Systematic review

Impact of changes in the transparency of infrastructure procurement and delivery on infrastructure access, costs, efficiency, price and quality

A systematic review of the evidence in developing countries




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May 2012

UKaid from the Department for International Development
Indian Institute of Technology Madras
ePPI Centre
IOE London
Leading education and social research
Institute of Education
University of London

The authors are part of Indian Institute of Technology Madras and Harvard University and were supported by the Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre).

This report should be cited as:
Thillairajan A, Rajan S.C, Deep A, Gómez-Ibáñez J.A (2012). Impact of changes in the transparency of infrastructure procurement and delivery on infrastructure access, costs, efficiency, price and quality: a systematic review of the evidence in developing countries. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.

ISBN: 978-1-907345-31-9

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List of abbreviations

DEA	Data envelopment analysis
DFID	Department for International Development (UK)
ITU	International Telecommunication Union
O&M	Operations and management
OLS	Ordinary least square
PSP	Private sector participation
T&D	Transmission and distribution
TFP	Total factor productivity
UNCITRAL	United Nations Commission on International Trade and Law
WTO	World Trade Organization

Executive summary

The review question

What is the impact of changes in the transparency of infrastructure procurement and delivery on infrastructure access, costs, efficiency, price and quality in developing countries?

Background

The role of infrastructure investment in the growth of economy and poverty reduction is widely recognised. However, the infrastructure sector is susceptible to corruption and rent seeking because of its complexity, long life, large capital outlays and natural monopoly characteristics. Favouritism, fraud, cash bribes or state capture are concepts commonly associated with the delivery of infrastructure services in many countries of the world. Increasing the levels of transparency can minimise some of these shortcomings often associated with infrastructure sectors.

Transparency has emerged as an important theme for policy making of late, and the benefits of transparency in public procurement and other areas have been commonly accepted. Since the mid-1990s many developing countries have implemented various reforms measures such as competition, regulation, and private sector participation, in an attempt to increase investment in infrastructure. Apart from addressing structural inefficiencies, these measures also lead to an increase in the levels of transparency. In addition to such sector-specific interventions, transparency levels are also influenced by the overall macro environment and project-specific micro-level interventions.

While transparency has also increasingly been a focus area for research scholars, many recognise that it is difficult to measure transparency in any substantive way. Measures of transparency have traditionally been proxies like rule of law, good governance, corruption, etc. In this review, different macro, sector- and micro-level interventions have been used as proxies to study the impact of changes in transparency. This review synthesises the evidence on the impact of such interventions on outcomes in the electricity, telecom, transport and water supply sectors.

Methods of the review

In order to reduce the heterogeneity in context, methodology, geographical focus and research objectives of different studies, the scope of the review was confined to econometric and quantitative studies on developing countries during 1995–2010. Ninety studies that met all the search criteria were taken up for in-depth review. A textual narrative synthesis, along with vote counting analysis, was used to synthesise the results. The textual narrative synthesis helped to generate a rich description of the selected studies and was useful in synthesising evidence of different types. It also helped to make the context of the study clearer and made transparent the heterogeneity between studies. To complement and strengthen the narrative synthesis, a vote counting technique, which helped to count the number of observations for different type of outcomes, was also used to synthesise the results.

Results

Out of a total of 862 observations that had information on statistical significance, 456 (53%) indicated that the interventions did not have any significant impact on outcome, either positive or negative. This indicates that the linkages between the interventions and outcomes are not very strong. Out of the remaining 407 observations which indicated a significant impact on outcomes, there was more positive evidence than negative. Positive evidence was found in 33 percent of the total observations and negative evidence in 14 percent.

On the access outcome, out of 264 observations, 40 percent indicated an increase in access as a result of an increase in transparency levels whereas only 13 percent indicated a decrease in access. The proportion of observations that did not show any impact was 47 percent, which was lower than that of the results of the overall sample. On costs, 45 percent of the observations indicated a decrease in costs as a result of increase in transparency levels. Only 4 percent of the observations indicated a negative impact (i.e., costs increased) and about half of the observations did not show any significant impact on costs.

Forty-one percent (60 out of 145) of the observations indicated an increase in efficiency as a result of the interventions. Thirteen percent of the observations indicated a reduction in efficiency while 46 percent did not show any impact. The proportion of findings that showed a positive impact on efficiency was more than what was seen in the overall results.

It is generally felt that prices increase following reform-related interventions. Our analysis indicated that more than 62 percent of the findings showed no significant impact on price and only 19 percent of the observations indicated an increase in price (i.e., a negative effect) as a result of the intervention. It is also interesting to note that the same fraction of cases (19 percent) showed a decrease in price. On the quality outcome, the proportions of positive, negative and no impact were very close to the proportions seen in the overall sample.

In terms of effectiveness (i.e., those that had a positive impact on outcome), it was seen that micro-level interventions had the highest fraction of observations (58 percent), indicating a positive impact on outcome, whereas this proportion for macro and sector level was 34 percent and 31 percent respectively. The fraction of observations that did not show any impact was the lowest for micro-level interventions at 29 percent, whereas it was 52 percent and 54 percent for the macro and sector-level interventions respectively. There was not much difference in the effectiveness of various sector-level interventions such as competition, private sector participation (PSP), regulation and reform.

Analysis of outcomes by sector indicated that transport had the highest proportion of positive outcomes, though the numbers of observations were low. The remaining three sectors had similar proportion of negative outcomes. Telecom had a higher proportion of positive outcomes (37 percent) among the three and a lower proportion of outcomes with no significant impact (47 percent). In contrast, the electricity and water sectors had a lower proportion of positive outcomes and a higher proportion of observations with no significant impact.

Analysis of the impact on different customer segments indicated that the proportion of positive outcomes for the rural, poor and illiterate segment (33 percent) was higher than the urban, rich and literate customer segment (20 percent). Taking into account the type of

outcomes, our analysis indicated that access and quality improved for the rural, poor and illiterate customer segment as a result of the interventions.

Implications

The importance of governance indicators and institutions: This review indicates the presence of a strong link between infrastructure project outcomes and other factors, such as governance and corruption. Improvements in performance and outcomes in infrastructure sectors depend not only on the sector-level factors, but also on the broader economic conditions, such as governance, institutional strength and prevalence of corruption. Overcoming the shortcomings in these macro-level factors takes time, and therefore any improvements from the interventions are likely to be seen only after many years. Since many developing countries implemented these interventions only since the mid-1990s, it may take a while before the improvements can be completely realised. More importantly, our study also indicates that interventions that focus only on sector-level issues are not sufficient. Interventions that strengthen governance and institutions, and reduce overall corruption are equally important to achieve the desired outcomes from infrastructure projects. Therefore, development agencies that focus on infrastructure development should also focus on bringing about improvements in broader areas like governance and institutions.

The need to continue the next stage of interventions: In a majority of the developing countries, the primary objective of sector reforms has been to attract private sector capital in infrastructure. For years, public sector capital constraints have led to rationing of supply in the infrastructure sectors. Private sector investment was expected to bring in additional investment to expand capacity and network. The focus was therefore on creating conditions that would first result in attracting private sector investment, rather than improvements in outcomes. For example, in many instances PSP was not accompanied by strong regulatory reforms. As the evidence indicates, PSP in itself does not result in outcome improvements unless accompanied by strong regulation and competition. There is a need to focus on next-generation interventions that would create strong regulatory institutions (such as incentive-based regulation rather than rate of return regulation) and enable competition in the marketplace.

An explicit focus on transparency: Studies have indicated that transparency can play a positive role in several of the outcomes. While the interventions reviewed in this study did impact on transparency, improving the level of transparency was not their main objective. Therefore, in many instances, these interventions did not improve transparency very much. By specifically focusing on the transparency component while implementing these interventions, it would be possible to increase the levels of transparency in a more explicit way. Assessment on the effectiveness of these interventions should also include criteria on how they have improved transparency levels.

The need to assess the ability of the government to keep its promises: On occasions, the interventions have failed as the government was not able to keep its promises. While the initial support for the interventions were with the objective of getting foreign assistance, in many cases the actions promised by the government as a part of the conditionalities to the assistance were not politically possible or were politically unlikely. Without appropriate follow-up measures, the outcomes from such interventions therefore fell short of expectations. Therefore it becomes important to determine at the outset whether the actions

assured by the government are politically feasible, as the entire outcomes from the interventions depend upon the fulfilment of those promises.

Recognising the trade-offs on different outcomes: Identification of the appropriateness of different interventions for different outcomes and sectors is also important. For example, community participation is seen as quite effective in improving project outcomes. However, it can be implemented only in limited instances. These interventions can succeed only in those places where there is a strong sense of belonging to the community, so it might be more appropriate in rural rather than urban areas. Not being local in nature, there is limited scope for using such community interventions in the electricity and telecom sectors. In general, PSP helps to increase sector-level efficiencies as a result of superior management capabilities and incentive systems. However, if PSP is not accompanied by regulation and competition, the benefits of these efficiencies are retained by the private utility and do not reach the customer. At least in the short run, many of these interventions involve trade-offs. For example, in the electricity sector, while regulation had a positive impact on costs, it did not have any significant impact on access. In telecom, PSP improved efficiency, but had a negative impact on price. Regulation had a positive impact on access, but a negative impact on quality. Being aware of such trade-offs is important to select the most appropriate intervention in achieving a given outcome.

Customising the interventions to suit the local context: Since the outcomes of these interventions vary differently across areas, it is suggested that the interventions should be tailored to suit the context of developing countries. For example, while a complex regulatory structure with well-laid-out procedures might suit the developed countries that have strong institutions, this might increase corruption in developing countries with comparatively weaker institutions. Therefore it is felt that an element of discretion in regulatory functioning might actually be better than having a well laid out completely transparent regulatory procedure. It has also been indicated that given the low level of development infrastructure markets in many developing countries, the introduction of measures oriented towards market-driven or indirect outcomes has not been as effective as direct measures, suggesting that some corrections have to be forced into place before competitive factors come into play.

A need for a greater understanding of the linkages between intervention and outcomes: Increase in transparency is expected to have a positive impact on outcomes. Our results indicate that the proportion of positive outcomes is higher than that of negative outcomes in most of the analysis parameters. However, it was also found that the highest proportion of observations indicated that the interventions did not have a significant impact on outcomes, indicating that the linkages between outcomes and interventions are not very strong. Further research is needed to study the reasons and causes behind this finding. The finding that in many instances the interventions did not lead to a positive impact also highlights the possible limitations of these interventions in their existing forms and emphasises the need for greater understanding of the theory of change that accompanies such interventions in order to increase their effectiveness.

Limitations

- Only those studies that have used quantitative methods were included in the review, which limited the number of studies that qualified for inclusion.
- The review is specifically focused on the experiences of developing countries.

- The inclusion of only quantitative studies meant that there were few opportunities to discuss the causal linkages.
- Effect size has not been considered.
- In transport, the number of studies identified was rather small, which limits our ability to make broad judgements.
- The interventions that have been chosen as proxies for transparency will influence outcomes through a range of means, and not just transparency. The evidence that we reviewed does not attribute how much of the impact on outcomes is due to a change in transparency.
- Synthesis did not capture the second level details of the interventions. For example, the type of PSP intervention, namely, concessions and divestitures, has not been captured as one of the variables in the synthesis.

1. Background

The complex nature of infrastructure projects makes it vulnerable to corruption and mismanagement. Research has indicated that the lack of transparency in infrastructure can adversely affect outcomes, and more so in developing countries. Given the potential benefits that can be realised as a result of an increase in transparency, several international agencies are increasingly focusing on policies that aim to improve this.

This chapter provides the rationale and background for this review. Since transparency is a context that cannot be defined clearly, measuring the impact of transparency on infrastructure outcomes is a difficult task. Using macro-, sector- and micro-level interventions as a proxy for change in transparency, this systematic review synthesises the evidence on the impact of these interventions on infrastructure outcomes.

1.1 Aims and rationale for the current review

Infrastructure provision entails high visibility and requires accountability for reasons of political and economic efficiency. But infrastructure projects tend to be bigger than those in other sectors, and services are often granted a monopoly on delivery with regulatory oversight to ensure that there is no abuse of monopoly power (Estache, 2004). Researchers have advocated greater transparency in procurement and delivery, and appropriate incentive structures for greater access, lower costs and better quality in infrastructure projects (Flyvbjerg *et al.*, 2003; Guasch, 2004).

The role of public infrastructure investment in the growth of the economy and poverty reduction is widely recognised (see, for instance, Calderon and Serven, 2004; Cook, 2005). Up to the early 1980s, government made much of investment in public infrastructure. The emergence of large budget deficits and pressures on public financing in the late 1970s and the early 1980s resulted in the move to invite private participation in infrastructure, first in the developed world and then later in the developing world (Gasmi and Virto, 2010).

PSP was often accompanied by reform, restructuring and regulation. Many of these changes have also arisen as a result of the inability of the state to provide good quality infrastructure to all its citizens. This has been attributed variously to the nature of incentives of the public firm that does not create sufficient motivation for managers (agents) to act on behalf of the citizens (principals) (Shleifer and Vishny 1994; Vickers and Yarrow 1988).

During the 1990s, the public sector financed 70 percent, the private sector 20–25 percent, and official development assistance 5–10 percent of infrastructure spending (DFID, 2002). According to a worldwide database, during 1990–2002, private sector commitments to infrastructure totalled $805 billion, or $62 billion a year (Estache, 2004). According the World Bank PPI Database, total investment commitments to infrastructure projects with private participation in developing countries was $79.3 billion per year during 1990–2000, but increased to $105 billion per year during 2001–2008 (World Bank, 2010). This indicates a shift in the delivery of infrastructure services towards the private sector in developing countries in recent years.

The benefits of transparency in public procurement and other areas have been widely accepted (OECD, 2007; Schooner, 2002). The issue of transparency is even more important in the case of infrastructure projects because of their huge capital outlays, their monopoly

nature, their widespread societal impact and the generally long duration of the contracts. It has been noted that favouritism, fraud, cronyism, patronage, embezzlement, state capture or cash bribes are all concepts commonly associated with the delivery of infrastructure services in many countries of the world, rich or poor (Estache and Trujillo, 2009). The Transparency International Global Corruption Index 2007 suggests that one third of the population is affected by corruption in utilities, which makes this as an area of significant concern for policy makers.

The infrastructure sector is susceptible to corruption and rent seeking because of the large capital outlays and the characteristics of construction costs, complexity, long life, asset specificity and natural monopoly, which provide large-scale opportunities for public officials to seek private gain through discretionary actions. Corruption can negatively affect the quality of the infrastructure services provided, leading to lower coverage and quality of public services. The costs of corruption are hypothesised to negatively affect economic growth, investment, international trade and price stability (Dreher and Herzfeld, 2005; Lambsdorff, 2007). Studies suggest that the financial costs of corruption in developing countries in infrastructure investment and maintenance might equal $18 billion a year (Kenny, 2006). Estache and Trujillo (2009) also indicate that corruption is an important problem to deal with in infrastructure.

Transparency can play an important role in the reduction of corruption (Johnston, 2005; Klitgaard, 1991; Rose-Ackerman, 1999) and subsequently the improvements in infrastructure services in developing countries. By bringing in more accountability, predictability and rule-based decision making, transparency can also play an important role in improving the efficiency levels of infrastructure.

The aim of this study is to systematically review the evidence on impact of changes in transparency on infrastructure outcomes. During the process of analysis, the authors have been careful not to conflate improvements in transparency with anti-corruption reform, though literature indicates that transparency, inter alia, is also inversely related to the prevalence of corruption (Johnston, 2005; Klitgaard, 1991; UNCITRAL, 2008). It is expected that the findings from this review will strengthen the capacity for evidence-informed decision making in infrastructure development.

1.2 Defining and measuring transparency

There are several commonly used definitions for transparency. Transparency International indicates that it can be defined as a principle that allows those affected by administrative decisions, business transactions or charitable work to know not only the basic facts and figures but also the mechanisms and processes. UNCITRAL (2008) also indicates that *competitive* conditions and using *objective criteria in decision making* can have an impact on transparency. Ohashi (2008) provides a working understanding of the concept when he states that replacing discretionary and opaque practices with a *rule-based practice* leads to an increase in transparency. The World Trade Organization (2005) defines transparency as the degree to which trade policies and practices, and the process by which they are established, are *open* and *predictable*.

While the definitions above suggest that procedural and operational transparency are most significant, there have been incremental additions that have broadened the definitions. Geraats and Eijffinger (2002) indicate that transparency has five different dimensions:

political, economic, procedural, policy and operational. While some dimensions are more important than others in some sector-specific interventions, it is when all of these come together that they are able to make an impact on outcomes. For example, procedural and policy transparency are important in Ohashi's context of public procurement. However, in contexts where there is no political transparency, increasing procedural transparency may not automatically lead to better outcomes.

In order to address the various dimensions of transparency, the World Bank (2001) suggested that transparency results from *predictability* (reducing the cost of uncertainty) and *simplification* (reducing information costs), in the context of a professional bureaucracy, an enlightened government and a strong civil society, all participating actively and behaving under the rule of law. Many studies that examine transparency also include other conditions such as clarity, autonomy, participation, accountability, and predictability (Noll, 2000; Stern and Holder, 1999). The expansion of the initial dimensions of transparency has meant that it is difficult to measure as it requires the fulfilment of many interrelated conditions. It has also meant that there are very few studies that have explicitly investigated the role of transparency (Bellver and Kaufman, 2005; Cubbin and Stern, 2005).

While the definitions above provide a general idea of the nature of transparency and the qualities associated with it, establishing a link between transparency and infrastructure outcomes is very difficult. This study therefore looks at a number of interventions that are generally correlated with greater levels of transparency.

The interventions will be examined in two modes: firstly, in terms of economy-wide, macro-level or institutional change towards greater transparency; and secondly, as sector- and project-level interventions such as private participation, regulation and decentralisation. Although such an approach might seem somewhat indirect, the empirical nature of this review makes it necessary to parse the relationships in this manner in order to discover the causal connections between specific transparency-improving interventions and outcomes.

This review has been restricted to empirical and quantitative studies, as the findings from such studies can attribute the changes in outcomes of interest to the intervention more clearly. The synthesis captures how the outcomes have been improved through transparency, though it was mediated by other outcomes.

1.3 Policy and practice background

Transparency is emerging as an important theme for policy making, judging by the focus of international agencies on the topic. For example, the DFID has been funding the Construction Transparency Initiative (CoST) since 2008. The initiative has been spearheading efforts to increase transparency and accountability in the complete construction life cycle of projects.

The World Trade Organization (WTO) has a working group to look at transparency, and the United Nations Commission on International Trade and Law (UNCITRAL) has a strong focus on it. While the WTO and UNCITRAL largely focus on the issue of transparency from the perspective of international trade, the context is equally important for procurement and delivery. The relevance of the topic can also be understood from the widespread recognition received for publications from agencies such as Transparency International and the increasing frequency of research papers on this area.

Many countries have set up anti-corruption agencies to ensure that due process is followed in awarding public contracts. Over 50 countries during the last 15 years have enacted freedom of information legislation, while many others are to do so in the near future. Many have tightened disclosure laws especially in the light of the financial crisis since 2008. The United Nations Convention on Anti-Corruption, which came into place in 2005, requires all parties to co-operate on the prevention and criminalisation of corruption.

1.4 Research background

Transparency has increasingly been a focus area of research scholars. While most would agree that it is associated with greater access to information, many recognise that it is difficult to measure it in any substantive way (Kaufmann, 2003). It has also been pointed out that measures of transparency have traditionally been proxies like rule of law, good governance or corruption that are associated with transparency (Vishwanath and Kaufmann, 1999; cf Bellver and Kaufmann, 2005). In this way, transparency, governance and corruption, though distinct, are interlinked.

Transparency is also strongly associated with the rule of law, strong institutions, a free press, an independent judiciary and a vibrant civil society. Many countries have been able to reduce corruption through the publication of information that gives all stakeholders knowledge of the due process to be followed for licenses, certificates etc. (Pope, 2005). A positive change in transparency implies improvement in the openness of institutions and greater voice and greater accountability to people (Kaufmann and Bellver, 2005). Good governance and accountability are seen to improve transparency, which directly impacts on the quality of information available to stakeholders.

1.4.1 Transparency studies

Studies suggest that greater levels of transparency in decision-making processes increase the possibility that corruption is identified and tackled effectively. Therefore, a negative relationship has been established between greater corruption and transparency (Vishwanath and Kaufmann 1999). (However, in a study on corruption and efficiency, Meon and Weill (2009) find that corruption may be positively associated with efficiency in countries where institutions are ineffective.) Estache and Kouassi (2002) also find that corruption increased the cost of providing water in Africa. Working on a larger and more recent database, Kirkpatrick *et al*. (2006) confirm these findings. Seim and Soreide (2009) try to estimate how performance across the utility sectors is affected by corruption, and find that in general, service delivery in the utilities functions significantly better in countries with few procedures and low levels of corruption.

Reduced corruption is generally associated with improved resource allocation, greater efficiency and economic growth (Kaufmann *et al*., 2005). Similarly, Vishwanath and Kaufmann (1999) find that transparency can lead to greater financial stability. Kaufmann (2003) suggests that an improvement in the rule of law in a country can significantly improve outcomes like infant mortality and literacy. Countries with high levels of transparency, effective parliamentary oversight, and high standards of corporate ethics had a higher rate of GDP growth than countries with lower levels (Pope, 2005).

While there are many studies on the positive impact of transparency on outcomes, there are cautionary voices also. Estache and Wren-Lewis (2008) suggest that developing countries are different due to their contexts and need to adopt different methods to ensure positive

outcomes. This is especially true in the case of access and affordability, where those with the greatest ability to pay are likely to hijack the benefits of subsidies in sectors like water and fuel. Greater transparency does not always lead to better outcomes due to the different contexts of the country. Bac (2001) suggests that greater transparency could be associated with greater corruption as a greater level of transparency reveals the key decision makers and therefore establishes incentives to establish connections for corruption. The connections effect could dominate the detection effect resulting in greater levels of corruption.

Bellver and Kaufman (2005) have developed a transparency index with two components, for economic/institutional and political transparency, which they compute for 194 countries. Their analysis suggests that there is not only enormous variety among countries, but that there are large differences in performance between the economic/institutional and political dimensions of transparency. In tune with Johnston (2005, 2006), they recommend that different types of transparency reforms are warranted for different stages of political and economic development, and that much more prominence ought to be given to transparency reforms as a core component of second-generation institutional reforms.

The issue of transparency is even more pertinent for developing countries, as indicated by Estache *et al.* (2009). The authors find that according to the corruption index published by the International Country Risk Guide, average corruption levels increased 29 percent in developing countries between 1990 and 2005.

1.4.2 Reviews on transparency and infrastructure

There has not been any systematic review done earlier that examined the impact of transparency on infrastructure outcomes. However, there have been studies that reviewed the results of interventions covered in this review. This section summarises some of these reviews.

In their review on global electric power reforms, Bacon and Besant-Jones (2001) mostly track the status and sequencing of various reform programmes worldwide. In their conclusion on outcomes from reforms, they indicate that power sector reform can yield huge productivity gains, particularly through dynamic efficiency gains under competitive pressures. They also find that productivity gains did not result in corresponding lower power prices in retail markets, as regulators wanted to reduce uncertainty about future revenues for private investors.

In a survey of empirical evidence on performance of electricity sector reform, Jamasb *et al.* (2004) indicate that country institutions and sector governance play an important role in success and failure of reform. Reforms appear to have increased operating efficiency and expanded access to urban customers. However, they have not passed on the benefits of efficiency gains to customers, nor improved access in rural areas.

Estache (2004) has undertaken a selective survey of economic literature on seven emerging infrastructure policy issues in developing countries. Among the seven themes, the following are especially relevant for this review: decentralisation, regulation and corruption. Reviewing the literature on decentralisation, Estache indicates that while there is a lot of literature on the topic, there is an 'amazingly modest amount in terms of its implications for infrastructure'. There is also little empirical evidence on the relative efficiency of the various delivery modes and types of infrastructure in the context of developing countries. Most of the

literature has focused on the type of decentralisation and the enabling institutional environment that is needed to sustain such initiatives. Reviewing the literature on corruption, Estache indicates that, 'there is little evidence on how it [corruption] affects infrastructure performance'. While the reasons for corruption in infrastructure can be many and are dependent on the incentives, Estache indicates that privatisation and regulation can play an important role in reducing it. Effective regulation can increase transparency and accountability and minimise the effects of corruption in the delivery of infrastructure services.

There is a general perception that interventions such as privatisation hurt the poor. Using evidence from Latin America, Estache *et al.* (2001) find that the poor would benefit from service expansion that may be possible through privatisation. Subsidies in the infrastructure sector mainly benefit the middle class and not the poor. The authors indicate that for privatisation to benefit the poor, it should be accompanied by institutional and regulatory reforms.

An exhaustive analysis of past reviews is beyond the scope of the report. But in general, most of the reviews have indicated that transparency-enhancing interventions have had a positive impact on several infrastructure outcomes.

1.5 Authors, funders and other users of the review

In 2010, the DFID started a pilot project that aimed to increase the use of evidence in policy and contribute directly to shaping international development policy and practice. The programme focused on developing and disseminating systematic reviews in international development that mapped, critically appraised and synthesised international development evidence. This systematic review was commissioned by the DFID as a part of this pilot exercise.

The authors of the review are Thillai Rajan and Sudhir Chella Rajan from the Indian Institute of Technology Madras, and Akash Deep and Jose Gomez Ibanez from Harvard Kennedy School, Harvard University. The authors all have PhDs and have a combined track record of several years of undertaking independent research projects as well as providing research guidance to PhD students. They have extensive experience of researching into the infrastructure sector.

The authors have also been involved in various research projects that involved an assessment of existing knowledge on the subject. Professor Jose Gomez Ibanez had served in the review panel of the US National Research Council Study Committees, which assessed and summarised evidence on a given area. For example, he was the Chair of the committee that produced Special Report No. 298 in 2009 on driving and the built environment for the US Transportation Research Board. Professor Sudhir Chella Rajan was the principal investigator in a two-year research project for the US State Department, where he developed the Decision Support Tool to Analyze Institutional Reform (DSTAIR), providing an alternative framework for identifying the institutional failures associated with a propensity for corruption. He also teaches a course on corruption and development at the Indian Institute of Technology Madras.

3ie assisted in organising the review of the protocol and draft versions of the report. The EPPI-Centre, Social Science Research Institute, Institute of Education, University of London provided the technology and the advisory support for the review.

The results of this review would be particularly useful to multilateral and bilateral funding agencies and policy makers in governments.

1.6 Review question

The question for this review is: 'What is the evidence of impact of changes in the transparency of infrastructure procurement and delivery on infrastructure access, costs, efficiency, price and quality in developing countries?'

1.7 The conceptual analysis framework

Measuring the impact of transparency on infrastructure outcomes is a difficult task. Transparency is a context that cannot be defined clearly. Various interventions can improve or make changes to that context, and for the purposes of this review, we consider a few. Previous studies have suggested that these interventions can reduce the impact of corruption and improve transparency.

The focus is on interventions that are used as a proxy for transparency, as the latter cannot be represented in terms of a measurable index. While many of these interventions have formal attributes, there is very little data on the informal attributes like transparency and the quality of regulatory processes that are enmeshed within these interventions. For example, better regulation can improve transparency through better information flows about the regulated utility. However, it is difficult to capture transparency as an intervention, though it is possible to capture regulation. The omission of variables like transparency and accountability can lead to biased findings, even though they form a significant part of the intervention (Cubbin and Stern 2006). As suggested in this study, transparency is the third strand of a braid: though invisible, it is an important and essential part of it.

One aspect is to look at interventions that affect governance and contexts where transparency improves through changes in the institutional framework, which we call macro-level factors. An improvement in the governance context can improve transparency, and this can eventually lead to better outcomes in the infrastructure sector. Studies show that such macro-level factors play an important role in infrastructure development (Henisz, 2002; Henisz and Zelner, 2001).

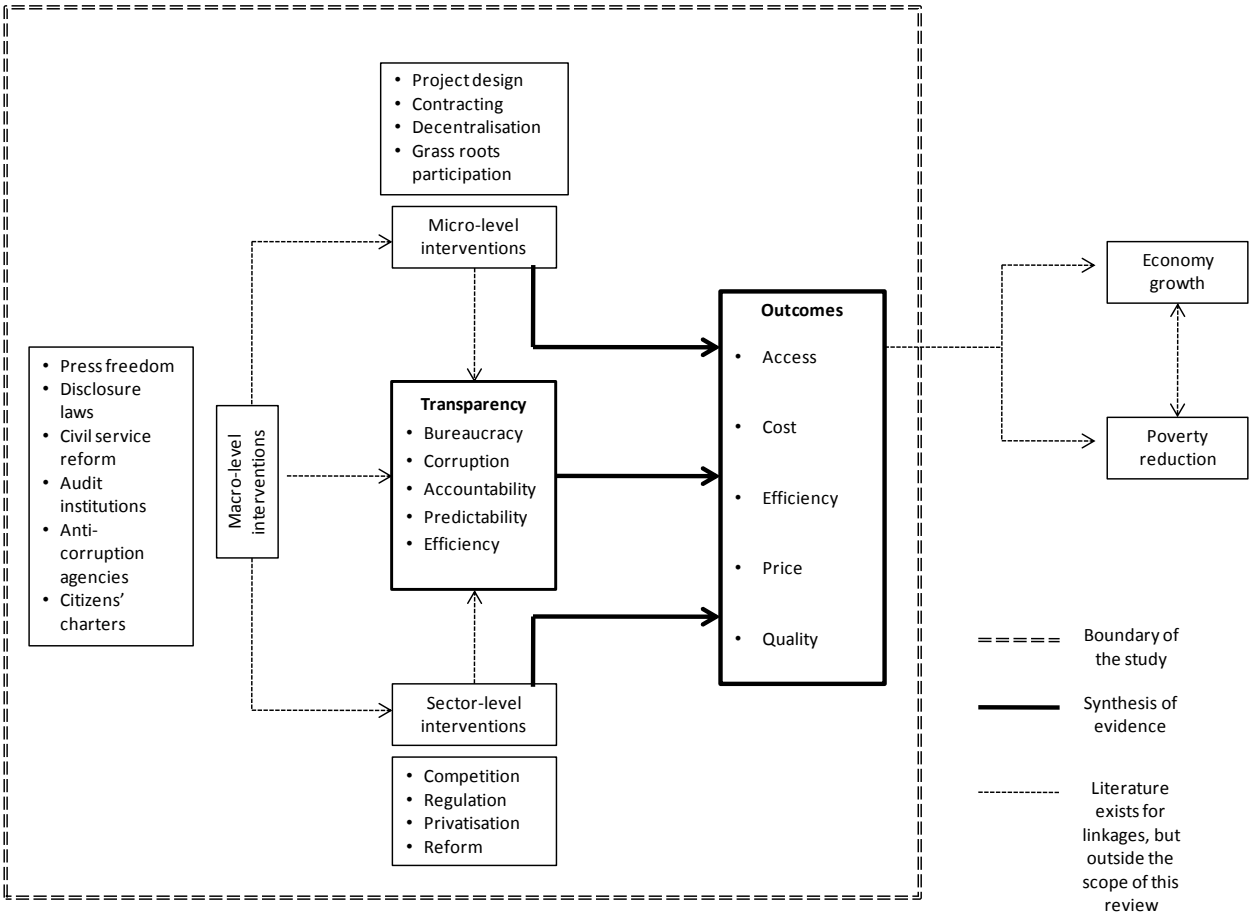
The second aspect is to look at programmatic or sector-level interventions that have an impact on transparency. The common interventions that were reviewed under this category were reform, private sector participation, competition and regulation. Implementation of these interventions generally results in an increased level of transparency.

The third aspect is to look at project-level interventions (which we call micro-level interventions) and their impact on outcomes. These interventions differ from the sector-level interventions in the sense that they are implemented in specific projects or regions and not for the entire sector. The project-level interventions that were included in the review were community participation and decentralisation.

The causal link between the interventions and change in outcomes can be split into two parts. In the first, the interventions among other changes, also lead to an increase in transparency. In the second, the changes in transparency levels lead to changes in outcomes. It is difficult to ascertain the magnitude of change in outcomes that can be attributed to change in

transparency. It must also be noted that studies on the impact of transparency and corruption in the utilities and infrastructure sector have been limited (Estache *et al.*, 2009; Kenny, 2009a).Therefore, we do not isolate the 'transparency' effect on outcomes in this review, and we review the impact of the three levels of interventions on outcomes in totality. The conceptual framework of this approach is given in Figure 1.1.

Figure 1.1: Conceptual framework of the review



The various interventions included in this review are briefly described below.

1.7.1 Macro-level factors

These include factors and conditions that are not targeted at the infrastructure sector in particular, but have widespread impacts on the economy as a whole. They include interventions like the setting up of an anti-corruption agency, access to information legislation and press freedom. Improvements in these areas are usually associated with an improvement in transparency.

1.7.2 Sector-level interventions

The key sector-level interventions that are included in the scope of this review are reform and its different components, such as private sector participation (or privatisation),

regulation and competition. The following paragraphs summarise the impact of these interventions on transparency.

Private sector participation

Private sector participation (PSP) in infrastructure is generally expected to increase transparency, in large part because of the introduction of legally binding contracts and hard budget constraints (Harris, 2003). In addition, corporatisation itself is associated with fiduciary oversight, which increases transparency. Furthermore, PSP introduces the state sector to competition, if not directly, at least in terms of providing a benchmark against which to evaluate public sector provision of infrastructure services. On the other hand, in circumstances where PSP is introduced as an intervention signifying collusion between private rent seekers and the state, contracts are secretive and the sale of public assets is seen as an opportunity for corruption. As Manzetti (2003) points out, 'enacting sweeping economic changes in a rush without holding public officials accountable is a recipe for disaster'. Boehm and Polanco (2003) also indicate that corruption is a likely outcome in infrastructure projects in developing countries, especially in cases where monopoly power remains after privatisation. Process design is indeed an especially important aspect of privatisation, requiring stakeholder monitoring and other transparency-enhancing measures. While there are voices of caution on the impact of PSP on transparency, there is a general agreement among researchers that PSP is a transparency-enhancing measure.

Regulation

Regulatory reform in the context of infrastructure restructuring can either accompany privatisation and competition or take place independently of them. In all situations, it is typically characterised by measures seeking to create the rules and regulations needed to generate capital for secure, adequate and reliable services at low cost and ensuring equity of access across social classes. Clear identification and protection of property rights, protection of the rights of consumers and long-term sustainability of the sector are also important goals. Regulation is especially important to ensure fair pricing by monopolies; where government is itself the provider, an independent regulator may play the necessary role. These regulatory functions have the effect of increasing transparency by providing clarity on rules for infrastructure service provision and, particularly where stakeholder consultation or public hearings are included, by allowing for greater scrutiny over the financial structure and operations of service providers. Gutierrez and Berg (2000) indicate that regulation favourably impacts on transparency, predictability and accountability. Nevertheless, transparency need not be a natural outcome of regulation reform, but may need to be an explicit aspect of its design (see, e.g., Stern and Holder, 1999).

Indeed, many developing countries continue to have problems with corruption even after regulatory reform, including challenges such as favouritism, fraud, cronyism, patronage, embezzlement, regulatory capture, cash bribes or extortion (Estache and Trujillo, 2009). There is evidence, however, that reform strategies that reduce the incentives for collusion among regulatory officials, providing release of public information, increasing public oversight through the use of consumer advocates, and reducing the discretionary power of officials, can have the effect of increasing transparency (Estache and Wren-Lewis, 2010; Laffont, 2005). Despite alternative voices and specific experiences to the contrary, there is a general agreement among researchers that regulation leads to an increase in transparency.

Competition
Along with privatisation and regulation, competition in infrastructure can help increase transparency if it is successful in providing public information on costs and reducing market power. Competition in infrastructure may itself be limited to certain sectors, such as telecommunications, where natural monopolies do not exist and where it therefore makes sense to introduce multiple players. Performance-based contracting and benchmark regulation can have effects similar to that of competition in the water, transport and electricity sectors. Competition mostly decreases the need for regulators to amass information to the extent that market signals can be believed as reflecting true costs. Nevertheless, capture cannot be ruled out simply because of the presence of competitors in infrastructure, especially under conditions of weak institutions and inadequate regulatory reform (see, e.g., Manzetti, 2003).

Reform
Reform is an overarching intervention, and the literature on the causal pathways between these interventions and transparency is rich, though contested. The components of reform usually include one or more of the components described previously: regulation, PSP and competition. Studies are classified under the category of 'reforms' when they either analyse the overall effect of reforms or when the impacts of the individual components of reform are not available.

Very often, the different components of reform act in tandem to create a more favourable outcome. For example, Estache *et al*. (2009) indicate that while privatisation could help to improve outcomes, it is most effective when put together with other outcomes like the establishment of a regulator and improved competition. Maiorano and Stern (2007) and Wallsten (2001) also record similar findings. Competition is also seen to clearly improve outcomes, as it reduces the informational asymmetry that monopoly utilities possess (Zhang *et al*., 2005).

1.7.3 Project-level interventions

The project-level interventions that are included in the scope of this review are decentralisation and community or grassroots participation. There are many other local interventions that can have an impact on transparency such as e-governance, which is increasingly becoming a tool for improving local accountability and transparency (Kumar, 2002). However, the scope of interventions was limited to decentralisation and community participation for this review as these were the most common forms of interventions studied in the infrastructure sector.

Decentralisation
Decentralisation is the process of devolving decision making to ground-level entities in order to be more responsive to meet the needs of consumers. In a normative sense, this should have a favourable impact on transparency. Previous studies have supported this view. While Bardhan and Mookherjee (2005) warn about the possible negative effects of decentralisation through elite capture, Crook and Manor (2000), in their study of four countries, suggest that over a period of time, decentralisation can have beneficial effects on both transparency and accountability, and can lead to better outcomes. However, Fan *et al*. (2009), looking at firm-level data across 80 countries, find that the number of tiers of decentralisation is negatively correlated with transparency and that there is a danger of uncoordinated rent seeking as

government structures become more complex. However, for this systematic review, we follow the generally accepted view that decentralisation increases transparency.

Community participation

It is generally felt that community and grassroots participation is likely to increase transparency and reduce corruption. Involvement of civil society can promote good governance, because the community can actively monitor policy implementation (Araral, 2009; McIntosh, 2003).

An example of community participation is the World Bank financed Kecamatan (Districts) Development programme in Indonesia, where the funds went directly to districts to be used for projects they prioritised. While the effort did not completely remove corruption, the reduction in loss due to corruption was seen as a good achievement (Guggenheim, 2009). World Bank (2003) found that infrastructure projects under the above development programme were on average 23 percent less expensive than other comparable government projects. Isham *et al*. (1995) have also shown, on the basis of 121 projects, that increasing beneficiary participation led to better overall project effectiveness in drinking water projects.

1.8 Summary

This chapter has highlighted that transparency levels impact on infrastructure outcomes. Since transparency is a context that cannot be defined clearly, measuring the impact of transparency on infrastructure outcomes is a difficult task. Using macro-, sector- and micro-level interventions as proxies for change in transparency, this systematic review synthesises the evidence on the impact of these interventions on infrastructure outcomes. The following chapters provide details of the methods used in the review, the results and the implications.

2. Methods used in the review

This chapter provides details of the search strategy and the methods that were used to identify the studies for inclusion in the review. The different steps in this process included:

- Formulating exclusion and inclusion criteria that would be used to determine the studies for inclusion in the review.
- The sources and the search methods (search phrases) that would be used to identify the studies.
- Managing the shortlisted and identified studies using review management software.

The entire search process was carefully documented and the number of studies identified was recorded at each stage so that it can be replicated, if need be, by other research groups. In addition, documenting the search process also enables the review to be updated in the future by expanding the time frame of the search to include future additional studies. Documenting the search process and the use of well-defined exclusion and inclusion criteria also help to reduce the study selection bias that might occur in non-systematic reviews.

2.1 User involvement

2.1.1 Approach and rationale

Policy makers in developing countries will benefit from this systematic review. Transparency is becoming an important feature in political and policy decision making. Therefore we chose to involve agencies such as the World Bank and the UK Department of International Development, which work closely with the governments in developing countries and play an influential role in policy decisions. Given the international focus of the review, we felt that involving international agencies would be more effective, as they would be bringing in a perspective that is not confined to national boundaries and would also be more interested in the findings of an international study.

2.1.2 Methods used

There were three stages of user involvement in the review process. The first stage was in the development of the protocol, when the review team had a detailed meeting with the DFID policy team as well as other organisations that were engaged by the DFID to work in similar areas. The discussion with the DFID policy team helped us to sharpen the review question to make it more relevant. The discussions with other organisations, such as Engineers Against Poverty and the Construction Sector Transparency (CoST) Initiative were also helpful in defining the boundaries of the review.

The second stage of user involvement was the review of the protocol; this was undertaken by a member of the DFID policy team, a member of the World Bank and 3iE. The protocol was revised based on the inputs received from the reviewers. In the third stage of user involvement, the draft report was reviewed by the DFID policy team as well as other reviewers. This final report incorporates the comments received from the reviewers of the draft report.

2.2 Identifying and describing studies

2.2.1 Defining relevant studies: Inclusion and exclusion criteria

Studies were included only if they met all the inclusion criteria given in Table 2.1.

Table 2.1: Inclusion criteria

No.	Inclusion criteria	Description
1.	Type of interventions/ impact of transparency	Studies belonging to either of the following two types were included in the study: • Studies that analysed various interventions (such as regulation, competition) in terms of their impact on levels of transparency. • Studies that analysed the impact of macro-level factors related to transparency (such as corruption) on outcomes.
2.	Sectors	Only studies that dealt with any of the following sectors were included: electricity, telecommunications, transportation or water supply and sanitation. Whenever studies also included other infrastructure sectors (such as internet, energy), only the results pertaining to the above four sectors were included for synthesis. Studies were excluded if the results were aggregated for all sectors, including sectors other than the four indicated above, and could not be disaggregated.
3.	Populations	The contexts and the operating environment for utilities in developing countries are different from those of developed countries. Only those studies that focused on developing countries were included for the review. When studies had both developed and developing countries in their sample, they were included only when the results for the developing countries was separately available. This helped to reduce the contextual heterogeneity to an extent.
4.	Outcomes	Studies were included that measured the impacts on the following outcomes: access, cost, price, efficiency or quality.
5.	Methodology	Only quantitative studies that were based on past secondary or primary data were eligible for inclusion in the review. Quantitative methods included statistical, mathematical, econometrics and regression, and part simulation (as in the case of construction of counterfactual scenarios in social cost-benefit analysis).

6.	Quality appraisal criterion	Overall assessment of the study should be either 'high' or 'medium', a score greater than three as defined in the coding tool in Appendix 2.2 (Question 37).

Studies were excluded from the review if any of the criteria listed in Table 2.2 applied.

Table 2.2: Exclusion criteria

No.	Exclusion criteria	Description
1.	Studies not published in English	Given the time limitations and the language constraints, only studies available in English were included for the review.
2.	Studies published before 1995	It was felt that more recent evidence would be more compelling for policy makers. Therefore we used a cut-off date to exclude studies that were published before that date. Our familiarity with the literature indicated that most of the studies that focused on developing countries were published after 1995.
3.	Studies that did not distinguish between infrastructure and non-infrastructure sectors	This review is focused on the infrastructure sector, which has characteristics such as monopoly conditions, large investment requirements, long asset lives, limited scope for competitive conditions, need for universal access, etc. This makes it different from other segments of the economy. Therefore studies that did not focus on infrastructure or those that did not distinguish infrastructure from other sectors in their findings were excluded.
4.	Purely qualitative and case studies were excluded	Generally, studies that used only qualitative methods were excluded. Given the different methodologies that the studies used, this helped us to reduce the heterogeneity that arises from different methods. While we realised that quite a few studies would be excluded because of this criterion, we were conscious of this trade-off to reduce the heterogeneity. Qualitative studies generally have a rich description of context and also trace the causal pathway in a more detailed fashion as compared to quantitative studies. Quantitative studies on the other hand, have findings that can be more clearly attributed to the intervention. Using both qualitative and quantitative studies would have resulted in a large number of heterogeneous studies, and it would thus have been very difficult to synthesise the findings. Nevertheless, we used qualitative studies to inform ourselves of the nuanced nature of the results that the quantitative studies showed, which in turn helped us to temper the assessments we developed in the course of the review.

5.	Review studies were excluded	Studies that were reviews of existing studies were not included in the review. On the other hand, these reviews formed rich sources of studies to be evaluated for inclusion.

Tables 4.9 to 4.12 provide a summary of the type of studies included in the review.

2.2.2 Identification of potential studies: search strategy

Hand search

As a first step, journals that published research in this area were identified and the studies published in these journals were manually examined for their inclusion in this review. Journals that were known to publish extensively in infrastructure areas were included in this process. Each article's title was individually reviewed in the shortlisted journals from the year 1995 till the most recent issue. The list of journals that were hand searched is given in Appendix 2.1.1. Hand searching ensured that no relevant study from these journals was missed. We started the study identification process with hand search, since it gave a good overview of the different types of studies that were done in this area, the prominent authors and researchers who published on this topic, and different key words that could be used for subsequent automated searches.

Website search

After the hand search of journals, specific websites, which would potentially have various unpublished studies and evaluation reports, were searched. The list of websites that were searched and the details of the search process are given in Appendix 2.1.2. The website search further enhanced our understanding of the literature in this area, which helped in sharpening the automated search process of the electronic bibliographic databases.

Electronic databases

The third step in the search process was to search for studies in the electronic bibliographic databases. The different databases that were searched and the search phrases and type of documents that were included in the search are given in Appendix 2.1.3. Wild characters were used to capture possible variations in the search terms.

Reference search

As a next step in the search process, the references of all the studies that were included in the review were scanned for additional studies that might not have been captured in the previous searches. In some cases, references in excluded papers (such as the literature review studies) were also searched.

Direct correspondence

Finally, active researchers in the field were contacted for recent studies and working papers that they might have authored but which had not yet been published. Given their familiarity with the subject area, the list of studies identified for inclusion at that stage was shared and we requested suggestions of studies that could potentially be considered for this review.

In some instances, where access to the studies that were shortlisted from electronic databases was not available, we corresponded directly with the authors requesting a copy of their study.

We used the EPPI-Reviewer software to manage the entire search process. Titles and abstracts were either imported electronically or entered manually.

2.2.3 Identifying eligible studies

Once a potential study was identified from any of the sources, the following steps were used to determine its inclusion in the review

Title screening

Studies were quickly screened based on the title of the article to determine its relevance for the review. Studies that were not found suitable at this stage were then excluded from further evaluation.

Abstract screening

For the studies that were shortlisted after title screening, the abstracts were read to determine their suitability for the review. If the abstracts were not found to be suitable, the study was not considered any further. At every stage, if there was any uncertainty about whether or not to exclude the article, the benefit of doubt was given to the study and it was passed on to the next step.

Full paper screening

For those studies that remained in the shortlist after review of the abstract, full papers were read and first appraised by the exclusion criteria (see Table 2.2), and those studies that met the criteria were excluded. Subsequently, the studies that remained in the shortlist after applying the exclusion criteria were appraised using the inclusion criteria (see Table 2.1).

2.2.4 Quality assurance process

At this stage, each study was independently reviewed by two researchers to determine their inclusion in the review. Studies for which both the reviewers were in agreement for their inclusion (exclusion) were then included (excluded). If there was a disagreement between the two researchers, then the study was reviewed by a third reviewer, following which it was discussed in the team and a decision was taken through consensus.

There were studies that mainly looked at the impact of the intervention and did not provide details of the causal pathway behind it. We chose to include such studies in the review, as excluding them would have limited the number of studies available. An example would be the study by Cabanda and Ariff (2002), which indicated an improvement in performance after adoption of privatisation and competition, but did not explain well the reasons for this improvement.

Studies that did not have the central theme of this review as their main objective, but had used transparency-related interventions as one of their input variables, were included. For example, Estache *et al.* (2008) studied the efficiency of electricity companies in sub-Saharan African countries. Their objective was to trace the evolution of efficiency in these companies rather than look at the impact of reform on efficiency. But since their sample also included utilities that had implemented reforms, this study could be seen as a cross-sectional study of transparency related intervention and was therefore included in this review.

2.2.5 Characterising the included studies

The studies that remained after the application of the exclusion and inclusion criteria and the quality assurance process were characterised on broad features, such as country of study, data period, type of study, aims of study, study design, sample details, data sources and data collection, summary of results, conclusion, evidence with respect to trustworthiness, appropriateness of research design and analysis, and relevance of the focus of the study. This helped to achieve a broad characterisation and overview of the included studies. Characterisation of the studies included in the review is given in Appendix 2.3.

2.3 In-depth review

After the broad characterisation, in-depth reviews were undertaken in order to synthesise the evidence and findings from the different studies.

The appropriate method of synthesis, it goes without saying, would depend on the nature of the studies included in the review. The studies that qualified for inclusion in this review were characterised by substantial heterogeneity – in the kind of interventions considered, the types of methods adopted, the outcomes studied, the datasets used, and the regions and context of the study. We therefore wanted to use a method that would give us full advantage of synthesising the evidence from such heterogeneous studies.

2.3.1 Approaches to synthesis

We used a textual narrative and vote counting method to synthesise the findings of the review.

Textual narrative synthesis

The heterogeneity of the studies, both in terms of the outcomes reviewed and the interventions considered, led to the use of a textual narrative for the synthesis of the findings. This method was chosen because it is better suited to reviews that aim to describe the existing body of literature, identifying the scope of what has been studied, and the strength of evidence available. In addition, this approach is useful in synthesising evidence of different types such as qualitative, quantitative, economic, etc. (Lucas *et al.*, 2007). Textual narratives make the context of the study clearer and are more likely to make transparent the heterogeneity between studies (Barnett-Page and Thomas, 2009).

Vote counting analysis

Given the extent of heterogeneity in the studies, we found it difficult to capture all the evidence effectively in textual narration. Therefore, to strengthen the findings of the review, we also incorporated elements of vote counting to strengthen the evidence synthesis. Light and Smith (1971) have indicated that vote counting is a review technique that helps to gather the body of evidence related to a theoretical relationship, count the percentage of tests that support the relationship, and use that percentage as the basis for drawing conclusions about the state of the literature. While there are some limitations to synthesising evidence by vote counting (Combs *et al.*, 2011) we feel that this can complement the narrative synthesis.

The vote counting process used in this review can be described as follows. First, we have only captured instances where the study indicated a relationship between an intervention and an outcome. Since the purpose of this review is to find a relationship between the intervention and the outcome, we are not positing any relationship to start with. There are no clear

theoretical links established between the interventions studied in this review and infrastructural outputs. Therefore we do not start with the theoretical premise, for example, that increase in levels of transparency would have a positive effect on access and then assess whether the studies support this theory. Instead, we use a procedure where we not only count the studies that have established a relationship between intervention and outcomes, but also count the types of evidence that they have established.

Second, in addition to capturing the presence of evidence, we have also recorded the strength of evidence. Generally vote counting analysis does not capture the level of significance, except to say that the study supports the theory (Combs *et al.*, 2011; David and Han, 2004, p. 44; Newbert, 2007, p.125). However, in this review we have also recorded the level of significance, along with the nature of the relationship. Since many of the studies used the 10 percent level of statistical significance, this was accepted as the benchmark in this review (Andres *et al.*, 2006; Andres *et al.*, 2008; Estache and Rossi, 2008; Estache *et al.*, 2009; Pombo and Ramirez, 2002). Choosing a higher level would have resulted in an even higher proportion of 'no significant impact' observations.

2.3.2 In-depth review: quality assurance process

During the in-depth review, a coding tool was used (given in Appendix 2.2) to assess the quality of the studies. Two researchers independently filled out the coding tool for each study. As indicated in the inclusion criteria in Table 2.1, only those studies that obtained a score greater than three from both the reviewers in the critical appraisal questions were included in the review. However, at the end it was found that all the studies that qualified for in-depth review had scores greater than three.

2.3.3 In-depth review: assessing bias and validity

Since this is a review of effectiveness, the quality assurance process included an analysis of how the studies addressed the issue of selection bias. Question 34 in the coding and appraisal tool in Appendix 2.2 was used to appraise the findings of the study for potential errors and biases.

The studies used a variety of methods to address this. In studies that used survey data, respondents were randomly selected (for example, Prokopy, 2005) to reduce sample selection bias. Many studies took comparable controls to attribute the impact of the interventions in a better way. For example, Gassner *et al.* (2007), in their analysis, used a corresponding sub sample of state-owned utilities as a counterfactual to determine the impact of PSP on a sample of utilities. Another common method used by studies that analysed data over a longer period, was to do a before and after analysis of the intervention. In regression analysis studies, control variables were commonly used to attribute the impact due to interventions (for example, Djiofack-Zebaze and Keck, 2009; Nagayama, 2009; Viani, 2004). In a couple of studies, randomised, controlled field experiments (for example, Olken, 2007) were used to minimise the selection bias.

Decisions regarding the validity of the studies were made based on the information extracted in Section VII of the coding tool (Appendix 2.2). The degree of attribution of causality to the intervention as high, medium and low for each study was ascertained by considering aspects relating to how the studies addressed the issue of possible omitted variables, accounting for the endogeneity of the variables used and the robustness of the estimation. These aspects controlled the various biases in the estimation, and hence ensured the effectiveness of the

evidence in the studies. Based on the assessment on the above parameters, the studies were classified as high, medium or low in terms of the validity of the results.

Section 4.1.6 presents an analysis of the observations based on the extent to which the studies addressed potential issues relating to causality and selection bias (internal validity).

2.3.4 In-depth review: deriving conclusions and implications

There are multiple approaches to grouping the studies – on the type of intervention, based on regions and countries included in the sample, or on the sector. Initial reviews indicated that the outcomes were different for the same interventions in different sectors. Moreover, the components of the same intervention tended to be different for different sectors. For example, PSP in electricity distribution was largely in the form of divestiture, whereas in water and sanitation, concession was the most common form of PSP (Gassner *et al.*, 2007). Grouping by interventions across sectors would therefore make it difficult to account for such differences.

The second option was to group the studies into different regions. Many studies have grouped developing countries into the following regions: Latin America, Transition economies, Caribbean and Central America, Africa and South Asia. While there are contextual differences between the developing countries in each of these regions, it was felt that the differences were not large enough to group them separately. There were several commonalities among them which ensured that we could make meaningful synthesis of the results by aggregating them across regions. In fact, many studies included in the review also seemed to be following this approach as they did not report their results separately by region (for example, Gassner et al., 2007). Since not all the studies reported the results by region, it would be difficult to synthesise the evidence by different regions. If the classification was to be on the basis of region, it might be necessary to exclude several high-quality studies from the review, which would then reduce the quality of the synthesis.

The third option was to group the studies by different sectors. This method was adopted for the following reasons. First, most studies that covered more than one sector reported their results for different sectors separately (for example, Clarke and Wallsten, 2002; Estache *et al.*, 2009; Gassner *et al.*, 2007; Kenny, 2009a). Therefore it would be possible to synthesise the results by different sectors. Second, there is substantial heterogeneity across the sectors. For example, competition is feasible in telecommunications and parts of the electricity industry, such as generation, but it is usually cost-inefficient in the market for water services (Kirkpatrick *et al.*, 2006). The social impacts of these sectors also differ substantially, since there are more positive externalities associated with some services than others. For example, the externalities argument is stronger for sewerage and water supply, and much weaker for sectors such as telecommunications and electricity (Clarke and Wallsten, 2002). As the type of interventions would depend on the social, technical and economic characteristics of the industry and as these differ considerably between sectors, the primary synthesis of evidence was done on the basis of sectors.

Vote counting

The findings of each study were extracted in a template covering: study sector segment (electricity, transport, etc.); sub-segments within the sector if any (for example, in the case of electricity, the sub-sectors were generation, distribution, etc.); the level at which the findings were presented in the study (i.e., whether the findings were at the global, regional,

country or firm level); the type of interventions studied (macro-, sector- or micro-level); the outcomes that were studied (i.e., access, cost, efficiency, price and quality); the impact of interventions or the level of transparency on the outcomes (positive, negative, or no impact); and whether any statistical tests were conducted to determine the significance of the impact. The strength of evidence in those studies where statistical significance was not available was classified as moderate and indicated separately. In addition to capturing both positive and negative evidence that was statistically significant, we also captured results that did not have any statistical significance, as it indicated that the interventions did not have any significant impact on the outcomes.

The results were captured separately for each of the interventions where available. For example, if the study specified separately the impact of competition and regulation, the information was captured accordingly in the template. In total, 1,137 observations were captured on different findings from the 90 studies, out of which 862 were from studies that had information on statistical significance. These observations formed the basis for the synthesis of the results from vote counting.

Textual narration

Broadly, the sequence that we followed to synthesise the findings can be described as follows. After identification of studies for inclusion as described in this chapter, the studies were divided into sub-groups. It was possible for one study to be listed in more than one sub-group. For example, Clarke and Wallsten (2002) provide evidence on both water and electricity sectors and therefore was included in both sub-groups. After classification of the studies into different sub-groups, the included studies were thoroughly reviewed by two researchers, and a study commentary was prepared. The individual study commentaries then formed the basis of the synthesis.

2.4 Summary

The commentaries of each study reviewed (grouped sector-wise) and the vote counting analysis were used to synthesise the evidence for each of the sectors as well as for the overall review. The narrative synthesis and the vote counting analysis are given in Chapter Four.

3. Identifying and describing studies: results

This chapter provides the results of the searching and screening process used to identify the studies for this review. A total of 90 studies were included in this review, obtained from various sources. This chapter provides details of the studies from each of the sources, and the number of studies that were screened to arrive at these 90 studies. This chapter also provides broad characteristics of the included studies in terms of the sectors, regions and period in which published, and a cross-tabulation of sector and regions.

The highlights are:

- The largest percentage of studies for this review came from hand searching and electronic database searching.
- The number of studies on electricity, water supply and telecommunication were roughly the same. Our searches yielded fewer studies in transport that qualified for inclusion.
- South America was covered in more than half the studies. This indicates that there has been very active research on this topic in that region as compared to other regions.

3.1 Studies included from searching and screening

Table 3.1 gives details of the hits obtained from each of the databases and the number of papers that were shortlisted based on title and abstract.

Table 3.1: Hits obtained from different databases

Database	Number of hits	After filtering based on title and abstract
ScienceDirect	33,557	45
EBSCO	12,203	35
ProQuest	15,639	101
Emerald	30,807	28
ISI Web of Knowledge	22,883	4
Total	115,089	213

The studies shortlisted based on title and abstract were then combined and duplicates were removed, leaving a total of 186 studies. Full texts were accessed for all these studies where not already obtained, and assessed using the exclusion and inclusion criteria. Since we could not access 18 studies, they could not be considered for inclusion in the review. Table 3.2 gives the number of studies obtained from different sources for this review.

