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Issues in Infrastructure Pricing

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Foreword

Economic infrastructure plays a vital role in our economy. Infrastructure services directly affect living standards. They make an important contribution to national output in their own right and also are crucial to the international competitiveness of Australian businesses. In this regard, the cost and quality of infrastructure services has a significant impact on the contribution business can make to economic growth and employment. It is, therefore, important that infrastructure services are delivered as efficiently as possible. Recent reforms by Commonwealth, state and territory governments have increased the commercial focus of government owned infrastructure providers. Pricing reform is also a key element in this process.

This report is the BIE's first on infrastructure pricing. It follows the Prime Minister's announcement in May 1994 that the BIE would extend its international benchmarking of infrastructure to encompass the analysis of policy issues including pricing. It therefore complements the BIE's work on international benchmarking of infrastructure and key government services.

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The BIE would like to thank Dr Robert Albon of the Australian National University for his comments.

August 1995

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Over the last decade, governments at all levels have been actively pursuing reforms to encourage more efficient provision of economic infrastructure. Promoting efficient pricing should be a central feature of these reforms. Efficient pricing will help to ensure Australia makes the best use of existing infrastructure assets. It will also provide a sound basis for future investment decisions. Efficient pricing is also critical if the costs of providing economic infrastructure are to be recovered, without placing undue burden on taxpayers and selected users.

Failure to pay serious attention to the role that pricing plays in improving the efficiency of government business enterprises (GBEs) and the economy would mean that many of the potential gains from infrastructure reform would be missed. This report focuses on a range of infrastructure pricing issues. It aims to stimulate debate and promote a wider understanding of the importance and complexity of the pricing task.

Pricing infrastructure efficiently

The provision of economic infrastructure in Australia has traditionally been dominated by governments, with the direct responsibility for the operation resting largely with GBEs. Often governments have not required or even encouraged their GBEs to recover costs or price efficiently. This has imposed unnecessary costs on the community. Underpricing encourages excess use of infrastructure services, bringing forward the need for additional investment in infrastructure assets. It also places additional burdens on the economy. Governments have typically introduced higher taxation and/or higher budget deficits in response to GBE's operating losses and asset funding constraints.

What constitutes "efficient" pricing of infrastructure services? This question raises many conceptual and implementation issues. Ideally, it involves finding pricing structures that will cover the economic costs of supply. At the same time prices should encourage maximum utilisation of existing assets and signal to users the costs associated with supplying additional units.

The characteristics of infrastructure provision make meeting these criteria complex. It may take many years before the capacity of key infrastructure assets, such as dams and gas reticulation systems, is fully utilised. This can have implications for inter-temporal pricing. In other cases, for example power stations, infrastructure may only be fully utilised at peak times. Costs can vary substantially between different types of users (households and businesses), between regions (cities and rural areas), at different times of day (peak and off-peak times) and over time. This report explores a range of pricing strategies to cope with these demand and supply characteristics. Most of these

strategies involve more price variability than current practices which encourage uniform pricing (see chapter 2).

Using infrastructure to pursue social objectives

For many years, governments, as infrastructure owners, have required GBEs to deliver services to certain groups below cost. These requirements — commonly termed community service obligations (CSOs) — have generally related to governments' broader social objectives. Cross-subsidisation — charging some users a price significantly in excess of the costs of supply — has often funded these CSOs.

Cross-subsidisation is not generally the ideal mechanism for funding CSOs as it can impose unnecessary costs on society. Users who pay inflated prices to subsidise the CSOs are effectively "taxed" and discouraged from using the service, while users who benefit from underpricing may overuse the service. Where business pays these inflated prices, their cost structures and competitiveness are adversely affected. Cross-subsidisation also disguises the true costs of provision, making assessment of the benefits of CSOs difficult. Importantly, cross-subsidisation can usually only be sustained by granting GBEs a monopoly right to supply the service. This restriction removes the potential for competitive pressures to improve performance.

Governments, for various reasons, may decide that GBEs are the most appropriate means of pursuing their broader objectives. In these instances, governments should take care when selecting the method for funding any associated losses. If cross-subsidisation is the funding mechanism, the costs to the community as a whole may outweigh the benefits. Other methods for funding CSOs do not suffer the same drawbacks as cross-subsidies. These methods include: upfront levies on users; direct cash payments to targeted users; vouchers; direct government funding of the GBE; and accepting lower rates of return (see chapter 3). More work on the funding of CSOs is a high priority for policy makers. Failure to address CSO funding issues will jeopardise current competition policy reforms (see chapter 5).

Rate of return targets and efficient pricing

Requiring GBEs to earn a return on the assets under their control is a central element of the reforms being pursued by governments. Rate of return targets force GBEs to consider the costs associated with the capital tied up in their assets. They can impose important pressures on those GBEs with a long history of under recovering costs. Targets also provide a basis for making investment decisions and can allow governments to monitor the management and performance of GBEs.

Return targets and measures should be based on the market value of infrastructure. However, determining the market value of infrastructure assets is not a simple task. As most infrastructure assets in Australia are government owned, they are rarely traded. The unique nature of many infrastructure assets, for example dams and power stations, compounds this thin market. As a consequence, there is often no reliable market

reference price to estimate asset value. Moreover, the true stream of potential earnings of the assets, which could be used as a valuation tool, is often distorted by government pricing directives and CSO requirements. Using a combination of valuation methodologies can help address these problems (see chapter 4).

Determining appropriate rate of return targets can also present difficulties. Return targets for GBEs should generally be based on a relevant risk free rate, for example the long bond rate, plus an indicative loading for risk. Policy makers, when setting targets, need to give proper consideration to the fluctuating returns typically associated with long-lived investments and any requirements to deliver unfunded CSOs. Failure to do so may force infrastructure providers to set inappropriate prices (see chapter 4).

Conflicts between rate of return targeting and efficient pricing and production decisions will arise if the rate of return approach is not used carefully. Efforts to improve efficiency will be frustrated if GBEs, to meet these return targets, simply increase prices, lower service quality or pursue other inappropriate strategies. Monitoring a range of complementary financial and non-financial performance indicators may help here.

Addressing monopoly concerns

The reforms being pursued by governments introduce stronger incentives for infrastructure providers to act commercially. Given the pressures to meet rates of return, infrastructure providers may pursue strategies such as "overpricing" or lowering service quality to improve their profitability. Increasing competition will limit the ability of infrastructure providers to pursue such strategies and should be central to reforms to improve infrastructure performance (see chapter 5). However, in some cases, even when governments vigorously pursue these pro-competitive reforms, some infrastructure providers will not face effective competitive disciplines. Mostly, this will be because they exhibit natural monopoly characteristics or because it will take some time before potential competitors emerge.

In these cases, regulation may be required to address concerns about monopoly behaviour. However, regulation can involve costs. These costs include information collection and assessment costs, dispute resolution costs, compliance costs incurred by regulated firms and the costs associated with regulatory capture and regulatory instability. Some forms of regulation such as rate of return regulation and price capping can distort production and investment decisions, and may also stifle innovation. Policy makers should take care to ensure these costs are minimised.

Given the costs and potential inefficiencies associated with regulations to address monopoly concerns, a cautious approach is warranted. Governments should, in the first instance, consider approaches such as price monitoring and international benchmarking. These allow greater pricing flexibility and impose some degree of competitive discipline. They are less likely to encourage managers to depart from efficient pricing and production practices (see chapter 5).

Incentives created by intergovernmental financial relations

The financial relationships that have evolved under the Australian federal system are not conducive to maximising the benefits of our infrastructure stock. The grants redistribution process breaks the nexus between spending and revenue raising. By indirectly compensating state and territory governments for operating losses associated with infrastructure provision, the redistribution process creates an incentive to underprice some infrastructure services with a view to passing costs on to other jurisdictions. The relatively narrow tax bases available to states and territories can create resistance to exposing government infrastructure providers to competition and increases the incentive for governments to use some infrastructure charges to raise revenue (see chapter 6).

An unprecedented level of intergovernmental cooperation is needed to encourage state and territory governments to pursue reforms conducive to more efficient pricing. The April 1995 Council of Australian Governments' agreement on a national competition policy and related reforms represents a major breakthrough. As the actual costs and benefits of undertaking the competition reforms and their distribution become clearer, the commitment of governments will be tested.

Conflicting pressures need to be resolved

Infrastructure providers are currently placed under a number of conflicting pressures. One set of pressures now being applied requires GBEs to earn a specified rate of return on their assets. However, often there are no markets for those assets and, consequently, few mechanisms for writing down the value of bad investments. As a result, some GBEs may be forced to earn the specified rate of return on the written down replacement cost of their assets, which may considerably exceed the asset's true market value or earnings potential. At the same time, GBEs often have limited control over their prices and in many cases approval for price increases still has to be sought from governments. In some cases this reflects fears of monopoly power. In other cases governments may have maintained this control because of reluctance to consider price increases for political reasons or a desire to deliver infrastructure services below cost to meet social objectives.

There is a danger that the only way GBE management may be able to deal with these conflicting pressures is by lowering service quality, cutting investment or running down their capital stock. On the other side of the coin, the community demands that infrastructure services be maintained or improved. These conflicting pressures highlight the importance of addressing infrastructure pricing issues as a high priority. Pricing reform is an integral part of the infrastructure reform process.

1. Introduction

Infrastructure services play an essential role in Australia's economic development and growth. They directly affect the living standards of all Australians. Indeed, many infrastructure services such as clean water, electricity, telecommunications and reliable transport systems are regarded by the community as basic necessities. With assets valued at around $400 billion or one third of the nation's total capital stock, infrastructure services make a significant contribution to economic growth in their own right. In addition, the competitiveness of Australian business is determined in part by the costs and quality of infrastructure services which, for most industries, make up between 10 and 25 percent of total costs.

The provision of economic infrastructure also has a number of indirect impacts on the economy. The greater the call that infrastructure providers make on resources such as capital and labour, the more expensive it becomes for other businesses to use these resources. Further, as many economic infrastructure providers are government owned, their financial performance can impact upon the level of taxes and government charges as well as the level of public sector debt.

Given the critical role it plays in our economy, it is important that infrastructure is delivered and priced as efficiently as possible. Australian governments, recognising the critical role played by infrastructure, have initiated a number of reforms to improve industry structure and reduce costs. This report examines infrastructure pricing, a priority for future reform.

The report seeks to focus attention on the importance of infrastructure pricing reform and promote a better understanding of pricing issues. Many of the notions discussed in this paper are not new in themselves. However, by synthesising a range of issues and providing stylised numerical examples, the paper aims to focus attention on the gains from pricing reform and the problems which may be encountered in achieving those gains. While the paper focuses on infrastructure reform issues as they relate to government business enterprises (GBEs), many of the issues discussed extend to other infrastructure activities.

This chapter provides some background to the provision and pricing of infrastructure in Australia and briefly outlines the current process of infrastructure reform.

1.1 Infrastructure in Australia

The provision of economic infrastructure in Australia is dominated by the public sector. Together, Commonwealth, state and local governments own around 90 per cent of the nation's economic infrastructure assets. The direct responsibility for the

provision and management of the majority of these assets rests with GBEs. Australian governments, as infrastructure owners, have had a significant impact on the pricing of infrastructure services.

Until recently, recovering the costs associated with providing infrastructure has not been accorded a high priority by governments. Consequently, costs have carried little weight in pricing decisions and often prices have been well below the costs of provision. Where underpricing has resulted in operating losses, governments have covered these by raising revenue from increased taxes or increased debt. Underpricing has encouraged excess use of infrastructure services, bringing forward the need for additional investment in infrastructure assets. Sometimes infrastructure investment has been undertaken prematurely to stimulate economic growth or in pursuit of other political objectives. At other times, commercially sound infrastructure investments have been delayed due to concerns about budgetary outcomes.

In pursuit of social or non-commercial objectives, such as equity and economic development, governments have sometimes required GBEs to deliver services below cost to particular users. While it may, in some instances, be appropriate to utilise infrastructure services to pursue these objectives, the approaches used to fund the associated loss has not alway been ideal. Funding to provide these services below cost has been predominantly provided by cross-subsidisation. This means that other users are charged prices significantly higher than the costs associated with suppling infrastructure services. The use of cross-subsidisation as a funding mechanism has given rise to pricing structures that do not reflect the costs of supply and can hence distort decisions to consume, produce and invest..

On other occasions, users have accused governments of overpricing infrastructure services and using their GBEs as revenue raisers. State and territory governments, in particular, have taken substantially larger dividend payments from their GBEs in recent years. These large payments, coupled with the state and territory governments' relatively narrow tax bases, have led to concerns that the benefits from recent efficiency improvements in GBEs have not been adequately passed on to users.

Governments have had an impact on pricing in other ways. For example, GBEs, via their statutory monopoly rights to deliver certain services, have been sheltered from competitive pressures to price and produce efficiently. Government ownership has also given GBEs a number of competitive advantages (eg low cost loans and tax exemptions) which reduced pressure to recover costs or price efficiently.

Overall, there has been little in the way of incentives for government owned infrastructure providers to minimise costs or price on a sound commercial and economic basis. As a consequence, the way in which infrastructure has been priced and delivered has not always been consistent with maximising its contribution to Australia's economic development and international competitiveness. The program of

microeconomic reforms currently underway in the Australian economy has included a number of initiatives designed to improve this situation. However, much still needs to be done.

1.2 Infrastructure reform

GBEs have been the focus of a wide range of reforms aimed at achieving more efficient provision of economic infrastructure. The reforms have included commercialisation, corporatisation, franchising and privatisation (see box 1.1). Each of these approaches attempts to introduce or mimic the commercial incentives provided by market disciplines. While there have been some privatisation initiatives, corporatisation and commercialisation are the approaches most often adopted for the reform of government owned infrastructure providers.

Many of the key elements associated with individual government reform programs have been brought together and reinforced by the national competition policy and related reforms recently endorsed by the Council of Australian Governments (COAG). The key elements of the policy include: reviews of regulatory restrictions to competition on a national level; structural reform of natural monopolies; ensuring the development of "fair" access regimes to essential infrastructure facilities (eg electricity transmission grids, railway tracks); addressing monopoly pricing issues; and ensuring that public and private firms compete on an equal basis.

Encouraging efficient pricing has, however, not been a central feature of infrastructure reforms to date. In many cases, GBEs still have limited control over their prices, particularly price increases. In some cases this is in response to concerns about monopoly power. In other cases, governments, for political reasons, want to continue using GBEs to deliver certain infrastructure services below cost to meet social objectives. Consequently, at this stage in the reform process, efficient infrastructure pricing is the exception rather than the rule.

A more appropriate set of infrastructure prices would see prices more closely reflecting the costs of supply. This will help ensure Australia is making the best use of existing infrastructure assets and that future investment decisions are soundly based. It also removes the unnecessary burdens that inappropriate pricing strategies have placed on taxpayers and some users.

The community cannot reap all of the gains achievable from infrastructure reform unless we pay serious attention to the role that pricing plays in improving the efficiency of GBEs. In practice, there is a range of complex issues and problems that make a move to more efficient pricing a challenging and difficult task. The following chapters highlight some of the problems with the current approach to pricing and some of the ways they can be dealt with.

Box 1.1 Approaches to GBE reform

The approaches pursued by governments in Australia for reforming GBEs can be loosely grouped under four headings — commercialisation, corporatisation, franchising (competitive licensing, leasing) and privatisation. In practice, there is often little to differentiate one approach from another and individual governments may not apply all the elements of each approach as described below.

Commercialisation aims to improve enterprise performance and accountability without changing the ownership. At a minimum, it involves reforming administrative procedures within a GBE to encourage better performance. This can involve: better specification of objectives; preparation of business plans; introduction of financial targets (eg rate of return, debt/equity ratios) and non-financial targets (eg service quality, productivity); reduced government involvement in day-to-day decisions; update of account keeping methods; and improved reporting requirements. It usually is not backed up by detailed legislation that specifies the operating environment of the GBE and its relationship with the government. It normally does not involve the appointment of a commercial Board or the application of certain commercial disciplines (eg Corporations Law, Trade Practices Act, etc).

Corporatisation aims to more formally replicate or introduce commercial and market disciplines while retaining full government ownership. The relationship between the GBE and government becomes one of a commercial Board and a dominant shareholder. The powers and responsibilities of each are clearly specified in legislation. Boards are given greater authority and autonomy. They are expected to achieve financial and non-financial targets that act as a proxy for market disciplines. These targets are monitored by government agencies. Wherever possible, non-commercial functions/objectives are removed from the GBE's responsibility (eg regulatory functions). Non-commercial functions (eg CSOs) are performed under contract type arrangements. Commercial pressures are introduced either directly or via legislation/regulations that attempt to mirror relevant arrangements (eg Corporations Law). Competitive advantages and disadvantages resulting from government ownership and regulatory/legislative barriers to entry are reduced.

Franchising involves tendering out the management of GBE assets for a fixed period. The firm with the lowest reasonable price (subject to a range of considerations such as management stability, relevant experience and supply quality assurances) is awarded the rights to manage and operate the assets. In addition to normal commercial and market disciplines, the contract between the government and the managing firm may be subject to certain conditions and constraints (such as investment and maintenance requirements, special reporting and disclosure requirements).

Privatisation, in its simplest form, involves selling a GBE to the private sector. It can be complete or partial (whereby the government retains some ownership rights and possibly management control). Typically, the privatised entity is exposed to normal commercial disciplines (eg conduct regulation such as the Trade Practices Act and Corporations Law, accounting conventions, preparation of business plans, taxation requirements etc) and market disciplines (eg sharemarket monitoring, bankruptcy, takeover, credit assessments etc). Specific regulation that imposes other constraints on conduct (eg government mandated reporting requirements) may also apply.

1.3 The issues to be examined

Before many of these complex issues can be examined, the meaning of efficient pricing in the context of infrastructure provision needs to be clarified. This is the task of chapter 2 which discusses the conceptual basis for efficient pricing and why it is important. Some of the difficulties in applying the basic approaches to setting infrastructure prices efficiently are then examined, along with some of the possible solutions.

Chapter 3 discusses the costs associated with using cross-subsidisation to support the pursuit of social objectives. The chapter also briefly reviews alternative methods of funding the pursuit of social objectives via infrastructure providers and examines how the costs of these services can be calculated. Some of the key issues associated with expecting GBEs to earn a target return on the capital invested in their assets and asset valuation are considered in chapter 4. Chapter 5 examines some of the ways that competition can be introduced into infrastructure markets. It also discusses the approaches that can be used for dealing with situations where infrastructure providers do not face strong competitive pressures. Finally, chapter 6 discusses the ways in which Australia's intergovernmental financial relations may impact upon the incentives for governments to pursue efficient infrastructure pricing and pricing-related reforms.

2. Efficient infrastructure pricing

This chapter discusses some key issues concerning efficient infrastructure pricing. It begins with a brief discussion of what is meant by efficient pricing to establish a benchmark against which to consider infrastructure pricing issues. The characteristics of infrastructure provision that present challenges in achieving efficient pricing outcomes, along with a number of solutions, are examined in section 2.2. Section 2.3 considers the information required to set prices to ensure the best use is made of infrastructure. Section 2.4 illustrates how the different approaches towards infrastructure pricing can be applied by reference to a practical example. Concluding comments are made in section 2.5.

