

ADB Institute Discussion Paper No. 6

INFRASTRUCTURE REGULATION: MODELS FOR DEVELOPING ASIA

Colin Kirkpatrick and David Parker

May 2004

Colin Kirkpatrick is at the Institute for Development Policy and Management University of Manchester, UK and David Parker is at the School of Management Cranfield University, UK. The views expressed in this paper are those of the authors and do not necessarily reflect the view or policies of the Asian Development Bank Institute.

Contents

1. INTRODUCTION.....	1
2. PRIVATE PARTICIPATION IN INFRASTRUCTURE IN DEVELOPING COUNTRIES	3
3. THEORY OF ECONOMIC REGULATION: A FRAMEWORK FOR ANALYSING PRACTICE IN DEVELOPING ASIA.....	8
4. REGULATING PRICES AND PROFITS IN UTILITIES	11
4.1 Introduction	11
4.2 Price Cap Regulation	13
4.3 Rate of Return Regulation.....	17
4.4 Sliding Scale Regulation	19
4.5 Social Regulation	22
5. DEVELOPING COUNTRY EXPERIENCE WITH PRICE AND PROFIT REGULATION.....	24
6. UTILITY REGULATION IN DEVELOPING COUNTRIES: THE ELECTRICITY AND WATER SECTORS	30
6.1 Introduction	30
6.2 Reform of the Electricity Sector.....	31
6.3 Reform of the Water Sector	33
7. REGULATORY CAPACITY AND GOVERNANCE IN DEVELOPING COUNTRIES.....	40
8. AREAS FOR FUTURE RESEARCH ON INFRASTRUCTURE REGULATION IN ASIA.....	42
Appendix 1:	Electricity Sector Reform in Developing Countries: An Econometric Analysis of the Effects of Privatisation, Competition and Regulation
Appendix 2:	State versus Private Sector Provision of Water Services in Sub-Saharan Africa : Empirical Evidence on Comparative Performance
Appendix 3:	Regulatory Impact Assessment in Developing and Transition Countries: Current Practice

Tables

Table 1: Top 10 Developing Countries by Cumulative Investment in Infrastructure Projects with Private Participation, 1990 – 2001	6
Table 2: Types of Private Water and Sewerage Projects in Developing Countries, 1990-2002	7
Table 3: Largest Investments in Water Services in Developing Countries, 1990-2002	8
Table 4: Summary of the Relative Advantages of Rate of Return, Price Cap and Sliding-scale Regulation in Developing Economies	20
Table 5: Linkages between Infrastructure Reform and the Poor.....	22
Table 6: Tariff Regulation in Latin America	25
Table 7: Methods of Regulation Used	28
Table 8: A Comparison of the Reported Difficulties Faced when Operating Price Caps and Rate of Return Regulation in Developing and Transition Economies.....	28
Table 9: Performance Ratios in African Water Utilities: 1999-2001	36
Table A1.1: Electricity Sector Regression Results	48
Table A2.1: Variables in the Stochastic Cost Function	52
Table A2.2: Cost Function.....	52
Table A2.3: Testing for the Importance of Regulation.....	53
Table A3.1: The Use of RIA in Developing and Transition Countries	55

Figures:

Figure 1: Cumulative Investment in Infrastructure Projects with Private Participation by region, 1990 – 2001	4
Figure 2: Cumulative Investment in Infrastructure Projects with Private Participation by Type and Region, 1990 –2001.....	5
Figure 3: Cumulative Investment in Infrastructure Projects with Private Participation by Sector, Developing Countries, 1990-2001	7

1. Introduction

An essential requirement for economic growth and sustainable development is the provision of efficient, reliable and affordable infrastructure services, such as water and sanitation, power, transport and telecommunications. Traditionally, infrastructure was the exclusive province of the public sector, with large, state-owned enterprises (SOEs) being responsible for investment and service delivery. Typically, the SOE sector was a costly and inefficient provider of infrastructure in most developing countries.¹ However, encouraged by international organisations such as the World Bank, privatisation has been a major component of the economic reform programmes pursued by many developing countries over the past two decades (Parker and Kirkpatrick, 2004a). Privatisation was predicted to promote more efficient operations, increase investment and service coverage, and to reduce the financial burden on government budgets (World Bank, 1995). Much of the early privatisation activity was concentrated in the manufacturing sector, but recent years have seen donor agencies advocating the privatisation of utility industries in developing countries and the introduction of semi-autonomous, dedicated regulatory bodies for these industries within government (World Bank, 1995, 1997). A large number of developing countries have introduced some private participation into their infrastructure industries, especially telecommunications, and to a lesser degree in electricity and water.

Utilities such as water supply, gas, electricity and telecommunications and certain modes of transport such as rail, include natural monopoly characteristics arising from pervasive economies of scale and scope. These characteristics mean that competition is unlikely to develop, or if it develops it will be uneconomic because of the duplication of assets. Although technological advances, notably in telecommunications, have whittled away some of the natural monopoly characteristics in utilities, permitting economic competition in certain areas of service delivery, nevertheless each of the utilities retains some natural monopoly features. As a consequence, privatisation of these industries, in whole or in part, risks the introduction of private-sector monopolies that will exploit their economic power in the market place, leading to supernormal profits (high 'producer surplus') and reduced consumer welfare (a lower 'consumer surplus'). Consumers suffer from no or a limited choice of goods and services and face monopoly prices.

To prevent this result, governments need to develop strong regulatory capabilities so that they can police the revenues and costs of production of the privatised utility firms and protect consumers from monopoly exploitation. It is argued that privatisation leads to greater incentives for managers to pursue productive efficiency because of the superior principal-agent relationship in the private sector compared to government (Vickers and Yarrow, 1988; Bös, 1994). But at the same time, in the absence of the threat of competition, managers could dissipate potential cost savings through padding their staffing, raising their own salaries and by pursuing an 'easy life' (Martin and Parker, 1997, ch.1). The results of privatisation where private-sector monopolies are created are therefore uncertain and this is borne out by empirical studies that have demonstrated that the greatest cost savings from privatisation occur in competitive industries (e.g. Vickers and Yarrow, 1988; Martin and Parker, 1997; Kikeri and Nellis, 2001). Moreover, monopoly firms price above their marginal costs of production leading to allocative inefficiency. It is, therefore, the task of the regulatory office to ensure that productive and allocative efficiency gains occur and that consumers benefit from lower prices and improved services.

As DFID (2000a, pp23-25) comments: 'Effective governments are needed to build the legal, institutional and regulatory framework without which market reforms can go badly wrong, at great cost – particularly for the poor.' This suggestion is supported by a growing body of empirical evidence that confirms that the quality of the regulatory environment has a significant effect on an economy's growth performance (Jalilian et al, 2003; Alexander and Estache, 1999). More particularly, in the case of utilities, the evidence confirms that

privatisation brings greater benefits when it is accompanied by an effective regulatory regime (Wallsten, 2001; Zhang et al., 2003a,b; Pargal, 2003). A large number of developing countries have introduced new, dedicated regulatory offices to supervise the activities of their privatised utilities, sometimes even when the utilities remain wholly or largely state owned. Most of these regulatory offices are expected to have some degree of independence from day-to-day political control, although in practice political intervention seems to occur in a number of countries (Cook et al. (eds) 2004).

Utility industries provide essential public services, and have an important role to play in meeting the needs of the poor (Willoughby, 2003). Often, the poor in developing countries suffer from both a high degree of exclusion from access to infrastructure services, and from poor quality of those services they purchase (Clarke and Wallsten, 2002). This suggests that regulation in developing countries may face a greater dichotomy than in developed countries between promoting economic and social goals (Smith, 2000). What is deemed regulatory ineffectiveness in one context, for instance, a failure to remove cross-subsidies that favour the poor, may not be in another context where poverty reduction is a primary goal of public policy. In practice, the industry regulator will need to pay detailed attention to tariffs so as to balance the need to supply poor households with affordable infrastructure services, with ensuring that companies earn sufficient profits to satisfy their investors. This may involve the use of subsidies to suppress tariffs, as for example, in the output-based aid (OBA) approach where the payment of a subsidy to the operator is made conditional on the private operator having delivered the specified output or performance measure (Brook and Smith, 2003).

Despite the importance of regulation in affecting the performance of privatised utilities, comparatively little consideration has been given to the detailed design of institutional structures and regulatory instruments appropriate to the conditions and capacities that characterise different developing countries. In most cases the new regulatory offices that have been created have been modelled on those in Western Europe, the USA or Australia. At the same time, there exists no comprehensive audit of the methods used by regulatory bodies in developing countries, although it does seem that, here again, advanced country practice has been followed, as for example in the widespread adoption of the price cap form of regulation, at least in Latin America (Guasch, 2001).

The objective of this paper is to review the experience of infrastructure regulation in low and middle income countries, to assess the applicability of this experience to developing Asia, and to identify areas for future research on infrastructure regulation in the low and middle income economies of the Asia region.

The paper is structured as follows. The next section reviews the recent growth in private participation in infrastructure in developing countries and describes the sectoral and geographical distribution of private investment in infrastructure. The third section is concerned with the theory of economic regulation, which is used to provide a framework for analysing regulation in developing countries. Section 4 deals with models for regulating prices and profits in utilities. Section 5 reviews the evidence on the use of different models for price and profit regulation in developing countries. The focus in section 6 is on the electricity and water sectors. A review of the evidence on the process and results of privatisation in each sector serves to highlight the differences in the characteristics of the electricity and water sectors, which are then related to a discussion of regulation design for each sector. Section 7 discusses issues of regulatory capacity and regulatory governance in developing countries. The final section proposes a methodological framework for conducting research on infrastructure regulation and identifies a number of issues for future research on infrastructure regulation in developing Asia.

2. Private Participation In Infrastructure In Developing Countries

The 1990s saw a sharp decline in the level of donor support for infrastructure projects in developing countries. Aggregate flows of aid for the infrastructure sector halved during the course of the decade, to \$8billion in 1999 (Willoughby, 2003). This shift away from infrastructure projects reflected the disappointment of donors with the performance of the infrastructure sector, which was often inefficient, poorly managed, socially and environmentally damaging, and lacking a clear and accountable process of governance to control corrupt practices (World Bank, 1994; DFID, 2002). In contrast to the decline in official aid, private capital flows for infrastructure increased significantly during the 1990s, in response to the general trend towards privatisation of infrastructure in developing countries. According to the World Bank's Private Participation in Infrastructure (PPI) database, 26 countries awarded 72 infrastructure projects with private participation in 1984-89, attracting almost \$19billion in investment commitments. In the 1990s, 132 low- and middle- income countries pursued private participation in infrastructure – 57 of them in three of the sectors covered in the database, or in all four (transport, energy, telecommunications, and water and sewerage). In 1990-2001 developing countries transferred to the private sector the operating risk for almost 2,500 infrastructure projects, attracting investment commitments of more than \$750billion. Annual investment commitments for infrastructure projects with private participation grew steadily from 1990 to a peak of \$128billion in 1997. After 1997, annual investment in infrastructure declined, and by 2001 had returned to a level similar to that in 1995.

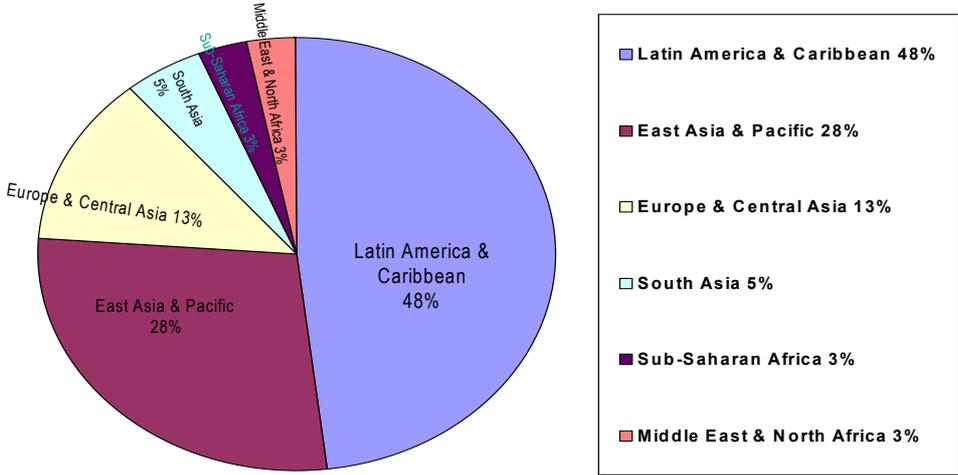
Private infrastructure projects have taken a number of forms:

- Management and lease contracts. A private entity takes over the management of the state owned enterprise for a given period. The facility is owned by the public sector and investment decisions and financial responsibilities also remain with the public sector.
- Concessions. A private entity takes over the management of a SOE for a given period during which it also assumes significant investment risk. The ownership of the facility reverts back to the public sector at the end of the concession period.
- Greenfield projects. A private entity or a public-private joint venture builds and operates a new facility for the period specified in the project contract. The facility may return to the public sector at the end of the contract period, or may remain in private ownership
- Divestitures (Privatisation). A private entity buys an equity stake in a SOE through an asset sale, public offering or mass privatisation programme.

Over the period 1990-2001, divestitures accounted for 41% (\$312billion) of total private participation infrastructure projects in developing countries, greenfield projects accounted for 42% and concessions for 16% (World Bank,2003a).

Among the developing regions, Latin America and the Caribbean accounted for 48% of the cumulative investment in infrastructure (figure1).In this region private participation in infrastructure was often part of a broader sectoral reform programme, aimed at enhancing performance through private operation and competition and generating the financial resources needed to improve service coverage and quality through tariff adjustments World Bank, 2003a, p2-3). Under this approach divestitures and concessions of existing assets predominated, accounting for 75% of the cumulative investment in private infrastructure projects in Latin America during the period (figure 2). In more recent years, Latin America's dominance of investment in infrastructure has declined, from 80% in 1990 to 40% in 2001, as other regions have opened their infrastructure sector to private participation.

Figure 1: Cumulative Investment in Infrastructure Projects with Private Participation by region, 1990 – 2001

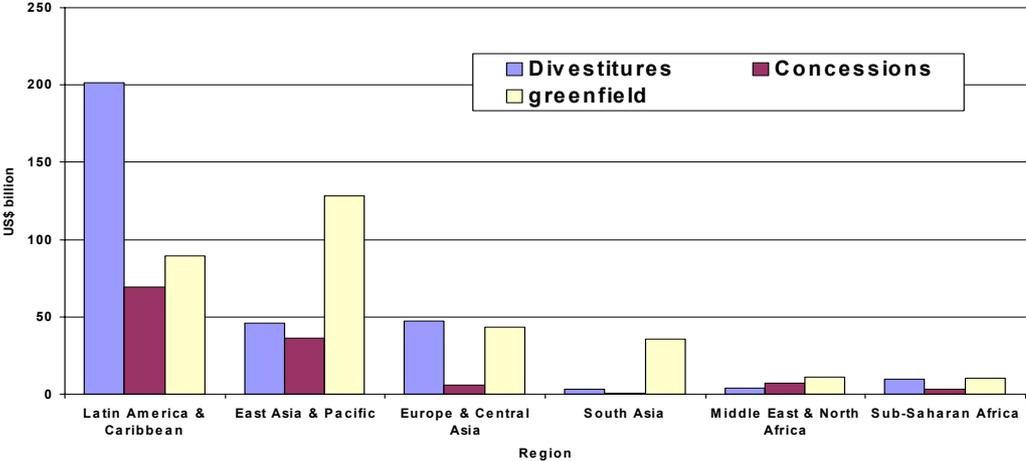


World Bank Overview : US\$ billion

Source: World Bank (2003a)

East Asia and Pacific has been the second largest recipient of private investment in infrastructure. Over the period 1990-2001 it accounted for 28% of cumulative private participation in infrastructure in developing countries (Figure 1). In contrast to Latin America, the Asia region has focused on the creation of new assets through greenfield projects, which accounted for 61% of the investment in East Asia in 1990-2001 (figure2). The Asian financial crisis of 1997-8 saw the region’s share in annual investment in infrastructure decline from 40% in 1996 to 11% in 1998, before recovering to 28% in 2001.

Figure 2: Cumulative Investment in Infrastructure Projects with Private Participation by Type and Region, 1990 –2001.



Sou

Source: World Bank (2003a)

Although private activity in infrastructure grew rapidly among developing countries, and particularly in Latin America and Asia, a small number of countries accounted for most of the investment. The 10 countries attracting the most investment in projects with private participation accounted for 68% of the cumulative investment in 1990-2001 and accounted for 47% of the projects. The leading Latin American economies were Brazil, Argentina, and Mexico. In Asia, the main economies were PRC, Malaysia, the Republic of Korea, the Philippines and India (Table 1).

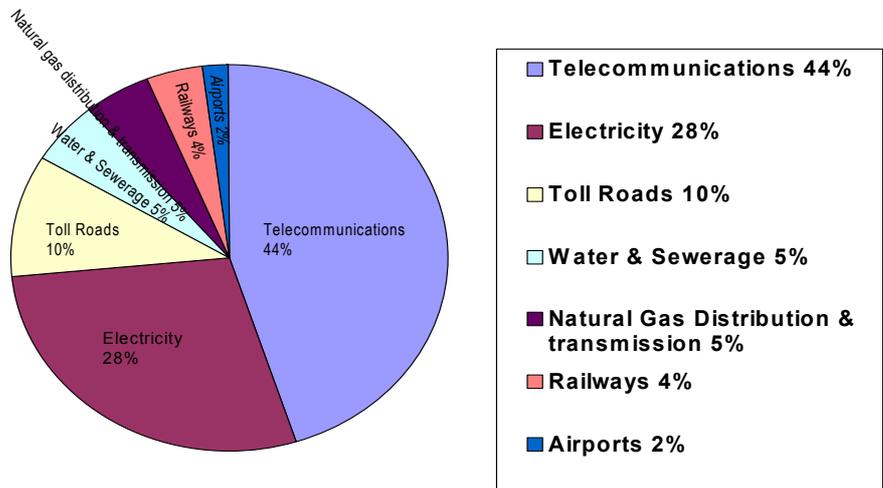
Table 1: Top 10 Developing Countries by Cumulative Investment in Infrastructure Projects with Private Participation, 1990 – 2001.

COUNTRY	INVESTMENT (2001 US \$ billion)	PROJECTS
Brazil	135.4	203
Argentina	82.6	165
Mexico	60.0	130
PRC	53.8	283
Malaysia	36.6	63
Republic of Korea	33.2	26
Philippines	32.1	67
Indonesia	28.9	62
India	27.7	122
Thailand	23.9	73
Total for Top 10	513.1	1.188
Total for All Developing Countries	754.1	2.494

Source: World Bank (2003a), Table 1.4

Private participation in infrastructure in developing countries has been concentrated in the telecommunications sector which accounted for 44% of the cumulative investment in 1990-2001 (figure 3). Energy, which includes electricity and the transmission and distribution of natural gas, attracted the second largest share of investment. Electricity accounted for 28% of the cumulative investment in private infrastructure projects in 1990-2001. Private participation in electricity has increased as a result of technological developments that have reduced the minimum size of efficient power plants. Much of the private investment in electricity has been in greenfield projects with independent power producers implementing buy-operate-own (BOO) or buy-operate-transfer (BOT) contracts.

Figure 3: Cumulative Investment in Infrastructure Projects with Private Participation by Sector, Developing Countries, 1990-2001



Source: World Bank (2003a)

In contrast, private participation in the water and sewerage sector has been limited, accounting for 5% of cumulative investments over the period 1990-2001. The limited amount of private involvement in water utilities is likely to reflect the inherent difficulties that face privatisation in this sector, in terms of the technology of water provision and the nature of the product, transaction costs and regulatory weaknesses. Where there has been private participation in water and sewerage, it has mainly been in the form of transferring vertically integrated water utilities through concessions. Of the 233 water projects on the World Bank PPI Project Database, 40% involved concession contracts and these accounted for 64% of the total amount invested (table 2). The private investments in water projects have been concentrated in a small number of developing countries, and within these countries the figures were dominated by a few large contracts. In the Philippines, for example, five contracts accounted for 38.4% of the total private investment in water services in East Asia (table 3).

Table 2: Types of Private Water and Sewerage Projects in Developing Countries, 1990-2002

Type	Total investment (US\$bn.)*	%	No. of Projects	%
Concessions	22.31	64	93	40
Greenfield	7.00	20	75	32
Operations and management	0.18	0.5	46	20
Divestiture	5.48	15.6	19	8

*This is the total invested in projects with private participation and not necessarily the private sector's commitment alone.

Source: calculated using data from the World Bank PPI Project Database, <http://rru.worldbank.org/PPI>

Table 3: Largest Investments in Water Services in Developing Countries, 1990-2002

	US\$bn	No. of projects
Argentina	7.23	10
Philippines	5.87	5
Chile	3.95	13
Brazil	3.17	33
Malaysia	2.75	6
PRC	1.93	44
Romania	1.04	3
Turkey	0.94	2
Indonesia	0.92	8

Source: calculated using data from the World Bank PPI Project Database, <http://rru.worldbank.org/PPI>

3. Theory Of Economic Regulation: A Framework For Analysing Practice In Developing Asia

The theory of economic regulation developed from the nineteenth century and the literature is now vast (for recent reviews e.g. Laffont and Tirole, 1993, 2000; Levy and Spiller, 1994; Newbery, 1999). The case for economic regulation of public utility markets is premised on the existence of significant market failure resulting from economies of scale and scope in production, that lead to higher unit costs if more than one firm competes in the market. Another possible source of market failure is information asymmetries in market transacting. Markets are able to maximise social welfare where consumers and producers are perfectly (or at least well) informed when making choices in the market place. Where one party to a transaction has more information than the other about the quantity or quality of the outputs to be transacted, a condition known as ‘asymmetric information’, then this party could act ‘opportunistically’, exploiting its superior knowledge to gain utility at the expense of the other party.

Since the 1960s, however, the economics of regulation literature has also focussed on circumstances where we might expect to find ‘regulatory failure’, that is to say circumstances where the regulation of markets might reduce rather than increase economic welfare. The seminal study in this literature is that by Averch and Johnson who, in 1962 presented a model of how regulation of a firm’s rate of return could lead to incentives to over-invest (Averch and Johnson, 1962). Following publication of this paper, studies highlighted other potential inefficiencies that could be introduced by rate of return regulation, notably distorted service quality and higher operating costs (e.g. Bailey, 1973).

