wide productivity gains are already captured in the retail prices index (RPI)**: this would ensure that the economy-wide productivity gains are not included in the scope for efficiency gains (ie, they are not double-counted).

– **Using a variety of techniques**: to assess the scope for efficiency gains, regulators have at their disposal a broad range of techniques. Since these may rely on different data requirements and different assumptions, they can lead to different results. By using a variety of techniques, regulators can cross-check the results of the efficiency assessment, thereby reducing the risk of setting efficiency targets that are not aligned with the real scope for efficiency gains. In addition, when choosing which techniques should be given more weight in cases where the results are different, as noted above

[1] Although care is required to ensure that comparisons are as like-for-like as possible (as well as taking account of endogenous information). Basing approaches on exogenous information only could lead to unrealistic targets being set for the regulated company.

regulators aim to ensure that they do this within a framework that has already been transparently agreed with the industry, and that gives more weight to techniques that rely on exogenous data sources.

– **Considering whether the benchmark is reasonable**: there might be questions about the reasonableness of the benchmark used to set efficiency targets, owing to aspects such as the quality of the data or cost allocation, or failure of the level of service. Regulators often employ methods to identify unreasonable benchmarks in order to avoid overestimating the real scope for efficiency gains.

– **Considering the existence of uncertainty**: a degree of uncertainty is inherent in the tools used to measure the scope for efficiency gains. This uncertainty can be difficult to remove, but regulators have tended to take pragmatic steps in order to take account of its existence.

RPI – X regulation, combined with strong incentive properties (including setting efficiency targets based on exogenous information while providing the potential to outperform), is most likely to emulate the outcomes of a competitive market, increase the level of innovation, and result in greater efficiency improvements.

# Contents

# 1 Introduction

This independent report on behalf of BT, produced by Oxera for submission to Ofcom, explores how regulators encourage efficiency using RPI – X regulation, and identifies a number of principles of best-practice regulation.

Utility regulators aim to ensure that markets with natural monopoly characteristics function as far as possible in the same way as competitive markets. This principle can be expressed in terms of two regulatory objectives:

– **cost-reflectivity (or rent extraction)**:[2] the extent to which appropriate, cost-reflective signals for the use of scarce resources are incorporated into the pricing structure;

– **efficiency (or effort inducement)**: the extent to which a given level of outputs is produced with the minimum amount of possible inputs using both the existing technology (productive efficiency) and new technologies developed over time (dynamic efficiency).

There is a trade-off between these two objectives. As such, depending on which objective in considered to be more important, in markets where ex ante regulation is justified, regulators choose between different approaches to regulation, including:

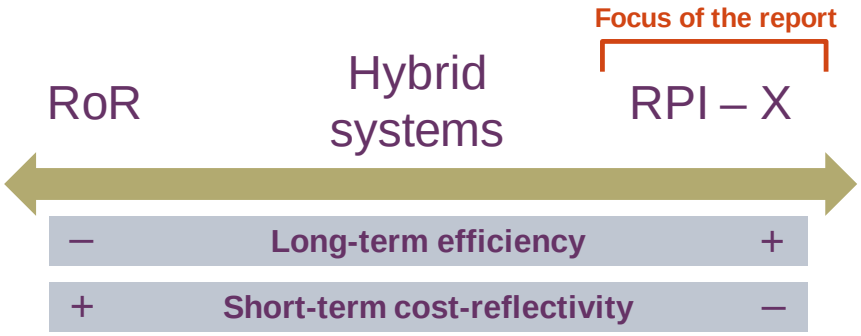
– RPI – X regulation, where prices are fixed and independent from costs for a period of time;
– rate of return (RoR) regulation,[3] where prices change when costs change;
– hybrids of RPI – X and RoR regulation.

The main advantage of RPI – X (and its hybrids) is that, by offering companies the possibility to outperform the regulatory settlement and thus earn a higher return than assumed by the regulator, it provides them with high-powered incentives to achieve efficiency gains. This, in turn, leads to benefits to customers in the form of lower prices at future price control reviews, thereby emulating the outcome of competitive markets in relation to long-term efficiency.

In contrast, as shown in Figure 1.1, RoR regulation is, in principle, less effective than RPI – X regulation in terms of providing high-powered efficiency incentives. However, it does allow the regulator to adjust prices to changes in costs more quickly than RPI – X regulation does, achieving more cost-reflectivity in the short term at the expense of greater efficiencies in the long term.

[2] Also referred to as 'allocative efficiency'.
[3] Also referred to as 'cost-plus regulation'.