2.1 What is efficient pricing?

The concept of "efficient pricing" is complex and is underpinned by a large body of economic theory (see Fischer and Dornbusch 1983; Hirshleifer 1984). In simple terms, efficient pricing requires that the prices paid by users for goods and services closely reflect the (avoidable) costs of supply. Prices should be sufficient to generate just enough revenue to enable costs to be recovered. For a typical business, supply costs would include things such as:

- returns to investors (eg dividends) to compensate them for the capital they have tied up in the business;
- interest payments on debt;
- labour;
- advertising and insurance expenses;
- rental payments for premises; and
- purchase of other inputs such as materials, electricity, water etc.

Another important class of costs that can be associated with production are *negative externalities*. Ideally, the costs associated with such externalities should be reflected in prices. Examples of negative externalities are congestion and pollution. Governments often introduce measures that require firms to take account of the cost of externalities in their supply decisions. Examples include charges for disposal of toxic waste and motor vehicle emission standards.

The supply costs that are relevant for efficient pricing, including infrastructure pricing, are "opportunity costs" or "shadow prices" — ie the returns that could be

earned by using inputs in their next best use. If they have no value, then the past costs are "sunk" and are of no relevance to future pricing decisions.

It is important to note that the concept of opportunity cost conflicts with traditional accounting approaches which seek to recover historical costs (ie the purchase price of capital equipment such as plant and machinery). The cost that is relevant to efficient pricing is the value of the inputs in their next best use. Consider the example of computer equipment used by a desk top publishing firm that was purchased originally for $1 million. A year later, $500 000 will buy new computer technology that does the same job as the original $1 million equipment. The computer equipment cost that is relevant for establishing efficient prices for desk top publishing services is $500 000, not $1 million. The $500 000 difference is "sunk" and should have no influence on pricing. This example highlights another important condition for efficient pricing — the costs that should be recovered through pricing are those that reflect least cost production or "efficient production".

The concept of the opportunity cost of supply is closely related to the concept of the "marginal cost" of supply. The marginal costs of supply are the costs involved in supplying an additional unit of output. As the inputs used to supply the additional output could be used for other purposes, the marginal cost is the value lost by not using the inputs in their next best use (ie producing the next most valuable output). In circumstances where the prices paid for inputs are not highly distorted (eg by externalities), then marginal costs will approximate opportunity costs.

The marginal costs associated with the production of goods and services vary according to the time frame being considered — short run or long run.

The "short run" is a period where businesses are constrained in their output responses to changes in market circumstances (eg increased demand) by a fixed level of capital. For example, if a cold snap resulted in a sudden increase in demand for electricity to run heaters, electricity authorities would have to try to meet the increased demand with existing power generating plant. Provided there was unused capacity, supply could be increased. In these circumstances, the opportunity costs that are important in terms of efficient pricing are the short run marginal costs — the incremental costs of supplying another unit of energy with existing capacity. This would include the "incremental" operating costs such as extra materials, extra fuel and increased maintenance expenditure.

In the "long run" firms can vary their capacity. Long run marginal costs include not only short run marginal costs but also the costs associated with bringing new capacity on stream.

The time frame that distinguishes the short run from the long run varies across industries. The long run will be shorter for those industries that can easily purchase and install capital equipment. For example, increasing the capacity of a taxi service by purchasing a new taxi would take less time than installing a new power station to

increase energy supply. In the case of most infrastructure industries, the long run is likely to be a period of several years.

Economic theory suggests that short run marginal costs are the relevant benchmark for setting efficient prices. This is because short run marginal costs reflect the incremental (opportunity) costs of supplying an additional unit of output to the next user. Long run marginal costs provide a guide for investment decisions. For instance, where short marginal costs equal or exceed long run marginal costs for sustained periods, investment in new capacity may be warranted.

Notwithstanding the general case for short run marginal cost pricing, there may be some instances where "second best" pricing practices for infrastructure services could be used (see box 2.1).

Box 2.1 Second best pricing

While inefficiencies can arise from departing from the short run marginal cost pricing benchmark, marginal cost pricing of infrastructure services may not be optimal where prices elsewhere in the economy are not also based on marginal costs. In these circumstances, "second best" pricing regimes that aim to offset the distortionary impacts of inappropriate prices in particular markets may be justified (Lipsey and Lancaster 1956). For instance, there may be excess use of electricity generated by coal fired power stations because charges do not reflect the potential costs associated with greenhouse gas emissions. The consumption of electricity can be brought back to a more appropriate level by encouraging the use of alternative energy sources such as gas. This could be achieved by pricing gas at below its marginal cost.

Pursuing second best pricing in order to compensate for inefficient prices in other markets would be informationally demanding. Assessing the adjustments to prices that would need to be made to compensate for the effects of the original distortion would be extremely difficult. A thorough understanding of the inter-relationships between the consumption and production of a myriad of goods and services would be required. Moreover, as the true marginal costs of production are continually changing, price adjustments under a second best pricing regime would also need to be ongoing. Given these factors, there is a very real prospect that second best pricing regimes would result in worse outcomes than were experienced under the original distortions.

Second best pricing regimes are an indirect means of addressing distortions arising from inappropriate prices in other markets. As a general rule, a more sensible strategy for dealing with distortions in resource use is to correct the source of the problem — pricing that does not reflect marginal costs. Such a strategy will ensure that pressures to pursue marginal cost pricing in all markets are maintained. Nevertheless, there will be instances where second best pricing practices may have to be used for infrastructure services.

2.1.1 Competition, markets and efficient pricing

Competition plays an important role in ensuring that prices do not depart substantially from short run marginal costs. For instance, where the marginal cost of supply is greater than the market price, this signals that consumers do not value a good or service as highly as what it cost to produce. The community loses in such circumstances because the resources used in production have greater value in alternate uses. In a competitive market, these goods or services will not be produced because the supplier is making a loss. As firms strive to at least generate sufficient revenue to cover costs — otherwise there is no point being in business — production will be wound back (possibly to the point where it is halted) and resources will be freed up to be used in areas more highly valued by society.

Conversely, if the marginal unit sells for significantly more than it cost to produce, consumption yields benefits in excess of the marginal cost. In these circumstances, suppliers have an incentive to produce more to earn more profits. While there may be some time lags, the pressures brought about by increased demand for inputs to produce the good, the subsequent increase in supply, and the decreasing value placed on the good as more is consumed, will bring marginal costs in line with the value consumers place on the additional output (ie price).

In markets where there is effective competition, there is pressure on firms to produce at least cost and to price close or equal to marginal cost, otherwise they will lose business to other firms. Take the example of the desk top publishing firm that purchased the $1 million computing equipment. If it attempted to price to recoup its $1 million, it would lose business to other firms who are able to offer a similar service for far less using the new $500 000 equipment.

The limitations of markets in generating "perfectly" efficient prices are well recognised by the BIE. The information upon which consumers and producers base their decisions is imperfect and, because getting better information involves costs, trade-offs are involved. For producers, production decisions involve considerable uncertainty about future costs and the demand for their products. Producers can, and do, get it wrong. Some externalities are not incorporated in prices. And the extent to which competition between firms is fully effective in encouraging efficient pricing and production varies. Nevertheless, the prices generated by markets characterised by some degree of competitive pressure are considered to be efficient in the sense that they provide the best possible guide to the community's ongoing assessment of the opportunity costs of supply. Moreover, where consumers or producers make wrong decisions, price movements resulting from competition provide the signals to bring the pattern of resource use more closely in line with costs.

Competition can promote efficient pricing (and production) outcomes. However, in Australia many infrastructure providers do not operate in competitive markets. In some instances, this reflects the natural monopoly characteristics of infrastructure

provision whereby competition does not evolve because one firm is the least cost provider and can supply the entire market. In other cases, it reflects the fact that governments have precluded competition by granting the infrastructure provider a statutory monopoly right to be the sole supplier a good or service. For instance, GBEs supplying electricity have traditionally been given a statutory monopoly over generation, transmission and distribution. While the transmission system displays natural monopoly characteristics, recent research suggests generation and distribution are potentially competitive or contestable. The role that competition or the threat of competition can play in imposing pressures on infrastructure providers to price (and produce) efficiently is important and is discussed in further detail in chapter 5.

2.1.2 Why is efficient pricing important?

Prices are the central mechanism by which resources are allocated in the economy. They provide signals to change consumption, production and to undertake investment in a manner which is consistent with the community's best interests — that is, making the best use of its resources. Unfortunately, it would appear that the pricing of much of Australia's infrastructure has been far from efficient (see box 2.2). Inefficient pricing practices can impact upon the economy in a range of ways.

Where infrastructure prices exceed supply costs, they act as a tax on users. Households are subsequently left with less income to put aside as savings or to spend on other goods and services. For businesses, cost structures are unnecessarily inflated and competitiveness suffers.

Where services are provided at less than cost, the use of infrastructure is being subsidised. Underpricing encourages overuse of infrastructure services, placing premature pressure on existing capacity and bringing forward the need for additional investment by governments in infrastructure assets. Hence, efficient pricing can delay the need for investment in costly infrastructure. A change in water pricing principles by the Hunter Water Board illustrates this point. A user pays system was introduced in 1982. As a consequence of the subsequent effects on demand, the Board's next major dam, originally planned for 1985, has been deferred by more than thirty years (Broad 1991).

If cross-subsidies are used to fund revenue shortfalls associated with underpricing, then some users are paying more than the costs of supply so that others can pay less. If the government is underwriting the losses associated with subsidisation, then the level of government taxes and charges and/or the level of public sector debt will be higher than otherwise.

Box 2.2 Some examples of inefficient infrastructure pricing practices

A number of pricing practices and outcomes suggest that infrastructure pricing has not been efficient in the past. The Industry Commission (1994a) identified several factors which are indicative of inefficient pricing practices that have been used in a range of infrastructure services:

Airports. Pricing policies of the Federal Airports Corporation (FAC) have resulted in the majority of FAC airports operating at a loss. In addition, revenue from non-aeronautical activities has been used to cross-subsidise aeronautical charges, and charges paid by general aviation aircraft bear little relationship to the costs of using smaller FAC airports.

Ports. Revenue comes from a mixture of charges that do not necessarily relate directly to the particular services provided by the port authority. For instance, the charges may be based on characteristics of the ship and the nature and volume of the cargo rather than on the cost of providing the particular service.

Water. Prices for water services in most parts of Australia do not fully recover costs. This situation has been exacerbated by governments traditionally accepting lower returns, while pursuing social and development objectives. Artificially low prices have encouraged water users to demand levels of service that exceed their willingness to pay for additional units of water. In addition, it has removed the incentive for governments to resist unreasonable demand for water service. The resulting over-use of water contributes to environmental damage and requires substantial investments in new capital works which could otherwise have been delayed or avoided.

Urban Transport. Fares for urban transport services have, in general, not reflected the cost of providing these services. Pricing structures should include a different fare for peak and off-peak travel to reflect the different costs involved. Fares should reflect, to a greater extent, the distance travelled by the passenger. Recently, fare structures in some areas have been redesigned to better reflect these factors.

2.2 The applicability of marginal cost pricing to infrastructure services

Where there is effective competition, producers essentially have to accept the prices generated by the market. However, for a range of reasons, many infrastructure providers operate under conditions where effective competitive pressures are largely absent and they potentially have considerable price setting flexibility. As outlined in

the preceding section, economic theory suggests the welfare of the community will be best served if infrastructure providers set prices to approximate the marginal costs of supply.

However, there are a range of (often inter-related) problems that may be encountered in applying the marginal cost pricing benchmark to some infrastructure services. These problems relate to:

- natural monopoly;
- lumpy investments in long-lived assets;
- peak load demands; and
- access pricing.

These problems, along with some pricing approaches for dealing with them, are considered in the following sections.

2.2.1 Natural monopoly

An industry is a natural monopoly if the entire market can be supplied by a single firm at a lower cost than by any combination of two or more firms. Infrastructure provision generally involves large and costly investments, which are characterised by low variable costs and increasing returns to scale. As a result of these features, many types of infrastructure, or components of infrastructure operations, are considered to have natural monopoly characteristics (eg electricity and gas transmission systems, and water supply networks).

One of the features of natural monopoly is the unusual relationship between costs and output — as output increases, average costs fall. And for each additional unit of output, the marginal cost is less than the average cost. Pricing at short run marginal cost will not adequately account for the capital (or fixed) costs involved and, as a consequence, a natural monopoly will make losses (see Hirshleifer 1984).

The government could offset the losses associated with marginal cost pricing of natural monopoly infrastructure services with an operating subsidy. This would avoid charging users more than the short run marginal costs of supply which could unnecessarily discourage use of existing infrastructure assets. However, pricing at short run marginal cost and subsidising losses from taxation revenue has a number of drawbacks. The community as a whole might incur larger unproductive costs if raising the additional taxation revenue to fund the subsidy is excessively costly or involves the imposition of distortionary taxes (see section 3.3.5). Also, funding such deficits from taxation revenue can be inequitable. Some consumers, who are willing and have the financial ability to pay, will be subsidised by less well-off taxpayers — some of whom may not even use the subsidised service.

Given these concerns with subsidisation, alternative pricing approaches which seek to directly recover costs from users — "user pays" — may be preferable. Such "second best" approaches often involve charging users not only for the marginal costs of supply but also for some proportion of the fixed capital costs. Two approaches which have been advocated are Ramsey pricing and multi-part tariffs (see Baumol and Bradford 1972; Hirshleifer 1984). These approaches can assist natural monopolies in recovering costs while, at the same time, minimising any efficiency losses associated with departures from short run marginal cost pricing. They may also be useful in dealing with some of the other infrastructure pricing problems discussed in subsequent sections.

Ramsey pricing

Ramsey pricing relies on the ability of suppliers to price discriminate between different customers. Under Ramsey pricing, customers are divided into separate groups and charged a different price depending on their responsiveness to a change in price. Consider a situation where an electricity utility is faced with two different consumer groups, say residential and industrial customers. Assume the residential users have the ability to convert readily to gas, whereas the industrial users do not. These two groups have different demand characteristics and can be charged different prices. The price charged to residential consumers, whose demand is more responsive to a price change (due to the availability of a substitute, ie gas), will be closer to marginal cost than the price charged to industrial consumers. Overall, the prices changed the two groups will be sufficient to cover total costs.

In order to price discriminate effectively, the ability to resell must be limited. In the above example, the residential customer would not be able to resell electricity to an industrial customer at a profit.

Multi-part tariffs

Multi-part pricing may take a number of forms. In its simplest form the utility determines an entry or access fee plus a charge, based on marginal cost, for each unit of the service consumed (referred to here as the consumption charge). Under a multi-part tariff, the user (in theory) treats the access fee as a sunk cost which, once paid, plays no part in the decision to consume additional units. Usage is therefore based on the consumption charge and each consumer makes an efficient consumption decision.

Consumption charges should reflect marginal costs. The consumption charge may be a constant price per unit where marginal costs do not vary substantially. Alternatively, where marginal costs do vary, the consumption charge may be a variable price per unit, based on the total quantity of units consumed in the billing period. The use of variable charges is attractive as it provides flexibility to deal with a range of circumstances, such as decreasing marginal costs associated with economies of scale.

A problem with multi-part pricing is that some consumers may opt out of the market because their valuation of the service is less than the entry fee, even though they value the service above the marginal cost of provision. One way around this problem is for different entry fees to be charged to groups of consumers with different characteristics and valuations of the service. In the extreme case, the entry fee to each consumer could equal the consumer's entire valuation.

One approach to ensuring that consumers with relatively low valuation of a product are not excluded from the market is to allow consumers to select a pricing structure which most closely suits their preferences. A self-selection option is currently available to consumers in the developing mobile telephone market (see table 2.1). Those consumers who use the mobile phone frequently — more than twice a day — are better off choosing the price structure with a relatively high entry fee, $35 per month, and a relatively low consumption charge. To be efficient, the entry fee should reflect the capital cost with the consumption charge approximating the short run marginal cost. Consumers with a relatively low valuation of the service, using the mobile phone occasionally or for emergencies only, can choose the payment plan with relatively lower monthly charges but higher consumption charges. Under these pricing structures a larger proportion of the capital cost is included in the consumption charge. While this pricing structure may impact on the consumption of mobile services, the loss of efficiency is likely to be less than the loss associated with excluding these consumers entirely with high entry fees.

Table 2.1 Optus schedule of selected mobile phone charges ($), 1 April 1994

Type of user	Monthly service charge	Peak[a]		Off-peak[a]	
		Local	Long distance	Local	Long Distance
Frequent	35	0.2	0.3	0.1	0.15
Occasional	20	0.4	0.6	0.1	0.15
Emergencies only	10	0.6	0.9	0.1	0.15

Note: (a) Charges are in dollars per 30 seconds.
Source: Optus user information pamphlet.

2.2.2 Lumpy investments in long-lived assets

The provision of infrastructure often involves investment in large "lumpy" assets. While there is much literature on the lumpiness of water supply assets, similar situations can apply to many forms of infrastructure including airport services, telecommunications services, electricity generation, gas reticulation and roads.

Due to the lumpy nature of investment in infrastructure assets, available capacity often greatly exceeds demand. Pricing at short run marginal costs will result in losses. However, provided the investment is soundly based, the initial losses do not mean

that marginal cost pricing is inappropriate. As the economy and population continues to grow, demand will increase and so too will revenue. Eventually demand growth will result in full capacity utilisation. At this point, the revenue generated from marginal cost pricing will be sufficient to ensure that capital costs begin to be recovered. Then, as demand continues to grow further, prices will increase to ration capacity.

For many infrastructure providers the problem of excess capacity arises where additions are made to the existing capital stock. For example, in the case of water supply, a dam may be constructed to provide an additional "lump" of capacity. When the new capacity comes on-line, marginal cost pricing will lead to a fall in price and losses will be incurred. As demand grows over time, losses are reduced and eventually the system becomes congested again. The higher price in times of congestion leads to higher profits which, in turn, signals that further investment may be required. This leads to a cycle of price and profit increases and reductions over time, or a "saw-tooth" pricing pattern (Ng 1987).

Short run marginal cost pricing of lumpy investments may lead to concerns about inter-generational inequities. This is especially relevant for infrastructure with extremely lumpy investments and long lifespans, such as water supply. A whole generation of users may be charged lower prices, while the water supplier makes losses in the initial stages, while their children face increased charges. Ng (1987, p. 33) suggests rather than reject short run marginal cost pricing, these inequities can be dealt with directly if they are considered to be a problem:

> ... the present generation has the option to vary the amount of transfers to the future generations in the forms of bequests, capital accumulation, borrowings, etc. If the economically efficient price is above the full-cost level, it is better to charge that price, and let individuals and governments make the adjustments to their decisions affecting general inter-generational transfers if they so desire.

Where lumpy investments are required, there may be some scope to use Ramsey or multi-part pricing approaches to smooth the variability in prices that would arise under a short run marginal cost pricing strategy. By setting prices above short run marginal cost, losses incurred in the initial years of the project would be lower. Hence, once capacity had been reached, prices could be set more closely to short run marginal costs than otherwise. A potential problem with these pricing strategies is that they may choke-off consumption that would have occurred if prices were set to reflect short run marginal costs.

Dealing with price variability

Where infrastructure provision is characterised by large lumpy investments, marginal cost pricing may lead to considerable price volatility. This variability could be the source of considerable concern. Consumers may not recognise that the low prices charged with the introduction of new capacity are only transitory. There may be

considerable resistance to steep price increases necessary to ration capacity as demand grows. For instance, ACT Electricity and Water (IC 1992b, p. 65) have noted that price fluctuations associated with marginal cost pricing could cause confusion:

> For all members of the community, it means adjusting their lifestyle which takes years of reinforcement. ... Most members of our community are not economists and do not understand why water prices should vary so greatly. They will resent being forced to change their lifestyle to conserve water only to discover later that water is no longer scarce.

