

EFFICIENCY AND PRODUCTIVITY STUDIES IN INCENTIVE REGULATION OF UK UTILITIES*

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ABSTRACT

The reform of the UK utilities over the last fifteen years has laid considerable emphasis on the incentive properties both of private ownership and the regulation of the privatised industries which has followed. This paper reviews the arguments for such a policy, and describes the use of efficiency and productivity studies, both in undertaking the regulation itself and in assessing its effectiveness. The establishment of separate industry specific regulators has resulted in a considerable variety of approaches, and the assessment of the outcome also provides a rather mixed result, both with respect to the impact and its timing.

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I. EFFICIENCY AND PRODUCTIVITY STUDIES IN INCENTIVE REGULATION OF UK UTILITIES

A. Background and philosophy

When the first Thatcher government was elected in 1979, about 10% of the UK national income was produced by nationalised industries. These included the basic utilities: water, gas, electricity and telecomms, as well as the railway system, the British Airports Authority and British Airways, the coal and steel industries and a variety of

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other smaller industries. Many of those had been nationalised after the Second World War, with a philosophy of arms length management (the government appointed the chairman of the board who was then supposed to act independently in routine management), and there were few guidelines about the economic principles which they should employ. There had been a series of discussions and government policy papers in the fifties, sixties and seventies about appropriate pricing and investment criteria, and the imposition of some financial discipline on the industries, but these issues were not satisfactorily resolved either in principle or in practice. Moreover successive governments could not resist the temptation to interfere in day to day decisions, and use the companies to achieve a variety of other objectives, from specific purchasing decisions (the electricity industry was instructed to increase coal use against its commercial judgement) to macroeconomic policies (changes in macroeconomic orthodoxy meant that sometimes prices were held down as an example to others, and sometimes raised to relieve the pressure on central government funds, all in the interests of reducing inflation). Moreover the industries had difficulty in raising sufficient funds for investment, because all their borrowing was included as government expenditure, at a time when macroeconomic policy was trying to curb such expenditure. Given this unsatisfactory guidance and interference, it is not surprising that the industries had a poor reputation for efficiency and customer service.

The Thatcher programme of privatisation started in a modest way with industries which were already operating in relatively competitive markets (*e.g.*, steel and oil) and concentrated on the importance of competition. By 1983 the Government decided to extend the policy to British Telecoms, badly in need of investment, but restricted from raising finance by the rules regarding nationalised industry borrowing. With some trepidation, the government sold 51% of the shares in British Telecom (BT) in 1984, the largest flotation there had ever been on the London stock exchange. The flotation was hugely oversubscribed. The government was not only released from responsibility for investment in the company, but also received the flotation proceeds which counted as negative government expenditure in the year in which they were generated. Those played a crucial part in the government's policy to reduce net government expenditure and lower taxes, and were easily justified by the pro market philosophy of the Conservative Party. However this was not so extreme as to suggest that industries which were sold with overwhelming market power needed no regulation, and so a system needed to be devised – first for BT, and later for the other utilities¹.

The regulation was devised against a background of poor perception of productivity within the nationalised industries. Regulation had been in force for many years in the United States of America, based on a cost-plus system of pricing, and focusing mainly on preventing monopoly exploitation of consumers by both private and publicly owned companies. There was widespread concern that, while this somewhat cumbersome system ensured that prices were related to costs, it did nothing to encourage companies to minimise those costs. In particular the practice of relating

1 This form of regulation was also applied to the British Airports Authority, but the railways are controlled through a different mechanism.

allowed revenue to capital assets encouraged over-development of the capital base, the so-called Averch-Johnson effect (Averch and Johnson, 1962). To avoid both these problems a different system of regulation was proposed for British Telecom, which provided high powered incentives for the company to minimise the level of costs, while still protecting consumers. This consisted of identifying the BT services where there was little competition, and requiring that the average of these prices be below a particular level each year. Companies were broadly free to choose their own balance of prices so long as the average fell within the cap, though sometimes separate constraints were set on a particular charge, for example on line rental in telecomms. The level of the cap was expressed as a percentage below the retail price index, providing direct safeguards to consumers by ensuring that the average price was reduced in real terms; the decrease, $X\%$, represented the real annual reduction in costs which the company was expected to pass on to consumers in lower prices. The company had every incentive to reduce costs by more than this amount, since it was able to keep any additional savings.