**Figure 1.1 Possible regulatory regimes**




Source: Oxera, based on Laffont, J.J. and Tirole, J. (1993), *A Theory of Incentives in Procurement and Regulation*, The MIT Press.

As indicated in Figure 1.1, this report focuses on the RPI – X regime, which, due to its long-term efficiency benefits, has been the option of choice for regulating utilities in the UK and many other countries over the past 20 years, and which is the regime currently used to regulate parts of BT.

The report is organised as follows.

– Section 2 approaches the discussion from the high-level perspective of the incentives of the regulatory regime, discussing fundamental questions such as: what are the key incentives of RPI – X? What is the role of comparative competition in relation to these incentives? How can sharing of out-/underperformance or additional incentive mechanisms strengthen these incentives?

– Section 3 focuses on how regulators set cost-reduction targets within an RPI – X model. This section discusses some more specific technical issues, such as: what exactly is meant by scope for efficiency gains? What types of efficiency gain can companies achieve? How can regulators assess these efficiencies?

– Section 4 picks up the key messages from the two previous sections and discusses best-practice lessons that can be drawn from them.

# 2 How do regulators incentivise efficient operation?

This section presents a high-level overview of how regulators incentivise efficient operation by companies regulated under an RPI – X regime.

– Section 2.1 starts by describing how the incentives of RPI – X work.

– Section 2.2 then discusses the role that comparative competition plays in ensuring that these incentives remain effective.

– Section 2.3 introduces the 'sharing dilemma', and describes additional efficiency incentive mechanisms that regulators often apply to ensure that the frontier companies remain incentivised.

– Lastly, section 2.4 touches on the issue of regulatory commitment, which can be understood to be a fundamental pillar underpinning all the RPI – X incentives discussed in the earlier sections.

The key messages from the discussion are presented in boxes at the start of each sub-section.

## 2.1 Incentives of RPI – X

Key message
**RPI – X incentivises outperformance by design**

Arguably, the most widespread form of incentive regulation used to regulate utility prices worldwide is RPI – X regulation.[4] Under this approach, the regulated company's (nominal) prices are allowed to increase by a measure of price inflation (RPI) minus an X factor—which represents the regulator's expectation of the scope for future efficiency improvements—over the course of the control period.[5] At the end of each control period, a price control review is undertaken and the realised cost reductions are (partially or fully) passed on to consumers through lower prices.[6]

Given that prices are fixed, the company becomes the residual claimant of any efficiency improvement in excess of that anticipated by the regulator at the time of the price control review. Conversely, if a company underperforms against its cost-reduction target, it will earn a rate of return below its cost of capital. Since the profits that the company actually makes under incentive regulation partly depend on its outturn costs, it would have the incentive to exert effort and attain efficiency savings in pursuit of higher profits. As such, incentive regulation is built on the notion that the outcome that the regulator considers to be in the best

[4] Sappington, D. (2000), 'Price Regulation and Incentives', in M. Cave, S. Majumdar and I. Vogelsang (eds) (2002), *Handbook of Telecommunications Economics*, Elsevier. The RPI – X model is generally attributed to Stephen Littlechild for his 1983 report for the UK government on the privatisation and regulation of BT. See Littlechild, S. (1983), 'The Regulation of British Telecommunications' Profitability', Department of Industry, reprinted in I. Bartle (ed), *The UK Model of Utility Regulation*, CRI Proceedings 31, University of Bath.

[5] In real terms, therefore, prices decline by X% per year, to reflect efficiency improvements.

[6] In theory, a permanent price cap (ie, no price reviews) is often discussed. In practice, assuming that the sector remains uncompetitive, a permanent price cap would lead to the company making unconstrained monopoly rents in perpetuity or going bankrupt—neither of which is socially desirable.

interests of customers (in the long run) is incentivised by making it in the (short-term) interests of the regulated company's shareholders.

Conceptually, RPI – X represents a 'hands-off' approach to regulation, which seeks to provide the regulated entity with the managerial discretion to achieve broad outcomes (such as cost reduction), rather than to prescribe specific behaviours. The realisation of cost savings is then driven by—and to a large extent relies on—the pursuit of profit (and profit outperformance) by the regulated business:

> the regulator delegates certain pricing decisions to the firm and...the firm can reap profit increases from cost reductions. Incentive regulation makes use of the firm's information advantage and profit motive. The regulator thus controls less behaviour but rather rewards outcomes.[7]

In summary, the key feature of RPI – X is that, by offering the companies the possibility to outperform the regulatory settlement, and thus earn a higher return than assumed, it provides them with high-powered incentives to achieve efficiency gains, which in turn leads to benefits to customers in the form of lower prices at future price control reviews.