Today the economics of regulation literature includes the following propositions (for further discussion on these propositions see e.g. Kahn, 1988; Sidak and Spulber, 1997; Baldwin and Cave, 1999; Joskow, 2000; Viscusi, Vernon and Harrington Jr., 2000).

- *The institutional context is critical to the process and outcomes of a regulatory regime.* As Granovetter (1985) recognised in his study of ‘embeddedness’, behaviour and institutions are constrained by social relations. This is true of any regulatory regime, which will be embodied in the specific institutional context of a country as reflected in its formal and informal rules of economic transacting and social behaviour. As Picciotto (1999, p.3) comments: ‘In all societies formal rules enacted by the state influence social behaviour only indirectly, filtered through layers of formal and informal social institutions, and

normative patterns and practices'. In turn these institutional effects are credited with having important effects on the trajectory of economic development (Lal, 1999, ch.3). In consequence, the World Bank has been criticised for adopting an 'under-socialised approach' to policy reform (Torp and Rekve, 1998, p.80).

Regulation in economies involves the setting of particular rules regarding market structure and business conduct and these rules both arise out of and influence the future shape of economic institutions. Levy and Spiller (1994) focus on regulatory arrangements to sustain private investment and how these vary with the institutional endowment in different countries. Also, 'new institutional economics' has had an impact on the economics of regulation especially through transaction cost theory. Transaction cost economics is concerned with the costs that enter into market transacting and that are associated with policing opportunistic behaviour in markets (Williamson, 1985; Allen, 1991). Economic development is seen not as simply a matter of amassing economic resources in the form of physical and human capital but a matter of 'institution building' so as to reduce information imperfections, maximise economic incentives and reduce transaction costs. Included in this institution building are the laws and political and social rules and conventions that are the basis for successful market production and exchange. Another important consideration is 'culture' or the way of doing things in society, which forms in North's analysis one of the 'informal' constraints on human interaction (North, 1990, 1991). Particularly relevant modes of conduct in the context of the regulatory state would seem to include probity in public administration, independence of the courts, low corruption and cronyism, and traditions of civic responsibility.

- *Regulation is associated with information asymmetries.* The regulator and the regulated can be expected to have different levels of information about such matters as costs, revenues and demand. The regulated company holds the information that the regulator needs to regulate optimally and the regulator must establish rules and incentive mechanisms to force and coax this information from the company. Given that it is highly unlikely that the regulator will receive all of the information required to regulate optimally to maximise social welfare, the results of regulation, in terms of outputs and prices, remain 'second best' to those of a competitive market. Shapiro and Willig (1990) argue that state ownership provides more information to regulators than private ownership so contracting should be less problematic when the state both owns and regulates. However, state ownership is associated with inadequate incentives to gather and use this information to maximise welfare (Hayek, 1945). In other words, there tends to be a trade off between state ownership reducing the information asymmetries and hence the transaction costs of regulation and the relative incentives under state control and market transacting for agents to maximise social welfare (Grossman and Hart, 1986; Sappington and Stiglitz, 1987; Shapiro and Willig, 1990; Yarrow, 1999). This leads to 'credibility' and 'commitment' considerations: specifically, *credibility* on the part of investors that the regulatory rules will bring about the intended outcome; and *commitment* of government to the current regulatory rules, so that post-privatisation or post-concession award the regulator does not act opportunistically to reduce the prices and profits of the private regulated businesses. Regulatory credibility will be enhanced if the regulator faces high costs of deviating from a commitment.
- *Investment in a regulated environment is subject to a threat of hold up leading to under-investment.* Because the regulatory contract, whether formal or informal, is incomplete, it is vulnerable to post-contract opportunism. Public utilities are capital-intensive and therefore post-contract one or other party may have an incentive to adopt opportunistic behaviour to improve its own wellbeing. Utility networks involve sunk investments that are specific to the venture, so that once a network is created the balance of bargaining advantage at the time of a contract renegotiation may shift

from the private-sector investor to the regulator (on behalf of the government) with implications for pricing and investment (Spiller, 1996; and for a recent review of the hold up literature, Schmitz, 2001). In principle prices could be reduced to short-term marginal costs. Where the investor fears this outcome, referred to as 'hold up', front-end loading of returns, take or pay contracts with governments and sovereign guarantees from the state or international agencies may be required by the private sector. In turn such guarantees reduce the net economic benefits of attracting private capital by reducing managerial incentives to control costs.

The precise result of opportunistic behaviour depends crucially, however, on the relative bargaining power of the regulated and the regulator. Alternatively, the regulator and hence the government could be subject to 'hold up', where post-contract private investors demand a tariff or other contract adjustment in their favour and the regulator has no alternative supplier to turn to.

- *Regulatory regimes are prone to capture.* 'Regulatory capture' involves the regulatory process becoming biased in favour of particular interest groups and notably the regulated companies. Regulators can be assumed to care about the levels of both consumer and producer surplus because both impact on social welfare – benefits to consumers are reflected in consumer surplus but producer surplus is necessary to stimulate innovation (Kirzner, 1997). A regulator that is neutral between consumer utility and profit would place an equal weighting on consumer and producer surplus. One that favours consumers would weight consumer surplus more highly. Regulatory capture is associated with a weighting favouring producer over consumer surplus. In the extreme case, the regulatory capture literature concludes that regulation *always* leads to socially sub-optimal outcomes because of 'inefficient bargaining between interest groups over potential utility rents' (Laffont, 1999; Newbery, 1999, p.134). In the Chicago tradition of regulatory capture (Stigler, 1971; Peltzman, 1976) regulators are presumed to favour producer interests because of the concentration of regulatory benefits and diffusion of regulatory costs, which enhances the power of lobbying groups as rent-seekers (Reagan, 1987). What is clear is that the capability of firms to influence public policy is an important source of comparative advantage (Shaffer, 1995).

Regulation is also subject to 'political capture'; indeed political capture may well be a much greater risk than capture by producer groups outside of the political system. Where political capture occurs, the regulatory goals are distorted to pursue political ends. This is most likely to arise where the regulation is directly under the control of government ministers; hence the case for some kind of arm's length or 'independent' regulatory agency. Under political capture, regulation becomes a tool of self-interest within government or the ruling elite (Stiglitz, 1998).

Balanced against the risks of regulatory and political capture, however, is the possibility that regulators might develop a culture of arrogant independence, bordering on vexatious regulation. This creates some uncertainty about the desirable degree of regulatory independence. In principle three broad forms of regulation can be identified: (a) the regulatory authority is *integrated* into the normal government machinery, notably where it is a section of the ministry and controlled by the minister; (b) the *semi-independent agency*, which has some independence from the ministry but where decisions can still be over-ruled by a superior government authority; and (c) the *independent agency*, where there is no right of appeal to a superior government (political) authority, though there usually will be a right of appeal to the courts to ensure fairness and rationality in the decision-making process (in a number of jurisdictions known as an appeal on 'due process') (Smith, 1997; Von Der Fehr, 2000, p.49). The independent agency is normally favoured by western advisors, who

draw from the experience of regulation in the UK and US. However, regulatory independence and an impartial judicial review of due process may not be credible in some institutional structures; an issue developed further below.

- *A regulatory system should be both effective and efficient.* Effective regulation achieves the social welfare goals set down by the government for the regulator at the time the regulatory office was established, and as subsequently amended after appropriate consultation. This can be achieved by regulation affecting (a) the structure of markets and (b) conduct in markets through appropriate incentives and penalties. Efficient regulation achieves the social welfare goals at minimum economic cost.

The economic costs of regulation take two broad forms: (1) the costs of directly administering the regulatory system, which are internalised within government and reflected in the budget appropriations of the regulatory body or bodies; and (2) the compliance costs of regulation, which are external to the regulatory agency and fall on consumers and producers in terms of the economic costs of conforming with the regulations and of avoiding and evading them. Both the administrative and compliance costs of regulation may rise over time especially if economic regulation becomes an industry in its own right. It has been suggested that regulators could empire build: 'The self-interest of regulators will, in general, make them tend to exaggerate benefits, under-estimate costs and over-estimate the demand for action on their part' (Blundell and Robinson, 2000, p.11).

- *Competition is superior to state regulation and should be preferred.* Economic regulation attempts to 'mimic' the social welfare results of competition, but it can do so only in a 'second best' way because competitive markets generate superior knowledge of consumer demands and producer supply costs (Sidak and Spulber, 1997, pp.522-26). Indeed, government regulation can introduce important economic distortions into market economies: 'regulation..... is far from being a full substitute for competition, it can create systematic distortions, it generally faces a trade-off between promoting one type of efficiency at the expense of another, and it is likely to generate significant costs, in terms of both direct implementation and exacerbation of inefficiency' (Hay and Morris, 1991, pp.636-7). For such reasons, in the economics of regulation literature there is a strong preference for competition over state regulation and, where there is not a natural monopoly, for adopting regulation only until competition arrives.

This review of propositions from the economics of regulation literature incorporates observations on the importance of the institutional setting, regulatory rules and the regulatory process. While the search for practical solutions may lead countries to adopt regulatory policies that do not necessarily accord with the theory (Crew and Kleindorfer, 1996, p.215), the theory is a useful starting point for analysing practice in developing economies.

4. Regulating Prices And Profits In Utilities

4.1 Introduction

There are broadly four main methods of regulating prices and profits in utilities, namely the use of a price cap, rate of return regulation(cost of service regulation),a sliding scale regime, which is a hybrid of the first two, and direct state setting of prices. The last may be based on costs of production, equating to rate of return regulation, but is likely to be associated with more arbitrary rules for price setting reflecting each government's political, social as well as economic priorities. Whatever precise method is used, the economics of regulation literature suggests that regulators, whether in dedicated regulatory offices or government departments,

are likely to face on-going difficulties arising from the inherent information asymmetries that exist in a regulated environment (Newbery, 1999; Parker, 2002).). If prices and profits are to be regulated effectively, the regulator needs access to accurate information on the forecast revenues and efficient costs of the regulated firm, the cost of raising capital and the economic value of the firm's asset base (Laffont and Tirole, 1993; Parker, 2002, p.502). But firms can be expected to raise costs and inflate capital investment needs and the costs of raising capital (the 'cost of capital') during regulatory reviews, leading to a form of 'regulatory gaming' (Armstrong et al., 1994, Alexander and Harris, 2001). Moreover, effective regulatory incentives and regulatory governance regimes need to be in place (Levy and Spiller, 1994) and both may be underdeveloped or even absent in developing economies. There may also be a continuous threat from regulatory capture. Regulatory capture occurs when regulatory policies become over-influenced by the goals of the regulated firm or where the regulator is subservient to political interests and lobbying groups (Stigler, 1971; Peltzman, 1976).

In practice, it is the firms not the regulators that have direct access to the values of costs, revenues and assets and know their true cost of capital. In effect, the job of the regulator is to provide the incentives for managers in regulated companies to maximise effort and reduce costs, while protecting consumers, and to minimise the information rent that the company achieves by failing to reveal its efficient costs of production to the regulator. However, many developing countries seem to lack strong regulatory capability in terms of trained personnel and sound laws to sustain regulatory commitment and credibility. Regulatory offices in developing countries tend to be small, under-manned for the job they face, and possibly more expensive to run in relation to GDP than in developed economies (Domah, et al., 2003). The other main difficulties found in many developing countries relate to governance problems (Stern and Holder, 1999; Minogue, 2002) or the legal powers and responsibilities of regulators, including their effective independence from regulatory (including political) capture. There is country-level case study evidence that suggests regulatory bodies may function poorly in a number of low and middle income Asian economies due to inadequate skills, governance problems and the prevalence of capture (e.g. Cariño, 2002, (the Philippines); Knight-John et al., 2003 (Sri Lanka); TERI, 2003 (India); also see World Bank, 2003b for a statistical overview). In consequence, leaving aside the form of price and/or profit regulation selected, prima facie, the regulatory environment in many developing economies appears to be much less conducive to effective utility regulation than is the case in Western Europe, the USA and Australia, from which the models of sector regulation came (Parker, 2002).

The economics of regulation literature has favoured the use of price cap regulation over rate of return or cost of service regulation because of its greater incentive effects. A third alternative, sliding-scale regulation, has been put forward as a compromise between the price cap and a controlled rate of return, which is said to combine the merits of both methods. We next consider the operation of a price cap in the context of developing economies and conclude that the case for its use is much reduced. This is because of its information requirements, need for regulatory expertise, and the institutional endowment found in many low and middle income countries. Instead, we argue that sliding-scale regulation is likely to be both better suited to the current stage of institutional development and quality of regulatory governance in most developing countries, and more appropriate as a means of reducing investment risk and encouraging service expansion.

4.2 Price Cap Regulation

Price cap regulation has operated in the UK, in a range of modified but related forms (Crew and Kleindorfer, 1996, p214). Increasingly, it is also being adopted as the preferred model for utility regulation in developing countries. Price cap regulation establishes a price ceiling so that the profitability of the firm then depends on the extent to which it is able to keep its costs below the determined maximum revenue under the cap (Weyman-Jones, 2003). While the cap can be initially set so that the forecast revenue will just cover the forecast operating and capital costs for the period to which the cap applies, the firm may then reduce these costs while providing the agreed quality and quantity of service. Price cap regulation, therefore, encourages productive efficiency and consequently is often referred to as 'incentive regulation'. However, if prices diverge from costs of production then allocative inefficiency occurs. Where the firm is successful in driving down costs, consumers suffer prices above the marginal costs of production and investors benefit from supernormal profits. Hence, periodically the price cap will need to be reviewed and adjusted to reflect the now lower costs of production and thus restore allocative efficiency. However, if this occurs very frequently then the management will have little incentive to pursue cost savings because they are quickly clawed back by the regulator – effectively, price caps equate more closely to rate of return regulation the shorter the regulatory lag. At the same time, if the price cap review does not occur for many years then public hostility to the regulatory regime can be expected to grow, in the face of evidence that the firm is making large profits and that prices are well above costs of supply. In general, a price cap review every four or five years has been judged optimal in a number of countries including the UK (in the absence of any sudden and large changes in the regulatory environment). But this period lacks a sound theoretical basis and should be seen as simply a pragmatic solution to setting the regulatory lag.

The operation of a price cap can be expected to be especially problematic to operate successfully in developing economies. To begin with, a price cap normally allows a cost pass throughs for any increase in costs of production that are outside the control of the firm's management. In particular, any general rise in costs resulting from inflation in the economy will usually be permitted as a cost pass through to consumers. This is obvious in the price cap formula in the UK, which takes the form of 'retail price index minus X' (RPI-X), where X is an efficiency adjustment. This method seems to work satisfactorily where inflation is low, as in the UK. However, developing economies commonly suffer from much higher inflation rates than in Western Europe. Moreover, inflation rates can move widely from year to year. In this environment, a cost pass through for general inflation may be politically risky and the social consequences severe because of the impact on prices of what are essential (low price-elasticity) goods, such as water, especially if wages are not adjusting upwards as quickly as prices. It can also be economically damaging as higher utility prices fuel further inflation at the economy level.

Also, the regulated firm's input costs may vary widely from the general movement of prices in the economy as a whole. A price index reflecting general inflation, which in most countries is the Consumer Price Index or CPI, which is equivalent to the UK's RPI, can be expected to reflect changes in the firm's input costs imperfectly. The aim under the price cap is to separate costs over which management should have control from those over which it can be expected not to have control, which are reflected in the inflation adjustment and allowed as a cost pass through. But, for example, an electricity generator reliant on oil as a fuel input will tend to find that its costs are more sensitive to world oil prices than national inflation rates. Therefore the result could be a cost pass through at a time of high inflation that does not reflect the true movement in the firm's input costs, leading either to excessive profits or losses and closure. Moreover, the X factor specifies the rate at which the regulated firm's prices must fall after correcting for inflation in the economy. But where the regulated firm's output can have a significant effect on the economy's inflation rate, such as power costs in

developing countries, it is important to modify the X factor to allow for the impact of this on the inflation rate (Bernstein and Sappington, 1999).

Further complications are added where the existence of large subsidies to state enterprises before privatisation means that post-privatisation the prices set by regulated utilities need to rise faster than inflation to restore profitability. In Western Europe, the USA and Australia price caps have typically been set so as to reduce real and in some cases nominal prices, thus minimising political opposition. In low-income economies with uneconomic prices as the starting point, the movement in real prices will be sharply upwards. Price caps are also affected by changes in government policy. Investors are likely to demand that changes in government taxes and other policy initiatives that have an effect of the firm's costs or revenues should be allowed as direct cost pass through. However, if these costs can be passed on, incentives to minimise the effects of government policies on costs and revenues are removed.

The price cap method allows profits to be earned in excess of those anticipated at the time the cap was set until such time as the cap is reset. But when the probability of a regulatory review to reset prices to achieve a normal profit level is taken into consideration, the perceived benefits of a price cap over regulating the rate of return are reduced (Bawa and Sibley, 1980). There may be a lack of credibility on the part of investors that a country can commit to more than a transitory price cap. Schmalensee (1989) demonstrates that, under conditions of uncertainty – which are likely to be found in many developing countries – regimes in which price depends in part on the actual costs of production generally substantially outperform pure price caps, particularly in terms of maximising consumer surplus. This is so because the more uncertain the environment, the higher will the price cap need to be set at the outset to ensure that the regulated firm is willing to invest. This can lead to a higher price-cost margin than where prices are set based on actual costs.

The successful operation of a price cap requires the determination of the correct X efficiency factor to provide the right carrot for management to pursue further efficiency gains without bankrupting the industry. In Western Europe, North America and Australia setting the X efficiency factor has been far from problem free. This contrasts with the earlier and optimistic view of Beesley and Littlechild (1983, p.20) that the setting of X could be left purely to 'bargaining' between the utility and government and that 'an exhaustive costing exercise is not called for'. In setting the price cap regulators commonly use what is essentially a truncated cash flow model, where the value of the opening asset base is rolled forward adjusted for new acquisitions and depreciation and efficient levels of operating expenditure are funded (Vass, 1997). The firm has an incentive to come in under budget for both operating expenditure (opex) and capital expenditure (capex). Equally, it creates an incentive for firms to overstate their opex and capex forecasts each time the cap is set.

In practice, the price cap is based on information relating to costs, revenues, the asset base, the allowed depreciation rate and the cost of capital – in essence, much the same variables that enter into rate of return regulation (Parker, 1999). However, unlike under rate of return regulation, it is not advisable to set the X according to the firm's own costs and revenues, otherwise this would remove the incentives for cost savings. Setting prices based on the most efficient supplier in the industry or through so-called 'yardstick competition' or 'benchmarking' performance (adjusted where necessary for differences in costs outside the control of the firm) proves necessary (Shleifer, 1985). The regulatory offices in Western Europe, North America and Australia have developed econometric and statistical models, sometimes including engineering models, to estimate efficient industry cost frontiers; (Weyman-Jones, 2003). Yardstick competition has been based on industry time series data, cross-sectional data where there are a number of utility companies operating within the industry and in broadly similar operating environments, and international industry studies to obtain comparative data from overseas. Nevertheless, the results of these modelling

exercises remain very controversial with the companies frequently complaining that they provide for targeted cost reductions that are unrealistic. The result has been a number of appeals by companies against their price caps to the courts or other appeal bodies. For example, in the Netherlands the telecommunications regulator had to back down after using mathematical modelling in the form of 'data envelopment analysis' to set prices. The Office of the Regulator General in Victoria, Australia, also faced a successful challenge after modelling relative efficiency. Even in the UK with its longer track record of regulators benchmarking efficiency, it has been suggested that 'The nature of yardstick comparisons and the way they are used in the [efficiency] analysis are not as transparent as they could be, and ongoing bargaining seems to characterise the evolution of the controls' (Weyman-Jones, 2001, p.246).

In developing countries setting the X efficiency factor is likely to be very problematic and the negotiating process is open to regulatory capture. To begin with the regulatory offices are likely to lack reliable historic data on a company's costs to forecast future cost movements. They may lack skilled economists and auditing staff to challenge the firm's operating and capital costs to identify efficiency trends. Also, there may be no or very few comparator firms within the country so as to undertake cross-sectional cost studies and the smaller the number of firms the greater their opportunity to collude against the regulator. Moreover, operating environments often differ substantially between countries thereby undermining the credibility of international cross-sectional studies at the sector level. In telecommunications regulation in Southern Africa and the Caribbean, comparative benchmarking between countries is under-development, but it is yet to provide an acceptable basis for setting price caps.

The information problems that arise when a regulator attempts to regulate with price caps increase the opportunities for regulatory capture and 'regulatory gaming' (Armstrong et al 1994). Alexander and Harris (2001) confirm such behaviour in the Indian electricity distribution sector. Evidence on regulatory contract renegotiation in Latin America and the Caribbean provides further more detailed support for the argument that price cap regimes may be more prone to regulatory capture and gaming than other forms of price and profit regulation. Some 38 per cent of infrastructure contracts using price cap regulation were subject to renegotiation on average 2.2 years after the award of the contract. This was on concessions granted for about 20 to 30 years that had a five year period for a tariff review for the price cap regime (Estache et al 2003). In 83 per cent of cases of price cap renegotiations, the initiative came from the operator, and only 6 per cent from government (the remaining 11 per cent of price cap renegotiations were initiated jointly by government and the operator). These figures for price cap regimes contrast sharply with rate of return renegotiations where only 13 per cent of all contracts were renegotiated and where the operator was responsible for initiating just over a quarter (26 per cent) of the renegotiations.

Even where the necessary data are available to the regulator, there remain formable problems in setting the level of the X factor. If the X factor is set too low, companies make large profits, which is likely to generate media and political criticism of the regulator. By contrast, if the X factor is set too high to fund proper investments, the quality of service will decline, although the damaging effects may not become obvious for years because the quality of the capital stock deteriorates over time. In these circumstances, and especially where regulators face short-term political pressures to keep prices down, there may be a tendency for price caps to be set too harshly. Also, because the price caps are re-set, say every four or five years, this may encourage regulated businesses to favour quick-return investments that improve operational efficiency over longer-term capital needs, fearing a tightening of the price cap at a later date. At the same time, if price caps are reset much more frequently, say annually, then the price cap will provide no incentive for managers to reduce costs because cost savings are almost immediately clawed back by the regulator in the form of lower consumer prices. High profits earned through efficiency increases are

welfare enhancing (Iossa and Stroppolini, 2002); but this is not likely to be well understood amongst the populace or for that matter in political circles. This leads to pressure for the regulator to 'intervene' outside of the scheduled price cap reviews. Estache et al (2003) argue that the efficiency gains accruing under price cap regimes in Latin American concession contracts were in part transferred to government by increasing the level of indirect taxation). In addition, the more volatile are profits the more difficult it becomes to maintain regulatory credibility under a price cap. In such circumstances, regulatory regimes, such as rate of return regulation that link revenues more closely to costs, 'are less prone to regulatory opportunism' (Newbery, 1999, p.72). As Alexander and Irwin (1996) conclude, regulatory risk is higher under price cap regulation than under rate of return regulation because under the latter consumers bear some of the risks that investors bear under price cap regulation.