The determination of X became crucially important. When he recommended this system for BT, Stephen Littlechild (Littlechild, 1983) expected real competition to develop rapidly in the industry, so that the need for regulation (and resetting the price cap) would fade away. However in practice the telecomms cap did need resetting (on several occasions) and by the time the first review was undertaken in 1987, the gas industry had also been privatised, and there were active moves to sell the water and electricity industries. As Littlechild acknowledged in a later paper (Littlechild, 1986) those industries contained networks where competition would be both impracticable and wasteful because of their natural monopoly, and they would therefore require long term regulation. However the so called "RPI- X " system was seen as having important benefits, since it had revealed even greater efficiency savings within telecomms than had been expected. It seemed a good compromise between a pure incentive based system, where the company retained indefinitely all the benefits from increased efficiency, and one where the company had no incentive to reduce costs because such efficiencies were immediately passed on to consumers in the form of lower prices. The price cap system with periodic reviews effectively provided incentives for the companies to reduce costs within the price cap period, when they could retain the benefits, but for these benefits to be passed onto consumers through lower prices when the cap was next set. The power of the incentives depended on how short-sighted the companies were, and here the relative discount rates of the private and public sectors are advantageous: because the private discount rate is generally assumed to be higher, companies should be more short-sighted, reducing costs for short term gains; while consumers should be relatively content to be patient and wait for the efficiencies to be passed on.

Moreover this system appeared to mitigate the perennial problem of asymmetric information within the regulatory process. Companies always have more information about their own operation than do regulators, and in any detailed investigations the regulator will be dependent on information from the regulatee. Naturally the company is reluctant to divulge information which will be interpreted by the regulator to its own disadvantage. Periodic price caps seemed to offer a partial solution by leaving

the company to its own devices, at least between price reviews. During these periods the companies' own efforts to reduce their costs in response to the high powered incentives would provide some information which the regulator could use in the next review (though of course companies would be aware of this, and might accordingly behave strategically). Here the question of whether there were independent comparators for each company was of fundamental importance in maintaining the incentive properties of this kind of regulation.

Initial price caps were set as part of the privatisation process: since the Government at that stage still owned the industries and had a particular interest in the flotation proceeds, it naturally erred on the side of generosity to the companies in setting the caps². There was also very little information at this stage about potential efficiency savings within the industries. However in resetting the price limits, the only criterion available seemed to be to base it on ensuring a reasonable rate of return on capital to ensure an adequate return to investors, allowing for potential efficiency savings within the company. This raised two sets of questions. The first centred around how to value the capital base³ and what constituted a reasonable rate of return. The second was the appropriate cost savings to expect. Since the price cap determined revenue, its level should arguably be set at the minimum achievable average costs for the level of demand determined by the revenue cap, so the company would just be viable if it realised all possible efficiencies. The RPI-X system focuses on the reduction of costs, and this in turn depends on achieved and potential levels of productivity improvements, as well as changes in input prices. It is productivity change which is the focus of this paper, and has made efficiency and productivity growth such a central part of the UK system of regulation.

The question of potential efficiency savings varied somewhat between industries. Of the four utilities (telecomms, gas, water and electricity) two originally constituted integrated national monopolies, with a single company owning all the infrastructure (wires and switches in telecomms, pipes and meters in gas⁴). The water and electricity industries had traditionally been organised along regional lines, and this structure was reflected in the privatised industry, with fifteen regional electricity companies and ten Water and Sewerage Companies. Three of the electricity companies (in Scotland and Northern Ireland) are vertically integrated with generation and transmission, while the others are concerned only with local distribution and supply; there were also about twenty much smaller companies who had a monopoly to supply water (not sewerage services) in some regions. Thus for water and electricity it was possible to make comparisons between different companies, while the regulators also had to set

2 In every case the cap was tightened at the first periodic review, by which time the government had usually sold all its shares in the companies.