## 2.2 The role of comparative competition

Key message
**By relying on exogenous data, comparative competition ensures that efficiency incentives are maintained**

A perverse incentive often highlighted in the literature on RPI – X regulation is the 'ratchet effect', which has been described as follows:

> The regulator infers from a high performance an ability to repeat a similar performance in the future and becomes more demanding. Consequently the firm has an incentive to keep a low profile[8]

This moral hazard problem means that if only endogenous information (information internal to the company) were used to set efficiency targets, the regulated company would have an incentive not to inform the regulator of the full potential for it to make cost reductions. For example, good performance in the first control period might induce the regulator to judge the company's performance against a higher standard (a 'ratcheting-up' of standards) in the second period.[9] The regulated company looking to increase first-period performance then has to weigh up the increase in its first-period reward against the potential decrease in its second-period reward due to the regulator increasing the efficiency target. This has been reported to lead to cycles in the cost-cutting activities of regulated companies.[10]

Comparative competition, which aims at setting efficiency targets on the basis of exogenous (or external) data, could provide one way of overcoming this problem. This is because it ensures that the regulated company's price control in each regulatory period is not set solely on the basis of its own costs and performance; rather, the costs and performance of relevant comparators are also taken into consideration. As a result, setting efficiency targets with less

[7] Vogelsang, I. (2002), 'Incentive Regulation and Competition in Public Utility Markets: A 20-year Perspective', *Journal of Regulatory Economics,* **22**:1, p. 6.

[8] Laffont, J.J. and Tirole, J. (1993), *A Theory of Incentives in Procurement and Regulation*, The MIT Press, p. 664.

[9] See Weitzman, M. (1976), 'The ratchet principle and performance incentives', *Bell Journal of Economics*, **11**, pp. 302–8. For further discussion, see, for example, Laffont, J.J. and Tirole, J. (1993), op. cit., chapter 9.

[10] See, for example, Pint, E.M. (1992), 'Price-cap versus rate-of-return regulation in a stochastic cost model', *Rand Journal of Economics*, **4**:23, pp. 564–78; Bottasso, A. and Conti, M. (2009), 'Price cap regulation and the ratchet effect: a generalized index approach', *Journal of Productivity Analysis*, **32**:3, pp. 191–201.

reliance on endogenous (or internal) data by applying comparative competition would have the effect of strengthening the incentives of the regulatory regime.

An alternative way to consider this issue is that the use of exogenous relevant comparators would mimic the market by creating a quasi-competitive pressure on the regulated entity to perform at least as well as the comparator companies, and would thus maintain efficiency incentives.

## 2.3 The sharing dilemma

Key message
**Additional efficiency incentive mechanisms tend to reward outperformers**

How outperformance and underperformance of efficiency targets are shared between companies and customers is one of the core elements of regulatory systems that enable regulators to control the power of incentives. This relationship has been highlighted by academics:

> the strength or power of incentives is measured by the percentage of cost reductions the firm may keep or of cost increases that it may have to suffer.[11]

That is, the less outperformance or underperformance that is shared with customers (ie, the higher the outperformance rewards and underperformance penalties), the more powerful the incentives of the regulatory regime will be. In general, under RPI – X regulation, companies are allowed to keep the outperformance and are obliged to pay for the underperformance of regulatory targets until prices are re-set at the next price review. As such, a fundamental variable that would determine how much of the outperformance or underperformance is shared with customers is the length of the regulatory period.

The optimal period of time between when an efficiency saving is made and when it should be passed through to consumers has been demonstrated theoretically to depend on whether the company is low- or high-cost, the demand elasticity, the responsiveness of costs to efforts, and the likelihood of effort being exerted to reduce costs.[12] In practice, the length of the regulatory period is not often changed, although regulators do revise this variable on occasion or amend the period over which outperformance is kept by the regulated company. For example,

- as part of Ofgem's framework for the upcoming energy transmission and distribution price control reviews (its RIIO framework), the regulator has chosen to lengthen the price control periods from five to eight years.
- in PR99, Ofwat introduced a rolling expenditure mechanism (which it kept in place for subsequent reviews), whereby companies keep their outperformance for a period of five years regardless of when the efficiencies were achieved within the price control period. This was introduced as the regulator felt that incentives were too weak towards the end of a five year price control period as regulated companies would only keep the benefit of any outperformance for one or two years. Ofwat stated,[13]

  > the Director has sought to ensure that companies have adequate incentives to outperform regulatory assumptions on efficiency savings. This has been achieved by incorporating a rolling incentive mechanism whereby efficiency savings in excess of the

[11] Vogelsang, I. (2010), 'Incentive Regulation, Investments and Technological Change', *CESifo Working Paper No. 2964*, p. 4. See also Laffont and Tirole (1993), op. cit.
[12] Armstrong, M., Rees, R. and Vickers, J. (1995), 'Optimal Regulatory Lag under Price Cap Regulation', *Revista Española De Economía*, **12**, pp. 93–116.
[13] Ofwat (1999), 'Final Determinations: Future water and sewerage charges 2000–05', Chapter 6.