Table 3.2: Studies obtained from different sources

Source of study	Number of studies	Percentage
Database search	21	23.3%
Website search	9	10.0%
Hand search	21	23.3%
Reference search	38	42.2%
Direct correspondence	1	1.1%
Total	90	

Where papers were found both through hand searching and database searching, they were listed under hand searching, as this was undertaken first. Taken together, database and hand searches accounted for the greatest number of studies (47 percent). Reference searches of those articles included from database and hand searches yielded the next highest number of studies (42 percent). The remaining studies were obtained from website searches and direct correspondence. When multiple versions of the same study were obtained, the latest version of the study was included in the review. If a working paper version of the study as well as a journal publication was obtained from the searches, the journal publication was chosen for inclusion since it would have benefited from the peer review process.

3.2 Characteristics of the included studies

3.2.1 Sectoral distribution of studies

Table 3.3: Studies in different sectors

Sector coverage	Number of studies	Percentage
Electricity	33	37%
Other	2	2%
Telecommunication	32	36%
Transport	7	8%
Water supply and sanitation	28	31%
Total	90	

Table 3.3 indicates the number of studies in the four different sectors. When a study covered more than one sector, it was counted in each of the sectors. This would explain why the sum of all the studies in each of the sectors is more than total studies in the review. We found a much smaller number of studies for the transport sector than for the other three sectors. Studies classified under ‘other’ included those studies where the sectoral classification was not available.

3.2.2 Regional distribution of studies

Table 3.4 lists the regional coverage in the studies. When the studies did not provide a list of countries covered, it was classified as 'others'. As in section 3.2.1, when a study covered more than one region, it was counted in each of the regions separately. The South American region accounted for the majority of the studies, indicating the large amount of work done in this region.

Table 3.4: Regions covered in different studies

Regions covered	Number of studies	Percentage
Africa	25	28%
Asia	34	38%
Central and North America	24	27%
Europe (Developing countries in Europe)	14	16%
Others/ not stated	5	6%
South America	54	60%
Total	90	

3.2.3 Distribution of studies by year of publication

Table 3.5 indicates the number of studies based on the year of publication. As can be seen, more than 50 percent of the studies in this review were published from 2005 onwards. This indicates that the evidence used in this systematic review is quite recent.

Table 3.5: List of studies by the year of publication

Year of publication	Number of studies	Percentage
1995 - 1999	7	8%
2000 - 2004	34	38%
2005 onwards	49	54%
Total	90	

3.2.4 Cross-tabulation of studies

Table 3.6: Cross tabulation of sector and regions covered in different studies

	SA	AF	AS	Europe	CA / NA	Others	Total
Electricity	23	11	13	8	9	2	33
	70%	*33%*	*39%*	*24%*	*27%*	*6%*	*100%*
Others	2	1	1	0	1	0	2
	100%	*50%*	*50%*	*0%*	*50%*	*0%*	*100%*
Telecommunication	21	14	13	8	14	4	32
	66%	*44%*	*41%*	*25%*	*44%*	*13%*	*100%*
Transport	1	1	3	0	2	0	7
	14%	*14%*	*43%*	*0%*	*29%*	*0%*	*100%*
Water supply & sanitation	16	7	11	3	5	1	28
	57%	*25%*	*39%*	*11%*	*18%*	*4%*	*100%*

Note: SA=South America; AF=Africa; AS=Asia; CA/NA=Central and North America

Table 3.6 provides a cross-tabulation of studies in different sectors and the regions covered. As can be seen, South America accounts for most of the studies, among the three main developing country regions. We were also able to get adequate number of studies on other developing country regions, such as Asia and Africa.

3.3 Summary results

The search yielded a very exhaustive list of 90 studies that qualified for inclusion in the review. Appendix 3.1 gives the list of different outcome indicators (dependent variables) that have been analysed in these studies. In-depth review of the studies, as well as the synthesis of the results, is given in Chapter Four.

4. In-depth review: results

This chapter provides the synthesis of the in-depth review, which has two parts. Part one presents the results of the vote counting analysis. Part two is a textual narration of the studies, with the objective of taking into account the context and the causal pathways.

4.1 Vote counting

A total of 1,137 observations were recorded from the 90 studies that were reviewed. Out of these, information on statistical significance was available for 862 observations from 71 papers (i.e., for about 76 percent of the total observations), and only those observations were used in the vote counting analysis.

The results are given in Tables 4.1–4.5. Table 4.1 indicates the overall results, Table 4.2 provides the results for different regions, Table 4.3 provides the results for different interventions, Table 4.4 provides the evidence on the four different sectors, and Table 4.5 summarises the results across different consumer segments. Several interesting trends that could be observed are highlighted below. Graphical representation of some of the results is given in Appendix 4.1. Detailed sectoral results are given in Appendix 4.2.

4.1.1 Overall results

Table 4.1 summarises the overall evidence for different outcomes. Out of a total of 862 observations (Panel F), 455 (53 percent) indicated that the interventions did not have any significant impact on outcome, either positive or negative. This has major implications for policy making, since the main rationale of many of these interventions would be to have a positive impact on outcomes. Out of the remaining 407 observations which indicated a significant impact on outcomes, the number of positive results was more than the negative results (281 and 126 respectively). Overall, positive evidence was found in 33 percent of the total observations and negative evidence was found in 14 percent.

The study design itself (global, regional, or country level) does not seem to have influenced the evidence, as the percentage of observations with no significant impact did not differ considerably across the different levels of evidence. Across levels, the proportion of findings that did not have any significant impact on outcome was more than 50 percent.

Panel A shows the results of the access outcome. Out of 264 observations, 40 percent indicated an increase in access as a result of increase in transparency levels whereas only 13 percent indicated a decrease in access. The proportion of observations that did not show any impact was 47 percent, which was lower than was seen for the overall observations. Panel B gives the results on cost. Forty-five percent of the observations indicated a decrease in costs as a result of an increase in transparency levels. Only 4 percent of the observations indicated a negative impact on costs (i.e., costs increased) and about half of the observations did not show any significant impact.

Panel C indicates results for the efficiency outcome. Forty-one percent (60 out of 144) of the observations indicated a positive impact on efficiency, i.e., efficiency increased as a result of an increase in the level of transparency. Thirteen percent of the observations indicated a reduction in efficiency while 46 percent did not show any impact. The proportion of cases showing positive efficiency outcomes is more than was seen in the overall observations,

indicating that the interventions have been more successful in creating a positive impact on efficiency as compared to other outputs.

Panel D indicates results for the price outcome. It would have been generally expected that following an intervention, price levels would increase. Our study indicates a surprising trend – more than 62 percent of the findings showed that there was no significant impact on price and only 19 percent of the observations indicated an increase in price (i.e., a negative effect) as a result of the intervention. It is also interesting to note that the same fraction of cases (19 percent) showed a decrease in price. The evidence that in a majority of the findings, price did not increase as a result of an increase in transparency levels, weakens the argument that reform and other interventions generally result in price increases.

Panel E indicates the results on quality. The trends on this outcome, i.e., the proportion of positive, negative, and no impact observations, were similar to what was seen for the overall results.

4.1.2 Results by region

Table 4.2 provides the results across different regions – global (i.e., studies that looked at the global data and presented the results at a global level without reporting separately for different regions), Africa, Asia and South America. Since the observations for Europe (only developing countries in Europe) and Central and North America (Mexico) were fewer in number, they are not being discussed separately. The objective of this analysis is to identify whether there were any significant differences in outcomes across different regions.

Of the 862 findings, 46 percent (395) of the findings were at the global level. The next highest proportion of findings was from South America, accounting for 28 percent of the observations, followed by Asia (13 percent) and Africa (7 percent). At the overall level (Panel F), there is not much difference in the proportion of 'no significant impact' observations for the global, South American and Asian regions. However the proportion of 'no significant impact' observations was noticeably higher for Africa, where 69 percent of the observations did not show any significant impact on outcome. The proportion of observations that showed a positive impact was not significantly different between the regions, with the values ranging between 28 and 35 percent. Within this range, Africa had the lowest proportion of observations that showed a positive impact, whereas the South America had the highest. Analysis of negative evidence indicated that the proportion was close to the overall sample values for global, Asia and South America, whereas for Africa, it was dramatically lower, at 3 percent. One possible explanation for the low proportion of negative evidence in Africa could be attributed to the low level of infrastructure development that is generally prevalent in the region. This finding highlights the need for further studies to understand the underlying causal factors.

Panel A in Table 4.2 provides the results on access. The main finding was that the proportion of observations with positive impact was higher for the global and Asia regions (42 percent and 49 percent respectively), as compared to South America (36 percent). The proportion of findings with no significant impact was also considerably lower for global and Asia (42 percent and 43 percent respectively) as compared to South America (55 percent). This indicates that many of the interventions, relatively speaking, did not have a positive impact on access in South America. Panel B provides the results on costs. The number of observations was the highest for South America indicating the strong focus on costs in the region. However, the

fraction of observations with positive outcomes on costs was the lowest for South America (45 percent). The weak impact on access and costs in South America deserves further study.

Panel C in Table 4.2 provides the results on efficiency. It can be seen that there were not many observations for Africa. For global studies, the highest number of findings (54 percent) did not show any impact, whereas for South America, the highest number of observations (46 percent) indicated a significant positive impact. This indicates that the interventions had a more positive impact on efficiency in South America as compared to other regions. Panel D indicates the results on price. The highest number of observations was recorded for the global and South America regions, and by and large, no major inter-regional differences could be seen between them. For Africa and Asia, the results are pretty striking – the proportion of observations that did not show any impact on price was 87 percent and 78 percent respectively. When many of the interventions are generally considered to result in an increase in price, such a large proportion of observations that did not show any significant increase in price indicate that the general perception on overall price increases following interventions needs to be examined further.

Panel E in Table 4.2 indicates the evidence on the quality outcome. In South America, the interventions had a positive impact on quality in 37 percent of the cases, with 51 percent of the cases showing no significant impact. In Asia, 29 percent of the cases showed a negative impact on quality, while 64 percent showed no significant impact. The low number of observations for Asia and Africa indicates that quality does not seem to a major objective of the interventions in these regions. At the global level, there were an equal number of observations showing positive and negative impact on quality (21 percent each), with 58 percent showing no impact. Interestingly, there were no observations on the quality outcome in the Africa region, indicating that other outcomes probably have more priority in that region as compared to quality.

Table 4.1: Summary of overall evidence

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Level of evidence	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	59	24	59	**142**	3		7	**10**	26	7	39	**72**
Region	32	3	51	**86**	11	2	11	**24**	20	8	17	**45**
Country	15	6	15	**36**	9	0	8	**17**	14	4	9	**27**
Total	**106**	**33**	**125**	**264**	**23**	**2**	**26**	**51**	**60**	**19**	**65**	**144**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Level of evidence	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	27	28	64	**119**	11	11	30	**52**	126	70	199	**395**
Region	12	12	68	**92**	25	7	30	**62**	100	32	177	**309**
Country	6	6	17	**29**	11	8	30	**49**	55	24	79	**158**
Total	**45**	**46**	**149**	**240**	**47**	**26**	**90**	**163**	**281**	**126**	**455**	**862**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10 percent has been used as the significance level.

Table 4.2: Summary of evidence by region

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Evidence by region	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	59	24	59	**142**	3	-	7	**10**	26	7	39	**72**
Africa	7	1	11	**19**	3	-	2	**5**	4	-	1	**5**
Asia	18	3	16	**37**	6	-	6	**12**	10	3	10	**23**
Europe	1	-	7	**8**	-	-	-	-	1	-	-	**1**
South America	21	5	32	**58**	10	2	10	**22**	19	9	13	**41**
Central & North America	-	-	-	-	1	-	1	**2**	-	-	2	**2**
Total	**106**	**33**	**125**	**264**	**23**	**2**	**26**	**51**	**60**	**19**	**65**	**144**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Evidence by region	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	27	28	64	**119**	11	11	30	**52**	126	70	199	**395**
Africa	3	1	27	**31**	-	-	-	**-**	17	2	41	**60**
Asia	4	2	21	**27**	1	4	9	**14**	39	12	62	**113**
Europe	3	2	11	**16**	7	2	12	**21**	12	4	30	**46**
South America	8	13	26	**47**	28	9	39	**76**	86	38	120	**244**
Central & North America	-	-	-	-	-	-	-	-	1	-	3	**4**
Total	**45**	**46**	**149**	**240**	**47**	**26**	**90**	**163**	**281**	**126**	**455**	**862**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10 percent has been used as the significance level.

4.1.3 Results by intervention

Table 4.3 provides the results classified according to the type of intervention. Panel F indicates the overall results. As indicated previously, the interventions have been classified into three categories, macro-level, sector-level and micro-level. The proportion of evidence at the macro-level was 13 percent, at the sector level 83 percent and at the micro level 4 percent. Within sector-level interventions, PSP had the largest number of observations (40 percent). In terms of effectiveness (i.e., those that had a positive impact on outcome), it can be seen that micro-level interventions had the highest impact with 58 percent of the observations indicating a positive impact on outcome, whereas these proportions for the macro and sector levels were 34 percent and 31 percent respectively. As expected, the proportion of observations that did not show any impact was the lowest for micro-level interventions, at 29 percent. The proportions for the macro and sector levels were 52 percent and 54 percent. This indicates that targeted micro-level interventions have a higher proportion of success. Within the sector level, there did not seem to be many differences in effectiveness between the competition, PSP, regulation and reform interventions.

Panel A of Table 4.3 provides the evidence on access outcome for the different type of interventions. It can be seen that the micro level has the highest proportion of positive outcomes, though the number of observations is not very high. The overall proportion of macro-level and sector-level observations are similar. However, within sector-level interventions competition and reform are more effective in improving access, as compared to PSP or regulation.

Panel B in Table 4.3 indicates the outcome on costs. While the overall number of observations is low when compared to other outcomes, some interesting observations could be noted. First is the impact of macro-level interventions – 73 percent of the observations indicated that an increase (decrease) in transparency was significant in reducing (increasing) costs. With corruption and transparency getting prominence in policy making, this evidence shows a clear benefit from an increase in levels of transparency. The effectiveness of micro-level interventions was also high – 64 percent of the observations indicated a reduction in costs. Comparatively, sector-level interventions did not seem to be so effective – only 28 percent of the observations indicated a reduction in costs, whereas 66 percent did not show any impact. Surprisingly, our review did not find any observations on the impact of competition on costs.

Panel C gives the results on efficiency. Forty percent of the sector-level observations indicate an increase in efficiency following the intervention, but 49 percent did not show any impact. Within the sector-level observations, overall reform had a better impact on efficiency as compared to the individual impacts of competition, PSP and regulation. Regulation appeared to be more effective in improving efficiency than competition. Micro-level interventions tended not to have a positive impact on efficiency and 50 percent of the observations indicated a reduction in efficiency. This is in line with expectation, as many of the interventions, such as decentralisation, can lead to a reduction in economies of scale, leading to a drop in efficiency.

Panel D in Table 4.3 gives the results on price. Seventy and 61 percent of the macro- and sector-level interventions, respectively, did not have any impact on price. Regulation had the least percentage of observations for positive impact (17 percent of the observations) whereas, surprisingly, a greater fraction of PSP interventions had a positive impact, compared

to competition (23 percent and 18 percent, respectively). One would have expected a higher proportion of observations of price increases from PSP.

Panel E gives the results on quality outcomes for different interventions. Though the numbers of observations are fewer, micro-level interventions are most effective in increasing quality – 50 percent of the observations indicated that quality improved after implementation of the intervention. Within the sector level, regulation and competition were the top two most effective interventions in improving quality, as compared to PSP or overall reform.

4.1.4 Results by sector

Table 4.4 provides the summary of evidence on the different sectors. Electricity (37 percent) and telecom (41 percent) account for the majority of the observations, indicating that these two sectors were the most frequently studied in developing countries. Panel F provides the overall results. The transport sector had the highest proportion of positive outcomes (67 percent), though the numbers of observations were low. For the remaining three sectors, the proportions of negative outcomes were similar (between 13 - 16 percent). Telecom had a higher proportion of positive outcome observations (37 percent) among the three and a lower proportion of outcome with no significant impact (47 percent).

Panel A gives the summary results on access outcomes. The number of observations on access is substantially higher for telecom as compared to other sectors. This indicates that the impact on access is more often studied in telecom than any other sector. The proportion of positive outcomes is substantially higher for telecom as compared to electricity or water. Panel B gives the results on costs. The number of observations is more for electricity than for telecom or water, though the proportion of positive outcomes is about the same for all the sectors (36, 33 and 33 percent, respectively). Transport has the highest proportion (67 percent) of cases showing a positive impact on the cost outcome.

Panel C gives the summary on efficiency. Telecom has the highest proportion of observations (55 percent) that found a positive impact on efficiency, whereas water had the least (21 percent). This indicates that efficiency does not seem to be a major objective of these interventions in social sectors like water supply. Panel D summarises the results on price. Of the observations in electricity sector, 68 percent did not record any significant impact on price, whereas for telecom, the figure was 61 percent, and for water, 53 percent. The proportion of observations that indicated a price increase for electricity and telecom was more or less the same (around 18 percent), with a noticeably higher proportion for water (27 percent).

Panel E gives the results on quality. The numbers of observations were higher for the electricity and water sectors as compared to telecom. This indicates that impact on quality is more often studied in the electricity and water supply sectors than in telecom. However, the proportion of positive observations did not differ much between electricity and telecom (29 percent and 30 percent respectively), whereas it was slightly lower for the water sector (25 percent).

Table 4.3: Summary of evidence by intervention

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Interventions	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Macro-level	15	6	21	**42**	8	-	3	**11**	6	2	2	**10**
Sector-level	85	27	102	**214**	8	2	19	**29**	52	14	62	**128**
Competition	*16*	*2*	*16*	***34***	*-*	*-*	*-*	***0***	*5*	*1*	*8*	***14***
PSP	*21*	*14*	*40*	***75***	*4*	*2*	*9*	***15***	*19*	*3*	*36*	***58***
Regulation	*19*	*5*	*22*	***46***	*4*	*-*	*5*	***9***	*12*	*6*	*7*	***25***
Multiple/reform	*29*	*6*	*24*	***59***	*-*	*-*	*5*	***5***	*16*	*4*	*11*	***31***
Micro-level	6	-	2	**8**	7	-	4	**11**	2	3	1	**6**
Total	**106**	**33**	**125**	**264**	**23**	**2**	**26**	**51**	**60**	**19**	**65**	**144**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Interventions	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Macro-level	6	5	26	**37**	5	3	8	**16**	40	16	60	**116**
Sector-level	38	41	122	**201**	40	22	81	**143**	223	106	386	**715**
Competition	*7*	*3*	*28*	***38***	*3*	*1*	*5*	***9***	*31*	*7*	*57*	***95***
PSP	*14*	*21*	*25*	***60***	*22*	*10*	*50*	***82***	*80*	*50*	*160*	***290***
Regulation	*9*	*13*	*31*	***53***	*10*	*9*	*10*	***29***	*54*	*33*	*75*	***162***
Multiple/reform	*8*	*4*	*38*	***50***	*5*	*2*	*16*	***23***	*58*	*16*	*94*	***168***
Micro-level	1	-	1	**2**	2	1	1	**4**	18	4	9	**31**
Total	**45**	**46**	**149**	**240**	**47**	**26**	**90**	**163**	**281**	**126**	**455**	**862**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10 percent has been used as the significance level.

Table 4.4: Summary of evidence by sector

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Sector	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Electricity	25	5	42	**72**	8	2	12	**22**	21	6	24	**51**
Telecom	64	20	54	**138**	1	-	2	3	32	4	22	**58**
Water	16	8	23	**47**	3	-	6	**9**	6	5	17	**28**
Transport	-	-	-	**-**	8	-	4	**12**	-	-	-	**-**
Others	1	-	6	**7**	3	-	2	**5**	1	4	2	**-**
Total	**106**	**33**	**125**	**264**	**23**	**4**	**26**	**51**	**60**	**19**	**65**	**145**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Sector	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Electricity	13	17	64	**94**	23	10	45	**78**	90	40	187	**317**
Telecom	27	23	77	**127**	9	7	14	**30**	133	54	169	**356**
Water	3	4	8	**15**	12	7	29	**48**	40	24	83	**147**
Transport	-	-	-	**-**	-	-	-	**-**	8	-	4	**12**
Others	2	2	-	**4**	3	2	2	**7**	10	8	12	**30**
Total	**45**	**46**	**149**	**240**	**47**	**26**	**90**	**163**	**281**	**126**	**455**	**862**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10 percent has been used as the significance level.

4.1.5 Results by consumer segment

Table 4.5 presents the summary results for different consumer segments. Broadly, four types of consumer segments were identified: (i) business and industrial; (ii) residential; (iii) rural, poor, and illiterate and (iv) urban, rich, and literate.

Table 4.5: Summary of evidence by consumer segment

	Overall total			
Consumer segment	**+**	**-**	**0**	**T**
Business + Industrial	10	9	42	61
Residential	10	18	44	72
Rural, poor, illiterate	13	8	18	39
Urban, rich, literate	4	5	11	20
Total	**37**	**40**	**115**	**192**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10 percent has been used as the significance level.

For the business and industrial segment, 69 percent of the observations did not indicate any significant impact as a result of the interventions. For the residential segment, the percentage of observations that did not have an impact was lower (61 percent), but the percentage of observations with a negative impact was higher (25 percent). This indicates that the residential segment has had a lower proportion of positive outcomes as compared to the business and industrial segment. This could be explained by the type of outcomes on which the observations were made – the entire evidence for the business and industrial segment was on price, whereas for the residential segment price and access accounted for 86 percent and 14 percent of the observations respectively.

An interesting finding was the proportion of positive outcomes for the rural, poor and illiterate segment (33 percent) as compared to the urban, rich and literate customer segment (20 percent). This could be explained by the type of outcomes on which the observations were made – 84 percent of the observations examined access and quality outcomes. Our findings indicate that as a result of the interventions, access and quality improved for the rural, poor and illiterate customer segment. While this proportion was not vastly different for the urban, rich and literate segment (89 percent), the percentage of no significant impact and negative outcomes were higher and the positive outcomes lower as compared to the rural segment. This indicates that while the interventions were able to improve the low level of infrastructure facilities for the rural segment, they did not have the same kind of positive impact on the urban segment. This could be because of the higher level of infrastructure facilities in urban areas as compared to rural areas.

4.1.6 Analysis of the validity of results

In this section, we present the results from three sets of analysis based on the extent to which the studies have addressed issues related to the validity of the results. Table 4.6 presents the results based on the data sources used in the studies. Studies were classified into two categories based on the type of data used:

- Only secondary data: these studies only used data from existing databases for their research.
- Primary studies: these studies collected primary data for their research using a variety of methods – large surveys, interviews, questionnaires, field observations, etc.

Table 4.6: Summary of evidence by source of data used

Validity	**+**	**-**	**0**	**T**
Primary	16	0	10	**26**
Secondary	233	117	422	**772**
Both	32	9	23	**64**
Total	**281**	**126**	**455**	**862**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10 percent has been used as the significance level.

Table 4.6 indicates that close to 90 percent of the observations were from studies that used only secondary sources of data. Since the most commonly used secondary databases (such as World Bank datasets, International Telecommunication Union databases, etc.) are fairly large and are considered very representative, the findings based on these databases have very low probability of sampling bias.

Table 4.7 presents the results based on methods used in analysis. The methods were classified into four categories as follows:

- Studies that used econometric methods such as regressions. One of the strength of such methods is the ability to clearly identify and attribute the impact to the interventions.
- Mathematical models such as data envelopment analysis (DEA). Though the results obtained from methods can be considered very robust, most studies do not give information about the strength of the results in terms of statistical significance.
- Simulation models, in which data used to construct counterfactual scenarios are simulated based on present trends.
- Statistical analysis, whose strength is in identifying the changes in outcomes; however, it is limited in its ability to attribute the impact to the interventions.

The statistical, mathematical and econometric methods deal with estimations using actual data, whereas a simulation technique uses the current data to analyse a counterfactual scenario. Studies with analysis based on simple averages, descriptive statistics and statistical tests for testing significance in differences including the F-test, chi-square test etc., were classified as statistical methods. Non-parametric estimation techniques like linear programming method and DEA were considered to be mathematical methods and grouped under this head. Under econometric methods, we classified those studies that had employed parametric estimations and were regression based. Studies that had developed counterfactual scenarios based on past trends were classified as having used simulation models.

The results in Table 4.7 indicate that observations based on econometric methods account for 96 percent of the total observations. This shows that the findings of the review are robust in terms of attributing causality. Since statistical significance of studies that used simulation models were not available, the evidence from these studies was not used for vote counting analysis.

Table 4.7: Summary of evidence based on method of analysis

Methodology	**+**	**-**	**0**	**T**
Econometric	261	123	446	**830**
Mathematical modelling	6	1	1	**8**
Simulation	0	0	0	**0**
Statistical	14	2	8	**24**
Total	**281**	**126**	**455**	**862**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10 percent has been used as the significance level.

Table 4.8A presents the results based on their validity in terms of how they addressed causality. The observations were classified into three categories as follows:

- High validity: studies that were able to establish strong causality between the intervention and outcome were classified as high validity, as were studies that used appropriate control variables, checked the results for robustness and accounted for potential endogeneity.
- Medium validity: studies that used appropriate control variables to establish causality were classified as having medium validity. Typically, such studies did not present results of robustness checks or did not account for potential endogeneity.
- Low validity: studies that were able to establish a difference in outcomes, but could not attribute the results clearly to the interventions were classified as low validity. Typically, such studies were characterised by lack of adequate control variables that could clearly indicate causality.

Table 4.8A: Summary of evidence based on strength of causality

Validity	**+**	**-**	**0**	**T**
High	96	41	189	**326**
Medium	174	84	247	**505**
Low	11	1	19	**31**
Total	**281**	**126**	**455**	**862**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10 percent has been used as the significance level.

Table 4.8A indicates that only 31 of the 862 observations (about 3.8 percent of the total observations) can be considered to have low validity. High and medium validity accounted for

a total of 96.2 percent of the observations. The overall high validity levels of the observations strengthen the findings of this review.

Table 4.8B lists the evidence based on the overall assessment of the studies (Question 37 of Appendix 2.2). As indicated previously, none of the 90 studies included in this review received a low overall rating in our assessment.

Table 4.8B: Summary of evidence based on the overall assessment of the studies

Validity	**+**	**-**	**0**	**T**
High	135	64	252	**451**
Medium	146	62	203	**411**
Total	**281**	**126**	**455**	**862**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10 percent has been used as the significance level.

Table 4.8B indicates that 52 percent of the observations were from studies that received a high overall rating, and the remaining 48 percent were from studies that received a medium overall rating.

4.2 Textual narration

As indicated previously, narration has been grouped into the four different sectors covered in this review. This summary of the review is presented first for each sector, followed by a study by study description of all studies included in the review. Within sectors, the narrative is grouped in terms of the different interventions. Broadly, the interventions are classified as macro, sector and micro level. Within the different type of interventions, the narrative begins with studies that provide global evidence, followed by those that provide evidence by region, country and firm.

4.2.1 Electricity

Summary of the evidence on electricity

Table 4.9 provides brief details of the papers that were reviewed in the electricity sector. While electricity reforms are found to be associated with positive impact in key economic variables related to the electricity sector, if abandoned half way, this impact can quickly turn negative. Substantial changes in performance or outcomes begin to occur only once a baseline level of reform has been undertaken.

The reform process and the associated privatisation brought about an improvement in the allocation of resources and the firms were able to attain greater efficiency. Private firms were more motivated than state-owned companies to optimise their financial position, and were more interested in deferring maintenance and reducing network losses to improve cash flows. However, it was also seen that private firms were more willing to inflate their operating costs, in response to the cost plus the nature of the incentives.

State-owned companies did not address electricity distribution network losses as effectively as privatised companies, perhaps due to low managerial motivation and weak governance

systems. Managers and employees of state-owned firms had weak internal incentives for cost reduction and achieving high performance. Private companies, on the other hand, had strong incentives to achieve good performance.

Some studies attribute the difference in performance between the public and private companies to the context and the endogenous nature of decision making. For example, the distribution arms of private generating companies would have higher efficiency scores since they did not have universal supply obligations like their public counterparts. Very often private firms cherry picked consumers. In many instances in the electricity sector, governments would offer to sell their most efficient organisations first, which also contributed to the difference in performance between the two types of ownership (Bagdadioglu *et al.*, 1996).

Sector-level intervention is a complex process and results from implementing just one of the components – privatisation, competition or regulation – might be disappointing. There is strong evidence that changes in ownership by themselves do not lead to improvements in performance and efficiency. The benefits are seen only with competition or at least when independent regulation is instituted. However, it might be difficult to achieve improvements in performance with competition and regulation without privatisation because of the incentive for government to protect its own assets from depreciation (Zhang *et al.*, 2008).

It has also been noted that each of these interventions impacts on different areas of outcomes. For example, private participation has more impact on labour efficiency than the establishment of a regulatory agency (Estache and Rossi, 2008). In many cases, these increases in efficiency are mainly seen during the transition period and within two years after change in ownership (Andres *et al.*, 2006). Privatisation improves the operating and financial performance of firms (Galal *et al.*, 1994; La Porta and Lopez-de-Silanes, 1999), however appropriate regulation was seen as more important in achieving access and quality targets (Anaya, 2010). Unbundling or restructuring was associated with significant reductions in industrial prices, but did not have any significant impact on residential prices.

The most visible impact on reforms can be seen in pricing. Changes in the mechanism of cross subsidies that occur with implementation of reforms affect retail electricity prices. While increase in electricity prices decreases electricity accessibility to the poor segments of the population, any decrease in prices becomes a negative factor for investors in terms of profit performance. Price reductions are unlikely in contexts where private sector investment is needed to increase capacity. While establishment of an independent regulatory agency is expected to reduce prices (Nagayama, 2007), in practice, reform increases the number of stakeholders because of unbundling, and the necessary procedures to operate the sector also increase. As the result, there is an increase in transaction costs, which tends to increase the final electricity cost. However, the negative effect on tariffs was expected to be a short-term trend immediately after implementation of the reform because of a move towards pricing based on market costs and removal of cross subsidies between industrial and residential segments.

Macro-economic effects such as corruption levels in the economy and quality of governance had an impact on outcomes as well. In general, an increased level of transparency and better governance (and by the same token, a lower level of corruption) was associated with a positive impact across all outcomes. Corruption causes a diversion of managerial effort away from the supervision and co-ordination of the production process. Firms then employ more

factors in order to make up for this diversion, and this extra use of resources leads to inefficiency. Corruption is strongly associated with inefficiency at the firm level in the sense that in more corrupt countries, more labour is used to produce a given level of output. Corruption plays a separate role that is distinct from the impact of an unstable or insecure environment (Bo and Rossi, 2007).

Macro-level results

There were six studies that examined the impact of macro-level transparency related factors on outcomes.

Cubbin and Stern (2006) analysed the impact of country governance effects on per capita generation capacity using data from 28 developing countries from Africa, Asia, Central and North America and South America over 1980 – 2001. The results indicated that both sector-level regulatory governance and country governance significantly affected the level of investment in per capita generation capacity, but the impact of sector-level variables was several orders of magnitude larger.

In a fairly large sample study using data from 220 electric utilities from 51 developing and transition countries for the period 1985–2005, **Estache and Rossi (2008)** included country-level corruption indicators in their analysis and found that the coefficient of the interaction variable between corruption and competition was negative and significant, indicating that more corruption in the country was associated with more labour-inefficient firms. However, the coefficient of the interaction variable between corruption and regulation was not significant.

Kenny (2009a) used a database on corruption in utilities based on a sample of 58 developing countries to do a regression analysis that linked various corruption measures (specifically petty corruption) with utility outcome measures after controlling for GDP per capita. The study found that corruption had a significant impact on coverage, i.e., per capita electric power consumption. The data also suggested a strong relationship between petty bribery and governance indicating that broader governance reforms that improve transparency, participation, competition, etc., can play a role in reducing corruption, which in turn can improve utility performance.

Seim and Soreide (2009) studied the impact of corruption and bureaucratic complexity on access and quality of electricity supply in 84 developing countries, which they classify into 53 high-income countries and 31 low-income countries. Generally, they found that the level of corruption and complexity coincided in the 53 high-income countries, i.e., where there was more complexity there was more corruption and vice versa. Access and quality were better in countries with lower corruption and less complexity. The average delay in obtaining an electrical connection was 15.78 days in countries with less corruption and less complexity, whereas it was 25.10 in countries with more corruption and more complexity. The mean number of electrical outages was 17.77 in the former and 25 in the latter. The mean electric power consumption was 2,450 kwh per capita in the former, whereas it was 1080 kwh per capita in the latter. However the study did not find any correlation with performance levels when the levels of corruption and complexity did not correspond.

Table 4.9: Summary of papers in electricity sector

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, validity measures, and robustness checks
1	Alcazar, Nakasone, Torero 2008	SA 1 (Peru) - -	Sector Price, Quality	Secondary Household survey	Statistical Treatment/ control	Appropriate measures used to control selection bias, 2 step propensity matching for robust determination of causality
2	Anaya 2010	SA 1 (Peru) 2 -	Sector Efficiency, Price, Access, Quality	Secondary Various industry annual reports	Social cost benefit analysis Counterfactual	Various counterfactual scenarios considered
3	Andres, Foster, Gausch 2006	SA 10 116 -	Sector Access, Cost, Price, Quality, Efficiency	Secondary Official reports to regulatory agencies	GLS regression Panel data, before /after	Fixed effects model, use of firm specific time trends, use of instrumental variables and macroeconomic control variables
4	Andres, Guasch, Azumendi 2008	SA 26 250 -	Macro, Sector Access, Quality, Efficiency, Cost, Price	Primary and secondary survey of regulatory agencies and World Bank data	GLS regression Before/after	Firm specific time trends included in the model. Principal component analysis to reduce multi-collinearity
5	Bagdadioglu, Price, Weyman-Jones 1996	EU 1 (Turkey) 70 -	Sector Efficiency	Primary and secondary Firm surveys and regulatory reports	Data envelopment analysis Cross sectional, treatment/control	Multi input and multi output nature of electricity distribution considered in the model

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, validity measures, and robustness checks
6	Berg, Lin, Tsaplin 2005	EU 1 (Ukraine) 24 -	Sector Efficiency	Secondary Various datasets	Data envelopment analysis Panel data, treatment/control	Stochastic frontier Analysis done to derive alternative indicators of efficiency, use of environmental variables in the model
7	Bo, Rossi 2007	SA, NA 13 80 -	Macro, Sector Cost	Primary and secondary survey responses, accounting statements and regulatory databases	OLS regression Panel data, treatment/control	Controlled for sample selection bias, use of instrumental variables, country fixed effects and firm fixed effects in the model
8	Clarke, Wallsten 2002	SA 4 - -	Sector Price, Access	Secondary DHS surveys	Statistical Cross sectional, before/after	-
9	Cubbin, Stern 2006	AF, AS, SA 28 - -	Macro, Sector Access	Secondary World Bank and other data sources	OLS Regression Panel Data, treatment/control and before/after	Country specific fixed effects model, Hausman test, tests conducted for appropriate control variables, use of instrumental variables
10	Estache, Goicoechea, Trujillo 2009	Global 141 - -	Macro Sector Price, Quality	Primary and secondary web search, commercial databases, questionnaire to experts in international organizations	GLS regression Panel data	Controlled for interaction effects, time trend, per capita income, country fixed effects

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, validity measures, and robustness checks
11	Estache, Rossi 2005	SA 14 127 -	Sector Efficiency	Secondary World Bank	OLS regression Panel data, treatment/control	Use of one input variable, 3 exogenous output variables, 1 exogenous capital input; GNP per capita and country fixed effects as controls
12	Estache, Rossi 2008	Global 51 220 -	Macro, Sector Access, Cost, Quality, Price, Efficiency	Secondary Firm level data and World Bank data	Regression Panel data, treatment/control and before/after	Difference in difference model for controlling heterogeneity, use of appropriate control variables, and other robustness tests
13	Estache, Tovar, Trujillo 2008	AF 12 12 -	Sector Efficiency	Secondary Firm level data	TFP and DEA Panel data, treatment/control and before/after	Use of two inputs and 3 outputs in the model
14	Gassner, Popov, Pushak 2007	Global 71 252 -	Sector Access, Cost, Price, Quality, Efficiency	Secondary Existing databases	Regression Panel data, treatment/control and before/after	Model specification includes firm random and fixed effects, firm specific time trends, use of instrumental variables, and nearest neighbour matching
15	Kenny 2009a	SA 58 - -	Macro Quality	Secondary World Bank data	Regression Cross sectional	Controlled for country GDP

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, validity measures, and robustness checks
16	Mota 2003	SA 1 (Brazil) 21 -	Sector Cost, Efficiency, Quality	Secondary Company and other industry reports	Social cost benefit analysis Counterfactual	Various counterfactual scenarios considered
17	Nagayama 2007	SA, EU, AS 83 - -	Sector Price	Secondary World Bank and other data sources	OLS Regression Panel data, before/after	Country specific fixed effects model, Hausman test, and relevant control variables
18	Nagayama 2009	SA, EU, AS 78 - -	Sector Price	Secondary World Bank and other data sources	Ordered probit regression Panel data, before/after	Fixed and random effects model, use of instrument variables, and appropriate control variables
19	Nagayama 2010	SA, EU, AS 86 - -	Sector Access, Quality	Secondary World Bank and other data sources	Regression Panel data, before/after	Use of appropriate policy and control variables, capture of interaction effects
20	Pardina, Rossi 2000	SA 10 36 -	Sector Access	Secondary Regulatory and other reports	OLS regression Panel data, before/after	Use of time trend and interaction variables
21	Perez-Reyes, Tovar 2009	SA I (Peru) 14 -	Sector Efficiency	Secondary Various industry reports	Data envelopment analysis Panel data, retrospective uncontrolled	Two models with 3 / 4 inputs and 2 outputs have been used to estimate the results

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, validity measures, and robustness checks
22	Plane 1999	AF 1 (Cote d'Ivoire) 1 -	Sector Efficiency, Price, Access, Quality	Secondary Firm level and World Bank data	Regression Panel data, before/after	Use of capital and labour inputs, time trend
23	Pombo, Ramirez 2002	SA 1 (Colombia) 32 -	Sector Efficiency	Primary and Secondary Surveys and datasets	OLS regression Panel Data, treatment/control	Controlled for appropriate variables, robustness checks: Cok Weisberg, Breuch Pagan, Ramsey RESET, Swilk
24	Pombo, Taborda 2006	SA 1 (Colombia) 12 -	Sector Efficiency, Quality, Cost, Price	Secondary Industry reports	Data envelopment analysis, pooled and panel regressions Before/after	RESET tests and various other robustness checks done
25	Ramos-Real et al 2009	SA 1 (Brazil) 17 -	Sector Efficiency	Secondary Industry reports	Data envelopment analysis Panel data, retrospective uncontrolled	2 output variables, 3 input variables, and one environmental variable used in the model
26	Seim and Soreide 2009	Global 84 - -	Macro Access	Secondary World Bank and other data sources	Regression Cross sectional, Treatment/control	Inclusion of appropriate control variables, RESET test for confounding variables, test for heteroskedasticity
27	Sen, Jamasb 2010	AS 1 (India) 19 States -	Sector Efficiency, Price, Access, Quality	Secondary Various industry databases and reports	Regression Panel data, treatment/control and before/after	Fixed effects model, bias corrected LSDV estimator, 3 stage least squares regression, various robustness checks

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, validity measures, and robustness checks
28	Shirley, Xu 1997	AF, SA, AS, EU 6 12 - -	Micro Efficiency	Primary and secondary Enterprise survey, field interviews, and World Bank data	Regression / TFP analysis Panel data, Before/after	Potential sample selection bias due to small sample size
29	Steiner 2001	SA 29 - -	Sector Price	Secondary World Bank and various regulatory datasets	Regression Panel data, treatment/control and before/after	Appropriate control variables, no explicit control of endogeneity
30	Vagliasindi 2004	SA,EU 26 - -	Sector Quality	Primary Enterprise survey	OLS regression Cross sectional, Treatment/control	Controlled for various policy and country level variables
31	Yunos, Hawdon 1997	AS 1 (Malaysia) 27 -	Sector Efficiency	Secondary World Bank and other sources	Data envelopment analysis Panel data, cross sectional comparison	4 input variables and 1 output variable used in the model
32	Zhang, Parker, Kirkpatrick 2005	SA, AF, AS 25 - -	Sector Access, Efficiency	Secondary Various industry datasets	Regression Panel data, treatment/control and before/after	Use of sequencing variables, environmental control variables, Hausman test, country and time specific fixed effects model used to address endogeneity to some extent

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, validity measures, and robustness checks
33	Zhang, Parker, Kirkpatrick 2008	Global 36 - -	Sector Access, Efficiency	Secondary World Bank and other industry yearbooks	Regression Panel data, treatment/control and before/after	Interaction variables, fixed effects model for country and time specific effects

In a study focusing on the South American region, **Bo and Rossi (2007)** studied the determinants of the efficiency of electric utilities with a focus on the role of corruption. Using firm-level information on 80 electricity distribution firms from 13 Latin American countries for the years 1994 to 2001 and country-level corruption indices, they developed OLS estimates of the labour requirement function. They found that the coefficient of the corruption variable was negative and significant at the 1 percent level, suggesting that firms operating in countries with lower levels of corruption use fewer employees to provide a given bundle of outputs than distributors operating in more corrupt environments. An improvement of one point in the corruption index was associated with a 10 percent decrease in the use of labour. They also tested the impact of corruption on O&M expenses and found that the coefficient of corruption was negative and significant at the 10 percent level, thus supporting the hypothesis that higher corruption at the country level had a negative impact on firm efficiency. An improvement of one point in the corruption index was associated with a 25 percent decrease in O&M costs.

In another study of a South American region, using data from 26 countries and 250 utilities, **Andres *et al*. (2008)** constructed an electricity regulatory governance index, which reflected the design and functioning of the regulatory regime, such as autonomy, transparency and accountability. They then calculated the impact of change in ownership on the performance of electricity distribution companies after controlling for regulatory governance. They found that an improvement of one standard deviation in the governance index was associated with a 8.7 to 9.1 percent additional increase in labour productivity, and a 7.5 to 8.2 percent reduction in duration and frequency of interruptions. The study also indicated that operational expenditures reduced by more than 10 percent with an increase in the regulatory governance index, while tariffs increased by 5.7 percent.

Sector-level results

PRIVATE PARTICIPATION

The topic of private participation in the electricity sector has been a focus area for researchers for some time now. For this study, we review 11 studies that mainly focus on the impact of private sector participation on the identified outcomes.

In a landmark global study, **Gassner *et al*. (2007)** studied the effect of PSP on electricity distribution in developing and transition economies. Their sample was 161 companies with PSP and 91 state-owned utilities in Latin America (111 utilities with PSP participation; 44 state-owned), Europe and Central Asia (36, 21); Sub-Saharan Africa (9, 19); South Asia (3, 3), and others (2, 4). Regression analysis indicated that the average number of electricity connections was significantly larger for utilities with PSP as compared to publicly owned utilities. The number of connections was larger for the concession type of PSP as compared to divestitures. Since concession contracts often included explicit connection targets, there were larger increases in the number of connections in a concession-type PSP as compared to divestiture, which allowed greater discretion to the private party whether to expand the connection base or not. Employment decreased substantially by 27.5 percent as a result of PSP, indicating that it was associated with a significant increase in employment-driven labour productivity. Utilities with divested assets witnessed an increase in service quality, a reduction of distribution losses and an increase in collection rates. The study did not find any evidence for an increase in consumer prices with any type of PSP beyond what was observed in public utilities. In sum, the study indicated that PSP had a positive impact on outcomes in electricity distribution, but the magnitude of outcomes depended on the type of PSP.

Yunos and Hawdon (1997) analysed the relative efficiency of 28 electricity producers in developing countries in 1987 using DEA. The results indicated that all the utilities that formed the reference frontier, i.e., those operating at a high level of efficiency, had a high public capacity factor that ranged between 44 and 59 percent. This implied that public ownership was not an impediment for efficiency provided that publicly owned plants were utilised intensively.

In a study based in the South American region, **Bo and Rossi (2007)** used data from 80 electricity distribution firms from 13 countries to determine whether ownership had an impact on efficiency. The coefficient was positive and significant at the 1 percent level, indicating that private firms outperformed public firms. The coefficient was also significant in economic terms: public firms used about 41 percent more labour than private firms to produce a given bundle of outputs.

Andres *et al*. (2006) analysed the impact of privatisation on the performance of 116 electricity distribution utilities in 10 Latin American countries. The statistical mean and median on outcome levels as well as growth rates was analysed before and after privatisation. The results suggested that changes in ownership caused significant improvements in labour productivity and service quality. However, the improvements did not appear as remarkable two years after change in ownership, indicating that change in ownership had the strongest effect on firms during the transition period. The study did not find any significant evidence of impact of privatisation on coverage.

Clarke and Wallsten (2002) used demographic health survey data from four Latin American countries, namely, Brazil, Bolivia, Colombia and Peru, to study the impact of reform (specifically, privatisation) in the electricity sector. The study found that in three of the four cases, prices, which were significantly lower than similar prices in OECD countries before reform, increased significantly. Coverage for urban consumers increased following privatisation in all four countries. Coverage also increased for the poor in three out of the four countries, despite large price increases in two of the three countries. The study indicated that since coverage increased despite price increases, supply-side constraints could have played an important role in blocking service to the poor under public ownership.

In exploring the impact of PSP, there were three studies, all using data from Latin American countries, which used counterfactual and social cost-benefit approaches. **Anaya (2010)** analysed the impact of the restructuring and privatisation of electricity distribution in Peru using a social cost-benefit analysis methodology. The study constructed a counterfactual scenario which simulated the continuation of government ownership and compared this with the actual scenario under privatisation, using data for the period 1986–2007 for the two distribution companies that were privatised. The study indicated that privatisation resulted in efficiency gains of between $153 and $349 million. Prices under private ownership on average were found to be 8.6 percent higher than they would have been under public ownership. Though the average actual price and counterfactual price were expected to close in 2022, the price differential during the first years after privatisation was noticeable. The number and duration of interruptions per customer dropped markedly during the first years after privatisation, indicating an improvement in quality. There was also significant reduction in distribution losses in the three years after privatisation; they decreased by 7.5 percent and 6.0 percent for the two firms that were privatised.

In another study on Peru, **Alcázar *et al*. (2008)** compared the differences in welfare between people with private provision of electricity and people in regions where electricity companies were not privatised. They also examined other indirect impacts, such as the type of energy sources used by consumers in privatised versus non-privatised areas, the effects of better quality of electricity service on time devoted to non-agricultural activities and the effects on time devoted to economic and non-economic activities in rural households. The results showed that privatisation improved the provision of electricity and the operating and financial performance of firms.

Mota (2003) analysed the impact of the restructuring and privatisation of the electricity distribution and supply business in Brazil using a social cost-benefit methodology using 1989–2000 data. To determine the change due to privatisation, the study constructed a counterfactual public scenario, based on the previous performance of the companies, which provided a benchmark against which the performance of the privatised industry was assessed. The study found that average annual controllable costs per unit fell by 10 percent after privatisation. The study also found that there had been a consistent and significant improvement in the quality of supply – security and availability – as a result of privatisation.

Use of stochastic frontier and Data Envelopment Analysis (DEA) methods were seen in three studies. **Bagdadioglu *et al*. (1996)** tested the relative performance of 66 public electricity distribution firms and 4 private electricity distribution firms in Turkey using DEA. Given the large number of public distribution firms in the sample, the mean efficiency scores of the public distribution firms were found to be very close to the sample mean, though a little lower, while the four private firms had technical and scale efficiency scores of 1.00, indicating that they were technical and scale efficient. Mann Whitney test results indicated that private distribution organisations had significantly higher efficiency scores. However, the test results should be treated with caution given the very small number of private distribution organisations in the sample.

Plane (1999) studied the effect of privatisation in Côte d'Ivoire by estimating a stochastic production frontier. Using data for the period 1959–95, he found that privatisation had a significant impact on efficiency. Wilcoxon tests indicated that technical efficiency measures of the post-privatisation period (1990–95) were significantly higher than the measures for the six years before privatisation occurred (1984–89). The organisational innovations that followed privatisation, such as decentralisation, contributed to the increase in productive efficiency. The study also indicated that customers had been the major beneficiaries from the increase in efficiency, through a significant decrease in the relative price of electricity.

Pombo and Ramirez (2002) analysed the impact of privatisation on thermal power plants in Colombia using DEA. Data for pre-privatisation were obtained for 33 thermal plants from 1988–1994 and data for post-privatisation was obtained for 32 thermal plants during 1995–2000. Results indicated that private ownership and regulatory policy had a positive impact on efficiency. However, private ownership did not have a significant impact if capital input was corrected for capacity utilisation and the assumption of constant returns to scale was relaxed, implying that the result on efficiency was inconclusive if there were structural differences in productive efficiency due to ownership.

REGULATION

There were five studies that mainly looked at the impact of regulation, out of which three were based on data from the South American region. In a global study, **Cubbin and Stern**

(2006) assessed the impact of regulatory law and higher quality regulatory governance in the electricity industry by analysing data for 28 developing economies (15 in Latin America, 4 in Caribbean, 5 in Africa, and 4 in Asia) over 1980– 2001. The results indicated that the effects of the presence of regulatory law and of an autonomous regulator were positive for per capita generation capacity and statistically significant at the 1 percent level. The estimated long-run impact of the preferred measures of regulation was of the order of 15–25 percent, all other things being equal, after controlling for country specific fixed effects.

In another large-sample global study, **Estache and Rossi (2008)** used firm-level data of 220 electric utilities from 51 developing and transition countries for the years 1985 to 2005 to explore the relationship between the establishment of regulatory agency and labour productivity and corruption. The results indicated that the coefficient of the regulation variable was negative and statistically significant. Firms that operated under the control of a regulatory agency used about 9.5 percent less labour to produce a given bundle of outputs. Controlling for ownership, the study found that private firms outperformed public firms in labour efficiency, and PSP had a greater impact on labour requirements than the establishment of a regulatory agency. The presence of a regulatory agency was strongly associated with a decrease in the frequency of interruption for both private and public firms. There was also a positive association between regulatory agencies and service coverage. Private firms that operated under a regulatory agency were associated with a reduction in average residential tariffs, indicating significant improvements in productivity following privatisation under regulatory supervision. However, regulatory agencies were positively associated with average tariffs of public firms, which could be due to improvements in cost recovery efforts and tariff rebalancing from regulation.

Andres *et al*. (2008) studied the impact of regulatory governance on electricity distribution in Latin America using data from 216 utilities. They found that the existence of a regulatory agency after controlling for ownership had a significant impact on cost and quality. For instance, the presence of a regulatory agency resulted in improved labour productivity of up to 19.4 percent. Similarly, utilities lowered the duration of power interruptions by 18.9 percent and frequency of interruptions by 17.3 percent. Under regulation, operational expenditures reduced between 27.4 percent and 32.1 percent. Residential tariffs increased 13.5 percent under the presence of a regulatory agency while industrial tariffs reduced by 4.6 percent.

Estache and Rossi (2005) studied the impact of alternative regulatory regimes on the labour productivity of private electricity distribution firms in Latin America. Three types of regulatory regimes were analysed: price caps, rate of return and hybrid regimes, in which some cost changes were automatically passed on to customers through higher tariffs. The incentive for improvements in efficiency was stronger in the price-cap regime and lesser in the rate of return regime, with the hybrid regime falling in between. The results indicated that private firms operating under the price-cap regime were the most efficient and the results were statistically significant. Private firms operating under the price-cap and hybrid schemes used about 60 percent and 20 percent less labour respectively to produce a given bundle of outputs than public firms and private firms under rate of return. The study also found that privatised firms operating under rate of return regulation had similar labour efficiency to public firms.

Pombo and **Taborda (2006)** researched the evolution in performance, efficiency and productivity of Columbia's power distribution utilities before and after the 1994 regulatory

reforms. The results from their study showed that after the reform, there was a recovery in the main performance indicators of profitability, partial input productivity and output. Plant efficiency and productivity increased after the reform, mainly in the largest utilities, as seen in the DEA efficiency score measures. The less efficient power distribution companies did not improve. Econometric results on DEA efficiency scores suggested a positive effect of policy reform.

SECTOR REFORM

There were 14 studies that looked at the impact of reform or multiple sector-level interventions on outputs. Three of them were global studies, seven were regional studies, three were country-level studies and one presented the findings at the firm level.

In a global study, **Estache *et al*. (2009)** studied the impact of privatisation and regulation on access, affordability (costs) and quality using a sample of 141 electricity companies from developing countries. The study indicated that the introduction of regulatory authority was associated with statistically significant reductions in access rates. Increase in levels of corruption also reduced access rates significantly. The study found that private participation was associated with increase in end-user prices, whereas regulation was associated with the opposite effect. Corruption did not significantly affect pricing. The study also found that the creation of a regulatory authority was associated with a statistically significant deterioration in the quality indicator, possibly because the measurement of actual performance improved with the creation of an independent regulatory authority. An increase in corruption, on the other hand, was associated with a decrease in the quality indicator. In sum, the study found evidence that reforms did not change the negative impact that corruption had on access and quality.

In the second global study reviewed, **Zhang *et al*. (2005)** assessed the impact of the sequencing of privatisation, regulation and competition in the electricity generation sector in 25 developing countries in Latin America, the Caribbean, Africa and Asia, using data for the period 1985–2001. The regression results indicated that taken separately, regulation, privatisation, and competition were each statistically insignificant on access (electricity generation per capita) and cost (labour productivity). However, the coefficients of the sequencing of the reforms variable was significant for electricity generation per capita, i.e., sequencing of regulation before privatisation and sequencing of competition before privatisation were associated with higher electricity availability. However, the study did not provide any conclusive evidence on the sequencing of reforms on labour productivity. The authors indicated that the reason for the non-significant effects of reforms on labour productivity could be due to limitations of data.

In the third global study, **Zhang *et al*. (2008)** performed an econometric assessment of the effects of privatisation, competition and regulation on the performance of the electricity generation industry using panel data for 36 developing and transitional countries over the period 1985–2003. Regression on electricity generation per capita (access outcome) indicated that regulation and privatisation were statistically insignificant, whereas competition was positively associated and significant and had the largest coefficient of any of the reforms. Since the interaction terms between privatisation and competition, and regulation and competition were not statistically significant, the study suggested that competition on its own was critical in explaining increased electricity output in the sample. Electricity generation per capita increased by 0.5 percent, 0.5 percent and 1.9 percent for a unit change in the regulatory, private ownership and competition variables respectively. Regression on labour

productivity (cost and efficiency) indicated that private participation alone did not lead to higher productivity, whereas the presence of regulation and competition improved productivity. In terms of quantitative effects, electricity generation per employee increased by 3.3 percent, 0.1 percent and 0.1 percent for a unit change in the regulatory, private ownership and competition variables respectively.

In a series of three studies that provided findings at regional level, Nagayama analysed the impact of reform on different outputs. **Nagayama (2007)** evaluated the impact of power sector reforms on industrial and household electricity prices using panel data for 83 countries in Latin America, Asian developing countries and transition economies during the period 1985 to 2002. The impact of reform was different in different regions. However, the findings suggested that neither unbundling on its own nor the introduction of a wholesale pool market on its own necessarily reduced the electricity price. Contrary to what was expected, the price tended to go up. Price reductions could be realised only with the existence of an autonomous regulator, along with improvements in internal efficiencies. Introduction of privatisation, foreign independent power producers, and retail competition lowered electricity prices in some regions, but not all.

In the second study, also focusing on prices, **Nagayama (2009)** studied the impact of liberalisation and reform on electricity prices. The econometric model was designed using panel data from 78 countries (26 developed countries, 11 Asian developing countries, 21 transition economy countries and 20 Latin American countries) for the period 1985 to 2003. The study found an impact of reform on prices for the industrial and residential segments. The results indicated that the impact of reform was different in different segments. Prices increased for both industrial and residential segments in developed countries, whereas for the total sample and in Asian developing countries, industrial electricity prices decreased. No statistically significant results could be obtained for the residential segment in the total sample, and in Asian developing countries. There was no statistically significant impact of reform on both the segments in Latin America and transition economy countries. The study indicated that the reason for the reduction in prices for the industrial segment was due to the removal of cross-subsidies with the implementation of reform, as industrial consumers tended to cross-subsidise residential customers in many developing countries.

In the third study, **Nagayama (2010)** studied the impact of power sector reforms on access (as measured by installed capacity per capita) and quality (as measured by transmission and distribution loss) using 1985 to 2006 data in 86 countries (Latin America – 21 countries; Transition economies – 27 countries; Asian developing – 13 countries; and developed countries – 25). Empirical analysis indicated that the impact of reforms was different in different regions. Establishment of independent regulator had a negative effect on generation capacity per capita in Asian developing countries. However, if regulation was combined with PSP, it had a positive effect. In Latin America, introduction of retail competition had a negative effect on generation capacity per capita. In transition economies, establishment of regulation and introduction of PSP had a positive effect on generation capacity per capita. On the whole, privatisation and unbundling individually did not have any significant effect on generation capacity per capita in any of the regions. In terms of transmission and distribution losses, the introduction of a foreign PSP had a negative effect in Asian developing countries, whereas it had an opposite effect in Latin American countries.

Steiner (2001) undertook a structural econometric approach to determine the impact of reform and restructuring on price. The data consisted of a panel of 29 countries over the

period 1986–1998. While a majority of the sample was from OECD countries and therefore excluded from the scope of the review, the sample also included three South American countries – Argentina, Chile and Brazil. The results indicated that for the South American countries, the estimated incremental effect of restructuring on prices was positive and significant for the industrial segment, while it was insignificant for residential prices. The total effect of restructuring in South American countries was an increase of $0.057 per kwh in equilibrium prices paid by industrial consumers. The electricity supply industry was less developed before restructuring – the quality of supply was poor, levels of electrification were low, and capacity was insufficient to meet demand. The price increase after reform was a result of these constraints as prices in a competitive market signalled the need to invest in and maintain existing capacity and stimulate construction of new capacity. The increase in prices could also be a reflection of a real-time balance between supply and demand, as they were no longer subject to manipulation by elected officials responding to political pressures.