3 Most of the companies had been sold to investors at only a fraction of the replacement costs of the assets, raising questions about whether share owners should receive a return on the price originally paid for shares, or on the (much higher) valuation of the assets.

4 The gas transmission and distribution system (BG Transco) separated from supply (which retained the British Gas name) in 1997.

price caps for three national networks (in gas, telecomms and high voltage electricity transmission in England and Wales) for which there were no obvious comparators.

Separate regulators had been established for each industry⁵, providing four separate patterns of price review, and as many approaches to how to estimate potential efficiencies in the next price review period. The political climate has also changed over the fifteen years since BT was sold. The high powered incentives had proved almost too successful: while consumers have seen real reductions in prices in telecomms, gas and electricity, those have often been modest compared with the high profits which the companies were able to make by 'beating' the price cap. At the same time new incentives based on share options for senior managers led to large personal benefits as share prices rose dramatically in the immediate aftermath of privatisation. Those efficiency gains were mostly achieved by reducing labour employed, which was also politically sensitive, particularly at times of high unemployment in the early nineties.

One of the benefits of the price cap form of regulation was that it needed fewer resources to administer than the more interventionist US system, at least between price reviews; this 'hands-off' approach extended to the quality of service provided, leading to some deterioration in the immediate post privatisation period, before the respective regulators addressed them through explicit quality targets and controls. When a Labour government was elected in 1997 many of those concerns were reflected in a review of the regulatory process, leading to a policy White Paper in 1998, and the likely introduction of legislation to make some adjustments in the 1999/2000 parliamentary session. However the basic system of periodic price reviews, with price levels dependent on achieved and potential efficiency in the system, look set to stay for network parts of the industries with remaining monopoly.

The next section explains the ways in which productivity and efficiency studies have been used by regulators, and section 3 reviews assessments of the regulators' achievements. We focus here on efficiency in the 'production' sense; *i.e.*, the conversion of inputs to outputs, rather than the broader economic sense of whether the prices which utilities charge are efficient relative to their costs. Section 4 concludes.

B. Use of Efficiency and Productivity Measures in UK Utility Regulation

The previous section describes the importance of knowing about achieved and potential productivity improvement in determining the price caps for the regulated industries. Price reviews, where the caps for the next period are determined, are occasions of considerable activity by the regulators, the regulated industries and their respective advisers. The nature of this activity varies according to whether or not comparisons can be made within the industry. If there is only one company of a particular kind, as in the case of the incumbent telephone provider, BT, the gas network company, BG, and the electricity transmission company, National Grid

⁵ The gas and electricity regulators are being merged during 1999.

Company, direct comparators are hard to find; for the regional electricity companies (RECs) the Water and Sewerage Companies (WASCs) and the Water Only Companies (WOCs) some comparisons can be made between companies. To identify the role of productivity studies, we examine their use in the most recent relevant review. All the regulators engage in extensive public consultation before the determination of each price cap, and this offers some insight into their different approaches.

First we consider the companies which have no direct comparators. In all three industries new price caps were required from 1997: for retail prices and network charges in the still vertically integrated BT, for the gas transmission and distribution network, and for the high voltage national electricity transmission system. The telecomms regulator, Oftel, named BT's efficiency gains as one of four factors determining the appropriate level of X; he stated that he had 'taken the external evidence of current and future efficiency levels in other telecomms operators to reach a view on BT's likely productivity improvements' (Office of Telecommunications, 1996, p. 66); an efficiency study by an external consultant estimated that BT was 10% less efficient than the then most efficient operator, and that this 'efficient boundary' could itself be improved by 3.5% over the four years of the next review period. The combination of this 'boundary' improvement and some closing of the gap by BT led to a potential 4.5% reduction in BT's costs over the period. The measure of productivity is not stated, but is most likely labour productivity. Price caps for BT's interconnection charges to other companies were also set for the first time in 1997. Achievable efficiency improvements were modelled separately for capital and operating costs. Oftel assumed that over four years the asset base could be reduced by 3.5%, and operating productivity could be raised by 1.75% per annum (Office of Telecommunications, 1997). Despite the lack of *local* comparators, the consultants based the latter estimates on the most efficient US companies.