> regulatory assumptions (outperformance) are retained by companies for five years before being passed to customers. Without this mechanism, outperformance achieved in the later years of the 1995–2000 period would only be retained by companies for a shorter period before being passed to customers. This was considered to be an inadequate incentive to improve efficiency in the later years of a review period.

The efficiency incentives under this mechanism operate over two price control periods. Outperformance of an efficiency target results in costs falling below revenue at the end of the first price control period. Prices at the end of the first price control period are then carried forward into the starting prices for the next charge control period. The benefits of the outperformance are therefore shared between the regulated firm and customers in the second charge control period through the operation of a glide path. This mechanism progressively passes-through the efficiencies until by the end of the second period all the efficiencies delivered in the first charge control period are reflected in prices.

Another way of modifying the degree of sharing between companies and customers is to set up additional incentive schemes. Regulatory practice shows that regulators tend to provide further incentives to those already provided by the standard RPI – X regime, and that, in general, these imply offering the most efficient companies additional rewards. This is justified on the basis that their incentives for innovation under standard RPI – X regulation might be limited.

Additional rewards therefore incentivise frontier companies to innovate and make productivity improvements—by adopting technologies and new working practices—above and beyond any cost reductions related to catching up to best practice. For example:

– in its two most recent price reviews of the water sector in England and Wales, Ofwat provided an outperformance 'incentive multiplier' based on the regulated companies' individual levels of efficiency;[14]

– when setting incentive schemes, Ofgem has also distinguished between high- and low-cost companies, while rewarding those companies closest to the efficiency frontier.[15]

## 2.4 Regulatory commitment

Key message
**Regulatory commitment is a pillar on which incentives are based**

An important aspect of the regulatory process, and one of the six principles highlighted by the Department for Business, Innovation and Skills (BIS) in April 2011,[16] involves consistency and the predictability of decision-making:

> The framework for economic regulation should provide a stable and objective environment enabling all those affected to anticipate the context for future decisions and to make long term investment decisions with confidence...[it] should not unreasonably unravel past decisions.[17]

[14] Ofwat (2007), 'PR09: The OPEX incentive allowance and the outperformance multiplier for 2005-10: Letter to all Regulatory Directors of water and sewerage companies and water only companies', October 18th.
[15] See, for example, Ofgem (1999), 'Reviews of Public Electricity Suppliers 1998 to 2000: Distribution Price Control Review – Final Proposals', December, p. 21 and Ofgem (2009), 'Electricity Distribution Price Control Review – Final Proposals – Allowed Revenue – Cost Assessment', December 7th, p. 8.
[16] The other principles were accountability, focus, coherence, adaptability and efficiency. See BIS (2011), 'Principles for Economic Regulation', April, pp. 4–5.
[17] Ibid, p. 5.

In acting in a consistent manner, regulators are able to enhance their credibility, reducing investors' perception of regulatory risks. Ideally, consistency in approach would not only apply throughout the duration of a price control, but also extend from one price control to the next. If regulators repeatedly alter the methodology underlying key aspects of the regulatory framework, they could increase the risk for investors and could potentially weaken the incentives for innovation.

The problem here is time inconsistency. Since information that is initially private is revealed over the course of the control period, the regulator would have an ex post incentive to renege on the ex ante policies it set for the company. However, a rational company, and rational investors, would take this into account when forming their expectations about the returns on their investment and the risks they will bear. Specifically, if the company expects that the regulator will force it to pass through a higher percentage of savings than was determined before the start of the control period, the potential upside from undertaking a project will be smaller, with no offsetting decrease in the downside risk.

This consideration is particularly important in sectors such as telecommunications and aviation, where the sunk nature of investments could give rise to the possibility of regulatory opportunism in ex post efficiency assessments. The potential for claw-back and capture of sunk investment increases the risk of any such investment, and may cause substitution towards lower-risk, short-term projects. Naturally, this would have an impact on efficiency.