Vagliasindi (2004) used the enterprise-level variables based on the Business Environment and Enterprise Performance Survey from 6,000 enterprises in 26 transition economy countries to find the impact of broader institutional infrastructure reforms. The results showed that the establishment of an independent regulator was significantly associated with a reduction in power outages. The reduction of utility arrears was significantly associated with the reduction in power outages suggesting that infrastructure providers that had been corporatised, and in many cases privatised, were improving their collection efficiencies and non-paying enterprises were getting disconnected.

There were two studies at the regional level that used stochastic frontier and DEA methodologies to study the impact of reform. **Estache *et al*. (2008)** studied the efficiency levels of 12 operators in South African countries by calculating Total Factor Productivity (TFP). Using DEA decomposition to identify the sources of changes in the TFP, they found that efficiency levels were independent of the degree of vertical integration and the presence of private ownership. The study also found that there had been no change in technical efficiency, and the growth in TFP had been from technology change. Technology opportunities had been utilised better to increase the volume of electricity generated, thereby reaching more customers and selling more electricity (access and coverage).

Pardina and Rossi (2000) analysed the impact of reform in the electricity distribution sector in South America for the period 1994-1997 by estimating a Maximum Likelihood stochastic frontier for 36 electricity distribution firms. Regression results indicated that the interaction of the reform variable with number of employees and the length of distribution lines had a significant impact on the number of customers. The study found partial evidence suggesting that the countries that implemented reform in the electricity sector had performed better than the others.

In a country-level study, **Sen and Jamasb (2010)** analysed the impact of electricity deregulation in India using panel data spanning 1991 – 2007 for 19 Indian states. They found that reform indicators such as regulation, unbundling and privatisation of distribution had a significant positive effect of increasing transmission and distribution (T&D) losses. The authors stated that this was because initial reform measures tended to reveal previously hidden levels of network losses. Regression on industrial prices implied that the establishment of a regulator increased prices, whereas passing tariff orders by the regulator and competition in transmission and distribution led to lower prices. This implied that prices rises

were not arrested during the initial reform period and prices did not decrease until the implementation of the complete reform programme.

Two country-level studies and one firm-level study used stochastic frontier and DEA methodologies to study the impact of reform. **Berg *et al*. (2005)** performed an empirical analysis of 24 Ukraine electricity distribution companies (14 state owned and 10 privatised) from 1998 to 2002 to evaluate the impact of regulatory incentives on utility performance and how ownership affected managerial behaviour in these utilities. DEA analysis indicated that the average efficiency of privatised companies exceeded that of state-owned companies, but they were very close. It was also found that the efficiency scores did not substantially improve after privatisation; this was because the privatised utilities began with relatively high performance, and increases in operating expenses allowed regulated profit-maximizing firms to increase cash flows because of shortcomings in regulatory incentives. The study also found evidence that state-owned companies did not address electricity distribution network losses as effectively as privatised companies, perhaps due to weak governance systems and incentive structures. The results also suggested that in contrast to state-owned firms, privatised companies responded aggressively to regulatory incentives associated with rate of return regulation.

Ramos-Real *et al*. (2009) estimated changes in the productivity of the Brazilian electricity distribution sector using DEA on a panel of 18 firms from 1998 to 2005. While the TFP index recorded a yearly positive growth rate of 1.3 percent, the study found that technical change was the principal component behind this growth, with an average growth of 2.1 percent per year. Technical efficiency had a negative yearly growth of −0.8 percent, indicating that reforms and regulation had not led the firms to improve their efficiency.

In a firm-level study, **Perez-Reyes and Tovar (2009)** estimated efficiency and productivity changes in the 14 Peruvian electricity distribution companies before and after reform using data for the period 1996–2006. Efficiency estimates obtained from DEA as well as the TFP change obtained using the Malmquist index showed that reform had a positive impact on efficiency and productivity. The annual average change in TFP during the study period was 4.3 percent, out of which 4.0 percent was explained by technological changes. The results showed that scale efficiency changes were minimal or irrelevant during the period. The study stated that given the low technological dynamics of the electricity industry, it could be reasonably assumed that productivity gains achieved through technological change were explained by the reform itself, indicating that reform resulted in the creation of an exogenous environment that was more favourable for the development of both state and private companies. The study indicated that introducing appropriate incentive mechanisms would even help the state-owned companies to improve their productivity.

Micro-level results

In a firm-level study, **Shirley and Xu (1997)** analysed the experience of performance contracts between developing country governments and the managers of their state-owned enterprises. Their analysis included six electricity firms in Ghana, India, Korea, Mexico, Philippines and Senegal. The results indicated that there was an improvement TFP trend only in the case of Mexico. In Senegal and India, the TFP trend actually deteriorated. There was no change in labour productivity trends in any of the six cases. The study concluded that concluded that all the enterprises suffered from serious contracting problems and there was no pattern of improved performance that could be attributed to the contracts.

4.2.2 Telecommunications

Summary of the evidence on telecommunications

Table 4.10 provides brief details of the papers reviewed in telecom sector. The overall evidence is that the macro-economic environment has an important role to play on all outcome indicators. The findings from the studies included in the review indicates that, in general, telephone access, efficiency of firms, price levels and quality of service are lower in countries with high corruption (i.e., lower levels of transparency).

Sector-level interventions also had an effect of improving performance and outcomes. However, several interesting findings emerge. PSP led to an increase in access and efficiency, but it also led to an increase in fees and tariffs. Privately controlled firms had higher productive efficiency than state-controlled firms due to stronger property rights that reduced principal–agent problems. Supply constraints, which played a role in blocking access service (specifically the poor) under public ownership, eased after PSP. PSP is often associated with a growth in access, which benefits the poor, at least in terms of being connected to the network. However, the tariff adjustment required to reflect long-term marginal costs has had a relatively negative impact on some consumers. In particular, increases in the fixed monthly payment and the price of local calls negatively affected low, and especially, very low income households.

As is commonly seen in other sectors, PSP by itself is associated with few benefits; these are mostly seen only when PSP is accompanied by other interventions like competition and regulation. Competition is associated with increased mainline penetration, payphones, connection capacity and lower prices for local calls. PSP, combined with an independent regulator, is also associated with increased payphone penetration, connection capacity and increased efficiency. However, competition plays a greater role in achieving performance improvements compared to regulation, and the presence of a strong regulator is important to create competitive conditions in the marketplace.

It is also important that the regulatory authority is independent. This can be interpreted as reducing discretionary actions on the part of regulators, which reduces uncertainty (Ros, 2003), and in turn reduces obstacles to sector investment and lessens the regulatory risks associated with the supply of telecommunications services. The existence of an independent regulator is associated with improvements in general telecommunications performance. Separating the industry regulator from the government, and having the sector supervised by professional bureaucracy rather than elected politicians, has had the effect of increasing access. However, the regulatory authority on its own did not influence the outcomes significantly, but coupled with PSP and competition had a positive impact. Aggressive, autonomous regulation can sometime have a negative impact on outcomes, and therefore the creation of a suitable regulatory structure becomes very important in influencing project outcomes.

Overall, the evidence of impact on changes in transparency on different outcomes has been positive. Most of the studies have indicated a strong and positive impact on access. Many studies have also indicated a reduction in input costs or an increase in efficiency as a result of the interventions. The evidence for the impact on tariffs has been mixed for fixed-line telephony, whereas for mobile telephony, the impact has been uniformly positive.

Given the nature of the industry, some of the other interventions, like decentralisation and community participation, did not have a significant role to play in this sector, and therefore we did not find any studies that analysed their impact. On the other hand, competition played an important role in this sector in influencing outcomes, something that was not seen in transport or water supply.

Macro-level results

There were four studies under this category, of which three were global studies and the fourth was based on data from Africa.

In the first global study, **Gasmi *et al*. (2009)** empirically investigated the impact of accountability and regulatory governance on coverage, subscription, number of mainlines per employee and tariffs using 1985-99 time-series-cross-national datasets for 29 developing countries. The regression analysis indicated that both regulatory governance and political accountability had a positive effect on all the variables studied. The study also indicated that privatisation had a positive impact on coverage, subscription, efficiency and tariffs. Competition in the fixed segment did not have any significant effect on prices and had a negative effect on efficiency. Competition in the mobile segment showed a positive impact on both fixed and mobile coverage, but no significant effect on prices. Granger-causality relationships indicated that at least one variable of political accountability (such as regulatory governance, corruption, efficiency of bureaucracy, strength of courts, enforcement capacity, currency risk) significantly affected each of the dependent variables.

In the second study, **Kenny (2009a)** used a database of corruption in utilities based on a sample of 58 developing countries to perform a regression analysis that linked various corruption measures (specifically petty corruption) with utility outcome measures after controlling for GDP per capita. The study found that corruption had a significant positive impact on mobile phone coverage. The findings also suggested a strong relationship between petty bribery and governance, indicating that broader governance reforms that improved transparency, participation and competition, could play a role in reducing corruption, which in turn could improve utility performance.

In the third study, **Seim and Soreide (2009)** studied the impact of corruption and bureaucratic complexity on quality, cost and access to telecommunications in 84 developing countries. Access, cost and quality were better in countries with lower corruption and less complexity. Delay in obtaining a mainline telephone connection was 16.59 days in countries with less corruption and less complexity, whereas it was 37.57 days in countries with more corruption and more complexity. Similarly, telephone subscribers per employee were 344.5 in the former and 247.85 in the latter. Telephone faults per hundred mainlines were 24.28 in the former and 53.12 in the latter. A contrasting finding of the study was that the price basket for mobile as well as fixed lines was relatively higher in countries that had less corruption and less complexity as compared to countries that had more corruption and more complexity.

Table 4.10: Summary of papers in telecom sector

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, Validity measures, and robustness checks
1	Azam, Dia, Guessan 2002	AF 1 (Senegal) 1 (Sonatel) -	Sector Efficiency	Secondary Firm level data	Regression Before/after	Checked for auto-correlation and heteroskedasticity
2	Cabanda, Ariff 2002	AS 2 (Malaysia, Philippines) 2 -	Sector Access, Cost, Efficiency, Price	Secondary Firm statements and industry datasets	Statistical Time series, before/after	5 years of pre-privatization and 7 to 10 years of post privatization data used in the analysis
3	Clarke, Xu 2001	EU, AS 21 - -	Macro, Sector, Micro Quality	Secondary World Bank	Regression Cross sectional Treatment/control	Controlled for enterprise, utilities and country level characteristics
4	Contessi 2004	SA, CA, AS, EU 46 - -	Sector Access, Efficiency	Secondary WTI and other sources	OLS regression Panel data, before/after and treatment/control	Both fixed and random effect models, use of appropriate control variables, Hausman test
5	Clarke, Wallsten 2002	SA, AF 21 - -	Sector Access	Secondary DHS surveys	Statistical Cross sectional, treatment/control	-

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, Validity measures, and robustness checks
6	Dasgupta, Lall, Wheeler 2001	SA, AF, AS 44 - -	Sector Access	Secondary World Bank and other sources	Regression Panel data, treatment/control	Inclusion of appropriate policy variables, tested for endogeneity, standard error corrected for heteroskedasticity
7	Djiofack-Zebaze, Keck 2009	AF 177 - -	Macro, Sector Price, Access	Secondary World Bank, ITU, and others	OLS regression Panel data, before/after	Identification of continent specific effects, fixed effect model, use of instrumental variable, use of appropriate control variables, separate analysis for different telecom segments to avoid misattribution
8	Estache, Goicoechea, Manacord 2006	Global 204 2856 observations -	Macro, Sector Access, Price, Quality, Efficiency	Secondary ICRG, ITU	Regression Panel data	Controlled for income, population and GDP per capita
9	Estache, Goicoechea, Trujillo 2009	Global 153 1989 Observations -	Macro, Sector Access, Price, Quality	Secondary ITU and World Bank	GLS regression Panel data, before/after and treatment/control	Controlled for interaction effects, time trend, country fixed effects
10	Facanha, Resende 2004	SA 1 (Brazil) 29 -	Sector Quality	Secondary Various industry datasets	Data envelopment analysis Panel data, retrospective uncontrolled	3 inputs and 2 outputs used in the model

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, Validity measures, and robustness checks
11	Fink, Mattoo, Rathindran 2001	AS 12 - -	Sector Access, Efficiency	Secondary World Bank, ITU datasets	Regression Panel data, before/after and treatment/control	Controlled for level of development, economic and policy variables, use of country fixed effect model and interaction variables
12	Fink, Mattoo, Rathindran 2002	AF, AS, SA 86 - -	Sector Access, Efficiency	Secondary World Bank / ITU Data base, and other datasets	OLS regression Panel data, before/after and treatment/control	Fixed effect model, controlled for appropriate country and policy variables
13	Garbacz, Thompson 2007	Global 53 - -	Sector Price	Secondary ITU, World Bank	OLS regression Panel data, before/after and treatment/control	Use of fixed effects model, Inclusion of appropriate control and other explanatory variables, use of instrumental variable
14	Gasmi, Um, Virto 2009	SA, CA, AS 29 - -	Macro, Sector Access, Efficiency	Secondary Various data sources	DIF-GMM regression Panel data, before/after and treatment/control	Country fixed effect model, use of instrumental variable, Granger-Causality test
15	Gasmi, Virto 2010	Global 86 - -	Macro, Sector Access	Secondary Various data sources	Regression Panel data, before/after and treatment/control	Use of instrumental variable, appropriate control variables, Granger-Causality test

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, Validity measures, and robustness checks
16	Gutierrez 2003	SA 22 - -	Sector Access, Efficiency	Secondary World Bank, ITU	Regression Panel data, before/after and treatment/control	Use of time trend, fixed effect model, Hausman and Wald tests
17	Gutierrez, Berg 2000	SA 19 - -	Sector Access	Secondary ITU, World Bank , and other sources	Regression Panel data, Treatment/control	Controlled for economic and demographic variables
18	Hamilton 2002	AF 37 - -	Macro, sector Access	Secondary World Bank and other sources	Regression Panel data, before/after and treatment/control	Inclusion of appropriate control variables, fixed effect model, and use of instrumental variable
19	Howard, Mazaheri 2009	Global 154 - -	Sector Access	Secondary ITU, World Bank, and other sources	Regression Panel data, before/after and treatment/control	Inclusion of appropriate control variables, fixed effect model
20	Kenny 2009a	SA 58 - -	Macro Access	Secondary World Bank, ITU, and other sources	Regression Cross sectional	Controlled for country GDP
21	Maiorano, Stern 2007	Global 30 - -	Sector Access	Secondary World Bank, ITU, and other sources	Regression Panel data, before/after and treatment/control	Fixed effect model, use of instrumental variable, inclusion of appropriate control variables

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, Validity measures, and robustness checks
22	Montoya, Trillas 2007	SA 23 - -	Sector Access	Secondary Various industry sources	Regression Panel data, before/after and treatment/control	Inclusion of appropriate control variables
23	Resende, Tupper 2009	SA 1 (Brazil) - -	Sector Quality	Secondary Regulatory filings and other industry sources	Data envelopment analysis Panel data, retrospective uncontrolled	4 inputs and 4 outputs used in the model, controlled for heterogeneity
24	Ros 1999	Global - - -	Sector Access, Efficiency	Secondary ITU	Regression Panel data, before/after and treatment/control	Use of fixed effect model, inclusion of appropriate control variables, and use of instrumental variable
25	Ros, Banerjee 2000	SA 23 - -	Sector Access, Efficiency	Secondary ITU	Regression Panel data, before/after and treatment/control	Random effect model, corrected for heterogeneities and autocorrelation
26	Ros 2003	SA 20 - -	Sector Access, Efficiency	Secondary ITU	Regression Panel data, before/after and treatment/control	Inclusion of relevant control and explanatory variables, use of instrumental variables
27	Seim, Soreide 2009	Global 84 - -	Macro Access, Price, Efficiency	Secondary World Bank datasets	Regression Cross sectional, treatment/control	Controlled for country GDP and other factors, RESET test for confounding variables

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, Validity measures, and robustness checks
28	Shirley, Xu 1997	AF, SA, AS, EU 6 12 -	Micro Efficiency	Primary and secondary Enterprise survey, field interviews, firm accounts and World Bank data	TFP Analysis Panel data, before/after	Potential sample selection bias identified due to small sample size
29	Torero, Schroth, Pasco-Font 2003	SA 1 (Peru) - -	Sector Cost, Efficiency	Primary and secondary Household survey and other industry sources	Regression, statistical, cross sectional, before/after	Controlled for various social and demographic factors
30	Vagliasindi 2004	SA, EU 26 - -	Sector Quality	Primary Enterprise surveys	OLS regression Survey data	Inclusion of various policy and country level variables
31	Viani 2004	SA, EU, AS, CA+NA 13 23 -	Sector Efficiency	Secondary Firm annual reports, World Bank, and other sources	Regression Panel data	Fixed effect model, inclusion of appropriate explanatory and control variables, standard error corrected for heteroskedasticity and auto-correlation
32	Wallsten 2001	AF, SA 30 - -	Macro, Sector Access, Efficiency, Price	Secondary ITU and other data sources	Regression Panel data, before/after and treatment/control	Fixed effects model, inclusion of appropriate control variables, standard errors corrected for autocorrelation

In the regional study on Africa, **Hamilton (2002)** focused on issues involving telecommunications development since 1980s in developing regions, using data from 23 African countries for 1985-97. The study found that institutional factors such as rule of law, bureaucratic quality, security of contract and risk of expropriation had a significant impact on access, as measured by mainlines per 1000 inhabitants. This indicated that credible institutions, including stable legal structures, were important driving forces behind the surge of modernisation in Africa's telecommunications sector. The study also determined that competition played an important role in telecom development, as incumbent wire line companies made more investments as more PSP and competition were allowed.

Sector-level results

PRIVATE SECTOR PARTICIPATION

We reviewed six studies in this category. Using data from 46 transition and emerging economies for the period 1989–2000, **Contessi (2004)** provided econometric evidence that PSP was significantly correlated with an increase in teledensity. The share of private ownership in the incumbent had a positive, concave impact on sector indicators. The establishment of a separate regulator had a positive significant effect on teledensity, the magnitude of which was close to what was seen for privatisation.

Using household data from the African and South American regions, **Clarke and Wallsten (2002**) analysed the coverage of telecom for urban households. They found that public sector service providers had better telephone coverage for urban households than private service providers. This study found moderate but inconclusive evidence in support of improvements in access as a result of PSP.

In a study focused on South America, **Ros and Banerjee (2000)** studied the effects of privatisation in a sample of 23 countries during the 1980s and 1990s. The study found very strong evidence for an improvement in performance after privatisation. Mainlines per 100 inhabitants, waiting list percentage and efficiency improved after privatisation. The study also found that excess demand for basic services was strongly related to tariff rebalancing, suggesting that an increase in residential service prices can mitigate unmet demand for basic services in the region by increasing the supply of mainlines.

There were three studies that reported the evidence at the country level. **Azam *et al*. (2002)** analysed Senegal's experience with telecommunications liberalisation and privatisation with the help of descriptive statistics and game theory analysis. The reforms of 1985 were a success but could not be sustained due to the pressure of international competition in the telecom market. After partially privatising the public monopoly, privatisation did not have a statistically significant impact on technical efficiency, but the privatised firm expanded the network drastically and substituted capital for labour.

Cabanda and Ariff (2002) investigated the performance of telecommunications firms in Malaysia and the Philippines after privatisation. The study found strong evidence in support of improvements in performance after privatisation. Output increased significantly after privatisation for both the fixed and mobile telephony segments.

Torero et al (2003) compared pre- and-post privatisation telecom performance and studied why the population of Peru was unhappy with the privatisation of the telecom sector even though it posted greater improvement than any other utilities sector after its privatisation.

They also analysed the welfare implications of telecommunications privatisation through the estimation of consumer surplus for different socio-economic levels. According to the authors, 'on aggregate, privatisation improved total consumer welfare, mainly by increasing consumer access to service. However the tariff adjustment required to reflect long-term marginal cost had a relatively negative impact on some consumers. In particular, increases in the fixed monthly payment and the price of local calls negatively affected low and, especially very low income households, as shown by a detailed per household analysis of consumer surplus.'

REGULATION

There were six studies that primarily looked at the impact of regulation. **Gutierrez and Berg (2000)** examined the determinants of telephone lines per capita, using economic, institutional and regulatory variables for 19 Latin American and Caribbean countries. Sound economic institutions and stable political systems reduced investors' risk, increased confidence in government policies and expanded the level of investment in utilities. The study found very strong evidence of improvements in performance of main phone lines installed per 100 inhabitants.

Howard and Mazaheri (2009) examined the effect of regulation on mobile phone adoption by using data on the number of mobile phones in 154 countries over the period 1990–2007. Regression analysis indicated that having a regulatory agency independent of the government had a significant positive impact on mobile phone adoption. However, the analysis also indicated that regulatory depoliticisation, which involved professionalizing the staff making decisions about telecommunications policy and appointing senior technocrats instead of political leaders to senior positions, had a significant negative impact on mobile phone adoption. The authors indicated that too little public oversight had a negative impact on mobile phone adoption.

Montoya and Trillas (2007) applied various alternative methods to measure the degree of regulatory independence for telecommunications regulators. The authors developed three indices that measured the degree of legal independence of telecommunications regulatory agencies in 23 Latin American countries for a 15 year period (1990-2004). Regression analysis of the regulatory indices indicated that higher levels of *de jure* regulatory independence had a positive impact on fixed-line telecom penetration rates.

Gutierrez (2003) examined the effect of regulation on telecom performance using a sample of 22 Latin American countries during the period 1980-1997. Regulation induced changes to firms' incentives that helped to increase productivity and reduce costs and therefore tariffs. This study found very strong evidence of impact of regulatory governance on network expansion and efficiency. The main finding of the study was that a sound and strong regulatory environment, the opening of the market and free entry of private investors in basic telecommunications services would have a positive effect on network expansion and efficiency across the sector.

Vagliasindi (2004) used the enterprise-level variables based on the Business Environment and Enterprise Performance Survey from 6,000 enterprises in 26 transition economy countries to determine the impact of regulation on the reliability of telecom services, as measured by the number of working days when business operations were disrupted due to telecom outages. After controlling for ownership, size and location, the study found that regulation had a significant positive impact on reliability of services, i.e., telecom outages reduced with the presence of a regulator.

Facanha and Resende (2004) analysed the impact of price-cap regulation in Brazil by constructing synthetic relative efficiency scores for quality, using data obtained for Brazilian local telephony for the period 1998–2002. The results showed that the mean efficiency score for quality indicator improved from 0.639 in July 1998 to 0.716 in March 2002. This indicated an improvement in quality which contrasted with the traditional view that quality would decrease under price-cap regulation. The authors however felt that there was significant scope for further increasing the quality of service levels in Brazil.

REFORM

Many of the studies that focused on reform or multiple interventions were global studies. Out of the 16 studies reviewed in this section, 11 were global studies. The global studies are summarised first.

Djiofack-Zebaze and Keck (2009) examined the impact of telecommunications liberalization on sector performance using data from 177 countries and territories (of which 45 are from Sub-Saharan Africa) over a seven-year period (1997-2003). Overall, competition and regulation were associated with lower prices and improved availability of telecommunications services. The reduction in prices from competition and regulation was lower in Africa as compared to other developing countries. Macro-economic effects such as GATS (General Agreement on Trade in Services) commitments had no discernible effect in price reductions or telecom penetration, whereas competition and quality of regulation played a positive role in both dimensions.

Ros (1999) used 1986–1995 data from the International Telecommunication Union (ITU) to examine the effects of privatisation and competition on network expansion and efficiency. The results indicated that those countries that had at least 50 percent of the assets of their main telecommunications provider in the private sector had a significantly greater number of mainlines per 100 inhabitants, indicating that PSP was positively associated with mainlines per employee and growth in mainlines per employee. Competition was found to positively affect efficiency as measured in mainlines per employee. The results indicated that low penetration rates in developing countries were primarily due to supply-side and not demand-side constraints. Higher access prices reduced unmet demand by increasing supply as well as reducing the level of demand at the higher price.

Viani (2004) compared the operating performance of 23 telephone firms from less-developed countries, both under private and state operations, during 1986-2001. Results indicated that firms with PSP had higher productive efficiency than public firms after controlling for monopoly conditions, income level and the scale of the firm's fixed telephone network. However, public telephone firms that faced competition showed higher productivity efficiency than those that did not. The results supported the property rights theory of the firm: private control was related to higher labour productivity than state-controlled firms after accounting for competition in basic services, competition from wireless firms, the scale of the firm's fixed telephone network and other country-specific variables.

Wallsten (2001) analysed the effects of competition, privatisation and regulation on telecom performance for a sample of 30 African and Latin American countries for the period 1984-1997. The study found very strong evidence for improvement in performance after the introduction of reform legislation. Privatisation alone, however, was associated with few benefits whereas privatisation combined with an independent regulator was positively

correlated with telecom performance. Similarly, an independent regulator alone did not bring performance improvements.

Dasgupta *et al*. (2001) performed a regression analysis to study the growth in mobile telephone subscription using data from 99 countries. The results indicated that competition policy had a significant positive impact on the growth of mobile telephone subscriptions.

Estache *et al*. (2006) assessed the effects of PSP and independent regulation on telecommunications performance by using cross-country panel data for the period 1990-2003 for 153 developing countries. The study found that independent regulation had a positive effect on tariffs and labour productivity, but had an opposite effect on quality. PSP, on the other hand, had a positive effect on access, quality and labour productivity, but an opposite effect on tariffs. Regression analysis indicated that corruption levels significantly affected accessibility and affordability in the countries that had not reformed. The less than systematic success of reforms across indicators could be because governance interfered with the effects of reform (although governance might also substitute for or trigger reforms when there was no willingness to reform). In sum, the study indicated that even though corruption might seem to lead to some performance improvements in the presence of red tape and resistance to change, reform policies could lead to stronger and better performance outputs in a much more ethical way.

Estache *et al*. (2009) analysed the impact of reforms on access, affordability and quality in telecommunications using data from 153 developing countries between 1990 and 2002. The marginal effects of regulation had a negative impact on access, whereas PSP had a positive impact. Contrastingly, they found that the corruption index had a statistically significant positive relationship with access. In terms of cost, they found that regulation and corruption had an effect of increasing the prices, whereas PSP lead to a reduction in price. In terms of quality, corruption had a positive impact while regulation had a negative impact. Based on the findings, the authors indicated that when corruption increased in countries with state-owned companies, those companies were able to offer higher access but at higher prices and with lower quality. In contrast, when corruption increased in countries with both regulatory systems and PSP, companies were able to offer higher access, lower prices and better quality. With only regulation, there was improvement in terms of quality, however with PSP there was improvement on all three dimensions. The authors therefore indicated that PSP in telecom was more effective than regulation in dealing with corruption.

Fink *et al*. (2002) analysed the impact of reform in basic telecommunications using panel data for 86 developing countries across Africa, Asia, South America and Central America over the period 1985 to 1999. The study found that privatisation and competition together significantly increased mainline penetration and teledensity (especially when within a regulatory framework). However, competition on its own did not have a significant impact on these outcomes.

Garbacz and Thompson (2007) examined the demand for residential-fixed and mobile telephone services for developing countries for the period 1996-2003, and also tested for cross-price effects between mainline and mobile services. Privatisation had no effect on price for the residential fixed segment, but contrastingly, the effect of having both privatisation and residential competition together appeared to have had an increase in prices. The authors indicated that this could probably be due to moving away from state monopoly prices to more self-sustaining market prices.

Gasmi and Virto (2010) demonstrated the importance of institutional and macro-economic features in the evolution of the telecommunications industry in developing countries. They conducted an econometric analysis of a 1985-1999 time-series cross-sectional database on 86 developing countries to analyse the impact of reforms on telecommunications infrastructure. The results indicated a positive relationship between competition in the digital cellular segment and the growth of the fixed-line segment.

Maiorano and Stern (2007) studied the relationship between regulation and liberalization on performance in the mobile telecommunications sector using a sample of 30 low- and middle-income countries over the period 1990-2004. The study found very strong evidence of a positive effect of an independent regulatory authority on mobile telecom penetration and at the same time strong evidence of negative effect of liberalization on mobile penetration. Better regulation through an autonomous regulator increased mobile penetration rates.

In the first of the three regional studies, **Fink *et al*. (2001)** examined the liberalization of basic telecommunication sector in Asian countries using 1985–1999 data for 12 developing Asian economies. The results indicated that the implementation of comprehensive reform that comprised corporatisation, privatisation, competition and regulation resulted in higher levels of mainline availability, service quality and labour productivity. Competition also had a positive effect on mobile penetration.

In the next study, **Ros (2003)** examined the impact of the liberalization and regulatory process on the Latin American telecommunications sector during the period 1990-1998. Autonomous regulation reduced uncertainty and enabled discretionary action that reduced obstacles to sector investment. The empirical results indicated that privatisation, competition and price-cap regulation had a very strong and positive impact on teledensity. The results also indicated an improvement in efficiency because of privatisation and the presence of an independent regulator.

In the third study, **Clarke and Xu (2001)** using data from 21 transition economies in Europe and Asia studied the characteristics of the utilities taking bribes (e.g., competition and utility capacity). Since the level of bribes can be seen to have an inverse relationship to the quality of service, we also included this study in the review. According to the authors, 'bribes paid to utilities are higher in countries with greater constraints on utility capacity, lower levels of competition in the utility sector, and where utilities are state-owned. Bribes in the utility sector were also correlated with many of the macro-economic and political factors that previous studies have found to affect the overall level of corruption.' It has also been found that bribe payments were lower in countries where infrastructure was better developed, suggesting that excess demand was an important determinant of corruption. By increasing competition and decreasing rents for all enterprises throughout the economy, privatisation might lower bribes for both privatised and state-owned enterprises.

In a study focused on Brazil, **Resende and Tupper (2009)** assessed the impact of increasing competition on quality in mobile telephone services using data for 2000–2003. Though they did not use competition or the degree of competition as input variables, the authors contended that the period of study was characterised by increasing competition in the sector. They used DEA techniques to construct synthetic service quality efficiency scores after controlling for heterogeneities related to the frequency band and technology under which the different mobile service companies operated. The results indicated an improvement in service quality though it was not uniformly observed for all companies.

Micro-level results
In a firm-level study, **Shirley and Xu (1997)** analysed the experience of performance contracts between developing country governments and the managers of their state-owned enterprises. Their analysis included three telecom firms in Ghana, Korea and Senegal. The results indicated that there was an improvement in labour productivity and TFP trends only in the case of Senegal. However, the improvement in labour productivity trend predated the contract. There was no change on these parameters after contracting in case of Ghana and Senegal. The study concluded that concluded that all the enterprises suffered from serious contracting problems and there was no pattern of improved performance that could be attributed to the contracts.

4.2.3 Transport

Summary of the evidence on transport
A total of seven transport studies were included in the review; brief details are given in Table 4.11. Our search did not yield as many studies on transport as on water, electricity or telecom. Given the width of our search, this probably indicates the shortage of studies examining the impact of reform and other interventions in the transport sector in the context of developing countries.

We did not find any studies that analysed the impact on access, price or quality. Of the seven studies, four of them provided evidence on cost and three on efficiency. The seven studies included one macro-level study, three sector-level studies and three micro-level studies.

At the macro level, the quality of governance and corruption had a significant impact on costs. Project costs increased with increase in corruption levels and low quality of governance. Sector-level studies indicated that there had been an overall increase in efficiency following the interventions, though there might be a few instances to the contrary. While there had been improvements in input efficiency because of labour adjustments following reform and privatisation, there has been strong evidence that there were substantial improvements in output efficiency.

As indicated by Estache *et al*. (2004), implementation of reform and privatisation led to adoption of new technologies and increases in capacity resulting from large investments right after the reform programme. The resulting technological changes and improvements in scale efficiency accounted for a large share of TFP increases, as compared to the changes from labour adjustments. Using evidence from Argentina and Brazil, Estache *et al*. (2002b) also found that TFP improvements after privatisation were mostly due to improvement in outputs rather than to improvement in input use.

Micro-level interventions, which take a variety of forms, such as decentralisation, grassroots participation, auditing of projects, can play an effective role in reducing costs. Among the various types, monitoring and auditing are more effective. Grassroots participation and competition take advantage of local information to weed out inefficiency and thereby reduce costs; however, the impact of grassroots participation can be effective only under a limited set of circumstances. The idea behind the grassroots approach is that community members are the people who benefit from a successful programme and so may have better incentives to monitor than uninterested central government bureaucrats (Stiglitz, 2002). However, the possibility of free-rider problems because of the public nature of the infrastructure projects and capture by local elites can limit the circumstances in which grassroots participation can be effective.

Table 4.11: Summary of papers in transport sector

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, validity measures, and robustness checks
1	Alexeeva, Padam,Queiroz 2008	AF 13 - 109 Projects	Macro Cost	Secondary Project data from World Bank	OLS regression Cross sectional	Controlled for country economic development levels and fuel costs
2	Chavis 2010	AS 1 (Indonesia) - Road projects from 3235 villages	Micro Cost	Secondary Project data and Indonesia Census data	OLS regression Cross sectional	Controlled for district, sub-district, village characteristics, and road type
3	Estache, Fe, Trujillo 2004	NA 1 (Mexico) 11 Ports -	Sector Efficiency	Secondary Mexican Transport Secretariate	TFP Post intervention	Inputs included capital, labour, and technology changes
4	Estache, Gonzalez, Trujillo 2002b	SA 2 (Argentina and Brazil) 15 -	Sector Efficiency	Secondary Firm financial statements and reports to regulators	TFP analysis Before/after	Inputs included capital, labour, and energy consumption
5	Estache, Gonzalez, Trujillo 2002a	NA 1 (Mexico) 11 Ports	Sector Efficiency	Secondary Firm level data	Stochastic frontier analysis Post intervention	Inputs included capital and labour

S. No.	Study Year	Geography No. of countries No. of firms No. of projects	Intervention level Outcome	Data type Data sources	Methodology Analysis	Controls, validity measures, and robustness checks
6	Olken 2007	AS 1 (Indonesia) - Projects from 608 villages	Micro Cost	Primary Surveys	OLS regression Cross section	Randomized treatment and control sample data, fixed effect for village strata, and team that conducted the survey
7	Olken 2009	AS 1 (Indonesia) - Projects from 477 villages	Micro Cost	Primary Surveys	OLS regression Cross sectional	Controlled for population demographics, social characteristics, and village level governance features

Macro-level evidence
Our search yielded one study in this category. **Alexeeva *et al*. (2008)** used data from contract procurement and implementation processes in the road sector for 185 contracts between 1999 and 2007 across 13 countries in Sub-Saharan Africa in 22 projects financed by World Bank. They used OLS regression to identify parameters that were outside the project, but might have influenced unit costs. Using the World Bank's governance indices and Transparency International's Corruption Perception Index values in their regression analysis, they found that quality of governance had a significant impact on unit costs.

Sector-level evidence
There were three studies under this classification, two of which used data from Mexico and while the third study was based on data from Brazil and Argentina.

Estache *et al*. (2002a) studied the efficiency effects of the 1993 port reform in Mexico using 1996–99 data. The main components of the reform programme were decentralisation, privatisation, and introduction of competition into the port system. They found that annual average technical efficiency increased from 49.5 percent in 1996 to 54.5 percent in 1999. They used the average annual growth rate to estimate the range of average efficiency gains and found it to be in the range of 2.8–3.3 percent since the reforms were implemented. This translated to an almost 5 percent increase in the average efficiency level over a four-year period.

Using data from the same period, but focusing on a slightly different outcome, **Estache *et al*., (2004)** tried to measure the changes in efficiency after reforms. The Malmquist index was used to calculate and decompose changes in productivity, in terms of infrastructure, for Mexico's 11 main ports between 1996 and 1999. TFP in Mexican ports rose by an average of 4.1 percent a year in 1996–1999. With one exception, all the ports maintained or improved their technical efficiency during the sample period. All these changes were attributed to a new legal framework built into the Ports Law passed in 1993, which allowed the entry of private firms as operators into the port industry. It was concluded that port reforms were quite successful in contributing to improvements in Mexico's economic competitiveness.

In the third study, also using data around the same but slightly longer period (1992–1999), **Estache *et al*. (2002b)** analysed the efficiency payoffs from reforms in freight railways in Brazil and both passenger and freight railway in Argentina. The results indicated that the average annual TFP growth for freight rail in Brazil was 8.4 percent after reform as compared to 5.5 percent before the change. In Argentina, the TFP growth after reform for was 5.3 percent freight rail, whereas for passenger rail it was 9.8 percent.

Micro-level results
There were three studies reviewed under this classification, all of which were based on data from Indonesia.

In the first study, **Olken (2007)** examined alternative approaches to fighting corruption by conducting a randomised and controlled field experiment in 608 Indonesian villages. In these experiments, he examined the impact of two types of interventions on missing expenditures: external monitoring by the government and increased grassroots monitoring. Missing expenditures were defined as the difference between what the village claimed it spent on the project and an independent estimate of what it actually spent. The evidence suggested that

increasing the probability of external audits substantially reduced missing expenditures in the project. In particular, increasing the probability that a village was audited by the central government audit agency from a baseline of 4 percent to 100 percent reduced missing expenditures from 27.7 percentage points to 19.2 percentage points. On the other hand, evidence showed that increasing grassroots participation in monitoring reduced missing expenditures only under a limited set of circumstances because of potential free-riding problems as individual citizens did not have a personal stake in ensuring that such expenditures were minimised.

In the second and related study, **Olken (2009)** used data from 477 villages from two provinces in Indonesia to analyse missing expenditures in a road project. Missing expenditures were defined as above. The study found a strong positive relationship between the likelihood of corruption in a road project and missing expenditures. OLS regression indicated that missing expenditures had a significant negative relationship with accountability and transparency enhancing interventions such as auditing.

Building on the Olken study, **Chavis (2010)** studied the effect of community involvement in decentralised road development projects in Indonesia. Using OLS regression the study found that increasing the number of villages that were bidding for a project by 10 percent led to a 1.8 percent decline in road construction costs. The results indicated that competition and increased participation from local communities could have a significant impact on the efficiency with which road development funds were used. Increased community participation increased the informational advantages of decentralised project development.

4.2.4 Water supply and sanitation

Summary of the evidence on water supply

Table 4.12 provides brief details of studies in the water and sewerage sector. The results from the studies indicate that macro-level factors such as governance issues and strength of institutions play an important role in sector performance. There is a negative relationship between overall corruption and access to both improved drinking water and adequate sanitation. This indicates that though interventions specific to the water sector can play an important role in improving sector performance, the gains from such interventions are limited if the macro-level factors are weak. Improvements in the governance systems and strengthening the institutions take time, and unless these are achieved, the full potential from these interventions cannot be realised.

Sector-level interventions broadly included PSP, regulation and competition. There is overall evidence that PSP improved access, efficiency and quality. This could be attributed to the management practices in private utilities; they hired more educated staff on higher salaries, maintained their facilities more regularly and implemented water quality and control programmes more diligently. Private sector operators seemed to face stronger incentives than public utilities to keep their customers satisfied. However, the effects of PSP were not homogeneous across income and across areas. For example, the improved service levels could result in higher connection fees as well as unit tariffs.

In developing countries, the public sector regime was generally characterised by capacity constraints, thereby restricting access to services. However, with investment from the private sector, the utilities were able to expand and strengthen their networks, thereby increasing access. Previously unauthorised connections in the public sector utility were regularised,

thereby increasing the number of legal connections. However, several studies suggest that there was no evidence that private water utilities performed better than public utilities. It is therefore felt that PSP by itself would not be enough for improving sector performance. It has to be accompanied by other measures, such as competition and regulation, which increase transparency in the water sector.

However, given the characteristics of the water sector, competition in the market, as seen in telecommunications and electricity generation, cannot be achieved in the water sector. Competition for the market at the time of bidding might not be very relevant because there are very few bidders for such projects in developing countries. Therefore, studies have indicated the relevance of benchmark or yardstick competition. The efficiency measures of comparable water utilities can be published, thereby making the users aware of the relative performance of their company. Such measures also help in creating public pressure to improve the performance of the utility. Benchmark competition also helps in setting prices based on the costs of comparable firms, rather than just the utility's own costs.

In the absence of strong competition as a disciplinary mechanism, it is important to create a strong regulatory structure to get the benefits of PSP. Regulatory institutions need to be put in place to rein in the monopoly profits of the private sector. As indicated by Casarin *et al.* (2007), the failure of concessions could be explained by the presence of a weak and inexpert regulator. It is common in many developing countries that several issues are not addressed by the government at the time of privatisation. In such circumstances, the presence of strong regulators, who can handle difficult situations as and when they arise, becomes very important for achieving the expected objectives of privatisation.

The creation of a regulatory structure should be appropriate to the context of developing countries. For example, as Kenny (2009a) suggests, in the context of developing countries, regulatory structures that combine transparency with limited discretion could be better. Seim and Soreide (2009) add that complex regulatory structures reduce transparency and can lead to corruption. While having a large number of administrative rules may function as intended in countries with strong institutions, the effect may be the reverse and increase the risk of corruption in countries where institutions are weak. However, the benefits from a simple regulatory structure cannot be automatic. Even though there could be benefits from few procedures, as less complexity can lead to more transparency, countries need to reach a certain level of institutional quality to benefit from less complexity.

The two common forms of micro-level intervention are decentralisation and community participation in project development. There has not been any strong evidence for the hypothesis that decentralisation improves performance and outcomes. A variety of reasons can be given to explain this. It has been indicated that the process of decentralisation is political rather than participative, and any gains are therefore liable to be captured by the local elite (Platteau, 2004). Another reason is that there are fewer obstacles to corruption at the local level; monitoring and inspection are better developed at the state level. At the local level, auditing systems are neither technically competent nor immune from political influence. Capacity building and institutional building at the local level take a long time, and unless these are achieved, benefits from decentralisation can only be marginal. Pressure of the media might not work, as the media at the local level is underdeveloped as compared to the state level. Further, decentralisation also results in foregoing the benefits of scale economies. Therefore, for the net result of decentralisation to be positive, it should result in an increase in efficiencies that more than compensates for the lack of scale benefits.

At an overall level, community participation improves project performance. However, the characteristics of infrastructure projects limit the situations where community interventions can be effective. Given the public nature of infrastructure projects, there could be a problem of free riding, where not all beneficiaries participate in project development or monitoring. Community participation can therefore succeed only in those instances where there is a high level of social capital, with active community groups and associations, and design participation and monitoring mechanisms are more likely to be in place. In such situations, households are accustomed to working together and social ties deter free riding. For example, while the economic characteristics of rural water supply can make it appropriate for community participation, the same cannot be said for projects in other sectors (Isham *et al.*, 1995).

Macro-level results

Six studies were reviewed under this category, out of which four were global studies and the remaining two were regional studies. While the global studies focused on the impact of corruption and transparency on access and quality outcomes, the regional studies focused on the impact on cost and efficiency.

In the first global study, **Anbarci *et al*. (2009)** used data on drinking water and sanitation from 85 countries observed in the years 1990, 1995, 2000 and 2004 to test for the effects of public sector corruption in the water and sanitation sector. The study found that public sector corruption significantly reduced the proportion of a country's population having access to improved water supply and adequate sanitation. The linear regression models indicated that a one-unit improvement in public sector corruption (on a six-unit scale) was associated with about a 1 percent increase in the percentage of population having access to improved water and about 3.75 percent increase in the proportion with access to sanitation.

In the second study, **Kenny (2009a)** used a database on corruption in utilities based on a sample of 58 developing countries to do a regression analysis that linked various corruption measures (specifically petty corruption) with utility outcome measures after controlling for GDP per capita. The study found that corruption had a significant negative impact on the percentage of population having access to improved water supply. The findings also suggested a strong relationship between petty bribery and governance, indicating that broader governance reforms that improved transparency, participation and competition could play a role in reducing corruption, which in turn could improve utility performance.

In the third study, **Seim and Soreide (2009)** studied the impact of corruption and bureaucratic complexity on quality and access to water supply and sanitation in 84 developing countries, which they classified into 53 high-income and 31 low-income countries. Generally, they found that the level of corruption and complexity coincided in the 53 high-income countries, i.e., where there was more complexity there was more corruption and vice versa. Access and quality were better in countries with lower corruption and less complexity. The average number of days of water supply failures was 7.53 in countries with less corruption and less complexity, whereas it was 20.31 in countries with more corruption and more complexity. The percentages of population with access to sanitation and improved water sources were 74.19 percent and 84.52 percent respectively in the former whereas they were 59.35 percent and 78.82 percent respectively in the latter. In the 31 low-income countries, where the levels of corruption and complexity did not correspond, the study found that performance was not generally better when corruption and complexity levels were lower.

Table 4.12: Summary of papers in water sector

	Study **Year**	**Geography** **No. of countries** **No. of firms** **No. of projects**	**Intervention Level** **Outcome**	**Data type** **Data sources**	**Methodology** **Analysis**	**Controls, validity measures, and robustness checks**
1	Anbarci, Escaleras, Register 2009	AF, AS, EU, NA, SA 85 - -	Macro Access	Secondary WB, WHO, ICRG	Generalized linear model Panel data	Controlled for per capita income, population, rural population percentage, population density, institutional environment, use of pooled clustered standard errors for dealing heterogeneity
2	Anwandter,Ozuna, 2002	NA 1 (Mexico) 110 Utilities -	Micro, Sector Efficiency	Secondary Operations data of utilities	Data envelopment analysis, second step econometric regression Cross sectional treatment (80 and 46) and control sample (30 and 64)	Each firm compared to a combination of firms that produce at least the same level of outputs, use of Brocket-Golany method to account for the effect of unobserved omitted variables
3	Asthana 2003	AS 1 (India) 1708 -	Micro Efficiency	Secondary Madhya Pradesh and Chattisgarh State Public Health Engineering Departments	Multivariate regression Cross sectional, treatment (459 villages) and control sample (1249 villages)	Controlled for utility size, age of utility, and source of water

	Study **Year**	**Geography** **No. of countries** **No. of firms** **No. of projects**	**Intervention Level** **Outcome**	**Data type** **Data sources**	**Methodology** **Analysis**	**Controls, validity measures, and robustness checks**
4	Asthana 2008	AS 1 (India) 200 small towns and village -	Micro Quality	Primary and secondary Indian census data, CMIE, World Bank, public health engineering departments of Madhya Pradesh and Chattisgarh States	Multivariate regression Cross sectional, treatment /control	Regression included other variables that could affect the level of corruption
5	Barrera-Osorio, Olinera 2007	SA 1 (Colombia) - 82 Municipalities	Sector Access, Price, Quality	Secondary Household and DHS surveys	Regression Before/after and treatment/control	Controlled variables for household characteristics and municipal characteristics
6	Carrillo, Bellettini, Coombs 2008	SA 1 (Ecuador) - -	Sector Access, Quality	Secondary National Income and expenditure surveys	Regression Before/after	Test of heteroskedasticity, use of demographic variables
7	Casarin, Delfino, Delfino 2007	SA 1 (Argentina) 1 -	Sector Efficiency, Price	Secondary Firm level data	TFP Analysis Time series , retrospective uncontrolled	Various input and output measures used in the model
8	Clarke, Kosec, Wallsten 2004	SA 3 (Argentina, Bolivia, Brazil) - -	Sector Access	Secondary Household surveys	Panel data regression Treatment (18 cities)/control (28 cities)	Controlled for population of city, country income

	Study **Year**	**Geography** **No. of countries** **No. of firms** **No. of projects**	**Intervention Level** **Outcome**	**Data type** **Data sources**	**Methodology** **Analysis**	**Controls, validity measures, and robustness checks**
9	Clarke,Wallsten 2002	AF 20 - -	Sector Access	Secondary DHS survey data	Statistical analysis Cross sectional, treatment/control	-
10	Estache, Goicoechea, Trujillo 2009	Global 72 - -	Macro, Sector Access	Primary and secondary Web search, commercial databases, questionnaire to experts in international organizations	GLS regression Panel data	Controlled for interaction effects, time trend, per capita income, country fixed effects
11	Estache, Kouassi 2002	AF 16 21 Utilities -	Macro, Sector Efficiency	Primary Survey	Unbalanced panel data analysis Before/after and treatment/control	Instrumental variables and Hausman test for endogeneity
12	Estache, Roosi 2002	AS 19 50 -	Sector Efficiency	Secondary ADB database	Stochastic cost frontier Treatment /control	RESET Test for omitted variables, Use of other models to check consistency of results
13	Estache, Trujillo 2003	SA 1 4 -	Sector Efficiency	Primary Survey questionnaire to regulators	TFP analysis Retrospective uncontrolled	Use of multiple inputs and outputs in the model

	Study **Year**	**Geography** **No. of countries** **No. of firms** **No. of projects**	**Intervention Level** **Outcome**	**Data type** **Data sources**	**Methodology** **Analysis**	**Controls, validity measures, and robustness checks**
14	Galiani, Rozada, Schargrodsky 2008	SA 1 (Argentina) - 33 Projects	Sector Access, Quality, Price	Primary Survey	Linear regression Cross sectional, treatment /control	Use of difference in difference model, stratified random sampling
15	Garm, Ishan, Kahkonen 2002	AS 1 (Cambodia) 8 -	Sector Quality, Cost, Access	Primary Household survey data	Statistical Cross sectional, treatment /control	Towns selected randomly to avoid selection bias
16	Gassner, Popov, Pushak 2007	Global 71 978 -	Sector Access, Price, Quality, Cost, Efficiency	Secondary Existing databases	Regression Panel data, before/after and treatment/control	Model specification includes firm random and fixed effects, firm specific time trends, use of instrumental variables, and nearest neighbour matching
17	Isham, Kahkonen 2002	AS 2 (Sri Lanka and India) - -	Micro Access	Primary Household and other surveys	Regression Cross sectional, retrospective uncontrolled	Controlled for household characteristics
18	Isham, Narayan, Pritchett 1995	AF,AS,SA 49 - 121 Rural water projects	Micro Efficiency, Access, Quality	Secondary Project data	Multivariate regression Cross sectional	Use of instrumental variables, observations from the timing of project cycle, case

	Study **Year**	**Geography** **No. of countries** **No. of firms** **No. of projects**	**Intervention Level** **Outcome**	**Data type** **Data sources**	**Methodology** **Analysis**	**Controls, validity measures, and robustness checks**
						studies of individual projects
19	Kenny 2009a	Global 58 - -	Macro Access	Secondary World Bank data	Regression Cross sectional	Controlled for country GDP
20	Kirkpatrick, Parker, Zhang 2006	AF 13 14 -	Macro, Sector Cost	Secondary SPBNET database	OLS regression and stochastic cost frontier model Cross sectional	Number of control and environmental variables included to capture cross country heterogeneity
21	Lin, Berg 2008	SA 1 (Peru) 38 water utilities -	Sector Efficiency, Quality	Secondary Firm level data	DEA Cross sectional, retrospective uncontrolled	Use of multiple inputs and multiple outputs in the model
22	Motta, Moreira 2004	SA 1 (Brazil) 104 -	Sector, Micro Access, Cost, Quality, Price, Efficiency	Secondary SNIS data	DEA Time series analysis, treatment /control	Use of multiple outputs in the models
23	Ozuna, Gomez 1998	NA 1 (Mexico) 115 -	Sector, Micro Cost	Secondary Mexico's National Water Commission	Maximum likelihood estimates Cross sectional, Treatment /control	Model checked for concavity, monotonicity, and non-negative conditions

	Study Year	Geography No. of countries No. of firms No. of projects	Intervention Level Outcome	Data type Data sources	Methodology Analysis	Controls, validity measures, and robustness checks
24	Padawangi 2010	AS 1 - 78	Micro Access, Price	Secondary Project data	Bivariate regression Cross sectional	-
25	Prokopy 2005	AS 1 (India) - -	Micro Access	Primary Survey	Regression Cross sectional, retrospective uncontrolled	Random selection of respondents, test of heteroskedasticity, justification provided for not using instrumental variables, inclusion of appropriate control variables
26	Sabbioni 2008	SA 1 (Brazil) - -	Sector, Micro Efficiency	Secondary SNIS database	Regression Panel data	Fixed effects, use of second stage regressions to check the sensitivity of the results, Hausman Test
27	Seim, Soreide 2009	Global 84 - -	Macro Quality	Secondary World Bank data	Regression Cross sectional, treatment/control	Inclusion of appropriate control variables, RESET test for confounding variables, test for heteroskedasticity

	Study **Year**	**Geography** **No. of countries** **No. of firms** **No. of projects**	**Intervention Level** **Outcome**	**Data type** **Data sources**	**Methodology** **Analysis**	**Controls, validity measures, and robustness checks**
28	Shirley, Xu 1997	AF, SA, AS, EU 6 12 - -	Micro Efficiency	Primary and Secondary Enterprise survey, field interviews, and World Bank data	Regression /TFP analysis Panel data, before/after	Potential sample selection bias due to small sample size

In the fourth study, **Estache *et al*. (2009)** found that the corruption index had a statistically significant negative relationship with access, though the marginal effects of corruption did not have any statistically significant effects on access.

In the regional study category, **Estache and Kouassi (2002)** studied the efficiency of 21 water utilities in Africa using data from the period 1995–97 and found that many of the utilities operated at unacceptable levels of technical efficiency. The study found that institutional variables such as corruption and governance were significantly linked with efficiency and helped to explain a large share in excess costs. While corruption was negatively linked to efficiency, governance was positively linked. The study also indicated that privatisation was positively associated with efficiency.

In a separate study, again using data from Africa, **Kirkpatrick *et al*. (2006)** performed a stochastic cost function analysis of 110 water utilities, in which they used an index of property rights as a measure of the quality of the investment environment. They found robust evidence of the influence of this variable, which showed negative and significant effects on cost, indicating that costs were lower in countries that gave better protection to property rights.

Sector-level results

In the sector-level studies, there were ten studies on PSP, one on regulation and three on multiple interventions and reforms.

PRIVATE SECTOR PARTICIPATION

In a global study, **Gassner *et al*. (2007)** conducted an empirical assessment of PSP in water distribution in developing countries. Using data from 1973–2005 on 141 water utilities with PSP and 831 public sector utilities in 71 developing and transitioning countries, they found that none of the indicators examined deteriorated under PSP. On the other hand, private utilities showed better labour productivity and operational efficiency as compared to public sector utilities. The study found that the average number of residential water connections increased by 12 percent, residential coverage in sanitation services rose by 19 percent, and hours of daily water service increased by 41 percent. The differences in averages before and after PSP observed for five years or more were above the change for similar public sector utilities.

In a regional study on South America, **Clarke *et al*. (2004)** empirically examined the effects of PSP on coverage for water supply and sewerage at the city and province levels based on household surveys in Argentina, Bolivia and Brazil. The study found that piped water and sewerage coverage generally increased following PSP. However, coverage also improved in cities that did not introduce PSP, and therefore the study found little evidence that PSP itself improved coverage. The study did not find strong evidence that the poor were significantly harmed by PSP, as connection rates for poor households were similar in cities that did and did not introduce PSP. The results seemed to support the hypothesis that benchmark competition with private utilities encouraged the publicly owned utilities to improve their own performance. If true, then the evidence demonstrated the potential benefits of competition and not of privatisation and does not explain why benchmark competition was not a potent force before privatisation.

In a second regional study, **Kirkpatrick *et al*. (2006)** performed an econometric analysis on the effects of water privatisation using data collected from 110 water utilities in Africa, out of which 14 utilities in 13 countries had PSP. The descriptive statistics indicated a higher productivity in private water utilities; charges were also higher, on average by 82 percent. However, the econometric analysis did not provide strong evidence for differences in the performance of public and private utilities in terms of costs and access. Regulatory variables included were statistically insignificant, which could be because of the crudity of the regulatory variables used. The authors indicated that the possibility of governments privatising worst-performing water utilities made it less likely for the private sector to exhibit superior performance.

In another regional study, **Estache and Rossi (2002)** provided evidence on the impact of ownership on the efficiency of water utilities by studying a sample of 50 countries from Asia. They concluded that efficiency was not significantly different in private companies than in public ones and that competition mattered much more than ownership. They also talked about the 'catching-up effect', which was gains to be made by firms that were still not on the frontier.

There were five studies that reported country-level findings. In the first study, **Barrera-Osorio and Olivera (2007)** determined the effect of water sector privatisation in 46 municipalities in Colombia using data obtained from household surveys and demographic health surveys. They found that while the overall effect of privatisation had been positive, the effects were not homogeneous across income groups or across areas. Privatisation increased access and improved the quality of water supplied in urban areas. On the other hand, the study found a strong negative effect on access in rural areas, while quality improved. The study indicated that privatisation created favourable outcomes when the infrastructure was already in place and in municipalities with higher technical capacity. The elimination of cross-subsidies and higher spending on water by households in rural areas that privatised water supply accounted for the higher price increases after privatisation. The authors indicated that privatisation worked better in urban than rural areas.

In the second study, **Garn *et al*. (2002)** compared the performance of water services provided by four private companies and four public utilities in Cambodia using data from a household survey. The results indicated that households served by private utilities were significantly more satisfied with the quality of piped water and services. However, households served by the private utilities paid significantly more for the service than the customers of public utilities.

In the third study, **Galiani *et al*. (2008)** examined the effects of a programme of expansion of the water network in urban shantytowns by a privatised water network (Aguas Argentinas) in Argentina. Primary data was collected using a systematic before-after household survey in the years 2004 and 2005. Results were calculated using a difference-in-differences model – more specifically a two-way fixed-effect linear regression model. The study indicated that the programme contributed to reducing the money families allocated to water-related expenditures. Families in the treatment group, on an average spent about 20 to 22 pesos per month less than families in the control group that bought water. Also health and savings effects were important for households that had previously had clandestine self-connections to the water network, which were free but of low quality.

In the fourth study, **Sabbioni (2008)** examined the relative efficiency of regional and three different types of local enterprises in providing water and sewerage services in Brazil between 2000 and 2004. Brazil is a country which lacks perfect access to water and sewerage services, and efficiency improvements could free up funds for network expansion which could be a step towards achieving the desired full service situation. This study utilised an unbalanced panel for 2000-2004. For Brazil, evidence of economies of scale was enough to claim that water and sewerage provision at the state level was more efficient that that at the municipal level. There was also evidence of inherently lower firm-specific costs for regional state-owned firms than for all other types of water and sewerage operators in Brazil, and there was no statistically significant difference between the firm-specific cost of private and public operators.

In the fifth study, **Carrillo *et al*. (2008)** made an objective comparison of several indicators of water coverage, quality and prices in Guayaquil and Quito. Two types of regression model, a traditional linear model and an ordered probit model with three different specifications were used to analyse the data from two national income and expenditure surveys of 1994-95 and 2004.The results indicated that water-coverage levels in Guayaquil had decreased during the given timeframe, particularly those among the lower end of income distribution. The opposite was true for Quito, and relative changes in coverage levels between the two cities could not be attributed to privatisation.