Having the prices of basic services, such as water, rising and falling from year to year is not likely to be politically popular. In these circumstances, multi-part tariffs may represent a compromise approach to infrastructure pricing. While the consumption charge would increase over time, similar to the increase in charges under a marginal cost pricing regime, the access charge would remain fairly constant so that the total charge is less volatile than under a pure marginal cost pricing regime.

2.2.3 *Peak load demands*

Many GBEs operate with fixed capacity and demand peaking at certain times. Peaks in demand may occur at certain times during the day and by day of the week, as is the case for airports, electricity and telecommunications. Peaks may also be seasonal, as is the case for water.

Charging different prices for usage at different times can smooth the demand cycle. To reduce strain on the system at peak times, prices can be increased to encourage people to shift demand to off-peak times. This takes some of the strain off the system and reduces the pressure for additional capital investment to meet peak load demand.

Outside peak periods, when there is effectively "excess" capacity, prices should be set at short run marginal costs unless higher prices to recover the capital cost component can be charged and do not discourage use of available capacity. This approach should also be applied if there is excess capacity during peak times (eg due to the lumpy nature of the investment). However, where capacity is fully utilised, which is often the case during peak periods, prices can be increased above short run marginal costs. If peak demand exceeds available capacity, prices should reflect congestion costs to ration demand and may exceed long run marginal costs. When considering increases in capacity due to congestion and the related higher prices, the level of off-peak demand should also be considered (see Williamson 1966).

Peak load pricing is used in a number of infrastructure industries including electricity and airports. Table 2.1 displays the schedule of charges indicating peak and off-peak times for Optus mobile phone services. The peak period in the pricing structure is from 7 am to 7 pm Monday to Saturday, inclusive.

2.2.4 Pricing access to essential facilities

Considerable concern has been expressed recently concerning the pricing of access to essential facilities (eg electricity transmission grids, railway tracks and gas transmission pipelines). The concern arises for a number of reasons. One reason is because essential facilities are typically natural monopolies and the pressures to price access efficiently are weak. Another reason is that the pricing of essential facilities not only impacts on the efficient use of those facilities, it also impacts upon cost structures, pricing and investment decisions in related upstream and downstream infrastructure markets (eg energy generation and distribution, rail services, gas processing). Where access prices are too high, competitive entry to related infrastructure markets may be discouraged. And where competitive pressures are absent, inefficient pricing and production practices by facility operators may persist.

Dealing with the problems which arise when infrastructure providers do not face effective competition is important and is discussed in chapter 5. From an efficiency perspective, the objective of access pricing should be no different than pricing of other types of infrastructure — that is, to ensure that prices reflect the opportunity costs of (least cost) supply and that the best use is made of existing assets. In this regard, the problems encountered in pricing access to essential facilities are fundamentally the same as those encountered in pricing other types of infrastructure — pricing to recover costs where the facility is a natural monopoly, pricing when there is excess capacity and pricing to cope with variable demands. And, by and large, the strategies that can be utilised to achieve efficient pricing outcomes are also the same.

Efficient component pricing rule

An approach that has been suggested for establishing a benchmark for efficient pricing of access to essential facilities is based on the efficient component pricing rule (ECPR). The rule applies in the case where the essential facility is provided by a firm which also competes with essential facility customers in an upstream or downstream market. The rule implies that the price that a facility operator should charge for network access should include:

- the direct marginal cost of permitting use of the facility (including incremental capital cost); and
- the opportunity cost of allowing access to the network (or the loss of contribution towards its common fixed costs from the sale of the service or good in the final market).

To illustrate the rule, Baumol and Sidak (1994, pp. 183-184) use an example of a railroad journey from point A to point C, where the journey is produced in two parts: A to B and B to C. The total cost of the journey is \$10, made up of \$3 incremental cost of each part (A-B and B-C) and a contribution of \$4 to cover the overhead costs

of the railroad. According to the rule, an entrant wishing to offer an alternative service using the existing A-B section of the railroad but its own track for the B-C section should be charged an access fee of $7, made up from the $3 incremental cost for the use of the network from A-B plus $4 lost contribution to overhead costs.

The appropriateness of the strict application of the rule is dependent upon the extent of competition in the final goods market. In the case where the owner of the essential facility is operating in a competitive final goods market, applying the ECPR will involve charging the entrant an access fee that includes the marginal cost of using the facility plus any lost contribution to overhead costs (which, given a competitive final goods market, would be equivalent to a normal rate of return on the network).

The application of the ECPR becomes less appropriate when the owner of the essential facility has market power in the final goods market and is earning surplus (monopoly) profits. In this case, the application of the ECPR would mean that an entrant would be charged an access fee that includes the incremental cost of using the facility, the lost contribution to overhead costs *and* any lost monopoly profits.

Baumol and Sidak (1994) acknowledge that the rule will tend to underwrite monopoly pricing if this is present in the final goods market. In the situation where the owner of the facility has market power in the final goods market, the rule should be applied in conjunction with direct price control or prices oversight in that market. These approaches are considered in chapter 5.

Irrespective of the approach used to determine access prices for essential facilities, the ultimate objective should be to ensure that prices reflect (as far as practicable) the costs of supply. To do otherwise would lead to over or under use of the assets. In the case of overpricing it could stymie competition in upstream and downstream infrastructure markets. The absence of competition could result in inefficient prices in these related markets.

2.3 Information needs

There are considerable information demands involved in setting prices to ensure that the best use is made of infrastructure. As a starting point, the costs of providing infrastructure services have to be established. This is straightforward for many of the inputs used in the provision of infrastructure services because the inputs are purchased and consumed in the current year — they are non-durable (eg labour costs, advertising and rental expenses). However, determining the cost of using durable infrastructure assets is more difficult. These assets often last for many years or decades and the task of identifying the cost of using them in any one year is problematic. The first step in this process is to establish their current market value. However, the assets are often unique in nature (eg dams, electricity transmission grids) and, as most infrastructure businesses in Australia are government owned, the

assets are rarely traded. As a consequence, there is no reliable market reference price for many of these durable assets. This means that proxies for the value of these infrastructure assets have to be established to provide a basis for estimating the costs associated with their use. Determining the cost of using infrastructure assets is difficult but critical for efficient pricing and is considered in more detail in chapter 4.

Matching the costs of delivering a service to use of that service can also be a problem. For instance, where more than one good is supplied (eg rail freight and passenger rail services) and there are different classes of users (eg residential, commercial and rural), attributing joint or common costs (eg head office expenses and track maintenance) introduces complications.

An understanding of how demand might respond to different prices and pricing structures is needed if price setting strategies are to be successful in generating sufficient revenue to at least recover costs. Information about the nature of consumption may also be necessary to pursue some pricing strategies. For instance, in order to peak load price it is necessary to know not only how much was consumed but at what time of day that consumption occurred.

In many instances, the costs of obtaining the information required to price on a sound basis may be prohibitive, assuming it can be obtained at all. As a consequence, some pricing approaches, while desirable, may not be feasible. For instance, where usage times and volumes are difficult or prohibitively costly to measure, peak load pricing cannot be sensibly applied. More generally, these information problems will mean that trade-offs must be made and pragmatism will be an important ingredient in efficient infrastructure pricing. As Paterson (1991, p. 1) commented with regard to the application of marginal cost pricing:

> Unfortunately, reality always complicates the application of marginal rules and we are then transported from the world of science to the world of art. This is because any real world system of production and consumption has literally scores of variables in its production function and hundreds of marginals ... We must choose, at most, a handful of these to price on. In that choice we express a quite subjective vision of what is considered to be both important and suitable ...

2.4 A practical application of different pricing approaches

This section illustrates how some of the different pricing approaches discussed in section 2.2 could be applied to the Star Gas Company (SGC) — a hypothetical gas utility. While the figures presented are *loosely* based on ABS (1994) and AGA (1994) data, they are nonetheless only illustrative.

The costs associated with the SGC's transmission and reticulation of natural gas may be divided into five categories which comprise fixed and variable cost components.

These are presented in table 2.2. As the SGC is setting its prices for the upcoming year, these figures represent its best estimates of the costs that are going to be incurred and that should be covered.

Table 2.2 SGC cost structure (1996)

	$ million
Fixed costs	
Building rental	10.0
Motor vehicles	7.2
Administration costs, wages etc.	20.0
Total costs of head office	37.3
Capital amortisation	424.5
Maintenance costs, wages etc.	70.8
Total capacity costs	*495.3*
Metering costs, wages etc.	28.3
Total customer specific costs	*28.3*
Total fixed costs	**560.9**
Variable costs	
Purchase of gas	
169 petajoules @ $2.59 GJ	439.1
Total variable costs	**439.1**
Total costs	***1000.0***

Note: There are 1 million gigajoules (GJ) in a petajoule (PJ). Figures may not add due to rounding.

Fixed costs comprise head office and administration costs, capacity costs and customer specific charges.

- Head office and administration costs are necessary for the efficient operation of the utility. These costs are incurred regardless of the level of gas consumed and are estimated to total $37.3 million in 1995.
- Capacity costs include capital costs (which implicitly includes the return to shareholders and an amount to represent the loss in the value of the assets over the upcoming year ie economic depreciation). These costs also include maintenance expenditure on items such as pipelines and compressor stations.
- Customer specific costs include costs associated with monitoring gas used by individual customers.

In this example all of these costs remain unchanged.

The variable costs are directly related to the level of gas consumed. They include commodity costs and peak load or congestion costs.

- Commodity costs primarily relate to the purchase and treatment of gas. These costs vary directly with the quantity of gas sold and should represent the minimum cost of supply.
- Congestion or peak load costs will only occur if demand in any period is greater than existing capacity. Hence, they are directly associated with the amount of gas reticulated.

The SGC supplies natural gas to residential, commercial and industrial consumers. Table 2.3 outlines possible pricing schedules that the SGC could adopt.

2.4.1 Marginal cost pricing

If the SGC chose to sell gas at its marginal cost of $2.59 per gigajoule, it would expect to sell 169 petajoules of gas. Marginal cost pricing, however, would not result in full cost recovery. Table 2.3 shows that charging each user $2.59 per gigajoule yields a total revenue of $439 million. This covers variable costs only, fixed costs are not recovered.

Two-part tariff

An access fee could be used to recover fixed costs. The access fee, once paid, is a sunk cost and has no impact on the decision to consume a unit of gas at marginal cost. This access fee *could* be calculated simply by distributing the $560.9 million in fixed costs (see table 2.2) over the 1 075 137 customers. This implies an access fee of around $511 for each consumer in 1996.

A uniform access fee, however, is not likely to attribute the true cost of capital appropriately to each user. Residential users consume less gas per customer than industrial or commercial users. Larger pipes, compressors and heavy duty meters are required to deliver gas to industrial and commercial users. Further, due to the greater size of the system, relatively more maintenance is required on the industrial and commercial networks. Accordingly, the access fee for these users should be higher. In this example, it is assumed for simplicity that half the capital costs of the system are associated with residential demand. The remaining capital costs are evenly associated with the commercial and industrial networks. Using this allocation of capital costs, the average access fee for residential customers is $270 (see table 2.3). Access charges of $38 885 and $2 285 would apply for industrial and commercial users, respectively.

This access fee ensures each customer group bears the cost associated with their decision to consume gas. However, the large access fee necessary to recover costs and the marginal cost of consumption may be too high. Some customers may not derive as much benefit out of the service as the access fee and will therefore opt out of the market, switching to electricity. If a large number of customers fall into this category, this pricing approach is not appropriate.

Table 2.3 SGC pricing schedules (1996)

	Marginal cost pricing	*Two-part tariff- Marginal cost*	*Ramsey pricing*	*Ramsey based two-part tariff*	*Two-part tariff no cross-sub.*
Customers[a]	*Numbers*	*Numbers*	*Numbers*	*Numbers*	*Numbers*
Residential	1 039 893	1 039 893	1 039 893	1 039 893	1 039 893
Commercial	61 368	61 368	61 368	61 368	61 368
Industrial	3 606	3 606	3 606	3 606	3 606
Total	***1 075 137***	***1 075 137***	***1 075 137***	***1 075 137***	***1 075 137***
Consumption charge	*$ per GJ*	*$ per GJ*	*$ per GJ*	*$ per GJ*	*$ per GJ*
Residential	2.59	2.59	5.95	4.65	5.00
Commercial	2.59	2.59	6.86	5.50	5.50
Industrial	2.59	2.59	8.47	6.05	3.84
Sales by customer type	*PJ*	*PJ*	*PJ*	*PJ*	*PJ*
Residential	40	40	26	31	30
Commercial	15	15	9	11	11
Industrial	115	115	74	91	106
Total	***169***	***169***	***109***	***133***	***147***
Consumption revenue	*$million*	*$million*	*$million*	*$million*	*$million*
Residential	171	171	154	146	149
Commercial	53	53	65	61	61
Industrial	215	215	627	547	408
Total	**439**	**439**	**845**	**756**	**618**
Access fee per customer	*$*	*$*	*$*	*$*	*$*
Residential	na	270	na	50	200
Commercial	na	2 285	na	1 500	1 755
Industrial	na	38 885	na	2 000	2 000
Revenue from access fee	*$million*	*$million*	*$million*	*$million*	*$million*
Residential	na	280	na	52	208
Commercial	na	140	na	92	108
Industrial	na	140	na	7	7
Total	**na**	**561**	**na**	**151**	**323**
Total revenue	*$*	*$*	*$*	*$*	*$*
Residential	171	451	154	198	357
Commercial	53	193	65	153	168
Industrial	215	355	627	557	415
Total	**439**	**1000**	**845**	**907**	**941**
Cost recovery	no	yes	yes	yes	yes
Elasticities assumed					
Residential	na	na	-0.27	-0.27	-0.27
Commercial	na	na	-0.22	-0.22	-0.22
Industrial	na	na	-0.16	-0.16	-0.16

Notes: (a) For simplicity, it is assumed that the number of customers remains unchanged under each pricing scenario, only the volume of gas consumed is assumed to change. In reality this is unlikely to be the case. Under some scenarios customers could be expected to leave the market. (na) not applicable.

Note: Figures may not add due to rounding.

2.4.2 Ramsey pricing

In the case where marginal cost pricing with an access fee excludes a large number of customers from the market, an alternative pricing system must be derived. The alternative pricing structures considered utilise the Ramsey pricing principles discussed previously. This approach to pricing can ensure the SGC covers costs, while minimising losses incurred by consumers as a result of pricing above marginal cost. Prices vary according to the sensitivity of individual consumer demand to changes in price. Consumers with the highest sensitivity (price elasticity of demand) are charged prices closer to marginal cost while the consumers who are less sensitive to price changes are charged prices which may be significantly greater than marginal costs.

The elasticities estimated by the SGC for the three customer groups are presented in table 2.3. Industrial consumers are less responsive to price changes (their elasticity of demand is -0.16) than commercial and residential users (whose demand elasticities are -0.22 and -0.27, respectively). These elasticities are influenced to a large extent by users perceptions of substitutability between electric and gas appliances for each user group. The purchase of a gas fuelled appliance, such as a boiler, by an industrial user is a relatively large investment and would take a large increase in price to warrant conversion to electricity. On the other hand, residential and commercial users have to spend relatively less to convert from gas to electricity and residential consumers are often encouraged by cash-back deals on appliances by gas and electric utilities. Residential users may already have invested in electrical equipment for many uses, such as space heating and cooking.

The first approach considered is a single tariff using Ramsey pricing principles. The second approach considered is two-part pricing applying Ramsey pricing principles.

Single tariff — Ramsey pricing principles

If a Ramsey pricing structure was adopted by the SGC, the entire costs would be recovered by a single tariff per gigajoule based on each customer's responsiveness to a change in price. In this example, the tariff rate chosen for any particular customer group does not drive any consumer in that group from the market. The Ramsey pricing schedule presented in table 2.3 shows that industrial consumers, with relatively inelastic demand, are charged a relatively higher price ($8.47 per gigajoule) compared with that levied on commercial and residential users ($6.86 and $5.95 per gigajoule, respectively).

Under the Ramsey pricing schedule, total sales of gas fall to 109 petajoules. Total variable costs at this level of consumption, although not shown in table 2.3, are $283 million. When this is added to fixed costs of $562 million that are constant regardless of the level of consumption, total costs are $845 million. Thus, the Ramsey pricing schedule proposed covers all the costs associated with production. Welfare losses

incurred by the users of gas can be *roughly* estimated by the loss in total consumption of 60 petajoules.

Industrial users in the example are contributing a larger proportion of the capital costs than residential and commercial users. In effect, industrial users are "cross-subsidising" residential and commercial users. This is shown in table 2.4. Half of the capital costs are attributed to residential users ($280 million), the remaining $280 million is split evenly between industrial and commercial users. The contribution to capital costs is the amount each user pays over and above variable costs, due to Ramsey pricing charging above marginal costs. Table 2.4 shows that the relatively small markup paid by residential and commercial users, is due to their relatively high sensitivity to price changes.

Table 2.4 Contribution to capital costs from Ramsey pricing

	Capital costs	*Contribution to capital costs*	*Net contribution to capital costs*
Residential	280	87	-194
Commercial	140	40	-100
Industrial	140	435	295
Total	***561***	***561***	

Note: Figures may not add due to rounding.

Two-part — Ramsey based pricing

An alternative to the single part Ramsey pricing structure is to combine the two-part and Ramsey pricing structures. An access fee must be chosen which is sufficiently low so as not to discourage any consumers from the market. The additional revenue generated from the access fee means that lower consumption charges are possible. This leads to an overall gain in the level of consumption, which approximates consumer welfare.

The Ramsey based two-part pricing schedule presented in table 2.3 shows that the SGC can recover costs by charging a lower access fee than was needed for marginal cost pricing, combined with a lower consumption charge than Ramsey pricing. By choosing an access fee that does not have as large an impact on usage levels, lower consumption charges result in a welfare gain over Ramsey pricing as consumption increases from 109 to 133 petajoules.

The capital contribution of industrial users relative to commercial and residential users is also lowered by the two-part Ramsey based pricing schedule proposed. Industrial customers are charged $6.05 per gigajoule plus the access fee of $2 000, generating total revenue of $557 million, $321 million of which is a contribution to the SGC's capital costs as shown in table 2.5.

Table 2.5 Contribution to capital costs from two-part Ramsey based pricing

	Capital costs	*Contribution to capital costs*	*Net contribution to capital costs*
Residential	280	117	-164
Commercial	140	124	-16
Industrial	140	321	181
Total	***561***	***562***	

Note: Figures may not add due to rounding.

Two-part tariff with no cross-subsidies

It was noted in the earlier Ramsey pricing examples that industrial customers were paying a relatively high proportion of capital costs (ie residential and commercial users were being cross-subsidised). A higher access charge for commercial and residential users would be required if capital costs were to more accurately reflect usage. The final column in table 2.3 illustrates an example of two-part pricing with no cross-subsidies.

The access fee charged to industrial customers remains unchanged at $2 000. The consumption charge falls from $6.05 in the Ramsey based two-part tariff scenario to $3.84 per gigajoule to cover their portion of capital costs. Their welfare rises as consumption increases from 91 to 106 petajoules.