The nature of the ownership of assets in developing countries can also be expected to complicate the operation of a price cap. In low-income countries commonly privatised services are provided by an international company; for example, Cable and Wireless is the dominant supplier of telecommunications in the Caribbean. Regulating multinational companies is usually more difficult than regulating nationally based ones. This is because multinational firms can move revenues and costs between their different operations and through 'transfer pricing' rig the levels of profits earned in each country. Regulation depends upon reliable information, but multinational companies are able to locate information outside of the reach of a national regulator, thereby hindering the ability of the regulator to regulate effectively. This is also a problem for rate of return regulation; but it can be expected to create special difficulties for the operation of a price cap because the difficulties in setting an efficiency factor using benchmarking are now compounded.

This problem also extends to determining the cost of capital. In Western Europe, the USA and Australia there are developed capital markets and estimating the costs of raising equity finance and loan finance, including any risk premium, can be undertaken using 'the capital asset pricing model'. But this is not true in most low-income countries and there is limitless scope for argument about the cost of capital where there are no capital market values. In addition, even where there are market values, if the company is a multinational then calculating its cost of capital for investment purposes in any particular country is problematic. A company such as Cable and Wireless with its share price quoted in London will have a cost of capital that reflects investors' views of their investment risk across all of the company's markets. Setting the cost of capital for regulatory purposes for one of these countries, for example Jamaica, based on Cable and Wireless's overall cost of capital could clearly be wrong. The true cost of capital when investing in Jamaica may be higher (or lower) depending on domestic risk relative to the risks the company faces elsewhere where it operates; but in any event the figure remains an unknown. Again, the lack of a cost of capital affects rate of return regulation as well. However, given that the price cap does not guarantee a given net revenue stream in the same way as under rate of return regulation, it is to be expected that the lack of a cost of capital figure will increase the scope for argument under a price cap regime. Also, a price cap implies a higher cost of capital than where profits are directly regulated, because of the higher investment risk. Under rate of return regulation a target rate of return is built into the regulation, whereas under a price cap profits are more variable reflecting management ability to reduce costs. Therefore, cost savings resulting from a price cap over rate of return regulation must more than offset the higher capital cost if a price cap is to be more economically advantageous.

As we have seen, a price cap creates incentives for managers to reduce costs. But this is only true where the jobs of managers depend upon retaining the confidence of investors by earning profits. Where regulated utilities remain wholly or largely state owned, the incentives change. In the absence of private investors who reward managers who maximise profits, a price cap provides ambiguous efficiency signals. A manager of a firm that is wholly or largely

state owned, and especially one that retains non-profit goals, may decide not to lower costs of production under the price cap. For example, lower costs may come from more efficient manning levels, but higher unemployment may not be an outcome rewarded by government as the firm's owner or 'principal'. Interestingly, in a study of state-owned and privately-owned electricity generators in Spain, Arocena and Waddams Price (2002) found that the introduction of a price cap was associated with greater efficiency amongst private-sector generators but not public-sector generators. They conclude that 'cost of service regulation may be more appropriate for plants within the public sector' (ibid., p.65). It seems that price caps have particular weaknesses when applied to firms that are still wholly or largely state owned; which is often the case in low-income countries. Managers in state enterprises have greater incentives than their private-sector counterparts to price below marginal cost or to set prices strategically in order to reduce the impact of a binding price-cap constraint (Sappington and Sibley 1992; Law, 1997).

Efficiency incentives are also only achieved under a price cap if a firm managed inefficiently is allowed to fail. This is largely untested even in the industrialised economies – although the recent government rescues of Railtrack and British Energy in the UK suggest that governments will be reluctant to allow privatised utilities to go under even when there have been management weaknesses. The likelihood of major utilities being allowed to fail in low-income economies seems to be at least as incredible. Often there will be no alternative supplier of essential services and failure to supply can be expected to lead to social unrest and perhaps a threat to public health. Also, a multinational company may threaten to repatriate its capital and knowledge, making it difficult for the state to step in as the default operator. As Shleifer (1985, p.323) has noted:

'Yardstick competition works because it does not let an inefficient cost choice by a firm influence the price and transfer payment that the firm receives. It is essential for the regulator to commit himself not to pay attention to the firms' complaints and to be prepared to let the firms go bankrupt if they choose inefficient cost levels. Unless the regulator can credibly threaten to make inefficient firms lose money..... cost reduction cannot be enforced.'

In low-income economies inadequate comparisons for yardstick competition purposes seem to combine with the incredibility of regulator enforced bankruptcy to undermine the foundations for the operation of an effective price cap. In developing countries a price cap regime could become a one-way profit guarantee in favour of investors, thus undermining its incentive effects.

Finally, because of the incentives under a price cap for cost reductions, it is essential that the firm does not achieve higher profits by reducing the quality of service. As part and parcel of price cap regulation, therefore, there has to be an on-going monitoring of service quality. Western European regulators have introduced service quality targets with fines and compensation payments to consumers from firms where service quality falls below target. Regulatory offices in developing countries will need to introduce service quality measures and monitor them, imposing further regulatory functions on what are usually small and understaffed offices.

4.3 Rate of Return Regulation

Rate of return regulation or cost of service regulation determines prices charged so as to achieve revenues that cover all legitimate operating and capital costs while providing the firm with a fair rate of return on its capital employed. This fair rate of return is related to the cost of capital and is akin to delivering the economist's 'normal profit'. In the USA, rate of return regulation takes the form of periodic rounds of regulatory rate setting triggered when the firm files for a price adjustment, for example after cost increases such as rising fuel charges or at

times of high inflation. The regulatory office then gathers information, both written and oral, from the company and other groups, including consumers, challenges the firm's cost base to ensure that there is no 'cost padding', and finally re-sets the charges (usually each price is individually approved). The firm then has the opportunity to appeal against the regulator's decision to the courts. This regulatory regime has operated within the USA for over a century.

Its shortcomings are well-known and relate to both *information* and *incentives*. Rate of return regulation requires that the regulatory office inspects the company's accounts carefully to reveal cost padding, including unnecessary capital expenditures that increase the asset base and therefore justify higher profits to achieve a given rate of return. Rate of return regulation provides an incentive for the management of the firm to pad costs and over-estimate the required revenue needed, lest both are subsequently scaled back by the regulator. Indeed, in the absence of effective policing of costs by the regulator, the method reduces to a form of 'cost-plus' regulation with its obvious efficiency disincentives. Moreover, whenever the allowed rate of return is above the firm's cost of capital the management has an incentive to invest in the firm's asset base. This leads to over-capitalisation or what is known as the 'Averch-Johnson effect', after the authors who first rigorously demonstrated the result (Averch and Johnson, 1962). It has also been demonstrated that under certain circumstances incentives are created to over-enhance the quality of service rather than compete for customers on price (Bailey, 1973). In general, rate of return regulation introduces a number of potential economic inefficiencies; hence why, when the UK began to privatise its utilities, it opted instead for the use of a price cap (Littlechild, 1983).

However, the inefficiencies of rate of return regulation, while real, should not be exaggerated. Management do have incentives to reduce costs because of 'regulatory lag'. In the USA the firm and therefore its investors retain supernormal profits earned from cost reductions until such time as prices are reset, which may be after a number of years. Also, the nature of the regulation is easy for the public to understand. Indeed, it is close to the form of price setting usually found in state-owned industries, where prices are determined by costs. Therefore, upon privatisation there is continuity in the form of regulation, leading to less need for new learning and skills within the company and the government.

Turning to developing economies, this continuity in regulatory practice may be important. Staff in the new regulatory body is likely to be heavily if not entirely recruited from government departments and therefore is likely to have experience of setting prices based on costs. Rate of return regulation can economise on the need for new regulatory training. But there are also other reasons why rate of return regulation may make sense in a developing economy context. What is not often articulated is that some of the 'inefficiencies' of rate of return regulation in a developed economy may be virtues in an economy that is trying to attract investment into industries and expand services to under-served populations.

Firstly, all other things being equal, rate of return regulation more or less guarantees a profit stream in the industry at least equal to the cost of capital, leaving aside any regulatory lag. It can therefore provide a more secure environment for investors than exists under a price cap regime, where profits may fluctuate significantly, as discussed further below. The more stable and secure the environment for investors, the greater will be the level of investment funds from both domestic and foreign investors that will be attracted into the industry.

Secondly, the incentive in rate of return regulation to over-expand the asset base may be less of an economic cost in developing economies, where there is a desperate need for more investment to improve the quality and scope of service provision. Rate of return regulation may have an important role in creating incentives for rapid investment in key infrastructure schemes at a time when cost minimisation is less of a priority. Crew and Kleindorfer (1996a, p.212) claim this was the case in the USA in the middle of the twentieth century when there

was a need to roll out utility services, such as power, across the country. In developing countries with their need to expand services to populations currently unserved, rate of return regulation may provide a greater incentive to service expansion. In such an environment the Averch-Johnson critique seems to lose some of its power, albeit only if the additional investment is socially and economically beneficial rather than simply politically-motivated 'gold plating'. More generally, the static efficiency gains from price caps must be judged against possible negative dynamic efficiency effects in terms of service expansion (cf. Ros, 2002).

Thirdly, rate of return regulation has the advantage of being more dependent on actual financial data when setting prices and not forecasts of costs and revenues over a lengthy future period, as under a price cap (Stelzer, 1996). It is therefore potentially less demanding in terms of collecting and analysing economic and financial data, and less judgemental in terms of negotiating price adjustments. The more accurate the data used when setting prices and profits and the less speculative the basis for the financial settlement, the less scope there should be for regulatory capture. Where prices and profits are based on notional figures there is considerable scope for 'rigging' the result to satisfy the industry, politicians or other powerful lobby groups.

4.4 Sliding Scale Regulation

Rate of return regulation has the benefit of setting prices according to costs, whereas a price cap can lead to prices well in excess of costs and therefore large supernormal profits. But the price cap does have the advantage of providing incentives for management to reduce production costs to their efficient level, something that may be missing under rate of return regulation.

Sliding-scale regulation is something of a compromise between rate of return regulation and a price cap and can be designed to be superior to both (Lyon, 1996; Mayer and Vickers, 1996; Burns, Turvey and Weyman-Jones, 1995, 1998). There are various types of sliding-scale regulation, sometimes referred to as 'earnings sharing', 'revenue sharing' and 'hybrid price caps' (for a review of each type see Kridel et al., 1996). They all have in common that they are designed to ensure that consumers share in unexpectedly high profits. Under sliding-scale regulation, a price cap is set and the firm has the usual incentives to raise profits by lowering costs of production. However, if profits rise above an agreed level then prices are adjusted downwards immediately so as to share some of the additional profit with consumers. In this way the level of supernormal profits earned by regulated firms is restricted. Equally, the sliding-scale can be symmetric so that if the firm earns losses above an agreed level, prices are adjusted upwards so that consumers fund some of the revenue deficiency. To summarise the differences between a sliding scale and rate of return and price regulation, if a firm suffers a δ increase in its controllable costs and this leads to a δ increase in price then this amounts to full 'cost-plus' regulation. Under a price cap the δ increase in costs would lead to a 0 increase in price. Under a sliding scale regime the change in price would lie between 0 and δ .

Provided that the profit and loss sharing is not such as to remove all incentive for the firm to seek out cost savings then efficiency incentives remain, although they are reduced pro rata to the sharing formula (for this reason most economists would not advocate that consumers benefit or lose more than 50 percent of any change in profits or losses). At the same time, when the sliding-scale is symmetric investors know that should there be an unanticipated change in costs or revenues that lead to financial losses, some compensation for these losses is automatically generated. This can be important because of the 'hold up' problem (Hart and Moore, 1988) in utility regulation. The hold up problem arises because utility industries involve high fixed and sunk costs. Once investors have made the investment to start production, presumably production will continue, even if loss making, providing that

variable costs are covered. With variable costs appreciably lower than total costs in high fixed cost industries, investors understandably fear that regulators will act opportunistically and exploit the difference between variable and total costs, driving down revenues to variable costs. This threat of opportunistic behaviour by the regulator effectively increases risks to investors and therefore raises the cost of capital and forecast revenues needed to bring about the initial investment. Under rate of return regulation, this problem is ameliorated by the opportunity for the firm to demand a rate rebase; but under a price cap, it could be a serious weakness in the regulatory regime leading to under-investment. The sliding-scale can reduce, although not remove, the threat.

Sliding scale regulation also has the advantage that where prices are reduced consumer demand will rise, dependent upon the price elasticity of the product, leading to more capital investment to meet the demand. The sliding-scale regime can therefore create investment incentives provided that new capital assets are allowed in the asset base for regulatory purposes and proper depreciation of these assets is allowed in annual costs. Moreover, sliding-scale regulation has the potential to provide both cost efficiency incentives to managers, while sharing any supernormal profits above a given level with consumers. This reduces the threat that regulators will be pressured by the media and politicians to intervene outside the agreed regulatory review periods, thus lowering the threat from regulatory capture. Profit sharing regimes do, however, require reasonably accurate accounts that reveal true economic profits. But the accounting requirements seem no more draconian than those required to set a price cap or to operate rate of return regulation.

Table 4 summarises the relative merits of rate of return, price cap and sliding-scale regulation within the context of developing economies with their expected institutional weaknesses. The use of a sliding-scale seems to add credibility to the regulatory regime in countries where there is a real likelihood that regulators will be captured and pressured to intervene whenever prices and profits rise or fall by more than expected. Therefore, the sliding-scale method appears to be very appropriate to economies where estimating costs and revenues in advance to set the correct price or profit at the outset is difficult or where the economic environment can change quickly and sharply. This seems to apply to many developing economies.

Table 4: Summary of the Relative Advantages of Rate of Return, Price Cap and Sliding-scale Regulation in Developing Economies

	Rate of return	Price Cap	Sliding-scale
Efficiency incentives	Low: incentives to inflate opex and capex	High: efficiency benefits retained by the firm until the next price review	Medium: share of efficiency benefits passed quickly to consumers
Difficulty of administration	Low: requires monitoring of revenue and cost data to prevent inefficient expenditures, but the process is similar to that which occurs under state ownership	High: requires considerable financial and economic data that may be well beyond the ability of a regulatory office in a low-income economy to collect and analyse	Medium: particularly need regular and reliable profit data

Threat of regulatory gaming

Low: rate of return can be reset to cover the cost of capital annually, or even more frequently if necessary	High: inflating of cost of capital and opex and capex needs when the cap is set. Difficult to correct quickly later	Medium: risk of hiding profits
--	---	--------------------------------

Threat of regulatory capture

Medium: frequent rate reviews may encourage capture	High: great benefits obtainable over a lengthy period if the price cap is too generous	Low: higher profits are shared with consumers
---	--	---

Risk of political and social rejection

Low: prices set according to costs and therefore more likely to seem fair	High: excess profits or losses leading to closure are both likely to be unacceptable	Medium: share higher profits, but also losses
---	--	---

Note: the terms low, medium and high are to be interpreted as ‘relative to the other two methods’.

In summary, it seems likely that a number of difficulties are likely to be faced in operating effective control of prices and/or profits when regulatory regimes are introduced in developing economies; difficulties that so far have received insufficient attention. On balance, we conclude that sliding-scale regulation offers the best solution for low and middle income countries. By contrast, the price cap, appears to have problems that are likely to be particularly acute in these economies. These arise from information asymmetries and weaknesses in regulatory skills and governance. In the context of developing countries the advantages of the price cap seem much less clear cut. Indeed, rate of return regulation could have powerful benefits in terms of maintaining stable profits and therefore investment incentives, especially in high inflation economies, where inflation can fluctuate sharply from year to year, and where costs and revenues cannot be reasonably estimated more than a few months in advance – i.e. where there is high regulatory uncertainty. Moreover, because rate of return regulation ties prices to costs, it should be easier for the public to understand the reason for price increases compared to those under a price cap and should protect investors against ‘hold up’ and losses that are not the result of mismanagement. By combining a price cap, with its productive efficiency incentives, with ceilings and floors to profits and losses, sliding-scale regulation appears to offer a useful compromise. It should both encourage necessary investment in utility sectors in low-income economies while protecting consumers from monopoly exploitation. Sliding-scale regulation by satisfying investors and consumers may be less open to regulatory capture. Regulatory capture occurs where firms feel the need to influence the regulator to achieve a fair rate of return and politicians feel the need to capture the regulator to avoid a consumer backlash against high prices. By helping to avoid both outcomes, sliding-scale regulation may contribute to better regulatory governance and the institution building needed if low-income economies are to develop.

Ultimately, the successful operation of price and profit regulation methods in developing countries will depend on building effective regulatory institutional infrastructures and strengthening governance environment. In the same way as privatisation alone has yielded only limited benefits, so the choice of regulatory instrument in itself is unlikely to generate substantial gains. The potential benefits of price and profit regulation will be realised only when the choice and application of regulatory instruments is part of a wider programme of regulatory reform in developing countries.

4.5 Social Regulation

While much of the discussion of regulation instruments has focused on improvements in economic and financial performance, distributional issues have strongly influenced public policy towards infrastructure in both developed and developing countries. Most developed countries specify universal access to certain infrastructure services, including telecommunications, water and sanitation and electricity, with the goal of ensuring access for all people at affordable prices. Universal service obligations are typically incorporated in licences and concession contracts and require operators to provide services within a specified time period to any consumer that requests them within a specified geographical area. In developing countries, concerns about the accessibility and affordability of infrastructure services are more pronounced, where the majority of the population lack access to safe and affordable water services and reliable electricity supplies. However, as Estache, Foster and Wodon, (2002, p6) point out, although universal service obligations are politically appealing, they have limited meaning in practice in the developing country context. This is because they fail to take into account the fact that low income households often cannot afford the service, and hence will not request it. Also, for communities that are not currently served by the formal utility network, service expansion will need to take place on a coordinated basis, and not simply in response to individual requests.

In theory, these access and affordability concerns can be financed by cross subsidies whereby above-cost prices are charged to low-cost and high-income consumers to subsidise high-cost and low-income consumers, who paid prices below cost. In practice, subsidies on prices of infrastructure services have often been poorly targeted and regressive in their incidence. Nevertheless, there are concerns that economic regulation may hurt the poor, where, for example, ‘tariff rebalancing’ – increasing prices in order to meet costs – could make service unaffordable for the poor.

There is range of policy instruments that can be used by the regulatory authority to mitigate the potential adverse effects of infrastructure privatisation on the poor. Table 5 summarises the potential impacts and the range of mitigation measures that can be deployed by the regulator to improve access and affordability of infrastructure services for the poor. Each of these instruments has certain advantages and disadvantages in promoting access and affordability which will need to be assessed before they are implemented. The choice of instruments will require an empirical understanding of the social dimensions of infrastructure services in the country or geographical area concerned, which can be used to assess the impact which a particular instrument will behave on access and affordability for poor households. Consideration will also need to be given to the financial costs, economic and administrative of using a particular instrument. Many of the measures involve subsidy mechanisms and will involve financial costs. Subsidies often introduce perverse economic incentives, for example, wasteful consumption by subsidised consumers, or reduced incentives for utilities to extend their services to poorer areas where subsidies are targeted. Also, there may be significant administrative costs, for example, in identifying households eligible for the subsidy.

Table 5: Linkages between Infrastructure Reform and the Poor

Category	Risks	Benefits & Mitigating
----------	-------	-----------------------

		Factors
Access issues Increase in connection fees.	The fee for obtaining a connection to the infrastructure service is likely to increase substantially when privatised firms reflect actual costs of connections.	Countries can adopt rules to ensure that connection costs are uniform across geographic areas.
Risk of 'cream skimming' or 'red-lining'	Firms may have incentives not to serve the poor on an individual (cream-skimming) or neighbourhood (red lining) basis	Rules against cream-skimming or re-lining can be imposed.
Reduction in the availability of alternative services.	The fee for obtaining a connection to the infrastructure service is likely to increase substantially when privatised firms reflect actual costs of connections.	Access to alternative services will not be affected if foreseen in contracts. Availability of communal services may increase as a result of privatisation.
Increase in network costs caused by service quality upgrades.	The quality of service is likely to improve but this may make network services unaffordable for the poor.	Evidence shows that poor households are willing to pay reasonable amounts to improve the quality of service.
Consumption Affordability Issues Increase in pricing.	Average tariff levels can increase because of cost-recovery requirements and the need to finance quality-related investments.	Increases in average tariffs depend on pre-reform price levels and the distribution of the benefits of private participation between stakeholders. Reform can cut costs significantly through improvements in efficiency or new technologies.
Tariff rebalancing.	Tariff structure is likely to be reformed in ways that could increase the marginal tariff faced by the poor.	Competition is likely to decrease average tariffs, thereby possibly compensating for the impact of tariff rebalancing.
Formalisation and revenue	Revenue collection and discouragement of informal connections are likely to be more effective and result in	A formal connection,

collection	an increase in the effective price paid.	even at a cost, may be desired by vulnerable households. Safety is likely to increase with the formalisation of connections. Informal connection may have been more expensive. Reform can bring technology choices that lower costs.
------------	--	--

Estache, Foster and Wodon, (2002)

The task of the regulator is to respond to these distributive and poverty reduction objectives in a way that does not significantly undermine the economic efficiency objective of economic regulation. Balancing the efficiency and effectiveness goals of regulation will particularly challenging in developing countries where a relatively greater weight will be given to the social objectives to be pursued by regulation policy. The regulator’s task will be made more difficult by the limitations in administrative and regulatory capacity. The economic and social data needed to evaluate the potential effectiveness of different regulatory instruments will often be limited or unavailable. In addition, the need to implement ‘pro-poor’ regulation measure could be perceived by investors as increasing the risk of regulatory discretion. The absence of sufficient safeguards against the misuse of such discretion will increase the cost of investment and impact adversely on investment or prices, depending on the form of economic regulation that is being applied (Smith,2000). Given the inevitable trade-offs between social and financial concerns, it is important for government to provide statutory guidance on the extent to which the regulator is responsible for meeting social objectives, and the level of financial transfer from the public budget to meet the costs of the subsidies that are introduced to ensure that regulation contributes to pro-poor public policy.