Regulators therefore tend to be very careful when they change key elements of the regulatory regime, such as how the efficiency targets are set—transparency and predictability of future determinations are key. This is confirmed by Weisman (1993),[18] who showed that if a company believes that a regulator will rebase a 'contract' to eliminate revealed excess profits, the company will refrain from cutting costs.

[18] Weisman, D. (1993), 'Superior regulatory regimes in theory and practice', *Journal of Regulatory Economics*, **5**, pp. 355–66.

# 3 How do regulators set efficiency targets?

This section focuses on how regulators arrive at a final overall efficiency target.

– Section 3.1 starts by looking at what scope there is for efficiency gains.

– Section 3.2 examines how this scope is assessed.

– Lastly, section 3.3 examines how regulators then determine the efficiency target to be achieved by the regulated company.

The key messages from the discussion are presented in boxes at the start of each sub-section.

## 3.1 What is the scope for efficiency gains?

Key message
**To avoid double-counting, the scope for efficiency gains should not include economy-wide productivity**

Theoretically, a company's potential to make efficiency improvements is twofold:

– **catch-up to current best practice**—to calculate this, regulators normally estimate the extent to which the company's cost level differs from current best practice, and consider whether the company can catch up to this best practice;
– **frontier shift**—to calculate this, regulators normally determine the rate at which the efficiency frontier would be expected to shift over time through the adoption of new technologies and working practices.

Regulators therefore establish both how inefficient the regulated company is relative to its peers and what the potential is for the industry best practice to improve. They then set cost allowances based on expected improvements in efficiency.

Another important principle which regulators consider when setting cost-reduction allowances is that changes in the final price of a service (at both the sector level and the economy-wide level) are related to changes in the costs of the inputs and improvements in efficiency in delivering the service. Thus, economy-wide prices, as represented by the RPI, capture both economy-wide movements in input prices and economy-wide productivity improvements. As such, the scope for real cost reductions in a regulated sector includes the following two components:[19]

– **the differential in input costs**—if the regulated company's input costs are, through circumstances beyond its control, increasing more quickly than those in the economy as a whole, the real cost-reduction target should be reduced accordingly (and vice versa);[20]

[19] See, for example, the discussion in Vasington, P.B. (2003), 'Incentive Regulation in Practice: A Massachusetts Case Study', *Review of Network Economics,* **2**:4, p. 456; and Littlechild, S. (2003), 'Reflections on Incentive Regulation', *Review of Network Economics,* **2**:4, pp. 308–9.
[20] It is generally assumed that input markets are competitive, such that input costs are outside the control of the regulated company.

– **the differential in productivity**—the cost-reduction target should include an adjustment for the differential in productivity growth between the regulated company's activities and the economy as a whole.

In order to avoid double-counting, the scope for efficiency gains should reflect anticipated productivity and input price movements for the regulated company over and above economy-wide productivity and input price movements only. In order to capture this point, when establishing the scope for potential efficiency gains, regulators often adjust their assumption on the frontier shift. That is, estimates of real input price growth and economy-wide productivity are netted off the frontier-shift assumption.

## 3.2 How is the scope for efficiency gains assessed?

### 3.2.1 Techniques used

Key message

**To assess the scope for efficiency gains, regulators usually use a combination of well-known techniques that rely mostly on external data, and they do this in a predetermined way that has been discussed transparently and agreed with the industry**[21]

To estimate the scope for efficiency gains, a wide range of comparative efficiency techniques can be used. These broadly fall into one of two categories: those reliant on external (or exogenous) data and those reliant on internal (or endogenous) data.

Techniques that rely on **external data** attempt to calculate the scope for efficiency gains by looking at the costs of other companies and comparing these with the costs of the regulated company. The most prominent tools within this category used by regulators can be summarised as follows.

– **Inter-company comparisons**—cost comparisons can be made between regional regulated utilities using a variety of methodologies, ranging from simple comparisons of unit costs to more sophisticated techniques.

– **International comparisons**—these involve comparing the costs of the national regulated utility with similar companies in other countries/jurisdictions.

– **Indirect comparisons**—this can include real unit operating expenditure (RUOE) analysis based on a set of comparators that are in a similar, but not necessarily the same, industry (eg, other regulated network utilities); and total factor productivity (TFP) growth, which provides a benchmark based on the overall productivity performance of a number of sectors that undertake activities deemed to be comparable with those undertaken by the assessed company.

– **Experience from others**—application of experience from academic literature and other regulated sectors, including the efficiency targets set by other regulators.

– **Process modelling**—this involves disaggregating the company's functions into a number of processes, where a process is defined as a collection of activities with identifiable inputs and outputs. These processes are then compared with other similar processes using external benchmarks.