The pricing structure for commercial consumers is not drastically altered. As table 2.5 shows, they were receiving a relatively small subsidy ($16 million). The additional revenue required from commercial users to cover their portion of capital costs can be generated by raising the access fee from $1 500 to $1 755.

Residential consumers are worse-off. While the price increases slightly to $5 per gigajoule, the access fee quadruples to $200 to cover their portion of capital costs.

This pricing schedule results in a welfare gain over the Ramsey based two-part tariff as consumption rises from 133 to 147 petajoules.

2.4.3 Peak load pricing

A third component to the tariff may be required if there are peak loads or congestion costs. As the population and demand for gas grows, the capacity of the system begins to reach its limits in peak periods. Consider the case where the government begins to tax black coal heavily to reduce greenhouse gas emissions, causing the price of electricity relative to gas to rise quite sharply. In response to this, there is a substitution away from electric to gas appliances. The SGC now faces peak demand problems, with more pronounced morning and night peaks.

There are two possible solutions. First, the SGC could increase the capacity of the system to cope with the peak period. Second, it could install better monitoring equipment to enable peak load pricing or congestion pricing. This could smooth demand out over the day, converting some consumers to off-peak use, thus delaying the installation of new capacity. The decision on whether to go ahead with the installation of monitoring equipment to enable peak load or congestion pricing depends on a number of factors, including:

- the cost of increasing the system's capacity;
- the length of the peak period (there is no point doubling a system's capacity to cater for one hour of peak use during the day);
- the cost of additional monitoring (installing and reading new meters);
- how much demand will be diverted from peak to off-peak periods; and
- the expected growth in demand.

In the SGC example, catering for the expected increase in demand would involve a $300 million investment to upgrade the current network. The installation of time-of-day monitors would enable better demand management, delaying the need to expand capacity for an estimated 10 years and result in a more efficient pricing structure. Currently, the cost of installing the monitors is $400 million, making it more cost effective to increase the system's capacity and keep the uniform pricing structure. However, if technology advances sufficiently to halve the cost of time-of-day monitors to $200 million, then it will be more cost effective to install the monitors and adopt peak load pricing.

2.5 Conclusion

The characteristics of infrastructure provision mean that notions of efficient pricing — that is, pricing to cover marginal costs — are not always viable. Nevertheless, there is a range of pricing strategies that can be applied which minimise the costs of departing from the ideal. They also go a long way towards dealing with the pricing quandaries generated by the characteristics of infrastructure provision. Applying these strategies requires considerable information. Efforts should be made to obtain as much information as possible, provided the benefits of obtaining the information exceed the costs. In practice, applying the different strategies will require a degree of subjectivity. A good rule of thumb is that if prices cannot be changed to make better use of existing assets and revenue is sufficient to just cover opportunity costs, then prices could be considered "efficient".

Applying the pricing strategies discussed in this chapter will result in considerable variation in the prices charged for infrastructure services - between different types of users (eg households and businesses), between regions (eg cities and rural areas), and

over time. In many areas, the community has come to accept the need for variations in the prices charged for a range of infrastructure services (eg peak and off-peak electricity tariffs for hot water, different rates for local, STD and mobile telephone services). However, as attempts are made to further improve the pricing practices of infrastructure providers, the tolerance of the community to variations may be tested. Consequently, the community will need to be informed of the need for change and how it will benefit them overall.

While the basic principles of efficient pricing have been outlined in this chapter, there remains a range of other important issues that will impact on the extent to which efficient pricing is achieved. These issues are considered in the following chapters and relate to: the use of GBEs to provide community service obligations (chapter 3); establishing one of the key costs involved in infrastructure provision — the cost of capital (chapter 4); dealing with situations where pressures on infrastructure providers to price and produce efficiently are weak because of the absence of effective competition (chapter 5); and the incentives created by the financial relationships that exist between the different levels of government under the Australian federal system (chapter 6).

3. Community service obligations

This chapter discusses some key issues concerning community service obligations (CSOs) and their impact on infrastructure pricing. Section 3.1 defines CSOs. Section 3.2 discusses some of the problems associated with using cross-subsidies as the method of funding CSOs, while section 3.3 discusses some alternative funding methods which are consistent with efficient infrastructure pricing and provision. Section 3.4 discusses two popular methods of estimating the costs of CSOs and section 3.5 provides an illustration of the differences arising from the use of alternate methods. Concluding comments are made in section 3.6.

3.1 What is a CSO?

Governments often require infrastructure providers to supply services to certain sections of the community on a non-commercial basis. These directions generally relate to the government's broader policies or social goals (eg employment, regional development, equity). Such a directive is commonly known as a community service obligation. The Steering Committee on National Performance Monitoring of Government Trading Enterprises (SCNPMGTE, 1994, p. xi) considers that a CSO arises:

> ... when a government specifically requires a public enterprise to carry out activities relating to outputs or inputs which it would not elect to do on a commercial basis, and which the government does not require other businesses in the public or private sectors to generally undertake, or which it would only do commercially at higher prices.

The combination of infrastructure provision and CSOs has a long history. Often the requirement to undertake a particular CSO has not been reviewed since the infrastructure provider's charter was set in place. Nevertheless, they continue to be supplied as a matter of "historical obligation". In some cases, the absence of government oversight or government directions to the contrary, have seen policies instigated by GBE management (eg underpricing and counter cyclical investment to promote development or employment in a region) become accepted CSO activities. CSOs may also be once-off in nature. For instance, the government may utilise rail services to deliver feed stock to farms in drought affected areas.

Examples of directives to GBEs that result in CSOs are presented in box 3.1. As is typical with many CSOs, they are not clearly defined. Consequently, their delivery is subject to interpretation by either the GBE, the minister responsible or, as is the case with Telecom, by the regulatory authority.

Box 3.1 Examples of directives to GBEs to perform CSOs

Directive to Telecom:

- ensure that a standard telephone service is reasonably accessible to all people in Australia on an equitable basis; and
- ensure that payphone services are reasonably accessible to all people in Australia on an equitable basis.

Directive to the Sydney Water Board:

- ensure water and related resources within the Board's area of operation are allocated and used in ways which are consistent with environmental requirements and provide maximum long-term benefit for the area and the State;
- provide water and related services to meet the needs of users in a commercial manner consistent with the overall policies of government;

In carrying out its functions, the Water Board pays particular attention to [among other things]:

- public interest and community needs ...

Source: Austel 1993, Sydney Water Board 1991.

3.2 Funding CSOs through cross-subsidies

In Australia, CSOs are often funded by cross-subsidies between regions or customer groups. These cross-subsidies can only be maintained if the infrastructure provider has a degree of monopoly power. This has often been achieved by statute or regulation granting the infrastructure provider sole operating rights in certain markets. (For a detailed discussion of cross-subsidisation and GBE pricing see Faulhaber 1975.)

The existence of a cross-subsidy is not, of itself, a "bad" pricing outcome. Cross-subsidies are, to some extent, a common commercial pricing practice in many markets. For example, a clothing manufacturer in a highly competitive segment of the market, may assess that a standard price is warranted for a particular design of suit even though more cloth is required for the larger sizes. In this case, the costs associated with "fine tuning" prices to reflect the amount of cloth used are judged to exceed the benefits.

Cross-subsidies may also be appropriate for pricing infrastructure services. Telecom, for example, may cross-subsidise some non-metropolitan services to keep them in the market, thus making non-metropolitan areas accessible to metropolitan phone users. In other cases, it may not be economic for an infrastructure provider to charge differential prices.

The cross-subsidies associated with CSOs are generally not based on commercial criteria. They might involve uniform charging for all consumers despite widely varying geographical or time-of-use cost structures. Alternatively, cross-subsidies associated with CSOs can arise by charging consumers with a particular characteristic a higher or lower price, although the underlying cost structures for all consumers are the same.

3.2.1 Impact of cross-subsidies

The use of cross-subsidies to fund the delivery of CSOs has a number of drawbacks. Cross-subsidies, in effect, tax a certain group of consumers in order to subsidise another group of consumers. This situation can distort consumption, production and investment decisions. For instance, the de facto taxation of particular users can lead to less consumption, even though those "taxed" consumers may value the additional units more than they cost to produce. Conversely, lowering the price to certain users acts as a subsidy. This can lead to consumption involving costs to the community which, at the margin, exceed the benefits to the individual consumers. For instance, the increased demand arising from subsidised prices can lead to investments in infrastructure which are either unwarranted or premature.

When cross-subsidisation "taxes" selected business inputs, they discriminate against industries that are relatively dependant on the input in question. Those industries that benefit from cross-subsidisation are able to expand at the expense of other industries. Subsidised businesses may attract resources which might be utilised more productively in industries that require less of the subsidised good. The taxation impacts of cross-subsidies are particularly relevant for those enterprises who are not able to pass the added costs on. Industries involved in the exporting and import-competing sectors will be particularly adversely affected.

Funding CSOs through cross-subsidisation often requires the government to maintain a monopoly. If competition was allowed, investors would be drawn to the 'taxed' market which would drive prices down and reduce the capacity of the GBE to cover the costs of delivering the CSO. The monopoly status granted to GBEs removes the disciplines imposed by competition and can lead to operational inefficiencies such as cost padding and slow technological take-up.

Cross-subsidisation also results in a lack of transparency of the actual costs of providing the CSO. Often the penalties imposed on non-subsidised consumers are difficult to quantify. Failing to directly account for CSOs makes the performance of GBEs more difficult to assess. In these circumstances it is difficult for governments, and society, to determine whether the benefits from any CSO justify its total cost.

3.3 Alternative methods of funding CSOs

Given the problems associated with financing CSOs by cross-subsidies, this section examines alternative ways of funding the delivery of CSOs. The main alternatives examined are:

- levies on users;
- direct cash payments to targeted users;
- direct funding of the enterprise; and
- accepting lower rates of return.

3.3.1 Levies on non-targeted users

An alternative to cross-subsidisation is to charge each non-targeted consumer of a particular infrastructure service a levy. This levy would be shown as a separate line on each customer's bill which explicitly states the levy is for the provision of the CSO. The revenue from the levy would be paid to government, or its agent, who would reimburse the service provider(s) which incurred the CSO costs.

Similar to cross-subsidisation, the levy increases costs to those in the non-targeted market. Notwithstanding this, the use of the levy has a number of advantages. Payments for the CSO are made transparent, providing a benchmark cost against which the benefits of the CSO can be assessed. The levy also removes the need to insulate the GBE from competition. It could be charged by all service providers.

3.3.2 Direct cash payments to targeted users

Under this approach, the infrastructure provider charges all consumers a commercially determined price. The government compensates the target group with a supplement to their income through the welfare or tax system. This gives the target group the financial capacity to purchase the service at the commercially determined price. This approach subjects the cost of CSO provision to the normal budgetary process and ongoing evaluation. In addition to permitting infrastructure providers to charge commercially, the approach allows competition in service provision.

However, with cash payments, fraud may be a problem. For example, if non-metropolitan area consumers receive additional payments to compensate for relatively more expensive infrastructure, there could be an incentive to maintain a rural address while living in the city. Therefore, policing and administration could be substantial under this approach.

Notwithstanding this problem, an advantage of the cash payments approach is that consumers are free to choose the goods or services that maximise their welfare. However, this freedom may be seen as a disadvantage by governments. The goods and

services chosen by some people within the targeted group may not even include the good or service the government considered necessary to maximise the *community's* welfare. A voucher system is one method of reducing this problem.

Vouchers

A voucher system is a form of in-kind transfer to the target group which entitles them to the use of a specific good (eg electricity) or service (eg transport) free or at a reduced price. The GBE is reimbursed for the reduction in revenue arsing from voucher use. The voucher system can also be used where there are many suppliers to choose from and the user retains choice regarding which service provider they wish to use.

Like cash payments, vouchers improve the transparency of the costs of providing CSOs, making the expenditures associated with the voucher system subject to ongoing scrutiny and normal budgetary processes.

3.3.3 Direct funding of infrastructure providers

As an alternative to using cross-subsidies, governments can choose to directly fund the infrastructure provider for any shortfall caused by pricing below cost in the targeted market while pricing commercially in the non-targeted market. As with the earlier approaches, competition in all markets can be allowed.

In some instances (eg provision of school bus services), the CSO could be put out to competitive tender. The government may specify the price it wishes to see charged for the defined service. The firm which requires the least compensation (ie direct funding), subject to meeting specified quality standards, would be awarded the contract. An added advantage of competitive tenders is that the funding requirement reflects the most efficient (ie least cost) method of delivering the CSO.

3.3.4 Accepting lower rates of return

Finally, the government, as enterprise owner, could make a downwards adjustment to the return it expects the GBE to achieve as a means of indirectly funding the CSO. Competition in the non-targeted market is allowed. This approach recognises that if the infrastructure provider services a target market at less than cost, and has to price competitively in the non-targeted market, the performance of the enterprise as measured by the overall rate of return (see chapter 4) will be poor.

Of the approaches discussed, accepting a lower rate of return is perhaps the least transparent. The cost of providing the CSO (ie the reduction in the rate of return multiplied by the asset base — see chapter 4) does provide a basis for tracking the costs of delivering the CSO. Notwithstanding this, the IAC (1989, pp. 129–130)

suggested that making adjustments to the required rate of return has a number of drawbacks:

> There is a danger that, once exceptions to the base rate are allowed, excessive allowances for the cost of CSOs, or excessive discounting of the rate of return target, could provide a cloak behind which inefficiencies might occur. Moreover, the scope for political interference in the management of the enterprise may be increased.

3.3.5 *Funding alternative delivery methods*

Three of these four alternative methods of funding CSOs — direct cash payments to users (including vouchers), direct funding of infrastructure providers and accepting lower rates of return — require either direct payments from government or a reduction in government revenue by way of reduced dividends. These methods, if adopted, will impose additional strain on government revenue raising or, alternatively, require the government to reassess expenditure priorities.

In Australia, most government revenue is raised from taxes. As in other countries, the taxation system imposes costs on the community. These costs include:

- compliance costs associated with filling out the appropriate forms, keeping appropriate records, etc;
- costs of administering and policing the taxation system — in 1990, for example, the administrative costs associated with raising $100 in personal income tax were estimated to be $1.25 (Working Party on Tax Powers 1991); and
- deadweight or disincentive costs associated with changes in behaviour induced by taxation — taxes distort the incentives to work, save and invest and the pattern of input use and production in the economy. Diewert and Lawrence (1994) recently estimated these costs to be in the order of 15 to 20 per cent (at the margin) for labour and consumption taxes in New Zealand. Findlay and Jones (1982) estimated that the deadweight costs associated with taxation in Australia ranged from 23 to 65 per cent of tax revenue.

These costs may be increased at the margin by introducing methods of funding CSOs that do not involve cross-subsidies. This needs to be weighed against the advantages of increasing the transparency of CSOs, removing pricing distortions and allowing increased competition in infrastructure provision.

3.4 Measuring the cost of CSOs

A key issue in replacing cross-subsidisation with other methods of funding CSOs is how to measure the costs associated with providing infrastructure to a targeted user group. Two approaches which have been advocated are the fully distributed costs method and the avoidable costs method.

3.4.1 Fully distributed costs

The fully distributed costs (FDC) method allocates the total costs incurred by an enterprise across all the services it provides. These costs include those that can be directly assigned to a particular service — attributable costs — as well as those not directly attributable — joint and common costs.

Joint costs are those a business incurs regardless of what combination of services it provides. Examples are overheads and advertising.

Common costs are those that can be attributed to a number of services provided through the same network. For example, there is a 'commonality' problem in supplying individual water services. Water for consumption or sewage purposes is supplied to households through the same pipe. While efficient pricing may dictate that different prices should be charged for the two services on the basis of different demand characteristics, it is difficult (and expensive) to measure consumption for each use.

Using the FDC methodology, joint and common costs incurred by all services are distributed using an ad hoc method, commonly a physical measure of utilisation or the gross revenue generated by each user group. Each consumer pays the costs identified to their use plus some proportion of unattributable costs based on their consumption. The basis of the cost allocation chosen can be rather arbitrary. Further, the FDC methodology does not provide any estimate of marginal costs. There is no indication of the amount an extra unit supplied costs. And costs can be over or under-estimated depending on the relationship between average and marginal costs. The method is likely to be most effective where there are constant returns to scale, although this situation is not common in infrastructure provision.

3.4.2 Avoidable cost

The avoidable cost method of calculating the cost of a CSO estimates what costs would be avoided if the particular service had not been provided? This measurement includes both the variable costs and capital costs associated with the additional production to fulfil the CSO.

A number of factors will impact upon the level of avoidable costs. The longer the time period chosen, the higher the avoidable cost as capital costs will have to be added into the avoidable cost of the CSO. The level of avoidable costs will also vary over the range of output being considered. For instance, if the CSO was defined as a single rail service for a passenger of a particular type (eg pensioner or a school student), the avoidable costs of that service may only consist of the expenses associated with ticketing. However, if the CSO was defined as retention of an uneconomic branch line, the avoidable costs would be the track costs and all other expenses directly associated with that line, including maintenance and provision of signalling. It might also include

the costs associated with rolling stock used on that line, depending on whether that rolling stock was suitable for use on other parts of the network.

3.4.3 Which approach is better?

The key difference between the avoidable cost and FDC method lies in the range of costs included. Under the FDC method, all costs are included, whether or not they would have been incurred if the CSO had not been provided. This is not the case under the avoidable cost method.

There will be instances where the level of some costs would not change, or would only change marginally, if the GBE was required to deliver a CSO. Costs that fall into this category might include expenses associated with advertising and head office rental. The use of the FDC method in these circumstances will have the effect of allocating certain costs to a CSO that would have been incurred in any case. The result is that the true cost of delivering the CSO would be overestimated if the FDC method was used. The degree of overestimation could be considerable for infrastructure providers who have a large proportion of joint (and common) costs that need to be attributed over many services. The differences between the two methods can be large and are illustrated in the following section.

Because it tends to overestimate the costs of CSO provision, the use of the FDC method could lead to the outright rejection of potential CSOs or lower levels of CSO provision because governments consider that the expenditures cannot be justified. Alternatively, it could lead to overpayment to CSO providers in the sense that they would have been prepared to provide the service for less compensation. This reflects the ability to "free-ride" on the fixed costs associated with the provision of existing goods and services.

While the avoidable cost method is likely to come closer to measuring the true costs associated with delivering a CSO and allow governments to make better decisions, it is more difficult to apply than the FDC method. Most of the information required for the FDC approach is available from standard accounts. The calculation of avoidable costs, however, will generally require more information than this although much of the information is likely to be available under more advanced accounting and management systems now commonly being adopted.

The avoidable cost methodology is the method preferred by the Steering Committee on Government Trading Enterprises (SCNPMGTE 1994a) and the Queensland Treasury (1992) as it provides a better estimate of the true costs of delivering CSOs. Its use will ensure that government funding of CSOs is not wound back in response to poor information about costs and that infrastructure providers are not over-compensated for the delivery of a CSO.

3.4.4 Other measurement issues

There are several important issues to be considered in measuring the cost of CSOs. The economic cost of a CSO, by definition, is the difference between revenue generated and the costs associated with providing a particular service with the most efficient pricing and production processes. If the costs of CSOs are to be measured accurately, the additional costs due to inefficient production should be taken into consideration. This requires a "best practice" costing, necessitating adjustments to cost data for GBEs that are not operating at best practice. However, defining what best practice may be for a particular GBE and making adjustments to observed costs is difficult.