In a firm-level study on the impact of private participation, **Estache and Trujillo (2003)** calculated TFP using data obtained from regulatory agencies for four operators in Argentina that had been privatised. The results indicated an overall increase in TFP, though the margins of annual change varied widely between utilities. Between outputs and inputs, the results indicated that improvements in inputs were much stronger. For the two provinces for which reasonable data was available, the TFP gains were roughly 2 percent per year. The authors indicated that they represented significant contributions from the reforms of the sector in these provinces.

Regulation

In a study that examined the impact of regulation, **Lin and Berg (2008)** indicated that benchmarking was critical to improving the service quality of regulated monopolies. Unless regulatory regimes introduced specific incentives, quality might not improve significantly. Using data from 38 Peruvian water utilities during the period 1996–2001, the authors found that average quality of service improved only very slightly. The authors suggested that this could be due to lack of incentives for companies to improve their service quality under the regulatory regime.

Competition

Given the natural monopoly characteristics of the water supply and sanitation industries, competition might not have an important role to play. Our searches did not yield any studies that examined the impact of competition on outcomes.

Reforms and multiple interventions

There were three studies that looked at the impact of multiple interventions and reform on outcomes. **Estache *et al*. (2009)** analysed the impact of reforms on access, affordability, and quality, using data from 153 developing countries between 1990 and 2002. They found that the presence of regulation did not affect access, whereas privatisation increased access significantly.

Anwandter and Ozuna (2002) studied the impact of institutional and regulatory reforms implemented in Mexico (administrative decentralisation and the establishment of an autonomous regulator among others) on the technical efficiency of the public water utilities. They used 1995 data of 110 urban water supply and sewerage utilities, of which 80 were operated by municipalities and 30 were operated by state-level firms. Using second step econometric regressions on technical efficiency measures obtained from DEA against dummy variable for the reforms, they found that decentralisation and regulation did not have a significant effect on the technical efficiency of the water utilities.

Casarin *et al*. (2007) used econometric analysis to examine, until the cancellation of the contract, the performance of the Buenos Aires sanitation concession in relation to the privatisation objectives of expanding coverage, reducing consumers' tariffs and increasing service standards. Despite a noteworthy increase, coverage rates remained significantly behind the goals and they found that several contract renegotiations came along with significant tariff changes that turned an initial access problem into an affordability one. The concession's high profits originated almost exclusively from tariff increases, as the contribution from total factor productivity improvements and changes in input prices were negligible. A good number of the concession's failures seem to have been explained by the presence of a weak and inexpert regulator. For various reasons, privatisation as part of water reforms in Buenos Aires did not work to a great extent; it remains to be seen if government ownership will overcome the obstacles faced by the private sector.

Micro-level results

Micro-level interventions could be broadly classified into two categories: decentralisation and community participation. There were five studies that looked at the impact of decentralisation and four studies that looked at the impact of community participation.

DECENTRALISATION

Clarke and Wallsten (2002) used household data from African countries to determine access to piped water in urban areas, when water supply was provided at the national and local levels. They found that coverage in countries with a national water supply agency was on average lower (30.88 percent) than for countries where supply was provided by the local agencies (37.77 percent). The evidence indicated that decentralisation can improve coverage. The presence of many local agencies could also result in some kind of benchmark competition between them, which could result in an improvement in service.

Asthana (2003) examined the effect of decentralisation on provision of drinking water in 1,708 villages in two states of central India. Some 459 villages had water schemes operated by the local government, and in the remaining 1,249 villages, the schemes were operated by agencies of the state government. The results indicated that operating expenses (after scaling for production levels) and asset utilisation were significantly higher and lower respectively for decentralised utilities. These results indicated that economies of scale prevailed in the sector. Efficiency could also be influenced by corruption, which was more prevalent at the local level as compared to the regional and national levels.

The same author in another study (**Asthana, 2008)** studied the impact of decentralisation in the provision of water supply and the prevalence of corruption. Using survey sample data on 200 water utilities and 6,000 households, obtained from rural and semi-urban areas in central India, he found that the prevalence of corruption was significantly higher in decentralised utilities as compared to centralised utilities. The author indicated that this could be because

of fewer obstacles to corruption at the local level. Monitoring and inspection mechanisms were better developed at the state level, whereas at the local level, auditing systems were neither technically competent nor immune from political influence.

Motta and Moreira (2004) performed an analysis of productivity between different types of sanitation firms in Brazil: state-owned firms, municipal operated firms and private concessionaires. The analysis was based on data for 104 operators during the period 1998–2002. The results indicated that state-owned firms had higher wage costs and distribution losses, and also had higher tariffs as compared to other firms. Private operators showed the same level of service coverage as that of the publicly owned firms.

Ozuna and Gomez (1998) performed an econometric analysis on potable water services in Mexico using data from the year 1995 on 115 water utilities. At low output levels, water utilities managed at the municipal level had lower variable costs than water utilities managed at the state level. However, as output levels increased, water utilities managed at the state level became more efficient than utilities managed at the municipal level, because of economies of scale.

COMMUNITY PARTICIPATION

Using data from 49 countries from Africa, Asia and Latin America, **Isham *et al*. (1995)** examined the effect of increasing beneficiary participation on project outcomes using data from 121 rural water supply projects. Regression of overall project effectiveness with overall beneficiary participation gave strong statistically significant coefficients. After addressing potential issues of reverse causation or 'halo effects', the study provided strong evidence to support the cause and effect relation between participation and project performance. The participation of beneficiaries was considered at three different stages of the project cycle, and analysis on the timing of participation indicated that participation in the early stages improved project performance at every stage, from implementation to maintenance.

The remaining three studies were centred on Asian experiences. **Padawangi (2010)** highlighted the relevance of community participation in water supply. Using data from 78 projects supported by the Pakistan Resident Mission of the Asian Development Bank, the study found that community driven development approach had extended water supply, drainage, and sanitation coverage to poor rural communities. The study also indicated that community participation had helped to overcome the resistance more effectively to changes in water tariffs. The study indicated that political interventions like decentralisation can be very effective if accompanied by community participation.

Using data from 1,088 rural households and 50 water committees in three projects in Sri Lanka and India financed by World Bank, **Isham and Kähkönen (2002)** studied the circumstances under which the community-based approach was most likely to succeed by analysing selected institutional determinants of the impact and performance of community-based water services. It was found that well-designed and well-constructed water services led to improved household health and reduced water collection times, and that well-designed services could be promoted by involving community members in the design process and not letting outsiders make the final decision about the service type. In communities with high levels of social capital, with active community groups and associations, participation at the project design stage was more likely to be high and monitoring mechanisms were more likely to be in place. Thus, community participation and decision making in service design led to

well-designed services, and monitoring of household contributions to construction led to better-constructed services.

Prokopy (2005) examined the role of participation in World Bank assisted rural water and sanitation projects in Karnataka and Uttar Pradesh. According to the study, decision making and capital cost contribution that involved each member of the community made a project more successful. But the variable that was the most significant statistically was transparency; transparency in how each community member's money was spent involved more participation and brought about the success of a project. Overall, participation benefited project outcomes.

PERFORMANCE CONTRACTING

In a firm-level study, **Shirley and Xu (1997)** analysed the experience of performance contracts between developing country governments and the managers of their state-owned enterprises. Their analysis included two water firms in Ghana and Philippines. The results indicated that there was an improvement TFP and labour productivity trend in the case of Ghana, whereas there was no change in labour productivity trend and the TFP trend actually deteriorated in Philippines. The study also indicated that the improvement in labour productivity trend in Ghana, actually predated the contract. The study concluded that concluded that all the enterprises suffered from serious contracting problems and there was no pattern of improved performance that could be attributed to the contracts.

4.2.5 Aggregated studies

Summary of the evidence on aggregated studies

Though there are several common features between the four infrastructure sectors covered in this review, there are several differences as well. Therefore, even papers that analysed the impact on more than one sector, presented the evidence separately for each of the sectors. Only two papers provided consolidated evidence of all the sectors that they had studied. Brief details of these studies are given in Table 4.13.

Both the studies broadly indicated that the interventions had a positive impact on outcomes. However, since both the studies aggregate their results across multiple sectors, the impacts on individual sectors could not be ascertained. Overall, the evidence from these studies was consistent with that of the sector-specific findings in other studies. While interventions such as private participation generated improvements, only a share of those benefits was transferred to consumers.

This could be attributed to laxity in regulatory governance. Many governments provided incentives for private sector investments, which in practice resulted in very loose sectoral regulation (Cook and Uchida, 2008). Since regulatory structure is also an important determinant of sector performance, just changing ownership did not help to realise the gains that would have been possible with robust sector regulation. Further reforms, such as creating a robust regulatory framework and competitive market conditions, would help in achieving further improvements from the interventions.

Efficiency increased after privatisation, but this was more often than not achieved through a reduction in employment. While privatisation was linked to in an increase in investment in the sector, the increase was largely seen only in the first few years of privatisation. Therefore, the need for an expanding labour force to meet the needs of investment expansion

tapered down after a few years of privatisation. Government guarantees that protected employment levels were time bound. Once guarantees elapsed, employment reduced, and was the major source of efficiency gains.

The studies also highlighted substantial heterogeneity within and among sectors as a result of the interventions. This can be attributed to the intrinsic characteristics of the interventions such as the type of concession, the privatisation mechanism and the level of regulation.

STUDY DESCRIPTIONS

In the first study, **Andres et al (2007)** evaluated the impact of economic regulation on infrastructure outcomes, using an extensive data set of about 1,000 infrastructure concessions granted in Latin America from the late 1980s to the early 2000s and using unbalanced panel data that included 181 firms and 1,885 firm-year observations from 15 Latin American countries. The study analysed the effects of regulation on productivity, quality of service, coverage and prices during and after transition. While the study found that regulation and the quality of regulation had a positive impact on the above outcomes, the evidence was mixed during and after transition. Large positive effects were observed during the transition periods, whereas the results were varied during the post-transition period.

In the second study, **Cook and Uchida (2008)** examined the impact of privatisation on utility companies using enterprise level data before and after privatisation from 22 developing countries in all the five regions identified in this review. The results indicated that privatisation had a significant positive impact on productivity. The sales per employee increased significantly after privatisation, while the number of employees decreased significantly.

Table 4.13: Summary of papers that have provided aggregate evidence

	Study **Year**	**Geography** **No. of countries** **No. of firms** **No. of projects**	**Intervention level** **Outcome**	**Data type** **Data sources**	**Methodology** **Analysis**	**Controls, validity measures, and robustness checks**
1	Andres, Guash, Straub 2007	SA, CA 15 181 -	Sector Access, Cost, Quality, Efficiency, Price	Secondary World Bank, ITU	FGLS regression Panel data, before/after	Fixed effects model, firm specific time trends, standard error accounted for heteroskedasticity
2	Cook, Uchida 2008	AF, SA, NA, AS 22 - -	Sector Cost, Efficiency	Secondary World Bank	Statistical Cross sectional, before/after	4 years pre and post privatization data used for analysis, large database expected to reduce sample selection bias

4.3 Summary of the results of the synthesis

- A total of 90 studies that analysed data from developing countries were included in this review.
- Two types of synthesis were undertaken: a vote counting method and a textual narrative.
- The vote counting analysis found that, out of the 862 observations, 456 (53 percent) indicated that the interventions did not have significant impact on outcome, either positive or negative. Overall, positive evidence was found in 33 percent of the total observations and negative evidence was found in 14 percent.
- At the regional level, there was not much difference in the percentage of observations that did not have a significant impact for the global, South American and Asian regions, whereas the proportion was higher for Africa, where 69 percent of the observations did not show any significant impact on outcome. Africa had the lowest proportion of observations that showed a positive impact, whereas South America had the highest.
- In terms of effectiveness (i.e., a positive impact on outcome), it was seen that micro-level interventions had the highest impact, with 58 percent of the observations indicating a positive impact on outcome, whereas the proportions for the macro- and sector-level interventions were only 34 and 31 percent respectively. The proportions of observations that did not show any impact were the lowest for micro-level interventions at 29 percent, whereas for the macro and sector levels, they were 52 and 54 percent respectively.
- The transport sector had the highest proportion (67 percent) of positive outcomes, though the number of observations was low. Among the remaining three sectors, telecom had a higher percentage of positive outcome observations (37 percent), and a lower percentage of observations (47 percent) with no significant outcomes.
- For the business and industrial segment, 69 percent of the observations did not indicate any significant impact, whereas for the residential segment, the figure was slightly lower at 61 percent. The proportion of negative outcomes was higher for the residential segment (25 percent), as compared to the business and industrial segment (15 percent).
- It was also observed that the proportion of positive outcomes for the rural, poor and illiterate segment was higher (33 percent) compared to the urban, rich and literate consumer segment (20 percent).
- The textual narrative method indicated that while the evidence was by and large positive in all infrastructure sectors, its manifestation differed across outcomes.
- In water, the positive evidence was mainly seen in access and quality, whereas in the electricity sector, it was seen in access and efficiency. In telecommunication, it was seen across all outcomes except quality, and in transport it was mainly on costs. There was no predominance of negative impact on any outcome as a result of these interventions, except tariff (price) levels.

5. Implications

This chapter provides the strengths and limitations of the review. The main strength of the review is its extensive coverage in terms of different sectors, interventions and outcomes. A limitation of this review is that the reductionist approach used in the synthesis has not been able to capture the causal links and variations in context and interventions in a significantly strong manner.

Implications for policy, practice and research have also been discussed. Increase in transparency is expected to have a positive impact on outcomes. Our results too indicate that the proportion of positive outcomes is higher than the negative outcomes in most of the analysis parameters. However, it was also found that the highest proportion of observations indicated that the interventions did not have a significant impact on outcomes. Further research is needed to study the reasons and causes behind this finding. The finding that in many instances the interventions did not lead to a positive impact also highlights the limitations of these interventions in their existing forms and emphasises the need for greater understanding of the theory of change that accompanies such interventions in order to increase their effectiveness.

The impacts of interventions differed between outcomes and policy makers should be cognisant of the potential trade-offs that accompany any such interventions. Practitioners need to be aware of the challenges in realising the objectives and goals of such interventions. For researchers, this presents a good opportunity to study why many of the interventions did not result in any significant positive impacts despite the substantial political backing that normally accompanies such efforts.

5.1 Main findings

The interpretation and application of the results of this review requires further work by different users of research, but initial implications for different stakeholders can be summarised as follows. A dashboard view based on the results of vote counting summary is given in Figures 5.1–5.3.

The results indicate that on the whole, the interventions did not result in harmful or negative outcomes. While the number of positive outcomes was more than the negative outcomes, given the high number of observations in the ‘no significant impact’ category, it can be said that the linkages between interventions and outcomes are not very strong. Thus, while the impact on outcomes has been positive, it is ‘weak positive’ and not ‘positive positive’.

Figure 5.1 provides the overall results for the four sectors and the five different outcomes. Figure 5.2 indicates the evidence for various interventions in each of the four sectors for all the outcomes. Figure 5.3 indicates the evidence in different geographical regions for the four sectors. The figures indicate the evidence that was most common for each of the categories. For example, if the fraction of evidence having no significant impact was the highest for access in electricity, as compared to positive or negative outcomes, then ‘no significant impact’ is shown in the dashboard view. If there was more than one outcome having the highest fraction, then fractional representation has been given to all the outcomes.

Figure 5.1 indicates that 'no significant impact' dominates all the outcomes for electricity and water supply. In telecom, positive impact was seen in access and efficiency outcomes while 'no significant impact' was seen for the remaining outcomes. The evidence was available only on cost for transport, and the evidence was positive.

The large number of blue circles in Figures 5.2 and 5.3 indicate that 'no significant impact' was the most common outcome in a majority of the observations. Negative impacts were seen in a few instances. PSP had a negative impact on price in telecom and micro-level interventions had a negative impact on efficiency in the water sector. The former can be easily explained as the result of market-based tariffs and reduction of subsidies following PSP. The latter can be explained by the fact that micro-level interventions can result in loss of economies of scale benefits, which in turn leads to a reduction in efficiency. The impact of regulation on quality was negative, which indicates that many regulatory environments do not provide adequate incentives for quality improvement.

Analysis of different geographical regions indicates that the South American region has the most positive impacts. However, unlike other regions, the evidence in South America was mixed on efficiency and price outcomes. Overall, the telecom sector had the maximum number of positive impacts, followed by the electricity and water supply sectors in that order.

5.2 Implications

5.2.1 Policy

The importance of governance indicators and institutions: This review indicates the presence of a strong link between infrastructure project outcomes and other factors such as governance and corruption. Improvements in performance and outcomes in infrastructure sectors depend not only on the sector-level factors, but also on broader economic conditions, such as governance, institutional strength and prevalence of corruption. Overcoming the shortcomings in these macro-level factors takes time, and therefore any improvements from the interventions are likely to be seen only after many years. Since many developing countries have implemented these interventions only since the mid-1990s, it may take a while before the improvements can be completely realised. More importantly, our study also indicates that interventions that focus only on sector-level issues are not sufficient. Interventions that strengthen governance and institutions, and reduce overall corruption are equally important to achieve the desired outcomes from infrastructure projects. Therefore, development agencies that focus on infrastructure development should also focus on bringing about improvements in broader issues like governance and institutions.

The need to continue the next stage of interventions: In a majority of the developing countries, the primary objective of sector reforms has been to attract private sector capital in infrastructure. For years, public sector capital constraints led to a rationing of supply in the infrastructure sectors. Private sector investment was expected to bring in additional investment to expand capacity and network. The focus was therefore on creating conditions that would first result in attracting private sector investment, rather than improvements in outcomes. For example, in many instances, private sector participation (PSP) was not accompanied by strong regulatory reforms. As the evidence indicates, PSP in itself does not result in outcome improvements unless accompanied by strong regulation and competition. There is a need to focus on next-generation interventions that will create strong regulatory

institutions (such as incentive based regulation rather than rate of return regulation) and enable competition in the marketplace.

An explicit focus on transparency: Studies have indicated that transparency can play a positive role in several of the outcomes. While the interventions reviewed in this study did impact on transparency, improving the level of transparency was not their main objective. Therefore, in many instances, these interventions did not improve transparency as much as they might otherwise have done. By specifically focusing on the transparency component while implementing these interventions, it would have been possible to increase the levels of transparency in a more explicit way. Assessment of the effectiveness of these interventions should also include criteria on how they have improved transparency levels.

The need to assess the ability of the government to keep its promises: On occasions, the interventions failed because the government was not able to keep its promises. While the initial support for the interventions was with the objective of getting foreign assistance, in many cases the actions promised by the government as a part of the conditionalities to the assistance were not politically possible or were politically unlikely. Without appropriate follow-up measures, the outcomes of such interventions therefore fell short of expectations. Therefore it becomes important to determine at the outset whether the actions assured by the government are politically feasible, as the entire outcomes of the interventions depend upon the fulfilment of those promises.

Recognising the trade-offs on different outcomes: Identification of the appropriateness of different interventions for different outcomes and sectors is also important. For example, community participation is seen as quite effective in improving project outcomes. However, it can be implemented only in limited instances. These interventions can succeed only in those places where there is a strong sense of belonging to the community. Therefore, it might be more appropriate in rural rather than urban areas. Not being local in nature, there is limited scope for using such community interventions in the electricity and telecom sectors. In general, PSP helps to increase sector-level efficiencies as a result of superior management capabilities and incentive systems. However, if PSP is not accompanied by regulation and competition, the benefits of these efficiencies are retained by the private utility and do not reach the customer. At least in the short run, many of these interventions involve trade-offs. For example, in the electricity sector, while regulation had a positive impact on costs, it did not have any significant impact on access. In telecom, PSP improved efficiency, but had a negative impact on price. Regulation had a positive impact on access, but a negative impact on quality. Being aware of such trade-offs is important in selecting the most appropriate intervention to achieve a given outcome.

Customising the interventions to suit the local context: Since the outcomes of these interventions varied across areas, it is suggested that the interventions should be tailored to suit the context of developing countries. For example, while a complex regulatory structure with well-laid-out procedures might suit developed countries that have strong institutions, this might increase corruption in developing countries with comparatively weaker institutions. Therefore it is felt that an element of discretion in regulatory functioning might actually be better than having a well-laid-out, completely transparent regulatory procedure. It has also been indicated that given the low level of development infrastructure markets in many developing countries, the introduction of measures oriented towards market-driven or indirect outcomes have not been as effective as direct measures, suggesting that some corrections have to be forced into place before competitive factors can come into play.

The need for a greater understanding of the linkages between intervention and outcomes: Increase in transparency is expected to have a positive impact on outcomes. Our results also indicate that the proportion of positive outcomes is higher than that of negative outcomes in most of the analysis parameters. However, it was also found that the highest proportion of observations indicated that the interventions did not have a significant impact on outcomes, indicating that the linkages between outcomes and interventions are not very strong. Further research is needed to study the reasons and causes behind this finding. The finding that, in many instances, the interventions did not lead to a positive impact also highlights the possible limitations of these interventions in their existing forms and emphasises the need for greater understanding of the theory of change that accompanies such interventions in order to increase their effectiveness.

5.2.2 Practice

This review highlights the challenges in achieving the objectives and goals of many of the interventions. While the broad principles of the interventions would be similar at the macro level, the practitioner needs to customise them to the local context to achieve a higher probability of success.

5.2.3 Research

In most circumstances, implementation of the different interventions included in the review had strong political support, in the sense that the dice was strongly loaded in favour of succeeding. Despite this, many of the efforts did not result in any significant positive impact. The results of the interventions do not seem to differ substantially across different regions, despite the different levels of existing infrastructure.

The overall mixed or weak nature of the results needs further investigation. While our review indicates that 'transparency' in infrastructure procurement cannot hurt, it does not seem to help much either. There is a need to do further research on the kind of transparency that is needed in infrastructure and the appropriate constructs that need to be developed for measuring such transparency.

5.3 Strengths and limitations of this systematic review

5.3.1 Strengths of the review

As far as the authors know, this is the first systematic review on the infrastructure sector. While there were previous review studies on infrastructure, the coverage both in terms of sectors, as well as outcomes, was limited. In general, previous studies (for example, Andres *et al.*, 2006, 2007; Contessi, 2004; Fink *et al.*, 2002; Noll, 2000; Wallsten, 2001) have found a positive impact from the interventions that form this review. This review did not find such a strong positive impact and the results differ substantially from many of the previous studies.

This review has several notable features. First, is the coverage in terms of sectors, outcomes and interventions. This review encompasses four infrastructure sectors (electricity, telecommunication, transport and water supply), five outcomes (access, cost, efficiency, price and quality) and three level of interventions (macro, sector and micro). Since most infrastructure sectors share some common features, this review provides a more holistic perspective on the impact of the interventions.

Second is the use of transparency as a common factor that unites the interventions across different levels. Previous reviews have analysed the formal attributes of the different interventions, with very little focus on the informal and practical attributes that accompany such interventions (Cubbin and Stern, 2006). This review assumes that the formal changes in industry structure also lead to changes in the levels of transparency and accountability. Therefore the impacts arise not only from the formal attributes but also from a change in the underlying levels of transparency and accountability. Since many of the studies did not separate the impact resulting from a change in the industry structure from that of the underlying change in transparency, this review has synthesised the aggregate impact from the implementation of various interventions. But by taking transparency as a common theme across different interventions, this review has been able to consolidate the evidence across multiple levels – macro, sector and micro levels.

Third is the focus on types of outcomes. Previous reviews have largely analysed the impact as a binary outcome. In this review, we have consciously highlighted the three different types of impact – positive, negative and no significant impact.

5.3.2 Limitations of the review

Only those studies that used quantitative methods were included for the review. In a sense, this limited the number of studies that qualified for inclusion. However, inclusion of qualitative studies would have yielded a large number of heterogeneous studies, and synthesising from such a large number would have been difficult.

A second limitation of this review is that it is specifically focused on the experiences of developing countries. While this limits the contextual heterogeneity, it does not give opportunities to contrast the experiences of developing and developed countries. The scope of a future review could include this comparison.

A third limitation is that given the heterogeneous context, most of the studies included in the in-depth analysis have concentrated on factors that can be attributed to the cause of impact without a rich description of the causal linkages between intervention, context and impact that is normally seen in qualitative studies. Therefore the generalisation and synthesis of this review has also limited discussion of causal linkages.

Fourth, the vote counting process used captures only the direction of the impact, and does not weight the observation in terms of sample size and the magnitude of the impact. Fifth, in transport, the number of studies identified was rather small, which limits our ability to make broad judgements. Sixth, the interventions that have been chosen as proxies for transparency will influence outcomes through a range of means, and not just transparency. The evidence that we reviewed does not specify how much of the impact on outcomes is due to change in transparency. Therefore, our review has not been able to identify the level of impact that can be clearly attributed to changes in transparency.

Finally, the variations in interventions have not been captured in the synthesis. For example, the type of PSP intervention, namely, concessions and divestitures has not been captured as one of the variables. Similarly, the different types of regulation, namely, price cap and rate of return, have been included under a single variable called regulation. Further studies that aim to capture these differences in interventions and their impact on outcomes could be studied at the next stage.

Figure 5.1: Dashboard view of the impact on outcomes in different sectors

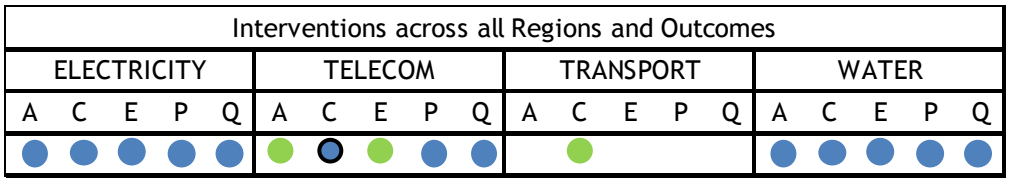


Figure 5.2: Dashboard view of the impact of different interventions on outcomes

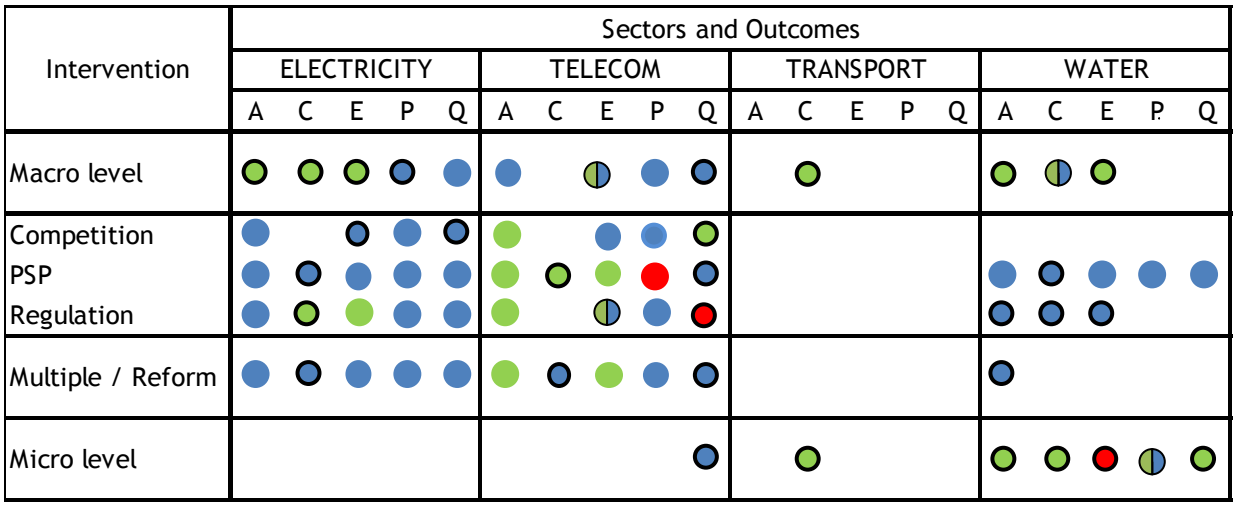
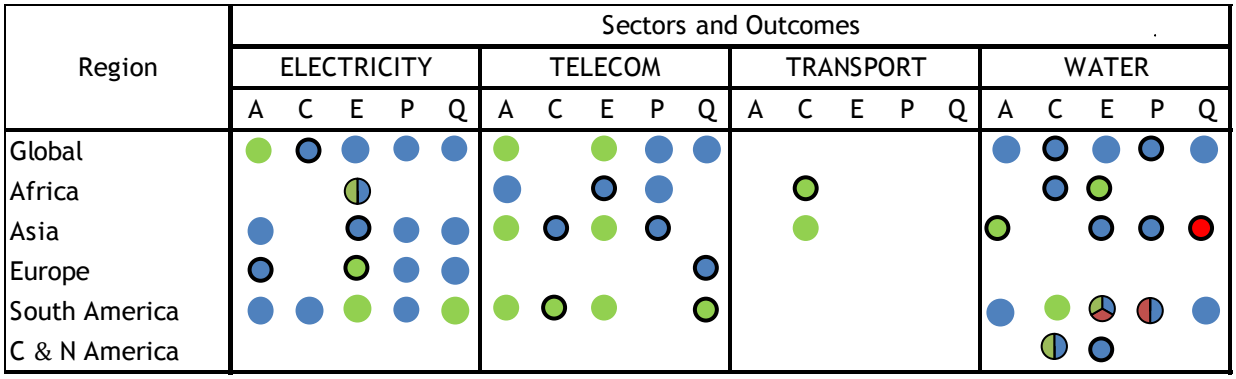


Figure 5.3: Dashboard view of the evidence on various sectors in different regions



Note for Figures 5.1-5.3

Impact
Negative
No Impact
Positive
A black border indicates the number of observations is less than 10

Outcomes
A - Access
C - Cost
E- Efficiency
P - Price
Q - Quality

10 percent has been used as the significance level

6. References

6.1 Studies included in the in-depth review

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Appendices

Appendix 1.1: Authorship of this report

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Acknowledgements

- DFID Research and Evidence Division: Rachel Blackman, Max Gasteen, Roy Metherell, Nicola Crissel, Maureen McWhirter
- DFID Policy team: Sarah Bloom
- Research assistance: Jacob John, Abhishek Kumar, M.S. Elayaraja, Deepika Mohan, Dheeraj Pandey, J. Prachitha, Santhosh Kumar
- 3iE: Hugh Waddington, Birte Snilstveit
- EPPI-Centre: Professor Sandy Oliver, Kelly Dickson, Jeff Brunton, Claire Stansfield, Carol Vigurs, Philip James Rose and Sylvia Potter.
- Engineers against Poverty: Jill Wells, Petter Matthews
- We would also like to thank the following colleagues who responded to our request by suggesting suitable studies for our review: Laura Recuerovirto at the OECD; Federica Maiorano; Sebastian Lobez Azumendi, Paul Noumba Um and Dr Luis Andres at the World Bank; Agustin Ros at NERA, Professor Colin Kirkpatrick at the University of Manchester; Professor David Parker at Cranfield University; Professor Jon Stern at City University; Professor Francesc Trillas at the IESE; Professor Luis Hernando Gutiérrez at the Universidad del Rosario; Professor Farid Gasmi at the Toulouse School of Economics; Professor Emmanuelle Auriol; and Professor Antonio Estache. We are grateful for their prompt response to our request for help.

Others: Anonymous reviewers of our protocol; our respective institutions for permitting us to undertake the study.

Appendix 2.1: Search strategy for electronic databases

A2.1.1 List of journals and sources that were hand searched

- Utilities Policy
- World Bank Economic Review
- World Development
- Journal of Public Economics
- Water Policy
- Journal of Regulatory Economics
- Journal of Development Economics
- Economic and Political Weekly
- IDS Bulletin

A2.1.2 Details of websites searched

The websites that were searched for this review are:

- African Development Bank
- Asian Development Bank
- Construction Sector Transparency Initiative
- Inter-American Development Bank
- Transparency international
- World Bank

In each of these websites, we went through the relevant sections provided, under various headings like infrastructure, private sector, transparency, water and sanitation, transportation, energy, electricity, ports and airports, working papers, information and communication technologies, infrastructure economics and finance, transport, urban development, water supply and sanitation. All the documents or studies under these headings were examined for inclusion. Whenever the lists of documents or studies were large, we searched using keywords.

The details of website search can be found in Table A2.1.

Table A2.1.1: Details of website search

Website	Sections	Keyword(s) used	Types of document	Number of documents/ hits	Number included for review
African Development Bank	Working papers	None	Working papers	82	None
Asian Development Bank	Infrastructure	None	Working papers, journals	18	None
Construction Sector Transparency Initiative	Working papers	None	Working papers	4	None
Inter-American Development Bank	Private sector, transparency, water and sanitation, transportation, energy, electricity, ports and airports	None	Working papers	49	4
Transparency International	Working papers	None	Working papers	17	None
World Bank	Energy, information and communication technologies, infrastructure economics and finance, transport, urban development, water supply and	Infrastructure, accountability, transparency, corruption, governance	Economic and sector work (other financial accountability study, other infrastructure study, PSD, privatization and industrial policy, sector or thematic evaluation), publications and research (departmental working paper,	1109	4

Website	Sections	Keyword(s) used	Types of document	Number of documents/ hits	Number included for review
	sanitation		internal discussion paper, journal article, PAS research paper, policy paper, policy research working paper, public policy for the private sector, publication, report on the World Bank Research Programme, staff working paper, WBI working paper, water and sanitation discussion paper, working paper, working paper (numbered series))		

A2.1.3 Details of electronic databases searched

The electronic databases that were searched for this review are as follows:

- ScienceDirect: Contains many popular journals like *Utilities Policy*, *Journal of Development Economics*, *Telecommunications Policy*, *Energy Policy*, *Transportation Research*. ScienceDirect also connects to other search tools in Scopus and SciVerse. Given the extensive coverage of this database, our first search yielded an unmanageable number of hits. To make the number of hits more manageable, we selected the list of subjects that would be included in the search given the scope of the review. The subjects included were business management and accounting, economics, econometrics, and finance and social sciences. Within these subject areas, 86 journals were chosen based on their coverage, focus and objectives. For more relevant hits, we also excluded a list of topics from the search in the identified journals. The list of 86 journals searched and the topics excluded are given in Table A2.1.2.

Table A2.1.2: List of ScienceDirect journals searched and topics excluded within these journals

Business Horizons; China Economic Review; Cities; The Columbia Journal of World Business; Developments in Environmental Economics; Ecological Economics; Economic Modelling; Economic Systems; The Electricity Journal; Emerging Markets Review; Energy; Energy Economics; Energy Policy; European Economic Review; European Journal of Political Economy; European Management Journal; Global Finance Journal; Government Information Quarterly; Government Publications Review; IIMB Management Review; International Business Review; International Journal of Critical Infrastructure Protection; International Journal of Transport Management; International Public Management Journal; International Review of Economics and Finance; International Review of Financial Analysis; International Review of Law and Economics; Journal of Accounting and Economics; Journal of Accounting and Public Policy; Journal of Air Transport Management; Journal of Applied Economics; Journal of Asian Economics; Journal of Banking and Finance; Journal of Corporate Finance; Journal of Development Economics; Journal of Econometrics; Journal of Economic Behavior and Organization; Journal of Economic Dynamics and Control; Journal of Economic Theory; Journal of Economics and Business; Journal of Empirical Finance; Journal of Energy Finance and Development; Journal of Financial Economics; Journal of Financial Intermediation; Journal of Financial Markets; Journal of International Accounting, Auditing and Taxation; Journal of International Economics; Journal of International Financial Markets, Institutions and Money; Journal of International Management; Journal of Macroeconomics; Journal of Management; Journal of Policy Modeling; Journal of Public Economics; Journal of Rural Studies; Journal of Urban Economics; Journal of World Business; Land Use Policy; Landscape and Urban Planning; Long Range Planning; The North American Journal of Economics and Finance; North American Review of Economics and Finance; Policy and Society; The Quarterly Review of Economics and Finance; Regional Science and Urban Economics; Regional and Urban Economics; Research in Economics; Research in International Business and Finance; Research in Transportation Economics; Resource and Energy Economics; Resources and Energy; Resources Policy; Review of Financial Economics; Scandinavian International Business Review; Scandinavian Journal of Management; Scandinavian Journal of Management Studies; Telecommunications Policy; Transport Policy; Transportation Research; Transportation Research Part A: General; Transportation Research Part A: Policy and Practice; Transportation Research Part B: Methodological; Transportation Research Part C: Emerging Technologies; Transportation Research Part D: Transport and Environment; Utilities Policy. Examples of topics excluded are: Exchange rate, CO2 emission, Delta, FDI, Theta, Human Capital, Climate Change, Ecological Economics, Renewable Energy, Natural Gas, GHG Emission, GDP,

Internet, Issue, Green Certificate, Kyoto Protocol, Homeland Security, Japan, Fuel Cell, Website, Market Power, Netherlands, ISO, Standard Cost, Ecosystem Management.

- EBSCO
- ProQuest: This also includes the SSRN database. The data source used in the ProQuest was Business ABI/INFORM Global.
- Emerald
- Web of Knowledge: Since 'unlimited' searches threw up an unmanageable number of hits, the search was limited by excluding subject areas that would not be relevant for this review. The list of subject areas that were excluded for each of the searches is given in Table A2.1.3.

Table A2.1.3: Search details used in Web of Knowledge

TS=(infra* AND transpar*) AND Language=(English)
Refined by: [excluding] Subject Areas=(MATERIALS SCIENCE, MULTIDISCIPLINARY OR MECHANICS OR MATERIALS SCIENCE, BIOMATERIALS OR PHYSICS, APPLIED OR THERMODYNAMICS OR GEOLOGY OR PHYSICS, CONDENSED MATTER OR NUCLEAR SCIENCE & TECHNOLOGY OR INFORMATION SCIENCE & LIBRARY SCIENCE OR CHEMISTRY, PHYSICAL OR METEOROLOGY & ATMOSPHERIC SCIENCES OR PHYSICS, MATHEMATICAL OR OPTICS OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR CONSTRUCTION & BUILDING TECHNOLOGY OR POLYMER SCIENCE OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR ECOLOGY OR MATERIALS SCIENCE, CERAMICS OR GEOSCIENCES, MULTIDISCIPLINARY OR MATERIALS SCIENCE, CHARACTERIZATION & TESTING OR MATERIALS SCIENCE, COATINGS & FILMS OR MULTIDISCIPLINARY SCIENCES OR PHYSICS, FLUIDS & PLASMAS OR ENGINEERING, ELECTRICAL & ELECTRONIC OR BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR MARINE & FRESHWATER BIOLOGY OR COMPUTER SCIENCE, THEORY & METHODS OR FOOD SCIENCE & TECHNOLOGY OR ENVIRONMENTAL STUDIES OR CHEMISTRY, MULTIDISCIPLINARY OR ENGINEERING, CIVIL OR NANOSCIENCE & NANOTECHNOLOGY OR ENGINEERING, MULTIDISCIPLINARY OR CRYSTALLOGRAPHY OR ENGINEERING, BIOMEDICAL OR AGRICULTURAL ENGINEERING OR INSTRUMENTS & INSTRUMENTATION OR ENGINEERING, MANUFACTURING OR DENTISTRY, ORAL SURGERY & MEDICINE OR CHEMISTRY, ANALYTICAL OR SURGERY OR GEOGRAPHY, PHYSICAL OR BIOPHYSICS OR ASTRONOMY & ASTROPHYSICS OR ENGINEERING, ENVIRONMENTAL OR MATHEMATICAL & COMPUTATIONAL BIOLOGY OR SPECTROSCOPY OR PHARMACOLOGY & PHARMACY OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING OR OPHTHALMOLOGY OR PHYSICS, MULTIDISCIPLINARY OR CHEMISTRY, ORGANIC OR DERMATOLOGY OR COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE OR NEUROSCIENCES OR PHYSICS, ATOMIC, MOLECULAR & CHEMICAL OR ENGINEERING, AEROSPACE OR OCEANOGRAPHY OR METALLURGY & METALLURGICAL ENGINEERING OR PHYSICS, PARTICLES & FIELDS OR PLANT SCIENCES OR MINERALOGY OR REMOTE SENSING OR AGRONOMY OR CHEMISTRY, APPLIED OR IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY OR BIODIVERSITY CONSERVATION OR COMPUTER SCIENCE, HARDWARE & ARCHITECTURE OR MATERIALS SCIENCE, COMPOSITES OR COMPUTER SCIENCE, SOFTWARE ENGINEERING OR MICROBIOLOGY OR GEOGRAPHY OR ENGINEERING, CHEMICAL OR LIMNOLOGY OR CHEMISTRY, INORGANIC & NUCLEAR OR ENGINEERING, INDUSTRIAL OR MATERIALS SCIENCE, TEXTILES OR ELECTROCHEMISTRY OR HEALTH CARE SCIENCES & SERVICES OR MEDICINE, LEGAL OR ENVIRONMENTAL SCIENCES OR MEDICAL INFORMATICS OR MINING & MINERAL PROCESSING OR ENGINEERING, MECHANICAL OR PHYSICS, NUCLEAR OR TOXICOLOGY OR BIOCHEMICAL RESEARCH METHODS OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR GEOCHEMISTRY & GEOPHYSICS) Timespan=1995-2010. Databases=SCI-EXPANDED.

TS=(utilit* AND transpar*) AND Language=(English)
Refined by: [excluding] Subject Areas=(ENGINEERING, ELECTRICAL & ELECTRONIC OR MARINE & FRESHWATER BIOLOGY OR ENVIRONMENTAL SCIENCES OR MATHEMATICS, INTERDISCIPLINARY APPLICATIONS OR MEDICAL ETHICS OR CHEMISTRY, MULTIDISCIPLINARY OR PHYSICS, MULTIDISCIPLINARY OR MEDICINE, RESEARCH & EXPERIMENTAL OR HEALTH CARE SCIENCES & SERVICES OR OCEANOGRAPHY OR MATERIALS SCIENCE, MULTIDISCIPLINARY OR REMOTE SENSING OR PHYSICS, APPLIED OR ENGINEERING, CHEMICAL OR SPECTROSCOPY OR CHEMISTRY, PHYSICAL OR ENGINEERING, INDUSTRIAL OR AGRICULTURE, MULTIDISCIPLINARY OR ENERGY & FUELS OR AGRONOMY OR HEALTH POLICY & SERVICES OR MEDICINE, GENERAL & INTERNAL OR BIODIVERSITY CONSERVATION OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR TOXICOLOGY OR CLINICAL NEUROLOGY OR COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE OR CRITICAL CARE MEDICINE OR NANOSCIENCE & NANOTECHNOLOGY OR ECOLOGY OR EDUCATION, SCIENTIFIC DISCIPLINES OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR ENGINEERING, BIOMEDICAL OR ENDOCRINOLOGY & METABOLISM OR COMPUTER SCIENCE, THEORY & METHODS OR ENGINEERING, ENVIRONMENTAL OR ENGINEERING, MULTIDISCIPLINARY OR ENVIRONMENTAL STUDIES OR MEDICAL INFORMATICS OR IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY OR PHARMACOLOGY & PHARMACY OR METALLURGY & METALLURGICAL ENGINEERING OR INFECTIOUS DISEASES OR CHEMISTRY, ANALYTICAL OR NUCLEAR SCIENCE & TECHNOLOGY OR MATERIALS SCIENCE, BIOMATERIALS OR COMPUTER SCIENCE, SOFTWARE ENGINEERING OR OTORHINOLARYNGOLOGY OR MATERIALS SCIENCE, CERAMICS OR PHYSICS, ATOMIC, MOLECULAR & CHEMICAL OR MATERIALS SCIENCE, COATINGS & FILMS OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING OR MATERIALS SCIENCE, COMPOSITES OR ENGINEERING, MECHANICAL OR MEDICINE, LEGAL OR OPTICS OR MULTIDISCIPLINARY SCIENCES OR SURGERY OR ASTRONOMY & ASTROPHYSICS OR NEUROSCIENCES OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR BIOPHYSICS OR NURSING OR COMPUTER SCIENCE, HARDWARE & ARCHITECTURE OR NUTRITION & DIETETICS OR CRYSTALLOGRAPHY OR ORTHOPEDICS OR THERMODYNAMICS OR ELECTROCHEMISTRY OR PEDIATRICS OR ENGINEERING, CIVIL OR ETHICS OR PLANT SCIENCES OR MECHANICS OR EVOLUTIONARY BIOLOGY OR PSYCHOLOGY OR PHYSICS, CONDENSED MATTER OR FOOD SCIENCE & TECHNOLOGY OR RESPIRATORY SYSTEM OR POLYMER SCIENCE OR GASTROENTEROLOGY & HEPATOLOGY OR BIOCHEMICAL RESEARCH METHODS OR LIMNOLOGY OR BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR ZOOLOGY OR INSTRUMENTS & INSTRUMENTATION) Timespan=1995-2010. Databases=SCI-EXPANDED.
TS=(telecom* AND transpar*) AND Language=(English)
Refined by: [excluding] Subject Areas=(ENGINEERING, ELECTRICAL & ELECTRONIC OR ENGINEERING, AEROSPACE OR ELECTROCHEMISTRY OR PHYSICS, ATOMIC, MOLECULAR & CHEMICAL OR ENGINEERING, INDUSTRIAL OR OPTICS OR CRYSTALLOGRAPHY OR ENGINEERING, MANUFACTURING OR PHYSICS, APPLIED OR MATERIALS SCIENCE, COATINGS & FILMS OR ENVIRONMENTAL SCIENCES OR MATERIALS SCIENCE, MULTIDISCIPLINARY OR ENVIRONMENTAL STUDIES OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR PHYSICS, MULTIDISCIPLINARY OR PHYSICS, CONDENSED MATTER OR COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE OR INSTRUMENTS & INSTRUMENTATION OR COMPUTER SCIENCE, THEORY & METHODS OR ENGINEERING, MULTIDISCIPLINARY OR MEDICINE, GENERAL & INTERNAL OR CHEMISTRY, PHYSICAL OR METALLURGY & METALLURGICAL ENGINEERING OR MATERIALS SCIENCE, CERAMICS OR POLYMER SCIENCE OR MULTIDISCIPLINARY SCIENCES OR ASTRONOMY & ASTROPHYSICS OR NUCLEAR SCIENCE & TECHNOLOGY OR INFORMATION SCIENCE & LIBRARY SCIENCE OR CHEMISTRY, INORGANIC & NUCLEAR OR ONCOLOGY OR NANOSCIENCE & NANOTECHNOLOGY OR CHEMISTRY, ORGANIC OR PHYSICS, NUCLEAR OR COMPUTER SCIENCE, HARDWARE & ARCHITECTURE OR COMPUTER SCIENCE, CYBERNETICS OR PSYCHOLOGY, MULTIDISCIPLINARY OR CHEMISTRY, MULTIDISCIPLINARY OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR SURGERY OR COMPUTER SCIENCE,

SOFTWARE ENGINEERING) Timespan=1995-2010. Databases=SCI-EXPANDED
TS=(energy AND transpar*) AND Language=(English)
Refined by: [excluding] Subject Areas=(PHYSICS, APPLIED OR CHEMISTRY, ANALYTICAL OR MINERALOGY OR MATERIALS SCIENCE, MULTIDISCIPLINARY OR ENGINEERING, MULTIDISCIPLINARY OR MATERIALS SCIENCE, BIOMATERIALS OR PHYSICS, CONDENSED MATTER OR METEOROLOGY & ATMOSPHERIC SCIENCES OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR OPTICS OR GEOSCIENCES, MULTIDISCIPLINARY OR SURGERY OR CHEMISTRY, PHYSICAL OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR EDUCATION, SCIENTIFIC DISCIPLINES OR PHYSICS, MULTIDISCIPLINARY OR ENGINEERING, CIVIL OR AGRICULTURAL ENGINEERING OR MATERIALS SCIENCE, COATINGS & FILMS OR CHEMISTRY, APPLIED OR COMPUTER SCIENCE, HARDWARE & ARCHITECTURE OR PHYSICS, ATOMIC, MOLECULAR & CHEMICAL OR ENGINEERING, INDUSTRIAL OR ENERGY & FUELS OR GEOCHEMISTRY & GEOPHYSICS OR MATERIALS SCIENCE, CHARACTERIZATION & TESTING OR ENGINEERING, ELECTRICAL & ELECTRONIC OR OPHTHALMOLOGY OR NUTRITION & DIETETICS OR NANOSCIENCE & NANOTECHNOLOGY OR ZOOLOGY OR CHEMISTRY, MULTIDISCIPLINARY OR NEUROSCIENCES OR BIOCHEMICAL RESEARCH METHODS OR PHYSICS, PARTICLES & FIELDS OR MARINE & FRESHWATER BIOLOGY OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR POLYMER SCIENCE OR MATERIALS SCIENCE, COMPOSITES OR LIMNOLOGY OR PHYSICS, NUCLEAR OR OCEANOGRAPHY OR MATHEMATICS OR ASTRONOMY & ASTROPHYSICS OR MINING & MINERAL PROCESSING OR MATERIALS SCIENCE, CERAMICS OR ECOLOGY OR AGRONOMY OR INSTRUMENTS & INSTRUMENTATION OR BIOPHYSICS OR AUTOMATION & CONTROL SYSTEMS OR NUCLEAR SCIENCE & TECHNOLOGY OR CHEMISTRY, ORGANIC OR MATERIALS SCIENCE, TEXTILES OR ENVIRONMENTAL SCIENCES OR COMPUTER SCIENCE, THEORY & METHODS OR PLANT SCIENCES OR SPECTROSCOPY OR BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR BEHAVIORAL SCIENCES OR MECHANICS OR RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING OR BIOLOGY OR CRYSTALLOGRAPHY OR DENTISTRY, ORAL SURGERY & MEDICINE OR ENGINEERING, CHEMICAL OR COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE OR THERMODYNAMICS OR ENGINEERING, MANUFACTURING OR GEOGRAPHY, PHYSICAL OR ENGINEERING, MECHANICAL OR FOOD SCIENCE & TECHNOLOGY OR IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY OR PHYSICS, FLUIDS & PLASMAS OR ENGINEERING, AEROSPACE OR PHARMACOLOGY & PHARMACY OR ELECTROCHEMISTRY OR ENGINEERING, BIOMEDICAL OR ROBOTICS OR PHYSICS, MATHEMATICAL OR MATHEMATICS, INTERDISCIPLINARY APPLICATIONS OR BIODIVERSITY CONSERVATION OR METALLURGY & METALLURGICAL ENGINEERING OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR CARDIAC & CARDIOVASCULAR SYSTEMS OR ENGINEERING, ENVIRONMENTAL OR MICROSCOPY OR COMPUTER SCIENCE, CYBERNETICS OR CHEMISTRY, INORGANIC & NUCLEAR OR ACOUSTICS OR ENVIRONMENTAL STUDIES OR COMPUTER SCIENCE, SOFTWARE ENGINEERING OR ENGINEERING, PETROLEUM) Timespan=1995-2010. Databases=SCI-EXPANDED.
TS=(road* AND transpar*) AND Language=(English)
Refined by: [excluding] Subject Areas=(ENGINEERING, ELECTRICAL & ELECTRONIC OR ECOLOGY OR ETHICS OR TRANSPORTATION SCIENCE & TECHNOLOGY OR FOOD SCIENCE & TECHNOLOGY OR ENVIRONMENTAL SCIENCES OR ENGINEERING, ENVIRONMENTAL OR LIMNOLOGY OR ENGINEERING, CIVIL OR MARINE & FRESHWATER BIOLOGY OR MATERIALS SCIENCE, CERAMICS OR OPTICS OR METEOROLOGY & ATMOSPHERIC SCIENCES OR MATERIALS SCIENCE, COMPOSITES OR NANOSCIENCE & NANOTECHNOLOGY OR MATHEMATICS, INTERDISCIPLINARY APPLICATIONS OR NUTRITION & DIETETICS OR MEDICAL ETHICS OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR PHARMACOLOGY & PHARMACY OR METALLURGY & METALLURGICAL ENGINEERING OR HEALTH CARE SCIENCES & SERVICES OR PHYSICS, ATOMIC, MOLECULAR & CHEMICAL OR MULTIDISCIPLINARY SCIENCES OR

ENGINEERING, INDUSTRIAL OR POLYMER SCIENCE OR NEUROSCIENCES OR HEALTH POLICY & SERVICES OR ACOUSTICS OR OCEANOGRAPHY OR COMPUTER SCIENCE, HARDWARE & ARCHITECTURE OR AGRICULTURAL ECONOMICS & POLICY OR OPHTHALMOLOGY OR COMPUTER SCIENCE, THEORY & METHODS OR ASTRONOMY & ASTROPHYSICS OR PERIPHERAL VASCULAR DISEASE OR ENGINEERING, MECHANICAL OR BIOLOGY OR PHYSICS, CONDENSED MATTER OR MATERIALS SCIENCE, MULTIDISCIPLINARY OR COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE OR PHYSICS, MATHEMATICAL OR COMPUTER SCIENCE, SOFTWARE ENGINEERING OR PHYSICS, MULTIDISCIPLINARY OR PHYSICS, APPLIED OR CONSTRUCTION & BUILDING TECHNOLOGY OR PHYSICS, PARTICLES & FIELDS OR SURGERY OR EDUCATION, SCIENTIFIC DISCIPLINES OR PLANT SCIENCES OR AGRICULTURAL ENGINEERING OR ELECTROCHEMISTRY OR PSYCHOLOGY, EXPERIMENTAL OR AGRICULTURE, MULTIDISCIPLINARY OR RESPIRATORY SYSTEM OR BIODIVERSITY CONSERVATION OR ENGINEERING, MULTIDISCIPLINARY OR RHEUMATOLOGY OR CHEMISTRY, MULTIDISCIPLINARY OR ENVIRONMENTAL STUDIES OR ROBOTICS OR CLINICAL NEUROLOGY OR ERGONOMICS OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS) Timespan=1995-2010. Databases=SCI-EXPANDED.
TS=(water* AND transpar*) AND Language=(English)
Refined by: [excluding] Subject Areas=(MATERIALS SCIENCE, MULTIDISCIPLINARY OR BIOPHYSICS OR BIODIVERSITY CONSERVATION OR MARINE & FRESHWATER BIOLOGY OR CRYSTALLOGRAPHY OR GEOLOGY OR CHEMISTRY, PHYSICAL OR MICROBIOLOGY OR ENVIRONMENTAL STUDIES OR POLYMER SCIENCE OR NUCLEAR SCIENCE & TECHNOLOGY OR MATERIALS SCIENCE, COMPOSITES OR ENVIRONMENTAL SCIENCES OR OPHTHALMOLOGY OR DENTISTRY, ORAL SURGERY & MEDICINE OR PHYSICS, APPLIED OR BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR ENGINEERING, PETROLEUM OR CHEMISTRY, MULTIDISCIPLINARY OR PHARMACOLOGY & PHARMACY OR SOIL SCIENCE OR OCEANOGRAPHY OR CHEMISTRY, ORGANIC OR CELL BIOLOGY OR MATERIALS SCIENCE, BIOMATERIALS OR SURGERY OR LIMNOLOGY OR SPECTROSCOPY OR COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE OR ECOLOGY OR BIOCHEMICAL RESEARCH METHODS OR COMPUTER SCIENCE, SOFTWARE ENGINEERING OR PHYSICS, CONDENSED MATTER OR ENGINEERING, CIVIL OR COMPUTER SCIENCE, THEORY & METHODS OR ENGINEERING, CHEMICAL OR BIOLOGY OR PHYSICS, PARTICLES & FIELDS OR MATERIALS SCIENCE, COATINGS & FILMS OR ENGINEERING, MULTIDISCIPLINARY OR AGRICULTURAL ENGINEERING OR NANOSCIENCE & NANOTECHNOLOGY OR ZOOLOGY OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR GEOSCIENCES, MULTIDISCIPLINARY OR ENGINEERING, BIOMEDICAL OR PHYSICS, MATHEMATICAL OR MATERIALS SCIENCE, CERAMICS OR PHYSICS, MULTIDISCIPLINARY OR PHYSICS, NUCLEAR OR ENGINEERING, ENVIRONMENTAL OR MULTIDISCIPLINARY SCIENCES OR METALLURGY & METALLURGICAL ENGINEERING OR ENGINEERING, AEROSPACE OR CHEMISTRY, ANALYTICAL OR PHYSICS, FLUIDS & PLASMAS OR MATHEMATICS, INTERDISCIPLINARY APPLICATIONS OR CHEMISTRY, APPLIED OR AGRONOMY OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR FOOD SCIENCE & TECHNOLOGY OR GEOCHEMISTRY & GEOPHYSICS OR TOXICOLOGY OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR MINERALOGY OR HORTICULTURE OR ELECTROCHEMISTRY OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR MATERIALS SCIENCE, PAPER & WOOD OR ENGINEERING, MECHANICAL OR CHEMISTRY, INORGANIC & NUCLEAR OR PHYSIOLOGY OR OPTICS OR AGRICULTURE, MULTIDISCIPLINARY OR CHEMISTRY, MEDICINAL OR FISHERIES OR IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY OR NEUROSCIENCES OR ENGINEERING, ELECTRICAL & ELECTRONIC OR REMOTE SENSING OR COMPUTER SCIENCE, HARDWARE & ARCHITECTURE OR PLANT SCIENCES OR ASTRONOMY & ASTROPHYSICS OR ENGINEERING, OCEAN OR INSTRUMENTS & INSTRUMENTATION OR FORESTRY OR EVOLUTIONARY BIOLOGY OR MECHANICS OR GEOGRAPHY, PHYSICAL OR MATHEMATICS, APPLIED OR THERMODYNAMICS OR RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING OR MINING & MINERAL PROCESSING OR PHYSICS, ATOMIC, MOLECULAR & CHEMICAL OR ACOUSTICS OR PALEONTOLOGY OR METEOROLOGY & ATMOSPHERIC SCIENCES) Timespan=1995-2010. Databases=SCI-EXPANDED.