[21] Although care is required to ensure that comparisons are as like-for-like as possible (as well as taking account of endogenous information). Basing approaches on exogenous information only could lead to unrealistic targets being set for the regulated company.

– **Hypothetical efficient company comparisons**—where there are not enough companies to perform a comparative exercise, benchmarking can be based on a hypothetical efficient company. Here, the optimal cost level for a regulated company is calculated by defining a 'model' company.[22]

Techniques that rely on **internal data** are summarised as follows.

– **Intra-company comparisons**—comparisons can be made between a company's separate service functions or processes.

– **Detailed examination of the company's business plan**[23]—this might involve reviewing the company's commentary on its past performance, examining its planned initiatives against what it implemented (and the explanations given for any differences), the outcomes of these initiatives, its planned future capital expenditure schemes, and its forecasts.

Given the asymmetry of information that exists with respect to the potential for cost reductions (ie, the company is better informed about what it can achieve than the regulator), a moral hazard problem arises. If only endogenous information is used, the regulated company has an incentive not to inform the regulator of the full potential for cost reductions. As such, regulators tend to avoid relying solely on endogenous information and, where possible, use tools that rely on external data.

Tools that rely on internal data are still used, in part since approaches based on exogenous information only could lead to unrealistic targets being set for the regulated company,[24] and in instances where external information is limited (eg, intra-company comparisons of RM delivery offices and mail centres[25]). In addition, regulators try to mitigate the moral hazard problem in the case of business plans through an expectation that external evidence is presented. (For example, Ofgem has stated that it considers that a 'well justified business plan' should include external evidence on efficiency.[26]) As discussed in section 2.2, the tools that rely on external data are useful to ensure that the incentives of the RPI – X regime remain high-powered.

Furthermore, regulators tend to use a combination of these techniques, and when they do this, they tend to follow a predetermined methodology (in terms of the tools and sources of information to be used) that has been discussed and agreed with the industry as part of a transparent consultation process. For example, Ofgem recently proposed the use of a wide range of methodologies or an 'assessment toolkit',[27] and engaged in a two-year consultation process to validate its proposals with the industry stakeholders. This can be seen to improve the regulatory commitment, leading to a positive impact on the overall incentives of the RPI – X system, as discussed in section 2.4.[28]

[22] For discussion see, for example, Viljainen et al. (2004), 'Regulation of Electricity distribution business', Proceedings of the 6th Nordic conference on Nordic Distribution and Asset Management (NORDAC), Esbo, Finland.

[23] For example, see Ofwat (2008), 'Setting Price Limits for 2010–15: Framework and Approach', March; and Postcomm (2005), 'Royal Mail Price and Service Quality Review: Final Proposals for Consultation', December, p. 134.

[24] As such, care is required to ensure that comparisons are as like-for-like as possible.

[25] Although, even in this case, various other external data-based tools were used in combination (included external process-based comparisons, indirect comparisons and experience from other sectors).

[26] Ofgem 'expect[s] companies to use a range of tools in demonstrating the efficiency of their costs including internal and external benchmarking evidence and market testing'. See Ofgem (2011), 'Consultation on strategy for the next transmission and gas distribution price controls – RIIO-T1 and GD1 Business plans, innovation and efficiency incentives', supplementary annex, December 17th, p. 20, para 3.57.

[27] Ofgem (2010), 'RPI–X@20: Implementing Sustainable Network Regulation', July, p. 76.

[28] For more information, see Ofgem (2010), 'Consultation on strategy for the next transmission price control – RIIO-T1 Tools for cost assessment', December; and 'Consultation on strategy for the next gas distribution price control - Supplementary Annex - RIIO-GD1 Tools for cost assessment', December.

### 3.2.2 Determining the reasonableness of the benchmark

Key message
**Additional tests are often undertaken on the benchmark to ensure that it is reasonable**

Before using a candidate benchmark to calculate the scope for efficiency gains, regulators try to ensure that this candidate would be a reasonable benchmark. As acknowledged by Ofwat:

> The benchmark company is not always the company at the efficiency frontier. It needs to satisfy a number of criteria, including size, to make it a suitable comparison with the rest of the sector.[29]

In practice, this means that regulators do not necessarily use the frontier company as the benchmark. If the frontier company is judged not to be a reasonable candidate for the benchmark, the next most efficient company is chosen and tested until a reasonable benchmark is identified.