The gas regulator also took external advice in determining potential efficiency gains for setting the five year control for gas transportation and storage. She, too, sought separate advice on potential reductions in operating and capital expenditure (opex and capex), and this division has become accepted practice in price reviews, implying little scope for changing the balance between them. Such a separation may lead to particular problems where one factor (capex) is used to determine the levels of future price cap through the capital base. Rather than any external comparison, potential operating cost savings were identified by internal examination of the company, though this included a comparison between TransCo's different regions. A potential annual improvement of 3% in labour productivity was identified (Office of Gas Supply, 1996). Adjustment to the capital expenditure estimates seems to have been made on a more ad hoc basis, implying that the company was proposing to 'over-engineer' the system. Such behaviour would be consistent both with the operation of the Averch-Johnson effect, and a common practice, emerging amongst companies, to forecast high investment requirements at review time. They argued for increased revenue to finance such expenditure, and then discovered economies (which the company would retain until the next review) once the price cap had been determined.

The electricity regulator, OFFER, was considering future price controls for the National Grid company, and also separated operating and capital expenditure. OFFER took into account the company's past performance, the views of consultants on potential efficiency savings, and international comparisons. The latter were difficult because most transmission networks were much smaller than that serving England and Wales, but did suggest that NGC's non-labour costs were relatively high (Office of Electricity Regulation, 1996). Engineering consultants advised on the likely requirement for capital expenditure, and seem to have based their advice on a detailed examination of NGC's investment programme.

The latest price reviews for the regional electricity and water companies are now in their final stages. The regulators have announced their proposed levels of 'X' for each company⁶, and companies are arguing their cases before the regulators announce their final decisions in November. If the companies find those final proposals unacceptable the Competition Commission (successor to the Monopolies and Mergers Commission) will arbitrate. Here the regulators are able not only to assess the potential for overall efficiency increases in the industry, but also to compare different companies. The two regulators have used this opportunity rather differently.

The water regulator, the Office of Water Services (Ofwat), has prided itself on being particularly open in the processes which it uses in regulation. It produced a technical paper on assessing efficiency (Office of Water Services, 1998), and invited comments on its methodology. Ofwat uses a number of complementary methods to assess the appropriate level of X. Although one report suggested that total efficiency could be satisfactorily measured using Data Envelopment Analysis (Bosworth, Stoneman and Thanassoulis, 1996), the regulator decided that the problems of collecting reliable data precluded such an approach, though it has been used to check other methodologies in the previous price review. The scope for improvements in the industry as a whole are considered separately from the comparative efficiency of the companies within it; each is further divided into operating expenditure, capital maintenance expenditure and capital enhancement expenditure (most other regulators combine the last two categories in considering capital expenditure as a whole). The regulator then examined the relations between the areas. This breakdown enabled the regulator to examine the relative efficiency in operating expenditure together with capital maintenance expenditure, categories which may be substitutes for each other. To determine overall potential efficiency improvements, comparisons were made between the water sector and other UK sectors, both for operating and capital expenditure. Trends in other utilities, especially those subject to some degree of competition, suggested that there was scope for continued productivity increases in the water sector.

The main methodology comparing operating expenditure and capital maintenance cost between companies within each category is an econometric model using regression analysis to examine different categories of cost. This relationship is re-estimated on an annual basis, rather than using panel data covering several years. However in applying