TS=(transpor* AND transpar*) AND Language=(English)
Refined by: [excluding] Subject Areas=(PHYSICS, APPLIED OR CELL BIOLOGY OR MATERIALS SCIENCE, MULTIDISCIPLINARY OR ENGINEERING, CIVIL OR ENGINEERING, AEROSPACE OR PHYSICS, CONDENSED MATTER OR SPECTROSCOPY OR ENGINEERING, INDUSTRIAL OR CHEMISTRY, PHYSICAL OR BIOPHYSICS OR MATERIALS SCIENCE, BIOMATERIALS OR ENGINEERING, ELECTRICAL & ELECTRONIC OR CHEMISTRY, ANALYTICAL OR MATERIALS SCIENCE, COMPOSITES OR NANOSCIENCE & NANOTECHNOLOGY OR THERMODYNAMICS OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR CHEMISTRY, MULTIDISCIPLINARY OR LIMNOLOGY OR VETERINARY SCIENCES OR MATERIALS SCIENCE, COATINGS & FILMS OR ASTRONOMY & ASTROPHYSICS OR ENGINEERING, MANUFACTURING OR POLYMER SCIENCE OR PLANT SCIENCES OR ENVIRONMENTAL STUDIES OR PHYSICS, MULTIDISCIPLINARY OR PHYSICS, MATHEMATICAL OR MATHEMATICS, INTERDISCIPLINARY APPLICATIONS OR OPTICS OR METALLURGY & METALLURGICAL ENGINEERING OR MICROBIOLOGY OR NUCLEAR SCIENCE & TECHNOLOGY OR RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING OR ENVIRONMENTAL SCIENCES OR TOXICOLOGY OR ELECTROCHEMISTRY OR COMPUTER SCIENCE, HARDWARE & ARCHITECTURE OR ENGINEERING, GEOLOGICAL OR ENGINEERING, BIOMEDICAL OR MICROSCOPY OR ENGINEERING, CHEMICAL OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR MINERALOGY OR PHYSICS, ATOMIC, MOLECULAR & CHEMICAL OR PHARMACOLOGY & PHARMACY OR NEUROSCIENCES OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR COMPUTER SCIENCE, SOFTWARE ENGINEERING OR ANATOMY & MORPHOLOGY OR OPHTHALMOLOGY OR METEOROLOGY & ATMOSPHERIC SCIENCES OR CHEMISTRY, ORGANIC OR GEOSCIENCES, MULTIDISCIPLINARY OR MATHEMATICAL & COMPUTATIONAL BIOLOGY OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR BIOCHEMICAL RESEARCH METHODS OR MEDICINE, RESEARCH & EXPERIMENTAL OR OCEANOGRAPHY OR PHYSICS, PARTICLES & FIELDS OR PERIPHERAL VASCULAR DISEASE OR CRYSTALLOGRAPHY OR PHYSIOLOGY OR UROLOGY & NEPHROLOGY OR MARINE & FRESHWATER BIOLOGY OR PHYSICS, NUCLEAR OR ZOOLOGY OR MECHANICS OR CHEMISTRY, INORGANIC & NUCLEAR OR AGRICULTURAL ENGINEERING OR INSTRUMENTS & INSTRUMENTATION OR ECOLOGY OR AGRICULTURE, MULTIDISCIPLINARY OR COMPUTER SCIENCE, THEORY & METHODS OR BIOLOGY OR ENGINEERING, PETROLEUM OR ENGINEERING, ENVIRONMENTAL OR BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR GENETICS & HEREDITY OR ENGINEERING, MECHANICAL OR MATHEMATICS, APPLIED OR MATHEMATICS OR MATERIALS SCIENCE, CERAMICS OR CHEMISTRY, APPLIED OR ONCOLOGY OR PHYSICS, FLUIDS & PLASMAS OR GEOCHEMISTRY & GEOPHYSICS OR PATHOLOGY OR MULTIDISCIPLINARY SCIENCES OR GEOLOGY OR RESPIRATORY SYSTEM OR ENGINEERING, MULTIDISCIPLINARY OR FOOD SCIENCE & TECHNOLOGY OR SURGERY) Timespan=1995-2010. Databases=SCI-EXPANDED.
TS=(infra* AND regulat*) AND Language=(English)
Refined by: [excluding] Subject Areas=(BIOCHEMISTRY & MOLECULAR BIOLOGY OR ENGINEERING, CHEMICAL OR ENGINEERING, MULTIDISCIPLINARY OR NEUROSCIENCES OR ZOOLOGY OR MICROBIOLOGY OR ENVIRONMENTAL SCIENCES OR INSTRUMENTS & INSTRUMENTATION OR NUCLEAR SCIENCE & TECHNOLOGY OR ASTRONOMY & ASTROPHYSICS OR CLINICAL NEUROLOGY OR NUTRITION & DIETETICS OR POLYMER SCIENCE OR PHYSICS, CONDENSED MATTER OR ENGINEERING, CIVIL OR GEOSCIENCES, MULTIDISCIPLINARY OR COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE OR METEOROLOGY & ATMOSPHERIC SCIENCES OR BIOCHEMICAL RESEARCH METHODS OR DERMATOLOGY OR CELL BIOLOGY OR PERIPHERAL VASCULAR DISEASE OR HEALTH POLICY & SERVICES OR BIOPHYSICS OR MULTIDISCIPLINARY SCIENCES OR HEMATOLOGY OR ENGINEERING, ELECTRICAL & ELECTRONIC OR ECOLOGY OR AGRONOMY OR PHYSIOLOGY OR CHEMISTRY, APPLIED OR ANESTHESIOLOGY OR CHEMISTRY, PHYSICAL OR SPECTROSCOPY OR PARASITOLOGY OR PHYSICS, PARTICLES & FIELDS OR GEOGRAPHY, PHYSICAL OR PHARMACOLOGY & PHARMACY OR MEDICINE, RESEARCH & EXPERIMENTAL OR MATERIALS SCIENCE, MULTIDISCIPLINARY OR RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING OR PHYSICS, NUCLEAR OR INFORMATION SCIENCE & LIBRARY SCIENCE OR ONCOLOGY OR PSYCHIATRY OR PLANT SCIENCES OR MATERIALS SCIENCE, BIOMATERIALS OR

ENGINEERING, ENVIRONMENTAL OR MEDICINE, GENERAL & INTERNAL OR CHEMISTRY, ANALYTICAL OR PHYSICS, MULTIDISCIPLINARY OR IMMUNOLOGY OR CARDIAC & CARDIOVASCULAR SYSTEMS OR OPHTHALMOLOGY OR CHEMISTRY, MULTIDISCIPLINARY OR COMPUTER SCIENCE, THEORY & METHODS OR PHYSICS, ATOMIC, MOLECULAR & CHEMICAL OR ENVIRONMENTAL STUDIES OR GENETICS & HEREDITY OR AGRICULTURE, MULTIDISCIPLINARY OR SURGERY OR ENGINEERING, INDUSTRIAL OR DEVELOPMENTAL BIOLOGY OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR TOXICOLOGY OR EDUCATION, SCIENTIFIC DISCIPLINES OR BEHAVIORAL SCIENCES OR MEDICAL INFORMATICS OR FOOD SCIENCE & TECHNOLOGY OR ELECTROCHEMISTRY OR HEALTH CARE SCIENCES & SERVICES OR MARINE & FRESHWATER BIOLOGY OR THERMODYNAMICS OR BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR PEDIATRICS OR AUTOMATION & CONTROL SYSTEMS OR ENGINEERING, BIOMEDICAL OR VETERINARY SCIENCES OR COMPUTER SCIENCE, HARDWARE & ARCHITECTURE OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR INFECTIOUS DISEASES OR ENDOCRINOLOGY & METABOLISM OR SPORT SCIENCES OR RESPIRATORY SYSTEM OR PHYSICS, APPLIED OR ENGINEERING, MECHANICAL OR CRITICAL CARE MEDICINE OR BIOLOGY) Timespan=1995-2010. Databases=SCI-EXPANDED.
TS=(infra* AND competition) AND Language=(English)
Refined by: [excluding] Subject Areas=(CHEMISTRY, PHYSICAL OR COMPUTER SCIENCE, THEORY & METHODS OR BEHAVIORAL SCIENCES OR ENVIRONMENTAL STUDIES OR BIODIVERSITY CONSERVATION OR INFORMATION SCIENCE & LIBRARY SCIENCE OR ASTRONOMY & ASTROPHYSICS OR BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR PHYSICS, ATOMIC, MOLECULAR & CHEMICAL OR CHEMISTRY, ORGANIC OR ENGINEERING, ENVIRONMENTAL OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR ENGINEERING, ELECTRICAL & ELECTRONIC OR BIOPHYSICS OR MATERIALS SCIENCE, MULTIDISCIPLINARY OR ENGINEERING, MULTIDISCIPLINARY OR ENGINEERING, BIOMEDICAL OR PHYSICS, CONDENSED MATTER OR COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE OR ENGINEERING, MECHANICAL OR ENVIRONMENTAL SCIENCES OR PHYSICS, MULTIDISCIPLINARY OR GEOCHEMISTRY & GEOPHYSICS OR PHYSICS, APPLIED OR COMPUTER SCIENCE, HARDWARE & ARCHITECTURE OR HEALTH POLICY & SERVICES OR POLYMER SCIENCE OR NANOSCIENCE & NANOTECHNOLOGY OR NEUROSCIENCES OR CHEMISTRY, MULTIDISCIPLINARY OR CHEMISTRY, INORGANIC & NUCLEAR OR NUTRITION & DIETETICS OR PARASITOLOGY OR FISHERIES OR PHYSICS, MATHEMATICAL OR ECOLOGY OR CHEMISTRY, APPLIED OR SPORT SCIENCES OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR AGRICULTURE, MULTIDISCIPLINARY OR ENGINEERING, CIVIL OR GEOSCIENCES, MULTIDISCIPLINARY OR ENGINEERING, MANUFACTURING OR ENGINEERING, AEROSPACE OR MARINE & FRESHWATER BIOLOGY OR FOOD SCIENCE & TECHNOLOGY OR GEOGRAPHY, PHYSICAL OR FORESTRY OR MATERIALS SCIENCE, BIOMATERIALS OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR HEALTH CARE SCIENCES & SERVICES OR MEDICINE, RESEARCH & EXPERIMENTAL OR MULTIDISCIPLINARY SCIENCES OR PHARMACOLOGY & PHARMACY OR OPTICS OR SOIL SCIENCE OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR MATERIALS SCIENCE, COATINGS & FILMS OR BIOCHEMICAL RESEARCH METHODS OR CELL BIOLOGY OR COMPUTER SCIENCE, SOFTWARE ENGINEERING OR ENGINEERING, PETROLEUM OR AGRONOMY OR INSTRUMENTS & INSTRUMENTATION OR IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY OR CHEMISTRY, ANALYTICAL OR NUCLEAR SCIENCE & TECHNOLOGY OR MATERIALS SCIENCE, CERAMICS OR ENGINEERING, CHEMICAL OR AGRICULTURAL ECONOMICS & POLICY OR ENGINEERING, INDUSTRIAL OR CRYSTALLOGRAPHY OR MEDICINE, GENERAL & INTERNAL OR SPECTROSCOPY OR METEOROLOGY & ATMOSPHERIC SCIENCES OR MINERALOGY OR ZOOLOGY OR OCEANOGRAPHY OR ORNITHOLOGY OR PLANT SCIENCES OR PHYSICS, FLUIDS & PLASMAS OR PHYSICS, PARTICLES & FIELDS OR SURGERY OR RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING OR ELECTROCHEMISTRY OR AUTOMATION & CONTROL SYSTEMS OR THERMODYNAMICS) Timespan=1995-2010. Databases=SCI-EXPANDED.

TS=(infra* AND private sector participation) AND Language=(English)
Refined by: [excluding] Subject Areas=(ENGINEERING, ENVIRONMENTAL OR ENGINEERING, CIVIL OR IMMUNOLOGY OR ENVIRONMENTAL SCIENCES OR AGRICULTURE, MULTIDISCIPLINARY OR INFECTIOUS DISEASES OR ENVIRONMENTAL STUDIES OR INFORMATION SCIENCE & LIBRARY SCIENCE OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR MULTIDISCIPLINARY SCIENCES OR ECOLOGY OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR ENGINEERING, CHEMICAL OR ENGINEERING, INDUSTRIAL OR ENGINEERING, ELECTRICAL & ELECTRONIC OR VIROLOGY) Timespan=1995-2010. Databases=SCI-EXPANDED
TS=(infra* AND reform*) AND Language=(English)
Refined by: [excluding] Subject Areas=(CHEMISTRY, PHYSICAL OR AGRONOMY OR PHYSICS, FLUIDS & PLASMAS OR ENERGY & FUELS OR COMPUTER SCIENCE, THEORY & METHODS OR PHYSICS, PARTICLES & FIELDS OR ENGINEERING, CHEMICAL OR MULTIDISCIPLINARY SCIENCES OR CLINICAL NEUROLOGY OR ENVIRONMENTAL SCIENCES OR PHYSICS, MULTIDISCIPLINARY OR CONSTRUCTION & BUILDING TECHNOLOGY OR HEALTH CARE SCIENCES & SERVICES OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR ENGINEERING, PETROLEUM OR PHYSICS, ATOMIC, MOLECULAR & CHEMICAL OR MATERIALS SCIENCE, COATINGS & FILMS OR IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY OR HEALTH POLICY & SERVICES OR POLYMER SCIENCE OR MATERIALS SCIENCE, CERAMICS OR ASTRONOMY & ASTROPHYSICS OR RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING OR MATHEMATICS, APPLIED OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR AGRICULTURE, MULTIDISCIPLINARY OR NURSING OR ELECTROCHEMISTRY OR CHEMISTRY, ANALYTICAL OR OTORHINOLARYNGOLOGY OR CHEMISTRY, APPLIED OR ENGINEERING, MULTIDISCIPLINARY OR PHARMACOLOGY & PHARMACY OR GEOSCIENCES, MULTIDISCIPLINARY OR PSYCHIATRY OR MEDICINE, GENERAL & INTERNAL OR HISTORY & PHILOSOPHY OF SCIENCE OR BIOCHEMICAL RESEARCH METHODS OR ENGINEERING, ENVIRONMENTAL OR MEDICAL INFORMATICS OR BIOLOGY OR ENGINEERING, CIVIL OR MEDICINE, RESEARCH & EXPERIMENTAL OR EDUCATION & EDUCATIONAL RESEARCH OR NANOSCIENCE & NANOTECHNOLOGY OR GEOCHEMISTRY & GEOPHYSICS OR INFORMATION SCIENCE & LIBRARY SCIENCE OR SPECTROSCOPY OR GEOGRAPHY, PHYSICAL OR MATERIALS SCIENCE, MULTIDISCIPLINARY OR SURGERY OR GERIATRICS & GERONTOLOGY OR CHEMISTRY, INORGANIC & NUCLEAR OR MATHEMATICS, INTERDISCIPLINARY APPLICATIONS OR ECOLOGY OR MEDICAL LABORATORY TECHNOLOGY OR ENVIRONMENTAL STUDIES OR ETHICS OR NUCLEAR SCIENCE & TECHNOLOGY OR MEDICINE, LEGAL OR ONCOLOGY OR CHEMISTRY, MULTIDISCIPLINARY OR OPTICS OR PHYSICS, APPLIED OR PHYSICS, NUCLEAR OR PERIPHERAL VASCULAR DISEASE OR PHYSICS, CONDENSED MATTER OR REMOTE SENSING OR PHYSICS, MATHEMATICAL OR FOOD SCIENCE & TECHNOLOGY OR PLANT SCIENCES OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR STATISTICS & PROBABILITY OR THERMODYNAMICS OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR URBAN STUDIES OR NUTRITION & DIETETICS OR ENGINEERING, INDUSTRIAL OR EDUCATION, SCIENTIFIC DISCIPLINES OR IMMUNOLOGY OR ANATOMY & MORPHOLOGY OR ENGINEERING, ELECTRICAL & ELECTRONIC OR LAW OR AUTOMATION & CONTROL SYSTEMS OR ENGINEERING, MECHANICAL OR MECHANICS OR BIODIVERSITY CONSERVATION OR INSTRUMENTS & INSTRUMENTATION OR MEDICAL ETHICS OR BIOPHYSICS OR METEOROLOGY & ATMOSPHERIC SCIENCES) Timespan=1995-2010. Databases=SCI-EXPANDED
TS=(infra* AND accountability) AND Language=(English)
Refined by: [excluding] Subject Areas=(HEALTH CARE SCIENCES & SERVICES OR ENGINEERING, BIOMEDICAL OR FORESTRY OR ENGINEERING, INDUSTRIAL OR GEOSCIENCES, MULTIDISCIPLINARY OR MEDICINE, GENERAL & INTERNAL OR ETHICS OR HEMATOLOGY OR ENGINEERING, CIVIL OR

INFORMATION SCIENCE & LIBRARY SCIENCE OR IMMUNOLOGY OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR MEDICAL ETHICS OR INTEGRATIVE & COMPLEMENTARY MEDICINE OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR SURGERY OR LAW OR EDUCATION, SCIENTIFIC DISCIPLINES OR MEDICINE, LEGAL OR ENVIRONMENTAL SCIENCES OR NUCLEAR SCIENCE & TECHNOLOGY OR HEALTH POLICY & SERVICES OR AGRONOMY OR OBSTETRICS & GYNECOLOGY OR COMPUTER SCIENCE, HARDWARE & ARCHITECTURE OR BIOPHYSICS OR ORTHOPEDICS OR MEDICAL INFORMATICS OR CHEMISTRY, ANALYTICAL OR REHABILITATION OR ONCOLOGY OR CHEMISTRY, PHYSICAL OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR SOCIAL SCIENCES, BIOMEDICAL OR ENVIRONMENTAL STUDIES OR ENERGY & FUELS OR SPECTROSCOPY OR PEDIATRICS OR ENGINEERING, CHEMICAL OR SPORT SCIENCES OR RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING OR ENGINEERING, ELECTRICAL & ELECTRONIC OR ENGINEERING, ENVIRONMENTAL OR TOXICOLOGY OR COMPUTER SCIENCE, SOFTWARE ENGINEERING OR ENGINEERING, MECHANICAL OR TRANSPLANTATION OR ECOLOGY OR ENGINEERING, PETROLEUM OR VETERINARY SCIENCES) Timespan=1995-2010. Databases=SCI-EXPANDED
TS=(infra* AND governance) AND Language=(English)
Refined by: [excluding] Subject Areas=(ENVIRONMENTAL SCIENCES OR NUTRITION & DIETETICS OR PHARMACOLOGY & PHARMACY OR COMPUTER SCIENCE, INFORMATION SYSTEMS OR AGRICULTURAL ECONOMICS & POLICY OR SOCIAL SCIENCES, BIOMEDICAL OR INFORMATION SCIENCE & LIBRARY SCIENCE OR CELL BIOLOGY OR BIOCHEMISTRY & MOLECULAR BIOLOGY OR CONSTRUCTION & BUILDING TECHNOLOGY OR BIODIVERSITY CONSERVATION OR ENVIRONMENTAL STUDIES OR FOOD SCIENCE & TECHNOLOGY OR BIOLOGY OR MEDICINE, GENERAL & INTERNAL OR HEALTH POLICY & SERVICES OR COMPUTER SCIENCE, CYBERNETICS OR ENGINEERING, CIVIL OR METEOROLOGY & ATMOSPHERIC SCIENCES OR DEVELOPMENTAL BIOLOGY OR EDUCATION & EDUCATIONAL RESEARCH OR HEALTH CARE SCIENCES & SERVICES OR COMPUTER SCIENCE, SOFTWARE ENGINEERING OR ENGINEERING, MECHANICAL OR ECOLOGY OR GEOGRAPHY OR GENETICS & HEREDITY OR ENGINEERING, ENVIRONMENTAL OR MEDICINE, RESEARCH & EXPERIMENTAL OR LIMNOLOGY OR AGRICULTURE, MULTIDISCIPLINARY OR MEDICINE, LEGAL OR BIOTECHNOLOGY & APPLIED MICROBIOLOGY OR MULTIDISCIPLINARY SCIENCES OR PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH OR OBSTETRICS & GYNECOLOGY OR COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE OR OTORHINOLARYNGOLOGY OR ENGINEERING, INDUSTRIAL OR EDUCATION, SCIENTIFIC DISCIPLINES OR PEDIATRICS OR ENGINEERING, ELECTRICAL & ELECTRONIC OR ENGINEERING, AEROSPACE OR PSYCHIATRY OR MEDICAL INFORMATICS OR ENGINEERING, MANUFACTURING OR REMOTE SENSING OR AGRONOMY OR ENGINEERING, MULTIDISCIPLINARY OR COMPUTER SCIENCE, THEORY & METHODS OR GEOGRAPHY, PHYSICAL OR SOCIAL SCIENCES, INTERDISCIPLINARY OR HISTORY & PHILOSOPHY OF SCIENCE OR SURGERY OR COMPUTER SCIENCE, INTERDISCIPLINARY APPLICATIONS OR NUCLEAR SCIENCE & TECHNOLOGY OR TOXICOLOGY OR NURSING OR GEOSCIENCES, MULTIDISCIPLINARY OR PATHOLOGY OR VETERINARY SCIENCES) Timespan=1995-2010. Databases=SCI-EXPANDED.

While we understood that there would be overlaps between the different databases (particularly EBSCO and ProQuest), we included all the above in our searches to ensure that we would not miss any relevant study.

Table A2.1.4 indicates the search phrases used in the different databases and Table A2.1.5 indicates the type of documents that were captured from the search. In order to cast the net wide and capture as many relevant studies as possible, the 'all available' option was chosen for the type of documents in the databases except for EBSCO and ProQuest. In EBSCO, the

captured documents were articles, reports, case studies and working papers (with available references), and in ProQuest, working papers, dissertations and scholarly journals. Publication types were also different for each database. In ScienceDirect, the publication types were journals and books; in EBSCO, they were academic journals, books and primary source documents (with available references); in ProQuest, they were all type of publications except newspapers; in Emerald, they were journals and books; and in Web of Knowledge, all types of publication were captured.

Table A2.1.4: Search phrases used for different databases

Database	Search phrase
ScienceDirect	(infra* or utilit* or energy or road* or water* or transpor* or telecom*) and (transpar* or corruption or regulat* or competition or reform* or accountability or governance)
EBSCO	(infra* or utilit* or energy or road* or water* or transpor* or telecom*) and (transpar* or corruption or regulat* or competition or reform* or accountability or governance)
ProQuest (Business ABI/INFORM Global)	(infra* or utilit* or energy or road* or water* or transpor* or telecom*) and (transpar* or corruption or regulat* or competition or reform* or accountability or governance)
Emerald	infra* AND transpar*, utilit* AND transpar*, telecom* AND transpar*, energy AND transpar*, water* AND transpar*, transpor* AND transpar*, infra* AND regulat*, infra* AND private sector participation, infra* AND reform*, infra* AND accountability
Web of Knowledge	infra* AND transpar*, utilit* AND transpar*, telecom* AND transpar*, road* AND transpar*, energy AND transpar*, water* AND transpar*, transpor* AND transpar*, infra* AND regulat*, infra* AND competition, infra* AND private sector participation, infra* AND reform*, infra* AND accountability, infra* AND governance

Note: The search phrases were modified after the protocol stage, to keep the search results manageable while ensuring that we did not miss any potential studies. The Boolean operators used in the search ensured that our searches resulted in a large number of hits.

Table A2.1.5: Document and publication types searched in different databases

Sources	Subjects	Document type	Publication type
ScienceDirect	Business, management and accounting, economics, econometrics and finance, social sciences	All	Journals and books
EBSCO	All	Article, report, case study,	Academic journal, book, primary source document (with available

		working papers (with available references)	references)
ProQuest (Business ABI/INFORM Global)	All	Working papers, dissertations, scholarly journals	All (except newspapers)
Emerald	All	All	Journals and books
Web of Knowledge	All	All	All

Appendix 2.2: Coding tool used to extract study information

Coding tool

Title:	**Year:**
Author(s):	**Source:**

Section I: Study aims, rationale and focus

		Tick Relevant	Details
1	What are the broad aims of the study? *(Please write in authors' description if there is one. Elaborate if necessary, but indicate which aspects are reviewers' interpretations. Other, more specific questions about the research questions and hypotheses are asked later.)*	☐ Explicitly stated ☐ Implicit ☐ Not stated/unclear	
2	Was the study informed by, or linked to, an existing body of empirical and/or theoretical research? *(Please write in authors' description if there is one. Elaborate if necessary, but indicate which aspects is reviewers' interpretation.)*	☐ Explicitly stated ☐ Implicit ☐ Not stated/unclear	
3	Do authors report how the study was funded?	☐ Explicitly stated ☐ Implicit ☐ Not stated/unclear	
4	When was the study carried out? Also, if applicable, what is the data period of study? *(If the authors give a year, or range of years, then put that in. If not, give a 'not later than' date by looking for a date of first submission to the journal, or for clues like the publication dates of other reports from the study.)*	☐ Explicitly stated ☐ Implicit ☐ Not stated/unclear	
5	What are the study research questions and/or hypotheses? *(Research questions or hypotheses operationalise the aims of the study. Please write in authors' description if there is one. Elaborate if necessary, but indicate which aspects are reviewers' interpretations.)*	☐ Explicitly stated ☐ Implicit ☐ Not stated/unclear	

Section II: Study identification

		Tick and Give Details where Relevant			
6	Identification of report (or reports)	☐ Website citation ☐ Contact ☐ Hand search ☐ Electronic database ☐ Unknown			
7	Status	☐ Published ☐ In press ☐ Unpublished ☐ Not known			
8	Linked reports	☐ Not linked ☐ Linked ☐ Not known			
9	Please specify the countries in which the study was carried out.	South America / Africa / Asia / Europe / Central and North America (including Caribbean) Others/ Not Stated			
10	Sector coverage. If the study is on a particular segment, please specify	Water, Sanitation and Solid Waste Mgmt	Yes / No	Segment	Sample Details
		Energy	Yes / No		
		Transport	Yes / No		
		Telecom	Yes / No		
		Others	Yes / No		
11	Main assumptions of the study				

Section III: Programme or intervention description

		Tick Relevant	Details
12	If an intervention is being studied, does it have a formal name?	☐ Not applicable (no programme or intervention) ☐ Yes ☐ No ☐ Not stated/ unclear	
13	Aim(s) of the intervention	☐ Not stated ☐ Not explicitly stated (Write in, as worded by the reviewer) ☐ Stated (Write in, as stated by the authors)	
14	Has the study stated the causal pathways or theory of change for the intervention?	☐ Not stated ☐ Not explicitly stated ☐ Stated	
15	How long has it been since the intervention was implemented?	☐ Not stated/unclear ☐ Not applicable ☐ > 2 years ☐ 2-5 years ☐ < 5 years	
16	Nature of intervention *(You can tick more than one where appropriate.)*	☐ Not stated ☐ Unclear ☐ Project level ☐ Sector level ☐ Macro level	

Section IV: Results and conclusions

		Tick and give details where relevant				
17	Indicator(s)/outcomes captured (continue at the end of the questionnaire if space is not sufficient)	Sector	Outcome area	Indicator	Finding	Significance level
18	What do the author(s) conclude about the findings of the study?					
19	What are the limitations of the study?	☐ Not stated ☐ Not explicitly stated ☐ Stated				

Section V: Study method

		Tick relevant	Details
20	Study timing *(Please indicate all that apply and give further details where possible.)*	☐ Cross-sectional ☐ Panel data ☐ Longitudinal ☐ Before-after ☐ Only after ☐ Not stated/unclear ☐ Any other	
21	What is the overall design and method of the study? *(Please tick all relevant.)*	☐ Quantitative ☐ Qualitative ☐ Both ☐ Other	

Section VI: Methods - data collection

		Tick and give details where relevant	
22	Which methods were used to collect the data? Is it primary or secondary data? *(Please indicate all that apply and give further detail where possible.)*		
23	Details of data collection instruments or tool(s)? Please specify all sources of data given in the study. *(Please provide details including names for all tools used to collect data, and examples of any questions/items given. Also, please state whether source is cited in the report.)*	☐ Explicitly stated ☐ Implicit ☐ Not stated/ unclear	
24	Data period	☐ Explicitly stated ☐ Implicit ☐ Not stated/unclear	

Section VII: Methods - data analysis

		Tick relevant	Details
25	What methods were used to analyse the data?	☐ Explicitly stated ☐ Implicit ☐ Not stated/unclear	
26	Do the authors describe strategies used in the analysis to control for bias from confounding variables?	☐ Yes ☐ No ☐ Not applicable	
27	Do the authors describe any ways they have addressed the repeatability or reliability of data analysis? *(e.g. using more than one researcher to analyse data, looking for negative cases.*)	☐ Yes ☐ No ☐ Not applicable	

CRITICAL APPRAISAL QUESTIONS
Section VIII: Quality of study – reporting

		Tick relevant	Details
28	Is the context of the study adequately described? *(Consider your previous answers to questions on study aims & objectives.*)	☐ Yes ☐ No	

29	Are the aims of the study clearly reported?	☐ Yes ☐ No	
30	Is there an adequate description of the data sources?	☐ Yes ☐ No	

31	Is there an adequate description of the methods of data analysis?	☐ Yes ☐ No	
32	Do the authors avoid selective reporting bias? *(e.g. do they report on all variables they aimed to study, as specified in their aims/research questions?)*	☐ Yes ☐ No	

Section IX: Quality of the study – methods

		Tick relevant	Details
33	Was the choice of research design appropriate for addressing the research question(s) posed?	☐ Yes ☐ No	
34	The research design and methods employed are able to rule out any other sources of error/bias which alternative explanations would lead to the findings of the study.	☐ Yes ☐ No	
35	The study results are widely generalised?	☐ Yes ☐ No	
36	The reviewers reasonably agree with the authors over the findings or conclusions of the study.	☐ Yes ☐ No	

Section X: Overall assessment of the study

37	What is the overall quality of the study? *(taking into account all the quality assessment issues*)*	☐ High (quality) ☐ Medium (quality) ☐ Low (quality)	For Qs. 28 to 36: Yes = 1; No = 0. Scores obtained from the summation of the responses from Qs. 28 to 36 would be used for determining the overall quality of the study. The rating criteria is as follows: Score >6, high quality; >3, medium quality; ≤3, low quality
38	Reason(s) for inclusion		

Appendix 2.3: Characterisation of studies included for in-depth review

Alexeeva, V., Padam, G., Queiroz, C. (2008). Monitoring road works contracts and unit costs for enhanced governance in sub-Saharan Africa, World Bank Transport Papers, TP 21.	
Country/Countries of study	13 countries in Sub- Saharan Africa, 22 projects and a total of 185 contracts financed by the World Bank
Data period	1999- 2007
Type of study	Descriptive quantitative
Aims of study	• "establish a framework for cross- country comparisons of the procurement processes and implementation of road works contracts in Bank- funded projects" (p3) • "To develop a list of quantitative indicators to recognize and track vulnerabilities to corruption in road sector projects of the World Bank" (p2) • "… facilitate measurement of the performance of road works contracting in projects financed by the Bank"(p2)
Summary of study design, including details of sample	The study uses OLS regression to identify parameters that were outside of the project, but might have influenced unit costs.
Data sources and data collection instruments	Data has been gathered from the contracts procurement and implementation documentation of the World Bank funded project in these countries
Methods used to analyze data, including details of checks on reliability and validity	The study develops a set of indicators that broadly attempt to calculate the difference between contract values and engineers estimates, the cost and time overruns as well as bidding statistics for contracts. A series of red flags was developed based on these indicators and they were compared to check if they exhibit a pattern of indicators consistent with the presence of allegations of corruption and fraud.
Summary of results	• Quality of governance had a significant impact on the unit costs • For asphalt concrete road works as well as gravel subbase road works, both the WB governance indicator as well as TI corruptions perceptions index are statistically significant and negative (p33) • For Portland cement concrete road works, the TI corruptions perception index is statistically significant and negative (p33)
Conclusion	• "Capturing costs and unit price information of road works is important for evaluation of the trends across countries and regions" (p42) • "Assessing bidding behavior is essential... as an important tool for the procurement decisions." "Detailed bidding data could facilitate… if the procurement process is affected by collusion and bid rigging". (p42) • "Measuring performance more consistently would help to address inefficiencies" (p42)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • The portion on transparency is a very small part of the whole study
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • The OLS regression done to test whether cost overruns are affected by factors including governance and transparency, are also relevant • Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3)	High

(relevance of focus of study to review)	• Transparency and governance are explicitly considered as a part of the study
Weight of evidence (4) (overall weight of evidence)	Medium Overall, a good study on the transport sector. It uses a good dataset and covers transparency explicitly

Alcazar, L., Nakasone, E., Torero, M. (2008). Learning from an incomplete electricity privatisation process in rural Peru. Chong, A. (Eds.), Privatisation for the Public Good? (pp.163-203.). Chapter: 7, Inter-American Development Bank.	
Country/Countries of study	Peru
Data period	2005
Type of study	Quantitative and Qualitative
Aims of study	• to compare the differences in welfare between people with private provision of electricity and people in regions where electricity companies are not privatized • to examine other indirect impacts such as the type of energy sources used by consumers in privatized versus non privatized areas, the effects of better quality of electricity service on time devoted to non-agricultural activities and the effects on time devoted to economic and non economic activities of rural households
Summary of study design, including details of sample	The survey conducted in Peru includes two components: population centers (communities) in each dominion of the study (446), and 6690 households
Data sources and data collection instruments	Primary data; Survey conducted during June and July 2005 in the 24 departments of Peru
Methods used to analyze data, including details of checks on reliability and validity	Summary statistics and Econometric analysis; the framework serving as a guideline to the empirical analysis is the Roy-Rubin model
Summary of results	"…there is significant improvement in the quality of the provision of electricity when the distribution firms are managed by the private sector." (p197) "…improvements in the quality and supply of electricity provision yield some efficiency gains in terms of the time allocation of the working labor force that can directly be linked to the use of electricity." (p197)
Conclusion	Privatisation improves the provision of electricity and the operating and financial performance of firms
Weight of evidence (1) (trustworthiness in relation to study question)	High • Transparency is explicit • Selective reporting bias has been avoided • Results are validated with other research paper findings
Weight of evidence (2) (appropriateness of research design and analysis)	High • The research design is appropriate for the study; the methodology uses the available data to deliver the necessary results. • Strong attribution of causality to the intervention
Weight of evidence (3) (relevance of focus of study to review)	High The focus of the study is on privatisation of electricity and its efficiency. The results are widely generalisable
Weight of evidence (4) (overall weight of evidence)	High • Overall a good paper which clearly states that privatisation is the key to performance and efficiency • Though the study is done in a specific context, the robust design makes the results widely generalisable

Anaya, L. K. (2010). The restructuring and privatisation of the Peruvian electricity distribution market, Electricity Policy Research Group, University of Cambridge Working Paper 1009.	
Country/Countries of study	Peru
Data period	Two periods between 1986- 1999 and 2000- 2007
Type of study	Quantitative
Aims of study	• "Measure the social welfare of restructuring and privatisation of the (electricity) distribution market" (p2) • "Quality issues such as distribution losses and number and duration of interruptions… with reference to both private and public distribution companies" (p2)
Summary of study design, including details of sample	Panel Data
Data sources and data collection instruments	The data is from the financial statement of the two electricity companies (Electrolima and Electro Sur Medio), obtained from the Annual Reports of the Electricity Tariff Commission (period 1986- 1999) and OSINERGMIN (2000- 2007)
Methods used to analyze data, including details of checks on reliability and validity	It uses the methodology of Jones et al. (1990) in order to calculate the changes in social welfare due to privatisation. The study creates a counterfactual scenario to test if there have been improvements in welfare post restructuring and privatisation
Summary of results	• "There is a total net efficiency gains (including future gains) equal to US$ 213.5 million in real terms and a gain of US$ 137.8 million upto 2007". (p17) These gains are sensitive to the size of the market • "… prices under private ownership would be in average 8.6 per cent higher than under public ownership" (p19) • "In 1993 the nationwide coverage was 57% and at the end of 2007 around 80% of the population had electricity" (p21) • "… quality indicators such as number and duration of interruptions per customer… dropped… 64.4% and 58.2% respectively for the period 1995- 2001" (p25)
Conclusion	• "The privatization of the electricity distribution market was worthwhile and amounts to US$ 542 million in 2007 prices, relative to the central-case scenario at 7.3% discount rate." (p31) • "During the period 1995- 99, the number of household connections increased at 6% p.a." (p31) • "Government and producers benefited the most, and consumers the least." (p31)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Transparency is mediated through a sector level intervention: privatization
Weight of evidence (2) (appropriateness of research design and analysis)	Low • It is a tested methodology that is used (Jones et al, 1990) • The selection of the central case is based on a single company rather than an average of all public companies or some other suitable method • Use of counterfactual scenarios rather than actual evidence
Weight of evidence (3) (relevance of focus of study to review)	High • The study looks at the social welfare implications of privatisation on the electricity distribution market • Intervention analyzed in the paper is appropriate for the review

Weight of evidence (4) (overall weight of evidence)	Medium • Overall, a study that uses an established methodology to test if there are gains in the Peruvian electricity market • It finds a strong link between privatisation and an increase in social welfare, though benefits for consumer not necessarily positive

Anbarci, N., Escaleras, M., Register, A. C. (2009). The Ill effects of public sector corruption in the water and sanitation sector, Land Economics, 85(2), pp. 363-377.	
Country/Countries of study	85 Countries in South America, Africa, Asia, Europe
Data period	4 different years: 1990, 1995, 2000, 2004
Type of study	Quantitative
Aims of study	• What are the negative effects of corruption in the water and sanitation sector? • "… does … corruption… lead to lower levels of provision of clean drinking water and adequate sanitation?" p367
Summary of study design, including details of sample	Data pertaining to improved drinking water and adequate sanitation of 85 countries
Data sources and data collection instruments	Secondary; International Country Risk Guide (ICRG), published by Political Risk Services Group, World development Indicators by the World Bank etc
Methods used to analyze data, including details of checks on reliability and validity	Regression
Summary of results	"… public sector corruption has deleterious effects in the water and sanitation sector… In the case of water provision… corruption is statistically significant only when it is lagged 4 to 6 years or better… the marginal effect of corruption… ranges from 3.2 to 3.8% when the focus is on adequate sanitation" (p373)
Conclusion	"Public sector corruption… reduces a population's access to clean water and adequate sanitation at any level of income… " (p373)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is implicit
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design is appropriate and each variable is analyzed in detail. • Quality of data included is an issue. Only four different years are taken for the study. • Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High The focus of study is on the effects of corruption on water and sanitation conditions which has been dealt with clearly.
Weight of evidence (4) (overall weight of evidence)	Medium A good study that links corruption to outcomes in the water and sanitation sector

Andres, L., Foster, V., Gausch, L. J. (2006). The impact of privatisation on the performance of the infrastructure sector: The case of electricity distribution in Latin American countries, World Bank Policy Research Working Paper 3936.	
Country/Countries of study	Argentina, Bolivia, Brazil, Chile, Columbia, El Salvador, Guatemala, Nicaragua, Panama and Peru
Data period	1103 firm years 98 of the 116 firms have information of previous three years
Type of study	Quantitative
Aims of study	" to study the impact of privatisation on the distribution of electricity sector… a broader range of indicators is evaluated, including indicators of output, efficiency, labour productivity, quality, coverage and prices… identifies the short and long run effects of privatisation… the counterfactual is accounted for and measured against the factual" p 2
Summary of study design, including details of sample	Used firm level data from different regulatory agencies in each country (10 countries)
Data sources and data collection instruments	Secondary data; official data reported by firms to their investors and statistical reports of the regulator agencies of each country. Furthermore, information was requested from each firm as well as from each regulatory office. Additional sources used include OLADE (Latin American Organisation of Energy) publications and data from different government offices
Methods used to analyze data, including details of checks on reliability and validity	Descriptive and Regression
Summary of results	"… levels of residential connections showed an increase from the pure public to pure private" ownership context (p14). "… important reduction in the number of employees was clearly observed… labour productivity showed improvements… while distributional losses was 5.5% per year during the transition…" (p15)
Conclusion	"The results suggest that changes in ownership caused significant improvements in labor productivity, efficiency, and product/service quality in the near term. However, the improvements do not appear as remarkable two years after the change in ownership". (p25)
Weight of evidence (1) (trustworthiness in relation to study question)	High • Aims and objectives clearly stated • The study examines a research topic that is appropriate for this review
Weight of evidence (2) (appropriateness of research design and analysis)	High The research design is appropriate; adequately uses suitable controls while doing the analysis; findings from other studies prove the validity of results; Use of instrumental variables to overcome endogeneity issues
Weight of evidence (3) (relevance of focus of study to review)	High The focus is on an intervention (privatisation); the results to an extent is fairly generalisable
Weight of evidence (4) (overall weight of evidence)	High A good paper with interesting results

Andres, L., Guash, L. J., Straub, S. (2007). Do regulation and institutional design matter for infrastructure performance? World Bank Policy Research Working Paper 4378.	
Country/Countries of study	Latin American countries
Data period	from late 1980s to early 2000s
Type of study	Quantitative
Aims of study	The study tries add to the literature on regulation by "testing the impact of regulation from three different angles (a) on aligning costs with tariffs - firms profitability (b) on reducing/deterring opportunistic renegotiation, and (c) on its effect on productivity, quality of service, coverage and price" p4.
Summary of study design, including details of sample	181 firms extensive data set of about 1000 concessions granted in Latin America from late 1980s to the early 2000s
Data sources and data collection instruments	Secondary data used, sourced from various sources including World Bank, ITU, OLADE and an official data set from both private and public infrastructure companies
Methods used to analyze data, including details of checks on reliability and validity	Regression analysis
Summary of results	"Privatisations and concessions that were sold via an auction process experienced a reduction of 5.8- 6.8% in connection numbers…" (p34) "When the regulatory body was partially autonomous, the number of connections decreased between 3.1 and 6.9% during the transition". (p35) "When regulation board appointments lasted 5 years or more… experienced decreases in output between 9.7 and 11.6%... number of employees by 25- 30% during transition… connections per employee increased between 27- 31%" (p38). When pricing is regulated according to the rate of return, companies have higher network expansion than in the case of price-cap regulation.
Conclusion	"Generally autonomous regulatory bodies seem to be correlated with greater reductions in the number of employees, while older- through experience and capacity- institutions result in lower price increases. When pricing is regulated according to rate of return, companies have higher network expansion than in the case of price cap regulation. Latter firms also present less improvement in both distributional losses and quality, while also exhibiting higher price increases". (p45)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Data is a small set • No control sample
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Strategies to control bias from confounding variables are described but not adequate; issue of repeatability is addressed; timing is one variable not accounted for
Weight of evidence (3) (relevance of focus of study to review)	Medium Widely generalisable
Weight of evidence (4) (overall weight of evidence)	Medium Good paper but some concerns on the data, lack of controls etc.

Andres, L., Guash, L. J., Azumendi, L. S. (2008). Regulatory governance and sector performance: Methodology and evaluation for electricity distribution in Latin America, World Bank Policy Research Working Paper 4494.	
Country/Countries of study	26 countries in Latin America and Caribbean
Data period	Circa 2005
Type of study	Quantitative
Aims of study	The paper aims to create different models to "explain the contributions of change in ownership and different characteristics of the regulatory agency and of its governance on the performance of the utilities". The study also "proposed an experience measure in order to identify the gradual impact of the agency on performance".(p2)
Summary of study design, including details of sample	250 utilities in 26 countries in Latin America and Caribbean
Data sources and data collection instruments	Secondary; World Bank's Electricity Performance Database and the Electricity Regulatory Governance Database
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis; regression model
Summary of results	"Labour productivity rose between 19.8 and 26.0 percent during the transition period… distributional losses decreased significantly after the transition, resulting in a 13.2 percent reduction" (p16) "Under the presence of a regulatory agency, utilities resulted with 19.4 and 18.2 percent higher labour productivity… 18.9 percent less average duration and 17.3 percent less frequency of interruptions" (p18) A standard deviation in the ERGI (*regulatory index)* is associated with a 8.7 and 9.1 percent additional increase in labour productivity… between a 7.5 and 8.2 reduction in duration and frequency of interruptions… and a 5.7% increase… in residential tariffs" (p20)
Conclusion	The results of the study suggests that "the mere existence of a regulatory agency, independent of the utilities ownership has a significant impact on performance… ownership dummies are significant with the expected sign… governance matters and has significant impacts on performance when we simulated a standard deviation in each of these indexes"
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is implicit; Data unavailability and missing data is an issue
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • The research design is appropriate but with a few drawbacks. • The concept of Regulation index is a doubt; Will it change if weightage changes etc? • Strategies used in the analysis to control for bias from confounding variables is explained in a limited way • Selective reporting bias is avoided
Weight of evidence (3) (relevance of focus of study to review)	Medium Focus of the study is relevant and is generalisable.
Weight of evidence (4) (overall weight of evidence)	Medium Overall a good paper which gives good outputs, but does not have adequate robustness checks that can increase the validity of the results

Anwandter, L., Ozuna, T. (2002). Can public sector reforms improve the efficiency of public water utilities, Environment and Development Economics, 7, pp. 687-700.	
Country/Countries of study	Mexico
Data period	1995
Type of study	Quantitative
Aims of study	The study aims to test "inefficiency of public water utilities depend … on the type of ownership… or the lack of competitive pressures and on information asymmetry, which creates principal-agency problems". It also tries to "evaluate the effects of public sector reforms… on the efficiency of public water utilities" (p688)
Summary of study design, including details of sample	110 urban water utilities are studied. It covers 15% of the 730 utilities in Mexico. It serves around 33% of the total population. 46 are controlled by an autonomous regulator and 64 are firms that are both regulators and operators.
Data sources and data collection instruments	Data came from a questionnaire which was developed by CNA and filled out by the managers of the water utilities. The dataset has been used earlier by Ozune and Gomez (1990)
Methods used to analyze data, including details of checks on reliability and validity	Data envelopment analysis, with a second step regression
Summary of results	The study finds that "Mexican reforms (*decentralisation and regulation*) did not have a significant positive effect on the efficiency of public water utilities" p 698
Conclusion	The study concluded that as the "reforms did not introduce competitive pressures… and did not reduce the informational asymmetry between the agent and the principal", they did not have a positive effect on the utilities. The interventions "should have been accompanied by reforms that increase competition and transparency" (p698)
Weight of evidence (1) (trustworthiness in relation to study question)	High Considers the effect of sector specific interventions like regulation, privatisation as well as project specific interventions like decentralisation and its impacts on outcomes
Weight of evidence (2) (appropriateness of research design and analysis)	High DEA followed by econometric testing in a second stage to ensure robustness of results; use of appropriate controls
Weight of evidence (3) (relevance of focus of study to review)	High The study identifies a key lacunae: transparency that needs to be improved in order for outcomes to improve, whether with privatisation or without
Weight of evidence (4) (overall weight of evidence)	High A good study that suggests strongly that transparency is correlated with better outcomes. Privatisation without transparency is unlikely to improve outcomes. Though the study is done in a specific context, the robust design makes the results widely generalisable

Asthana, N. A. (2003). Decentralisation and supply efficiency: The case of rural water supply in central India, Journal of Development Studies, 39(4), pp. 148-159.	
Country/Countries of study	India
Data period	circa 2000
Type of study	Quantitative
Aims of study	The study aims to test empirically if decentralisation leads to supply efficiency in rural water supply.
Summary of study design, including details of sample	Cross sectional data, 1,708 rural piped water schemes in two states
Data sources and data collection instruments	Secondary data; Source: Public Health Engineering Departments of the State Governments of Madhya Pradesh and Chhattisgarh
Methods used to analyze data, including details of checks on reliability and validity	Regression analysis with 5 models
Summary of results	The study finds that centralisation is actually more efficient and that "the coefficients for the centralisation variable are small, but they are significant" (p158). Funds utilisation is higher and expense ratio is lower when the utility is centralized.
Conclusion	"There may be sound political reasons for decentralisation; however the economic efficiency is doubtful at least in the short and medium term." (p159) However, the author suggests that there is a "valid argument in favour of decentralisation, rarely advanced, is that of learning by doing" (p158)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is partially explicit
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design is appropriate and the variables have all been dealt with in the 5 models • Data availability has been easy for this project and data has been collected from reliable sources • Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High Analyses the intervention that is pertinent to the review
Weight of evidence (4) (overall weight of evidence)	Medium Good quality study which has relevant outputs

Asthana, N. A. (2008). Decentralisation and corruption: Evidence from drinking water sector, Public Administration and Development, 28, pp. 181-189.	
Country/Countries of study	India- rural and semi-urban areas of Madhya Pradesh and Chhattisgarh
Data period	Approximately between 2000 and 2008
Type of study	Quantitative
Aims of study	The study seeks to "compare the level of corruption between the utilities run by local governments defined as decentralized agencies and those run by state (regional) governments defined as centralized" (p183)
Summary of study design, including details of sample	Primary Data, Cross Sectional Survey
Data sources and data collection instruments	"The data was obtained from a large survey which also covers issues other than corruption and decentralisation" (p185)
Methods used to analyze data, including details of checks on reliability and validity	Simple Multivariate Regression has been used to analyze the data. Hypothesis: Level of corruption is higher in case of decentralized agents. All the seven dependent variables in the model were assumed to be continuous.
Summary of results	The study suggests that "51% respondents had paid bribes in decentralised agencies and 41% in centralised agencies. The difference is statistically significant". (p186) The study also suggests that there is a "…small but statistically significant difference in proportion of transactions which involved speed money and the difference in the amounts involved in the transaction." (p 186)
Conclusion	The main reason for "higher level of corruption in decentralized agencies seems to be that there are fewer obstacles to corruption at local level. Monitoring and inspections are better developed at the state level" (p187) Under the guidance of the state governments and under pressure from the people and NGOs, the local governments have to learn to be less corrupt. This would take time even if a carefully formulated strategy is put in place."(p188)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Fairly explicit; Aims and objective of the study relevant to the review
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The research design is simple and precise. The methodologies used helps to link decentralisation and corruption and arrive at relevant conclusions. The analysis is not too complex or in detail but it answers the question in study. The data has been used well and some valid conclusions have been arrived at. Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High The study provides a fairly large picture on the link between decentralisation and corruption. It also does some econometric data analysis and gives interesting results which are relevant to the aim of the study.
Weight of evidence (4) (overall weight of evidence)	Medium Overall the paper presents a clear picture on the link between decentralisation and corruption and breaks the notion that decentralisation decreases corruption. Limited robustness checks do not make the results widely generalisable.

Bagdadioglu, N., Price, W. M. C., Weyman-Jones, G. T. (1996). Efficiency and ownership in electricity distribution: A non-parametric model of the Turkish experience, Energy Economics, 18, pp. 1-23.	
Country/Countries of study	Turkey
Data period	1991
Type of study	Quantitative
Aims of study	Article concentrates on finding the sources of inefficiencies by analysis of data and market structure and discuss these in context of the Turkish electricity market
Summary of study design, including details of sample	Sample consists of 70 retail distributions firms (66 public and 4 private)
Data sources and data collection instruments	The data for this analysis were taken from Turkish Electricity Authority and the Ministry of Energy and Natural Resources for supplying the data on public distribution organisations. The data for local and franchised private companies are obtained from their 1991 annual financial reports and from their response to the survey sent by the first author as part of his doctoral studies.
Methods used to analyze data, including details of checks on reliability and validity	Data development analysis
Summary of results	• Private distribution organisations have higher efficiency scores
Conclusion	• 10 distribution organisations offered for private franchise have higher average efficiency score than those of the other 58 distributional organisations
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Aims of the study clearly defined • Context of study adequately mentioned • Not generalized study, findings pertain to the context of the study
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design or methodology has been clearly defined • All the included variables explained properly • Data sources are explicitly defined • Adequate description of method of data analysis • Appropriate research design to addressing the research question • Causality has not been strongly attributed to the intervention
Weight of evidence (3) (relevance of focus of study to review)	Medium • Addresses a relevant topic related to the focus of this review • Outcome clearly defined
Weight of evidence (4) (overall weight of evidence)	Medium • Based on above three weight of evidences, it is a medium type study

Berg, S., Lin, C., Tsaplin, V. (2005). Regulation of state-owned and privatized utilities: Ukraine electricity distribution company performance, Journal of Regulatory Economics, 28(3), pp. 259-287.	
Country/Countries of study	Ukraine
Data period	1998-2002
Type of study	Quantitative
Aims of study	The study "tests the extent to which privately owned firms respond to incentives in ways that are different from publicly owned firms". The study also considers regulatory incentives that "add to net cash flows" and "incentives associated with cost of service regulation and examines managerial behavior in state-owned and privatized firms" (p260)
Summary of study design, including details of sample	24 Ukraine electricity distribution companies
Data sources and data collection instruments	Secondary Data; Data sources are not mentioned explicitly
Methods used to analyze data, including details of checks on reliability and validity	Data Envelopment Analysis (DEA)- a non-parametric method that evaluates performance relative to frontier
Summary of results	"The cost-based DEA model shows significant cost inefficiency of privatized companies, especially for companies privatized in 1998 by Investment Pool." (p284)
Conclusion	"…privately owned firms do respond to incentives that add to net cash flows (associated with reducing commercial and non-commercial network losses)….they also respond more aggressively than do state-owned distribution utilities to mark up(cost plus) regulatory incentives that increase shareholder value but decrease cost efficiency (p259)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is implicit. Data used is not exhaustive and the source of data is not clearly specified
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The research design used is fairly appropriate and the use has been justified by the authors. However it has its limitations. "…as the number of variables in a DEA model increases, more firms tend to be on the efficiency frontier; a firm is likely to be using relatively less of a particular input or producing more of a particular output…" "…in original DEA models, the statistical properties of efficiency scores could not be quantified." Causality has not been strongly attributed to the intervention
Weight of evidence (3) (relevance of focus of study to review)	Medium Focus is on the interventions- privatisation and regulation which relates to the infrastructure sector
Weight of evidence (4) (overall weight of evidence)	Medium Though the paper has a lot of limitations it has been included given the focus of the paper

Cabanda, E., Ariff, M. (2002). Performance gains through privatisation and competition of Asian telecommunications, Asian Economic Bulletin, 3, pp. 254 – 279.	
Country/Countries of study	2 Asian countries namely, Malaysia and Philippines
Data period	1983 to 1999; 2 years of data before privatisation and 7 to 10 years of data after privatisation
Type of study	Quantitative analysis
Aims of study	"…to provide long-term effects of the simultaneous adoption of both privatisation and competition reforms on performance and efficiency in Asian communications" (p 255). Also tries to prove that competition is the effective agent for change rather than mere privatisation
Summary of study design, including details of sample	panel data, longitudinal and before-after data were used. Number of telecom firms used in the study =3 (Nippon Telegraph and Telephone Company – NTT, Telekon Malaysia –TM, Philippine Long Distance Telephone Company – PLDT)
Data sources and data collection instruments	Secondary data -audited accounts of firms, telecommunication statistics from ITU and country demographics
Methods used to analyze data, including details of checks on reliability and validity	Performance and efficiency improved after simultaneous adoption of privatisation and competition reforms in Asian telecommunications.
Summary of results	"….profitability measure of performance increased significantly in Malaysia but not in Japan or Philippines. … operating efficiency rose significantly in the three cases… capital expenditure also increased significantly in the Philippines(but not Japan and Malaysia)…" (p276)
Conclusion	"…performance and efficiency improved after simultaneous adoption of privatisation and competition reforms in Asian telecommunications."(p 276) Overall efficiency has also increased after privatisation as compared to the period of monopoly.
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is implicit. Limited sample size.
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Research design (quantitative method) used was appropriate for addressing the research question. But it does not totally rule out error/bias in the study as difference in performance cannot be totally attributed to privatisation and competition alone. The sample used was small in size so results cannot be generalized. The study does not show any causal pathways for the change in performance and efficiency of firms. Not controlled for other factors.
Weight of evidence (3) (relevance of focus of study to review)	High The topic is within the focus of review as it shows the impact of privatisation on two developing countries in Asia.
Weight of evidence (4) (overall weight of evidence)	Medium The overall quality and weight of evidence is relevant and reliable to a large extent. The authors have avoided selective reporting bias. Overall the study is an informative one on the effect of privatisation and competition on performance and efficiency.

Casarin, A. A., Delfino, A. J., Delfino, E. M. (2007) Failure in water reform: Lessons from the Buenos Aires's connections, Utilities Policy, 15, pp. 234-247.	
Country/Countries of study	Argentina
Data period	1993-2003
Type of study	Quantitative
Aims of study	To examine the performance, until the cancellation of the contract, of the Buenos Aires sanitation concession in relation to privatisation objectives of expanding coverage, reducing consumers' tariffs and increasing service standards
Summary of study design, including details of sample	The data used varies as population increased over the years; Aguas Argentina's data which consists of data on various variables such as Population, sanitation services, sludge treatment facilities have been used
Data sources and data collection instruments	Secondary data; Data from Concession Contract and Aguas Argentinas Customer Reports have been used
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis- use of regression analysis; Also a simple model disaggregated performance of measurement was used to analyze the economic performance of the concessionaire
Summary of results	• Despite a noteworthy increase, coverage rates remained significantly behind goals and that several contract renegotiations came along with significant tariff changes that turned an initial access problem into an affordability one • The concession's high profits originated almost exclusively from tariff increases, as the contribution of total factor productivity improvements and of changes of input prices have been negligible • A good number of the concession's failures seem to have been explained by the presence of a weak and inexpert regulator. • Regulators should consider protecting the interests of consumers by setting capital requirements.
Conclusion	Due to various reasons privatisation as part of water reforms in Buenos Aires did not work to a great extent; it remains to be seen if government ownership will overcome the obstacles faced by the private sector
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Transparency is implicit • Aims and objective of the study very relevant for the review
Weight of evidence (2) (appropriateness of research design and analysis)	Low • Research design (quantitative method) used was appropriate for addressing the research question • Selective reporting bias has been avoided • Lack of appropriate controls raises issues of validity
Weight of evidence (3) (relevance of focus of study to review)	Medium • The overall quality and weight of evidence is relevant and reliable to a large extent • The study shows causal pathways on why privatisation failed
Weight of evidence (4) (overall weight of evidence)	Medium A good paper which pinpoints why privatisation is not always favorable. Limited generalisability of the results.