### 3.2.3 Accounting for uncertainty

Key message
**Regulators tend to take into account the existence of uncertainty when they assess the scope for efficiency gains**

No matter how the scope for efficiency gains is estimated, it is subject to some degree of uncertainty. Regulators have tended to take pragmatic steps to take account of the existence of uncertainty in the estimation of cost-reduction targets. For example, in 2009 Ofgem noted:

> We do not consider that our benchmarking results or the quality of the underlying data justify setting allowances according to the frontier, and to do so would discredit our work.[30]

Approaches to adjust for uncertainty have included techniques that attempt to account for noise, such as stochastic frontier analysis (SFA);[31] mechanistic rules for establishing the benchmark, such as the upper-quartile, upper-third or median;[32] and regulatory judgements on the required adjustment, such as adjusting the gap by a predetermined percentage.[33]

[29] Ofwat (2009), 'Relative efficiency assessment 2008-09 – supporting information', December, p. 13.
[30] Ofgem (2009), 'Electricity Distribution Price Control Review Final Proposals – Allowed Revenue – Cost Assessment', December 7th, p. 12.
[31] See, for example, ORR (2010), 'International Cost Efficiency Benchmarking of Network Rail', September, p. 14, para 4.16.
[32] See, for example, Ofgem (2009), 'Electricity Distribution Price Control Review Final Proposals – Allowed Revenue – Cost Assessment', December 7th, p. 4.
[33] See, for example, Ofwat (2004), 'Future water and sewerage charges 2005-10 – Final determinations', December, p. 153.

## 3.3 Determining the efficiency targets

Key message
**When setting efficiency targets, extremes do not seem to be commonplace**

Assessing the scope for efficiency gains is, by its nature, an imprecise science. Setting a target that is too lenient will result in a regulated company earning higher returns than necessary in the short term, with the regulatory settlement being realigned at the next price control review and any outperformance being passed on to customers. By contrast, setting a target that is, in effect, unattainable could have serious implications for the regulated company in terms of:

– **financeability**—under-recovery of costs could affect the company's ability to finance its functions, with implications for the delivery of expenditure programmes and consequent risks to customers;

– **entry**—the company could be forced to set prices at too low a level, thereby preventing efficient entry into the market;

– **operating and capital expenditure**—attempts to cut costs may lead to insufficient investment and sub-optimal levels of expenditure on network maintenance;

– **levels of service** may be compromised.

The above argument promotes the necessity for caution when determining the size of the 'sticks' (ie, efficiency targets) and 'carrots' (ie, the possibility of outperforming those targets) applied to the company, in order to mitigate any risk of getting the assessment incorrectly. As such, regulators tend to be prudent when setting their cost-reduction targets. In particular, the company should be left with a reasonable prospect of profit improvement in order to motivate it to reveal efficiency improvements that will facilitate long-term consumer benefits. As an example of this in practice, Ofgem chose 'not to tighten the efficiency frontier' (that is, it assumed a frontier shift of 0%) for the duration of the third electricity distribution price control review.[34]

[34] Ofgem (1999), 'Reviews of Public Electricity Suppliers 1998 to 2000', Distribution Price Control Review – Final Proposals', December, p. 21, para 2.23.

# 4 Best-practice principles

This report has looked at how regulators deal with efficiency under an RPI – X regime. Section 2 considered this from the high-level perspective of the efficiency incentives provided by RPI – X regulation, while the discussion in section 3 moved on to focus on more technical issues surrounding how regulators set cost-reduction targets under RPI – X. A number of key messages, presented at the start of each sub-section, have emerged from this review.

Picking up these key messages, some best-practice principles that can be drawn from them are presented below.

## RPI – X incentivises outperformance by design

If regulators consider that there are still significant efficiency gains to be made (ie, if they think it is worth pursuing the efficiency objective), RPI – X seems to be a suitable regime to regulate the industry.

However, regulators would need to ensure that the high-powered incentives that the RPI – X regime is intended to provide are indeed provided. If some elements of the regime are neglected (eg, if companies are set such demanding targets that they would no longer expect to receive a reward for their efficiency gains; or if regulatory commitment is broken), the regime might fail to continue to deliver the intended benefits.

## By relying on exogenous data, comparative competition ensures that efficiency incentives are maintained

Regulators aim to apply comparative competition, which relies mostly on techniques that use exogenous data to fully exploit the efficiency incentives provided by the RPI – X system.

In cases such as water or energy, where there is more than one regulated company, applying comparative competition might be easier than where there is only one company, although this does not prevent regulators applying comparative competition in the latter situation. For example, international comparators could be used, or even comparators from other sectors where appropriate.

Tools that rely on internal data are still used in instances where external information is limited. However, regulators try to mitigate the moral hazard problem in such cases (eg, if business plans are used, regulators expect external evidence on efficiency to be presented within them).