6 X is expressed as '-K' in water, where K represents the annual permitted price increase.

this to determination of specific X factors the regulator also makes a qualitative assessment of the robustness of the analysis and its conclusions. The water case illustrates an interesting issue of measuring output. This is not an uncommon problem in industries which, although their product may appear homogeneous, are supplying in different places and at different times in the presence of considerable seasonal and/or diurnal fluctuations in demand. The current debate in water centres on how to measure the output of an industry most of whose residential consumers pay a fixed amount independent of consumption, so that revenue is not an adequate surrogate for demand. The traditional measure has been the quantity of water put into the system, but companies are reducing leakage, so that the ratio of water input to water consumed is rising. If water input is used, output appears to be falling at a time when it is known that demand and consumption are increasing. Quality improvements are also being implemented, so that quality-adjusted demand is rising still faster. This raises fundamental questions about the nature of the output in water, which might more appropriately be defined as access to the water and sewerage systems for consumers paying unmeasured charges. Using such an output measure might lead companies to degrade the quality of what the system delivers, and whichever measure is chosen significantly affects the outcome of productivity measures, and is strongly debated within the current review.

The review of the price caps for the Regional Electricity Companies also provides scope for comparisons between companies, and the regulator expressed his support for yardstick regulation. However he took a rather different approach from the water regulator, using a combination of qualitative and quantitative techniques. A variety of statistical techniques was discussed for benchmarking operating expenditure, including data envelopment and stochastic frontier analysis, but in practice the regulator restricted himself to a regression analysis of one year's data. He states that "the regression analysis forms only part of the overall assessment of operating costs, which is principally informed by the work of PKF and Peter Warry" (Office of Gas and Electricity Markets, 1999, p. 25). The consultant PKF analysed the efficiency of the firms through responses to business plan questionnaires, and used this information to identify past cost improvements, benchmark costs for the main business activities and examine human resource and IT costs, producing a range of potential cost savings for each company. A second consultant then assessed the regression and PKF evidence to reach an overall assessment of each company's efficiency. Capital expenditure allowance was based on a model of the investment required by each company to deliver a forecast load at the required quality of supply. As for water, expenditure to connect new customers and extend the system was distinguished from reinforcement expenditure, and potential cost savings modelled separately. A significant proportion of the draft proposals document was devoted to the issue of quality of supply, which would affect both categories of capital expenditure. Those estimates were then used to assess the allowed average price cap.

Although they are somewhat different, both the regulators who compare companies are effectively identifying best practice within the industries, and setting price caps on the basis of such best practice. This gives rise to practical difficulties of ensuring that all exogenous factors, outside each company's control, are accounted for, leading to

much 'special pleading'. While efficient companies are generally given some 'reward' in the form of a cap less close to their supposed achievable boundary, the system is based on the principle that each firm can indeed achieve 'best practice'. Regulation is supposed to mimic the discipline of a competitive market, yet in such markets a variety of levels of efficiency are generally observed at any one time. Regulators however seem to envisage an ideal world where everyone is working at their respective efficient boundaries when they set the cap. The fact that companies so frequently outperform those tough ideals can be interpreted either as a victory for the system of incentive regulation, or as a failure by regulators to overcome the problems of asymmetric information. Which verdict is chosen depends largely on independent evidence on the changes in productivity and efficiency which have been achieved by the industries under the current regulatory regime. The next section reports how productivity analysis has been used in such assessments.

C. Assessment of Regulatory Reform in the UK

The UK regulatory regime was introduced when the industries were sold into the private sector, and coincided with a move to introduce more competition, making it difficult to identify the effects of each separate policy (for a review see Markou and Waddams Price, 1999). Initial studies of productivity changes focused on the change of ownership from public to private. A number of studies were undertaken in the post privatisation period to assess how the flotation of the shares on the stock exchange had affected the companies' efficiency. One interesting aspect of those studies has been the identification of the timing of any productivity changes, which do not generally coincide with the year of privatisation. These various studies are reported on an industry by industry basis, although some studies cover several industries.