Any estimation of the costs of delivering a CSO should recognise the conditions of supply. For instance, the consumption of some infrastructure services is characterised by peak load demands (see chapter 2). There can be costs associated with installing the capacity needed to meet peak demands. If the provision of a CSO related to peak demands, then the costs of the extra capacity should be included in the measurement exercise. However, it would not be appropriate to include these extra capacity costs if the CSO related to off-peak use. Where the CSO involves peak and off-peak use by a particular class of user, the task of measuring avoidable costs becomes quite difficult.

Another supply consideration relates to the large investments in lumpy assets involved in the provision of many infrastructure services. Such assets face a demand cycle where there is underutilisation in the early stages, but as demand grows, a capacity constraint is reached (see chapter 2). When there is underutilisation, the relevant cost benchmark for assessing avoidable costs is the short run marginal cost. However, as capacity is approached, long run marginal costs and the costs associated with congestion become relevant. The implication is that avoidable costs will vary with capacity utilisation.

3.5 Costing CSOs: a practical example

In this section the FDC and avoidable costs methods of costing CSOs are illustrated using the example of a courier service. The courier operator wishes to obtain a licence to operate four courier vans in the city. To ensure universal access to courier services at an affordable price, the government has imposed certain conditions on the licence. It requires the licence operator to also provide courier services in a country town 200 kilometres away at the same price as charged in the city. The losses made in providing the country service are covered by the government.

The cost break up between attributable and joint (including common) costs by service is presented in table 3.1. Attributable costs are those costs that can be directly linked to the sole provision of a particular service, whereas common costs are incurred by the courier service as a whole. The costs directly related to the country van service would

not have been incurred were it not for the special provisions of the licence. As an additional van was needed to provide the country service, the full cost of this van can be attributed to this service.

Table 3.1 Economic costs per year of running a courier van

	City van service	*Country van service*	*Total*
Attributable costs			
Cost of capital	$16 000	$5 000	$21 000
Wages	$80 000	$25 000	$105 000
Fuel	$8 000	$2 200	$10 200
Repairs	$8 000	$2 000	$10 000
Total attributable costs	$112 000	$34 200	$146 200
Joint costs			
Fully Distributed Costs I[a]	$40 000	$10 000	$50 000
Fully Distributed Costs II[b]	$46 154	$3 846	$50 000
Avoidable Costs[c]	$49 800	$200	$50 000
Total costs			
Fully Distributed Costs I	$152 000	$44 200	$196 200
Fully Distributed Costs II	$158 154	$38 046	$196 200
Avoidable Costs	$161 800	$34 400	$196 200
Total parcels carried	600 000	50 000	650 000
Price per parcel			
Fully Distributed Costs I	$0.25	$0.25	na
Fully Distributed Costs II	$0.26	$0.26	na
Avoidable Costs	$0.27	$0.27	na
Revenue generated			
Fully Distributed Costs I	$152 000	$12 667	na
Fully Distributed Costs II	$158 154	$13 179	na
Avoidable Costs	$161 800	$13 483	na
Government subsidy required			
Fully Distributed Costs I	na	$31 533	na
Fully Distributed Costs II	na	$24 867	na
Avoidable Costs	na	$20 917	na

Notes: (a) Fully distributed costs I pro-rates joint costs between city and country services on the basis of vans employed per service. (b) Fully distributed costs II pro-rates joint costs between city and country services on the basis of letters delivered per service. (c) Avoidable cost assumes running the country service adds $200 to joint costs. (na) Not applicable.

For a number of reasons, the costs of running the country van are higher than running a city van. It suffers more wear and tear travelling on rough country roads and covers more kilometres travelling from the city to the country and back. Wages are higher because the country driver does more overtime driving greater distances. Fuel costs are naturally higher as the van does more travelling.

The country service provides only 50 000 parcel deliveries in the year as opposed to 600 000 in the city (150 000 per city van).

Joint costs total $50 000. These include such items as administration, head office wages, rental of the office, advertising, stationery and other costs associated with running the office. These costs are allocated over city and country services below using fully distributed and avoidable cost methodologies.

3.5.1 Fully distributed costs

To calculate the cost of providing the CSO using the fully distributed cost method, the $50 000 in joint costs must be *pro-rated* over the city and country services using some measure of physical utilisation of the system. Two possibilities are to allocate costs according to the number of vans and the number of letters delivered by services.

Joint costs allocated by vans per service

In this case, joint costs are attributed by the number of vans that service each market. There are four city vans and one rural van. Using this approach, 80 per cent of joint costs are attributable to the city service and the remaining 20 per cent to the country service (see table 3.1).

To cover costs (including capital), the price charged per letter in the city is $0.25 (total allocated costs of $152 000 divided by 600 000 total parcels carried). The service provided to rural customers is charged the same, as stipulated by the conditions of the licence, generating revenue of $12 667. The country service costs $44 200 to operate, requiring a government subsidy of $31 533.

Joint costs allocated by letters delivered per service

Alternatively, joint costs could be allocated by using the relative shares of letters delivered in each service as a measure of physical utilisation. As there are relatively more letters delivered in the city service, this service is consequently apportioned a greater share of the joint costs. Following this criterion, the city service is attributed $46 154 in joint costs. This is over $6 000 more than is attributed to the city service on the first measure of utilisation, the per van basis. The joint costs attributed to the country service subsequently fall from $10 000 in the previous example to just under $4 000.

With a higher proportion of fixed costs attributed to the city service, the charge per letter in the city rises by 1 cent to cover costs. The revenue generated by the country service rises, however, due to the lower costs apportioned to this service. The government subsidy overall falls to just under $25 000, as opposed to $31 533 in the previous example.

3.5.2 Avoidable cost

Valuing CSOs using the avoidable cost method requires data on overhead costs that could have been avoided if the particular service had not been provided to be added to the variable cost of the CSO. Using FDC, joint costs are pro-rated across city and country services. However, in all likelihood many of these costs would be incurred whether the country service operated or not. In this case, joint costs include administration staff who would be hired whether there was a country service or not. Similarly, rental on the office, stationery etc. would need to be paid whether the country service is provided or not.

The example assumes that operating the country service adds $200 to joint costs. Under these assumptions, the joint costs are mostly attributed to the city service ($49 800). The price charged by the city service is required to increase another cent to cover costs and, consequently, revenue raised by the country service increases to $13 483. Due to costs falling to $34 400, the government subsidy is reduced to around $21 000.

In summary, the calculated cost of a CSO can vary significantly under different costing methodologies. It highlights how the choice of methodologies can have a significant impact on the CSO funding burden imposed on the government. As shown in table 3.1, the government could pay up to $10 000 more than was required to ensure the provision of courier services to the country area if it chose the FDC methodology rather than the avoidable cost methodology.

3.6 Conclusion

Governments have a right to direct GBEs involved in infrastructure provision to pursue CSOs. However, before giving such directions governments should ask:

- whether the objectives encompassed within the CSOs continue to conform with government objectives?; and
- whether the CSOs are most appropriately delivered via the infrastructure provider?

If both of these questions are answered in the affirmative, then it is necessary to assess whether the CSO is most appropriately delivered by a cross-subsidy. Cross-subsidies are distortionary, non-transparent and often necessitate the granting of a monopoly right to the incumbent which has the effect of removing the pressures to perform brought about by competition. There are other methods available which do not suffer the same drawbacks as cross-subsidies. The methods include levies on users; direct cash payments to targeted users; providing targeted users with vouchers for the service; direct funding of the enterprise; and accepting lower rates of return. Under most of these methods the effectiveness of CSOs can be properly assessed as their costs are known and markets can be opened to competition.

These approaches do, however, require estimates of the cost of delivering CSOs. This gives rise to a number of complications. Joint (and common) costs have to be allocated. This is especially relevant to infrastructure providers as they generally provide a number of services. Two popular methods of allocating joint costs are the fully distributed and avoidable costs methods, of which the avoidable costs method is preferred as it best reflects the true costs of provision. There are also other difficult issues to be considered, such as determining best practice costs. Inevitably, measuring the costs of CSOs will involve some trade-offs between resolving all these issues and the costs involved in achieving more refined estimates. The important first step is to make all CSOs as transparent as possible so that they can be subject to normal budgetary scrutiny. Moving to funding methods other than cross-subsidies will improve incentives for efficient infrastructure pricing and provision.

4. Rate of return targets and efficient pricing

As part of the reforms to improve the performance of GBEs, most governments now specify a rate of return (RoR) target that they expect GBEs to earn on the assets under their control. As many GBEs are capital intensive, generating sufficient revenue to meet the required RoR has important implications for the prices GBEs charge for infrastructure services.

This chapter discusses some of the implications of RoR targeting for efficient pricing. The next section briefly discusses the role of RoR targeting in improving the performance of GBEs. Section 4.2 discusses different measures of the RoR to establish which one is most compatible with the concept of efficient pricing. Sections 4.3 and 4.4 examine key issues that impact upon the pricing implications of RoR targeting — asset valuation and depreciation; and the basis for setting RoR targets. Section 4.5 discusses the potential conflicts between RoR targeting and efficient pricing. Concluding comments are made in section 4.6.

4.1 The role of rate of return targeting

In simple terms, the RoR relates income to the value of assets used to generate that income. It is the main measure used by the private sector to assess the performance of investments and to guide investment decisions.

In recent times, the specification of RoR targets has been central to many of the reform programs being pursued by governments to improve the performance of GBEs. Targets are usually expressed as a percentage. When they are applied to the asset value of the GBE, they provide an estimate of the yield required to justify using the capital tied up in the GBE's assets in a similar way that input prices represent the cost of using other inputs.

RoR targets can play a role in improving the performance of GBEs in a number of ways. They provide GBEs with a clear commercial objective. Achievement of a RoR target can indicate that a GBE has recovered, through its pricing and production behaviour, all the costs associated with the infrastructure goods and services it provides. As discussed in chapter 2, cost recovery (or, more correctly, recovery of opportunity costs) is an important condition for efficient pricing.

The process of financial monitoring using RoR targets (ie comparing actual returns with targets) provides governments with information that can assist in improving decisions about where to invest the community's funds. For instance, where actual

returns fall below the target for an extended period, and that result cannot be attributed to other factors (eg poor management performance), the case for additional investment is weak and capacity should be wound back. Conversely, where actual returns exceed targets for sustained periods, further investment may be required.

The financial monitoring process also provides a substitute, albeit an imperfect one, for the pressures created by the sharemarket for good performance. Many private sector firms comparable in size to GBEs are publicly listed companies. Sustained poor performance by a publicly listed company would see its share price fall, while good performance would see an increase in its share price. In this way, share prices provide information about the market's assessment of the way companies are performing. Where a company's share price falls, it is susceptible to takeover or merger by investors that consider that they can make better use of its resources. Shareholders may also elect new board members in response to poor performance. In both cases, a management shake-up is the outcome. In the case of GBEs, the process of comparing actual returns to targets allows the government to assess the performance of the GBE and its management. Failure to meet an appropriately set RoR target can signal that a change in commercial strategy is required. It may also signal that management performance has been sub-standard and sanctions are justified.

Before decisions are made to change commercial strategies, sanction boards or re-direct investment funds, the reasons why differences between actual and target rates of return have arisen must be established. There could be a temporary divergence between the actual and the target RoR due to conditions beyond the control of the GBE, such as fluctuations in economic activity. However, where poor performance can be attributed to operational inefficiencies (including inappropriate pricing practices) changes are necessary in order to ensure that the community does not continue to carry the burden (eg reduced dividends, overpricing).

Against this background, the following section discusses how the measure chosen to estimate a GBE's RoR can have ramifications for the pricing strategies employed by the GBE.

4.2 What is the appropriate measure of the rate of return?

The two principal measures of the rate of return are the economic rate of return (ERR) and the historic cost rate of return (HRR).

In its simplest form, the ERR is the economic income derived from an asset as a proportion of the market value of the asset at the start of the period. Economic income includes both the net cash flow and the change in the value of assets over the period (ie economic depreciation). Net cash flow is simply cash receipts *net* of operating

expenses generated by the assets. A more detailed description of the ERR can be found in Commonwealth Treasury (1990), Fallon (1993a) and Dodd (1993).

The ERR is a RoR measure that is consistent with the way the market normally assesses the performance of an investment. Consider the example of an investment in a rental property. At the beginning of the year the property is valued at $150 000. During the year, the net income (rental income less maintenance expenses, etc.) is $7 000. An appraisal of the property indicates that its value has risen over the year to $155 000. The economic income for that year is the net income of $7 000 plus the increase in asset value of $5 000 — a total of $12 000. The economic rate of return is 8 per cent [(7 000 + (155 000 – 150 000))/150 000]. Performance can be assessed by comparing this return with returns on comparable investments.

Most of the information required to calculate the ERR is available from standard historic cost accounts. However, information about the change in market values is also required. A detailed example of the calculation of the ERR for a fictitious toll-road business is provided in appendix 1.

The historic cost rate of return (HRR), is the cash flow minus the book value of depreciation divided by the average book value of the investment. In essence, the HRR is based on depreciating capital value against the original purchase price or construction cost. The annual depreciation provision is calculated on the basis of written down historical cost. Unlike the ERR, all the information necessary to calculate the HRR is available from standard historic cost accounts.

To highlight how the RoR measure chosen can impact upon measured performance, consider the example of a lawnmowing business. It begins the year with a $1000 lawnmower. Using historic cost accounting, the depreciation rate on the lawnmower is set at 20 per cent, or $200 for the year. However, the resale value of the lawnmower at the end of the year is $750. Economic depreciation is thus $250. Net cash flow for the year is $350, this comprises revenue from lawnmowing services less associated expenses — fuel, wages, repairs, etc. Table 4.1 shows that in this case the ERR provides a less positive assessment of the performance of the lawnmowing business than the HRR. However, the HRR overstates performance in this example, as it does not reflect the "true" cost of using the capital tied up in the assets.

Table 4.1 Economic versus historic cost rate of return

	Economic RoR	*Historic cost RoR*
Cash flow (i)	$350	$350
Depreciation (ii)	$250	$200
Net income [y = (i) - (ii)]	$100	$150
Asset base (a)	$1000	$900
Rate of return [y/a x 100]	10%	16.7%

Asset base: ERR = asset value at beginning of period
HRR = average value of asset over period ie ($1000 + $800)/2 = $900

4.2.1 Implications of different RoR measures for pricing

The choice of the RoR measure has important implications for efficient pricing as it impacts upon the cost of capital considered by infrastructure providers.

Infrastructure prices should reflect the opportunity cost of all the inputs used to supply the good or service. The use of the HRR as a performance target could cause GBE management to inadvertently pursue price setting strategies that do not reflect these opportunity costs. Historic costs reflect values at a particular point in time, whereas the opportunity cost of using the assets can vary over time as a result of factors such as inflation, technological change and changes in supply and demand. Where the true cost of the assets is greater than the historic cost, the prices set to meet a given HRR target will be too low. This will reduce the potential dividend flow to the owners and encourage excessive use of the service(s), possibly causing congestion problems. In these circumstances, owners may be pressured to advance investment in additional capacity prematurely. Conversely, where the true cost of the asset is less than the historic cost, prices will be too high. This will unnecessarily discourage use of the services, meaning that consumption opportunities are lost. The potential implications of the choice of RoR measure for price setting is highlighted in the example provided in box 4.1.

The shortcomings of using historic cost information to assess the performance of GBEs and as a basis for setting prices are widely recognised. As Graham and Xavier commented (1987, p. 19):

> It has long been recognised that, particularly where inflation is significant, accounts drawn up on historical cost conventions are misleading especially where assets are long-lived. Balance sheet figures of original cost do not represent the values of the assets to the business ... If accounts are to show resource use and economic performance they must allow for general inflation, fluctuations in specific prices and costs, and for technological progress resulting in changes to the value of capital equipment.

A more sophisticated accounting framework that attempts to address these shortcomings is current cost accounting (CCA). The strict application of the CCA standards involves the annual revaluation assets on the basis of the market buying price of an asset of similar service potential. Revaluation procedures also apply to inventory, cost of goods sold, and holding gains and losses. While CCA provides a far more accurate method of tracking the costs of resources tied up in a business than accounts based on historic costs, its strict application is extremely costly and time consuming. This may explain why CCA is not widely used by the private sector, which suggests that it would also be inappropriate for GBEs. According to Fallon (1993a, p. 14), the use of the CCA approach is unlikely to be warranted as the results obtained will differ little from those obtained from correct application of the less demanding ERR.

Box 4.1 Impact of different RoR measures on the Longcord Yo Yo company's prices

Longcord Yo Yos has made an investment of $1 000 in a new yo yo factory. Being a fad, the investment only has an expected life of three years, after which time the assets have no alternate use and, therefore, no value. Under the historic cost approach, business assets would be depreciated on a straight line basis of 33.3 per cent per annum. Actual depreciation, based on the forecast change in the market value of the assets (ie economic depreciation), is quite different, being comparatively large in the last year.

Longcord Yo Yo Company - Financial details ($)

	Year 0	*Year 1*	*Year 2*	*Year 3*	
Asset base					
Market value	1 000	700	400	0	
Depreciated historic cost	1 000	667	333	0	
Average book value	..	834	500	166.5	
Depreciation					
ERR (change in market value)	..	-300	-300	-400	
HRR (straight line 33% pa)	..	-333	-333	-333	
Operating expenses	..	100	100	100	
Gross income required to earn 10 % RoR					
ERR		500	470	540	= 1 510
HRR		516	483	450	= 1 449
NPV					
10% ERR target	1 000				
10 % HRR target	958				

The RoR target measure used to assess Longcord Yo Yo's performance influences the level of income it strives to achieve. Consider the first year of operation. If the 10 per cent ERR target is used, it would have to price to earn $500 in gross income to cover economic depreciation of $300 and operating expenses of $100. If a 10 per cent HRR target is used, $516 in gross income is required to cover straight line depreciation of $333 and operating expenses. Over the life of the project, it would require more income (ie higher prices) to meet a 10 per cent ERR than a 10 per cent HRR.

Box 4.1 Impact of different RoR measures on the Longcord Yo Yo company's prices *(continued)*

Also shown in the table is the net present value (NPV) of the project based on the income required to meet the 10 per cent rate of return under the HRR and the ERR methods. The NPV should equate to the value of the original investment in order to ensure that the opportunity cost of the capital tied up in the project will be recovered. The NPV associated with the prices charged to meet the HRR is $958 - ie less than the original $1 000 investment. This suggests pricing to meet the HRR would not generate sufficient revenue to cover the costs of the capital tied up in the investment. This is not the case when prices are set to meet the ERR. Net present values are discussed in more detail in section 4.3 and box 4.2.

Because the ERR is based on the market value of assets, it is the RoR measure that is most likely to provide the appropriate basis for efficient prices. Notwithstanding this, use of the ERR as the RoR benchmark still requires information on the market value of assets and how those values are likely to change from year to year — ie economic depreciation. For a range of reasons, the valuation of infrastructure assets is a difficult exercise. Some of the key issues are considered in the following section.

4.3 Asset valuation

Establishing a market value for the assets under a GBE's control is a difficult task, complicated by a number of factors. For instance, many GBEs have a history of underpricing, meaning that commercial approaches for valuing assets based on cash flows will provide misleading information. Attempting to derive a value by aggregating the market values of individual assets will require strategies for dealing with assets that are not traded or do not have a market value. Even where estimates for the value of non-traded assets can be derived, the aggregated value of the GBE's assets may not be supported by its cash flows. In order to deal with these issues, a number of steps and cross checks using different methodologies may be required to value GBE assets. The following discussion indicates the components that should be central to any valuation process and highlights some of the issues that will be encountered.