Carrillo, P., Bellettini, O., Coombs, E. (2008). Stay public or go private? A comparative analysis of water service between Quito and Guayaquil. Chong, A. (Eds.), Privatisation for the Public Good? (pp.99-137). Chapter: 5, Inter-American Development Bank.	
Country/Countries of study	Ecuador (Quito and Guayaquil)
Data period	1995 to 2005
Type of study	Quantitative and Qualitative
Aims of study	• to provide an objective comparison of several indicators of water coverage, quality and prices in both the cities- both before and after privatisation of water services in Guayaquil • to assess why such an exercise cannot identify the effects of the privatisation of water provision
Summary of study design, including details of sample	• Secondary data used • The data base compiled from the surveys is a representative sample of the population of both the cities. The 1994 sample consists of 1737 respondents in Quito and 1713 in Guayaquil • The sample size in the 2004 survey were higher by more than 40% in both the cities
Data sources and data collection instruments	• Data from national income and expenditure surveys administered in both the cities in 1995(before concession of water services) and 2004(after concession) were used • A detailed household employment survey was also used where the heads of the house were asked about changes in water services for a period of six years • Evolution of water prices also analyzed in the two cities for a period of 10 years (1995-2005)
Methods used to analyze data, including details of checks on reliability and validity	Descriptive statistics and Econometric analysis; two types of regression models used- a traditional linear model and an ordered probit model For both the models three different specifications are estimated; in the first and second only income variables are controlled for; the third one adds several other independent variables to control for household demographics
Summary of results	• A series of quantitative indicators of water performance in the two cities offers evidence that water-coverage levels in Guayaquil have decreased during the given timeframe, particularly those among the lower end of income distribution. The opposite is true for Quito. • Households systematically perceive that water pressure had worsened relatively in Guayaquil than Quito • In both nominal and real terms the average price of water in Guayaquil is higher and has increased at a faster rate than Quito • Relative changes in coverage levels between the two cities cannot be attributed to privatisation as before-concession water-coverage trends and rural-to-urban migration patterns are completely different in both cities • The two entities face significantly different environments and thus institutional differences alone may explain a large portion of the results obtained in the statistical analysis
Conclusion	• Water-coverage levels in Guayaquil have decreased during the given timeframe, particularly those among the lower end of income distribution. The opposite is true for Quito • Relative changes in coverage levels between the two cities cannot be attributed to privatisation
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is implicit; Aims and objective of the study very relevant for the review
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Research design is fairly appropriate; Appropriate control variables used, but issues of validity have not been completely addressed

Weight of evidence (3) (relevance of focus of study to review)	Medium The focus of this study is very pertinent for this review.
Weight of evidence (4) (overall weight of evidence)	Medium A good paper but further research is needed to evaluate the effects of water performance on performance; the results are narrow and cannot be widely generalized

Chavis, L. (2010). Decentralizing development: Allocating public goods via competition, Journal of Development Economics, 93, pp. 264- 274.	
Country/Countries of study	Indonesia
Data period	Not Mentioned
Type of study	Quantitative & Qualitative
Aims of study	The broad aims are: • To study how structuring a program can change the incentive structure in organisations • To see if a decentralized government program improve outcomes The specific aims are: • To see if competition between villages in a sub-district reduce road construction cost • To check if increased grass root participation reduce costs in the local government
Summary of study design, including details of sample	Cross sectional and longitudinal data; The 72 different projects under KDP is classified into 8 categories by the author
Data sources and data collection instruments	Secondary data used from KDP records.
Methods used to analyze data, including details of checks on reliability and validity	Simple statistical tools as well econometric analysis; The author has not described any way to address the issue of reliability.
Summary of results	• Competition weeds out less effective projects • Increasing the number of villages bidding by 10% leads to a 1.8% decline in road construction costs
Conclusion	"Competition between localities can have a significant impact on the efficiency with which development funds are used. Competition dampens the decrease in accountability associated with a decentralized allocation of public goods… Competition between villages for CDD funds provides an avenue for reducing corruption, inefficiency and waste" (p273)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Data used is problematic: While the data used is that of the KDP program and is reliable. The proxies used though correct, are weak (competition proxy for example is a number of villages as opposed to number of proposals from villages etc.)
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Issue of data repeatability and reliability has not been tackled in this paper; Otherwise the tools used are fairly comprehensive and relevant; The strategies used in the analysis to control for bias from confounding variables is weak
Weight of evidence (3) (relevance of focus of study to review)	High Very focused study and all the variables were researched
Weight of evidence (4) (overall weight of evidence)	Medium Many issues regarding the quality of data used; However it definitely is a medium quality paper which provides some interesting findings

Clarke, G. R. G., Colin Xu, L. (2001). Ownership, competition, and corruption: Bribe takers versus bribe payers, World Bank Policy Research Working paper, No.2783, pp.1-33.	
Country/Countries of study	21 transition economies in Eastern Europe and Central Asia
Data period	mid-1999
Type of study	Quantitative and Qualitative
Aims of study	to look at how characteristics of the firms paying bribes (e.g., ownership, profitability and size) and characteristics of the utilities taking bribes (e.g., competition and utility capacity) affect the equilibrium level of corruption in the sector
Summary of study design, including details of sample	Cross sectional data; sample includes about 3000 enterprises from 21 transition economies
Data sources and data collection instruments	Secondary data; main source of data-World Business Environment Survey, a cross sectional survey of industrial and service enterprises conducted in mid-1999
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis; Regression analysis where the dependent variable is the percent of revenues paid by the enterprise to electricity and telecommunications utilities in the form of bribes
Summary of results	• Bribe payments are lower in countries where infrastructure is better developed, suggesting that excess demand is an important determinant of corruption. • The extent of competition in the telecommunications sector, measured by the number of cellular operators in the country, also appears to reduce the equilibrium level of bribes. • After controlling for capacity and competition, it is found that bribes are lower in countries where the utility companies have been privatized • Characteristics of the enterprise offering the bribe also affect payments • firms with higher overdue payments to utilities appear to pay higher bribes, perhaps because they have a weaker bargaining position vis-à-vis the employees of the utility company • *de novo* private firms are found to pay higher bribes than established firms • There is strong evidence for the complementarity of the overall level of corruption in a country and bribes in the utility sector
Conclusion	"On the side of bribe payers, enterprises that are more profitable, enterprises that have greater overdue payment to utilities, and *de novo* private firms pay higher bribes. On the side of bribe takers, bribes paid to utilities are higher in countries with greater constraints on utility capacity, lower levels of competition in the utility sector, and where utilities are state-owned. Bribes in the utility sector are also correlated with many of the macroeconomic and political factors that previous studies have found to affect the overall level of corruption." (p1)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Transparency is implicit • Does not directly focus on the outcome indicators of the review
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Research design is appropriate; Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3)	Medium

(relevance of focus of study to review)	• The finding that more profitable firms pay higher bribes is not interpreted clearly • The study does not show any causal pathways
Weight of evidence (4) (overall weight of evidence)	Medium Future empirical work on this issue is desirable

Clarke, G. R. G., Wallsten, J. S. (2002). Universal (ly bad) service: Providing infrastructure services to rural and poor urban consumers, World Bank Policy Research Working Paper 2868.	
Country/Countries of study	Latin America and Africa
Data period	1990s
Type of study	Descriptive quantitative
Aims of study	The paper "reviews the evidence on universal access in developing countries… discuss the rationale for universal access laws and review the different ways subsidies can be financed and allocated, along with the implications of those various methods".(p4)
Summary of study design, including details of sample	Comparison of access in African countries with public and private water operators, public and private telecom providers in Africa and Latin America and r\time series comparisons of the effect of private sector participation in the electricity sector in Latin America
Data sources and data collection instruments	Secondary; data taken from Demographic and Health Surveys
Methods used to analyze data, including details of checks on reliability and validity	Simple statistical illustrations and discussion
Summary of results	• Private sector participation does not harm, and may actually help, low income households • Capacity was constrained before reforms • Supply constraints played an important role in blocking service to the poor under public ownership • In Latin America, coverage appears lower in countries with public operators than in countries with private operators
Conclusion	• Low prices might increase the demand for infrastructure services but they also lead to supply-side distortions that might lessen or nullify their impact • The opaque nature of cross subsidies makes it difficult to determine who pays for them and who benefits from them • Reforms provides an opportunity to completely rethink the role of subsidies and of how to ensure access by the poor
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Aims and objective of the study are clearly specified; Large datasets used to arrive at the results
Weight of evidence (2) (appropriateness of research design and analysis)	Low Simple statistical results presented. Validity of the results and attribution of the impact to the intervention becomes difficult.
Weight of evidence (3) (relevance of focus of study to review)	Medium The focus of the study is on the role of subsidies and reforms and how to make it completely accessible by the poor; part of the results are widely generalisable though most of it depends on the reforms and extent of monopoly supervision in each country
Weight of evidence (4) (overall weight of evidence)	Medium Though the results are not very robust, the paper is widely cited and has interesting results. That is the reason for the inclusion of the paper.

Clarke, G. R. G., Kosec, K., Wallsten, S. (2004). Has privatisation in water and sewerage improved coverage? Empirical evidence from Latin America, World Bank Policy Research Working Paper 3445.	
Country/Countries of study	Argentina, Brazil, Bolivia
Data period	1991-2001
Type of study	Quantitative
Aims of study	The study "uses household level data to explore the effect on water and sewerage coverage over time (before and after privatisation) and across cities, including compared to control cities that never privatized". It looks at whether private participation in water and sewerage improves coverage and if the poor are worse off after privatisation.
Summary of study design, including details of sample	Cross sectional and longitudinal data used;
Data sources and data collection instruments	Secondary data; MECOV data was used
Methods used to analyze data, including details of checks on reliability and validity	Regression analysis where one equation was created
Summary of results	The study states that "privatisation is positively and significantly correlated with piped water coverage when controlling only for population and income" and "adding in the dummy control variable (*for public ownership*)" makes the "coefficient on private to turn negative, though it is statistically insignificant" (p22) "PSP is positively and significantly correlated with coverage until one controls also for time trends" and controls in which case there is no "statistically significant correlation between private sector participation and coverage rates" (p22)
Conclusion	The study concludes that "the existing evidence on the effects of privatisation in the water sector is spotty, at best". The study also did not find evidence that in coverage "the poor were significantly harmed by privatisation" (p22)
Weight of evidence (1) (trustworthiness in relation to study question)	High Transparency is pretty explicit Very clearly specified data sources; In Appendix 2 of the study the authors have clearly mentioned the limitations with respect to the data set used.
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The research design used is appropriate and it links relevant variables together and arrives at some interesting conclusions; Some graphs are also used which also brings out relevant conclusions. The variables such as GNP, years etc. are all accounted for. Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High The study focuses on privatisation as an intervention and provides relevant conclusions. All the variables have been analyzed well
Weight of evidence (4) (overall weight of evidence)	High A good paper on a whole as the area explored in this paper has very little empirical work done earlier.

Contessi, S. (2004). FDI in the telecommunication sector of transition and developing countries, http://www.cepr.org/meets/wkcn/2/2344/papers/Contessi.pdf.	
Country/Countries of study	46 Transition And Less Developed Countries (Central And Eastern European Countries, Middle East and North African countries, South American and Central American countries
Data period	1989-2000
Type of study	Quantitative and Qualitative
Aims of study	The study "evaluates the potential impact of the WTO liberalisation measures in the telecom sector using a model of Foreign Direct Investment (FDI) and technology transfer in an oligopoly setting". (p2)
Summary of study design, including details of sample	Establishment of a separate regulator has a positive significant effect on teledensity of a magnitude close to that of privatisation. Regression Analysis and Panel Data
Data sources and data collection instruments	Secondary data; ISLA-Telecom, ITU World Telecommunications Indicators 2002 and the World development Indicator 2002 were the sources of data
Methods used to analyze data, including details of checks on reliability and validity	A model of FDI and technology transfer in an oligopoly setting was used; density function is used ; the model is based on game theory, also empirical testing using econometric modeling was also done
Summary of results	The study finds that the "initial privatisation process turns out to be non significant, while the establishment of a separate regulator has a positive significant effect on teledensity". Foreign penetration in the cellular market captures the competitive effect coming from foreign presence in the wireless market. It also find that "… the existence of a separate regulator turns out to be positively and significantly correlated to fixed teledensity growth" (p28)
Conclusion	The "entry of foreign investors through Foreign Direct Investment might… remove the under-investment… and improve the supply of telecom services". The author also concludes that "privatisation processes are significantly correlated with increases in teledensity" and that "the establishment of a separate regulator has a positive significant effect on teledensity, teledensity growth and the ratio between fixed lines and staff" (p30) The study finds that share of foreign ownership in the incumbent has a positive, concave impact on sectorial indicators.
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Transparency is explicit to an extent; Control variables used are GDP per capita, Population, and Percentage of the total population living in the urban areas. Lack of firm specific data which gives a clear view on the impact of privatisation, regulation and competition on firms' strategies • Inadequacy of data is a problem which affects results stemming from empirical analysis • Interventions of this review is not the main focus of the study
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	Medium The results are widely applicable; the authors themselves point out the flaws in the paper and also suggest methods to correct them in the future. There are a good number of outcomes.
Weight of evidence (4) (overall weight of evidence)	Medium Overall a good paper which can be worked upon given good institutional details and a large and detailed sample.

Cook, P., Uchida, Y. (2008). The performance of privatized enterprises in developing countries, Journal of Development Studies, 44(9), pp. 1342- 1353.	
Country/Countries of study	South America, Africa and Asia
Data period	1993-97 and 1998-2002
Type of study	Quantitative
Aims of study	This paper "examines the performance of privatized enterprises in developing countries since privatisation". The study also aims to compare "between different periods of privatisation and not with pre- and post- privatisation episodes" (p1343).
Summary of study design, including details of sample	Analysis based on mean, privatized enterprises, regulated utilities (electricity, gas, water and telecommunication) and non utilities. Analyzing only listed enterprises from The World Bank privatisation data base for the period 1988-1998 out of 2800 enterprises 22 developing countries
Data sources and data collection instruments	Thomson One Banker Analytics and World Bank Privatisation, Database (secondary sources)
Methods used to analyze data, including details of checks on reliability and validity	Descriptive but statistical analysis
Summary of results	The study finds that "the privatized utilities reduced their output by 13%... though tests are all insignificant" and also showed an increase in sales efficiency by 23% (p1347-48). Utilities employment fell in private enterprises" (p1348)
Conclusion	The study suggests that "there appear to be significant differences between the performance of privatized utilities and non- utilities" (p1352). The study also finds that differences emerge between the performance of enterprises in different sectors and across countries in which institutions, structural factors and legal environment also varies
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Analysis based on huge number of enterprises • Large database expected to reduce sample selection bias
Weight of evidence (2) (appropriateness of research design and analysis)	Low • Analysis based on averages (mean and medians) though statistically tested • Issues of validity, no control sample • Research design is not very appropriate • Transparency is implicitly defined
Weight of evidence (3) (relevance of focus of study to review)	Medium • Informative • Analyzing four utilities (electricity, gas, water, and telecommunications) • Showing different results from others literature
Weight of evidence (4) (overall weight of evidence)	Medium • Enterprises included in the study were chosen on the basis of data availability so it results cannot generalized for all the developing countries • Very few indicators captured • Sample can be biased as there are enterprises of low and very high performance (not uniform)

Cubbin, J., Stern, J. (2006). The impact of regulatory governance and privatisation on electricity industry generation capacity in developing economies, World Bank Economic Review, 20(1), pp. 115-141.	
Country/Countries of study	28 developing countries
Data period	1980-2001
Type of study	Quantitative
Aims of study	The study "provides an econometric analysis of the relationship between the quality of regulatory governance and the level of generation capacity per capita for electricity supply industries… controlling for privatisation and competition" (p116) It looks at the utilisation of generation capacity and the technical losses in transmission and distribution
Summary of study design, including details of sample	Cross sectional data
Data sources and data collection instruments	Secondary data; data on 28 developing countries over a 21 year period (1980- 2001). Of the 28 countries in the sample, 15 were in Latin America, 6 in the Caribbean, 4 were in Asia and 5 were in Africa; data was taken from US Energy Information Agency, World Bank Development Indicators, The Preetum Domah 2001
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis using panel data; descriptive statistics
Summary of results	The study finds that "a regulatory agency with good governance characteristics can not only improve regulatory outcomes in principle… and practice" (p134) The effects of enacting a regulatory law, having an autonomous regulator and using license fees to fund the regulatory agency were each positive and statistically significant at the 1% level. Each unit increase in the regulatory governance index leads to 4.3% higher per capita generation capacity. There was some evidence of the "effects on generation capacity of majority privatisation… but the effects of competition are almost certainly more a reflection of a country's commitment to electricity reform than of a genuine market effect" (p134)
Conclusion	The authors conclude that "good regulatory governance does have a positive and statistically significant effect on some electricity industry outcomes in developing economies". There is also evidence that superior regulatory governance improves generation utilisation rates and can sustain long term investments in the sector.
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Absence of data on regulatory practice • Limited data set • Selective reporting bias has been avoided
Weight of evidence (2) (appropriateness of research design and analysis)	High Research design is appropriate; Use of instrumental variables and appropriate control variables give high validity to the results
Weight of evidence (3) (relevance of focus of study to review)	High The study focuses on topics that directly fall within the scope of the review.
Weight of evidence (4) (overall weight of evidence)	High A good paper with robust research design and interesting results.

Dal Bo, E., Rossi, A. M. (2007). Corruption and inefficiency: Theory and evidence from electric utilities, Journal of Public Economics, 91, pp. 939- 962.	
Country/Countries of study	13 Latin American countries
Data period	1994-2001
Type of study	Quantitative
Aims of study	To "…investigate the connection between corruption and the efficiency of electricity distribution firms in Latin America" (p932)
Summary of study design, including details of sample	Three different sets of data used; Country level data on corruption; Firm level information on inputs and outputs of 80 electricity distribution firms and a number of control variables that can fall in any of the categories above
Data sources and data collection instruments	Secondary data; data collected from different sources and verified using information provided by regulators and governmental agencies.
Methods used to analyze data, including details of checks on reliability and validity	Regression analysis; 3 regression models were constructed
Summary of results	The study finds that "the coefficient of the corruption variable is negative and significant at the 1% level", implying that "an improvement in one point in the corruption index is associated to a 10% decrease in the use of labour". (p951) "Public firms use 41% more labour to produce a given bundle of outputs, conditional on corruption and capital inputs" (p951) "Corruption is still significantly associated to higher labour requirements" (p952)
Conclusion	The study concludes that "corruption is strongly associated with inefficiency at the firm level" and that "the association… between corruption and firm efficiency is robust" (p959)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is implicit • Quality of data is a concern • Completely secondary and many 'perception indicators'
Weight of evidence (2) (appropriateness of research design and analysis)	High The research design is apt for the study question. The authors have described strategies they have used to control bias from confounding variables; They have also used many ways to test the data for reliability and many factors were taken into account
Weight of evidence (3) (relevance of focus of study to review)	Medium The study is on a very specific topic. The study can be generalized but needs to be done carefully.
Weight of evidence (4) (overall weight of evidence)	Medium Fairly good paper but quality of data is a cause of concern

Dasgupta, S., Lall, S., Wheeler, D. (2001) Policy reform, economic growth, and the digital divide: An econometric analysis, World Bank Policy Research Working paper, No.2567, pp.1-18.	
Country/Countries of study	African, Asian and Latin American countries
Data period	Mid and Late 1990s
Type of study	Quantitative
Aims of study	To investigate the sources and evolution of the digital divide- focus is on two dimensions of the problem: Internet use and telecommunications access
Summary of study design, including details of sample	44-country sample; The study uses 7-year span of newly-available data for a more systematic assessment of cross-country growth in Internet intensity, or Internet subscriptions per telephone mainline
Data sources and data collection instruments	Secondary data; Data has been collected from various World Bank sources and Pyramid Research (for data on Internet subscribers and telephone mainline connections)
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis; Gompertz technology diffusion model was used to test the impact of income, policy and urbanisation
Summary of results	The model explains about 96% of total sample variation in the growth rate of Internet intensity. Estimated elasticities for urban population and competition policy are large, positive and highly significant (.83 and .59, respectively Economic development does not have a significant impact on Internet intensity Controlling for other factors, developing countries have intensities as high as those of developed countries Policy differences matter a great deal Access promotion would yield substantial benefits for poor households, and that cost-effective intervention strategies are available Spread of mobile phones has been the most significant feature of the growth of the telecom sector
Conclusion	Digital divide is not really new, but reflects a long-standing gap in per-capita availability of mainline telecom services
Weight of evidence (1) (trustworthiness in relation to study question)	High Usage of new data gives a clear picture of the present situation Transparency is implicit issue of repeatability and reliability of data may arise Causal pathways have been analyzed to an extent
Weight of evidence (2) (appropriateness of research design and analysis)	High The quality of the methodological approach used is robust
Weight of evidence (3) (relevance of focus of study to review)	Low Interventions of this review is not the main focus of the study
Weight of evidence (4) (overall weight of evidence)	Medium A good paper which focuses on the present data and yields concrete results

Djiofack-Zebaze, C., Keck, A. (2009). Telecommunications services in Africa: The impact of WTO commitments and unilateral reform on sector performance and economic growth, World Development 37 (5), pp. 919-940.	
Country/Countries of study	South America, Africa, Asian, European Countries, CA, North American, Caribbean (177 countries and territories)
Data period	1997-2003
Type of study	Quantitative
Aims of study	The study aims to examine the impact of telecommunications liberalisation in Africa on sectoral performance and economic growth coupled with account for WTO commitments fostering the credibility of reforms
Summary of study design, including details of sample	Panel study, 45 countries from Sub-Saharan Africa over a 7 year period (1997-2003)
Data sources and data collection instruments	ITU, World Development Indicators, Kaufmann, Kraay and Mastruzzi. Secondary data source
Methods used to analyze data, including details of checks on reliability and validity	Regression
Summary of results	The study finds that there was a significant decline in price in the local fixed-line segment only, unlike other developing countries where prices declined in all segments (p926). Regulatory quality plays a major role in reducing prices and improving access to telecom services in Africa. Increasing penetration by 1% translates into a between 0.7% and 1% increase in real GDP per capita. (p929) GATS commitments do not have any discernable effect on penetration and price (p 928)
Conclusion	The study "finds some evidence that competition and regulation are associated with prices and improved availability of telecommunications services, albeit not for all indicators and in all segments". In Africa, "multilateral commitments have no significant impact on performance". It also suggests that "regulation is a key factor affecting the performance of the telecommunications sector, and especially the local fixed segment". (p929)
Weight of evidence (1) (trustworthiness in relation to study question)	High • Aims of the study clearly defined • Context of study adequately defined • Very generalized study • Limited data period • Transparency is implicit
Weight of evidence (2) (appropriateness of research design and analysis)	High • Research design or methodology has been clearly defined • All the included variables explained properly • Data sources are explicitly defined • Adequate description of method of data analysis • Appropriate research design to addressing the research question
Weight of evidence (3) (relevance of focus of study to review)	High • Intervention clearly mentioned • Outcome clearly defined • Incorporating many outcomes and explanatory variables

	• Considering fixed and mobile sections
Weight of evidence (4) (overall weight of evidence)	High • Based on above three weight of evidences, it is rated as a high quality study

Estache, A., Goicoechea, A., Manacorda, M. (2006). Telecommunications performance, reforms and governance, World Bank Policy Research Working Paper 3822.	
Country/Countries of study	204 developing and developed countries
Data period	1990-2003
Type of study	Quantitative
Aims of study	To assess the effects of private capital and independent regulatory agencies on telecommunications performance
Summary of study design, including details of sample	Cross-country panel data; Study was carried out for a group of developing (153) and developed (51) countries separately; Unbalanced panel of 2856 observations for 204 countries
Data sources and data collection instruments	Secondary data; Data from ITU and other international organisations
Methods used to analyze data, including details of checks on reliability and validity	Econometric Regression, descriptive statistics
Summary of results	Governance plays an important role as it affects performance and interacts with reform policies
Conclusion	"…having independent regulatory agencies positively affects affordability and labor productivity, but negatively affects quality; while having private capital positively affects access, quality and labor productivity, but negatively affects affordability." (from the abstract)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Transparency is implicit • Findings of other studies used to back up results • Issues of repeatability and reliability is assumed to be addressed in the original data source
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Choice of research design was appropriate; Study timing is not indicated; Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	Medium Widely generalisable results and a good number of outcomes; Data on quality perception of telephone services is limited so the authors have relied on technical quality data reported by telephone companies which are available for a longer duration
Weight of evidence (4) (overall weight of evidence)	Medium Good study with interesting results; Does not have adequate robustness checks that can increase the validity of the results

Estache, A., Goicoechea, A., Trujillo, L. (2009). Utilities reforms and corruption in developing countries, Utilities Policy, 17, pp. 191-202.	
Country/Countries of study	153 developing countries
Data period	Between 1990 and 2004
Type of study	Quantitative
Aims of study	"…compare the impact of economic reforms across all sectors (electricity, fixed telecom and water)' (p 192) "…compare impact of reforms on access, affordability and quality of service" (p 192) "…to do a systematic assessment of the interactions between reforms and corruption in terms of the three dimensions of performance i.e, access, affordability and quality of service" (p192)
Summary of study design, including details of sample	Longitudinal data from across developing countries were used for the telecom, energy and water sectors.
Data sources and data collection instruments	Secondary data was collected was collected from various sources like WHO and WDI. Also, data for energy was collected from various sources like International Energy Agency (IEA); data on corruption from ICRG; data on water from Joint Monitoring Program (JMP); telecom data from ITU; Primary data obtained from questionnaire to experts in international organisation
Methods used to analyze data, including details of checks on reliability and validity	• Basic data analysis (in terms of percentages and statistical tools) for each sector • Econometric estimation of a simple model for each sector was used where the dependent variable was a performance output reflecting access, affordability or quality and the independent variables were reform policies, corruption and additional regressors. A linear time trend is also included to take into account technological advances and the dependent variables also include country fixed effects. The model was estimated using Generalized Least Squares (GLS).
Summary of results	"…privatisation significantly increases outcomes (p200)
Conclusion	"… reforms have not always delivered on their promises while they helped improve some dimensions of performance (p201)"
Weight of evidence (1) (trustworthiness in relation to study question)	High Privatisation and regulation are being studied here using empirical data analysis. Lack of data definitely is a problem here; However the basic data analysis which provides a somewhat optimistic picture contradicts with the views projected by the econometric analysis.
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The entire analysis has been well structured where a basic analysis is followed by an econometric analysis for the three sectors. The study results are not widely generalisable nor is it very specific. The study suggests that when looking at the reforms process in developing countries, there are wide differences not just between countries but also between sectors. Bias from confounding variables has been addressed by a variable that is introduced in the regression; income levels and urbanisation rate are captured in this model.
Weight of evidence (3) (relevance of focus of study to review)	High The study provides empirical evidence substantiating the study question. It provides theoretical links to other papers which is relevant to this context.
Weight of evidence (4) (overall weight of evidence)	High Overall the paper, with available data and methodologies, more or less brings out a clear picture on the impact of corruption and reforms on the various sectors in developing countries.

Estache, A., Gonzalez, M., Trujillo, L. (2002). What does privatisation do for efficiency? Evidence from Argentina's and Brazil's railways, World Development, 30(11), pp. 1885-1897.	
Country/Countries of study	Argentina, Brazil
Data period	1996- 99
Type of study	Quantitative
Aims of study	…provides the first analysis of the efficiency payoffs of railway reform for a couple of developing countries (Argentina and Brazil) (p 1886) …computing total factor productivity study track down the evolution of performance of the private operators in both countries since reform and distinguish between output and input sources of efficiency changes (p 1886)
Summary of study design, including details of sample	The study uses performance indicators and their evolution over a period of time to check if privatisation has improved the performance of firms
Data sources and data collection instruments	The data were obtained from balance sheets and reports to the regulators
Methods used to analyze data, including details of checks on reliability and validity	Performance Indicators of the railways in both passenger and freight sectors were compared over time
Summary of results	"…average annual growth rate of total factor productivity increased from 5.5% (before the change) to 8.4% since all the systems were operated privately" (p 1892) "…9.8% efficiency gains achieved in passenger concessions are almost twice the 5.3% achieved for freight" (p 1893) "…the private operators managed to obtained significant improvement in output growth" (p 1893)
Conclusion	…conclusions are brief simply that freight and passenger railways are more efficient now than before privatisation (p 1896) …the public sector can also be improved with sufficient inputs, and employment does not always reduce due to privatisation (p 1896)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium A good study for a nuanced explanation of the events of privatisation. The data have some limitations (p 1886)
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Performance indicators used, though not tested statistically. Comparison with other public sector operators in other countries could add to this study; No control sample, though the study design is robust
Weight of evidence (3) (relevance of focus of study to review)	Medium Transparency is intermediated through privatisation in the study. Interventions and outputs clearly mentioned
Weight of evidence (4) (overall weight of evidence)	Medium A good study, though could be improved with the introduction of suitable controls and counterfactuals

Estache, A., Gonzalez, M., Trujillo, L. (2002). Efficiency gains from port reform and the potential for yardstick competition: Lessons from Mexico, World Development, 30 (4), pp. 545-560.	
Country/Countries of study	Mexico
Data period	1996-1999
Type of study	Quantitative
Aims of study	"…to estimate the efficiency gains achieved since Mexico introduced its port reforms." (p 546)
Summary of study design, including details of sample	Panel study, analyzing after reform improvement. Sample covering 13 independent port administration for the period 1996-1999 but production frontier estimate is based on the performance of 11 ports over the four-year period
Data sources and data collection instruments	Not explicitly mentioned
Methods used to analyze data, including details of checks on reliability and validity	To assess the technically efficiency of each port in each year based on the translog production function measures using stochastic Production frontier
Summary of results	…after the reform in 1993, annual average technical efficiency increased from 49.5% in 1996 to 54.5% in 1999 and average annual efficiency gain in the sector was around 2.8-3.3% since the reform (p 556)
Conclusion	….autonomous management of each port in a competitive environment can generate large short-term improvements in the average performance of the sector and analytically sound performance rankings allowed by these post-specific efficiency measures can help in promoting yardstick competition (p 558)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Aims and the context of the study adequately explained but limitations of data period
Weight of evidence (2) (appropriateness of research design and analysis)	Low Research design or methodology has been clearly defined (p 553-554), the included variables explained properly adequate descriptions of method of data analysis, appropriate research design to addressing the research question but the data sources are not explicitly mentioned. Retrospective uncontrolled study, resulting in validity issues.
Weight of evidence (3) (relevance of focus of study to review)	Medium Port sector analysis and intervention clearly impacts outcome (cost) i.e. efficiency
Weight of evidence (4) (overall weight of evidence)	Medium Overall evidence is reasonably strong, but not widely generalisable

Estache, A., Kouassi, E. (2002). Sector organisation, governance and the inefficiency of African water utilities, World Bank Policy Research Working Paper 2890.	
Country/Countries of study	16 countries in Africa (21 water utilities)
Data period	1995-1997
Type of study	Quantitative & Qualitative
Aims of study	The main aim of the study is "to show that it is worth assessing more carefully the potential efficiency improvements that should result from the much emphasized reforms". This is to "allow for quantitative assessments of the potential improvements in the overall use of inputs and a more analytical discussion of optimal scale of operation" (p2)
Summary of study design, including details of sample	21 water utilities across 16 countries of Africa are studied in this paper
Data sources and data collection instruments	Primary data, Surveys
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis; Stochastic frontier models for a panel of data
Summary of results	The results find that "institutional variables are statistically significant at the five percent level; their signs are as expected… privatisation is significant at the five percent level" (p16)
Conclusion	The study finds that "only 12.9% of the water utilities operate efficiently compared to their peers". The "improvement in efficiency of the sector should go a long way in financing the need to improve access and/ or quality of water production and distribution… Efficiency savings exceed revenue from user fees… average tariff levels continue to be too high" (p17)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is implicit; Sources of data are not mentioned. The aims of the study could be a little more explicit.
Weight of evidence (2) (appropriateness of research design and analysis)	High Appropriate control samples used; use of instrumental variables to control for endogeneity
Weight of evidence (3) (relevance of focus of study to review)	High The focus of the study is relevant to the infrastructure sector. Reforms and its impact for the performance of a firm is relevant and all the variables in the study have been analyzed well.
Weight of evidence (4) (overall weight of evidence)	High Overall a good study with robust methodology.

Estache, A., Rossi, A.M. (2002). How different is the efficiency of public and private water companies in Asia, World Bank Economic Review, 16 (1), pp. 139-148.	
Country/Countries of study	29 Asian and Pacific region countries
Data period	1995
Type of study	Quantitative
Aims of study	To provide evidence on the impact of ownership on efficiency of water utilities
Summary of study design, including details of sample	1995 data from a sample of 50 water companies in 29 Asian and Pacific region countries
Data sources and data collection instruments	Secondary data used; Cost frontier for Asian water utilities was estimated from a database published by the Asian Development Bank
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis; Stochastic cost frontier model used; two approaches – error components (EC) and technical efficiency effects (TEE) models used to measure efficiency due to the problem of conflicting empirical evidence
Summary of results	Efficiency is not significantly different in private companies than in public ones
Conclusion	"… inconclusiveness of the comparison of efficiency in public and private water utilities may simply reflect the fact that competition matters more than ownership." (p147)
Weight of evidence (1) (trustworthiness in relation to study question)	Low Transparency is implicit The data covers only one year and they are not enough to support complete analysis No information on asset base makes it difficult to assess whether operational costs are consistent with the maintenance requirements of assets The outcome of this study is vague and cannot be widely applied in similar situations elsewhere
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The methodology is an advantage as it allows inclusion of environmental variables in the model specification; appropriate robustness checks done to check for consistency of results
Weight of evidence (3) (relevance of focus of study to review)	Medium The study analyzes the relevant intervention for this review
Weight of evidence (4) (overall weight of evidence)	Medium The methodology is good but more robust analysis is needed to increase the validity of the results.

Estache, A., Fe, B.T., Trujillo, L. (2004). Sources of efficiency gains in port reform: a DEA decomposition of a Malmquist TFP index for Mexico, Utilities Policy, 12, pp. 221-230.	
Country/Countries of study	Mexico
Data period	between 1996 and 1999
Type of study	Quantitative
Aims of study	to measure the changes in, and sources of, efficiency since the reforms
Summary of study design, including details of sample	Annual sets of data used for 11 main ports in Mexico which are not too specialized; provide a data panel with 44 observations
Data sources and data collection instruments	Secondary data; Data provided by the Mexican Transport Secretariat
Methods used to analyze data, including details of checks on reliability and validity	Malmquist index is used to calculate and decompose changes in productivity, in terms of infrastructure, for Mexico's 11 main ports between 1996 and 1999.
Summary of results	• Total Factor Productivity in Mexican ports rose by an average of 4.1% a year in 1996–1999. • They also suggest the fourth year, because some ports saw their scale efficiency deteriorate as a result of the effects of the East Asia crisis. • With one exception, all the ports maintained or improved their pure technical efficiency during the sample period.
Conclusion	Port reforms were quite successful in contributing to improvements in Mexico's economic competitiveness
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Transparency is implicit • Available data allows only for focus on two inputs- labor and capital • Absence of data • Omitted variable bias
Weight of evidence (2) (appropriateness of research design and analysis)	Low Research design is appropriate; Retrospective uncontrolled sample, leading to validity issues of the study findings
Weight of evidence (3) (relevance of focus of study to review)	Medium The study suggests various policy lessons for Mexico as well as other countries considering major port reforms; The authors say that these types of results could be used by any port regulator to improve the effectiveness and fairness of its regulatory decisions which implies it is widely generalisable
Weight of evidence (4) (overall weight of evidence)	Medium The overall quality and weight of evidence in this study is relevant and reliable to a large extent

Estache, A., Rossi, A. M. (2005). Do regulation and ownership drive the efficiency of electricity distribution? Evidence from Latin America, Economic Letters, 86(2), pp. 253-257.	
Country/Countries of study	14 countries in Latin America
Data period	1994-2001
Type of study	Quantitative
Aims of study	To "investigate the connection between the creation of regulatory agencies and the performance of electricity operators in developing and transition countries". The study aims to "investigate the connection between regulatory agencies and the performance of operators in the electricity distribution sector" (p3)
Summary of study design, including details of sample	Uses data for 127 firms from 14 Latin American countries between 1994-2001
Data sources and data collection instruments	Secondary, World Bank Sources
Methods used to analyze data, including details of checks on reliability and validity	Regression analysis
Summary of results	The study finds that "firms operating under the control of a regulatory agency use about 9.5% less labour to produce a given bundle of outputs". (p10) It also indicates that "private firms outperform public firms... and private participation has more impact on labour requirements than the establishment of a regulatory agency" (p11) "The presence of a regulatory agency is strongly associated with a decrease in the frequency of interruption… and being a private firm operating under a regulatory agency is negatively associated to average residential tariffs" (p14)
Conclusion	The "introduction of regulatory agencies in developing and transition countries is associated with more efficient firms and with higher social welfare". "Regulatory agencies are associated with higher firm efficiency and decreased frequency of interruptions" (p16)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Aims and objectives of the study are relevant for this review; Data collection method nor sources have been clearly explained
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Number of outcomes from the study are very few; Strategies for controlling bias have been used where GNP per capita and country fixed effects have been used as controls
Weight of evidence (3) (relevance of focus of study to review)	High The focus of the study is on regulation and ownership (public/private) which are important interventions and it is relevant to the infrastructure sector; Both the issues have been handled in detail
Weight of evidence (4) (overall weight of evidence)	Medium Overall, the paper provides results but which is not fully validated; Further research needs to be done to strengthen these results

Estache, A., Rossi, A. M. (2008). Regulatory agencies: Impact on firm performance and social welfare, World Bank Policy Research Working Paper 4509.	
Country/Countries of study	51 developing countries
Data period	1985-2005
Type of study	Quantitative
Aims of study	Connection between creation of a regulatory agency and performance of electricity operations in developing and transition countries
Summary of study design, including details of sample	Cross sectional and longitudinal; 220 electric utilities in 51 developing countries during the given data period
Data sources and data collection instruments	Secondary data
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis - difference-in-differences model
Summary of results	"…regulatory agencies are strongly associated with higher labor efficiency at the firm level in the sense that less labor is used to produce a given level of output." (p16) …private firms are substantially more efficient in their use of labor than state-owned firms."(p16)
Conclusion	"…the introduction of regulatory agencies in developing and transition countries is associated with more efficient firms and with higher social welfare." (p16)
Weight of evidence (1) (trustworthiness in relation to study question)	High Transparency is explicit; Strategies to control bias – time, firm structure; issue of repeatability addressed. Selective reporting bias avoided
Weight of evidence (2) (appropriateness of research design and analysis)	High Adequate description of methodology, aims and context of study Choice of research design is appropriate; Model uses appropriate control variables and robustness checks done for the results
Weight of evidence (3) (relevance of focus of study to review)	High Focus of study is on the electricity sector and the intervention is appropriate for this review
Weight of evidence (4) (overall weight of evidence)	High Overall a very good paper with adequate research on the electricity sector

Estache, A., Tovar, B., Trujillo, L. (2008). How efficient are African electricity companies? Evidence from the South African countries, Energy Policy, 36, pp. 1969-1979.	
Country/Countries of study	Southern Africa
Data period	1998-2005
Type of study	Quantitative
Aims of study	To provide a first assessment of the performance changes since the main reforms took place in the late 1990s for a sample of Sub-Saharan African countries
Summary of study design, including details of sample	Over the period analysis, sample consists 12 countries for the period 1998-2005
Data sources and data collection instruments	AFREN, AFUR. Secondary data source
Methods used to analyze data, including details of checks on reliability and validity	Data Envelopment Analysis
Summary of results	• Under all models, the changes in productivity have been positive • An average improvement in total efficiency of 5.3% as indicated by the mean of the sample of operators covered. Only Zambia, Swaziland, Namibia and Malawi are below that total average performance (pp. 1978) • Overall all trend is positive and this positive trend is driven by technological change observed in the sector with exception of Namibia, Angola and Tanzania
Conclusion	• Many improvements in sample countries covered in this study can be assigned to two very clear sources: the adoption of better technologies and the improvements in commercial practices • No significant improvements have been observed on technical side
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Aims of the study clearly defined • Context of study adequately defined • Limited data period • Limitations of data quality and volume (as suggested by authors pp. 1997) • Much more data is needed, in particular on the cost side of business (as suggested by authors pp. 1997)
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design or methodology has been clearly defined • All the included variables explained properly • Adequate description of method of data analysis • Appropriate research design to addressing the research question • Limitations in attributing causality to the intervention
Weight of evidence (3) (relevance of focus of study to review)	Medium • Intervention clearly mentioned • Outcome clearly defined
Weight of evidence (4) (overall weight of evidence)	Medium • Based on above three weight of evidences, it is good study and but not generalized enough as it is very specific to the African context

Estache, A., Trujillo, L. (2003). Efficiency effects of "privatisation" in Argentina's water and sanitation services, Water Policy, 5(4), pp. 369-380.	
Country/Countries of study	Argentina
Data period	1992 - 2001
Type of study	Quantitative analysis
Aims of study	..”to present an assessment of the efficiency gains achieved since the reforms for a sample of provinces from the viewpoint of a regulator of the sector.” (p 370). The sector in focus is the water and sanitation sector.
Summary of study design, including details of sample	Longitudinal data for the given time period was used; 18 provinces were included in the study out of which only 4 provinces had provided enough details to calculate TFP
Data sources and data collection instruments	Primary data- obtained from a survey questionnaire sent to provincial water regulators in Argentina.
Methods used to analyze data, including details of checks on reliability and validity	Total factor productivity (TFP) is adopted here as a specific measure of economic efficiency. Econometric methods for calculating TFP have been used. Output and Input index is also used.
Summary of results	Annual changes in TFP – 2.3% (for Aguas Argentinas) and 13.5% (for Mendoza). During the data time period the public operator has managed to sustain its modest efficiency gains. “…there is not only a wide margin of changes across operators but there is also a wide margin in terms of sources of changes in efficiency.”(p 376) “The strong performance by Mendoza in terms of TFP results completely from its improvement in input efficiency.” (p 376)
Conclusion	“…the gains come not only from the input side (and not only from employment reductions) but also from the output side.” (p 378) “…as long as operators continue to increase investment as scheduled in their concession contracts, major inputs increases, and hence efficiency gains estimates, continue to be low since output gains are related to this specific increase in inputs.” (p 378) “…reform processes seem to largely ignore the importance of regulatory accounting for the monitoring of the performance of these privatized or commercialized monopolies in this sector.” (p 378)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency has been implicit. Data sources have been mentioned but no adequate description. The context of the study has been adequately described and the aims of the study have been clearly reported although the findings do not wholly substantiate the aims due to data unavailability.
Weight of evidence (2) (appropriateness of research design and analysis)	Low The research design was fairly appropriate owing to lack of data. Limitations in data collected might not allow a fully satisfactory assessment of efficiency gains. All variables have not been studied due to various limitations mentioned in the paper. Also, who gains and loses due to regulatory decisions have not been analysed. “…with the data available there is not much scope for an inter-company comparison which could result in some form of yardstick competition.” (p 378) Retrospective uncontrolled study, leading to validity issues
Weight of evidence (3) (relevance of focus of study to review)	High Study looks at the impact of intervention on costs (efficiency).
Weight of evidence (4) (overall weight of evidence)	Medium Overall this paper is “an illustration of what can be achieved in developing countries with nascent regulatory capacity and limited data availability.” (p 371)

Facanha, O. L., Resende, M. (2004). Price cap regulation, incentives, and quality: The case of Brazilian telecommunications, International Journal of Production Economics, 92, pp. 133-144.	
Country/Countries of study	Brazilian
Data period	1998-2002
Type of study	Quantitative
Aims of study	Paper aims to address service-quality measurements for local telecom operators in Brazil
Summary of study design, including details of sample	Over the period analysis (time series), sample consists telecommunication sector data for the period July 1998 to March 2002 for 29 firms
Data sources and data collection instruments	ANATEL, secondary data source
Methods used to analyze data, including details of checks on reliability and validity	Data Envelopment Analysis
Summary of results	• Service quality in Brazilian telecommunications is an important issue and therefore cannot be ignored in the context of regulatory practices • The magnitude of the productivity offset was increased over the considered period • The increase in mean efficiency level from 1998 to 2002 • The assessment of quality changes following regulatory shifts is not entirely conclusive
Conclusion	• Overall improvement could be detected between1998-2002, quality underperformance is pervasive. Period was associated with stable competition and an increasing productivity offset
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Aims of the study clearly defined • Context of study adequately defined • Limited data period • Transparency is implicit in nature
Weight of evidence (2) (appropriateness of research design and analysis)	Low • Research design or methodology has been clearly defined • All the included variables explained properly • Appropriate research design to addressing the research question • Retrospective uncontrolled study, leading to validity issues
Weight of evidence (3) (relevance of focus of study to review)	Medium • Considering fixed telecom • Intervention clearly mentioned • Outcome clearly defined
Weight of evidence (4) (overall weight of evidence)	Good • Based on above three weight of evidences, it is classified as a medium quality study

Fink, C., Mattoo, A., Rathindran, R. (2001). Liberalizing basic telecommunication: The Asian experience, http://ssrn.com/abstract=634429.	
Country/Countries of study	12 developing Asian economies
Data period	1985-1999
Type of study	Quantitative
Aims of study	Paper broadly aims to examine the liberalisation in basic telecommunications sectors in Asian countries with a view to identify the elements of good policy and how it can be promoted through multilateral negotiations
Summary of study design, including details of sample	Over the period study using panel data regression. Sample consists of 12 developing nations (all Asian countries) for the period 1985-1999
Data sources and data collection instruments	World bank, ITU. Secondary data used
Methods used to analyze data, including details of checks on reliability and validity	Regression
Summary of results	• Corporatisation and privatisation significantly improves mainlines per worker and main line penetration • Privatisation with Regulation significantly decreases mainlines per worker • Privatisation with Competition significantly improves Main line penetration and mainlines per worker • Privatisation, Regulation and Competition significantly improves main line penetration and mainlines per worker
Conclusion	• Corporatisation, as an indicator of public sector's determination to improve sector performance was found to have a significantly positive effect on mainline availability, service quality and labor productivity • The implementation of comprehensive reform-measured by the state of privatisation, competition and regulation- also led to higher levels of main line availability, service quality and labor productivity • Mobile penetration was positively affected by competition, although the effect was only significant when competition was only proxied by the number of digital operators
Weight of evidence (1) (trustworthiness in relation to study question)	High • Aims of the study clearly defined • Context of study adequately defined • Extended data period • Transparency is implicit in nature • Considering both fixed and mobile sections of telecommunications
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design or methodology has been clearly defined • All the included variables explained properly • Data sources are explicitly mentioned • Adequate description of method of data analysis • Appropriate research design to addressing the research question
Weight of evidence (3) (relevance of focus of study to review)	High • Providing detailed information about telecom policy and multilateral negotiations • Intervention clearly mentioned

	• Outcomes adequately captured • Considering three interventions
Weight of evidence (4) (overall weight of evidence)	High • Based on above three weight of evidences, it is good study and widely generalized

Fink, C., Mattoo, A., Rathindran, R. (2002). An assessment of telecommunications reforms in developing countries, World Bank Policy Research Working Paper 2909.	
Country/Countries of study	86 developing countries in Sub-Saharan Africa, Asia, Middle East, Latin America and the Caribbean
Data period	1985-1999
Type of study	Quantitative
Aims of study	To analyze the impact of telecom policy on telecom sector performance
Summary of study design, including details of sample	Sample of 86 developing countries over the period of 14 years
Data sources and data collection instruments	ITU, World Bank, Trade port and International Trade Administration Database, Economist Intelligence Unit. Secondary database used
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis; regression model
Summary of results	• Privatisation and Competition significantly increase mainline penetration • Privatisation and Competition significantly increase mainlines per employee • Privatisation with Competition, Competition with Regulation and Privatisation with Regulation significantly increase mainlines penetration and mainlines per employee • Full liberalisation significantly increases mainlines penetration and mainlines per employee • Sequencing of reform significantly improves mainlines penetration and mainlines per employee
Conclusion	• The years which had privatisation, competition and independent regulators increased teledensity by 8% and labor productivity by 21% compared to years which didn't have reforms or had partial reforms. • Both privatisation and competition improves performance and the latter reinforces the former • Sequences are important i.e. order in which competition and privatisation is introduced matters • Rapid technological progress and public investment also contribute autonomously to the performance of the telecom sector other than the above said factors
Weight of evidence (1) (trustworthiness in relation to study question)	High • Aims and objective of the study are clearly specified • Validation of results using findings from other studies • Transparency is implicit
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Research design is fairly appropriate; Available measures of policy do not capture the multiple dimensions of a complex reform process. More research is needed to verify and refine the other findings presented in the study. Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High Focus of the study is on reforms and performance of the telecom sector. It is widely generalisable but needs more detailed analysis
Weight of evidence (4) (overall weight of evidence)	High Overall a good paper; with interesting results

Galiani, S., Rozada, G. M., Schargrodsky, E. (2008). Water expansion in Shantytowns: Health and savings. Chong, A. (Eds.), Privatisation for the Public Good? (pp. 25-41). Chapter: 2, Inter-American Development Bank.	
Country/Countries of study	Argentina
Data period	2003 - 2005
Type of study	Quantitative and Qualitative
Aims of study	To examine the effects of a program of expansion of the water network in urban shantytowns by a privatized water network (Aguas Argentinas) in Argentina
Summary of study design, including details of sample	Before-and-after study comparing the performance in treated neighborhoods relative to a control group; 6 neighborhoods participating in the MPG program used for the research; in addition 3 neighborhoods were selected to form a control group
Data sources and data collection instruments	Primary data used; Systematic household survey of each neighborhood was conducted; baseline survey conducted in the last two weeks of February and first week of March 2004 and the follow-up survey in the same weeks in 2005
Methods used to analyze data, including details of checks on reliability and validity	Mean equality tests; difference-in-differences model used- more specifically a two-way fixed effect linear regression model was used
Summary of results	• Large reductions in the presence (measured with a dummy variable), severity(whether the episodes included blood and/or parasites), and duration (measured in days) of diarrhea episodes among children in the treated population and a reduction in water related expenses • Unserved households needed to rely on alternative sources of water that need more monetary expenditures and higher transportation costs than households that have network connections • Health and savings effects are important for households that earlier had clandestine self-connections to the water network which were free but of low quality
Conclusion	"First, there are significant savings from gaining access to the water network of those households that previously had to rely on alternative water sources……, Second, the apparent money loss for those households when replacing their free clandestine self-connections with a formal water network connection may be overcome by important health improvements." (p41)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Transparency is fairly explicit • Omitted variable bias • Limited data set • Selective reporting bias has been avoided
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The research design is appropriate for obtaining relevant results. A primary survey followed by econometric analysis is done but data set is not complete and hence results may not be accurate
Weight of evidence (3) (relevance of focus of study to review)	Medium The focus of the study is on water expansion; the results are relevant to the study but as the process is still ongoing the results from this paper cannot be concluded as final. Results cannot be widely generalized
Weight of evidence (4) (overall weight of evidence)	Medium More research needs to be done on this issue as the results obtained in this paper are not the final results

Garbacz, C., Thompson, G. H. (2007). Demand for telecommunication services in developing countries, Telecommunications Policy, 31, pp. 276-289.	
Country/Countries of study	South America, Africa, Asian, European Countries, CA, North American, Caribbean
Data period	1996-2003
Type of study	Quantitative
Aims of study	• Estimating telecommunications demand for developing countries • to find cross-price effects between mainline and mobile services and important policy implications
Summary of study design, including details of sample	Panel Data, Sample consists of data from 53 countries depending on the information available for the developing countries for the period 1996-2003
Data sources and data collection instruments	World Bank, ITU and Barro and Lee, Harvard. Secondary data source
Methods used to analyze data, including details of checks on reliability and validity	Regression
Summary of results	• In the residential model privatisation has no effect on price • Competition in the residential fixed-line market alone has the effect of lowering prices • Independent regulator variable has a small positive effect on price rises
Conclusion	• Universal service that seeks to put more of the poor on the network will not be successful with untargeted residential monthly price subsidies • As a result of the elasticities for mobile monthly service and residential connection charges estimated here the advantage to mobile is overwhelming • Market competition in telecommunications service, income growth and expanded educational achievement may be important promoters of universal service • Mobile competition alone appears to be very effective means of expanding the overall network
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Aims of the study clearly defined • Context of study adequately defined • Transparency is implicit in nature
Weight of evidence (2) (appropriateness of research design and analysis)	High • Research design or methodology has been clearly defined • All the included variables explained properly • Data sources are explicitly defined • Adequate description of method of data analysis
Weight of evidence (3) (relevance of focus of study to review)	High • Outcomes clearly defined • Provide reasonably good information about fixed and mobile telephony
Weight of evidence (4) (overall weight of evidence)	High • Based on above three weight of evidences, it is good study and fairly generalised

Garn, M., Isham, J., Kahkonen, S. (2002). Should we bet on private or public water utilities in Cambodia? Evidence on incentives and performance from seven provincial towns? Middlebury College Economics Discussion Paper No. 02-19.	
Country/Countries of study	Cambodia (Asia)
Data period	1997 and 1998
Type of study	Quantitative
Aims of study	• Analyzes the level and quality of water services provided by private water companies and public utilities and consumer reaction to these services • Assesses whether there has been any significant change in the level and quality of water services provided as a result of private sector involvement
Summary of study design, including details of sample	Comparison of four private and four public utilities, sample consists household survey data
Data sources and data collection instruments	Household Survey, primary data
Methods used to analyze data, including details of checks on reliability and validity	Descriptive
Summary of results	• The households served by private utilities: the daily availability and quality of piped water is better and service interruptions are less frequent • Household served by private utilities pay significantly more for piped water services and that are not served by private utilities are partially limited by the high connection fees
Conclusion	• Household served private utilities are significantly more satisfied with the piped water than consumer of public utilities
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Aims of the study clearly defined • Context of study adequately defined • Not generalized study • Limited data period and few numbers of firms • Transparency is implicit in nature
Weight of evidence (2) (appropriateness of research design and analysis)	Low • Research design or methodology has been clearly defined • Adequate description of method of data analysis • Appropriate research design to addressing the research question • Difficulty in attributing causality to the intervention
Weight of evidence (3) (relevance of focus of study to review)	High • Intervention (restructuring) clearly mentioned • Outcome clearly defined
Weight of evidence (4) (overall weight of evidence)	High • Based on above three weight of evidences, it is rated as a medium level study.