An early study by Bishop and Kay (1988) questioned how far the advantages claimed for privatisation had been realised, though British Telecom was the only utility which had then been privatised for long enough to be included. They constructed composite output and input indices to measure trends in total factor productivity, and found that at that stage there was little evidence that the change of ownership itself made much difference, and that competitive market forces were much more significant in productivity growth than the flotation of shares. In a follow-up study Bishop and Green (1995) tested how well these improvements had weathered the recession of the early nineties. In view of the relatively stable demand for utility products it is not surprising that the recession had relatively little effect on total factor productivity; again they concluded that competition rather than regulation had the strongest positive influence on productivity. Moreover they noted similar results for the Post Office which had stayed in public ownership, and they remained dubious about long term and permanent efficiency gains from privatisation. Parker and Martin (1995) and Martin and Parker (1997) used data envelopment analysis across several privatised industries to measure changes both in labour and total factor productivity, but included only two utilities, British Telecomms and British Gas. They examined six periods for each industry: nationalisation, pre-privatisation, post- announcement, post-privatisation, recession and most recent (where applicable).

Performance of individual industries was assessed both in those 'general' papers and in others which addressed the issues in particular industries. British Telecom, the first to be privatised in 1984, is different from other utilities in a number of respects, especially in enjoying considerable technical development over the last fifteen years which has fundamentally changed the economic characteristics of the industry. For example, the natural monopoly element, which characterises all the utilities and necessitates regulation, has changed considerably in telecomms, moving from the local loop to the local switch over the past fifteen years; cables laid for entertainment, but also available for telecomms, now duplicate the local fixed telephony loop in many UK cities. At the same time the development of electronic communications and mobile telephony have drastically changed usage patterns. It is difficult to disentangle the effect of regulatory reform from those various other influences. Forreman-Peck and Millward (1994) reported a drop in total factor productivity immediately before privatisation, but an increase back towards pre-privatisation levels in 1985-88. Parker and Martin find largely similar results, with a drop in productivity post-announcement (as measured by a Tornquist index), and an increase in the late eighties, but not to nationalisation levels. In contrast labour productivity increased over the period, showing considerable factor substitution.

British Gas, privatised in 1986, shows similar increases in efficiency just prior to privatisation. Parker and Martin use a Tornquist index to measure total factor productivity, and find it increases in the period before flotation, but becomes negative in the post-privatisation recession. Bishop and Kay (1988) find a similar increase immediately before and after privatisation, but Bishop and Green find a reduced growth rate (but still positive) during the recession of 1989-94. Waddams Price and Weyman-Jones find a similar phenomenon of a pre-privatisation surge in the total productivity measured by an output weighted Malmquist index. Labour productivity shows similar general trends until the recession period, immediately after privatisation, when it increases; combined with a fall in total productivity, this indicates considerable factor substitution away from labour. Comparison of a panel of the different operating regions of British Gas indicates that the increase in efficiency is almost entirely due to shifting the frontier, rather than any significant catching up by the less efficient regions, suggesting a lost opportunity in not separating the regions at privatisation and using comparisons between them to impose yardstick regulation.

There are fewer academic studies of the water industry, privatised in 1989, though both the regulator and the companies have undertaken their own studies (described above), most of which remain commercially confidential. Markou and Waddams Price find a simple measure of real turnover per labour employed has continued a rising trend since before privatisation, and seems to have turned sharply upwards in recent years. Hunt and Lynk (1995) estimate the efficiency not of the water industry itself, but of the separation of the economic and environmental regulation introduced at privatisation. They estimate that this policy sacrificed economies of scope which increased cost by between 6% and 18%.

Electricity, privatised in 1990, and subject to least comparative statistical analysis by its regulator, has been the subject of a number of academic comparisons. Weyman-

Jones (1994) described some of the difficulties of imposing yardstick competition in the industry; using data envelopment analysis he reported that both mean and minimum levels of efficiency amongst the companies improved immediately prior to privatisation, and that the variance of efficiency fell, consistent with the studies of other industries. Burns and Weyman-Jones (1996) used stochastic frontier cost estimation on data which covered the early years of privatisation, and reported a significant positive effect on cost efficiency immediately post privatisation, though this might be due to changing accounting conventions at flotation. This analysis was updated by Tilley and Weyman-Jones (1999); disaggregation of Malmquist indices shows that productivity growth in the industry was entirely achieved by an outward shift of the frontier, rather than to any catching up process. Privatisation is providing incentives to innovate, but not for the less efficient firms to catch up, suggesting that the separation of regions suggested for the gas industry is not delivering effective benefits in electricity, and that in this respect yardstick regulation of the distribution companies is ineffective.