5. Developing Country Experience With Price And Profit Regulation

Price cap regulation has adopted as the preferred model for utility regulation in a growing number of developing countries. In the Latin America and Caribbean region, a recent study for the World Bank indicated that the price cap method for regulating prices and profits is well established there and seemingly preferred to rate of return regulation (Guasch 2001). Table 6 summarises Guasch’s findings on tariff regulation.

Table 6: Tariff Regulation in Latin America

Country	Sector	Method used
Argentina	Electricity	Price cap
	Telecoms	Price cap
	Railways	Price cap
	Roads	Price cap
	Water	Price cap
Bolivia	Electricity	Price cap
	Telecoms	Price cap
	Railways	Price cap
	Roads	Price cap
	Water	Rate of return
Brazil	Electricity	Price cap
	Telecoms	Price cap
	Railways	Price cap
	Roads	Price cap
	Water	Price cap
Chile	Electricity	Price cap
	Telecoms	Revenue cap
	Railways	Price cap
	Roads	Price cap
	Water	Rate of return
Columbia	Electricity	Price cap
	Telecoms	Price cap
	Railways	Price cap
	Roads	Price cap
	Water	Price cap
Ecuador	Electricity	Rate of return
	Telecoms	Price cap
Mexico	Electricity	Price cap
	Railways	Price cap
	Roads	Price cap
	Water	Price cap
Peru	Electricity	Rate of return
	Telecoms	Price cap
	Railways	Price cap
	Roads	Price cap
	Water	Price cap
Venezuela	Electricity	Price cap
	Telecoms	Price cap
	Railways	Price cap
	Roads	Price cap

*a form of price cap regime.

Source: Guasch, 2001.

A related study has analysed almost one thousand utility sector concession contracts awarded between the mid 1980s and 2000. This has revealed that 56 per cent of the contracts were regulated under a price cap regime. A further 24 per cent of contracts used a hybrid regime which were close to a price cap but allowed for cost pass-through on a few cost categories. Only 20 per cent per cent of the contracts were based on rate of return regulation (Estache et al 2003). The study finds that 'the adoption of price caps implied higher costs of capital and hence, tariffs, and brought down levels of investment'. This finding is consistent with the view that price caps create a more uncertain environment for international investors than rate of return regulation. In this paper, the authors comment (pp5-6):

'the choice [of price caps] was consistent with the advice of the international consultants recruited to assist in the preparation of the reforms. The marketing of this choice was based on now common but then innovative theoretical arguments. The regime, it was argued, would provide high powered incentives for securing efficiency gains, at least between tariff reviews and the regime was low maintenance in the sense that it did not require, at least between tariff reviews, large amounts of information about firm-operation-levels. The fact that it induced a higher cost of capital because they tended to pass on to the operators a larger share of the project risks was very seldom mentioned. Also, the fact that the regime was associated with a risk of under-investment (which has happened) was surprisingly seldom addressed in a region in which one of the main reasons to try to reform and privatise was to attract private investment to compensate for a reduction in public investment'.

The study also found that the use of the price cap strongly increased the probability of a renegotiation of a concession contract in Latin America well before the scheduled renegotiation date.

A recent survey of utility regulatory practice in developing countries provided further insight into the different methods used to regulate prices and profits in the regulated utilities in these countries (Kirkpatrick, Parker and Zhang, 2004a).

Table 7 reports the regional distribution of replies to the question in the questionnaire on how prices of profits are regulated. It should be born in mind that the questionnaires returned may be mainly from countries where regulatory practices are well established, introducing some sample bias. Those countries from which replies were not received may be those in which no formal price cap or rate of return regulation operates and where prices are still a matter for political action. In which case the 'government pricing' column in Table 1 may under-estimate the degree of direct government involvement in prices in utility industries. Nevertheless, the survey results provide a useful initial insight into price and profit regulation in developing and transition economies.

The results reported in Table 7 reveal that some form of price cap is currently being applied in the majority (24 out of 36) of the countries, although this figure tells us nothing about *how* the price cap is used or the *form* it takes. By contrast, rate of return regulation is used in 17 countries, sliding-scale regulation in only seven countries, and direct government setting of prices in 13. In some of the 36 countries more than one method is used, reflecting different approaches adopted for different regulated industries within the same country (sometimes this applies to even different segments of the same sector, e.g mobile and fixed line telecommunications). Other methods of pricing mentioned by respondents were 'adjustment of prices proposed by industrial operators' (negotiation), and 'benchmarking'. It is interesting to note that Asian countries are more likely to use price cap regulation than rate of return, but

have a lower propensity than the other regions to rely still on direct government setting of prices.

The questionnaire also sought to identify the difficulties faced when using price cap and rate of return regulation. When a price cap form of regulation is used, the difficulty most often cited in answers concerned 'information asymmetries', a problem highlighted in the theoretical literature on economic regulation, reviewed earlier. Respondents in twenty-three countries mentioned information asymmetry as a serious problem. Other difficulties cited were 'serious levels of customer complaints about rising prices' (17 countries), 'political pressures' (15 countries), 'enterprises providing misleading information' (14 countries, and a further manifestation of information asymmetry in regulation), 'problems related to 'quality of service' (12 countries) and 'enterprises under-investing in capital equipment' (10 countries). The latter two problems also featured in the earlier review of the literature on price caps. Less often cited were difficulties relating to 'inability to recruit skilled staff' (4 countries), 'enterprises earning excessive profits' (4 countries), 'enterprises over-recruiting labour' (4 countries and a sign of padding operating expenditures), 'over-investing in capital equipment' (4 countries and a sign of padding capital expenditures), 'under-recruiting labour' (2 countries) and 'excessive rises in the pay of senior management' (3 countries).

Respondents were also asked to comment on difficulties faced when operating rate of return regulation. Again, the most cited difficulty related to 'information asymmetries' (10 countries), 'serious levels of customer complaints about rising prices' (10 countries), 'enterprises over-investing in capital equipment' (9 countries), 'enterprises providing misleading information' (8 countries), 'political pressures' (7 countries), 'excessive rises in the pay of senior management' (6 countries) and problems related to 'quality of service' (6 countries). The least cited difficulties related to 'enterprise earning excessive profits' (4 countries), 'enterprises over-recruiting labour' (3 countries), 'enterprises under-recruiting labour' (3 countries), 'inability to recruit staff skilled in the management of regulation' (3 countries), 'improvements in the quality of service' (2 countries) and 'enterprises under-investing in capital equipment' (2 countries).

To assist a comparison of the answers to the questions, relating to difficulties faced when operating a price cap and rate of return regulation respectively, Table 8 provides a summary of the answers. The figures in parentheses show the percentage of countries in which regulators using price caps/rate of return regulation reported each difficulty.

Table 7: Methods of Regulation Used

Region	Price caps	Rate return regulation	of Sliding scale	Government setting prices	Other
Asia (no. of countries)	7	4	1	2	
Africa (no. of countries)	7	7	1	5	1
Latin America (no. of countries)	5	2	3	4	1
Transition Economies (no. of countries)	5	4	2	2	
Total number of countries	24	17	7	13	

Source: Kirkpatrick, Parker and Zhang, (2004a)

Table 8: A Comparison of the Reported Difficulties Faced when Operating Price Caps and Rate of Return Regulation in Developing and Transition Economies

(Number of countries in which regulators reported a difficulty: figures in parentheses show the percentage of countries in which regulators using price caps/rate of return regulation reported this difficulty)

Difficulties:	Price cap	Rate of Return Regulation
Information asymmetries or inadequate information on the firm's costs and revenues	23 (96%)	10 (59%)
Enterprises providing misleading information	14 (58%)	8 (47%)
Serious levels of customer complaints about rising prices	17 (71%)	8 (47%)
Enterprises earning excessive profits	4 (17%)	4 (24%)
Enterprises over-recruiting labour	4 (17%)	3 (18%)
Enterprises under-recruiting labour	2 (8%)	3 (18%)
Enterprises over investing in capital equipment	4 (17%)	9 (53%)
Enterprises under investing in capital equipment	10 (42%)	2 (12%)
Excessive rises in the pay of senior management	3 (13%)	6 (35%)
Problems with quality of service	12 (50%)	6 (35%)
Inability to recruit staff skilled in the	4 (17%)	3 (18%)
	15 (58%)	7 (41%)

management of regulation		
Political pressures e.g. ministerial intervention in setting prices		
Total number of difficulties reported	112	69

Source: Kirkpatrick, Parker and Zhang, (2004a)

Comparing the replies is interesting. In particular, it appears that regulators operating price caps complain more about information asymmetries and misleading information from enterprises than regulators using rate of return regulation – 96% of countries using price caps report the former as a problem compared to 59% of countries using rate of return regulation. This suggests that rate of return regulation, while not entirely free from the same problems, is perceived to be superior in terms of generating accurate regulatory information. Rate of return regulation is based on a ‘bottom-up’ approach of calculating operating and capital costs and imposing an agreed rate of return on capital to generate the annual revenue requirement. It seems that this method of regulation may create less incentive for management to ‘cheat’ by concealing information from the regulator than under a price cap regime.

It seems also to be the case that the price cap generates more customer complaints to regulators about rising prices than rate of return regulation. This may reflect the fact that rate of return regulation is easier to comprehend and more transparent in the way that it sets prices than a price cap, where calculation of the X factor and ‘cost pass throughs’ can be highly controversial, especially in the absence of sound cost benchmarking. At the same time, this comes at an apparent cost in terms of both distorting employment levels (both up and down) and over-investment; the latter result being very consistent with expectation from the theoretical literature (the Averch-Johnson effect). However, price caps also seem to be associated with perceived employment distortions and stand accused of promoting *under*-investment, which, as discussed earlier, is undesirable in economies where expanding provision to under-supplied communities is a priority. The evidence from the survey suggests that price caps do cause firms to reduce investment, probably reflecting uncertainty about the outcome of ‘periodic reviews’ when price caps are re-set and the threat of regulatory intervention in prices at other times. Consistent with such a fear, price caps seem to be more open to political pressure than rate of return regulation – regulators in 58% of countries using price caps report this as a problem compared with 41 percent that use rate of return regulation. Again, this probably reflects the uncertainties surrounding the setting of optimal X factors to promote maximum efficiency incentives while enabling the enterprises to properly fund their operations. Politicians face more pressures from the public and business to intervene outside the price review periods when profits are rising. We also had confirmation that price caps can lead to distortions in the quality of service as regulated firms attempt to cut costs to boost profitability within the cap. This seems to be less of a problem for rate of return regulation, probably reflecting the fact that under this form of regulation, firms are financed to meet agreed output targets.

To conclude, both price caps and rate of return regulation have been studied at length in the theoretical literature and experiences with their operation are well documented for developed economies and notably the US and UK. However, the extent of their use and the difficulties faced when using them are much less well documented for developing economies. Nevertheless, recent research has confirmed that price caps have been widely adopted for utility sectors in developing economies, although in many countries both price caps and rate

of return regulation operate in different utility industries and occasionally in the same industry. Equally, some countries have adopted other methods, especially hybrids such as the 'sliding scale', while others still report high usage of direct government setting of prices. While the price cap has proved successful in countries such as the UK in raising efficiency in regulated enterprises, its use in developing economies, with their different institutional structures and often reduced administrative capacity, is proving particularly problematic. These conclusions are consistent with the view that great care is needed when transferring regulatory policy from one country (or region) to another.

6. Utility Regulation In Developing Countries: The Electricity And Water Sectors

6.1 Introduction

Infrastructure has long been seen as one of the key drivers of economic growth in developing economies, and research has consistently shown that investment in infrastructure has the potential to make a major contribution to sustainable development (Willoughby, 2002). The adoption of the Millennium Development Goals has again focused attention on the contribution that infrastructure can make to pro-poor growth and poverty in low-income economies (Leipziger et al., 2003; Clarke and Wellsten, 2002). It is clear, however, that this potential has not been fully realised and that there remains an immense gap between the current supply of infrastructure services and the needs of the majority of the population in developing countries. The world wide estimates for developing (and transitional) countries show the shortfall in the provision of essential infrastructure services (World Bank, 2003c, quoted in Willoughby, 2002):

- 1 billion people do not have access to improved water supplies
- 2 billion people live without improved sanitation
- More than 1.6 billion people are without electricity, including 90% of the population in most sub-Saharan African countries
- About 900 million rural people lack access to an all-purpose road.

Comparison of these numbers with the current estimate (1.2 billion) of those living on less than one dollar a day, suggests that the vast majority of these very poor people are excluded from direct service.

The privatisation of infrastructure can be expected to contribute to poverty reduction both indirectly and directly. By promoting economic efficiency and economic growth, infrastructure investment will contribute indirectly to poverty reduction. For the Latin America region, a single percentage point of growth reduces the number of people living in poverty by half a percentage point (Estache, Foster and Wodon, 2002, p.2). The direct contribution of infrastructure to poverty reduction will occur through improved access to services by the poor.

This section reviews the regulation experience in developing countries with the privatisation in the electricity and water sectors. Particular consideration will be given to assessing the impact of regulation on the economic and social performance measures, as indicators of the indirect and direct contribution that privatisation in these two sectors has made to meeting the infrastructure needs of the poor. As was shown in section 2, there are significant differences in the level and form of private participation in infrastructure in developing countries. Private investment in electricity projects accounted for 28% of cumulative investment during the period 1990 to 2001, whereas water and sewerage accounted for only 5%. The dominant forms of private participation also differed. In electricity, much of the private investment was in greenfield projects, as independent power producers implemented BOO or BOT contracts. In contrast, in the water sector, 40% of private investment projects involved concession contracts, which accounted for 64% of the total amount invested. Divestitures or the sale of state-owned water businesses to the private sector have been

rare, accounting for only 8% of the funds invested. These differences in the form of private sector involvement in the electricity and water sectors are, in part, a reflection of the technological characteristics of each sector, which are in turn reflected in the market structure. This affects the potential of introducing competition into the market, a factor which will be an important consideration in designing and implementing a regulatory regime appropriate to the sector's structural characteristics.

6.2 Reform of the Electricity Sector

Over the last two decades, the notion of 'natural monopoly' has been rejected in electricity generation and supply and these parts of the supply chain have been opened up to competition; though transmission and distribution systems still retain important economies of scale that usually limit the scope for competition.

A number of studies and reports (for example, Bacon, 1995; World Energy Council, 1998; Czamanski, 1999; APERC, 2000; Bacon and Besant-Jones, 2001) have already described the principal driving forces behind electricity reforms. Although they may not be present in every country that is reforming its electricity sector, they can be summarised as: (1) the poor performance of state-run electricity operators in terms of high costs, inadequate expansion of access to electricity services and unreliable supply; (2) the inability of the state sector to meet the investment and maintenance costs of the electricity industry, in order to keep pace with the increasing demands for power resulting from economic development in other sectors of the economy; (3) rapid changes in technology in both the generation of electricity and in the computing systems used to meter and dispatch power, making new industrial structures possible; (4) the need to remove electricity subsidies so as to release resources for other areas of public expenditure; (5) the desire to raise immediate revenue for the government through the sale of state assets; (6) the demonstration effects of the pioneering reforms of the power sectors in Chile, England and Wales and Norway in the 1980s; and (7) pressure for reform from international financial organisations and donor agencies such as the IMF and World Bank, through their 'lending for institutional reform' programmes.

The reform programmes adopted by developing countries have tended to include the following four main elements:

1. Introduction of competition to the sector in order to improve efficiency, customer responsiveness and innovation.
2. Restructuring the industry in order to enable the introduction of competition. This means breaking up, or 'unbundling', the incumbent monopoly utilities possibly into separate generation, transmission, distribution and supply providers.
3. Privatisation of the unbundled generators and suppliers. It is expected that entities under dispersed ownership will facilitate competition and that private investors and operators will bring in financial resources and managerial expertise into production and supply, previously dominated by sleepy state-owned monopolies.
4. Development of a new regulatory framework. State regulation is still required especially of those areas of electricity supply that remain dominated by one or a very small number of operators, to prevent monopoly abuse. Instead of direct regulation by a government department, the establishment of 'independent' or quasi-independent regulatory bodies, in the forms of offices and commissions, has been favoured, drawing particular on the regulatory models of the US and UK. This form of arm's length regulation is expected to encourage private capital to invest in capacity in the face of a potential 'hold up' problem (Hart and Moore, 1988). Privatisation requires investors to sink funds into fixed assets in the electricity sector that may have little if any residual value if government should renege on power contracts, say in the form of failing to take supplies or preventing

price increases when input costs rise. Energy supplies and prices are always of interest to politicians because supply failures and sharply higher prices can provoke social unrest. Some form of independent regulation can provide reassurance to investors that prices, outputs and inputs will not be politically manipulated. However, there is an extensive literature on the distorting effects of state regulation even when conducted by dedicated regulatory bodies (Armstrong *et al.*, 1994; Guasch and Hahn, 1999).

While the reform programmes for the electricity sector have been built around these four elements, the detail has varied to reflect local circumstances (Bacon and Besant-Jones, 2001). In developing countries privatisation is rarely complete. The result is electricity systems with private and public ownership co-existing. Also, the degree of competition permitted can vary depending on which restructuring model has been used, for example the single-buyer model, wholesale competition (which can itself take various forms), or retail competition (Lovei, 1996; Hunt and Shuttleworth, 1996). Finally, regulation can take many shapes (Gilbert and Khan, 1996; Stern and Holder, 1999) and, as Crew and Kleindorfer note (1996, p.215), the need for workable solutions can lead to the design and implementation of regulatory systems that are not necessarily in line with economic theory.

A number of studies have examined the effects of ownership and competition on industrial performance. The main aspects of economic performance studied have been labour and total factor productivity, costs of production, profits and other financial ratios, and prices. The conclusions of these studies are not completely consistent, however. Hawdon (1996), analysing the performance of power sectors supported by World Bank loans, found that those countries using privatisation had significantly higher efficiency than the non-privatising group. Bortolotti *et al.* (1998), studying data on the privatisation of electricity generation in 38 countries (both developed and developing) between 1977 and 1997, concluded that effective regulation is crucial to the success of privatisation (also see Pollitt, 1997). In a comparison of electricity production in 27 developing countries in 1987, Yunos and Hawdon (1997) found that public sector suppliers performed as well as private sector companies; though in none of the countries studied had effective competition been introduced.

Vickers and Yarrow (1988) argue that the mixed results from the empirical literature on the effects of privatisation are due to a focus on the ownership variable. Other factors that should be taken into account include the nature of market competition and the role of institutions, such as well-developed capital markets and private property rights (Vickers and Yarrow, 1988; Lee *et al.*, 1999; Villalonga, 2000). This conclusion is supported by studies that have found that competition is associated with lower costs, lower prices and higher productive efficiency (Bouin and Michalet, 1991; Kwoka, 1996; Kleit and Terrell, 2001; Martin and Vansteenkiste, 2001) and that the success or failure of privatisation depends on the post-privatisation regulatory framework, which in turn is affected by political and social norms (Levy and Spiller, 1996; Torp and Rekve, 1998; Jamasb and Pollitt, 2000; Villalonga, 2000; Arocena and Price, 2002).

Arguably, therefore, in appraising the performance of the electricity sector in developing countries it is important to take account of the effects of ownership, competition *and* regulation, perhaps alongside other institutional factors. One of the practical difficulties, however, is how to measure such factors. Using 11 political variables, Bergara *et al.* (1997) composed two political indexes to examine the effect of institutions on electric utility investment. They found that well-defined and credible political institutions were positively and significantly correlated with global electricity generating capacity. Based on three aspects of regulation – entry conditions, access to the network and prices – Bortolotti *et al.* (1998) concluded that the smoothness of the privatisation process was highly and positively correlated with the extent of regulation. Taking regulation as a dummy variable, Wallsten (2001) reports that privatisation in the telecommunications sector, which alone was

associated with few benefits in his study, showed positive correlations with performance measures when combined with the existence of an independent regulator. Alongside Wallsten's work, the study by Steiner (2000), used a panel data set for 19 OECD countries and dummy variables for market liberalisation of electricity generation, ownership and privatisation of generation (partial or complete), along with variables for vertical integration, the existence of an electricity market and consumer choice. The results from this study are mixed.

The study by Zhang, Parker and Kirkpatrick (2003a) is one of the few empirical studies of the effects of privatisation, competition and regulation *together*, for the electricity sector in developing countries. Using panel data for 51 countries in Africa, Latin America and the Caribbean, and Asia over the period 1985 to 2000, the study confirms the importance of competition and/or effective independent regulation if economic performance is to improve following privatisation. Privatisation on its own does not generate many benefits. However, when accompanied by a regulatory regime that is supportive of investor confidence, privatisation does lead to more capacity, higher output, and an improvement in productive efficiency.²

These empirical results have policy implications for electricity reformers in developing countries. Like Pollitt (1997), the study finds that competition is the most reliable driver of economic benefits. In the light of the benefits associated with competition, reformers should introduce measures conducive to promoting liberalised electricity markets. When privatising industries where significant monopoly powers remain, emphasis should also focus on designing and implementing an effective regulatory framework. Because competition is confirmed as the most reliable means of improving performance, this suggests that the use in a number of developing countries of exclusivity periods granted to new generators and long-term purchase contracts for IPPs, arranged so as to stimulate investment, may be unwise. Such measures may dim efficiency incentives and reduce economic performance by removing the incentive of competition.

The sequencing of privatisation, competition and regulatory reforms can also affect performance. Zhang, Parker and Kirkpatrick (2003b) examine the impact of establishing an independent regulatory authority and introducing competition before privatisation. Using data for the electricity sector in a sample of developing countries, the empirical results show that the establishment of regulation and/or the introduction of competition, are correlated with higher electricity generation and higher generation capacity. The implication for policy is that the sequencing of reforms has a significant effect on post-reform performance.

Overall, the empirical evidence seems to suggest that, in assessing the results of electricity reforms, the effects of privatisation, competition and regulation should be taken into account, both separately and in some form of combined or interactive way. Most of the existing studies of electricity have dealt only with one or two of these factors. Another gap in the literature exists because the studies focusing on changes in the electricity sector have been mostly drawn from the developed economies, such as the UK, US and Scandinavian countries. Where developing countries have been examined, studies have usually concentrated on Latin America, and especially Chile and Argentina (Lalor and Garcia, 1996; Chisari *et al.*, 1999).