Gasmi, F., Virto, R. L. (2010). The determinants and impacts of telecommunications reforms in developing countries, Journal of Development Economics, 93, pp. 275- 286.	
Country/Countries of study	86 developing countries
Data period	1985-1999
Type of study	Quantitative
Aims of study	"…seeks to identify the key determinants of some policies that have been at heart of the reforms of the telecommunications industry in developing countries, namely, liberalisation, privatisation and (re)structuring of regulation." (p275) "…it attempts to estimate the extent to which these policies have translated into actual deployment of telecommunications infrastructure." (p275)
Summary of study design, including details of sample	Cross sectional data used;
Data sources and data collection instruments	Secondary data; Only after data used.
Methods used to analyze data, including details of checks on reliability and validity	Empirical analysis; econometric methods; regression analysis
Summary of results	Positive relation between the decision to introduce competition in the digital cellular segment and the growth of the fixed line segment Negative relationship between the decision to introduce competition in the analogue cellular segment and the growth of the fixed line segment Digital cellular and fixed service are complements while analogue cellular and fixed service are substitutes Privatisation has a strong impact on fixed service penetration rate
Conclusion	Creation of regulator has a significant impact on fixed line deployment
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Data used is relevant for the study but future data cannot be subject to the same analysis and the same results would not carry forward in the future years
Weight of evidence (2) (appropriateness of research design and analysis)	High Issue of repeatability and reliability of data collection tools have been tackled; Selective reporting bias has been avoided; Use of instrumental variables and appropriate control variables
Weight of evidence (3) (relevance of focus of study to review)	Low The paper has not handled all the variables efficiently and effectively; this paper is very specific in nature as it uses a particular time frame and is for a particular context
Weight of evidence (4) (overall weight of evidence)	Medium More of a historical paper which is not very useful for going forward. Changes in telecom space and income as an omitted variable makes it difficult to classify this as a high quality paper

Gasmi, F., Um, N. P., Virto, R. L. (2009). Political accountability and regulatory performance in infrastructure industries: An empirical analysis, World Bank Economic Review, 23(3), pp. 509-531.	
Country/Countries of study	29 developing countries; 23 developed countries
Data period	1985-1999
Type of study	Quantitative
Aims of study	To empirically investigate the impact of political accountability on the performance eof regulation in telecommunications
Summary of study design, including details of sample	Time series cross sectional data
Data sources and data collection instruments	Data source or collection method has not been mentioned explicitly
Methods used to analyze data, including details of checks on reliability and validity	Econometric regression analysis; generalized method of moments (DIF-GMM)
Summary of results	• The greater the political accountability, the better the regulatory performance as reflected in higher output, higher efficiency and lower prices in developing countries • The apparently counterintuitive case, where a higher political accountability leads to higher prices, lower efficiency and output occurs only in the initial stages of reforms in developing countries • Global accountability is found to have a higher impact on regulatory performance than local accountability
Conclusion	The impact of political accountability on the performance of regulation is stronger in developing countries
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Aims and objective of the study very relevant for the review • Transparency is implicit • Issues of repeatability and reliability have not been addressed
Weight of evidence (2) (appropriateness of research design and analysis)	High Choice of research design is appropriate; Strategies to control bias from confounding variables have been mentioned
Weight of evidence (3) (relevance of focus of study to review)	High The results are widely generalisable; All the variables were classified into local accountability and global accountability which are relevant to the study.
Weight of evidence (4) (overall weight of evidence)	High The empirical analysis in this study supports defining a set of instruments of effective intervention, with the objective of improving political accountability in the implementation of regulation

Gassner, K., Popov, A., Pushak, N. (2007). An empirical assessment of private sector participation in electricity and water distribution in developing and transition countries, World Bank, PPIAF, Trends and Policy Option No. 6.	
Country/Countries of study	71 developing and transition countries
Data period	beginning of the 1990s to 2005
Type of study	Quantitative and qualitative
Aims of study	• To evaluate the impact of PSP on firm performance in electricity distribution and water and sanitation services • To analyze over time a number of output variables for both groups of utilities and isolate effect of PSP from time trends and firms – specific characteristic
Summary of study design, including details of sample	302 utilities with PSP and 928 state owned enterprises in 71 developing and transition countries
Data sources and data collection instruments	302 utilities with private sector participation (PSP) and 928 utilities without PSP
Methods used to analyze data, including details of checks on reliability and validity	Regression analysis
Summary of results	• Authors report robust evidence in the global sample that PSP has a strong impact on performance (mainly as reported by other authors or positive results) • Authors state that some of the effects of PSP are realized during the transitional period & most of the effects takes place during the post PSP period when the private part is fully in control of the operating rights • There is lack of evidence for an increase in investment following PSP for any contact type divestitures in electricity • No conclusive evidence for a change in prices as a result of PSP
Conclusion	Post – PSP performance (mostly) for electricity and water and sanitation sector is better than pre- PSP
Weight of evidence (1) (trustworthiness in relation to study question)	High Aims and objective of the study are clearly specified; Very large datasets
Weight of evidence (2) (appropriateness of research design and analysis)	High Model specification includes firm random and fixed effects, firm specific time trends, use of instrumental variables, and nearest neighbour matching; robust study design gives strong evidence for causality to the intervention
Weight of evidence (3) (relevance of focus of study to review)	High Intervention very pertinent to this review
Weight of evidence (4) (overall weight of evidence)	High It is a very highly cited paper. The large data sets and the robustness of study design makes the results very generalisable

Gutierrez, H. L., Berg, S. (2000). Telecommunications liberalisation and regulatory governance: Lessons from Latin America, Telecommunications Policy, 24(10-11), pp. 865-884.	
Country/Countries of study	19 Latin American and Caribbean countries
Data period	1985-1995; Data for the years 1986,1990 and 1995 were used for the Economic freedom index
Type of study	Quantitative Study
Aims of study	To examine the determinants of telephone lines per capita, using economic, institutional and regulatory variables
Summary of study design, including details of sample	57 observations; Panel data consisting of time series and cross section
Data sources and data collection instruments	Secondary data; sources of data have not been mentioned explicitly; assumed to be taken from different studies
Methods used to analyze data, including details of checks on reliability and validity	Econometric model; Regression analysis; Dichotomous index of regulatory development; Economic freedom index also used; Instrumental variable technique was also applied
Summary of results	• Openness (exports plus imports as a percentage of GDP) captures significant external links which require telecommunications to coordinate the production and delivery of goods and services. This variable had a positive (but not statistically significant) impact. • The regulatory framework and freedom factors have significant positive impacts on telephone lines per capita • Institutional factors have a significant and positive impact on the deployment of telephone main lines • Economic freedom index not statistically significant; but has expected sign which implies a sound institutional endowment consisting of a strong telecom regulatory body and a stable political system increase the level of main lines per 100 inhabitants
Conclusion	Telecommunications services are income-elastic
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Limited availability of data is an issue; Transparency is explicit to an extent; Other empirical studies have been mentioned to validate the results of the study
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The research design used is appropriate; But more complicated models need to be tested as national policy is endogenous and other questions related to privatisation and the promotion of competition need to be answered; Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	Medium This empirical study calls for extensions; comprehensive analysis is needed; all results are not widely generalisable while some are. Transparency, accountability and predictability is stressed upon in this study
Weight of evidence (4) (overall weight of evidence)	Medium "…initial study sheds new light on the determinants of telecommunications investment in this region." (p880)

Gutierrez, H. L. (2003). The Effect of endogenous regulation on telecommunications expansion and efficiency in Latin America, Journal of Regulatory Economics, 23(3) pp. 257-286.	
Country/Countries of study	22 Latin American countries
Data period	1980-1997
Type of study	Quantitative
Aims of study	To investigate the effect a specialized regulatory body has on telecommunications sector performance
Summary of study design, including details of sample	Cross sectional; telecommunications market in 22 Latin American countries is used for a 17 year period; network deployment and efficiency are the two dependent variables used; privatisation, competition and regulatory development are explanatory variables
Data sources and data collection instruments	Secondary data; data collection instruments are not mentioned explicitly
Methods used to analyze data, including details of checks on reliability and validity	Econometric; regression analysis; static and dynamic models using panel data
Summary of results	Better regulatory environment is definitely associated with better performance (measured by main lines per 100 inhabitants) Privatisation is associated with network expansion
Conclusion	Sound regulatory governance in telecommunications has a positive impact on network expansion and efficiency in both static and dynamic model. competition and privatisation leads to more efficient firms and better telecom performance
Weight of evidence (1) (trustworthiness in relation to study question)	High Transparency is implicit; author has not explicitly mentioned the ways he has addressed the issues of repeatability or reliability of data. The trustworthiness of the data collection tools have also been implicit; but there has been sufficient attempts to establish this point; Data is a limitation; but many ways it is cut allows for it to be compensated
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Strategies used to control bias arising from confounding variables have been mentioned; choice of research design is appropriate but data is a concern; Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High The study results are widely generalisable and there are some good findings in the study related to the telecom sector
Weight of evidence (4) (overall weight of evidence)	High The study suggests lines of future research in the region and on this sector

Hamilton, M. J. (2002).Telecommunications reform in Africa and The United States, PhD. dissertation submitted to University of Florida.	
Country/Countries of study	African Countries
Data period	1985-1997
Type of study	Quantitative
Aims of study	Not clearly mentioned
Summary of study design, including details of sample	Panel data. Sample consists of 23 African Countries for the period of 1985-1997
Data sources and data collection instruments	ITU, ICRG, Polity III and World Bank. Secondary data used
Methods used to analyze data, including details of checks on reliability and validity	Regression
Summary of results	…Mainline penetration significantly improves with the variables rule of law, security of contract, government operations and significantly deteriorate with the variables bureaucratic quality and democracy
Conclusion	• Credible institutions, including stable legal structures are important force behind the surge of modernisation in Africa's telecommunications sector • Competition is important in fostering telecom development • Competition from mobile can do much to improve main-line access
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Aims of the study not clearly explained. Context of study adequately explained. Transparency is implicit in nature.
Weight of evidence (2) (appropriateness of research design and analysis)	High Research design or methodology has been clearly defined. All the included variables explained properly. Data sources are explicitly defined. Adequate description of method of data analysis. Appropriate research design to addressing the research question. Taking care of adequate controls and endogenity.
Weight of evidence (3) (relevance of focus of study to review)	Medium • Interventions clearly mentioned • Outcome clearly defined • Only a part of the study focuses on developing countries
Weight of evidence (4) (overall weight of evidence)	Good • Based on above three weight of evidences, overall it is good study and but not generalized enough

Howard, N. P., Mazaheri, N. (2008). Telecommunications reform, internet use and mobile phone adoption in the developing World, World Development, 37(7), pp. 1159-1169.	
Country/Countries of study	South America, Africa, Asian, European Countries, CA, North American, Caribbean (154 countries)
Data period	1990-2007
Type of study	Quantitative
Aims of study	Aims to find two answers • How do telecommunications policies influence technology adoption? • Has regulatory reform helped mitigate or exacerbate the digital divide?
Summary of study design, including details of sample	Panel study. Sample consists of 154 developing countries over the period 1990-2007
Data sources and data collection instruments	ISC (2008), ITU (2008) and World Bank (2008). Secondary Data used
Methods used to analyze data, including details of checks on reliability and validity	Regression
Summary of results	• Years of privatisation has significant but declining effect on mobile phone adoption • Regulatory separation has significant and increasing effect on mobile phone adoption • Years of regulatory depoliticisation has significant and increasing effect on mobile phone adoption
Conclusion	• Controlling for economic, demographic, political and infrastructural factors, study found that four most common policy reform strategies have quite different effects on the distribution of information technologies
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Aims of the study clearly defined • Context of study adequately explained • very generalized study • Adequate data period and few numbers of firms • Transparency is implicit in study
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design or methodology has been clearly defined • All the included variables explained properly • Adequate description of method of data analysis • Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High • Intervention clearly mentioned and very relevant for the review • Outcome clearly defined
Weight of evidence (4) (overall weight of evidence)	Medium • Based on above three weight of evidences, it is good study and generalized enough

Isham, J., Narayan, D., Pritchett, L. (1995). Does participation improve performance? Establishing causality with subjective data, World Bank Economic Review, 9(2), pp. 175-200.	
Country/Countries of study	49 countries across Africa, Asia and Latin America
Data period	Not given
Type of study	Quantitative
Aims of study	• Review the construction of data on project performance and beneficiary participation for 121 rural water supply projects • Consider if there exists a halo effect of public participation in projects
Summary of study design, including details of sample	Data from 121 rural water supply projects assembled from various project documents
Data sources and data collection instruments	Secondary; from various project documents
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis; Regression model
Summary of results	• Regression of overall project effectiveness with overall beneficiary participation gave strong statistically significant coefficients • After addressing potential issues of reverse causation or "halo effects", the study provided strong evidence that support the cause effect relation between participation and project performance • Participation at early stages improved project performance at every stage, from implementation and maintenance
Conclusion	Increasing participation directly causes better project outcomes
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Context of study adequately explained. Adequately generalized study. Transparency is implicit in nature.
Weight of evidence (2) (appropriateness of research design and analysis)	High • Research design or methodology has been clearly defined • All the included variables explained properly • Data sources are explicitly defined • Adequate description of method of data analysis • Use of instrumental variable to control endogeneity
Weight of evidence (3) (relevance of focus of study to review)	High Intervention clearly mentioned. Outcome clearly defined
Weight of evidence (4) (overall weight of evidence)	High • Based on above three weight of evidences, it is a high quality study

Ishan, J., Kahkonen, S. (2002). Institutional determinants of the impact of community-based water services: Evidence from Sri Lanka and India, Economic Development and Cultural Change, 50 (3), pp.667-691.	
Country/Countries of study	Sri Lanka and India
Data period	1990s
Type of study	Quantitative and Qualitative
Aims of study	To analyze under what circumstances the community-based approach is most likely to succeed by analyzing selected institutional determinants of the impact and performance of community-based water services
Summary of study design, including details of sample	Data from 1088 households and 50 water committees used; 3 community-based rural water projects introduced in Sri Lanka in two Indian states in the early 1990s
Data sources and data collection instruments	Data gathered through focus group interviews with community members and interviews with local government officials
Methods used to analyze data, including details of checks on reliability and validity	Summary statistics and Econometric analysis
Summary of results	• Well-designed and well-constructed water services lead to improved household health and reduced water collection times • Well-designed services can be promoted by involving community members in the design process and not letting outsiders make the final decision about the service type • Communities with high levels of social capital with active community groups and associations-design participation is more likely to be high and monitoring mechanisms are more likely to be in place • Projects in India have had a greater and more positive impact on health than the projects in Sri Lanka; Projects in India have also indicated greater time savings
Conclusion	"…community participation and decision making in service design lead to well-designed services…monitoring of household contributions to construction leads to better-constructed services." (p678)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is implicit The overall quality and weight of evidence is relevant and reliable to a large extent
Weight of evidence (2) (appropriateness of research design and analysis)	Low Retrospective uncontrolled study leads to issues of validity
Weight of evidence (3) (relevance of focus of study to review)	High The study is relevant to rural projects and it shows what can be done to improve the design of community based projects. Pertinent intervention for this review.
Weight of evidence (4) (overall weight of evidence)	Medium A good paper which provides guidelines for future community based projects. Generalisability limited.

Kenny, C. (2009). Is there an anti-corruption agenda in utilities? Utilities Policy, 17, pp. 156-165.	
Country/Countries of study	58 developing countries; details of countries not given
Data period	Not mentioned but have given links to the surveys which would have the information on dates
Type of study	Quantitative with qualitative examples and reasoning based on previous studies
Aims of study	To study the relationship between infrastructure outcomes, sector corruption measures and general indicators of corruption and governance
Summary of study design, including details of sample	Study timing is assumed to be cross sectional as implied in the paper; Uses data from surveys done in 58 countries
Data sources and data collection instruments	Secondary data; uses previously conducted surveys as data sources
Methods used to analyze data, including details of checks on reliability and validity	Econometric; regression analysis
Summary of results	• Income levels are a good indicator for corruption in utilities; overall governance indicators does not give additional information on corruption in utilities • Only 4 out of 28 regressions support a theorized relationship between corruption measures and utility outcomes
Conclusion	If utilities deliver quality services efficiently, corruption can have had little impact on development outcomes
Weight of evidence (1) (trustworthiness in relation to study question)	Medium The study uses qualitative examples and reasoning based on previous studies. Results of the study are validated by findings from other studies
Weight of evidence (2) (appropriateness of research design and analysis)	Low Research design is fairly appropriate but measures of corruption may not be enough to test the impact of corruption. Limited controls makes attribution of causality weak to the intervention
Weight of evidence (3) (relevance of focus of study to review)	High Given its focus on corruption, it is a very pertinent study for this review
Weight of evidence (4) (overall weight of evidence)	Medium More robust design would have increased the validity of the results and the generalisability of the results

Lin, C., Berg, V. S. (2008). Incorporating service quality into yardstick regulation: An application to the Peru water service, Review of Industrial Organisation, 32, pp. 53-75.	
Country/Countries of study	Peru
Data period	1996 to 2001
Type of study	Qualitative and Quantitative
Aims of study	to evaluate quality-incorporated firm performance and to identify changes in efficiency, technology (frontier), and service quality
Summary of study design, including details of sample	Data from 38 Peruvian water utilities used; sample has 136 observations and involves an unbalanced panel
Data sources and data collection instruments	Data collected from the Peruvian water utilities; The method of data collection is not clearly mentioned
Methods used to analyze data, including details of checks on reliability and validity	The study utilizes the nonparametric data envelopment analysis (DEA) model, a preference structure model, and the quality-incorporated Malmquist productivity index in evaluating firm performance
Summary of results	• TFP in Mexican ports rose by an average of 4.1% a year in 1996-1999 • Adoption of better technologies by the operators led to dramatic improvements
Conclusion	Port reforms were quite successful in contributing to improvements in Mexico's economic competitiveness
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Transparency is implicit • Absence of data – problem of missing values • Extreme value problem • Limited data set • Selective reporting bias has been avoided
Weight of evidence (2) (appropriateness of research design and analysis)	Low Research design (quantitative method) used was appropriate for addressing the research question-DEA analysis can easily accommodate multiple inputs and multiple outputs simultaneously. Retrospective uncontrolled sample limits the validity of the results for this review.
Weight of evidence (3) (relevance of focus of study to review)	Medium • Study focuses on an intervention that is not directly related to the focus of the review
Weight of evidence (4) (overall weight of evidence)	Medium A good paper; concern is the data set and research methods

Maiorano, F., Stern, J. (2007). Institutions and telecommunications infrastructure in low and middle income countries: The case of mobile telephony, Utilities Policy, 15, pp. 165-181.	
Country/Countries of study	30 low and middle income countries
Data period	1990-2004
Type of study	Quantitative
Aims of study	To look at the relationship between measures of telecommunications development and regulatory governance.
Summary of study design, including details of sample	Data of 30 low and middle income countries used. Not much about the sample is given in the study which needs to be studied from the survey articles used in this study.
Data sources and data collection instruments	Secondary Data used (previously conducted surveys used as data)
Methods used to analyze data, including details of checks on reliability and validity	Regression Analysis; Estimation of system of simultaneous equations; The study explicitly takes into account the role of income and other institutions and country governance. Variables used in the model are the penetration rate of mobile telecommunications, GDP per capita and a measure of regulatory governance which are the three endogenous variables while the average price of mobile telecom, the average price of fixed communication lines, the country population density, the telecom investment/GDP ratio are the exogenous variables
Summary of results	…autonomous regulation has positive impact on infrastructure performance (access) …Infrastructure performance has positive impact on growth
Conclusion	"…explicitly taking account of endogeneities results in higher and better-determined coefficients-at least for mobile telephony. This is particularly obvious for the impact of mobile penetration on the level of GDP per capita. …the system results indicated a more powerful effect on the presence of an autonomous regulator on mobile penetration than a single equation results." (p178)
Weight of evidence (1) (trustworthiness in relation to study question)	High Transparency is fairly explicit. The data used is from previously conducted surveys by reputed agents and thus the sources and validity of the data are assumed to be reliable. The measure of regulatory governance is based on formal characteristics of legal framework and this may not coincide with the actual governance of the regulatory authority. The study does not allow to quantify differences between countries regulators in detail. Country institutions measurement not clear. Used literature of other authors to address the validity of the results
Weight of evidence (2) (appropriateness of research design and analysis)	High The authors have used suitable measures to control bias while doing the analysis; They have stated that this paper has used a system of simultaneous equations of estimation which has not been adopted anywhere for infrastructure industry models.
Weight of evidence (3) (relevance of focus of study to review)	High The study is very specific and cannot be generalized. The aim has been more or less achieved but the modeling of regulation has not been very successful. Hence the aim and focus of study has not been fully covered. But the authors have not deviated from their aim of study either.
Weight of evidence (4) (overall weight of evidence)	High The approach of the paper is different and definitely puts forth some good valid results.

Montoya, A. M., Trillas F. (2007). The measurement of the independence of telecommunications regulatory agencies in Latin America and the Caribbean, Utilities Policy, 15, pp. 182-190.	
Country/Countries of study	23 Latin American countries
Data period	15 year period 1990-2004
Type of study	Quantitative
Aims of study	To measure the degree of regulatory independence for telecommunications regulators
Summary of study design, including details of sample	New homogeneous data set for 23 Latin American countries
Data sources and data collection instruments	Secondary data; Uses data from previously conducted surveys and studies and uses other available database
Methods used to analyze data, including details of checks on reliability and validity	3 indices constructed – IR1,IR2,IR3 to measure regulatory independence; Econometric; Regression analysis
Summary of results	• The three indices are highly correlated • The three indices are significant and each estimated index coefficient has a strong and highly statistically significant positive impact
Conclusion	Authors created three different independent regulatory indices and after analysis they find that regulatory independence has an estimated positive impact on fixed line telecom penetration rates
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Aims and objective of the study are clearly specified Selective reporting bias is avoided
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Choice of research design is appropriate But the three indices do not measure how the regulators operate in practice, including whether or not the legal obligations are met by governments and by regulators; The results reported in the paper do not take into account the potential endogeneity of independence, which is an important issue; Control variable used to control bias from confounding variables is GDP per capita; Validity of results is addressed using findings of other studies
Weight of evidence (3) (relevance of focus of study to review)	Medium Very specific (limited generalisibility) as it specifically explains the relation of regulatory independence to land telecommunication
Weight of evidence (4) (overall weight of evidence)	Medium Overall a good paper which needs more research on the issue

Mota, R. L. (2003). The restructuring and privatisation of electricity distribution and supply business in Brazil: A social cost benefit analysis, DAE Working Paper Working Paper 0309.	
Country/Countries of study	Brazil
Data period	1989- 2007
Type of study	Quantitative
Aims of study	To measure the change in social welfare due to privatisation. To understand the winners and losers due to privatisation among the consumers, government and the privatized firm
Summary of study design, including details of sample	The study uses the established methodology of Jones et al (1990) to test whether privatisation has any welfare implications. The study reviews 21 electricity distribution firms in Brazil.
Data sources and data collection instruments	Secondary, Company and other industry reports
Methods used to analyze data, including details of checks on reliability and validity	The study compares the actual performance of the private firms with a suitable counterfactual. The study explores the likely rate of reduction in costs without privatisation, and compares it with the actual performance of the firm. The limitation of this study is that the authors do not test statistically, or have a control.
Summary of results	• There is an average fall in costs per unit of 10% during the post privatisation period (1995- 2000) • Labour productivity improved by 147% • At a 12% discount rate, the efficiency gains of privatisation come to around R$ 9 billion • Producers receive a disproportionate share of the benefit (over 50%)
Conclusion	Labour productivity improved and costs decreased post privatisation. Overall, privatisation has had significant welfare gains for the Brazilian economy
Weight of evidence (1) (trustworthiness in relation to study question)	High As the study does a good comparison between two scenarios, it does set up a good basis on which to check the performance of the Brazilian electricity distribution business
Weight of evidence (2) (appropriateness of research design and analysis)	Low • Use of counterfactual scenarios could limit the validity of the results • Adding suitable controls and performing suitable statistical tests in a second stage analysis could have made this study complete
Weight of evidence (3) (relevance of focus of study to review)	Medium • Does not focus directly on the outcomes related to this review
Weight of evidence (4) (overall weight of evidence)	Medium • Given that the findings pertain to a specific context, there could be difficulties in generalisability

Motta. R. S., Moreira, A. R. B., (2004). Efficiency and regulation in the sanitation sector in Brazil, IPEA, Discussion Paper 1059.	
Country/Countries of study	Brazil
Data period	1998-2002
Type of study	Quantitative
Aims of study	Aims of the study to show that the issues like 'government level in which conceding authority should reside and how private operators can fulfill social objectives' are not the crucial barriers to the development of the sector when one looks at the productivity performance of the operators
Summary of study design, including details of sample	Study design is comparison across operator types. Study based on the assumptions that there are no sound market mechanisms and incentives in place to regulate pricing, service coverage and investment in the W & S sector in Brazil. Sample of the study contained 104 operators (25 serving only water, 20 are regional types and 11 are private concessions) from Brazil to the period 1998-2002
Data sources and data collection instruments	National System on Sanitation Information, Secondary data used
Methods used to analyze data, including details of checks on reliability and validity	Data Envelopment Analysis and Regression Analysis
Summary of results	• Regional and autarchic operators performances in each year and all measures • Scale effects are larger in regional operators and lower in autarchies • Tariff levels are lower in autarchy operators
Conclusion	• Regional operators show higher wage costs and distribution losses than other local operators although they practice tariff levels almost 60% higher and capture a much higher share • Private operators show the same level of service coverage those public locals • Productivity gains rather than scale effects are only observed at municipal levels • In the absence of incentives for efficiency, operators dissipate their productivity potential and apply higher tariffs
Weight of evidence (1) (trustworthiness in relation to study question)	High • Aims of the study clearly defined • Context of study adequately explained • Adequate description about data limitations • Study assumption clearly explained • Transparency is implicitly in study
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design or methodology has been clearly defined • All the included variables explained properly • Adequate description of method of data analysis • Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	Medium • Considering Water and Sanitation • Intervention clearly mentioned • Outcome clearly defined

	• Detailed analysis of the productivity performance
Weight of evidence (4) (overall weight of evidence)	Medium • Based on above three weight of evidences, it is good study, but results may not be widely generalisable

Nagayama, H. (2007). Effects of regulatory reforms in the electricity supply industry on electricity prices in developing countries, Energy Policy, 35(6), pp. 3440-3462.	
Country/Countries of study	83 countries - 20 Latin America, 26 former Soviet Union and Eastern Europe 11 Asian countries
Data period	1985-2002
Type of study	Quantitative
Aims of study	To examine how each policy instrument of the reforms measures influenced the electricity prices
Summary of study design, including details of sample	Original panel data for 83 countries
Data sources and data collection instruments	Secondary data from different sources
Methods used to analyze data, including details of checks on reliability and validity	Regression Analysis-Basic panel data estimation technique
Summary of results	• Neither unbundling nor introduction of a wholesale pool market on their own necessarily reduces the electricity power price • There was a tendency for price to rise • Coexistent with an independent regulator, unbundling may work to reduce electricity prices
Conclusion	Privatisation and the introduction of TPP and retail competition lower electricity prices in some regions, but not all
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Data availability and data accuracy was a problem • Use of dummies to represent major variables of reform
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Problem in evaluating countries of a different size • Dummy variables also cannot capture the degree of privatisation and competition and effectiveness of independence of regulatory institutions • Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	Medium • The impact of a few variables on electricity prices were not consistent with the expected results • Long term effects of prices cannot be identified as time frame of reforms is small • Results are generalisable to an extent
Weight of evidence (4) (overall weight of evidence)	Medium Overall a paper which is merely a basic step to empirical analysis; variables and data needs to be worked upon

Nagayama, H. (2009). Electric power sector reform liberalisation models and electric power prices in developing countries: An empirical analysis using panel data, Energy Economics, 31, pp. 463- 472.	
Country/Countries of study	Countries in South America, Asia, Europe, central & north America (including Caribbean)
Data period	1985-2003
Type of study	Quantitative
Aims of study	Empirically analyze the impact of the electric power price
Summary of study design, including details of sample	Panel data;
Data sources and data collection instruments	Secondary data used
Methods used to analyze data, including details of checks on reliability and validity	Regression – 2 models
Summary of results	Higher prices are linked with greater / more liberalisation
Conclusion	Liberalisation is undertaken to reduce prices and introduce effectiveness however it usually results in higher prices
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Aims and objective of the study clearly specified and very relevant for the review; There is certain missing data; Transparency is implicit
Weight of evidence (2) (appropriateness of research design and analysis)	High Appropriate research design; Good attempt to rule out bias; High selective reporting bias avoided; Ordered responses, fixed effect & a random effect model, instrumental variable technique to address the problems of simultaneously bias between the electric power price and liberalisation models selected
Weight of evidence (3) (relevance of focus of study to review)	Medium The paper focuses on an intervention pertaining to this review, though not in a direct way
Weight of evidence (4) (overall weight of evidence)	Medium “In many countries, regulatory reform in electricity supply is still an ongoing process a fact that also highlights the need for continued study.” (p 472) Overall a good study with robust methodology and interesting results

Nagayama, H. (2010). Impacts on investments and transmission/ distribution loss through power sector reforms, Energy Policy, 38, pp. 3453- 3467.	
Country/Countries of study	86 countries
Data period	1985 – 2006
Type of study	Quantitative
Aims of study	To examine the impact of power sector reform measures on performance indicators (capacity, transmission and distribution)
Summary of study design, including details of sample	Panel data used
Data sources and data collection instruments	Secondary data; WB and USEA data used
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis; Regression model
Summary of results	Different electric industry reform policies / measures have different impact on geographically and economically diverse countries
Conclusion	• Different stages of economic development have, different impact on policy effects of reforms • Independent Regulatory Agencies interact with other variables to improve performance
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Limitations of the data set; Data quality needs to be improved
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Research design is appropriate Dummy variables cannot capture the realism and scale of impact that reforms have on generation per capita Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High Outcomes are substantial and is widely generalisable
Weight of evidence (4) (overall weight of evidence)	Medium A good paper with relevant results. A more robust methodology would have made this a high quality study

Olken, A. B. (2007). Monitoring corruption: Evidence from a field experiment in Indonesia, Journal of Political Economy, 115(2), pp. 200-249.	
Country/Countries of study	Indonesia
Data period	2003- 2004
Type of study	Descriptive Quantitative
Aims of study	"…examines the results of a field experiment in Indonesia, designed to investigate alternative approaches to fighting corruption" (p243) "…author examines the effect of two strategies: top-down monitoring by government auditors and bottom-up monitoring through grassroots participation in the village monitoring process (p243)
Summary of study design, including details of sample	"…experiments design discusses in this paper examine ways of altering the probability that corruption is detected and punishments are enforced. Three interventions are examined: increasing the probability of external audits ("audits"), increasing participation in accountability meetings and providing an anonymous comment form to villages" (p207) "…sample draws from KDP projects in 608 villages in two Indonesian provinces" (p205)
Data sources and data collection instruments	The data was sourced from the official government records of the Kecamantan Development Project (KDP) and key informant surveys, data on village meetings, and a household survey (p244-245). Primary data sourced has been used
Methods used to analyze data, including details of checks on reliability and validity	OLS regression was conducted to test if missing expenditures (a difference between the actual expenditure on a project and an independent estimate of the project) had a relationship with auditing and grassroots participation
Summary of results	Increasing the probability of an audit from 4% to 100% reduces missing expenditure from 27.7 percentage points to 19.2 percentage points. Inviting local people to monitoring meetings help to reduce missing labor expenditure, with no impact on materials. Anonymous comments forms were effective, provided they by-pass the local implementers of the project (p243)
Conclusion	The study found a strong positive relationship between the likelihood of corruption in a road project and missing expenditures. OLS regression indicated that missing expenditures had a significant negative relationship with accountability and transparency enhancing interventions such as auditing
Weight of evidence (1) (trustworthiness in relation to study question)	High It tests if grassroots participation (a project level intervention) has an impact on missing expenditures. Transparency is not explicitly stated, but is measured through missing expenditures and change in missing expenditures after various type of auditing
Weight of evidence (2) (appropriateness of research design and analysis)	High A good study that looks at considering independently if grassroots participation can reduce cots. Adequate research design based on primary research and econometric analysis. Data sources are explained well. Appropriate control samples enhance the validity of the results.
Weight of evidence (3) (relevance of focus of study to review)	High Study considers an intervention that is very pertinent for this review.
Weight of evidence (4) (overall weight of evidence)	High The study is a high quality study. The road projects are reviewed and compared to see if grassroots participation has an impact on reducing costs as a result of better monitoring. Though the study is based on a particular context, the robustness of study design makes the results highly generalisable.

Olken, A. B. (2009). Corruption perception v/s corruption reality, Journal of Public Economy, 93, pp. 950- 964.	
Country/Countries of study	Indonesia
Data period	Sept 2003 – Aug 2004
Type of study	Quantitative
Aims of study	To examine the accuracy of corruption perception of reported perception of corruption vs. missing expenditure (objective measures of corruption)
Summary of study design, including details of sample	Cross sectional data; 603 villages surveyed but only 477 included
Data sources and data collection instruments	Primary data survey
Methods used to analyze data, including details of checks on reliability and validity	Game theory methodology – solving for a a Perfect Bayesian Equilibrium, regression
Summary of results	There is a link between perceptions of corruption and a more objective measure of corruption. However it is difficult to track corruption at village level as most of the inflating takes place in quantities rather than prices
Conclusion	"…evidence that for some village- level characteristic, particularly those perceptions with levels of trust… using perceptions to measure corruption can produce very different answer from the result obtained using a more objective measure of corruption."(p 963)
Weight of evidence (1) (trustworthiness in relation to study question)	High Aims clearly explained. There is data on corruption and missing expenditure which is a plus point
Weight of evidence (2) (appropriateness of research design and analysis)	High An appropriate empirical study; Data on roads are also included; The quality of the methodological approach is impressive. Impressive explanation of biases.
Weight of evidence (3) (relevance of focus of study to review)	High Focus on the study is on corruption which is very relevant in today's infrastructure sector; widely generalisable
Weight of evidence (4) (overall weight of evidence)	High A very good paper with a good empirical study and results. Though the study is based on a particular context, the robustness of study design makes the results highly generalisable.

Osorio, B. F., Olinera, M. (2007). Does society win or lose as a result of privatisation? Provision of public services and welfare of poor: The case of water sanitation privatisation in Colombia, Inter-American Development Bank, Research Network Working Paper R-525.	
Country/Countries of study	Colombia
Data period	1997-2003
Type of study	Quantitative & Qualitative (to an extent)
Aims of study	To analyze the effects of the water sector privatisation on consumers' welfare in 46 municipalities in Colombia. "…evaluates the impact of privatisation on access, price and quality of water as well as health outcomes using differences-in-differences methodology with variation across time (before and after privatisation) and between treatment and control group (privatized and non-privatized municipalities) and controlling for household and municipality characteristics." (p3)
Summary of study design, including details of sample	Longitudinal data used;
Data sources and data collection instruments	Secondary data used; Source - Encuesta de Calidad de Vida (ECV);1995 and 2005 Demographic and Health Surveys (DHS)
Methods used to analyze data, including details of checks on reliability and validity	Panel regression was used to study the data. A panel of municipalities for which data was available was built.
Summary of results	Access increased in privatized urban areas; water in privatized areas need less treatment for use; the frequency of service in privatized areas is lower;… In addition, municipal technical capacity is important in generating these positive effects, potentially through better regulation." (p21)
Conclusion	"…Privatisation leads to change in outcomes (positive effects)…" "…Privatisation in urban areas increases access, has positive effects on the quality measured as the need for treatment and the aspect of water…and improves health outcomes, as well as improves the frequency of the service for the lower quintiles…" (p3) "…Privatisation increases the prices of water in the lower quintile, although these effects may be the result of the joint implementation of privatisation and the elimination of cross subsidies…" (p3) "…In privatized municipalities with better governmental technical capacities there are positive effects on access, prices and quality…" (p3) "…the positive effects of privatisation in rural areas on the frequency of the service and on health outcomes are outweighed by negative impacts on access and prices…" (p3) "…Privatisation is apparently working better in urban than rural areas"
Weight of evidence (1) (trustworthiness in relation to study question)	High Aims and objective of the study very relevant for the review
Weight of evidence (2) (appropriateness of research design and analysis)	High Appropriate methodology has been used to analyze the data and the aims of the paper have been met. The results are clear and precise. The data available to the researcher has been used very well and the paper has been well structured with appropriate methodology being used. The paper is fairly explicit. Selective reporting bias has also been avoided by the author.
Weight of evidence (3) (relevance of focus of study to review)	High The paper provides an in-depth analysis of the subject matter and reviews each aim in detail. There are breakthrough results which are widely applicable.

Weight of evidence (4) (overall weight of evidence)	High Overall the paper gives a good clear answer to the questions that have been laid forth with reliable data and appropriate methodology.

Ozuna, T. Jr., Gomez, A. I. (1998). Regulation, organisation and incentives: The political economy of potable water services in Mexico, Inter-American Development Bank R-326	
Country/Countries of study	Mexico
Data period	From 1995
Type of study	Quantitative
Aims of study	"…to examine how institutional changes in Mexico's potable water sector influence public and private investment, incentives, efficient water use, and administrative capacities in the sector." (p1)
Summary of study design, including details of sample	146 water utilities throughout Mexico excluding Mexico City formed the initial sample; due to missing data this was reduced to 115 utilities
Data sources and data collection instruments	Secondary data; Sources: Unidad de Programs Rurales y Participación Social branch of Mexico's National Water Commission
Methods used to analyze data, including details of checks on reliability and validity	Descriptive as well as Econometric analysis; Model estimated using an iterative nonlinear seemingly unrelated regression \, which in convergence approximates maximum likelihood estimation
Summary of results	"…adoption of the National Water Commission's model state law does not influence the performance (in terms of variable cost) of water utilities, at least not for the utilities included in the data. (p15) "…neither type of organisational structure (autonomous or directly administered) statistically influence the relative efficiency of water utilities. (p16) "…if Mexico wants more efficient water utilities that it needs to focus more on managing water utilities at the municipal t\rather than focusing on the separation of normative and operative functions." (p16) "…as output increases, water utilities that are managed by municipalities become relatively less efficient." (p16) "… no differences between autonomous and directly administered water utilities in the effect of shadow price son cost…"(p16) "…labour and energy prices have a lower impact on costs for municipally managed water utilities than state managed water utilities." (p16)
Conclusion	"…institutional endowment of the sector significantly influences Mexico's potable water and sewage sector." (p18)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Mexico City is excluded from the data set. There was also a problem of missing data for a lot of water utilities
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Insignificant variables were deleted from the model; the research design and methods employed are appropriate for the limited data. The issue of bias has been addressed by the authors
Weight of evidence (3) (relevance of focus of study to review)	Medium The focus of the study is only Mexico and how far the results are applicable to other countries is a question.
Weight of evidence (4) (overall weight of evidence)	Medium Overall a good paper but results are not widely applicable

Padawangi, R. (2010).Community driven development as a driver of change: water supply and sanitation projects in rural Punjab, Pakistan, Water Policy, 12(S1), pp. 104-120.	
Country/Countries of study	Punjab in India and Pakistan
Data period	1990-2009 (including other research papers which have been cited in this paper)
Type of study	Quantitative and Qualitative
Aims of study	To examine how effective is a community driven development (CDD) approach to rural water supply To find out the measures of successful rural water supply and sanitation project
Summary of study design, including details of sample	Sample data of 78 subprojects from ADB Pakistan resident mission
Data sources and data collection instruments	Secondary data from the Punjab community water supply and ADB Pakistan resident mission
Methods used to analyze data, including details of checks on reliability and validity	Simple bivariate regression analysis
Summary of results	Slight correlation between the percentage of the poor population and the percentage of benefiting households
Conclusion	• the community-based approach in this project shows the greater potential of driving community change in terms of improving women's education, the role of women in the workforce, and water conservation vis-à-vis the belief system • highlights the importance to tie water supply and sanitation project to social protection, industry and trade, law, economic management, and public policy • Integrations among sectors to ensure stability after political and cultural reform is central to achieve the overarching goal of the project, which is to reduce poverty
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Data from reliable sources but too early to gather substantial data and so the research may not be adequate to arrive at conclusions The issue of repeatability and reliability must have been addressed in the original data document
Weight of evidence (2) (appropriateness of research design and analysis)	Low Simple bivariate regression; issues of validity and difficulty in attributing the results to the intervention
Weight of evidence (3) (relevance of focus of study to review)	Medium The focus of study is limited to the success of CCD; it is not widely generalisable; the study is restricted to Pakistan and Punjab and hence the study is country specific
Weight of evidence (4) (overall weight of evidence)	Medium Overall a paper which tracks the progress of CCD and which is country specific; The study has been included because of the attempt to study an interesting and unexplored topic.

Pardina, R. M., Rossi, M. (2000).Technical change and catching-up: The electricity distribution sector in South America, CEER working paper 11.	
Country/Countries of study	South America
Data period	1994-1997
Type of study	Quantitative
Aims of study	To analyze technical change in the electricity distribution sector in South America
Summary of study design, including details of sample	Comparison before and after reform scenario. Sample consists of 36 firms from 10 South American countries for the data period 1994-1997
Data sources and data collection instruments	CIER reports, Datos Estadisticos, Empresas Electricas, Ano1994 and Datos Estadisticos, Empresas Electricas, Anos 1995-1996-1997
Methods used to analyze data, including details of checks on reliability and validity	Regression
Summary of results	• If the firm belongs to country which has already reformed its electricity sector has statistically significant effect on number of customers • Relative efficiency does not show significant differences between the firms belonging to the countries that made or did not make the reform
Conclusion	• No evidence of catching up effects in the sector • Partial evidence suggesting that the countries that made the reform in the electricity sector had performed better than the others
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Aims of the study clearly defined • Context of study adequately explained • Not much generalized study • Limited data period • Transparency is implicit in nature
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design or methodology has been clearly defined • All the included variables explained properly • Data sources are explicitly defined • Not adequate description of method of data analysis, internal validity has not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	Low • Intervention (reform) clearly mentioned • Outcome clearly defined • The main focus of the study is not on the interventions identified in this review
Weight of evidence (4) (overall weight of evidence)	Medium • Based on above three weight of evidences, it is a medium study and but not generalized enough

Paul Azam, J., Dia, M., Guessan, N. T. (2002). Telecommunication sector reform in Senegal, World Bank Policy Research Working Paper, No. 2894, pp.1-46.	
Country/Countries of study	Sénégal
Data period	1985 to 2001
Type of study	Quantitative and Qualitative
Aims of study	to analyze Senegal's experience with telecommunications liberalisation and privatisation
Summary of study design, including details of sample	Comparison of the performance of Sonatel which was a monopoly telecom firm formed during the 1985 reforms and after the 1995 reforms after the entry of France Telecom, who partially bought the shares of Sonatel
Data sources and data collection instruments	Secondary data; Data from the national company Sonatel which was formed in the 1985 reforms were used
Methods used to analyze data, including details of checks on reliability and validity	Descriptive statistics; Game theory analysis; Financial and Quantitative performance indicators also used
Summary of results	• The reforms of 1985 was a success but could not sustain due to the pressure of international competition in the telecom market • After partially privatizing the public monopoly, privatisation did not have statistically significant impact on technical efficiency but the privatized firm expanded the network drastically and substituted capital for labor
Conclusion	This paper throws light on the risks incurred by a private party in contracting with a sovereign entity.
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Sample size is small and thus the results derived is limited • Transparency is implicit • There are issues of reliability and repeatability of data
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The research design used is fairly appropriate but as the sample size is small not much can be done with the methodology
Weight of evidence (3) (relevance of focus of study to review)	Medium The focus of the study is on the telecom sector in Sénégal only but the results cannot be widely generalized
Weight of evidence (4) (overall weight of evidence)	Medium Overall, the topic needs more research with a larger sample size

Plane, P. (1999). Privatisation, technical efficiency and welfare consequences: The case of the Cote d Ivoire electricity company, World Development, 27(2), pp. 343-360.	
Country/Countries of study	Cote d'Ivoire
Data period	1959- 1995
Type of study	Quantitative
Aims of study	Investigate the economic consequences of privatisation in the case of the Ivorian electricity company
Summary of study design, including details of sample	The study creates a production frontier with Maximum Likelihood Estimates for parameters of selected inefficiency stochastic frontier production frontiers
Data sources and data collection instruments	Secondary, Firm level and World Bank data
Methods used to analyze data, including details of checks on reliability and validity	A PPF comparison at first level and at the second stage a comparative tabulation of productivity gains
Summary of results	• Private management has improved outcomes. The company after privatisation, has been consistently profitable • Productivity gains by a reduction in costs of around 24% was possible through privatisation
Conclusion	• Private management improves the organisational structure and technical efficiency of the firm. • Consumers were the main beneficiaries of privatisation • Institutional conditions and political support for privatisation is necessary for improvements
Weight of evidence (1) (trustworthiness in relation to study question)	High The study does a thorough historical examination of the entire data period from 1959- 1990 of the Ivorian utility
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The study does not specify data sources, especially as historical data are likely to be difficult to compare with more recent data and the checks taken to control for these variations
Weight of evidence (3) (relevance of focus of study to review)	High The study explicitly considers the impact of a sector intervention: privatisation on productivity
Weight of evidence (4) (overall weight of evidence)	High A good study as it takes a historical review of one utility. The study though might not be widely generalisable, robust study design makes this a high quality study

Pombo, C., Ramirez, M. (2002). Privatisation in Colombia: A plant performance analysis, University Del Rosario, Economia No. 21.	
Country/Countries of study	Colombia
Data period	1988-1994 (pre-reform years) and 1995-2000 (post reform years)
Type of study	Quantitative
Aims of study	For the power sector the paper studies the impact of regulatory reform on market entry, ownership structure, market competition and productive efficiency
Summary of study design, including details of sample	Longitudinal Data, Before and after study. Sample consists 33 thermal plants of pre reform years and 32 thermal plants for post reform years
Data sources and data collection instruments	MEM-ISA reports and ISA reports; surveys
Methods used to analyze data, including details of checks on reliability and validity	Data Envelopment Analysis
Summary of results	• The efficient unite before the reform are no longer the most efficient after the reform • All profitability indicators fell after the regulatory reform • Privatisation significantly improves TFP • Regulatory policy significantly improves input-oriented efficiency scores • Presence of regional market significantly deteriorate input-oriented efficiency scores
Conclusion	• The measurement of efficiency scores at plant level showed that there were important efficiency gains after reform • The Regulatory policy has had positive effects on plant efficiency • The increasing number of non-regulated users has led generators to offer more competitive prices in order to ensure generation on contract bases
Weight of evidence (1) (trustworthiness in relation to study question)	High • Aims of the study clearly defined • Context of study adequately explained • Adequate data period • Transparency is implicit in study
Weight of evidence (2) (appropriateness of research design and analysis)	High • Research design or methodology has been clearly defined • All the included variables explained properly • Data sources are explicitly mentioned • Adequate description of method of data analysis • Appropriate research design to addressing the research question
Weight of evidence (3) (relevance of focus of study to review)	High • Intervention clearly mentioned • Outcomes adequately captured
Weight of evidence (4) (overall weight of evidence)	High • Based on above three weight of evidences, it is classified as a high quality study. Robust design increases the validity of the results

Pombo, C., Taborda, R. (2006). Performance and efficiency in Colombia's power distribution system: Effects of the 1994 reform, Energy Economics 28, pp.339-369.	
Country/Countries of study	Columbia
Data period	1985-2001
Type of study	Quantitative
Aims of study	to assess the evolution in performance, efficiency and productivity of Columbia's power distribution utilities before and after the 1994 regulatory reforms
Summary of study design, including details of sample	Before and after analysis of the 1994 reforms; data drawn from 12 large electricity distribution companies that cover the 20 largest cities belonging to the National Interconnected System
Data sources and data collection instruments	Secondary data; Data taken from various sources
Methods used to analyze data, including details of checks on reliability and validity	Performance is evaluated by changes in mean median by Wilcoxon Rank Sum and Pearson tests on financial and other performance indicators Technical efficiency is measured by means of Data Envelopment Analysis (DEA). The nature of the dataset allows the estimation of Malmquist productivity index and its evolution over time
Summary of results	• Independent variables are statistically significant and show the expected sign in all cases except for the industry adjusted loss index • Efficiency scores are positively related to input intensity and plant size indicators • Regression co-efficients show on average an overall 5% gain • On average, there was an overall efficiency loss of 10% from not being fully specialized
Conclusion	• The results show a recovery after the reform in the main performance indicators of profitability, partial input productivity and output • Plant efficiency and productivity increased after the reform, mainly in the largest utilities sued as benchmarks in the DEA efficiency scores measures • The less efficient power distribution companies did not improve after the reform and were not able to undertake plant restructuring to catch-up in plant efficiency with respect to the Pareto efficient input allocations. • Econometric results on DEA efficiency scores suggest a positive effect of policy reform
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is implicit Findings in this study are consistent with other studies There may be issues if repeatability and reliability of the data
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Research design (DEA) used was appropriate for addressing the research question; However, issues remain in terms of attributing causality to the intervention
Weight of evidence (3) (relevance of focus of study to review)	Medium The results are not widely applicable to all countries
Weight of evidence (4) (overall weight of evidence)	Medium The study is a good analysis on Colombia's power distribution system

Prokopy, L. S. (2005). The relationship between participation and project outcomes: Evidence from rural water supply projects in India, World Development, 33(11), pp. 1801-1819.	
Country/Countries of study	India
Data period	End of 1999/beginning of 2000
Type of study	Quantitative and Qualitative
Aims of study	to examine the role of participation in World Bank assisted rural water and sanitation projects in Karnataka and Uttar Pradesh
Summary of study design, including details of sample	The sampling frame for the study consists of all project villages that had been in the operation and maintenance stage for at least six months at the time of data collection.; A total of 1523 households were interviewed in the 45 villages
Data sources and data collection instruments	Primary data; In Karnataka, 25 villages were randomly selected from the sampling frame by region, and in UP, 20 villages were randomly selected by region. Data was collected from various sources within the villages, including households, VWSC members, project records and the system operator; Approximately 40 households per village were randomly selected and were questioned on various aspects of rural water supply
Methods used to analyze data, including details of checks on reliability and validity	Descriptive Statistics- Measures of participation and measures of project outcomes were calculated; Measurement of the level of transparency, participation and project effectiveness was also done; Pearson correlation of each of the two measures of participation (capital cost contribution, multiple decisions) against the five measures of project outcomes (satisfaction, tariff payment, equal access, time savings, belief in system) were also calculated; Econometric analysis- OLS estimation
Summary of results	• **Decision making** - Controlling for other variables, the more the households in a village that participated in decisions about the water project, the better the project outcomes-statistically significant for satisfaction (marginally), equal access, time savings and belief in system; For every additional percentage increase in households that participated in more than one decision in a village, there is a 0.2% increase in the percentage of households that are satisfied, 0.39% increase in equal access and 0.44% increase in time savings • **Capital cost contribution** - Positive relationship between the number of households in a village that contributed towards capital costs and project outcomes-significant for satisfaction, equal access and time savings • **Transparency** – Capital cost contribution has no significant relationship with tariff variables when other variables including transparency is controlled; Transparency is highly significant and the only significant variable; Households are more likely to pay tariffs under a system in which they know how their money is being spent. For every 1% increase in transparency, there is a 0.16% increase in rural access, 0.38% increase in time savings and 1.98% increase in satisfaction
Conclusion	Participation benefits project outcomes
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Small sample size but sufficient control variables are included • Transparency is explicit • Limited data set
Weight of evidence (2) (appropriateness of research design and analysis)	Low Research design (quantitative method) used was appropriate for addressing the research question; appropriate justification provided to justify the robustness of study design; retrospective uncontrolled raises validity issues

Weight of evidence (3) (relevance of focus of study to review)	High Focuses on a very pertinent intervention for this review
Weight of evidence (4) (overall weight of evidence)	Medium A good study in a new area, and presents interesting results

Ramos-Real, F. J., Tovar, B., Lootty, M., De Almeida, E. F., Pinto Jr, H. Q. (2009). The evolution and main determinants of productivity in Brazilian electricity distribution 1998 - 2005: An empirical analysis, Energy Economics, 31, pp. 298 – 305.	
Country/Countries of study	South America
Data period	1998-2005
Type of study	Quantitative
Aims of study	• What degree the reforms have improved the productivity and efficiency of the industry • Estimating changes in the productivity of the Brazilian electricity distribution sector on a panel of 18 firms from 1998-2005
Summary of study design, including details of sample	17 Brazilian electricity distribution firms, panel study, period of study 1998-2005
Data sources and data collection instruments	The data set were constructed on the basis of the Abradee (Brazilian Association of Electricity Distribution Companies) reports and complemented by information provided by annual reports of the companies. Secondary data source
Methods used to analyze data, including details of checks on reliability and validity	Data Envelopment Analysis
Summary of results	• 11 out of 17 firms present a moderate performance during the 1998-2005 period • Total factor productivity (TFP) index records a yearly positive growth rate of 1.3% • Technical change was the main component of evolution, with the average growth of 2.1% per year, while technical efficiency presented a yearly negative performance of -0.8% • 70.6% of the sample firms have presented an increase in TFP rates
Conclusion	• The behavior of the pure technical efficiency seems to indicate that the reforms in the regulation have not led the firms to a more efficient behavior • The negative performance in the 2002-2003 period is explained by reduction in the companies efficiency (-1.3%) • In 2001-2002 TFP reduced by 1.2% and is mainly explained by the contraction of the production frontier which is probably related to electricity shortage in Brazil
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Aims of the study clearly defined • Context of study adequately defined • Transparency is implicit in nature
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design or methodology has been clearly defined • All the included variables explained properly • Data sources are explicitly defined • Adequate description of method of data analysis • Appropriate research design to addressing the research question
Weight of evidence (3) (relevance of focus of study to review)	Low • More a study of the Brazilian electricity distribution. Interventions pertaining to this review is not the main focus of the study

Weight of evidence (4) (overall weight of evidence)	Medium • Based on above three weight of evidences classified as medium quality, study specific to a context and findings not widely generalisable

Resende, M., Tupper, H. C. (2009). Service quality in Brazilian mobile telephony: an efficiency frontier analysis, Applied Economics, 41, pp. 2299-2307.	
Country/Countries of study	Brazilian
Data period	2000- 2003
Type of study	Quantitative
Aims of study	Assess the quality efficiency of mobile telephony companies in Brazil in the 2000-2003 period
Summary of study design, including details of sample	It's a time series study and Sample consists Brazilian 7 companies
Data sources and data collection instruments	Secondary, Data source is primarily from the Brazilian Regulatory Agency (ANATEL). Quarterly data from 2000-2003
Methods used to analyze data, including details of checks on reliability and validity	Data Envelopment Analysis with Econometric Estimation
Summary of results	• Evidence indicated an overall improvement in efficiency over time • Nonparametric tests were consistent with a positive evolution of quality over time even for shorter subperiods • There is a substantial number of underperforming firms, indicating one should be concerned with service quality in the mobile segment
Conclusion	• Indication of improvement of service quality during sample periods although the improvements were not monotonic for all the companies • Overall service quality improved over time
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Data from reliable sources but too early to gather substantial data and so the research may not be adequate to arrive at conclusions • The issue of repeatability and reliability must have been addressed in the original data document • Transparency is implicit in nature
Weight of evidence (2) (appropriateness of research design and analysis)	Low • Short data period used • Small data set • Research design and methodology used are appropriate; causality attribution is limited • Retrospective uncontrolled sample leading to validity issues
Weight of evidence (3) (relevance of focus of study to review)	Medium • Focusing on reasonably good number of outcomes and interventions explicitly mentioned • Explaining outcomes clearly • Showing significant results with the interventions but very specific study
Weight of evidence (4) (overall weight of evidence)	Medium • Based on above three weight of evidences, it is reasonably good study but less generalised

Reyes, P. R., Tovar, B. (2009). Measuring efficiency and productivity change (PTF) in the Peruvian electricity distribution companies after reforms, Energy Policy, 37(6), pp. 2249-2261.	
Country/Countries of study	Peru
Data period	Between 1996 and 2006
Type of study	Quantitative
Aims of study	• To analyze the evolution in the productivity of electricity distribution companies in Peru in order to know if the 1993 reforms have achieved their objectives • To provide a comparative assessment of the technical efficiency levels of the distribution companies
Summary of study design, including details of sample	14 Peruvian electricity distribution companies
Data sources and data collection instruments	Secondary data; Efficiency estimates obtained with DEA
Methods used to analyze data, including details of checks on reliability and validity	Malmquist TFP Index, Statistics, Regression
Summary of results	• Improvements in the efficiency and productivity of electricity distribution in Peru have occurred after reforms • Main source of factor productivity change has been technology change which is a situation specific to the industry
Conclusion	There is a relationship between the restructuring of distribution sector and the enhancement of productivity
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Data source not specified so reliability and repeatability of the data is a cause of concern The issue of reforms and its impact is specific only to Peru and so it is not widely applicable to other countries
Weight of evidence (2) (appropriateness of research design and analysis)	Low Research design is appropriate and a good number of outcomes have been derived Retrospective uncontrolled sample leads to issues relating to validity of findings
Weight of evidence (3) (relevance of focus of study to review)	Medium The focus of this paper is relevant for this review.
Weight of evidence (4) (overall weight of evidence)	Medium The paper is country specific but gives a good example of a country's situation after reforms and whether the reforms which had been implemented had a positive or negative effect on the economy

Ros, J. A., Banerjee, A. (2000). Telecommunications privatisation and tariff rebalancing: Evidence from Latin America, Telecommunications Policy, 24, pp. 233-252.	
Country/Countries of study	Latin America
Data period	1985-1995
Type of study	Quantitative
Aims of study	• Examine the previous paper data and replicate the results • Examine the way that privatisations have been carried out in Latin America telecommunications market • Testing tariff rebalancing has had any effect on network expansion
Summary of study design, including details of sample	Panel Study, comparing privatized and non privatized telecommunication, 23 countries of which 10 Latin American countries which were privatized some point between 1986 and 1995 and 13 that did not. There are 23 cross sections (countries) and 10 time periods (years)
Data sources and data collection instruments	All ITU publication, secondary
Methods used to analyze data, including details of checks on reliability and validity	Regression
Summary of results	• Privatization has a significant positive impact on both network expansion and technical efficiency • Privatisation, tariff rebalancing (very strong evidence) and the percentage of mainlines served by digital switches significantly (very strong evidence) explain wait list percentage
Conclusion	• Low penetration rates in Latin America arise from service prices that are too low • Privatization altered incentives sufficiently to relieve the supply bottlenecks from the days of public ownership and increased the supply of main lines • Privatization generates concrete efficiency gains • Privatization clearly favours supply led growth and network expansion, the all important role of the tariff rebalancing and compensatory pricing cannot be overlooked in sustaining the expansion and reducing the unmet demand
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Gives expected evidence • Results are compatible to previous study (results) • Study specific to a context and findings not widely generalisable
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Fairly appropriate research design (regression) • Panel study considering 23 countries and 10 time periods • Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High • Providing three important outcomes • The study results has some good findings in the study related to the telecom sector
Weight of evidence (4) (overall weight of evidence)	Medium Based on above three weight of evidence overall all it's a medium quality paper

Ros, J. A. (1999). Does ownership or competition Matter? The effects of Telecommunications reform on network expansion and efficiency, Journal of Regulatory Economics, 15, pp. 65-92.	
Country/Countries of study	Countries – not explicitly stated
Data period	1986 – 1995
Type of study	Quantitative
Aims of study	To look at the effects of ownership and competition on telecommunication industry
Summary of study design, including details of sample	Cross sectional data;
Data sources and data collection instruments	Secondary; ITU datasets
Methods used to analyze data, including details of checks on reliability and validity	regression analysis
Summary of results	The result presented are for both developed and developing countries show that main lines per 100 inhabitants are not necessarily increasing (like in developed countries) for the developing countries
Conclusion	• No evidence that privatisation leads to higher growth in main lines per 100 inhabitants in those countries whose GDP per capita is less than $10000 • Those countries that have privatized have 31% higher network coverage • Higher residential prices are positively associated with higher growth in main lines per 100 inhabitants
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is implicit; Number of countries not explicitly stated
Weight of evidence (2) (appropriateness of research design and analysis)	High • Choice of research design is appropriate but some issue regarding the methodology and variables remain • Growth in mainlines shows a huge spurt in 1988 and then flattens out. It is not explained. Same for competition (fig 16) • Use of fixed effects model and appropriate control and instrumental variables
Weight of evidence (3) (relevance of focus of study to review)	Medium The focus of the study is on ownership and competition; the countries are not stated clearly so the results may not be widely generalisable
Weight of evidence (4) (overall weight of evidence)	Medium Based on the above weights, the overall rating of the study is medium quality

Ros, J. A. (2003). The impact of the regulatory process and price cap regulation in Latin American Telecommunication Markets, Review of Network Economics, 2(3), pp. 270-286.	
Country/Countries of study	20 Latin American countries
Data period	1990-1998
Type of study	Quantitative
Aims of study	• To confirm the impact that the regulatory process has had on telecom development in Latin America • To specifically analyze the impact that an independent regulator has had on the performance of the sector
Summary of study design, including details of sample	Cross sectional data; Eleven countries had private telecom operators at the time of study
Data sources and data collection instruments	• Secondary data on the telecom markets in 20 Latin American countries between 1990-1998 • ITU data on independence of regulators
Methods used to analyze data, including details of checks on reliability and validity	Econometric methodology; regression analysis; Ordinary Least Square (OLS) and Instrumental Variable (IV) estimator were used
Summary of results	• OLS and IV estimators were significantly different, providing evidence that the decision to privatize, permit competition, create an independent regulator and implement price cap regulation should be considered as endogenous and for econometric analysis, estimated through an IV approach. • The countries with a price cap regulation are significantly associated with greater teledensity. (22% greater than countries that do not have price cap regimes) Privatisation and competition on an average are associated with approximately 18% and 200% more teledensity respectively and are significant at 1% level.
Conclusion	• Competition significantly reduces profitability, employment and efficiency after privatisation • Creation of an independent regulatory agency significantly increases output • Price cap regulation is strongly associated with network penetration • Correct for policymakers to continue to open these markets and put pro-competition policies in place
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Fairly implicit in terms of transparency The data has been taken from reliable sources; Repeatability issue has been addressed. Selective bias has also been avoided
Weight of evidence (2) (appropriateness of research design and analysis)	High The author has used control variables to avoid bias. Use of control and instrumental variables.
Weight of evidence (3) (relevance of focus of study to review)	High Almost all the variables have been analyzed well and the findings are relevant to the study question
Weight of evidence (4) (overall weight of evidence)	High A good study. But as the context has changed so much, the relevance of the study findings could be limited in today's context.