Newbery and Pollitt (1997) undertook a cost benefit analysis of the structural and regulatory changes to the generation and high voltage transmission system, and concluded from comparison with a counterfactual situation that there was a substantial improvement in the operating efficiency of the companies, partly due to the abandonment of the nuclear programme, and largely achieved through more than doubling labour productivity.

O'Mahony (1999) has examined productivity on a sectoral basis from 1950 to 1996, comparing both labour and total factor productivity in the UK with the US and Germany. Labour productivity was measured by output per hour, and total factor productivity using a standard growth accounting methodology, weighting capital by its share in value added. Levels of total factor productivity lagged behind the US in each of the electricity, gas and telecomms sectors, and for gas, electricity and water taken together. However the UK was more productive than Germany in all those sectors except gas. But it was the pattern of changes over the period which was most remarkable, showing a much greater increase in labour productivity for the UK than other countries in each of those sectors in the 1989-96 period. Although labour productivity still lags behind the US in each sector, and behind Germany in gas, the difference in UK growth rates before and after privatisation, and between the UK and other countries in the post-privatisation period is very marked. As O'Mahony remarks, "It is unlikely to be a coincidence that Britain's large labour productivity gains in those sectors came at a time of deregulation".

Overall those various productivity studies point to a number of conclusions. The privatisation and reregulation of the UK utilities resulted in a major increase in labour productivity, and a smaller increase in total factor productivity. There may be substitution between labour and materials which decreases material productivity, but may not be captured in value-added measures of total productivity. Those changes are often associated with corporate restructuring prior to flotation. Much greater increases in efficiency are associated with industries, or those parts of them, which are exposed to competitive forces. Overall costs are probably lower in those industries

than they would have been if they had remained in the public sector under the previous control régime, largely due to reductions in employment; some of those cost savings have been passed on to consumers. Meanwhile there is growing political concern in the UK about the ‘fairness’ of the division of benefits, and about other aspects such as quality of service and safety.

D. Conclusions

The claims made for the success of the UK programme of regulatory reform rest on the high powered incentives which it provides to companies to improve their productivity. However the incentives themselves are limited by the need to reset the price caps - essentially a balance between the efficiency incentives themselves and the equity concerns of forcing the companies to share their effects with consumers. Much of the political debate now centres around those distributional issues, focusing on allegations that consumers have not received a sufficient share of the benefits. There are also concerns about quality of supply, which may need separate regulation, as is being suggested for safety in the railway industry in the light of recent accidents. Productivity studies are a crucial tool for regulators in resetting the caps, when they need to assess both realised cost reductions, and the potential for further efficiency gains during the next regulatory period. Because the UK system depends on independent regulators who have used their (typically British) discretion to develop a variety of regulatory review procedures, they display considerable variation in using productivity studies, even in industries as similar as those within the utility sector. There is considerable scope for greater use of productivity studies to inform regulators in implementing the price cap system within the UK.

Productivity studies assessing UK regulatory reform have used a variety of models and definitions for assessing productivity and its change. All are agreed that labour productivity has increased ahead of the rest of the economy and faster than similar sectors in other countries. The verdict on total factor productivity is a little more mixed, with many studies finding that productivity improvements precede rather than follow flotation, and suggesting that private ownership and explicit regulation may be less important than corporate restructuring in preparation for privatisation.

Regulatory reform is high on the agenda both of the UK, where issues of social and environmental concern are forcing some rethinking of the current framework, and in other countries who may consider emulating the UK example. Several European countries are reorganising their telecomms and energy industries to conform with the European Union directives, and many developing countries find such a programme a prerequisite for receipt of international aid. However those countries are far from identical in the characteristics of their utility sectors and in the likely impact of such reforms. Cultural expectations and legal framework are particularly crucial to the appropriateness and political success of reform in this sector which is so central to industry and households. In this context it is crucial that regulators can obtain reliable and impartial information about productivity changes which is not subject to changes by ‘special pleading’ from interested companies. Similar impartial analysis is

important in assessing the regulatory process in each particular context and learning lessons from experience. The challenge is to incorporate new dimensions into productivity, including quality and reliability of service, so that the powerful incentives generated by the process are appropriately directed. Ironically it is in incorporating *non efficiency* aspects of government policy where productivity studies can expand their scope to provide a broader focus, reflecting the different priorities and weights which governments may hold. As techniques continue to develop, such studies have much to offer both in the implementation and in the assessment of utility regulation world-wide.