An important first step in deriving a market value for the assets under a GBE's control is to document the assets owned in an asset register. While this may seem trivial, the a lack of a commercial focus in the past leaves many GBEs without even the most rudimentary of management systems. Assets which individually have a low value but which jointly make up a costly network or system are most appropriately included on the register as an asset class.

As it would be costly to record information on every single asset under a GBE's control, it is useful to determine a recording threshold to act as a guide to determine whether or not assets should be included. There are a number of issues to be considered in determining the threshold. If the threshold is set too low, the costs of accounting for a large number of relatively low-value assets may exceed the value of the information. Conversely, if the threshold is set too high, the information base will be inadequate.

Establishing asset values

Once a GBE has determined what "significant" assets it owns, the difficult task of establishing their value must be undertaken. A range of different approaches can be used. A detailed description of various valuation techniques can be found in SCNPMGTE (1994d).

A useful starting point is to value individual assets or classes of assets. If there is an active second-hand market for the asset, then the price paid for assets of a similar type, age and condition can be taken as a measure of the value of the asset. The use of market prices would generally be suitable for assets such as land, houses, computers and office equipment. Provided the market is sufficiently deep, realistic market prices may also be available for much larger assets such as aircraft, ships, cranes and railway rolling stock.

The secondary market for some of the assets GBEs control is thin, and where the assets are unique, no secondary market exists. This problem is likely to be encountered in the case of assets such as power stations, dams, and electricity transmission networks. In these circumstances, there is no reliable market value (ie price) for the asset and a proxy is required. For assets which have been recently purchased or constructed (ie within the preceding one to two years), the *purchase price* or *construction cost* would provide a reasonable proxy for the asset value, provided the investment was commercially sound and there had not been substantial inflation or technological advances. However, many of the assets GBEs control are several years old. In these circumstances, a proxy market value for assets can be derived by estimating the cost of reproducing or replacing the asset with a modern equivalent asset with the same capacity and subject to the same restrictions (eg conditions applying to use of commercial land).

Proxy values for assets in these situations can be derived using two techniques. The *current replacement cost* is the price of a similar asset that can provide similar services using the most appropriate modern technology. It should be used where a similar asset is not available or is available but technologically outdated. The *current reproduction cost* is the cost of constructing or reproducing the original asset today, even though it may no longer be in production. It is relevant where a similar asset can be reproduced and the existing asset is based on essentially unchanged technology. Estimates derived

under both methods should be written down to reflect the remaining useful life of the asset and its condition. Where both approaches are used to value an asset, the lower value should be taken.

The values for individual assets or asset classes (ie each of which is derived using either market price, purchase price, construction cost, current replacement cost or current reproduction cost) can be summed to provide an "aggregate value" of the assets under the GBE's control. This value provides an estimate of what it would cost to replace the service potential of the GBE's assets.

Asset valuation and economic concepts of value

While the aggregate value of assets is a useful benchmark, it is not consistent with economic or commercial concepts of value. In economic and commercial terms, the value of an asset (or group of assets that make up a business) is the discounted net present value (NPV) of the future economic benefits (net cash flows) it will generate over the life of the investment (see box 4.2).

The value of a GBE's assets based on the NPV of its future cash flows could be quite different from the aggregate value. In many instances, the aggregate value will be significantly greater than the NPV of the GBE. Provided this does not reflect poor application of the various valuation techniques, this indicates that the net cash flow of the GBE (income less operating expenses) is not sufficient to support the GBE's service potential. That is, the GBE is not generating sufficient net revenue to maintain existing productive capacity. In these circumstances, GBEs would have to rely on borrowing or revenue from the consolidated fund to finance the future investment necessary to continue to provide the goods and services.

Two reasons why the NPV could be less than the aggregate value are:

- bad investments; and
- unfunded community service obligations (CSOs).

In the case of bad investments, the value should be written down to reflect more closely the NPV (ie earning capacity) of the investment. Valuation of bad investments on the basis of their aggregate value would result in overpricing. This would unnecessarily discourage use of the good or service provided by the GBE, leaving capacity unused. In terms of promoting efficient pricing, the losses associated with asset write-downs should be treated as sunk costs (see chapter 2). However, governments, as infrastructure owners, may be reluctant to write down asset values, particularly where substantial outstanding debt on the asset(s) exists.

Box 4.2 The net present value of the Longcord Yo Yo Company

The *net present value (NPV)* of a business (collection of assets) is defined as:

$$NPV = \sum_{t=1}^{n} \frac{C_t}{(1+r)^t}$$

where

n = remaining asset life;

C_t = expected net cash flow in each year; and

r = discount rate.

As an example, consider the net income (gross income less operating expenses) earned by the Longcord Yo Yo company if it priced with a view to meet its ERR target. The NPV of this income stream is:

$$NPV = \frac{400}{(1+0.10)} + \frac{370}{(1+0.10)^2} + \frac{440}{(1+0.10)^3}$$

$$= 363.64 + 305.79 + 330.58$$

$$= 1\,000$$

The discount rate of 10 per cent reflects the reward that investors in the Longcord Yo Yo Company demand for accepting delayed use of their money in the project. Generally, the discount rate can be viewed as the RoR the investor needs to achieve to justify an investment, given the prospective returns available from investing in other projects of equivalent risk. The calculation of the NPV involves forecasting future costs and revenue. As a consequence, sensitivity analysis is often warranted and results should be interpreted carefully.

The NPV method does not assist in valuing individual assets where cash flows attributable to the assets cannot be readily identified. For instance, the NPV could be used to estimate the value of an airport but not the individual assets that make up the airport such as the land, terminals, maintenance buildings, control towers and radar equipment.

The technique of discounting the cash flows of a business (or a group of assets) is also used for making investment decisions. The cost of the investment makes a negative contribution to cash flow in the first period. This cost is weighed up against the positive discounted net cash flows for the life of the investment. The discount rate is the required RoR. If an investment has a non-negative NPV, it is considered to be worthwhile. In the case of the Longcord Yo Yo company, the initial investment of $1 000 would be compared to the NPV of the cash flows which are also $1 000. This suggests that the yo yo project is worthwhile, provided these net cash flows can be achieved.

Source: BIE and Brealy and Myers, 1987

Where governments require infrastructure providers to underprice services (ie CSOs), the aggregate value of the assets will not be supported by the cash flows. However, writing down the value of assets on the basis of their NPV in these circumstances would be inappropriate. These assets should be valued at their aggregate value. This ensures that the true costs associated with delivering CSOs are evident. This, in turn, will allow the perceived benefits of CSOs to be assessed against the "true" costs of delivery. It also provides a sound basis for costing a range of direct funding mechanisms (see chapter 3). The funding of CSOs, or at least the imputed value of the CSO, should be included in any NPV estimates of value. The issue of unfunded CSOs is discussed in section 4.4.3.

Where market values have been adjusted to reflect bad investments and CSOs are fully funded (or properly accounted for), the aggregate value of a GBE's assets and the NPV should be roughly the same.

It is important to recognise that checking the aggregate value of a GBE's assets against its NPV introduces an element of circularity. It provides GBEs with a basis to "justify" downward revisions in the aggregate asset value. GBEs may pursue this strategy because it makes meeting a given RoR target easier. In view of the subjectivity involved in asset valuation exercises, the case for revaluations may appear convincing. However, the reason for the difference may be an incorrect aggregate asset value. Rather, it may reflect inefficient pricing and production practices (ie the NPV is lower than it should be because it is based on a revenue stream that is too low and/or a cost stream that is too high). Hence, independent scrutiny (eg auditors or a government monitoring agency) of the data used to calculate the NPV and the aggregate value, as well as the basis of asset write-downs, should be an important element of the valuation process. Where adjustments to asset values are found to be warranted, the new asset values should form the basis of RoR calculations and price setting strategies.

4.3.1 Frequency of asset valuations

While accurate asset valuation is crucial to performance measurement and setting appropriate infrastructure prices, trade-offs have to be made between having the most up-to-date information and the cost of the exercise. Full revaluations using the types of extensive processes described above may only be justified every three to five years. In these circumstances, proxies for the change in asset values between major revaluations could be established by applying relevant industry price and technology indices or escalators.

From a pricing perspective, the indices and escalators chosen are critical as they provide a basis for forecasting the economic depreciation or appreciation in the value of assets. This information is needed to enable the GBE to determine the pricing and

production strategies it will pursue to meet a RoR target. Where indices are inaccurate, prices will be inappropriate. Subsequent full revaluations (ie three to five year valuations) will result in major changes to the market value of the assets and will necessitate significant changes to prices. Consequently, care needs to be taken to ensure that the indices are soundly based.

Notwithstanding the problems that can arise as a consequence of the application of inappropriate indices, GBEs may have an incentive to select inappropriate indices. For instance, by over-appreciating the value of the assets, a GBE can add to its economic income, making it easier to meet its RoR target as measured by the ERR. This reduces the pressures on the GBE to meet its RoR target by pursuing more efficient pricing and production practices. As was the case with the asset valuation exercise, independent scrutiny of revaluation indices is likely to be necessary.

4.4 Setting rate of return targets

Once an infrastructure provider has information about variable costs, the value of its assets and economic depreciation, the other factor that will impact upon the prices it sets will be the RoR it is expected to achieve. From an efficiency perspective, the RoR should reflect the opportunity cost of using the capital tied up in the enterprise.

A commonly used benchmark for establishing the opportunity cost of capital tied up in GBE assets is the commercial return available from comparable private sector projects. A counter view could be made that RoR targets should not be commercially based on the grounds that GBEs are publicly owned and, as a consequence, private sector principles are not applicable. However, many GBEs produce saleable goods and services that could be provided by the private sector. Consequently, there is merit in assessing performance against private sector criteria. Moreover, if GBEs are to use the community's resources properly, price efficiently and compete on an equal basis with the private sector, it is critical that they incur the same cost for using the community's scarce capital resources as the private sector. As the Queensland Treasury (1992, p. 129) commented:

> The Government has an obligation to ensure that those community resources invested in GBEs are used productively. By using these resources in activities which did not generate a commercial rate of return, the government is tying up resources which could be employed for a better return elsewhere. Hence, as a general rule GBEs should earn a rate of return on assets sufficient to justify investments in the enterprise rather than investments elsewhere.

In practice, determining the RoR of comparable commercial projects and setting the target is complex and requires careful consideration of a range of factors relating to:

- risk;
- lumpy investments in long lived assets;
- unfunded CSOs; and
- whether targets should be set in real or nominal terms.

Each of these issues is considered in more detail below.

4.4.1 Risk

The returns required by the private sector cover the risks associated with alternative investments. As the level of perceived risk increases, so does the return required by investors. In order to ensure that GBEs are paying the appropriate opportunity cost of capital, it is important that RoR targets reflect the associated risks.

There are two risks that are considered to be of most relevance to GBEs: unique risk and market risk. *Unique risk* is that risk which is specific to the particular investment under consideration. *Market risk*, on the other hand, is the risk due to changing economic conditions that applies generally to all investments in the portfolio. Generally, unique risk is ignored in the private sector. Investors spread their funds over a portfolio of investments and losses from one type of investment are expected to be outweighed by gains from other investments. Similarly, governments can ignore unique risk because the owners of GBEs are the public who also have a diversified investment portfolio. Market risk, however, cannot be diversified away and should be included in any target rate of return.

Determining the level of market risk of individual GBEs is a difficult task. The approaches extensively used by the private sector to estimate the RoR (which includes an assessment of the risk associated with an investment) are the capital assets pricing model (CAPM) in conjunction with the weighted average cost of capital (WACC) (see box 4.3).

Although widely used in the private sector, the application of the CAPM to GBEs is problematic. Many GBEs effectively operate as monopolies. Consequently, there are few, if any, competitors from which to obtain data to perform CAPM type exercises. Reference to similar businesses throughout Australia or overseas may assist in overcoming this data problem. However, there are difficulties in this approach due to different operating conditions such as accounting requirements, CSOs, tax arrangements and regulatory environments.

Box 4.3 WACC and CAPM

A target RoR for a firm can be derived by calculating its *weighted average cost of capital* (WACC). The approach recognises that there are two types of capital providers (lenders and investors). In general, lenders have the highest level of security (having first call on a firm's assets) and require a lower return than equity holders. The WACC provides a basis for aggregating the returns required by both types of capital providers and is defined as:

$$R_a = R_d \frac{D}{D+E} + R_e \frac{E}{D+E}$$

Where R_a = before-tax RoR on assets;
R_d = interest rate on debt;
R_e = before-tax RoR on equity;
D = market value of the firm's debt; and
E = market value of the equity in the firm.

The interest rate R_d is the market's assessment of the risk of debt held by the firm. The main complication in the above formula is deriving the appropriate return on equity (R_e).

The capital assets pricing model (CAPM) estimates the relationship between market risk and the required rate of return on equity. It looks at a particular investment in the context of a fully diversified market portfolio of investments. The return required over and above the risk free rate (eg the government bond rate) depends on an investment coefficient, known as beta (b_e). Beta measures how sensitive an individual investment's return is to general movements in the market portfolio. For example, if a 1 per cent rise in the market produces a 0.5 per cent rise in the firm's returns then its beta is 0.5. Under CAPM, R_e is defined as:

$$R_e = R_f + b_e(R_m - R_f)$$

Where R_e = the expected return on equity;
R_f = the risk-free rate of return;
b_e = measures performance with respect to changes in returns in the market portfolio; and
R_m = the expected return on the market portfolio which can be estimated by the yield on the market portfolio of common stocks.

Ideally, estimates of beta and the risk premium of the market portfolio should be based on forward looking data as future returns are relevant to investors, not past returns. However, required rates of return estimated from CAPM are typically post company tax, pre-investor returns based on historical movements in stock exchange data. Converting R_e to a pre tax rate requires an estimate of the effective tax rate that would apply.

Source: Brealy and Myers (1987) and Commonwealth Treasury (1990).

These problems suggest that the CAPM may have limited practical application in assessing risk and assisting in setting RoR targets for GBEs. This raises a significant issue in that RoR targets should reflect market risk in order to ensure that GBEs face the appropriate cost of capital and therefore price infrastructure efficiently. Fallon (1993a, p. 12), while generally supporting the CAPM methodology, considers that the inability to measure market risk associated with investments in GBEs accurately is not currently a significant issue:

> Generally rates of return for government enterprises are so low that even to realise the government bond rate on a sustained basis would be an impressive achievement. In addition, many government enterprises (eg electricity) have very stable cash flows so that the market risk is relatively small.

He proposes a general guide of around 2 to 4 percentage points above the long-term government bond rate as an appropriate target rate of return for most infrastructure providers. The Queensland Treasury (1992, p. 133) suggested a similar approach. Reference to variations in the market risk could be used to assist in the determination of loadings. For a GBE with very stable cash flows, its loading would be significantly below the average commercial market risk.

In the short to mid term this approach would ensure that GBEs that were under-recovering would at least be moving towards covering the opportunity cost of capital. In the longer term, however, careful consideration may have to be given to the need for more accurate assessment of market risk. A fundamental question that should be considered at that time is whether the benefits of fine-tuning RoR targets to allow for market risk outweigh the costs.

4.4.2 Lumpy investments

Infrastructure often involves the acquisition of large lumpy assets. It is not unusual for available capacity to greatly exceed demand initially, with congestion occurring at later stages. Efficient pricing in these circumstances requires that prices be set to approximate short run marginal cost while there is excess capacity, and increased above short run marginal cost when capacity is reached (see chapter 2).

The implications of this pricing strategy for the ERR are highlighted in the example in table 4.2. The investment has a life span of ten years and demand is expected to increase progressively over the life of the asset. The forecast net cash flow stream is based on short run marginal cost pricing in the early years when there is excess capacity. As demand grows so does income relative to costs. Once at full capacity, it will be necessary, in response to excessive demand, to increase prices above short run marginal costs to ration output from the existing assets. As a result of this demand pattern and pricing strategy, the yearly ERR is low initially but high in later years. Although the yearly ERR is variable, the NPV of the project's net cash flows when

discounted at the required RoR is zero. This indicates that the project is commercially sound and the pricing strategy is sufficient to ensure that the opportunity cost of capital is covered.

Table 4.2 Forecast rate of return for a lumpy investment

Year	*Market value of assets ($)*	*Net cash flow ($)*	*Economic income ($)*	*Economic rate of return (%)*
0	1 000 000	-1000 000		
1	900 000	72 089	-27 911	-2.8
2	800 000	86 506	-13 494	-1.5
3	700 000	103 808	3 808	0.5
4	600 000	124 569	24 569	3.5
5	500 000	149 483	49 483	8.3
6	400 000	179 379	79 379	15.9
7	300 000	215 255	115 255	28.8
8	200 000	258 306	158 306	52.8
9	100 000	309 968	209968	105.0
10	0	371 961	271961	272.0
Net present value (discount rate 10%)		$0.00		

It is evident that the specification of RoR targets where GBEs have large lumpy investments and demand grows over time requires careful consideration. Setting annual targets on the basis of a risk free rate plus a loading for risk, or the average market rate is likely to result in inefficient prices. It would pressure the GBE to overprice when capacity was not being used, and underprice when capacity constraints were being reached. This problem will be most pronounced where lumpy assets comprise a significant proportion of the asset base. Where GBEs control a relatively large number of lumpy assets of different ages and age profiles, the fluctuations in returns will be less pronounced.

Where GBE's annual returns are susceptible to considerable fluctuations due to the lumpy nature of their investments, RoR targets could be set in a fashion that is consistent with the life cycle of the investment. Ideally, the target RoR should be based on comparable projects that are at a similar stage in their life cycle. However, such comparisons are unlikely to be available. In these circumstances, an assessment of the GBE's forecast demand growth and cash flows may assist in setting a sensible target. This introduces considerable subjectivity into RoR target setting.

4.4.3 Unfunded CSOs

Many GBEs are required to deliver CSOs — which typically involves delivering services at less than commercial prices (see chapter 3). The way in which CSOs are funded has important implications for the specification of RoR targets.

Where a GBE is expected to meet a commercially based RoR, and is required to deliver a CSO without compensation, it will be under pressure to pursue inefficient pricing strategies. For instance, the GBE may lower service quality standards and pay less attention to safety in a bid to reduce costs and meet the target. The GBE may also increase prices in non-targeted markets. Where there is competition, the ability of the GBE to increase prices would be limited, making it difficult to meet a RoR target. However, in non-competitive markets, the GBE may be able to overprice (ie cross-subsidise the delivery of the CSO) to meet the target.

The pressures on GBEs to pursue these inefficient strategies can be reduced by utilising one of the direct funding methods for funding CSOs discussed in chapter 3. Direct funding has the advantage that it increases transparency and provides a basis for assessing the benefits of CSOs. However, where governments require GBEs to deliver CSOs and are not prepared to provide direct funding, the rate of return should be adjusted downwards. This would be by an amount which reflects the impact that the unfunded CSO is likely to have on measured RoR performance. Alternatively, the costs of delivering the CSO could be treated as notional income for performance measurement purposes. In this regard, avoidable costs based on best practice production methods are the appropriate basis for adjusting the target or determining notional income.