Sabbioni, G. (2008). Efficiency in the Brazilian sanitation sector, Utility Policy, 16, pp.11-20.	
Country/Countries of study	Brazil
Data period	2000-2004
Type of study	Quantitative
Aims of study	To examine the relative efficiency of Regional and three different types of local enterprises in providing water and sewerage services in Brazil between 2000 and 2004
Summary of study design, including details of sample	Panel data used; this study utilizes an unbalanced panel for 2000-2004. There are approximately 180 observations for 2000 and 340 observations for 2004 with almost 1200 observations in total
Data sources and data collection instruments	Secondary data used; Source of data is the National System of Sanitation Information (SNIS) of Brazil
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis; cost function estimated using a fixed effects panel data model; firm-specific costs from the first stage are explained by means of firm-type indicator variables
Summary of results	• Regional state-owned providers have the lowest firm-specific cists, reinforcing the savings they achieve from actual economies of scale • Local private operators have similar firm-specific costs as compared to local Public-Corporative providers whereas local Public-Non-Corporative providers have the highest firm-specific costs • The statistically insignificant difference between the Private and Public-Corporative operators is also verified in the second-stage regressions
Conclusion	• For Brazil, evidence of economies of scale is enough to claim that water and sewerage provision at the state level is more efficient that at the municipal level • Evidence of inherently lower firm-specific costs for Regional state-owned firms than for all other types of water and sewerage operators in Brazil
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Transparency is explicit • The author gives reasons for incomplete results and also provides guidelines for future research on the topic
Weight of evidence (2) (appropriateness of research design and analysis)	High The paper considers only relative measures of efficiency; robust research design
Weight of evidence (3) (relevance of focus of study to review)	Medium The focus of the study is on the water and sanitation services in Brazil and the efficiency of these services which is a relevant topic to the world but the results are not widely generalisable
Weight of evidence (4) (overall weight of evidence)	Medium Good paper but as the authors themselves put it “Clearly, much work remains.” (p18)

Seim, T. L., Soreide, T. (2009). Bureaucratic complexity and impacts of corruption in utilities, Utilities Policy, 17, pp. 176-184.	
Country/Countries of study	84 developing countries
Data period	2003-2006
Type of study	Quantitative & Qualitative
Aims of study	To explore how the relationship between bureaucratic complexities and corruption affects the performance in utilities.
Summary of study design, including details of sample	Cross sectional data used for 84 developing countries
Data sources and data collection instruments	Secondary data from various sources; Only after data was used
Methods used to analyze data, including details of checks on reliability and validity	Simple statistical tools and regression
Summary of results	• Lower number of procedures associated with stronger control of corruption • Interaction between number of procedures and GDP is positive
Conclusion	• Corruption coupled with a complex regulatory structure can have negative effects on performance • For lower income countries there is no longer a correspondence between corruption and complexity levels
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Implicit transparency; number of data points are limited; therefore countries are classified into four categories Bias from confounding variables has been handled well. The issue of repeatability and reliability have also been addressed in the study
Weight of evidence (2) (appropriateness of research design and analysis)	Medium Use of appropriate control variables and robustness checks for results
Weight of evidence (3) (relevance of focus of study to review)	Medium The study is fairly focused; The study is widely generalisable as the study itself is a 'trend' study
Weight of evidence (4) (overall weight of evidence)	Medium The paper could be a high level quality paper; Data is of concern and methodology used could be more relevant and explanatory; More results could have been derived..

Sen, A., Jamasb, T. (2010). The economic effects of electricity deregulation: An empirical analysis of Indian states, University of Cambridge, EPRG Working Paper 1001.	
Country/Countries of study	India
Data period	1991-2007
Type of study	Quantitative
Aims of study	• Aims to analyze econometrically the determinant and impact of electricity reform in India, giving special regard to political economy and regional diversity that determine sectoral efficiency, prices and investment inflows
Summary of study design, including details of sample	Panel study, taking 19 states of India spanning 1991-2007
Data sources and data collection instruments	World Bank (PPIAF), Power Ministry and State Electricity Regulatory Commissions, planning Commission, Power Finance Corporation, Central Electricity Authority, CSO, EPW research foundation, The Energy and Resources Institute
Methods used to analyze data, including details of checks on reliability and validity	Panel data estimators
Summary of results	• Presence of an independent regulatory agencies in a state has significantly increasing transmission and distribution losses (TDL) • Separation of generation, transmission and distribution segments in a state has significantly increasing effect on TDL • Privatisation of the distribution segment (amongst two or more companies) increasing transmission and distribution losses (TDL) • Presence of an independent regulatory agencies in a state has significantly increasing industrial price • Passing out tariff orders in state significantly decrease industrial price
Conclusion	• Within electricity, of the efficiency indicators, improvements have occurred most visibly in the levels of transmission and distribution losers in reformer states • With respect to plant load factor, there seems to be an immediate improvements with the implementation of tariff and unbundling rationalisation
Weight of evidence (1) (trustworthiness in relation to study question)	High • Aims of the study clearly defined • Context of study adequately defined • Generalized study in India's state context • Long data period • Transparency is implicit in nature
Weight of evidence (2) (appropriateness of research design and analysis)	High • Research design or methodology has been clearly defined • All the included variables explained properly • Data sources are explicitly defined • Adequate description of method of data analysis • Appropriate research design to addressing the research question
Weight of evidence (3)	High

(relevance of focus of study to review)	• Intervention (restructuring) clearly mentioned • Outcome clearly defined • Provide reasonably good information about Indian electricity reform and its effects
Weight of evidence (4) (overall weight of evidence)	High • Based on above three weight of evidences, it is a high quality study and the findings are widely generalisable

Shirley, M. M., Colin Xu, L. (1997). Information, incentives, and commitment, World Bank Policy Research Working Paper, No. 1769, pp.1-45.	
Country/Countries of study	6 developing countries
Data period	mid 1980s to early 1990s
Type of study	Quantitative and Qualitative
Aims of study	to analyze the experience with performance contracts between developing country governments and the managers of their state owned enterprises to identify how problems of information asymmetry, commitment and managerial bargaining power can lead to low powered incentives and shirking
Summary of study design, including details of sample	a sample of 12 contracts with monopoly state enterprises in 6 developing countries is used
Data sources and data collection instruments	Secondary data; Sources are implicit
Methods used to analyze data, including details of checks on reliability and validity	A static model is used to show that when enterprises have an information advantage the government will choose lower-powered incentives, which lead to an efficiency loss compared to when the government has complete information
Summary of results	• Three of the 12 companies showed a turnaround in TFP after contracts were introduced; 6 continued past trends; 3 performed substantially worse under contracts than they had before • "Labor productivity improved at a faster pace in 4 cases, and deteriorated in none, but the improvement predated the contract." (summary findings)
Conclusion	all the enterprises suffer from serious contracting problems and there is no pattern of improved performance that can be attributed to the contracts
Weight of evidence (1) (trustworthiness in relation to study question)	Low • Transparency is implicit • Source of data not explicit • Data used leads to the issue of repeatability and reliability • Potential sample selection bias
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The quality of the methodological approach used is relevant
Weight of evidence (3) (relevance of focus of study to review)	Medium The study shows causal pathways for the outcomes and can be generalized to an extent
Weight of evidence (4) (overall weight of evidence)	Medium Good paper but the research design needs to be more robust

Steiner, F. (2001). Regulation, industry structure and performance in the electricity supply industry, PhD. dissertation submitted to Stanford University.	
Country/Countries of study	OECD member countries as of 1998 (excluding Austria, Luxembourg, Iceland) as well as three South American Countries: Argentina, Chile and Brazil
Data period	1986-1998
Type of study	Quantitative
Aims of study	To reveal the behavior of producers, consumers and regulators that underlies the market response to restructuring in electricity sector
Summary of study design, including details of sample	Panel study, sample consists of 29 countries over the period 1986-1998
Data sources and data collection instruments	International Energy Agency (IEA), Energy Prices and Taxes Data, IEA Energy Information Data, the Organisation for Economic Co-operation and Development (OECD) regulatory database for electricity, the Latin America Energy Organisation (OLADE) Energy and Economic Statistics and Indicators of Latin America and Caribbean, the Privatisation International Database, the International Telecommunication Union (ITU) Privatisation Survey and Regulators websites. Secondary data uses
Methods used to analyze data, including details of checks on reliability and validity	Regression
Summary of results	• Unbundling significantly affects Industrial Price for South American countries • Unbundling significantly affects Residential Price for South American countries
Conclusion	• Producers and consumers do change their behavior when regulators decide to restructure the electricity sector • Shift in equilibrium price is most profound for industrial consumers • Under restructuring, residential consumers do not see a shift in equilibrium price, though relative prices do change significantly • The incidence of benefits of restructuring in industrial prices is consistent with the structure of costs and elasticity of demand across industrial and residential consumers
Weight of evidence (1) (trustworthiness in relation to study question)	High • Aims of the study clearly reported • Context of study adequately defined • Adequate data period • Transparency is implicit in nature
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design or methodology has been clearly defined • All the included variables explained properly • Adequate description of method of data analysis • Appropriate research design to addressing the research question • Use of appropriate control variables but endogeneity not clearly addressed
Weight of evidence (3) (relevance of focus of study to review)	High • Intervention clearly mentioned • Outcome clearly defined

Weight of evidence (4) (overall weight of evidence)	High • Based on above three weight of evidences, it is classified as a high quality study

Torero, M., Schroth, E., Font, P. A. (2003). The impact of telecommunications privatisation in Peru on the welfare of urban consumers, Economia, 4 (1), pp. 99-128.	
Country/Countries of study	Peru
Data period	1997
Type of study	Quantitative
Aims of study	• To compare pre and post privatisation telecom performance • To study why the population of Peru is unhappy with the privatisation of the telecom sector even though the telecom sector posted greater improvement than any other utilities sector after its privatisation. • To analyze the welfare implications of telecommunications privatisation through the estimation of consumer surplus for different socio-economic levels
Summary of study design, including details of sample	The survey sample of 1701 urban households represented approximately 7.6 million habitats which is half of Peru's urban population.
Data sources and data collection instruments	Primary data; Household panel regarding access and monthly consumption of telecommunications services in 1996-97 Houses chosen on the basis of criteria of population and demand for telephone services in Metropolitan Lima and four other major cities was categorized into high, middle, low and very low socioeconomic levels
Methods used to analyze data, including details of checks on reliability and validity	• Comparison of pre and post privatisation firm performance indicators using two tests- first difference analysis using firm and year fixed effects to analyze the difference between pre and post privatisation information; and difference in differences test which also takes into account performance relative to a control group that didn't go through the privatisation process • To measure consumer welfare econometric analysis was used; First the market for the product was modeled in the pre and post privatisation scenarios using a probit model then changes in access and use of each service was identified and finally consumer surplus changes were measured in both stages
Summary of results	• Effective price faced by the households is a linear combination of both peak and off-peak prices • The price of international long- distance service is significant (and has a positive sign) in explaining the use of local and national long-distance calls showing some degree of substitution between the two products • The fixed district effects that was included were significant as a whole • Demand for use of local and national long-distance services is inelastic • When the percentage change in tariffs is the same, the percentage of change in household welfare is also the same
Conclusion	"…on aggregate, privatisation improved total consumer welfare, mainly by increasing consumer access to service. However the tariff adjustment required to reflect long-term marginal cost had a relatively negative impact on some consumers. In particular, increases in the fixed monthly payment and the price of local calls negatively affected low and, especially very low income households, as shown by a detailed per household analysis of consumer surplus." (p115)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium • Transparency is implicit • Primary data used leads to the issue of repeatability and reliability • There may be a problem of generalisability because the study is situated to a specific context
Weight of evidence (2)	Medium

(appropriateness of research design and analysis)	Research design used was appropriate for addressing the research question but more research is needed; Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	Medium The results can be generalized in certain cases but majority of the cases do not follow a similar situations
Weight of evidence (4) (overall weight of evidence)	Medium Given the above weights, this study is classified as a medium quality study

Vagliasindi, M. (2004). The role of investment and regulatory reforms in the development of infrastructure across transition economies, Utilities Policy, 12, pp. 303- 314.	
Country/Countries of study	Not explicitly mentioned but we assume that all the 26 countries surveyed under BEEPS are taken
Data period	Till 1999
Type of study	Quantitative
Aims of study	To look at enterprises (ALL) and how they were affected by electricity and telecom reforms; to assess if investment in infrastructure and broader institutional reforms have been reflected in improved performance indicators of infrastructure services.
Summary of study design, including details of sample	Sample taken from BEEPS which has over 6000 enterprises in 26 countries of the region The survey sample was designed to be broadly representative according to given criteria
Data sources and data collection instruments	Secondary data used; Enterprise level variables are based on the Business Environment and Enterprise Performance Survey (BEEPS)
Methods used to analyze data, including details of checks on reliability and validity	Standard OLS regression
Summary of results	• Increase in financial arrears is associated with more outages (at 1%) • Larger enterprises are characterized by lower level of interruptions • More favourable business environment implies less outages •
Conclusion	Increased investments, increased tariffs and establishment of a regulator correlated to less outages
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is explicit to an extent; Repeatability of data has been avoided to some extent but unavailability and inconsistency of data is a problem.
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The research design used is simple due to unavailability of data; Sources of error and bias are not completely ruled out (Income levels not adjusted for)
Weight of evidence (3) (relevance of focus of study to review)	Medium The study on infrastructure is widely generalisable. The content of the study has fairly good results but needs more validation
Weight of evidence (4) (overall weight of evidence)	Medium An average study where the results cannot be taken as final conclusions; further research is needed

Viani, E. B. (2004). Private control, competition, and the performance of telephone firms in less developed countries, International Journal of the Economics of Business, 11.1, pp. 215-240.	
Country/Countries of study	Countries not explicitly mentioned
Data period	1986-2001
Type of study	Quantitative
Aims of study	Comparing the operating performance under private and state control of 23 public telephone firms from less developed countries
Summary of study design, including details of sample	Panel Study, 23 public telephone firms
Data sources and data collection instruments	Consolidated balance sheet and the statement of profit and loss from each firm's annual report, World Bank (the Development Economics Research Group), World Bank Development Indicators, country Information database, Economist Intelligence Unit's ViewsWire. Secondary data used
Methods used to analyze data, including details of checks on reliability and validity	Regression
Summary of results	• Fixed-effects estimation indicates that privately controlled firms exhibit higher productivity efficiency than their state counterparts after controlling for monopoly conditions, income level and the scale of the firm's fixed telephone network • Public telephone firms that face competition on basic services and from wireless firms tend to exhibit higher productive efficiency than those that do not
Conclusion	• Support property rights theory of the firm: private control is related to higher labor productivity after accounting for competition on basic services, competition from wireless firms, the scale of the firm's fixed telephone network and other country specific variables • Contrary to the common view, private telephone firms are not more profitable than state controlled • Monopoly status is strongly related with higher profits • Privately controlled telephone firms tend to exhibit higher investment growth than state controlled
Weight of evidence (1) (trustworthiness in relation to study question)	High • Data information is not very clear (regarding number of countries) • Captures good number of outcomes • Transparency is not explicitly mentioned
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • Research design and methodology clearly mentioned • Variables clearly mentioned • Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High • Reasonably generalized study • Providing results compatible to other studies • Based on less developed countries • Long period analysis

Weight of evidence (4) (overall weight of evidence)	High • A paper with a good qualitative research work which provides a background for further quantitative analysis • Based on above weight of evidences, it is a good paper

Wallsten, J. S. (2001). An econometric assessment of telecom competition, privatisation and regulation in Africa and Latin America, Journal of Industrial Economics, 49(1), pp. 1- 19.	
Country/Countries of study	A study of 30 countries in Africa, South America and the Caribbean
Data period	1984- 1997
Type of study	Regression
Aims of study	The paper explores econometrically, the effects on telecommunications performance of privatisation, competition and regulation.
Summary of study design, including details of sample	Panel data study
Data sources and data collection instruments	The study takes panel data from 30 countries which was primarily sourced from primary communications and price indicators maintained by the International Telecommunications Union (ITU)
Methods used to analyze data, including details of checks on reliability and validity	The study creates two regression models to test the effect of privatisation, competition and regulation on mainline penetration. The second model tests for the interaction between the variables and if they have an impact on outcomes.
Summary of results	• Competition is significant for both number of mainlines and connection capacity. Privatisation interacting with regulation is significant for both number of mainlines and connection capacity. • Cost of call reduces with greater competition and privatisation interacting with regulation.
Conclusion	• Competition associated with increased mainline penetration, payphones, connection capacity and lower price for calls • Privatisation by itself is associated with few benefits • Privatisation + independent regulator associated with greater payphone, tele capacity and labour efficiency
Weight of evidence (1) (trustworthiness in relation to study question)	High • While data is stated to be an unbalanced panel, it is still a good size sample of 30 countries • More information on relation to the kind and quality of regulation would be useful
Weight of evidence (2) (appropriateness of research design and analysis)	Medium • The model constructed was appropriate and relevant • Firm level data needs to be looked at in future studies • Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	High • The study reviews sector level interventions of privatisation, competition and regulation • It also looks at access and cost indicators in the telecom sphere
Weight of evidence (4) (overall weight of evidence)	High • It is a good study despite its limitations that highlight the importance of increasing transparency interventions in the telecom space

Yunos, J. M., Hawdon, D. (1997). The efficiency of the National Electricity Board in Malaysia: An intercountry comparison using DEA, Energy Economics, 19, pp. 255-269.	
Country/Countries of study	Malaysia is the focus with 18 other countries of similar income plus Great Britain also included for comparison
Data period	1975- 1990
Type of study	Quantitative
Aims of study	To evaluate the performance of the electricity sector in Malaysia using an inter country comparison of productivity growth
Summary of study design, including details of sample	The study uses a sample of 27 countries in an efficiency frontier analysis to compare the efficiency levels of these firms with the National Electricity Board (NEB) of Malaysia. In a second stage data envelopment analysis, NEB is compared with the Electricity Generation Authority of Thailand (EGAT) and CEGB (UK)
Data sources and data collection instruments	Data sources are not explicitly specified. Likely to be data provided by NEB, EGAT and CEGB
Methods used to analyze data, including details of checks on reliability and validity	The method used was an efficiency frontier analysis, followed by a data envelopment analysis on a subset of the total sample.
Summary of results	• Changes in ownership do not always lead to performance improvements • Introduction in competition can introduce significant welfare gains in the electricity sector • Other results are not relevant for this review
Conclusion	This study is mainly one that is done for the NEB in Malaysia. Therefore, most of the conclusions are not relevant for this review including the finding that DEB is less efficient and that scale economies do matter in electricity generation. However, the main finding is that privatisation on its own does not always lead to performance improvements. What is necessary are other interventions like competition
Weight of evidence (1) (trustworthiness in relation to study question)	Medium It assess the efficiency of NEB very well; limited dataset
Weight of evidence (2) (appropriateness of research design and analysis)	Medium A two stage study that uses both production frontier analysis and data envelopment analysis; causality to intervention not clearly attributed
Weight of evidence (3) (relevance of focus of study to review)	Low The study is predominantly one that is for NEB, Malaysia. The findings on privatisation and competition are quite heavily qualified. Interventions of this review is not the main focus of the study
Weight of evidence (4) (overall weight of evidence)	Medium A study that is empirically sound, however the interventions are not explicitly tested.

Zhang, F. Y., Parker, D., Kirkpatrick, C. (2005). Competition, regulation and privatisation of electricity generation in developing countries: Does the sequencing of the reforms matter? Quarterly Review of Economics and Finance, 45, pp. 358- 379.	
Country/Countries of study	25 developing countries from Latin America and the Caribbean, Africa and Asia
Data period	1985-2001
Type of study	Quantitative
Aims of study	To study the effect of the sequencing of privatisation, competition and regulation reforms in electricity generation
Summary of study design, including details of sample	Data base of 25 developing countries which was developed for the purpose of researching market liberalisation, regulation and privatisation policies in such economies;
Data sources and data collection instruments	Secondary data; Data on electricity generation and generation capacity taken from the database of Asia Pacific Energy Research Centre(2005); data on population from World Development Indicators published by the World Bank; employment data from the Industrial Statistics Yearbook (various years) and the database of ILO
Methods used to analyze data, including details of checks on reliability and validity	Econometric analysis; A fixed effects panel data model is used; Two sets of hypotheses were tested: • the order between privatisation and competition • between privatisation and regulation
Summary of results	"… each of the three reform elements-competition, regulation and privatisation-has little impact on allocative efficiency and labour and capital productivity in electricity generation in our sample of developing countries." (p370)
Conclusion	"The study has found that having an independent regulator before privatizing generation is associated with higher electricity availability and more generating capacity; and introducing competition before undertaking privatisation in electricity generation appears to bring about favourable effects in terms of service penetration, capacity expansion, capacity utilisation and capital productivity
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Aims and objective of the study are clearly specified; The data set used is a sub set of the entire data base as countries which had missing data were not included; data on employment also posed to be a problem due to inconsistent data for countries
Weight of evidence (2) (appropriateness of research design and analysis)	High The research design used was appropriate; country and time specific fixed effects model used to address endogeneity to some extent
Weight of evidence (3) (relevance of focus of study to review)	High The focus of study is very relevant to infrastructure and handles an important issue of privatisation, regulation and competition; The paper covers all the variable in detail
Weight of evidence (4) (overall weight of evidence)	High The study presents some interesting results. Based on the above weights, it is classified as a high quality study

Zhang, F. Y., Parker, D., Kirkpatrick, C. (2006). An empirical analysis of state and private sector provision of water Services in Africa, World Bank Economic Review, 20(1), pp. 143-163.	
Country/Countries of study	13 African countries
Data period	Data relating mainly to the year 2000
Type of study	Quantitative & Qualitative
Aims of study	To examine the impact of privatisation of water services in Africa; to substantiate the findings with econometric evidence and assess consistency across results
Summary of study design, including details of sample	Longitudinal data; covers 13 countries and 14 utilities that reported private sector involvement
Data sources and data collection instruments	Secondary data collected from the Water Utility Partnership for Capacity Building in Africa's Service Providers' Performance Indicators and Benchmarking Network Project database
Methods used to analyze data, including details of checks on reliability and validity	Performance measures were used to assess the impact of private capital on performance in water services. First a set of statistical measures like labour productivity, average tariffs etc. were computed. Stochastic Cost Function Analysis was done to provide an econometric analysis. Data envelopment analysis was also done;
Summary of results	• Privatisation has the capacity to improve water services in developing countries, reversing decades of underinvestment and low productivity under state supply. • However, the results put together do not provide strong evidence of differences in the performances of state-owned water utilities and water utilities involving some private capital in Africa. • Private sector superiority is established through the data envelopment analysis but the stochastic cost frontier analysis provides evidence that state-owned utilities have better cost performance, but results are statistically insignificant. • Descriptive statistic also fails to show statistically significant differences.
Conclusion	• Private operation of water facilities is associated with much higher average water charges and with greater use of water metering. • "…water privatisation raises a complex set of political economy questions that deserve fuller exploration than has been possible here because of data limitations" (p18)
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Implicit transparency; The analysis fails to show evidence of better performance by private utilities than by state-owned utilities. Data permits to take ownership as a binary variable. Heterogeneity, small sample size and small number of privatized firms also pose a problems and lead to statistically insignificant results. Therefore results must be treated as tentative.
Weight of evidence (2) (appropriateness of research design and analysis)	Medium This paper tries and validates its aims through performance measures. Appropriate control variables used, but issues of validity have not been completely addressed
Weight of evidence (3) (relevance of focus of study to review)	Medium Various theoretical links are provided but the study does not explore the topic fully due to data limitations.
Weight of evidence (4) (overall weight of evidence)	Medium Overall this paper does not provide any break-through evidence or results due to data inconsistency and limited data availability.

Zhang, F. Y., Parker, D., Kirkpatrick, C. (2008). Electricity reform in developing countries: an econometric assessment of the effects of privatisation, competition and regulation, Journal of Regulatory Economics, 33, pp. 159- 178.	
Country/Countries of study	36 developing and transitional countries
Data period	1985-2003
Type of study	Quantitative
Aims of study	To examine the separate effects of privatisation, competition and regulation as components of electricity sector reforms on performance
Summary of study design, including details of sample	Cross sectional as well as longitudinal data used
Data sources and data collection instruments	Secondary data; Before and after data was used;
Methods used to analyze data, including details of checks on reliability and validity	Regression model was used. 2 regression equations were formed
Summary of results	Electricity generation per capita: • Regulation and Privatisation are statistically insignificant; on their own they actually decrease electricity output • Regulation and Privatisation as an interaction variable is positively correlated, significant at 10% level • Competition is positively associated with electricity generation per capita • Competition is an effective driver of increased electricity production Installed generation capacity per capita: • Same as above; significant at 10%
Conclusion	Regulation is the most important variable among the three for electricity reforms in developing countries
Weight of evidence (1) (trustworthiness in relation to study question)	Medium Transparency is fairly implicit. Selective reporting bias is a problem with this study. Lack of data availability to create needed variables; more work at the international level is needed to obtain superior measures especially on the effectiveness of regulation. The paper has also not developed an analysis on how poverty and income distribution affect privatisation. “Finally the paper has not explored the long-term developmental effects of price and service changes in the developing countries resulting from privatisation and market liberalisation in the electricity sector” (p175)
Weight of evidence (2) (appropriateness of research design and analysis)	Medium The choice of research design was appropriate for the study although the analysis seems incomplete due to certain factors not being analyzed. The research design employed does not completely rule out errors and bias.
Weight of evidence (3) (relevance of focus of study to review)	Medium Focus of study review is good although not all aspects of the study question has been covered.
Weight of evidence (4) (overall weight of evidence)	Medium This work remains a subject of future research but has valuable results. More consistent data is needed to increase the robustness of findings.

Appendix 3.1: List of outcome indicators

Table A3.1.1: List of outcome indicators used in electricity studies

Access	Cost/tariff	Quality
• Number of connections • Residential connections per XXX households • Electricity generation capacity per capita • Electric power consumption per capita	• Net efficiency gains • Number of employees • Net electricity generation per employee • Net electricity generation per average installed capacity (measured in terms of capacity and labour force in electricity generation) • Connections per employee • OPEX per connection • Energy sold per employee • O&M expenses • Total factor productivity • Overall technical efficiency • Pure technical efficiency • Scale efficiency • DEA efficiency scores • Average price of electricity • Residential electricity power price • Industrial electricity power price	• Number and duration of interruptions per customer • Frequency of interruptions • Distribution losses • Proportion of energy lost • T&D losses as a percentage of output • Collection ratio • Delay in obtaining an electrical connection • Number of working days where business operations were disrupted due to power outages

Table A3.1.2: List of outcome indicators used in telecommunication studies

Access	Cost/tariff	Quality
• Telephone lines per XXX inhabitants • Number of cellular subscribers per XXX inhabitants • Percentage of households with telephone • Number of fixed lines installed • Percentage of population subscribed to fixed lines • Mobile penetration (percentage of population	• Lines per employee • No. of employees • Tele-density/staff employed • Number of telecommunication staff • Telephone mainline per employee • Employees per mainline • Labour productivity	• Waiting list for telephone lines • Number of telephone faults • DEA efficiency score for quality • Years of waiting times for phone • Percentage of unsuccessful calls • Waiting list for mainlines per XXX of population

subscribed and having telephone service activated within the last 9 months) • Network expansion • Payphones per million population • Connection capacity per hundred population	• Tariff • Price of local phone call • Residential subscription fee • Business subscription fee • Price of monthly subscription to fixed-line service • Price of residential user to obtain initial connection to the network • Price of cellular service • Price basket for mobile • Price basket for fixed line • Price of 3 minute local call	• Faults per XXX mainlines per year • Delay in obtaining a mainline telephone connection • Quality of long distance call • Waiting time • Ratio of waiting list to mainlines in operation • Number of working days where business operations were disrupted due to unavailable mainline telecom services

Table A3.1.3: List of outcome indicators used in transport studies

Access	**Cost/tariff**	**Quality**
	• Unit cost of XXX road type • Labour productivity (train kilometres per employee) • Total factor productivity • Technical efficiency • Missing expenditures in road construction	• Accidents per million train kilometres a year

Table A3.1.4: List of outcome indicators used in water supply studies

Access	Cost/Tariff	Quality
• Fraction of population that has reasonable access to an adequate amount of improved drinking water and proper sanitation facilities • Dummy variable to capture connection to water services or not • Percentage of total population with access to safe water • Percentage of households with	• Technical efficiency • Costs • Total factor productivity • Overall project performance • Total water production • Connections per employee • Output (in m^3) per employee • Operating expenses	• Bribes paid in the last one year • Frequency of service • Need for treatment for consumption • Aspect of service (whether water is turbid or has particles) • Unaccounted-for water

connection to water • Share of urban population with piped water and sewerage connections • Number of water/ sewerage connections • Length of distribution network	• Annual production of potable water/assets (Asset utilisation) • Monthly payments per household • Actual price per cubic metre of water • Tariff	• Bill collection rate (ratio) • Number of pipe breaks per connection • Number of sewerage blockages per connection • Average number of hours with water daily • Number of water supply failures

Appendix 4.1: Graphical illustration of overall evidence

Figure A4.1.1: Proportion of various interventions in different sectors

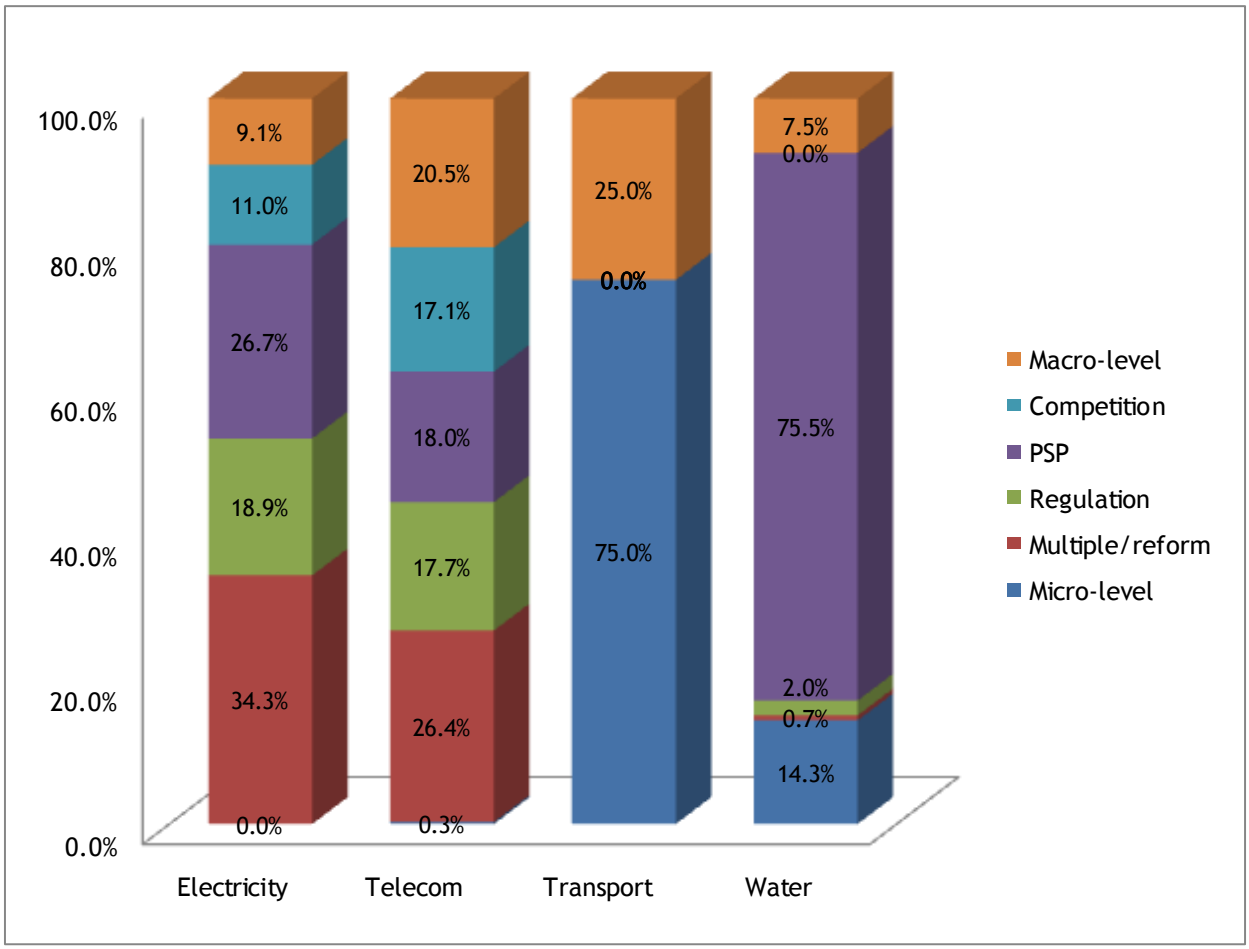
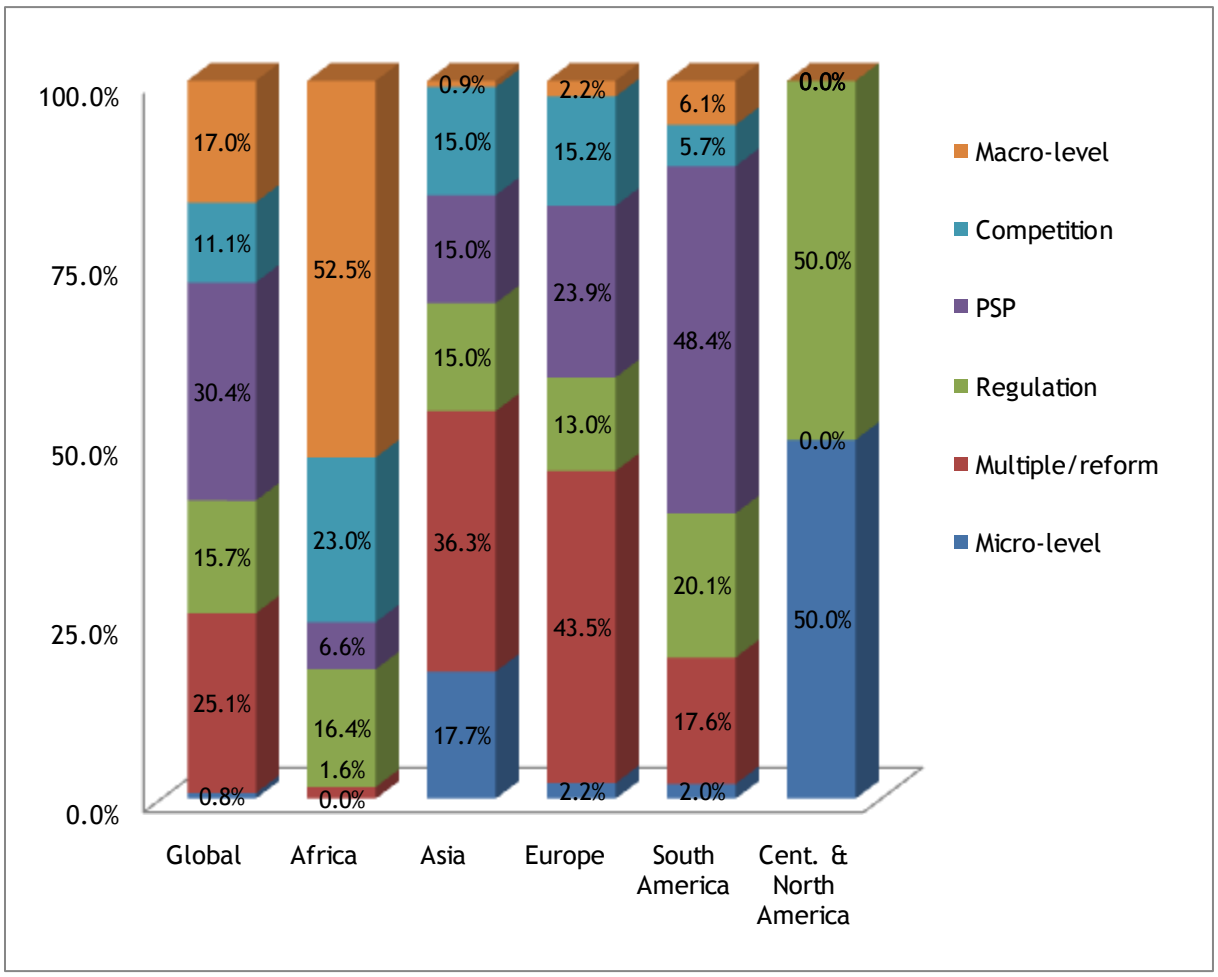
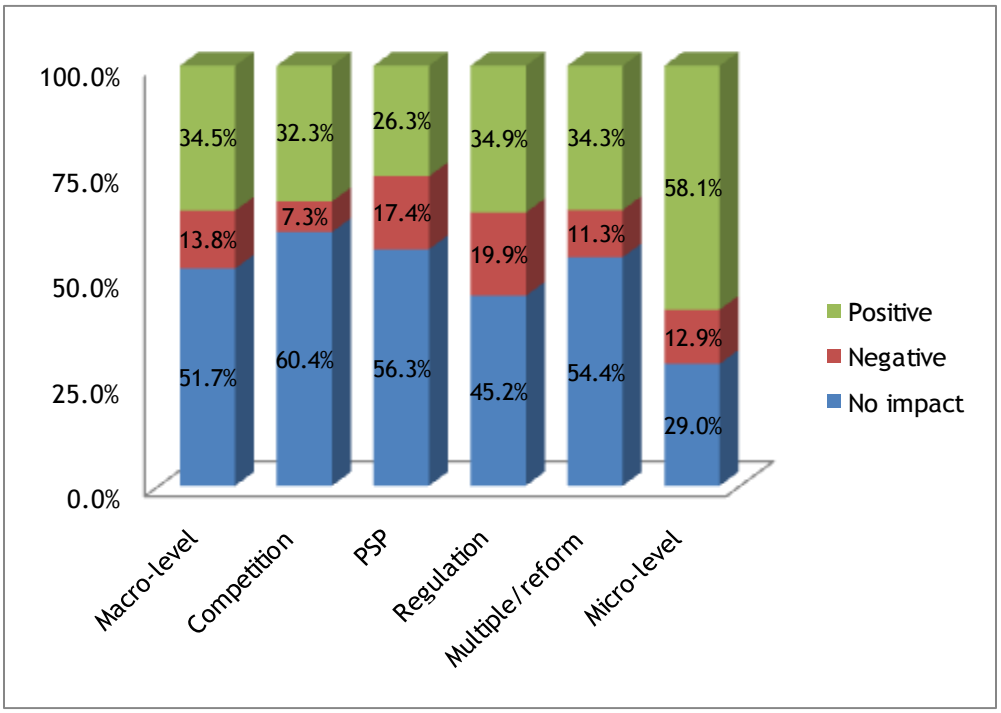


Figure A4.1.2: Proportion of various interventions in different regions



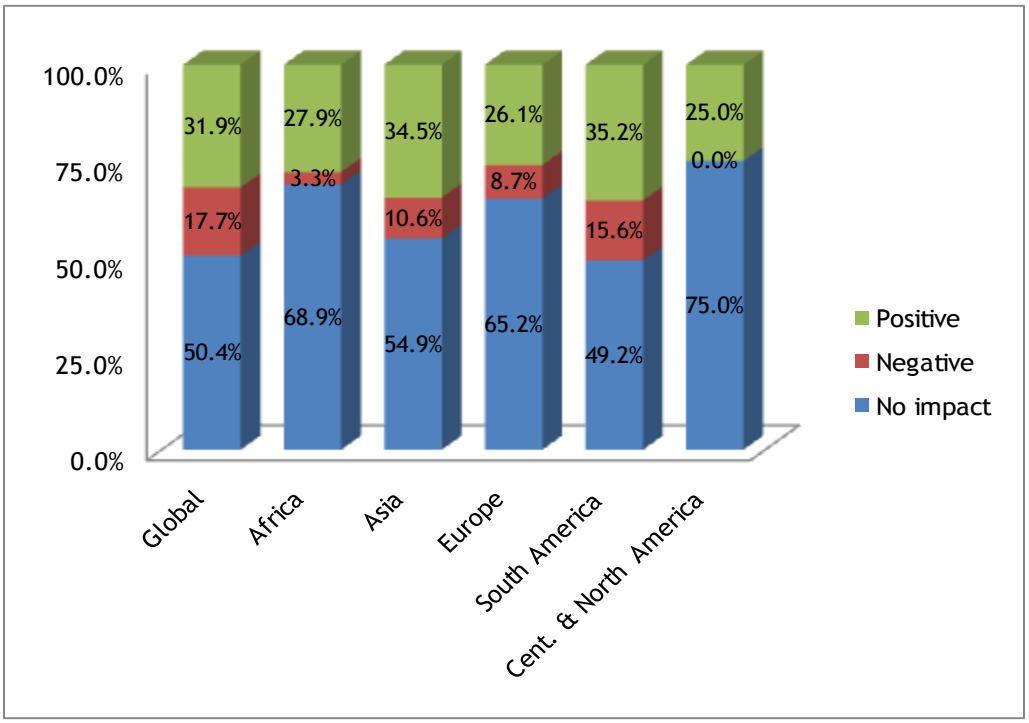
Note: 10% has been used as the significance level

Figure A4.1.3: Overall impact for different interventions



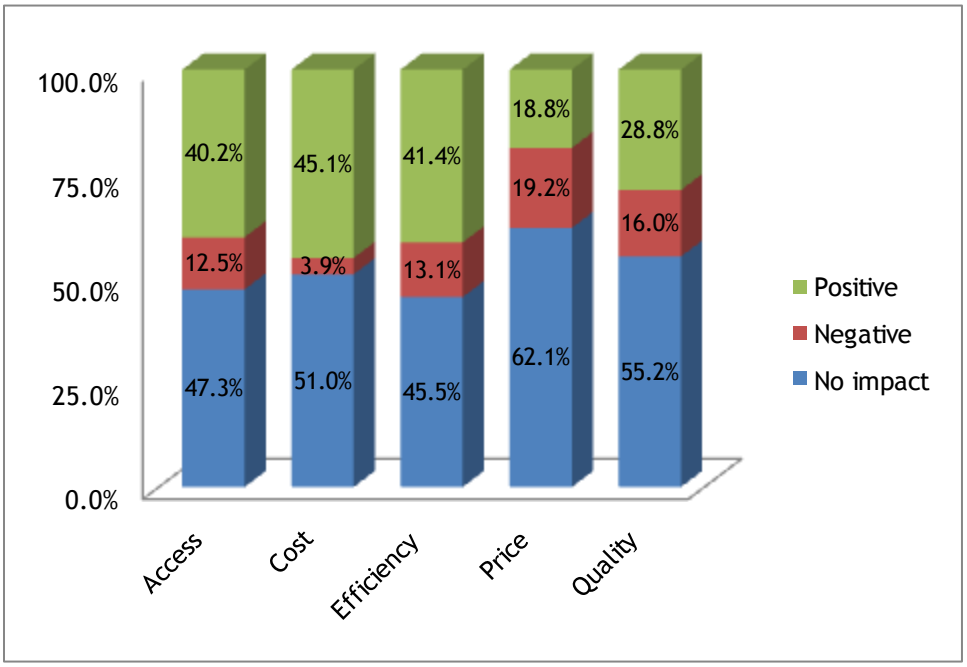
Note: 10% has been used as the significance level

Figure A4.1.4: Impact of interventions in different regions



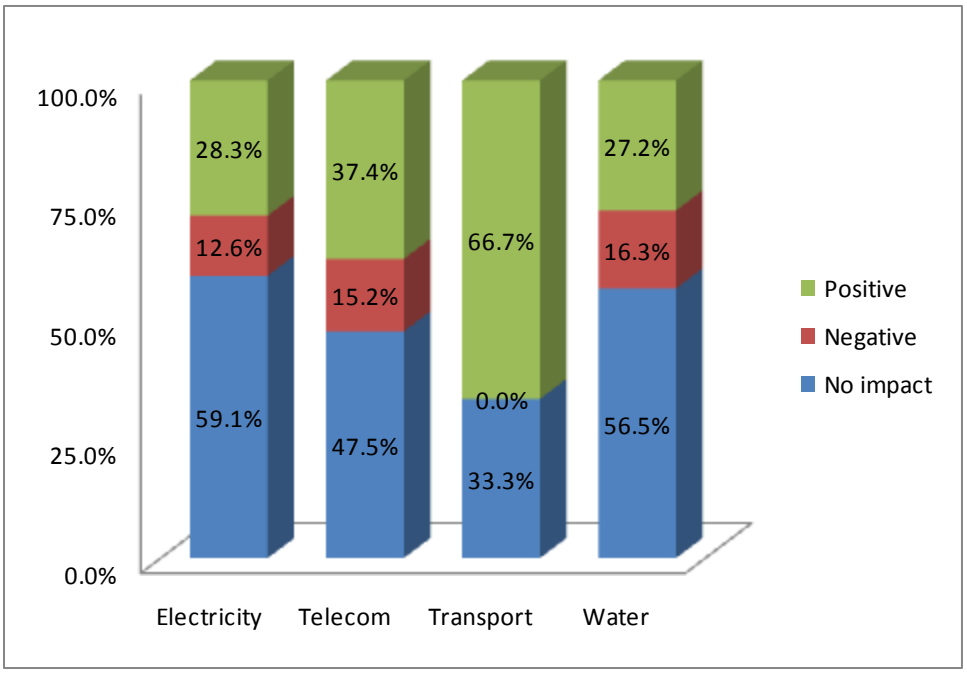
Note: 10% has been used as the significance level

Figure A4.1.5: Impact of interventions in different outcomes



Note: 10% has been used as the significance level

Figure A4.1.6: Outcome of interventions in different sectors



Appendix 4.2: Sectoral results of vote counting analysis

A4.2.1 Electricity

Table A4.2.1: Summary of overall evidence in electricity

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Level of evidence	+	-	0	**T**	+	-	0	**T**	+	-	0	**T**
Global	17	2	16	**35**	2	-	4	**6**	6	2	13	**21**
Region	6	2	23	**31**	6	2	7	**15**	7	3	6	**16**
Country	2	1	3	**6**	0		1	**1**	8	1	5	**14**
Total	**25**	**5**	**42**	**72**	**8**	**2**	**12**	**22**	**21**	**6**	**24**	**51**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Level of evidence	+	-	0	**T**	+	-	0	**T**	**+**	**-**	**0**	**T**
Global	3	6	13	**22**	4	2	16	**22**	32	12	62	**106**
Region	7	9	41	**57**	18	5	23	**46**	44	21	100	**165**
Country	3	2	10	**15**	1	3	6	**10**	14	7	25	**46**
Total	**13**	**17**	**64**	**94**	**23**	**10**	**45**	**78**	**90**	**40**	**187**	**317**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

Table A4.2.2: Summary of evidence by region in electricity

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Evidence by region	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	17	2	16	**35**	2	-	4	**6**	6	2	13	**21**
Africa	0	-	0	**0**	-	-	-	**0**	1	0	0	**1**
Asia	4	2	7	**13**	-	-	-	**0**	3	0	4	**7**
Europe	1	-	7	**8**	-	-	-	**0**	1	-	-	**1**
South America	3	1	12	**16**	6	2	8	**16**	10	4	7	**21**
Total	**25**	**5**	**42**	**72**	**8**	**2**	**12**	**22**	**21**	**6**	**24**	**51**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Evidence by region	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	3	6	13	**22**	4	2	16	**22**	32	12	62	**106**
Africa	0	-	0	**0**	0	-	-	**0**	1	0	0	**1**
Asia	4	2	18	**24**	1	3	9	**13**	12	7	38	**57**
Europe	3	2	11	**16**	3	2	7	**12**	8	4	25	**37**
South America	3	7	22	**32**	15	3	13	**31**	37	17	62	**116**
Total	**13**	**17**	**64**	**94**	**23**	**10**	**45**	**78**	**90**	**40**	**187**	**317**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

Table A4.2.3: Summary of evidence by intervention in electricity

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Interventions	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Macro-level	4	-	-	**4**	4	-	2	**6**	2	1	-	**3**
Sector-level	21	5	42	**68**	4	2	10	**16**	19	5	24	**48**
Competition	*4*	*1*	*6*	***11***	*-*	*-*	*-*	*-*	*1*	*-*	*3*	***4***
PSP	*2*	*2*	*13*	***17***	*1*	*2*	*5*	***8***	*5*	*1*	*13*	***19***
Regulation	*3*	*1*	*8*	***12***	*3*	*-*	*2*	***5***	*8*	*1*	*2*	***11***
Multiple/reform	*12*	*1*	*15*	***28***	*0*	*-*	*3*	***3***	*5*	*3*	*6*	***14***
Total	**25**	**5**	**42**	**72**	**8**	**2**	**12**	**22**	**21**	**6**	**24**	**51**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Interventions	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Macro-level	1	1	4	**6**	4	1	5	**10**	15	3	11	**29**
Sector-level	12	16	60	**88**	19	9	40	**68**	75	37	176	**288**
Competition	*1*	*2*	*10*	***13***	*1*	*1*	*5*	***7***	*7*	*4*	*24*	***35***
PSP	*2*	*5*	*13*	***20***	*8*	*2*	*14*	***24***	*18*	*12*	*58*	***88***
Regulation	*3*	*6*	*11*	***20***	*5*	*4*	*7*	***16***	*22*	*12*	*30*	***64***
Multiple/reform	*6*	*3*	*26*	***35***	*5*	*2*	*14*	***21***	*28*	*9*	*64*	***101***
Total	**13**	**17**	**64**	**94**	**23**	**10**	**45**	**78**	**90**	**40**	**187**	**317**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

A4.2.2 Telecom

Table A4.2.4: Summary of overall evidence in telecom

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Level of evidence	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	36	18	32	**86**	-	-	-		17	3	15	**35**
Region	22	1	21	**44**	-	-	-		10	1	6	**17**
Country	6	1	1	**8**	1	-	2	**3**	5	-	1	**6**
Total	**64**	**20**	**54**	**138**	**1**		**2**	**3**	**32**	**4**	**22**	**58**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Level of evidence	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	24	22	48	**94**	4	7	9	**20**	81	50	104	**235**
Region	3	1	27	**31**	4	-	5	**9**	39	3	59	**101**
Country	-	-	2	**2**	1	-	-	**1**	13	1	6	**20**
Total	**27**	**23**	**77**	**127**	**9**	**7**	**14**	**30**	**133**	**54**	**169**	**356**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

Table A4.2.5: Summary of evidence by region in telecom

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Evidence by region	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	36	18	32	**86**	-	-	-	-	17	3	15	**35**
Africa	7	1	11	**19**	-	-	-	-	-	-	1	**1**
Asia	9	1	7	**17**	-	-	2	**2**	7	1	3	**11**
Europe	-	-	-	**0**	-	-	-	-	-	-	-	**0**
South America	12	-	4	**16**	1	-	-	**1**	8	-	3	**11**
Total	**64**	**20**	**54**	**138**	**1**	**-**	**2**	**3**	**32**	**4**	**22**	**58**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Evidence by region	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	24	22	48	**94**	4	7	9	**20**	81	50	104	**235**
Africa	3	1	27	**31**	-	-	-	**0**	10	2	39	**51**
Asia	-	-	2	**2**	-	-	-	**0**	16	2	14	**32**
Europe	-	-	-	**0**	4	-	5	**9**	4	-	5	**9**
South America	-	-	-	**0**	1	-	-	**1**	22	-	7	**29**
Total	**27**	**23**	**77**	**127**	**9**	**7**	**14**	**30**	**133**	**54**	**169**	**356**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

Table A4.2.6: Summary of evidence by interventions in telecom

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Interventions	+	-	0	**T**	+	-	0	**T**	+	-	0	**T**
Macro-level	7	6	18	**31**	-	-	-	**-**	2	1	2	**5**
Sector-level	57	14	36	**107**	1	-	2	**3**	30	3	20	**53**
Competition	*12*	*1*	*10*	***23***	-	-	-	**-**	*4*	*1*	*6*	***11***
PSP	*13*	*2*	*8*	***23***	*1*	-	-	***1***	*10*	-	*5*	***15***
Regulation	*15*	*2*	*8*	***25***	-	-	-	***0***	*4*	-	*4*	***8***
Multiple/reform	*17*	*9*	*10*	***36***	-	-	*2*	***2***	*12*	*2*	*5*	***19***
Micro-level	-	-	-	**0**	-	-	-	**0**	-	-	-	**0**
Total	**64**	**20**	**54**	**138**	**1**		**2**	**3**	**32**	**4**	**22**	**58**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Interventions	+	-	0	**T**	+	-	0	**T**	**+**	**-**	**0**	**T**
Macro-level	5	4	22	**31**	1	2	3	**6**	15	13	45	**73**
Sector-level	22	19	55	**96**	8	5	10	**23**	118	41	123	**282**
Competition	*6*	*1*	*18*	***25***	*2*	-	-	***2***	*24*	*3*	*34*	***61***
PSP	*2*	*11*	*4*	***17***	*3*	-	*5*	***8***	*29*	*13*	*22*	***64***
Regulation	*3*	*6*	*15*	***24***	*1*	*4*	*1*	***6***	*23*	*12*	*28*	***63***
Multiple/reform	*11*	*1*	*18*	***30***	*2*	*1*	*4*	***7***	*42*	*13*	*39*	***94***
Micro-level	-	-	-	**0**	-	-	1	**1**	-	-	1	**1**
Total	**27**	**23**	**77**	**127**	**9**	**7**	**14**	**30**	**133**	**54**	**169**	**356**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

A4.2.3 Transport

Table A4.2.7: Summary of overall evidence in transport

Outcomes	**Panel A: Access**				**Panel B: Cost**				**Panel C: Efficiency**			
Level of evidence	+	-	0	**T**	+	-	0	**T**	+	-	0	**T**
Region	-	-	-	**-**	2	-	-	**2**	-	-	-	**-**
Country	-	-	-	**-**	6	-	4	**10**	-	-	-	**-**
Total	**-**	**-**	**-**	**-**	**8**		**4**	**12**	**-**	**-**	**-**	**-**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Level of evidence	+	-	0	**T**	+	-	0	**T**	**+**	**-**	**0**	**T**
Region	-	-	-	**-**	-	-	-	**-**	2	-	-	**2**
Country	-	-	-	**-**	-	-	-	**-**	6	-	4	**10**
Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**8**		**4**	**12**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

Table A4.2.8: Summary of evidence by region in transport

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Evidence by region	+	-	0	**T**	+	-	0	**T**	+	-	0	**T**
Africa	-	-	-	**-**	2	-	-	**2**	-	-	-	**-**
Asia	-	-	-	**-**	6	-	4	**10**	-	-	-	**-**
Total	**-**	**-**	**-**	**-**	**8**		**4**	**12**	**-**	**-**	**-**	**-**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Evidence by region	+	-	0	**T**	+	-	0	**T**	+	-	0	**T**
Africa	-	-	-	**-**	-	-	-	**-**	2	-	-	**2**
Asia	-	-	-	**-**	-	-	-	**-**	6	-	4	**10**
Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**8**		**4**	**12**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

Table A4.2.9: Summary of evidence by intervention in transport

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Interventions	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Macro-level	-	-	-	**-**	3	-	-	**3**	-	-	-	**-**
Micro-level	-	-	-	**-**	5	-	4	**9**	-	-	-	**-**
Total	**-**	**-**	**-**	**-**	**8**	**0**	**4**	**12**	**-**	**-**	**-**	**-**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Interventions	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Macro-level	-	-	-	**-**	-	-	-	**-**	3	-	-	**3**
Micro-level	-	-	-	**-**	-	-	-	**-**	5	-	4	**9**
Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**8**	**0**	**4**	**12**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

A4.2.4 Water

Table A4.2.10: Summary of overall evidence in water

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Level of evidence	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	6	4	11	**21**	-	-	3	**3**	2	2	11	**15**
Region	3	-	1	**4**	1	-	2	**3**	3	-	3	**6**
Country	7	4	11	**22**	2	-	1	**3**	1	3	3	**7**
Total	**16**	**8**	**23**	**47**	**3**		**6**	**9**	**6**	**5**	**17**	**28**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Level of evidence	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	-	-	3	**3**	3	2	5	**10**	11	8	33	**52**
Region	-	-	-		-	-	-	**0**	7	-	6	**13**
Country	3	4	5	**12**	9	5	24	**38**	22	16	44	**82**
Total	**3**	**4**	**8**	**15**	**12**	**7**	**29**	**48**	**40**	**24**	**83**	**147**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

Table A4.2.11: Summary of evidence by region in water

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Evidence by region	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	6	4	11	**21**	-	-	3	**3**	2	2	11	**15**
Africa	-	-	-	**0**	1	-	2	**3**	3	-	-	**3**
Asia	5	-	2	**7**	-	-	-		-	2	3	**5**
South America	5	4	10	**19**	1	-	-	**1**	1	1	1	**3**
Cent. & North America	-	-	-	**0**	1	-	1	**2**	-	-	2	**2**
Total	**16**	**8**	**23**	**47**	**3**		**6**	**9**	**6**	**5**	**17**	**28**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Evidence by region	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Global	-	-	3	**3**	3	2	5	**10**	11	8	33	**52**
Africa	-	-	-		-	-	-	**0**	4	-	2	**6**
Asia	-	-	1	**1**	-	1	-	**1**	5	3	6	**14**
South America	3	4	4	**11**	9	4	24	**37**	19	13	39	**71**
Cent. & North America	-	-	-	-	-	-	-	**0**	1	-	3	**4**
Total	**3**	**4**	**8**	**15**	**12**	**7**	**29**	**48**	**40**	**24**	**83**	**147**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

Table A4.2.12: Summary of evidence by intervention in water

Outcomes	Panel A: Access				Panel B: Cost				Panel C: Efficiency			
Interventions	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Macro-level	4	-	3	**7**	1	-	1	**2**	2	-	-	**2**
Sector-level	6	8	18	**32**	-	-	5	**5**	2	2	16	**20**
PSP	*6*	*8*	*16*	***30***	-	-	*4*	***4***	*2*	*2*	*15*	***19***
Regulation	-	-	*1*	***1***	-	-	*1*	***1***	-	-	*1*	***1***
Multiple / Reform	-	-	*1*	***1***	-	-	-	***0***	-	-	-	***0***
Micro-level	6	-	2	**8**	2	-	-	**2**	2	3	1	**6**
Total	**16**	**8**	**23**	**47**	**3**	**0**	**6**	**9**	**6**	**5**	**17**	**28**
Outcomes	**Panel D: Price**				**Panel E: Quality**				**Panel F: Total**			
Interventions	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**	**+**	**-**	**0**	**T**
Macro-level	-	-	-	**-**	-	-	-	**-**	7	-	4	**11**
Sector-level	2	4	7	**13**	10	6	29	**45**	20	20	75	**115**
PSP	*2*	*4*	*7*	***13***	*10*	*6*	*29*	***45***	*20*	*20*	*71*	***111***
Regulation	-	-	-	***0***	-	-	-	***0***	-	-	*3*	***3***
Multiple / Reform	-	-	-	***0***	-	-	-	***0***	-	-	*1*	***1***
Micro-level	1	-	1	**2**	2	1	-	**3**	13	4	4	**21**
Total	**3**	**4**	**8**	**15**	**12**	**7**	**29**	**48**	**40**	**24**	**83**	**147**

Note: +: No. of significant positive observations; -: No. of significant negative observations; 0: No. of observations with no significant impact; T: Total number of observations. 10% has been used as the significance level

The authors of this report were supported by the Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre).

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This material has been funded by the Department for International Development. However the views expressed do not necessarily reflect the department's official policies. The report was first published in 2012 by:

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ISBN: 978-1-907345-31-9
Cover images by Thillai Rajan