6.3 Reform of the Water Sector

Donor agencies advocate the privatisation of public utilities in lower-income economies to promote more efficient operation, increase investment and service coverage, and to reduce the financial burden on government budgets (World Bank, 1995). In response, a range of services including water supply has been opened up to private capital. This section looks at the impact of water services privatisation.

The provision of high quality water services remains a priority for most developing economies. According to the World Bank (2003c, p.1), more than 1bn people in the developing world lack access to clean water and nearly 1.2bn lack adequate sanitation. An estimated 12.2m people die every year from diseases directly related to drinking contaminated water. Improved investment in water services and their more efficient management are a development priority (OECD, 2000). The Millennium Development Goal is to halve the number of people using unsafe water by 2015 (Hulls, 2003, p.32). The pressing question for public policy is the extent to which privatisation is critical to achieving that objective.

Private water suppliers exist in all developing countries in the form of water vendors at the street level, but there was little privatisation of piped water services in developing countries before 1990 (Snell, 1998; Collignon and Vézina, 2000). Between 1984 and 1990 only eight contracts for water and sewerage projects were awarded to the private sector world-wide and the cumulative new capital expenditure in private water services totalled less than US\$1bn.

However, during the 1990s there was increased water privatisation activity, stimulated by donor agency pressures, and in 1997 the total figure for private investment had risen to US\$25bn. By the end of 2000, at least 93 countries had privatised some of their piped water services, including Argentina, Chile, PRC, Colombia, the Philippines, South Africa and the transition economies of Central Europe, as well as Australia and the UK (Brubaker, 2001). Taking the period from 1990 to 2002, there were 106 such projects in Latin America and the Caribbean and 73 in East Asia and the Pacific region. By contrast there were only seven projects in the Middle East and North Africa and 14 in sub-Saharan Africa. In terms of the amounts invested, Latin America and the Caribbean and East Asia and the Pacific accounted together for over 95% of the total investment (calculated on the basis of data from the World Bank PPI Database). A small number of countries accounted for most of the privatisation of water services, and within these countries figures were dominated by a few large contracts. Indeed, one project, Aguas Argentinas, accounted for US\$4.9bn or 20% of the investment in the whole of Latin America; while five Philippines contracts accounted for 38.4% of the total private investment in water services in East Asia.

Evidence suggests that the privatisation of monopolies produces ambiguous results in terms of improving economic performance (Megginson and Netter, 2001) and it is to be expected that the institutional requirements to ensure that privatised monopolies perform well, notably an effective system of state regulation and supporting governance structures, will be particularly missing in many developing countries (Parker and Kirkpatrick, 2004a). Privatising water services is normally associated with contracts that take the following forms, namely service contracts (contracts to provide specialist services such as billing), management contracts and leases for existing facilities (private companies operating existing facilities but without new private sector investment), concessions (requiring the private sector to invest in facilities), divestitures (sale by the state of some or all of the equity in SOEs) and greenfield investments (including build-operate-transfer [BOT] type schemes) (Johnstone and Wood, 2001, pp.10-11). In practice, contracts under which private firms provide the services but government remains the ultimate owner of the water system and may remain responsible for some investment are commonplace (OECD, 2003). Of 233 water and sewerage contracts with the private sector arranged between 1990 and 2002 on the World Bank's PPI Project Database, 40% involved concession contracts and these accounted for 64% of the total amount invested (see Table 3). Where greenfield projects have occurred, for instance in PRC, they have often involved the building and operation of new water treatment plants; while BOT schemes for water supplies have been largely restricted to Latin America and the Caribbean. Divestitures or the sale of state-owned water businesses to the private sector have been rare, accounting for only 15.6% of all water projects and 8% of the total funds invested. Also, although privatisation of water services has occurred, it is important not to

exaggerate its importance. At present little more than 5% of the world's population is provided with drinking water through private operators (OECD, 2003) and since the Asian economic crisis of 1997/98 there has been a marked slow down in infrastructure privatisation in lower-income economies, including in the water sector (Harris, 2003).

The existing statistical or econometric evidence on the results of water privatisation presents a mixed picture with some improvements in the reliability and quality of services and population served, but instances of much higher water charges and bouts of public opposition leading to cancelled schemes. This evidence is reviewed in Kirkpatrick et al (2004d).

The earliest such study was undertaken by Estache and Rossi (1999). They compared 50 private and public water companies in the Asian and Pacific region, using 1995 survey data from the Asia Development Bank, and found that private operators were consistently more efficient than state-owned ones. In stark contrast, however, a follow up study by the same authors came to exactly the opposite conclusion (Estache and Rossi, 2002). Using the data from the same 1995 survey by the Asian Development Bank, they concluded that efficiency was not significantly different in the private and state water sectors. Fifty water enterprises were included in their study from 29 Asian and Pacific-region countries, with 22 having some form of private sector participation.

A further study, this time by Estache and Kouassi (2002), used a sample of 21 African water utilities for the period 1995/97. They estimated a production function from an unbalanced panel data set and used Tobit modelling to relate resulting inefficiency scores to governance and ownership variables. The study concluded that private ownership *is* associated with a lower inefficiency score. However, only three firms in their sample had any private capital and levels of corruption and governance were far more important in explaining efficiency differences between firms than the ownership variable.

A study of water supply in Africa in the mid to late 1990s by Clarke and Wallsten (2002) reported greater service coverage under private ownership. On average, they found that supplies for lower-income households (proxied by educational attainment) were smaller where there was a state-sector operator. Clarke and Wallsten (2002), therefore, concluded that private participation in water schemes leads to more supplies to poorer households than where there is a reliance on state-owned suppliers. Their study suggests that privatisation can improve service provision. However, there may be offsetting service difficulties and especially higher charges when supplies are privatised. In other words, drawing strong conclusions on the desirability of water privatisation based on one measure, such as service coverage, may mislead. In the analysis below we use a range of performance measures in an attempt to address this problem.

Finally, a recent study examines the economic impact of water services privatisation in Africa using data on up to 110 water utilities in the year 2000 (Kirkpatrick, Parker and Zhang, (2004b). To assess the impact of private capital on performance in water services, a range of performance measures was calculated for both state-owned and privately-owned water suppliers and a number of statistical measures were computed from the data set, including:

- Labour productivity, labour costs to total costs, number of staff to number of water connections and staff per million cubic metres of water distributed – all of these measures will reflect *efficiency in the use of labour*.
- The proportion of operating costs spent on fuel and chemicals – to reflect *economies in non-labour operating costs*.
- The percentage of capital utilised – to reflect *capital stock efficiency*.
- Average tariffs – to reflect the *costs of services to consumers*.

- The percentage of the population served, unaccounted for water (water losses), and hours of availability of piped water per day – to reflect the *quality of service to consumers*.

Average figures were computed for both state-owned and privately-owned water suppliers and the results are provided in Table 9, with standard deviations shown in parentheses. This stage of the analysis involved between 61 and 84 utilities depending upon the performance measure.

Table 9: Performance Ratios in African Water Utilities: 1999-2001

<i>Labour productivity</i>	
Labour costs in total costs:	
Average for state owned firms	29% (17)
Average for privately-owned firms	21% (27)
Staff per thousand water connections	
Average for state owned firms	20.1 (19.9)
Average for privately-owned firms	13.1 (14.4)
Staff per million cu.mts of water distributed	
Average for state owned firms	123 (519.7)
Average for privately-owned firms	78 (151.8)
<i>Operating costs</i>	
Proportion spent on fuel	
Average for state owned firms	20% (16)
Average for privately-owned firms	11% (12)
Proportion spent on chemicals	
Average for state owned firms	17% (16)
Average for privately-owned firms	4% (5)
<i>Capital</i>	
Capital utilisation	
Average for state owned firms	60% (21.6)
Average for privately-owned firms	67% (21.8)
<i>Consumer charges (US\$ per cu. mt.)</i>	
Average tariff	
Average for state owned firms	168 (473)
Average for privately-owned firms	305 (440)
<i>Quality of service</i>	
Percentage of population served	
Average for state owned firms	63% (29.8)
Average for privately-owned firms	64% (30.2)

Unaccounted for water	
Average for state owned firms	34.8% (13.5)
Average for privately-owned firms	29.0% (13.1)
Availability of piped water (hours per day)	
Average for state owned firms	17 (6.7)
Average for privately-owned firms	16 (9.3)
% of customers metered	
Average for state owned firms	60 (41.5)
Average for privately-owned firms	79 (38.4)

Source: Kirkpatrick, Parker and Zhang (2004b)

The figures in Table 9 confirm that, on average, private sector water utilities have higher labour productivity (both a lower number of staff per connection and per million cubic metres of water distributed) and a lower proportional spend on labour in operating costs than state-owned firms. On average, the private sector is also more economic in its use of other inputs, namely fuel and chemicals, and achieves a slightly higher capital utilisation, of 67% as against 60%. Turning to tariffs, charges are on average 82% higher in the private sector and more customers have their water consumption metered where services are privatised. Metering water can be a means of extracting higher revenues from consumers by linking payments to the volumes of water used. The private sector also achieves a lower percentage of water losses, averaging 29% as against 34.8% for state-owned water firms (probably assisted by more metering). But, interestingly, other measures of customer service suggest fewer differences between the private and state sectors. On average, state-owned firms supply piped water for 17 hours per day, while the private sector records a slightly lower figure of 16 hours. The state and private sectors serve about the same percentage of population in their areas, 63% and 64% respectively. These results, however, may simply reflect that it is where services are poor that governments have been most inclined to turn to the private sector for a solution.

The performance ratios in Table 9 reveal interesting differences across the private and state-owned water firms in Africa but with the standard deviation figures (in parentheses) confirming a high degree of variance in performance within both the state and private sector categories. This suggests that conclusions based on average performance need to be interpreted with care.³

The studies of water privatisation in developing countries suggest that private ownership can be associated with higher performance, although it is not axiomatic that private suppliers are more efficient. It is interesting to consider, therefore, why privatisation of water services may be problematic in lower-income economies. The answer seems to lie in a combination of the technology of water provision and the nature of the product, the costs of organising long-term concession agreements or transaction costs, and regulatory weaknesses, to which we now turn.

Past studies of privatisation in developing countries have indicated that competition is generally more important than ownership, per se, in explaining performance improvements in developing countries (e.g. Zhang et al., 2003a; Parker and Kirkpatrick, 2004a). But unlike in the case of telecommunications and parts of energy supply, such as generation, where competition is feasible, competition in the market for water services is usually cost inefficient. While there is scope for introducing some competition into billing and metering and into construction, replacement and repair work within water services, competition in the actual provision of water supplies is normally ruled out by the scale of the investment in fixed assets

or network assets that are needed to deliver the product. Moreover, even where actual competition for consumers might seem feasible, for example where the boundaries of different water utilities meet, the costs of moving water down pipes is far higher than the costs of transmitting telephone calls and distributing electricity, and this places a serious limitation on the development of competition. Also, mixing water from different sources can raise complications in terms of maintaining water quality, which can be an important consideration for domestic consumers but more especially water-using industry, such as brewing and food processing.

In other words, the technology of water supply and the nature of the product, together, severely restrict the prospects for competition in the market and therefore the efficiency gains that can result from encouraging competition following privatisation. This leaves rivalry under privatisation mainly in the form of 'competition for the market' or competition to win the contract or concession agreement. However, here serious problems can also arise. These problems relate to the existence of pervasive transaction costs.

As already explained, water privatisations involve various types of contracts. Transaction costs arise in contracting for water services provision, in terms of the costs of arranging the agreements, including organising the bidding process, monitoring contract performance, and enforcing the contract terms where failures are suspected (Williamson, 1985). The economics literature demonstrates that such costs are likely to be high where there are serious information asymmetries at the time of the contract agreement. These information imperfections are likely to be especially prevalent when contracts have to be negotiated to cover service provision over long periods of time because many future events that could affect the economic viability of the contract and the acceptability of the service offering are unforeseen, and may be unforeseeable. Concession agreements in water are typically negotiated for 10 or 20 years or more. Inevitably, therefore, the contracts will need to permit periodic adjustment of variables such as price, volume and quality during the contract life. The contract will be incomplete in terms of specifying all of the contingencies that may trigger such adjustments and the form the renegotiation might take. This places a large emphasis on the skills of both government and companies when operating water concessions, to ensure as far as possible that the outcome is mutually beneficial.

The usual approach in water concessions is to have a two-part bidding process. The first stage involves the initial selection of approved bidders, based on technical capacity, and then a final stage in which the winner is selected, based on criteria such as the price offered and service targets. However, the smaller the number of bidders, the greater the scope for either actual or tacit collusion when bidding and the less effective will be the competitiveness of the bidding process. The evidence suggests that water concessions in developing countries are subject to small numbers bidding. For example, in 2001, 18 companies expressed interest in operating a contract for Nepal in the first stage of the process, but in the final stage only two serious bidders remained (cited in Mitlin, 2002, p.17). In Argentina, there have usually been only a small handful of applicants for water concessions, typically between two and four (Estache, 2002); the ill-fated Cochabamba concession had a sole bidder. Prequalification criteria and risk restrict the bidding for water concessions mainly to a small number of players (McIntosh, 2003, p.2). In an attempt to stimulate interest from more potential suppliers, concessions can include sovereign (government or donor agency) guarantees of profitability, but this introduces obvious moral hazard risks – with profits guaranteed, what incentive exists for the concession winner to produce efficiently? While there appears to be a number of players, in most bids only a few of these firms choose to become involved, often reflecting preferences regarding regional investment. In practice, this is not a market composed of large numbers of active competitors for all or even most contracts.

The literature on transaction costs demonstrates that small numbers contracting is a source of opportunistic behaviour leading to higher transaction costs (Williamson, 1985). The result

can be both adverse selection and moral hazard. Adverse selection takes the form of sub-optimal contracts at the outset, resulting from one of the contracting parties acting opportunistically to arrange especially favourable terms; while moral hazard occurs when one of the contracting parties renegotiates the terms of the contract in their favour during its lifetime. During contract renegotiation either the company or the government could be the loser, depending upon the results of the renegotiation. For example, in the concession involving Maynilad in Manila, the company terminated the concession when it was refused a rate adjustment to which it considered it was entitled. By contrast, in Dolphin Bay, South Africa, the municipality felt that it had little alternative but to agree an unplanned price rise when the private sector supplier threatened to withdraw services (Bayliss, 2002, p.16). By transferring operations to the private sector, government loses the internal skills and expertise that enable it to takeover a failing enterprise.

Guasch (1999) concludes that 55% of water concession contracts in Latin America were renegotiated significantly within a few years of being signed – in Buenos Aires prices were raised within months of the start of the water concession (Alcazar et al., 2000). But even the ability to renegotiate terms may not be sufficient to overcome investor reluctance to participate in water privatisations, thus reinforcing the small numbers bargaining problem. Difficulties arise especially when private investors fear that there is no long term political commitment to water privatisation (Rivera, 1996). Moreover, corrupt payments to win concessions and 'cronyism' undermine the legitimacy of the privatisation process; for example, in Lesotho the Highlands Water Project was associated with bribes to government officials (Bayliss, 2000, p.14). Esguerra (2002) shows how the water concessions in Manila were backed by the Philippines' two wealthiest families with support from multinationals: 'It appears that the two companies' approach was to win the bid at all costs, and then deal with the problems of profitability later' (ibid., p.2). They are also accused of trying to influence the subsequent regulatory process. The way in which the privatisation in Buenos Aires helped promote the interests of elite groups is highlighted by Loftus and McDonald (2001, p.198).

Studying cancelled concession contracts in developing countries, Harris et al. (2003) find that water and sewerage concessions have the second highest incidence after toll roads. Given the existence of substantial potential 'sunk costs' in the water industry, this is not surprising. Tamayo et al. (1999, p.91) note that the specificity of assets in the water industry is three to four times that in telecommunications and electricity. Reflecting this, water companies in Brazil have a high cost of capital compared to the electricity sector, reflecting the bigger regulatory risk (Guasch, 1999). Handley (1997) stresses the problems caused by inadequate risk management techniques in developing countries; while the preference on the part of the private sector for the state to remain responsible for the infrastructure in water contracting, reflects the desire of companies to minimise their sunk costs.

Pargal (2003, p.23) based on an econometric assessment of private investment flows and data from Latin America concludes that: 'the water sector differs materially from [telecoms, electricity and roads]...: private investment in water is not significantly affected by the passage of reform legislation in the sector and public expenditure is very important and only mildly substitutable for private spending.' Studies have shown that in telecommunications (Wallsten, 2001) and electricity generation (Zhang, et al., 2003a, 2003b) the regulatory system put in place to monitor and control the prices and quality of services supplied by the private monopolist is important. However, transaction costs in water concessions reinforce serious weaknesses in government regulatory capacity in developing countries (Spiller and Savedoff, 1999, pp.1-2). For example, in India there have been some local moves to attract private capital into water supply, notably in Tiruppur, Maharashtra and Gujarat. But regulatory systems are underdeveloped and in Tiruppur they are largely under the indirect control of the water operator (Teri, 2003, pp.171-21). As Mitlin (2002, pp.54-55) concludes on the experience in Manila:

The experience in Manila suggests that the gains [from privatisation] may be less than anticipated because the assumption that the involvement of the private sector would remove political interference from the water sector was wrong. It may be that processes and outcomes have simply become more complex because the water supply industry now has the interests of private capital in addition to a remaining level of politicisation and an acute level of need amongst the poorest citizens.

The decline in private sector infrastructure investments since 1997 is consistent with growing concerns about regulatory capacity and governance within developing countries (Harris, 2003). The next section of the paper, therefore, considers issues of regulatory capacity and governance in lower-income economies.

7. Regulatory Capacity And Governance In Developing Countries

Where the privatisation of utility industries in developing countries has been accompanied by the development of dedicated regulatory offices, these have been, to varying degrees, independent from government departments (Guasch and Spiller 1999). However, experience in Western Europe, the USA and Australia indicates that these regulatory offices will face a number of on-going difficulties arising from the inherent information asymmetries that exist in a regulated environment (Newbery, 1999). In practice, it is the firms not the regulators that have direct access to the values of costs, revenues and assets and know their true cost of capital. In effect, the job of the regulator is to provide the incentives for managers in regulated companies to maximise effort and reduce costs, while protecting consumers; and to minimise the information rent that the company achieves by failing to reveal its efficient costs of production to the regulator. The regulator may also retain powers to fine or in other ways penalise the firm for regulatory 'cheating'. In Western Europe, the USA and Australia such powers are used and regulated firms have redress through appeal against regulatory decisions to the courts or to another appeals body, such as the Competition Commission in the UK.

Compare this with the economic and legal environment in many developing economies and the differences are stark. The institutional endowment of an economy is now recognised to be a critical factor in the economic success of an economy (Rodrik, 2000) As Douglass North (1990, p.66) comments: '...when economists talk about efficient markets, they have simply taken for granted an elaborate framework of constraints.' The institutional endowment of a country includes formal constraints - such as constitutions, laws and rules - and informal constraints, such as conventions, customs and norms of behaviour. Industrialised economies are composed of inter-related formal and informal constraints on human behaviour that are generally conducive to market transactions. The efficiency and effectiveness of state regulation is an important part of this institutional structure (Spiller, 1993). Economic development is related to a stable political environment, low corruption and respect for law and order (Kauffman and Kraay, 2002; Jalilian et al., 2003). When new regulatory offices are created they build on and complement this wider institutional structure.

By contrast to the situation in developed economies, the institutional context of developing economies is often much less conducive to market transactions. Regulatory rules and conventions are often weak and under-developed. Many developing economies lack sound institutional structures to promote private entrepreneurship and competition, leading to disappointing economic results even when policies that have 'worked' elsewhere, such as privatisation and market liberalisation, are imported. Also, and on a more micro-level, regulatory regimes in developing countries can suffer from considerable management deficiencies. The other main difficulties to be found in developing countries relate to expertise and governance problems and include:

- Unclear powers – the regulatory ‘carrots and sticks’ may be ill-defined and their use may be unpredictable because of political control.
- The inability of regulators to commit to some form of ‘regulatory contract’ to remove inconsistency and unpredictability in regulation, especially in countries with unstable political structures that lead to frequent changes of government and where contracts are not protected by the courts.
- Lack of a developed legal code for regulatory appeals.
- Lack of a developed competition policy to complement sector regulation, which places even greater demands on the sector regulator to police successfully the competitive environment and protect consumers.
- A weak macroeconomic environment, including relatively high inflation and exchange rate weaknesses that impact on the cost base of utilities and create disincentives for investors to invest.

In consequence, even before the form of economic regulation is selected, the regulatory environment in many developing economies can be expected to be much less conducive to effective utility regulation than is the case in Western Europe, the USA and Australia, from which the models of sector regulation come (Parker, 2002).

In summary, effective regulatory incentives and regulatory governance regimes both need to be in place (Levy and Spiller, 1994). Where either or both are underdeveloped or absent there is likely to be a continuing threat from regulatory failure.

There is a growing body of evidence of regulatory weaknesses in many developing countries. To begin with, studies show that regulatory offices in developing countries tend to be small, under-manned for the job they face, and possibly more expensive to run in relation to GDP than in developed economies (Domah, et al., 2003). There is a lack of knowledge and trained regulatory staff, especially of economists, accountants and lawyers skilled in regulatory policy analysis and contract design (Jacobs, 2004). In a survey of 22 regulators in 13 Asian countries, Jacobs (2004) found a lack of well trained staff as a major constraint on good quality regulation. Engineers made up the largest group of professional employees in the regulatory agencies, and generalists and managers the second largest. Regulatory staff also have limited capacity in the use of methods of regulation policy analysis, such as regulatory impact assessment (RIA), which can assist in the design and implementation of new regulatory measures.

If state regulation is to promote economic and social welfare, it needs to be both *effective* and *efficient*. Effective in the sense of achieving its planned goals, and efficient in the sense of achieving these goals at least cost, in terms of government administration costs and the costs imposed on the economy in terms of complying with regulations. There is, therefore, a compelling case for the systematic appraisal of the positive and negative impacts of any proposed or actual regulatory change. This appraisal should encompass the likely economic, environmental, social and distributional consequences, thereby providing a comprehensive analysis of regulatory impacts on sustainable development in lower-income economies.