4.4.4 Real or nominal targets?

Targets can be set in either real or nominal terms. From a practical perspective, it is likely to be simpler to set rates in nominal terms. For instance, if the RoR was defined as the long term government bond rate plus a loading for risk, it would be necessary to make an adjustment to convert the rate to real terms. This is because the long term bond rate already encompasses the market's assessment of future inflation. Setting targets in nominal terms avoids the problem of attempting to estimate future inflation trends.

Notwithstanding the reasons for setting targets in nominal terms, GBEs will have to assume an inflation rate so that they can determine their pricing strategies in the face of increases in the nominal cost of their inputs. If it is likely that GBEs will make vastly different and inaccurate inflationary forecasts, there may be a case for infrastructure owners to provide an inflation estimate or range, in order to avoid the inappropriate pricing strategies that would otherwise arise. If this step is taken, targets could be set in real terms.

From a performance monitoring perspective, there is some merit in converting actual nominal returns into real levels. This provides a better basis for comparing the performance of GBEs with other firms that may have faced different inflationary pressures. This is particularly important where the performance of a GBE is being compared with firms offshore.

4.5 Conflicts between efficiency and RoR targeting

Requiring GBEs to pursue target rates of return on their assets is crucial in promoting better performance. However, by itself, RoR targeting will only ensure that GBEs strive to recover costs (operating and capital) and will not necessarily promote efficient pricing (and production) practices. Indeed, the practice of setting RoR targets for GBEs may conflict with efficient outcomes in a number of ways.

A GBE may attempt to achieve a RoR target by increasing prices or lowering service quality, rather than removing inefficiencies in pricing and production practices. Such strategies would not be sustainable under competitive market conditions, as the GBE would lose business to rivals. This, in turn, would mean that the RoR target was not met. However, many GBEs involved in the provision of infrastructure services are often sheltered from competition due to legislative barriers, the existing structure of the industry (eg vertical integration) or natural monopoly characteristics of service delivery. In these circumstances, GBEs may have considerable scope to pursue inefficient pricing and production practices to achieve RoR targets.

In both competitive and non-competitive markets, RoR targets may be achieved at the expense of capital maintenance and investment programs. Such behaviour may be extremely difficult to identify as the impacts of sacrificing maintenance and investment will only be obvious in the longer term when the ability of the GBE to deliver a certain quality and level of services has suffered. GBEs may also attempt to achieve targets by increasing debt levels or entering into risky investment projects. Such behaviour would jeopardise the financial integrity of the enterprise.

The application of a range of other financial and non-financial performance measures can help to address these problems (see box 4.4). These measures provide a basis for "benchmarking" various dimensions of a GBE's performance (eg productivity, capacity utilisation, service quality, financial integrity) against similar activities in Australia and overseas. The measures can be monitored and assist in guarding against the use of inappropriate practices (eg lowering service quality standards) to achieve RoR targets. Benchmarking can also play an important role in assisting to identify the reasons why a GBE may have failed to meet a RoR target (eg inefficient production practices).

Box 4.4 Financial and non-financial performance measures

A range of financial and non-financial measures can be used in conjunction with RoR targets in order to create pressures for GBEs to pursue efficient pricing and production strategies.

The financial measures that can be used include a range of operating ratios, and leverage and liquidity ratios. Operating ratios measure profitability and efficiency and include ratios relating to profit margins, turnover, and sales to creditors and debtors. Leverage and liquidity ratios are useful in assessing the financial health of a business and include the debt to equity ratio, debt to asset ratio, dividend payout ratio (dividends divided by operating profits after tax) and interest cover (ability to cover interest from earnings).

The non-financial performance measures that can be used can broadly be categorised as productivity (or efficiency); effectiveness; and service quality indicators. Certain non-financial indicators, such as working days lost (productivity measure) and customer satisfaction (a service quality measure), can be applied across all GBEs. However, most non-financial measures are GBE specific. For instance, reserve plant margin (capital productivity) and number of Gwh sold per employee (labour productivity) are both productivity measures that are specific to the electricity industry. Berth occupancy and ship turnaround times are productivity measures that are specific to ports. And water purity is a service quality measure that is specific to the water supply industry.

The particular characteristics of the GBE in question must be considered in determining the financial and non-financial measures to apply. In addition, the indicators described above are partial indicators. Therefore, it is critical that they are interpreted as a group as individual measures can give misleading signals about performance. For instance, capital productivity could be improved by the use of "excess" labour.

One efficiency measure that does not suffer from this "partial" problem is total factor productivity (TFP). TFP is an index of the ratio of total output quantity to total input quantity (see Lawrence, Swan and Zeitsch 1991). TFP indices also encompass effects relating to the scale of operation and changes in operational and management practices.

In order to set sensible financial and non-financial performance targets, and to understand fully a GBE's measured performance, it is normally necessary to compare the results with those achieved by comparable businesses and best-practice operations. As many GBEs do not face direct competition, this "benchmarking" process will often necessitate comparisons with GBEs in other countries and states.

RoR targeting regimes may also conflict with efficient pricing in other ways. Where targets are set at inappropriate levels and there is strict insistence that targets are met, GBEs may pursue the wrong pricing strategies. For instance, if targets are set above the market rate, the prices charged by GBEs to meet the target will be too high. Of course, in competitive markets, GBEs pricing to meet a target that was above the market rate would lose market share and probably fail to meet the target. In this case, the impact on pricing is limited. However, as noted above, many infrastructure providers do not face direct competition and they have considerable scope to vary prices to meet a target. In addition, where RoR targets are strictly enforced, they in effect become rate of return regulation. As discussed in the following chapter, rate of return regulation can lead GBEs to use an inefficient mix of inputs.

For these reasons, it is important that RoR targets are only used to provide a guide to the returns required by the government. In this respect, there is some merit in setting a target range rather than a point estimate. The target range could allow for normal variability due to effects such as the business cycle.

4.6 Conclusion

RoR targeting is a central element of the GBE reform programs being pursued by governments. In general terms, RoR targets can play an important role in improving pricing efficiency as they force GBEs to consider the costs associated with the capital tied up in their assets. In this regard, RoR targets have a particularly important role to play where cost recovery has been low.

It is important that the right measure is chosen to assess the rate of return performance of GBEs. Measures such as the HRR, that do not recognise the opportunity cost of the capital tied up in GBEs (ie the market value of the assets), are likely to result in prices being set at inappropriate levels. RoR measures that are based on the market value of assets, such as the ERR, are more compatible with providing the appropriate basis for efficient prices.

Determining the market value of infrastructure assets is important, in terms of both performance measurement and providing the appropriate measure of capital costs for price setting purposes. However, valuing infrastructure assets is a difficult task. A combination of asset valuation methodologies should be used. There is likely to be considerable judgment involved in making decisions about valuations and the indices to apply in intervening periods. In this regard, independent oversight may be required to ensure that GBEs do not make inappropriate adjustments to asset values with a view to making it easier to achieve a RoR target. Such adjustments could reduce the pressure on GBEs to pursue more appropriate pricing and production strategies to meet a RoR target. In the longer term, they could cause unnecessary price fluctuations.

Like asset valuation, determining a target RoR for GBEs involved in the provision of infrastructure is difficult. Application of the techniques widely used by the private sector (eg CAPM) to determine a target RoR is problematic and there are rarely similar enterprises that can be used as a basis for comparison. As a consequence, setting RoR targets for GBEs may have to be based on a relevant risk free rate (ie long term bond rate) plus a loading for market risk. Failure to give proper consideration to requirements to deliver unfunded CSOs and to the fluctuations that are typically associated with returns from lumpy, long-lived investments when setting targets will see infrastructure providers set inappropriate prices.

It is important to recognise that there are potential conflicts between RoR targeting and efficient pricing (and production). Efforts to improve efficiency will be frustrated if GBEs simply increase prices, lower service quality or pursue other inappropriate strategies to meet RoR targets. Setting a range of other financial and non-financial performance indicators can reduce the ability of GBEs to pursue such strategies. RoR targets should be used only as a guide as to the returns expected by the government.

The potential conflicts between RoR targeting and efficient pricing can also be addressed by increasing the scope for competition in infrastructure markets. Where there is competition, the need for authorities to monitor all aspects of GBE performance is reduced. The scope for increasing the level of competition in infrastructure markets is considered in more detail in the next chapter.

5. Limiting monopoly pricing

Over the last decade or so, governments have actively pursued reforms that have encouraged GBEs to adopt a commercial focus, make profits and pay a dividend to shareholders. These initiatives have intensified pressures on GBEs involved in the provision of infrastructure to exploit their market power by overpricing. Exposing GBEs to competition can discourage such behaviour. However, there are situations where effective competition will be difficult to achieve, or will take time to establish. For instance, the incumbent may have a high degree of market power or may control "essential facilities" or networks to which they will not be prepared to provide rivals with access. Another way governments can limit the ability of GBEs to overprice is through price regulation. However, regulation creates a variety of incentives, not all of which are consistent with efficient pricing and production outcomes. Further, the design and enforcement of price regulation is not without problems and costs.

Against this background, section 5.1 examines the importance of competition in achieving efficient pricing of infrastructure services and outlines recent actions governments have taken to foster competition. Regulation to limit the ability of GBEs with monopoly power to overprice is discussed in section 5.2, while the costs associated with price regulation are examined in section 5.3. Concluding comments are made in section 5.4.

5.1 Competition in infrastructure markets

5.1.1 The link between competition and efficient infrastructure pricing

In Australia, many infrastructure providers operate under circumstances where they are the only supplier of a good or service to the market. This gives them a high degree of market power. In the absence of effective competition, there is a risk that infrastructure providers will use this market power to charge users "above-normal" or monopoly prices. Historically, this has not been a major concern as the overwhelming majority of infrastructure assets have been owned and operated by government.

Under government ownership, many infrastructure providers have had a "social" rather than "commercial" orientation. Consequently, pressure for infrastructure providers to make profits and monopoly-price has not been strong. Indeed, governments have encouraged or even forced infrastructure providers to undertake commercially inappropriate investments and pursue CSOs — which typically involves providing services below cost to users (see chapter 3). Moreover, possibly reflecting the political

sensitivity of increases in infrastructure prices, governments have been heavily involved in approving and, in many instances, setting infrastructure prices. While these interventions may meet social objectives, they have contributed to an incentive structure that lacks both a "profit motive" and pressure to minimise costs (Leibenstein 1966). In many cases this has been to the detriment of consumers and shareholders (ie taxpayers).

To remedy poor performance in the past, governments at all levels have attempted to introduce a profit motive by commercialising, corporatising, franchising and privatising their GBEs (see chapter 1). Privatisation and franchising do this directly, with shareholders or business owners expecting the highest possible return from their investment. In the case of commercialisation and corporatisation, management or boards are held accountable for the performance of the enterprise. Financial performance benchmarks are now commonly used to assess the "profitability" of public sector businesses. These performance benchmarks include the rate of return and dividend payments.

While the introduction of commercial objectives may be necessary for better performance, there are concerns that infrastructure providers will engage in monopoly pricing. The ability of infrastructure providers to do this is strongly influenced by the degree of competition they face in the market place. In competitive markets, monopoly pricing is not sustainable because above-commercial returns attract new entrants (who will compete excess returns away) and/or lead consumers to rival or substitute suppliers. The threat that real or potential competitors will "steal" business acts as an incentive for firms to minimise their costs and pass on the benefits of lower costs as lower prices.

5.1.2 Recent reforms to encourage competition

Most governments have accepted the role that competition can play in discouraging monopoly pricing. The Prime Minister (1992, p.15) and the Hilmer (1993) report have commented on the virtues of competition in promoting efficiency. These competitive principles have been endorsed by Commonwealth, state and territory governments. For example, in its policy guidelines for the corporatisation of GBEs, the Queensland Treasury (1992b, p. 97) stated:

> ... limiting competition ... would remove the pressures on GOEs [GBEs] to price and produce efficiently. In competitive markets, GOEs which were not attuned to consumer demands or which overprice their goods and services would lose business. Failure to match the performance of competitors would result in loss of market share and deteriorating financial performance. In view of the importance of competitive pressures in improving performance, regulations which have the effect of restricting competition would be carefully examined ... Where regulations were found to be inappropriate, they would be removed ...

The reforms being pursued by governments at all levels encompass measures aimed at facilitating competition in markets that traditionally have been the sole domain of GBEs. These reforms include:

- removal of legislated barriers to entry;
- structural separation; and
- network interconnection.

These are considered briefly below.

Removal of legislated barriers to entry

Arguably, the greatest impediment to effective competition in the provision of infrastructure services in the past has been government-imposed restrictions on market entry. Notably, governments created separate statutory monopolies to provide telecommunications, postal, road, airports, water, rail, electricity and gas services.

Since the mid 1980s, Australian governments have come to realise that, by granting statutory monopoly rights to non-natural monopolies, they have given GBEs the capacity to monopoly-price. This has reduced their incentive to improve efficiency in production. It also has imposed substantial costs on the consumers of infrastructure services and taxpayers. Governments are now removing statutory monopoly provisions that restrict competition in many areas. For instance, in several telecommunications markets (including long distance, international and mobile call service and customer premises equipment) statutory monopoly rights have been removed and competition is beginning to take hold.

However, lifting statutory monopoly provisions may not be sufficient to introduce pressures to price efficiently. There are two main explanations for this.

First, even though legislative barriers to entry are removed, effective competition may not follow automatically. Many GBEs exhibit large economies of scale and scope and there are high sunk costs associated with investments in assets. These factors can deter new entrants even though the incumbent is no longer shielded from competition by government statutes. And competitors are unlikely to enter infrastructure markets which are natural monopolies because they will not be able to price as competitively as the incumbent.

Second, even if there is entry, the incumbent still may not price its services efficiently because it is vertically integrated — owning and operating all elements of the production chain. For example, GBEs involved in the provision of electricity services have often owned and operate generation plants, transmission networks and distribution businesses. In this situation, a GBE may charge higher than normal prices for competitors to access an essential facility (eg transmission grids in the case of electricity) or it may simply frustrate access to an essential facility. Either can prevent new competitors from eroding the incumbent's profits in downstream or upstream

markets (eg distribution or generation, respectively). This type of behaviour can be overcome, or at least deterred, through structural separation.

Structural separation

Governments in Australia are currently separating monopoly GBEs along three lines.

The first involves separating regulatory responsibilities from the GBE's commercial operations. In the past, responsibility for regulations often rested with the GBE who was affected by those regulations. This dual role created a conflict of interest — what may have been best for the community (and therefore ideal from a regulatory point of view) may have been deleterious to the GBE's commercial interests. For example, in the past, Telecom (with some oversight from the Department of Transport and Communications) was responsible for equipment and cabling specifications. By insisting that only Telecom workers be allowed to install Telecom approved equipment and cabling for customer premises and network services, the carrier restricted the scope for competition. Responsibility for technical regulation in telecommunications was transferred from Telecom to Austel (the industry regulator) in 1989.

The second involves separating natural monopoly from potentially competitive functions. As noted earlier, vertical integration gives GBEs the capacity to charge competitors monopoly prices for access to an essential facility. This could allow GBEs to support inefficiencies, or drive away potential competitors, in any of the GBE's potentially competitive upstream or downstream markets. Governments are now making it more difficult for GBEs to exploit their monopoly power in these ways by isolating essential facilities. For example, in the case of electricity, generation and distribution (the "potentially competitive" activities) and transmission (considered an essential facility) have now been separated in Victoria, Queensland and New South Wales.

The third form of separation involves forming potentially competitive functions within a GBE into independent businesses. These independent businesses may form smaller GBEs or be privatised. This type of separation encourages competition and more efficient pricing in a number of ways:

- it disperses the market power of a GBE and therefore reduces its ability to practice monopoly pricing;
- it facilitates new market entry by reducing an incumbent's ability to dominate new entrants, for example through predatory behaviour;
- it can create more information (eg annual reports and, in the case of private operators, credit ratings and sharemarket assessments) about the performance of incumbents, thereby increasing the prospect of entry if performance is poor; and

- in the case where separated business units are privatised, it increases the threat of takeover in the event of poor performance.

Electricity in Victoria is a good example of where potentially competitive functions have been separated. Generation Victoria (the former generation business) has now been separated into five separate generation businesses and Electricity Services (the former distribution business) has now been separated into three metropolitan and two non-metropolitan distribution businesses. Generation Victoria and Electricity Services were themselves formed by breaking up the former vertically integrated State Electricity Commission of Victoria (SECV).

While breaking GBEs down into smaller independent units has a role in facilitating competition, Hilmer (1993, p. 223) recognised that separation of potentially competitive functions is, of itself, not necessarily a guarantee of competitive outcomes:

> The potential benefits of separating potentially competitive activities will depend in part on the contestability of the market. The case for such separation will be stronger where there are substantial barriers to new market entry. The economies of scale and scope of each industry also need to be considered, as do the costs of transition, although these should not obscure the assessment of the longer term benefits of creating more competitive industry structures.

It is important to recognise that, while structural separation removes the ability of a former monopoly to overprice, it may significantly increase the costs associated with coordinating the provision of infrastructure services. For example, the break up of SECV necessitated the establishment of the Victorian Power Exchange to coordinate trade in the Victorian wholesale electricity market. Additionally, the breakup of business entities may also involve substantial transitional costs. For example, supply contracts may have to be renegotiated and new premises found for each entity.

An alternative to structural separation is "ring fencing" or account separation. Generally, account separation is less costly than structural separation but far weaker. The ownership and management of the GBE remains unchanged. Business units remain integrated — it is only their financial accounts which are separated. Account separation can increase the transparency of the financial relationships between core areas of business and assist in discouraging anti-competitive behaviour such as monopoly pricing. For example, Telstra's local call, mobile, STD and international telecommunications service accounts have been separated since the early 1990s. The aim was to discourage the carrier from cross-subsidising between business units in order to dominate potential competitors.

Account separation is often not an effective alternative to structural separation. For instance, there can be problems in allocating joint costs. And account separation may not be sufficient to deter a government owned infrastructure provider from abusing its monopoly position. In this context, Hilmer (1993, p. 220) noted:

While separation of this kind may place some practical constraints on cross-subsidisation, and facilitate regulation of the natural monopoly element, it will not be sufficient to remove potential incentives to misuse control over access to a vertically integrated element. Full separation at the level of ownership or control is required.

Integration of networks

Where it is possible, governments are introducing reforms to link their infrastructure networks to take advantage of economies of scale and eliminate costs and delays associated with a state-by-state approach (see chapter 6). Multi-state or national networks are being developed to provide electricity, gas and rail services. National networks already exist for telecommunications, roads and postal services, due to their provision by Commonwealth rather than state governments.

Interconnection of traditionally separate networks encourages competition between GBEs within and across jurisdictions wherever users can choose their infrastructure provider. This places a check on inefficient infrastructure pricing, since overpricing and underpricing encourages users to switch between infrastructure providers to obtain the best price for a given quality of service. For instance, if an infrastructure service is overpriced, users will switch to competing infrastructure providers which offer a better deal. In this situation, there will be pressure on GBEs to reduce prices to attract demand — otherwise they will incur losses and their performance will be poor. Underpriced infrastructure services, on the other hand, effectively subsidise consumption. Underpricing will attract users from other jurisdictions who are keen to take advantage of the "subsidy" on offer. Provided there are no capacity constraints, increased demand will result in increased losses. Where capacity constraints are reached, the price of services will be bid up to ration demand. If prices are not increased to ration demand, and there are no quantity restrictions, then congestion problems will be encountered.