REFERENCES

- Averch, J. and Johnson, L., 1962, "Behavior of the firm under regulatory constraint", *American Economic Review*, 52, 1052-69.
- Bishop, M. and Green, M., 1995, *Privatisation and Recession - The Miracle Tested*, Centre for the Study of Regulated Industries, discussion paper 10, London.
- and Kay, J., 1988, *Does privatization work? Lessons from the UK*, Centre for Business Strategy, London Business School, London.
- and D. Thompson, 1992, "Regulatory Reform and Productivity Growth in the UK's Public Utilities", *Applied Economics*, 24, 11.
- Bosworth, D., P. Stoneman and E. Thanassoulis, 1996, "The measurement of comparative total efficiency in the water and sewerage industry: An exploratory study", available in the Office of Water Services library, Birmingham.
- Burns, P. and Weyman-Jones, T., 1996, "Cost functions and cost efficiency in electricity distribution: a stochastic frontier approach", *Bulletin of Economic Research*, 48, I, pp. 41 -64.
- Foreman-Peck, J. and Millward, R., 1994, *Public and Private Ownership of British Industry 1820-1990*, Clarendon Press, Oxford.
- Hunt, L. and Lynk, E., 1995, "Privatisation and efficiency in the UK water industry: an empirical analysis", *Oxford Bulletin of Economics and Statistics*, 57, 3, 371-388.
- Littlechild, S., 1983, *Regulation of British Telecommunications Profitability*, HMSO, London.
- , 1986, *Economic regulation of privatised water authorities*, HMSO, London.
- Markou, E. and Waddams Price, C., 1999, "UK utilities: Past reform and current proposals", *Annals of Public and Co-operative Economics*, September, forthcoming.
- Newbery, D., and M. Pollitt, 1997, *The restructuring and privatisation of the CEBG: Was it worth it?* *Journal of Industrial Economics*, XVI, 3, September, forthcoming.

Office of Electricity Regulation, 1996, *The Transmission Price Control Review of the National Grid Company: Proposals*, Birmingham, October.

Office of Gas and Electricity Markets, 1999, "Review of Public electricity Suppliers 1998 to 2000", *Distribution Price Control Review Draft Proposals*, London, August.

Office of Gas Supply, 1996, 1997 "Price Control Review British Gas Transportation and Storage: The Director General's final proposals", London, August.

Office of Telecommunications, 1996, "Pricing of Telecommunications Services from 1997", London, March.

—, 1997, "Network charges from 1997", London, July.

Office of Water Services, 1998, "Assessing the scope for future improvements in water company efficiency, a Technical paper", April, Birmingham.

O'Mahony, M., 1999, *Britain's Productivity Performance 1950-1996, an international perspective*, National Institute of Economic and Social Research, London.

Parker, D. and Martin, S., 1995, "The impact of UK privatisation on labour and total factor productivity", *Scottish Journal of Political Economy*, 42, 2, 201-220.

Martin, S and Parker, D., 1997, *Ownership and Corporate Performance in the UK*, Routledge, London.

Tilley, B and Weyman-Jones, T., 1999, "Productivity growth and efficiency change in electricity distribution", paper presented to the British Institute of Energy Economics, Oxford, September.

Waddams Price, C. and Weyman-Jones, T., 1996, "Malmquist indices of productivity change in the UK gas industry before and after privatisation", *Applied Economics*, 28, 29-39.

Weyman-Jones, T., 1995, "Problems of Yardstick Regulation in Electricity Distribution" in Bishop, Kay and Mayer (eds.), *The Regulatory Challenge*, Oxford University Press, pp. 423-444.