More generally, utility regulation needs to be embedded within a broader process of regulatory governance. Irrespective of whether the regulatory authority is ‘independent’ or within government, it is necessary to establish a policy environment that sustains market incentives and investor confidence. The regulator needs to be shielded from political or political interference, and government needs to support a regulatory environment that is transparent, consistent and accountable.

Regulatory impact assessment (RIA) is a term used to describe the process of systematically assessing the benefits and costs of a new regulation or an existing regulation. At the beginning of 2001, 20 OECD countries were applying regulatory impact assessment, although the extent of its use appeared to vary (Jacobs, 1997, 2002; Radaelli, 2002). By

contrast, there has been little analysis of either the actual use or potential for using RIA in developing countries in the design and formulation of development policy. This is despite the considerable interest in measuring the impact of development policy and in the design and implementation of regulation measures (Stern, 2002). There is an absence of even rudimentary data on the use of regulatory impact assessment procedures in most developing and transition countries, in spite of a recognised need to build regulatory capacity (DFID, 2000a; World Bank, 2001a). In an attempt to close this gap in knowledge about the current use of RIAs in these countries, Kirkpatrick et al (2004c) report on the results of a questionnaire survey of the state of awareness and use of RIA in 40 developing and transition economies⁴.

The main questions, drawing from the above discussion of the principles of RIA, relate to:

- existing familiarity with RIA as a concept and the OECD guidelines;
- the existing use of RIA within the country;
- legal requirements to adopt RIAs and the existence of published RIA guidance within government;
- the form RIAs take when used;
- the processes used within government when undertaking RIAs;
- RIA transparency, in terms of published documentation;
- public consultation and participation in RIA exercises;
- RIA and wider regulatory reforms.

The questionnaire answers confirmed that there is some understanding of RIA and its principles amongst regulators in a number of developing and transition economies. At the same time, this understanding does not seem deep or widespread, with variations in knowledge between different agencies and government departments within the same country. These findings lead to the conclusion that there is a need to improve understanding and practice of RIA in lower income economies, including many which already claim to use the practice. In this context, while the OECD “best practice” guidelines provide some pointers to how a RIA framework for lower-income countries might be developed, they are unlikely to be a complete template or model for transfer and adoption in countries with very different conditions and objectives. The OECD guidelines need translating to reflect the particular issues that arise when regulating in developing and transition countries, including issues to do with regulatory capacity, poverty reduction and development goals. This should be a priority for development agencies. . The World Bank (2001b, p.72) has commented that: “Better regulation does not always mean less regulation”. To date, however, it does not appear that donor agencies have been particularly active in promoting better regulation by initiating processes that lead to effective RIAs, comparable to the OECD’s efforts for its members. This contrasts with the heavy emphasis that these agencies have put on privatisation, including the establishment of government agencies to regulate newly privatised, monopoly markets. Thus, while regulation is now acknowledged to be a key component of development policy, comparatively little attention has been given, so far, to the monitoring of the effectiveness of regulation in the promotion of development in lower-income countries. This paper contends that RIA provides an method for improving the consequences of regulation and regulatory governance.

8. Areas For Future Research On Infrastructure Regulation In Asia

The past decade has seen a ‘second wave’ of privatisation which has resulted in a significant increase in private sector involvement in investment and delivery of infrastructure services in developing countries. This has, in turn, heightened awareness of the need for effective regulation of the now privatised monopoly or near-monopoly utilities, and has led to the

creation of around 200 regulatory agencies in developing countries (Harris, 2003, p38). Evidence on the impact of the growing participation of the private sector in infrastructure is still limited, but suggests that the results have been mixed, and that the anticipated economic and social benefits have not been fully realised. The reasons for these disappointing results are complex and are currently under-researched. They are likely, however, to be context specific, reflecting the particular conditions and characteristics of the economy concerned.

The early evidence that is available, and that has been reviewed in this paper, is consistent with a failure to establish and apply an effective regulatory policy framework within the utilities sector. There is evidence of 'uninformed transfer' (Dolowitz and Marsh, 2000 p17), in models of price and profit regulation and in the broader area of regulatory governance. The price-cap model, which was developed in the context of the UK and other advanced economies, has been widely adopted in low-income economies where the regulatory institutional capacity and availability of data and human resources for regulation, are severely constrained. Similarly, in the area of regulatory governance, the OECD best practice model has been transferred without modification to the conditions of developing countries.

This points clearly to the need for further research in this area, to establish an empirical evidence base on which to develop 'good' regulation models and practice in developing countries. Building on the discussion in the preceding sections of this paper, it is possible to outline the broad parameters of an analytical framework for studying regulation in developing countries.

Developing countries are heterogeneous and therefore any methodology needs to combine rigour with sufficient flexibility to incorporate the differing situations facing developing economies. The approach proposed here is rooted in a well-developed and respected theoretical literature, the economics of regulation, but uses the experiences of developing countries to refine and develop the theory, through an iterative process, so as to ensure that its detail is relevant and thorough. The methodology is intended to be valuable both for *ex ante* and *ex post* regulatory analyses; that is to say when both researching proposed regulations in developing countries and when reviewing existing regulatory regimes. The aim is the gradual development of a rigorous analysis of regulation directly applicable to the challenges and circumstances of a low income economy which is meaningful in terms of lesson drawing (Rose, 1993).

Using this methodology would involve, first, an assessment of the regulatory goals and the weightings attaching to social goals as well as economic ones, leading to a relevant definition of regulatory effectiveness and efficiency for assessing the performance of regulation in a particular context. Second, an assessment of the institutional context within which the regulatory regime is embedded, including an assessment of (a) the political, economic and cultural values that either sustain or frustrate the intended regulation; (b) the scope for, or likelihood of, maintaining regulatory independence in the face of the forces for regulatory and political capture in a country; and (c) the extent of regulatory commitment, leading on to an assessment of regulatory credibility. Third, a review of the likelihood and extent of any information asymmetries, so as to develop an analysis of the consequences of asymmetry for the design of the most appropriate regulatory procedures and processes. Fourth, an assessment of the scope for competition, including the existence of a developed capital market and competition policy, so as to help define both the need for regulation and the relevant forms it should take. The fifth stage involves developing conclusions about the extent of regulatory capacity in a country and the policy implications, including the existing skills base and personnel and training needs. This stage would involve a consideration of mitigation and enhancing issues that could improve the outcomes. The result feeds back into the analysis with the aim of producing an improved outcome (in this sense this stage is similar to a 'regulatory impact assessment' (Lee, 2002; Kirkpatrick et al, 2004b).

The discussion in the paper, which has been based on the theory and practice of regulation in a wide range of countries, suggests the following important areas for research into regulation in the developing economies of the Asia region:

- The nature of information asymmetries in the specific context of Asian developing economies and how these might be best addressed
- The role of incentives within different regulatory regimes and the lessons to be learned
- The rationale for regulatory practice and the comparative roles of market failure and political capture
- The extent to which the attributes of 'good' regulation can be realistically achieved in a developing country and the implications for regulatory reform
- The optimal regulatory structures to adopt and particularly the relevance of 'independent' regulation and 'regulatory gaming' where there is a lack of regulatory capacity.
- The relative merits of cost of service regulation, price caps and sliding scales in economies very different to those developed countries where these methods primarily originated.
- The relationship between utility regulation and the broader process of regulatory governance.
- The need for regulatory capacity building and the precise forms this should take.

As Kanbur (2001, p.16) explains: 'If the world is complex, or if the evidence is uncertain, or if legitimate differences in perspective and framework explain differences in conclusions, analysis must take these on board. And the policy messaging that comes from such analysis must reflect the nature of those complexities. The approach proposed in this paper is consistent with this view and recognises the complexity of economic regulation in the context of development needs. It draws on propositions from the economics of regulation literature because they form a recognised theoretical basis for analysing regulatory problems from an economic perspective. But at the same time, the methodology incorporates recognition of the need to inform and refine theory through the experiences of regulatory policy in developing countries. The result is intended to lead to more coherent and rigorous analysis of regulation in the context of Asian developing economies and through this a symbiosis of theory and practice. In turn this should lead to improved regulatory capacity and ultimately, to enhanced regulatory policy outcomes.

APPENDIX 1: Electricity Sector Reform in Developing Countries: An Econometric Analysis of the Effects of Privatisation, Competition and Regulation

Most of the theoretical arguments for privatisation are concerned with the effects on productive efficiency. It is expected, for example, that privatisation will lead to higher labour productivity and more economic use of the capital stock (higher capacity utilisation). When applying the theoretical insights into aspects of economic performance in the electricity sector, however, specific features of that sector need to be taken into account. The electricity utility industry is characterised by large sunk investments, minimum economic scale, and non-storable and massively consumed outputs. These factors provide governments (either national or local) with the possibility of behaving opportunistically *vis-à-vis* the investing company, as already noted. Knowing that under some circumstances governments may not be able to refrain from renegeing on explicit or implicit agreements and behaving opportunistically, private investors may be cautious about investing in capacity. As a result, the actual effect of privatisation on generation-capacity expansion and use is not clear,

although one of the expectations of governments from privatisation is more capital invested in the electricity infrastructure.

Ownership change is usually accompanied by a shift of functional objectives (Martin and Parker, 1997, p.3). Historically electricity is priced by governments in a manner that is allocatively inefficient (prices not related to marginal costs), in order to reach as much of the population as possible and because individual electricity users are also voters. Hence, residential consumers are often cross-subsidised by other categories of consumers, notably industrial users. Privatisation could lead, therefore, to higher prices to residential consumers and lower prices to industry, as prices are aligned with long-run supply costs and because profits, not votes, are the main concern of private investors.

From the above arguments the following three hypotheses on privatisation are derived:

- Privatisation will lead to higher operating efficiency and higher capital utilisation.
- Privatisation will lead to more capacity and hence higher output, provided that the regulatory regime is supportive of investor confidence.
- Privatisation will lead to higher prices to residential consumers and lower prices to industrial users as prices are aligned with marginal costs.

In the economics literature competition is regarded as a reliable mechanism for stimulating both allocative and technical efficiency (Leibenstein, 1966). In a competitive market, prices and profits reveal important information about the costs of a firm and the efficiency of input use, thus providing the firm with incentives to improve internal efficiency. As a result, it is to be expected that competition will lead to higher electricity generation per employee. Moreover, lower per-unit costs resulting from increased technical efficiency may be passed through in lower prices, thus increasing the quantity demanded. Therefore, competition is likely to have positive effects on both electricity supply and capacity expansion.

The introduction of competition may impact on electricity prices in different directions depending on the categories of customers. Competition undermines the feasibility of cross-subsidising one set of customers at the cost of another set because entrants target over-charged consumers. Given the cross-subsidies prevalent under state ownership in electricity, already referred to, competition is likely to lower industrial user prices. There might be an expectation of consequent higher pricing to (at least some) residential users, though this is by no means certain. Competition could result in lower production costs and therefore lower prices to residential users, even while cross-subsidies are being unwound.

The following two hypotheses are therefore put forward on the effects of competition:

- Competition will lead to a larger capacity, a higher output and greater labour productivity.
- Competition will lead to lower industrial user prices and could either raise or lower residential user prices.

Electricity production is characterised by scale economies and sunk investments. This is why an effective regulatory system is crucial for both investor confidence and consumer protection. At the same time, because electricity is viewed as an essential public service, local and central governments have incentives to intervene in price, output and investment. Public ownership becomes the default mode of organisation if it is not possible to create an

efficient and credible system of private-sector regulation (Short, 1984). The primary purpose of a well-designed regulatory system is to protect consumers from monopoly abuse, while providing investors with protection from arbitrary political action alongside incentives for efficient operation and investment (Laffont and Tirole, 1993). Carefully designed regulation can be expected, therefore, to be a key component of a successful process of electricity privatisation.

Regulation can affect a firm's efficiency. Regulation that is too onerous will negatively affect a firm's input (Averch and Johnson, 1962) and output decisions and depress productivity. Private operators will be unwilling to invest and will produce less under risky regulatory conditions (Gupta and Sravat, 1998; Holburn, 2001). At the same time, clearly stated regulatory rules within a well-defined regulatory framework can be expected to reduce 'regulatory risk' and provide incentives for private investment and this is the main objective when 'independent' regulatory bodies are established.

The effects of regulation on electricity prices, or allocative efficiency, is more difficult to predict. Different regulatory policies could be adopted by different countries, producing divergent results (Jamansb and Pollitt, 2000). However, the first big task of new regulators in many developing countries is to reduce or even remove subsidies to domestic users and align residential prices with supply costs (Tenenbaum, 1995). For this reason we propose the following two hypotheses for the effects of regulation:

- Independent regulation in place of direct government department regulation will improve productive efficiency.
- Independent regulation will raise prices charged to domestic consumers as cross-subsidies are removed.

The above hypotheses were tested using panel data for 51 countries in Africa, Latin America and the Caribbean and Asia, over the period from 1985 to 2000. The starting date for the study, 1985, was dictated by data availability, though little reform of the electricity sector began before this date. The final date, 2000, represented the last year for which data were available at the time the research was conducted. The choice of the sample countries was based on access to data and especially information on privatisation, competition and regulation in each country.

The primary performance indicators used in the study include net electricity generation per capita, installed generation capacity per capita, net electricity generation per employee, electricity generation to average capacity (capacity utilisation) and residential and industrial user electricity prices. These indicators capture the extent of electricity available to the economy, labour and capital productivity in the generation of electricity, and the effects on consumers in terms of prices. Another useful measures of performance, quality of service, could not be estimated because of a lack of data.

Ideally privatisation in the generation sector would be measured as the percentage of electricity produced by private companies or as the percentage of generation capital owned by private investors. However, there was not sufficient, consistent information across the 51 sample firms to define privatisation in this way. Therefore, a dummy variable was used that indicates whether the economy has *any* private sector generation capacity. The limitation of this approach is, of course, that the dummy does not capture the *extent* of privatisation and it is to be expected that the extent of privatisation will impact on managerial incentives and performance. This should be borne in mind when interpreting the results. The measure of competition is also a dummy variable, which equals 1 either when there is a wholesale market where generators compete to conclude supply contracts with distributors or if large users can negotiate contracts directly with generators. Again, ideally some form of

concentration ratio for the electricity sector in each country would also be used to measure competition but such data are not available.

Particular difficulties arise in measuring regulation for the purposes of empirical study. There is limited published information on the forms of regulation adopted in particular developing countries and, in any event, practice may be different to the published information. To simplify the regulatory measure, a dummy variable was employed to indicate whether a separate electricity regulatory agency existed not directly under the control of a ministry. As pointed out by Wallsten (2001), who uses the same approach in his study of telecommunications reform, the effect of having a separate regulator in a regression analysis is best interpreted as indicating a country's propensity to undertake regulatory reform rather than being a precise indicator of the operation of a separate regulator.

Non-reform variables were included in the analysis as controls. In particular, both an increase in GDP per capita and of the share of the population living in urban areas can be expected to be associated with a higher demand for electricity, thus inducing higher investment by utilities. Other control variables included the percentage of industrial output as a share of GDP and a variable to measure the 'economic freedom' of a country. A large proportion of industrial customers implies a higher potential for co-generation and a more even demand for electricity. Holding other factors constant, there would, therefore, be a reduction in the need for generation capacity. The economic freedom variable can be interpreted as a proxy for wider institutional factors associated with the success of market liberalisation, other than privatisation, competition and independent regulation in electricity generation, such as lower taxation and fewer restrictions on foreign investment.

The model employed in this study draws from those used in Ros (1999), Wallsten (2001) and Bergara *et al.* (1997). Log-linear functional specifications are adopted in the regression to transform a likely non-linear relationship between the performance indicators and the explanatory variables into a linear one. Also, the logarithmic transformation enables the elasticity of the dependent variable with respect to various independent ones to be directly obtained.

In order to control for unobserved country-specific factors, a fixed-effects panel model was used, taking the form:

$$\ln y_{it} = \alpha_i + \beta_1(R_{it}) + \beta_2(C_{it}) + \beta_3(PG_{it}) + \delta(\ln x_{it}) + v_i + \varepsilon_{it} \quad (1)$$

where y_{it} is the electricity indicators discussed above; R_{it}, C_{it}, PG_{it} are regulation, competition and privatisation dummies respectively; x_{it} donates the control variables; v_i is the unit-specific residual that differs between units but remains constant for any particular unit, while ε_{it} is the remainder of the disturbance.

The control variables included in the model vary depending on the performance indicators regressed. For electricity generation per capita and generation capacity per capita, all the four exogenous variables were included as controls. For electricity generation per employee and capacity utilisation only GDP per capita (GDPP) and economic freedom (FDOM) were involved in the regression. Apart from GDPP and FDOM, urban population as a share of the total (UB) and industrial output as percentage of GDP (IN) were used as a control in the estimations of residential prices and industrial prices, respectively.

As noted above, privatisation alone may not result in performance improvement. Competition and in its absence effective regulation may be required to capture any potential benefits

privatisation might bring. To explore further the effects of regulation, equation (2) was estimated:

$$\ln y_{it} = \alpha_i + \beta_1(R_{it}) + \beta_2(C_{it}) + \beta_3(PG_{it}) + \beta_4(R_{it} * C_{it}) + \beta_5(R_{it} * PG_{it}) + \delta(\ln x_{it}) + v_i + \varepsilon_{it} \quad (2)$$

Equation (2) allows for the separate effects of the reform variables and of their interactions to be examined.

Equations (1) and (2) were estimated for each of the five dependent variables. To overcome the problem of autocorrelation in the initial estimations, adjustments were made using the method described in Gujarati (1995, pp.430-433). Table A1.1 resents the regression results.

Table A1.1: Electricity Sector Regression Results

	Electricity per capita	Electricity generation	Capacity per capita	Electricity generation per employee		
	Eq (1)	Eq (2)	Eq (1)	Eq (2)	Eq (1)	Eq (2)
R	.011 (.557)	.054 (.821)	-.019 (1.037)	.015 (.545)	.022 (.223)	.113 (1.113)
C	.025 (1.722)***	.013 (2.155)**	.036 (1.657)***	.065 (2.451)*	.131 (2.254)**	.277 (2.406)**
PG	.019 (.438)	.0184 (.487)	.244 (1.465)	-.022 (.655)	.061 (1.158)	-.293 (1.506)
R*C		-.104 (1.258)		-.042 (.970)		-.207 (.806)
R*PG		.075 (1.858)***		.041 (2.323)*		.213 (2.106)**
LGDP#	.407 (7.096)*	.540 (23.667)*	.608 (14.489)*	.999 (13.830)	.647 (3.658)*	.501 (2.867)*
LUB#	1.236 (17.662)*	.727 (13.575)*	.608 (6.493)*	.371 (4.637)*		
LIN#	.288 (3.909)*	.697 (12.470)*	-.050 (.679)	-.080 (1.163)		
LFDOM#	.302 (3.531)*	.564 (5.889)*	.145 (3.088)*	.349 (2.974)*	-.983 (5.950)*	-1.292 (5.171)*
Adjusted R-squared	.982	.982	.955	.946	.809	.809
D-W test	1.712	1.739	1.690	.1788	1.689	1.759
Number of observations	782	782	782	782	357	357

	(Electricity generation)/(average capacity)		Residential prices		Industrial prices	
	Eq (1)	Eq (2)	Eq (1)	Eq (2)	Eq (1)	Eq (2)

R	-0.149 (2.416)**	-0.032 (.446)	.069 (.351)	.010 (.186)	.036 (.848)	-.034 (.740)
C	-0.125 (1.574)	0.104 (1.246)	.049 (.229)	-.035 (.520)	-.061 (1.193)	-.241 (3.836)*
PG	0.079 (1.869)***	0.135 (3.015)*	.025 (.142)	.106 (1.288)	-.0178 (.428)	-.071 (1.311)
R*C		-0.501 (3.246)		.152 (1.363)		.286 (2.886)*
R*PG		-0.269 (.333)		-.215 (.644)		.038 (.478)
LGDPP#	0.098 (.578)	0.101 (.604)	1.418 (2.502)**	.201 (2.044)**	-.170 (.911)	-.183 (.980)
LUB#			-4.099 (2.787)*	-1.093 (5.172)*		
LIN#					-.768 (11.038)*	-.759 (10.845)*
LFDOM#	4.380 (34.544)*	4.367 (34.511)*	.7421 (1.355)	.963 (2.668)*	-.147 (.916)	-.147 (.902)
Adjusted R-squared	.827	0.829	.727	.740	.797	.801
D-W test	1.659	1.656	1.970	1.880	1.766	1.788
Number of observations	782	782	332	332	324	324

For the key to the independent variables, see Table 1.

the prefix L indicates a logged variable; t-statistics in parentheses.

*, ** and *** indicate that the coefficient is significant at the 1%, 5% and 10% levels respectively.

The empirical results presented above seem consistent with the findings of a number of the studies reviewed earlier, that point to the importance of competition and/or effective independent regulation if economic performance is to improve following privatisation.

Reviewing our findings in relation to the hypotheses generated from the literature, in detail:

Privatisation will lead to higher operating efficiency. This hypothesis was rejected for labour productivity when privatisation occurred independently of competition or where privatisation was not associated with regulatory reform. The result is consistent with the emphasis in the economics literature on competition rather than ownership as the key to performance improvements. Ownership change, *per se*, is not decisive but needs to be coupled with other institutional reforms, notably the introduction of either competition or independent regulation. However, capacity utilisation does seem to improve under privatisation, independently of competition and regulation, a result consistent with the idea that the private sector is a more effective manager of capital stock use than the public sector.

Privatisation will lead to more capacity and hence higher output, provided that the regulatory regime is supportive of investor confidence. Like regulation, privatisation

on its own did not seem to generate many benefits. However, the interaction term between privatisation and regulation did show a positive impact on electricity penetration, capacity expansion and labour efficiency. The results underline the importance of regulatory reform along with privatisation. The results are therefore consistent with the hypothesis.

Privatisation will lead to higher prices to residential consumers as prices are more aligned with supply costs. The results suggested that privatisation, even when linked with competition or regulation, does not have a statistically significant effect on residential prices. The results are the same for industrial user prices.

Competition will lead to a larger capacity, a higher output and greater labour productivity. The findings from the research are consistent with the notion that competition does lead to a higher generating capacity per capita and a higher output per capita. It also leads to higher labour productivity.

Competition will lead to lower industrial user prices and to either higher or lower residential user prices. The effect on prices was ambiguous. Competition does seem to lower industrial prices, but the result is reversed when competition co-exists with regulation. The hypothesis is therefore only partially supported. Also, competition does not necessarily lead to more efficiency in capacity utilisation – this is possibly because the entry of competitors expands generating capacity leading to a fall in average utilisation, at least for a time (this has happened in the liberalised British electricity market).