## Additional efficiency incentive mechanisms tend to reward innovation

Regulators can boost the power of incentives through additional regulatory incentive schemes that reward innovative companies over and above the standard rewards of the RPI – X system. Failure to reward innovative good performers appropriately might have the unintended effect of discouraging innovation in the regulated industry.

## Regulatory commitment is a pillar on which incentives are based

Regulatory commitment is the fundamental component that makes incentive mechanisms work effectively. This means that regulators should try to clarify as far as possible the rules of the RPI – X regime, and adhere to them. These rules include almost every aspect of the regulatory regime, from simpler process issues, such as what data will be requested from

companies and how it will be used, to more fundamental aspects, such as which costs should be expected to be passed through to customers and which should not.

Any breach of these rules by the regulator could have the effect of increasing, from the companies' perspective, the likelihood of the regulator clawing back future returns, which could in turn jeopardise the efficiency incentives of the regulatory regime.

Not all the rules can be set ex ante, however. Regulators may prefer to retain some discretion to allow them to adapt to changing circumstances. When regulators exercise such discretion, they should consider carefully the associated costs, which, as noted above, often arise in terms of a reduction in the power of the incentives of the regulatory regime.

### To avoid double-counting, the scope for efficiency gains should not include economy-wide productivity

When setting the scope for efficiency gains, regulators should take care not to include economy-wide productivity, since this is already included in the RPI. Including economy-wide productivity in the scope for efficiency gains would mean that these productivity gains are double-counted.

Any such double-counting could unintentionally result in targets being set that are too stringent, thereby undermining the financing of the regulated company.

### To assess the scope for efficiency gains, regulators usually use a combination of techniques that rely mostly on external data, and they do this in a predetermined way that has been discussed transparently and agreed with the industry

In order to achieve best regulatory practice, regulators can make use of several techniques. Not doing so would be a missed opportunity, since it could impose an unnecessary degree of uncertainty that, from the investors' perspective, might be perceived as increased regulatory risk.

There are alternative ways in which these techniques could be used. For example, a predetermined mechanistic approach could be adopted, whereby regulatory decisions are based on the efficiency assessment undertaken using one or more preferred techniques, with the other techniques used as a cross-check, or a simple average across techniques could be taken.

If, instead, a more discretionary approach is followed, whereby regulatory decisions are made by exercising judgement, without following a preset rule, regulators may need to consider the regulatory commitment issue discussed above. For example, they may need to bear in mind that simply choosing to use the results of techniques that deliver a tougher efficiency challenge might be perceived by the companies as biased, and might weaken the power of incentives going forward.

### Additional tests are often undertaken on the benchmark to ensure that it is reasonable

This highlights the importance of the choice of the benchmark. Regulators are careful when selecting the benchmark to avoid imposing efficiency challenges that could be unrealistically stringent.

As noted, setting targets that are too stringent might not allow investors to recover their cost of capital, thereby undermining the financing of the regulated company.

## Regulators tend to take into account the existence of uncertainty when they assess the scope for efficiency gains

Regulators should ensure that companies are not unfairly punished by the uncertainty involved in the setting of efficiency targets.

Approaches to adjust for uncertainty have included techniques that attempt to account for noise (such as stochastic frontier analysis, or SFA), mechanistic rules for establishing the benchmark (such as the upper-quartile, upper-third or median), and regulatory judgements on the required adjustment (such as adjusting the gap by a predetermined percentage).

## When setting efficiency targets, extremes do not seem to be commonplace

On occasion, regulators applying RPI – X regulation might be tempted to pass through efficiency benefits immediately to customers, by setting challenging efficiency targets.

Examples from good regulatory practice suggest, however, that such extreme approaches are not usually pursued. If the targets are too stringent, the downside risks (the probability that the company does not hit its target) are greater. Moreover, given that, under RPI – X, downside risks are borne by the companies, the returns to investors might be brought below a reasonable level, thereby undermining the economic and financial sustainability of the regulated company.

Park Central
40/41 Park End Street
Oxford OX1 1JD
United Kingdom

Tel: +44 (0) 1865 253 000
Fax: +44 (0) 1865 251 172

Stephanie Square Centre
Avenue Louise 65, Box 11
1050 Brussels
Belgium

Tel: +32 (0) 2 535 7878
Fax: +32 (0) 2 535 7770

Thavies Inn House
7th Floor
3/4 Holborn Circus
London EC1N 2HA
United Kingdom

Tel: +44 (0) 20 7822 2650
Fax: +44 (0) 20 7822 2651

www.oxera.com