Independent regulation in place of direct government department regulation will improve productive efficiency. The results suggest that while competition has a beneficial effect on labour productivity in electricity generation, the direction of the effect of having an independent regulator is unclear. This suggests that regulation may well diminish efficiency incentives, as some of the economics of regulation literature suggests (Parker, 2002). Privatisation alone does not lead to improved labour productivity, but there is a significant, positive effect from having both privatisation and independent regulation.

Independent regulation will raise prices charged to domestic consumers as cross-subsidies are removed. The research found that regulation, even when associated with privatisation or competition, does not appear to have a statistically significant effect on residential user prices. This finding is contrary to expectation. Independent regulation also seems to have no reliable impact on industrial user prices, though when independent regulation and competition co-exist, surprisingly, industrial prices are found to be higher. These results may reflect the particular crudity of the regulation measure used, in the absence of a superior alternative. Nevertheless, on the basis of our regression results the hypothesis has to be rejected.

In summary, the research findings suggest that only the competition variable had the full results expected. Privatisation and regulation, especially on their own, appear to have disappointing effects on electricity output, labour productivity and prices.

More and more developing countries are thinking of or have already undertaken reforms in their electricity industry, with the objectives of increasing private capital, promoting competition and introducing new regulatory structures. In more detail the reform measures implemented usually involve unbundling existing utilities, possibly into separate generation, transmission, distribution and supply providers; privatising state-owned incumbents; introducing competition among operators, especially in the generation sector; and establishing new regulatory bodies to regulate the remaining monopoly infrastructure. The

main purposes of electricity reform include improving the efficiency of the electric power sector, expanding private investment in infrastructure building and relieving government from ever-increasing budgetary pressures.

These empirical results have policy implications for electricity reformers in developing countries. Like Pollitt (1997) the study finds that competition is the most reliable driver of economic benefits. In the light of the benefits associated with competition, reformers should introduce measures conducive to promoting liberalised electricity markets. When privatising industries where significant monopoly powers remain, emphasis should also focus on designing and implementing an effective regulatory framework. Because competition is confirmed as the most reliable means of improving performance, this suggests that the use in a number of developing countries of exclusivity periods granted to new generators and long-term purchase contracts for IPPs, arranged so as to stimulate investment, may be unwise. Such measures may dim efficiency incentives and reduce economic performance by removing the incentive of competition.

APPENDIX 2: State versus Private Sector Provision of Water Services in Sub-Saharan Africa: Empirical Evidence on Comparative Performance

Using data on water utilities in Sub-Saharan Africa in the year 2000, we assess the impact of private capital on performance in water services using a cost function approach. The data base was developed with financial and technical support from the Department for International Development in London and can be found at www.wupafrica.org/spbnet. Estimation of a cost function requires data on the cost level, the output level and input prices. The dependent variable used in the cost frontier was operating and maintenance costs (*COST*) or non-capital costs. Average manpower cost per employee (*MP*) was used to reflect the cost of labour. The amount of water distributed per year (*WD*) was included in the cost function as the output variable. Also included in the function was a quality variable, measured by the hours of piped water available per day (*QUALI*). In addition, some environmental variables were included in the model specification. These are variables that may be expected to affect the performance of the firm but are not entirely under its control. Their inclusion ensures that the various water operators are effectively comparable. A density variable, measured by population served per connection (*DEN*), was included because it plays an important role in defining the network infrastructure. Another variable used as a control was the annual water resources per capita (*WRS*). GDP per capita (*GDP*) and the freedom index (*FRD*) were included in an attempt to capture the extent of economic development and the quality of governance, respectively. In order to account for the effects of ownership on performance, a dummy variable (*ONS*) was included in the model, which took the value of 1 if the utility was privately owned. Table A2.1 lists the variables used in the estimation.

Table A2.1: Variables in the Stochastic Cost Function

Variable	Definition	Data Source
<i>COST</i>	Operating and maintenance costs (US\$)	SPBNET
<i>WD</i>	Water distributed per year (cub m)	SPBNET
<i>QUALI</i>	Number of hours of water availability per day	SPBNET
<i>MP</i>	Manpower costs per employee (US\$)	SPBNET
<i>WRS</i>	Water resources per capita	World Resources Institute
<i>DEN</i>	Population served per connection	SPBNET
<i>GDP</i>	GDP per capita (US\$)	World Development Indicators
<i>FRD</i>	Freedom index	The Fraser Institute
<i>ONS</i>	Ownership dummy (1=privately owned)	SPBNET

The results shown in Table A2.2 are the Technical Efficiency Effects (TEE) estimates. The TEE frontier is a standard method within stochastic cost frontier analysis. In total 76 observations were included in the estimations, including nine private sector firms. Table A2.2 shows the results.

Table A2.2: Cost Function

Variable	Coefficient Value
<i>Constant</i>	7.28 (3.18)***
<i>Ln(WD)</i>	0.45 (4.96)***
<i>Ln(QUALI)</i>	-0.23 (0.90)
<i>Ln(MP)</i>	0.69 (9.77)***
<i>Ln(WRS)</i>	0.28 (2.50)***
<i>Ln(DEN)</i>	-0.23(2.60)***
<i>Ln(GDP)</i>	-0.25(1.53)*
<i>LN(FRD)</i>	-0.99 (0.83)
δ (<i>ONS</i>)	0.88 (1.10)
γ	0.92 (10.64)

<i>LR test</i>	8.68 ***
Total observations	76

Figures in parentheses are *t* statistics.

*** significant at 1% level.

** significant at 5% level

* significant at 10% level

As expected, the output variable, $\ln(WD)$, has a positive and significant effect on operating costs. So does the variable labour price, $\ln(MP)$. The density variable has a negative and significant sign, and accords with the expectation that it is more cost efficient to serve a population located more densely. The negative and significant coefficient of $\ln(GDP)$ suggests that the cost of water distribution is lower in wealthier countries. The freedom variable which is included to capture wider governance or regulatory effects on performance in water utilities, which might otherwise have been attributed to ownership, seems to have negative effects on the level of costs, but the impact is not statistically significant. Contrary to expectation, however, the quality variable results show negative, although not significant, effects and the water resources variable shows positive and significant effects. Turning to the role of ownership, which is our main concern, surprisingly the coefficient of the ownership dummy (ONS) is positive, suggesting that private ownership is associated with higher costs. However, the result is not statistically significant. The safest interpretation of the cost frontier results is that there are no significant differences in cost efficiency between private and state-owned water companies in Africa.

To assess the effects of regulation on water privatisation in Africa, the stochastic cost function analysis was repeated, but this time incorporating a regulatory variable as a dummy, alongside the existing freedom variable (representing wider good governance in a country). The regulation variable was based on information on the existence of regulation of prices, water quality and customer services. Our expectation is that regulation will impact on costs, depending upon the form regulation takes. For example, a good regulatory regime should create more investor certainty and may reduce costs of production. Alternatively, regulation could raise costs by imposing higher and more expensive standards or by raising uncertainty for investors (usually referred to as 'regulatory risk'). The results from the new regression analysis are reported in Table A2.3. They show that the regulation dummy has a negative sign, suggesting lower costs, but it is not statistically significant. Similarly, the freedom variable is also negative and insignificant, as it was in the earlier analysis. The ownership dummy (ONS) remained positive but insignificant, as before.

Table A2.3: Testing for the Importance of Regulation

Variable	Coefficient Value
<i>Constant</i>	6.64 (3.14)***
<i>Ln(WD)</i>	0.50 (5.72)***
<i>Ln(QUALI)</i>	-0.32 (1.05)
<i>Ln(MP)</i>	0.69 (10.62)***
<i>Ln(WRS)</i>	0.27 (2.56)***
<i>Ln(DEN)</i>	-0.23(2.06)***
<i>Ln(GDP)</i>	-0.26(1.75)*
<i>LN(FRD)</i>	-0.99 (0.89)
δ_1 (ONS)	0.93 (0.67)
δ_2 (Regulation)	-0.89 (0.36)
Γ	0.92 (10.64)

<i>LR test</i>	8.68 ***
Total observations	76

The results from this stage of the analysis were, therefore, inconclusive. Regulation, both sector specific and as reflected in the general standards of governance in a country, proved to be statistically insignificant, though there was some suggestion that they led to lower costs. Clearly, more research is needed in this area. The regulation variable used was far from ideal and future research would benefit from developing a set of superior regulatory variables - variables that more closely reflect the impact of regulation rather than simply its existence.

APPENDIX 3: Regulatory Impact Assessment in Developing and Transition Countries: Current Practice

The principles surrounding the introduction and operation of RIAs led to the formulation of a number of questions that were included in a questionnaire sent to 311 departments with regulatory responsibilities in 99 countries. The questionnaires completed and returned came from 40 countries – a country response rate of 40% - with more than one official in some departments replying. In total 68 useable questionnaires were returned, giving an overall response rate from government officials of 17%. The regulatory activities covered included economic, social and environmental regulation, but with a bias towards economic regulation. The majority of the responses were from regulators of the network utilities, with 25 replies from the energy (electricity, gas, oil and alternative energy) sector, and a further 23 replies from the telecommunications sector. Twenty replies were from other government bodies.

The survey also found that the use of RIA is a legal requirement in ten of the 40 countries, namely Korea, the Philippines, Algeria, Botswana, Tanzania, Jamaica, Mexico, Albania, Lithuania and Romania. This is perhaps a surprisingly high number given the previous general perception that RIA was largely an OECD phenomenon. Moreover, respondents in a larger number of countries, 30 out of the 40, claimed that RIA was used in some form even though in most of these it was not a legal requirement. However, the coverage and formal status of regulatory assessment was found to vary considerably between countries.

On the subject of whether RIAs are used, Table A3.1 summarises the results according to the different regions surveyed. Taking Asia and the Middle East first, RIA is applied in eight of the nine countries that responded (India, Thailand, Korea, Jordan, Malaysia, Oman, Pakistan, the Philippines, Sri Lanka), while in Africa, RIA seems to be used to some degree in 11 of the 16 countries for which replies were received. By contrast, in Latin America and the Caribbean the results suggested that RIA is being used to assess some or all new regulation proposals in six of the nine countries for which questionnaires were returned. This finding is perhaps relatively low given this region's longer and more developed operation of regulatory systems, especially in the utilities sectors.

Table A3.1: The Use of RIA in Developing and Transition Countries

Region	RIA Applied to All or Most New Regulations	RIA Never Applied	Do Know	Not
Asia (no. of countries)	8	0	1	
Africa (no. of countries)	11	3	2	
Latin America (no. of countries)	6	3	0	
Transition Economies (no. of countries)	5	1	0	

While some form of regulatory assessment is being applied to some extent in the majority of countries that returned completed questionnaires, there are marked regional differences in familiarity with RIA principles. Three fifths of the replies from Africa reported little or no awareness, whereas the majority of respondents from Asia were fully aware of the concept. Only six of the respondents, however, were familiar with the OECD guidelines. In four countries respondents reported that guidance on how RIA should be undertaken had been prepared within their government. However, these countries included Mexico and Korea, both of whom are members of the OECD. None of the respondents from Africa claimed that their country had developed guidelines for the conduct of RIA.

Returns from nineteen countries reported using RIA to evaluate existing regulations. It seems that where RIA is being applied, it is mostly being used for ex ante appraisal, rather than for

monitoring or ex post evaluation purposes. This may reflect a lack of resources within governments to undertake such appraisal or, alternatively, there may be reluctance on the part of governments to dwell on whether previously introduced regulatory measures have achieved their desired results.

The second part of the questionnaire was concerned with the process aspects of RIA in contributing to the principles of “good governance”. The responses received indicated that in the majority of countries where RIA is applied to new regulations, public consultation does occur with a main emphasis on the use of public notices and invitations to comment on proposals. Consultation involves outside experts, government bodies and the private business sector. But consumer groups and other bodies representing civil society are less commonly included. In most cases (34 countries) consultation occurs either both before or after the government prepares detailed regulations. However, fewer countries (15) make the views of participants in the consultation exercise public, suggesting scope for improved regulatory transparency.

The final section of the questionnaire was designed to gather information on the role of RIA as part of a government-wide strategy for regulatory reform. The impact of regulatory impact assessment is likely to be enhanced where RIA is adopted as part of an overall strategy for regulatory governance reform and institutional capacity building (Stern and Holder, 1999; Kirkpatrick et al, 2004c). Of the 40 countries for which replies were received, 22 were reported to have a strategy in place for promoting government-wide regulatory reform. The countries having a government-wide strategy in place were cross-checked with the 30 countries applying RIA. This confirmed that in the majority of these countries, 10 out of the 22, RIA is being applied as part of a broader programme of regulatory governance reform.

References

- Alcazar, L., Abdala, M. and Shirley, M. (2000) 'The Buenos Aires Water Concession', *World Bank Research Working Paper* 2311, Washington, DC: World Bank.
- Alexander, I., and Estache, A. (1999) 'The Role of Regulatory Reform and Growth: Lessons from Latin America' TIPS Annual Forum, mimeo. World Bank.
- Alexander, I. and Harris, C. (2001) 'Incentive regulation and multi-year price controls: an application to the regulation of power distribution in India', *International Journal of Regulation and Governance*, vol.1, no.1, pp.25-46.
- Alexander, I. and Irwin, T. (1996) 'Price Caps, Rate-of-Return Regulation, and the Cost of Capital', *Public Policy for the Private Sector*, September, pp.25-28, Washington DC: World Bank.
- Allen, D.W. (1991) 'What are Transaction Costs?', *Research in Law and Economics*, vol.14, pp.1-18.
- APERC (2000), *Electricity Sector Deregulation in the APEC Region*, Asia Pacific Energy Research Centre, Institute of Energy Economics, Japan.
- Armstrong, M., Cowan, S. and Vickers, J. (1994) *Regulatory Reform: Economic Analysis and British experience*, Cambridge, Mass.: MIT Press.
- Arocena, P. and Price, C.W. (2002), 'Generating Efficiency: Economic and Environmental Regulation of Public and Private Electricity Generators in Spain', *International Journal of Industrial Organization*, 20, 41-69.
- Averch, H. and Johnson, L.L. (1962) 'Behavior of the Firm under Regulatory Constraint', *American Economic Review*, vol.52, pp.1052-69.
- Bacon, R.W. (1995), 'Privatization and Reform in the Global Electricity Supply Industry', *Annual Reviews Energy & the Environment*, 20, 119-43.
- Bacon, R.W. and Besant-Jones, J. (2001), 'Global Electric Power Reform, Privatization and Liberalization of the Electric Power Industry in Developing Countries', *Annual Reviews Energy & the Environment*, 26, 331-59.
- Bailey, E.E. (1973) *Economic Theory of Regulatory Constraint*, Lexington, DC: Heath.
- Baldwin, R. and Cave, M. (1999) *Understanding Regulation: Theory, Strategy and Practice*, Oxford: Oxford University Press.
- Bawa, V.S. and Sibley, D.S. (1980) 'Dynamic Behaviour of a firm subject to Stochastic Regulatory Review', *International Economic Review*, vol.21, no.3, pp. 627-42.
- Bayliss, K. (2000) 'The World Bank and Privatisation: a flawed development tool', mimeo, London: Public Services International Research Unit, University of Greenwich.
- Beesley, M. and Littlechild, S.C. (1983) 'The Regulation of Privatized Monopolies in the United Kingdom', *RAND Journal of Economics*, vol.20, no.3, pp.454-72.

- Bergara, M, Henisz, W.J. and Spiller, P.T. (1997), 'Political Institutions and Electric Utility Investment: a Cross-nation Analysis', Working Paper, University of California Energy Institute.
- Bernstein, J. and Sappington, D. (1999) 'Setting the X factor in price cap regulation', *Journal of Regulatory Economics*, vol.16, pp.5-25.
- Blundell, J. and Robinson, C. (2000) *Regulation without the state... The Debate Continues*, Readings 52, London: Institute of Economic Affairs.
- Bortolotti, B., Fantini, M. and Siniscalco, D. (1998), 'Regulation and Privatisation: the Case of Electricity', Working Paper, Department of Economics and Finance, University of Turin.
- Bös, D. (1994) *Pricing and Price Regulation: An Economic Theory for Public Enterprises and Public Utilities*, Amsterdam: North Holland/Elsevier.
- Bouin, O. and Michalet, C.A. (1991), *Rebalancing the Public and Private Sectors: Developing Country Experience*, OECD, Paris.
- Brook PJ and Smith SM (eds) (2003) *Contracting for Public Services. Output Based Aid and Its Applications*. Washington DC: World Bank and International Finance Corporation.
- Brubaker, E. (2001) *The Promise of Privatization*, Toronto: Energy Probe Research Foundation.
- Burns, P., Turvey, R. and Weyman-Jones, T. (1995) 'General Properties of Sliding Scale Regulation', *Technical Paper no.3*, London: Centre for the study of Regulated Industries.
- Cariño, L.V. (2002) 'Regulatory Governance in the Philippines: A Profile', Paper no.44, Centre on Regulation and Competition, Institute for Development Policy and Management, University of Manchester.
- Chisari, O., Estache, A. and Ronlero, C. (1999), 'Winners and Losers from Utility Privatisation in Argentina: Lessons from a General Equilibrium Model', Working Paper, Washington D.C.: World Bank
- Clarke, R.G. and Wallsten, S.J. (2002) 'Universal(ly Bad) Service: Providing Infrastructure Services to Rural and Poor Urban Consumers', *Policy Research Paper 2868*, Washington, DC.: World Bank.
- Collignon, B. and Vézina, M. (2000) *Independent Water and Sanitation Providers in African Cities: Full Report of a Ten-Country Study*, mimeo, Washington, DC.: UNDP-World Bank Water and Sanitation Program.
- Cook, P. (1999) 'Privatization and Utility Regulation in Developing Countries: The Lessons So Far' *Annals of Public and Cooperative Economics*, 70:4, 549-587
- Cook P, Kirkpatrick C, Minogue M and Parker D (eds) (2004) *Competition and Regulation in Developing Countries*, Cheltenham: Edward Elgar.

- Crew, M.A. and Kleindorfer, P.R. (1996) 'Incentive regulation in the United Kingdom and the United States: Some lessons', *Journal of Regulatory Economics*, 9, 211-225.
- Czamanski, D. (1999) *Privatization and Restructuring of Electricity Provision*, Westport, Conn.: Praeger.
- DFID (2000a) 'Making Markets Work Better for the Poor: A Framework Paper' Mimeo, November.
- DFID (2000b) *Eliminating World Poverty: Making Globalisation Work for the Poor*, Working Paper on International Development, CM. 5006, London: Department for International Development
- DFID (2002) Making Connections: Infrastructure for Poverty Reduction DFID, London.
- David, C. (2001) 'Private Sector Participation in Water Supply and Sanitation: Realising Social and Environmental Objectives in Manila', in N. Johnstone and L. Wood (eds.), *Private Firms and Public Water: Realising Social and Environmental Objectives in Developing Countries*, Cheltenham: Edward Elgar.
- Dolowitz, D.P. and Marsh, D. (2000) 'Learning from Abroad: The Role of Policy Transfer in Contemporary Policy Making', *Governance: An International Journal of Public Administration*, vo.13, no.1, pp.5-24.
- Domah, P., Pollitt, M.G. and Stern, J. (2003) 'Modelling the Costs of Electricity Regulation: Evidence of Human Resource Constraints in Developing Countries', mimeo, *Risk Regulation, Accountability and Development Workshop*, 26 & 27 June, University of Manchester.
- Esguerra, J. (2002) *The corporate muddle of Manila's water concessions: how the world's biggest and most successful privatisation turned into a failure*, London: Water Aid.
- Estache, A. (2002) 'Argentina's 1990 utilities privatization: a cure or a disease?' mimeo.
- Estache, A, Foster V and Wodon, Q (2002), *Accounting for Poverty in Infrastructure Reform: Learning from Latin America's Experience*, World Bank Institute, Washington DC: World Bank.
- Estache, A., Guasch, J.-L. and Trujillo, L. (2003) 'Price Caps, Efficiency Payoffs, and Infrastructure Contract Renegotiation in Latin America', *Policy Research Working Paper 3129*, Washington, DC: World Bank.
- Estache, A. and Kouassi (2002) 'Sector Organization, Governance, and the Inefficiency of African Water Utilities', *World Bank Research Working Paper 2890*, Washington, DC: World Bank.
- Estache, A. and Rossi, M. (1999) 'Comparing the Performance of Public and Private Water Companies in Asia and the Pacific Region: What a Stochastic Cost Frontier Shows', *Policy Research Working Paper*, Washington, DC; World Bank.
- Estache, A. and Rossi, M. (2002) 'How Different is the Efficiency of Public and Private Water Companies', *World Bank Economic Review*, vol.16, no.1, pp.139-48.

- Gilbert, R.J. and Khan, E.P. (1996) *International Comparisons of Electricity Regulation*, Cambridge: Cambridge University Press.
- Granovetter, M. (1985) 'Economic action and social structure: the problem of embeddedness', *American Journal of Sociology*, vol.91, no.3, pp.481-510.
- Grossman, S.J. and Hart, O.D. (1986) 'The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration', *Journal of Political Economy*, vol.94, no.4, pp.691-719.
- Guasch, J.L. (1999) 'Experience from Concession Design in Latin America and Caribbean', mimeo.
- Guasch, J.L. (2001) 'Contract renegotiation in LAC', mimeo, World Bank: Washington, DC.
- Guasch, J.L. and Hahn, R.W. (1999) 'The Costs and Benefits of Regulation: Implications for Developing Countries', *The World Bank Research Observer*, 14 (1), 137-158.
- Guasch, J.L. and Spiller, P. (1999) Managing the Regulatory Process: Design Concepts, Issues and the Latin America and Caribbean Story. World Bank Latin America and Caribbean Studies, Washington DC, World Bank.
- Gujarati, D N (1995), *Basic Econometrics*, McGraw-Hill Inc, Singapore.
- Gupta, J.P. and Sravat, A.K. (1998) 'Development and Project Financing of Private Power Projects in Developing Countries: a case study of India', *International Journal of Project Management*, 16 (2),99-105.
- Handley, P. (1997) 'A Critical Review of the Build-Operate-Transfer Privatisation Process in Asia', *Asian Journal of Public Administration*, vol.19, no.2, pp.203-43.
- Harris, C. (2003) 'Private Participation in Infrastructure in Developing Countries: Trends, Impact, and Policy Lessons', *World Bank Working Paper No.5*, Washington, DC: World Bank.
- Harris, C., et al. (2003) 'Infrastructure Projects: A Review of Cancelled Private Projects', *Public Policy for the Private Sector*, vol.252, Washington, DC: World Bank.
- Hart, O. and Moore, J. (1988) 'Incomplete Contracts and Renegotiation' *Econometrica*, 56, 755-85.
- Hawdon, D. (1996) *Performance of Power Sectors in Developing Countries – A Study of Efficiency and World Bank Policy using Data Envelopment Analysis*, Surrey Energy Economics Centre Discussion Paper 88, University of Surrey.
- Hay, D.A. and Morris, D.J.(1991) *Industrial Economics and Organization: Theory and Evidence*: Oxford: Oxford University Press.
- Hayek, F.A. (1945) 'The Use of Knowledge in Society', *American Economic Review*, vol.35, pp.519-30.
- Holburn, G.F. (2001) 'Political Risk, Political Capabilities and International Investment Strategy: Evidence from the Power Generation Industry' Mimeo. Paper presented at 5th EUNIP Conference, Vienna 29 November – 1 December 2001.

- Hulls, D. (2003) 'Water for sale?', *Development*, 1st quarter, pp.32-4, London: DFID.
- Hunt, S. and Shuttleworth, G. (1996) *Competition and Choice in Electricity*, Chichester: Wiley.
- Iossa, E. and Stroffolini, F. (2002) 'Price cap regulation and information acquisition', *International Journal of Industrial Organization*, vol.20, pp.1013-36.
- Jacobs, S. (1997) 'An overview of regulatory impact analysis in OECD countries' in OECD (1997) *Regulatory Impact Analysis: Best Practices in OECD Countries*, Paris: OECD.
- Jacobs S (2004) 'Evolution of East Asian Utility Regulators: Diversity and Challenges' mimeo Jacobs and Associates, Washington DC.
- Jalilian, H., C. Kirkpatrick and D. Parker (2003) 'The Impact of Regulation on Economic Growth in Developing Countries – A Cross-Country Analysis', Centre on Regulation and Competition, IDPM, University of Manchester, mimeo.
- Jamasb, T. and Pollitt M. (2000), 'Benchmarking and Regulation of Electricity Transmission and Distribution Utilities: Lessons from International Experience', Working Paper, University of Cambridge.
- Johnstone, N. and Wood, L. (2001) 'Introduction', in N. Johnstone and L. Wood (eds.), *Private Firms and Public Water: Realising Social and Environmental Objectives in Developing Countries*, Cheltenham: Edward Elgar.
- Joskow, P.L. ed.(2000) *Economic Regulation*, Cheltenham: Edward Elgar.
- Kahn, A.E. (1988) *The Economics of Regulation: Principles and Institutions*, Cambridge, Mass.: MIT Press.
- Kanbur, R. (2001) 'Economic Policy, Distribution and Poverty: The Nature of Disagreements', mimeo., Cornell University.
- Kauffman, R. and Kraay, A. (2002) 'Growth without Governance' Mimeo. Washington DC: World Bank.
- Kikeri, S. and Nellis, J. (2001) 'Privatization in Competitive Sectors: The Record So Far' Private Sector Advisory Services. Washington DC: World Bank.
- Kleit, A.K. and Terrell, D. (2001), 'Measuring Potential Efficiency Gains from Deregulation of Electricity Generation: a Bayesian Approach', *Review of Economics and Statistics*, 83(3), 523-530.
- Kirkpatrick C and Parker D (2004) 'Regulatory impact assessment,' *Public Administration and Development*, forthcoming.

- Kirkpatrick, C., Parker, D. and Zhang, Y-F (2004a) 'Price and Profit Regulation in Developing and Transition Economies: Methods used and Problems Faced: A Survey of the Regulators' Public Money and Management forthcoming.
- Kirkpatrick C, Parker D and Zhang, Y-F (2004b) 'State versus Private Sector Provision of Water Services in Developing Countries: the Evidence and a New Analysis', Mimeo, University of Manchester: Centre on Regulation and Competition.
- Kirkpatrick C and Parker D (2004) 'Regulatory impact assessment,' *Public Administration and Development*, forthcoming.
- Kirkpatrick C, Parker D and Zhang Y-F (2004c) 'Regulatory Impact Assessment in Developing and Transitional Economies: A Survey of Current Practice and Recommendations for Further Development', *Public Money and Management*, forthcoming.
- Kirkpatrick, C., Parker, D. and Zhang Y-F (2004d) 'Regulation, Trade Liberalisation and the Provision of Water Services in Developing Countries: An Assessment of the Impact of the General Agreement n Trade in Services (GATS)', mimeo, Manchester: Centre on Regulation and Competition, Institute for Development Policy and Management, University of Manchester.
- Kirzner, I.M. (1997) *How Markets Work: Disequilibrium, Entrepreneurship and Discovery*, Hobart Paper No. 133, London: Institute of Economic Affairs.
- Knight-John, M., Jayasinghe, S. and Perumal, A. (2003) 'Regulatory Impact Assessment in Sri Lanka: The Bridges that have to be Crossed', mimeo, Institute of Policy Studies, Colombo, Sri Lanka.
- Kridel, D. and Sappington, D.E.M. and Weisman, D.L. (1996) 'The Effects of Incentive Regulation in the Telecommunications Industry: A Survey', *Journal of Regulatory Economics*, vol.9, pp.269-306.
- Kwoka, J.E. (1996), *Power Structure, Ownership, Integration and Competition in the US Electricity Industry*, Boston: Kluwer.
- Laffont, J.-J. (1999) *Incentives and the Political Economy of Regulation*, Oxford: Oxford University Press.
- Laffont, J.-J. and Tirole, J. (1993) *A Theory of Incentives in Procurement and Regulation*, Cambridge, Mass.: MIT Press.
- Lal, D. (1999) *Unfinished Business: India in the World Economy*, Oxford: Oxford University Press.
- Lalor, R.P. and Garcia, H. (1996), 'Reshaping Power Markets: Lessons from South America', *The Electricity Journal*, March 1996, 63-71.
- Law, P. (1997) 'Welfare Effects of Pricing in Anticipation of Laspeyres Price Cap Regulation: An Example' Bulletin of Economic Research, 49, 17-27.

- Lee, J.D., Park, S. and Kim T. (1999), 'Profit, Productivity, and Price Differential: an International Performance Comparison of the Nature Gas Transportation Industry', *Energy Policy*, 27, 679-89.
- Lee, N. (2002) "Developing and Applying Regulatory Impact Assessment Methodologies in Low and Middle Income Countries", mimeo, Manchester: Centre on Regulation and Competition, Working Paper No.30 IDPM, University of Manchester.
- Levy, B. and Spiller, P. (1995) "A Framework for Resolving the Regulatory Problem", in B. Levy and P. Spiller (eds.) *Regulations, Institutions and Commitment: Comparative Studies in Regulation*, Cambridge: Cambridge University Press.
- Leibenstein, H. (1966), 'Allocative Efficiency versus X-Efficiency', *American Economic Review*, 56, 392-415.
- Leipzig D, Fay M, Wodon Q and Yepes T (2003), 'Achieving the Millenium Development Goals: The Role of Infrastructure', World Bank Policy Research Working Paper 3163. November.
- Levy, B. and Spiller, P. (1994) 'The Institutional Foundations of Regulatory Commitment: a Comparative Analysis of Telecommunications Regulation', *Journal of Law, Economics and Organization*, vol.10, no.2, pp.201-45.
- Levy, B. and Spiller, P.T. (1996), *Regulations, Institutions, and Commitment: Comparative Studies of Telecommunications*, Cambridge: Cambridge University Press.
- Littlechild, S.C. (1983) *Regulation of British Telecommunications*, London: HMSO.
- Loftus, A.J. and McDonald, D.A. (2001) 'Of liquid dreams: a political ecology of water privatization in Buenos Aires', *Environment and Urbanization*, vol.13, no.2, pp.179-99.
- Lovei, L. (1996), 'The Single-buyer Model: a Dangerous Path toward Competitive Electricity Markets', *Electricity Journal*, 19(2), 21-27.
- Lyon, T.P. (1996) 'A Model of Sliding-Scale Regulation', *Journal of Regulatory Economics*, vol.9, pp.227-47.
- Martin, R. and Vansteenkiste, I. (2001), 'EU Telecommunications and Electricity Markets – Heading Towards Price Convergence?' *Intereconomics*, May/June, 131-41.
- Martin, S. and Parker, D. (1997) *The Impact of Privatisation: Ownership and Corporate Performance in the UK*, London: Routledge.
- Martin, R. and Vansteenkiste, I. (2001), 'EU Telecommunications and Electricity Markets – Heading Towards Price Convergence?' *Intereconomics*, May/June, 131-41.
- Mayer, C. and Vickers, J. (1996) 'Profit-sharing regulation: an economic appraisal', *Fiscal Studies*, vol.17, no.1, pp.1-18.
- McIntosh, A.C. (2003) *Asian Water Supplies: Reaching the Urban Poor*, London: Asian Development Bank and International Water Association.

- Meggison, W.L. and Netter, J.M. (2001) 'From State to Market: A Survey of Empirical Studies on Privatization', *Journal of Economic Literature*, vol.39, June, pp.321-89
- Minogue, M. (2002) 'Governance-based Analysis of Regulation', *Annals of Public and Cooperative Economics*, Vol 73, no. 4.
- Jalilian, H., C. Kirkpatrick and D. Parker (2003) 'The Impact of Regulation on Economic Growth in Developing Countries – A Cross-Country Analysis', mimeo, Centre on Regulation and Competition, IDPM, University of Manchester
- Mitlin, D. (2002) 'Competition, Regulation and the Urban Poor: A Case Study of Water', *Discussion Paper no.37*, Manchester: Centre on Regulation and Competition, Institute for Development Policy and Management, University of Manchester.
- Newbery, D. (1999) *Privatization, Restructuring and Regulation of Network Industries*, Cambridge, Mass.: MIT Press.
- North, D.C. (1990) *Institutions, Institutional Change and Economic Performance*, Cambridge: Cambridge University Press.
- North, D.C. (1991) 'Institutions', *Journal of Economic Perspectives*, vol.5, winter, pp.97-112.
- OECD (2000) *Global Trends in Urban Water Supply and Waste Water Financing and Management: Changing Roles for the Public and Private Sectors*, Paris: OECD.
- OECD (2003) 'Water partnerships: Striking a balance', 7 April, *OECD Observer*, Paris: OECD.
- Pargal, S. (2003) 'Regulation and Private Sector Investment in Infrastructure: Evidence from Latin America', *Policy Research Working Paper 3037*, Washington, DC; World Bank.
- Parker, D. (1999) 'Regulating Public Utilities: What other countries can learn from the UK experience', *Public Management*, vol.1, no.1, pp.93-120.
- Parker ed. (2001) *Privatisation and Corporate Performance*, Cheltenham: Edward Elgar.
- Parker, D. (2002) 'Economic Regulation: A Review of Issues', *Annals of Public and Cooperative Economics*, vol.73, no.4, pp.493-519.
- Parker, D. and Kirkpatrick, C. (2004a) 'Privatisation in Developing Countries: A Review of the Evidence and the Policy Lessons', *Journal of Development Studies*, forthcoming.
- Peltzman, S. (1976) 'Toward a More General Theory of Regulation', *Journal of Law and Economics*, vol. 14, August, pp.109-48.
- Picciotto, S. (1999) 'Introduction: What Rules for the World Economy?', in (eds.) S. Picciotto and R. Mayne, *Regulating International Business: Beyond Liberalization*, London: Macmillan.
- Pollitt, M.G. (1997) 'The Impact of Liberalization on the Performance of the Electricity Supply Industry: An International Survey', *The Journal of Energy Literature*, 3 (2), 3-31.
- Radaelli, C.M. (2002) "The Politics of Regulatory Impact Analysis in the OECD Countries: Best Practice and Lesson-Drawing", mimeo, Bradford: University of Bradford.

- Rivera, D. (1996) *Private Sector Participation in the Water Supply and Wastewater Sector: Lessons from Six Developing Countries*, Washington, DC; World Bank.
- Rodrick, D. (2000) 'Institutions for High-Quality Growth: What They Are and How To Acquire Them' Studies in Comparative International Development, 35, 3, 3-31.
- Roland G (1994) 'On the speed and sequencing of privatisation and restructuring' *The Economic Journal*, 104, pp 1158 – 1168.
- Ros, A. J. (1999), 'Does Ownership or Competition Matter? The Effects of Telecommunications Reform on Network Expansion and Efficiency', *Journal of Regulatory Economics*, 15, 65-92.
- Rose, R. (1993) *Lesson-Drawing in Public Policy*, Chatham, NJ: Chatham House.
- Rosenthal, S (2002), 'The design of the Manila concessions and the implications for the poor'. Mimeo.
- Sappington, D. (1994) 'Principles of Regulatory Policy Design' Policy Research Working Paper 1239. Washington DC: World Bank.
- Sappington, D. and Sibley, D. (1992) 'Strategic Non-Linear Pricing under Price Cap Regulation' RAND Journal of Economics 20, 3, 417-36.
- Sappington, D.E. and Stiglitz, J.E. (1987) 'Privatization, Information and Incentives', *Journal of Policy Analysis & Management*, vol.6, no.4, pp.567-82.
- Schmalensee, R. (1989) 'Good regulatory regimes', *RAND Journal of Economics*, vol.20, no.3, pp.417-36.
- Schmitz, P.W. (2001) 'The Hold-Up Problem and Incomplete Contracts: A Survey of Recent Topics in Contract Theory', *Bulletin of Economic Research*, vol.53, no.1, pp.1-17.
- Spiller, P. (1993) 'Institutions and Regulatory Commitment in Utilities Privatization', *Industrial and Corporate Change*, vol.2, no.3, pp.421-52.
- Spiller, P. (1996) 'Institutions and Commitment', *Industrial and Corporate Change*, vol.5, no.2, pp.421-452.
- Shaffer, B. (1995) 'Firm Level Responses to Government Regulation: Theoretical and Research Approaches', *Journal of Management*, vol.21, no.3, pp.495-515.
- Shapiro, C. and Willig, R.D. (1990) 'Economic Rationales for the Scope of Privatization', in E.N. Suleiman and J. Waterbury, *The Political Economy of Public Sector Reform and Privatization*, Boulder CO: Westview Press; also reprinted in D.
- Schleifer, A. (1985) 'A Theory of Yardstick Competition' RAND Journal of Economics, 16, 3, 319-27.
- Short, R. (1984), 'The Role of Public Enterprises: an International Statistical Comparison', in Floyd, R.; Gary, C. and Short, R. (eds.), *Public Enterprises in Mixed Economies: Some Macroeconomic Aspects*, IMF, Washington, D.C..

- Sidak, J.G. and Spulber, D.F. (1998) *Deregulatory Takings and the Regulatory Contract: The Competitive Transformation of Network Industries in the United States*, Cambridge: Cambridge University Press.
- Smith, W. (2000) 'Regulatory Infrastructure for the Poor: Perspectives on Regulatory System Design' Mimeo. World Bank.
- Snell, S. (1998) *Water and Sanitation Services for the Urban Poor – Small-Scale Providers: Typology and Profiles*, mimeo, Washington, DC.: UNDP-World Bank Water and Sanitation Program.
- Spiller, P.T. and Savedoff, W. (1999) 'Government opportunism and the provision of water', in W.D. Savedoff and P.T. Spiller (eds.) *Spilled Water: An Institutional Commitment to the Provision of Water Services*, Washington, DC: InterAmerican Development Bank.
- Smith, W. (1997) *Utility Regulators: The Independence Debate*, Viewpoint 127, World Bank, Washington, DC.
- Stelzer, I.M. (1996) 'Lessons for UK Regulation from Recent US Experience' in M. Beesley (eds) Regulating Utilities: A Time for Change? London: Institute of Economic Affairs.
- Steiner, F. (2000) 'Regulation, Industry Structure and Performance in the Electricity Supply Industry', *Economics Department Working Papers No.238*, Paris: OECD.
- Stern, N. (2002) 'The Challenge of Monterrey: Scaling Up', Annual World Bank Conference on Development Economics, Oslo, 24-26 June.
- Stern, J. and Holder, S. (1999) 'Regulatory Governance: Criteria for Assessing the Performance of Regulatory Systems: An application to Infrastructure Industries in the Developing Countries of Asia', *Utilities Policy*, 8, 33-50.
- Stigler, G. (1971) 'The Theory of Economic Regulation', *Bell Journal of Economics and Management*, vol.2, spring, pp.3-21.
- Stiglitz, J. (1998) 'Private Uses of Public Interests: Incentives and Institutions', *Journal of Economic Perspectives*, vol.12, no.2, pp.3-22
- Tamayo, G., Barrantes, R., Conterno, E. and Bustamente, A. (1999) 'Reform efforts and low-level equilibrium in the Peruvian water sector', in W.D. Savedoff and P.T. Spiller (eds.) *Spilled Water: An Institutional Commitment to the Provision of Water Services*, Washington, DC: InterAmerican Development Bank.
- Tenenbaum, B. (1995), 'The Real World of Power Sector Regulation', Note No. 50, Washington, D.C.: World Bank.
- TERI (2003) Draft Report on Regulation in India for Centre on Regulation and Competition, University of Manchester, New Delhi: Energy and Resources Institute.
- Torp, J.E. and Rekve, P. (1998) 'Privatisation in Developing Countries: Lessons to be Learnt from the Mozambican Case', *Transformation*, no.36, pp.73-92.
- Vass, P. (1997) 'The Methodology for Resetting X', in P. Vass (ed.) *Regulatory Review 1997*, London: Centre for the study of Regulated Industries

- Vickers, J. and Yarrow, G. (1988), *Privatization: An Economic Analysis*, London-Cambridge MA, The MIT Press.
- Villalonga, B. (2000), 'Privatization and Efficiency: Differentiating Ownership Effects from Political, Organizational, and Dynamic Effects', *Journal of Economic Behaviour & Organization*, 42, 43-74.
- Viscusi, W.K., Vernon, J.M. and Harrington, J.E. Jr. (2000) *Economics of Regulation and Antitrust*, 3rd edition, Cambridge, Mass.: MIT Press.
- Von Der Fehr, N-H. M, (2000) 'Who should be responsible for competition policy in regulated industries', in (ed.) E. Hope, *Competition Policy Analysis*, London: Routledge.
- Wallsten, S. (2001) 'An Econometric Analysis of Telecom Competition, Privatization, and Regulation in Africa and Latin America', *Journal of Industrial Economics*, 49 (1), pp.1-20.
- Weyman-Jones, T. (2001) 'Yardstick and incentive issues in UK electricity distribution price controls' *Fiscal Studies*, 22, 2, 233-47.
- Weyman-Jones, T (2003) 'Regulation Prices and Profits' in DS Saal and D Parker (eds.) *International Handbook on Privatisation*, Cheltenham: Edward Elgar.
- Williamson, J. (1985), The Economic Institutions of Capitalism: Firms, Markets and History. Cambridge: Cambridge University Press.
- Willoughby C (2002) 'Infrastructure and Pro-Poor Growth: Implications of Recent Research'. Report prepared for the UK Department for International Development. Mimeo.
- Willoughby C (2003) 'Can Public Infrastructure Institutions be Leading Agents for Pro-Poor Growth?' Paper prepared for ADBI Conference, June, Tokyo:ADBI
- World Bank (1994) 'Infrastructure for Development' World Development Report. World Bank: Washington DC
- World Bank (1995) *Bureaucrats in Business: The Economics and Politics of Government Ownership*, Oxford and Washington, DC: Oxford University Press and World Bank.
- World Bank (1997) World Development Report: The State in a Changing World, Washington DC: World Bank.
- World Bank (2001a) *Private Sector Development Strategy – Directions for the World Bank Group*, Mimeo, World Bank, Washington, DC.
- World Bank (2001b), *World Development Report, 2000/2001*, Washington, DC.: World Bank.
- World Bank (2003b) *Doing Business in 2004: Understanding Regulation*: Washington, DC: World Bank & Oxford University Press.
- World Bank (2003a) *Private Participation in Infrastructure: Trends in Developing Countries, 1990 – 2001* World Bank and Public Private Infrastructure Advisory Facility: Washington DC.

- World Bank (2003c) *World Development Report 2004: Making Services Work for the Poor*, Washington DC: World Bank.
- World Energy Council (1998), *The Benefits and Deficiencies of Energy Sector Liberalisation*, Vol.1, World Energy Council, London
- Yarrow, G. (1999) 'A Theory of Privatization, or Why Bureaucrats are Still in Business', *World Development*, vol.27, no.1, pp.157-68.
- Yunos, J.M. and Hawdon, D. (1997), 'The Efficiency of the National Electricity Board in Malaysia: an Intercountry comparison using DEA', *Energy Economics*, 19 (2), 255-69.
- Zhang, Y-F., Kirkpatrick, C. and Parker, D. (2003a) 'Electricity Sector Reform in Developing Countries: An Econometric Assessment of the Effects of Privatisation, Competition and Regulation', *Discussion Paper no.31*, Manchester: Centre on Regulation and Competition, Institute for Development Policy and Management, University of Manchester.
- Zhang, Y-F., Kirkpatrick, C. and Parker, D. (2003b) 'Competition, Regulation and Privatisation of Electricity Generation in Developing Countries: Does the Sequencing of Reforms Matter?', *mimeo*, Manchester: Centre on Regulation and Competition, Institute for Development Policy and Management, University of Manchester.

Endnotes

¹ The term 'developing countries' is used to denote low and middle income countries. Following World Bank classification, GNI per capita is used to denote the following income classifications: low-income, \$735 or less in 2002; middle income, \$736 to \$9,075; and high-income ('developed' or 'industrial countries'), \$9,076 and above. There is considerable differentiation within the developing countries category (and within the low and middle income sub-categories) which cautions against generalisations. Attention is drawn in the paper to these differences between low and middle income countries, and to the importance of individual country characteristics and conditions in the analysis of experience and design of policy.

² The econometric results are reported in detail in Appendix 1.

³ To provide a fuller appraisal of relative performance, a stochastic cost frontier analysis was carried out drawing on the same data base for Africa. The results are presented in Appendix 2.

⁴ The results are reported in detail in Appendix 3.