5.2 Regulation to limit monopoly pricing

While the reforms discussed in the previous section go a long way in encouraging GBEs to adopt a more commercial focus, they may not be sufficient to introduce pressures for them to price efficiently. The incentive to monopoly-price will remain wherever infrastructure providers are shielded from effective competition. This includes situations where:

- the reforms necessary to facilitate effective competition are not introduced because governments consider the costs associated with coordinating production, marketing and investment decisions are too great;
- the market is poorly contested (see box 5.1);

- it takes a number of years before effective competition (or the threat of competition) has the desired effect on the pricing behaviour of infrastructure providers;
- natural monopolies exist, such as in the case of the essential facility element of telecommunications, electricity, gas and rail services; and
- governments maintain a monopoly with a view to enabling the delivery of CSOs via cross-subsidisation.

Box 5.1 When is a market contestable?

Concerns have been raised that even where pro-competitive reforms have been undertaken there will not be enough competition to ensure efficient outcomes. In part this reflects the perception that, in order to be competitive, a market should comprise a large number of smallish firms trading in virtually identical products (eg courier services in Australia). However, this perception of the requirements for a competitive market is misleading for a number of reasons.

Under the "right" circumstances, the threat of competition can create a competitive environment even in markets characterised by a few large firms taking advantage of scale economies (Baumol, Panzar and Willig 1982). If firms can easily enter and exit the market to become "potential" competitors — so that the market is "contestable" — then the market can keep a check on monopoly behaviour.

Importantly, the threat of competition need not come from "potential" rivals in a particular infrastructure market. They may come from the market for a substitute good or service. Competition between substitutes or "horizontal competition" is particularly relevant in the case of infrastructure provision. To some extent, it exists between electricity and gas and between the different modes of transport, such as road, rail and coastal shipping.

Advances in technology can also bring new potential competitors to a market to increase effective competition. For example, telecommunications services provided by facsimile machines and electronic mail now provide alternatives for postal services. Hence, provided governments have removed legislative barriers to competition and undertaken appropriate structural reforms, the threat of competition, horizontal competition and technological developments will all play a role (admittedly, in some cases, a small role) in promoting efficient price outcomes — even in those markets dominated by a small number of players.

In these circumstances, it may be necessary for governments to introduce regulations to limit the abuse of monopoly power. The main approaches that are being used in Australia and overseas are discussed below.

5.2.1 Methods of regulation

Governments have usually responded to natural or statutory monopolies by playing a direct role in price setting, including regulating prices. Two forms of regulation which have been popular overseas, and have been used in a few instances in Australia, are *rate of return regulation* and *price caps*. Increased awareness of the pricing and production inefficiencies that rate of return regulation can generate has prompted a shift towards price cap regulation. However, price caps can also encourage inefficient pricing and production. *Prices oversight* is an alternative which is more conducive to efficient price and output decisions. These three methods of addressing monopoly concerns are considered in greater detail below.

Rate of return regulation

Rate of return regulation seeks to control a monopoly's behaviour by defining maximum allowable profits. The approach emerged in the United States more than fifty years ago, following public concern over the large profits being earned by some monopoly GBEs and the (perceived) excess prices charged to achieve those profits (Sherman 1989). Rate of return regulation has been used in a few instances in Australia (eg airlines prior to 1990 and gas in New South Wales prior to 1990) to restrict the overall returns being earned by some infrastructure providers with monopoly power.

Following a review of the firm's costs, the regulator sets a rate of return which, ideally, allows a GBE to earn a "fair" return (Berg and Tschirhart 1988). The enterprise then sets its prices to achieve that target, with the knowledge that it cannot retain any extra returns. However, setting the regulated rate of return to guarantee only "fair" profits is extremely difficult. If it is set too high or too low, it can exacerbate any production and pricing inefficiencies. Usually, the regulator will not know ex-ante whether it has set an inappropriate rate of return, since many infrastructure providers do not have directly comparable enterprises in the private sector. Often the only source for comparison is the rate of return being earned by a substitute infrastructure service. These are often monopoly infrastructure providers, lacking an incentive to aim for only "fair" returns themselves.

Even if regulators could set the regulated rate of return to *guarantee* only "fair" returns, the regulation itself can introduce market distortions. Once the rate of return is set, firms (particularly private firms) have an incentive to manipulate price and production practices in a bid to earn and keep high profits. They may choose to do this by pricing and/or producing (more) inefficiently, rather than by improving efficiency (Sherman 1989; Officer 1986). Three possible distortions are considered below.

First, when the allowed rate of return is greater than the cost of capital, rate of return regulation can create an incentive for a firm to use more capital relative to other inputs, even though this may not be consistent with least cost production (Averch and

Johnson 1962). This occurs because under rate of return regulation, the amount of profit that a regulated firm is allowed to earn increases as more assets (ie capital) are used in production. In order to increase total profits without riposte from the regulator, the firm has only to employ more capital. It can therefore become rational for a regulated firm to opt to pay higher rather than lower prices for assets that perform a similar function (ie gold plate) or install capital that does not contribute to production (ie cost pad).

Second, a firm may opt simply to manipulate prices, so that they no longer reflect costs, in order to achieve rate of return requirements. For instance, it may offer lower prices for relatively more capital intensive services and higher prices for less capital intensive services. This is likely to create inefficiencies, but it may be easier to meet regulatory requirements in this fashion than the alternative — developing and implementing strategies to improve performance.

Third, rate of return regulation can reduce incentives for the monopoly infrastructure provider to innovate. Innovation allows a firm to produce the same level of output at lower cost. Under a rate of return approach, if production costs fall, so does allowable profit. Where innovation does occur, it is more likely to augment non-capital inputs, even though this may not be consistent with least cost production.

In combination, these distortions may result in efficiency losses which are greater than the benefit of rate of return regulation to the community. Consequently, the application of rate of return regulation to infrastructure industries should be considered only on a case by case basis. Where overcapitalisation is already believed to be a problem, there is potential for this approach to make matters worse. Using other forms of price regulation, such as price cap regulation, to encourage cost minimisation and discourage monopoly pricing may reduce this risk. However, they often introduce their own distortions.

Price cap regulation

Price cap regulation aims to limit the incidence of monopoly pricing by containing price increases to below some index, normally a price index such as a general measure of the rate of inflation in the economy. A CPI – X price cap restricts price increases to the rate of increase of the consumer price index (CPI) less an expected or required productivity improvement factor (X).

Price caps attempt to set prices to pressure monopoly firms to achieve productivity improvements, while providing for at least a satisfactory return. They have been used extensively in the United Kingdom since the 1980s (Rees and Vickers 1995) and more recently for several enterprises in Australia (eg Telstra, Australia Post, various state electricity utilities and AGL, the New South Wales gas utility).

A price cap can be applied generally or specifically — that is: to all services offered by a firm; a group of services; or to a particular service. There is a risk that, the more

price caps are applied specifically (ie to prices in individual service areas), the more regulators restrict the flexibility of a GBE to price discriminate on a commercial basis — even though it may be efficient to do so.

In the telecommunications industry, Telstra faces a layered system of price cap regulation. An overall price cap (encompassing local, trunk and international calls, connections, lines and mobile telephone services) is set at CPI – 5.5 per cent. Three sub-caps have also been set for the group of connections, rentals and local calls (CPI – 2 per cent); the group of all trunk calls (CPI – 5.5 per cent); and the group of international calls (CPI – 5.5 per cent). Telstra is also prevented from increasing prices for individual trunk calls, local calls, connections or rentals by more than the CPI in any one year (Austel 1994).

In recent years, price caps have been chosen in preference to rate of return regulation where price controls are being introduced for the first time. Price caps are favoured primarily because they introduce incentives to operate at least cost while limiting scope for monopoly pricing and, therefore, avoid some of the pitfalls commonly associated with rate of return regulation (Berg and Tschirhart 1988, p. 519–20). They also encourage firms to share cost savings with consumers. Enterprises which achieve efficiency gains in excess of those built into the price cap (for example, through innovation) can retain them in the form of higher profits. The value of factor X can be reviewed in subsequent periods to maintain pressure for the enterprise to pursue further efficiency improvements.

Like rate of return regulation, there is a possibility that price cap conditions will be met by reducing quality of service. However, if consumers' demand for infrastructure services is sensitive to reductions in quality, reduced quality may lead to reduced profit. Even if quality of service is not reduced, price cap regulation can deter firms from undertaking quality improvements. The price capped firm can only increase prices to recover the cost of quality improvements to the extent that there is direct provision (ie the value of X is set deliberately lower to allow for such costs) or slack in the cap itself (ie the value of X has been set too low). Consequently, the firm's incentive to continually pursue quality improvements is reduced. This contrasts with the incentives under rate of return regulation for excessive quality improvements (ie gold plating).

The extent to which price caps can in practice achieve desired improvements in productive efficiency and pricing efficiency has been questioned (for example, see Baumol and Willig 1989). How the value of X is set and reset is particularly important in this respect. If X is set too low, an enterprise can easily meet the price cap requirement and will be under little, if any, pressure to improve efficiency. If X is set too high, because productivity improvements are overestimated, the price cap will be too low and the enterprise will not be able to achieve its target rate of return. It has also been argued that, as price capping mechanisms evolve, they become profit limiting mechanisms. This can occur where the regulator increases the value of X in

response to observed "high" profits. In this environment, firms may come to learn that increased efficiency will be offset by a higher X in the next period, while poor cost control will result in a lower X and may alter their behaviour accordingly. If this occurs, the benefits of price capping over rate of return approaches will be eroded.

Prices oversight

An alternative method for addressing monopoly pricing concerns is prices oversight. There are two forms of prices oversight: price monitoring and prices surveillance.

The *price monitoring* approach is the less intrusive form of prices oversight. A government agency requests a firm to regularly provide detailed price data relating to a particular product or service. In most cases, the informational demands do not go beyond the sorts of data that a well-managed firm collects as a matter of course. The regulator makes no comment on whether prices are appropriate, but the knowledge that it is being watched may discourage a monitored firm from overpricing. Prices monitoring can be used in industries where:

- there is borderline market power;
- there are concerns about the effect of monopoly provision of essential facilities on downstream markets (see section 5.2.2); or
- even though the TPC (or an equivalent body) may have judged that market power is not a problem, the public is suspicious about the abuse of market power and sustainability of competition.

However, in cases where an infrastructure provider has very substantial market share and there are no substitutes or sources of potential competition (see box 5.1), price monitoring may be too weak to discourage monopoly pricing. A stronger form of prices oversight known as prices surveillance may be required in these instances.

Under a *prices surveillance* regime, firms are required to provide detailed cost and price data and sometimes information relating to investment plans, financial and non-financial targets. The regulator scrutinises this information much more intensely than under the price monitoring approach. According to Hilmer (1993, p. 282):

> The [surveilling authority] ... does not limit its attention to price levels per se. It also looks at whether costs are minimised and at the structure of prices, including inefficiently low prices achieved through cross-subsidisation between different classes of consumers.

The surveilling authority then makes a non-binding recommendation as to whether the price is consistent with the relevant pricing principles.

By creating pressures of transparency and public scrutiny, both prices monitoring and prices surveillance can induce a firm with monopoly power both to price and produce more efficiently. From an efficiency perspective, prices oversight may be preferable to rate of return and price cap regulation. This is because it does not define infrastructure prices and therefore leaves infrastructure providers with flexibility to make pricing and

production decisions. Prices oversight — especially price monitoring — is also less likely to introduce perverse incentives for regulated firms to adopt inefficient practices (as rate of return regulation and price capping can).

However, the potential dangers of poorly designed and administered prices oversight regimes — especially prices surveillance — should be considered.

First, if governments grant their prices oversight authority the power to set prices directly and/or impose price controls such as price caps and rate of return targets (ie in addition to prices oversight responsibilities), there may be a temptation to go straight to them as a starting point for addressing monopoly concerns. Even where the overseer has these powers but does not use them, it may lean on infrastructure providers to accept "suggestions" regarding prices. Moreover, where the authority has no powers beyond prices oversight, there may be some threat that it could acquire them.

The threat of more direct control — whether explicit or implied — means that prices oversight can develop into informal price control and de facto rate of return regulation. This is most likely to occur in the case of publicly owned monopolies where management may be prepared to accept informal price directions, particularly if there are commensurate adjustments to accountability measures (eg a reduction in the expected rate of return).

Second, the demands on firms could become invasive, particularly under prices surveillance. If the prices overseer required more information than would normally be available from a well-managed operation, then the approach would become burdensome and costly. Of course, this problem can arise under more direct forms of regulation such as rate of return regulation and price caps (see section 5.3.1).

In view of the pricing and production flexibility that a well designed pricing approach offers, prices oversight — particularly prices monitoring — should always be considered as an option for addressing concerns about monopoly pricing. If prices monitoring is judged not to work, then other approaches such as prices surveillance and price caps may have to be considered. In judging the success of prices monitoring, however, governments should bear in mind that more efficient pricing does not necessarily imply real price reductions. In some instances, prices may need to rise or be aligned to different customer groups.

5.2.2 Access arrangements for essential facilities

Governments seeking to promote competition, and hence efficient pricing, in infrastructure markets have given special attention to the essential facility elements of infrastructure networks (such as electricity transmission grids, water and gas pipelines and local area telecommunications networks). This attention is justified on natural monopoly grounds.

By virtue of its monopoly position, there is a potential for an essential facility operator to overprice. If the facility operator is also involved in related upstream or downstream markets it may even restrict or deny access to the facility. Monopoly pricing or restricting access will stifle competition in related markets and increase the costs to users unnecessarily. The restriction of access problem can be overcome through structural separation, where the facility operator severs its links with related markets (see section 5.1.2). It may also be mitigated, at least in part, by legislating that access be provided on a non-discriminatory basis to "eligible" market participants. The problem of monopoly pricing, however, is more difficult to overcome.

As discussed in chapter 2, if access prices are set too low there will be insufficient investment by the facility operator to maintain and upgrade the facility. On the other hand, setting access prices too high will deter firms from competing in related markets. It is therefore important to put in place mechanisms that allow the facility operator to set prices to cover the costs of access, including some contribution toward fixed costs, but not allow pricing behaviour that would unduly restrict competition. Three mechanisms for deriving an access price are negotiation, arbitrated negotiation and regulation.

Negotiated access arrangements

Under a negotiated approach, the facility operator bargains with the party (or parties) seeking access to come up with an agreed access price and set of conditions. This approach to access pricing is being considered for the national electricity market. It is most appropriate in situations where there are a small number of firms seeking access to the sole supplier and both buyers and seller have roughly equal bargaining power (for example, electricity transmission grid operator and electricity generators). However, the success of a negotiated approach will be limited where:

- the facility operator participates in upstream and/or downstream markets. If the downstream market is monopolistic, the facility provider and the entrant have an incentive to engage in collusive behaviour to maximise monopoly rents jointly. Even if the downstream market is competitive, the facility provider will prefer to overprice access to allow it to underprice in the downstream market (ie predatory pricing) (King 1995);
- transaction costs associated with negotiations are too high, for example where there are many firms seeking access to the essential facility requiring separate costly negotiations; and
- those seeking access have less bargaining power than the facility operator due to differences in market share. In these situations the incumbent may be able to monopoly-price.

Arbitrated negotiation

Arbitrated negotiation may be appropriate where one infrastructure provider has greater bargaining power or where there is a real prospect of collusive behaviour. Under this approach, an independent party (usually a regulatory authority) monitors the progress of negotiations and may even have powers to impose upper and lower bounds within which negotiations should occur. This approach to access pricing was used in the telecommunications industry in the early 1990s when the dominant carrier (Telecom) was required to negotiate a series of access agreements with Optus and Vodafone. These agreements were arbitrated and registered with Austel, the industry-specific regulator.

Where there is concern that arbitrated negotiation is not sufficient to deter collusive or predatory behaviour, governments should consider monitoring access prices — especially for nationally significant essential facilities. Under price monitoring arrangements, facility operators face a risk that any overpricing will be identified and more intrusive sanctions imposed (see section 5.2.1).

Regulated access arrangements

Where governments are concerned that arbitrated negotiation, even with price monitoring, will not deter overpricing, they may opt to regulate access. Under a regulated approach, a government regulatory authority could utilise price capping or rate of return approaches or set the access price. Irrespective of which approach is used, determining an efficient access price is not straightforward (see chapter 2 and section 5.3). And there are no guarantees that a regulated price will be more efficient than a negotiated price. To begin with, obtaining the necessary information from a facility operator and identifying "relevant" costs is complex (see section 5.3.1). While rules such as the Efficient Component Pricing Rule may provide some guidance (see section 2.2.4), there are great difficulties in obtaining and interpreting the necessary information. Additionally, where the access price regulator is also responsible for promoting competition in related markets, it may deliberately underprice access to stimulate more vigorous competition. This may lead to operating losses and/or underinvestment in the facility. Nevertheless, while regulated access prices can introduce inefficiencies, it can prevent the facility operator from overpricing access to make monopoly profits on the essential facility or to support predatory pricing in downstream markets to discourage competition and make monopoly profits.

Regulation in downstream markets

Where facility operators are involved in downstream markets, and there is concern that the approach used to achieve a "fair" access price (ie negotiation, arbitrated negotiation or regulation) has not discouraged predatory behaviour, governments may consider some form of price regulation, including prices oversight, in the final goods market.

It should be recognised that approaches such as price capping and rate of return regulation are unlikely to discourage predatory behaviour by themselves. This is because these types of regulation only place a ceiling on prices, not a lower limit. Consequently, facility operators that overprice access will still be able to underprice in the final goods market and thereby stifle competition.

General considerations

Addressing monopoly concerns associated with essential facilities is a particularly complex area due to the relationships with related infrastructure markets. It is important, however, that any intervention should attack the source of monopoly concerns wherever possible. In this regard, it is likely to be inappropriate to address monopoly concerns in the essential facility market by regulating the final goods market alone.

A range of approaches could be used at different levels. Where regulatory approaches are used, care will have to be taken to ensure they are not inconsistent and that the regulatory system is not "over-engineered". In this regard, prior to the introduction of any regulatory response to monopoly concerns, it is important that governments consider options to introduce competition or competitive pressures, such as removal of legislative barriers to entry, structural separation and network interconnection (see section 5.1.2).

5.3 The cost of regulation

All forms of price regulation impose costs. Some of these are specific to the method chosen, such as the potential for gold plating and cost padding under rate of return targeting, and were considered earlier. However, there are also generic costs which apply, to a greater or lesser extent, to any form of price regulation. These include information costs, dispute resolution costs and costs associated with regulatory capture, regulatory instability and institutional design.

All of these can undermine the ability of regulation to reduce the costs to society associated with monopoly behaviour. Depending on their magnitude, it is possible that in aggregate they may outweigh the benefit to the community of limiting monopoly power. Thus, a fundamental question that should be addressed when considering a regulatory response to monopoly concerns is whether to intervene at all. In this respect, it is important to recognise that a regulatory response will be a "failure" from the community's perspective if it leads to worse outcomes by imposing higher net costs than would have arisen where monopoly power was abused.

5.3.1 Information costs and regulatory capture

In order to encourage efficiency, regulations to address monopoly concerns should aim to deliver prices which reflect efficient production practices and incorporate an appropriate return relative to the cost of supply.

Irrespective of which approach is taken — rate of return regulation, price capping, prices oversight or regulated access prices — considerable information is needed to ensure that prices incorporate both of these requirements. Regulators must have access to detailed information concerning operating costs, revenue, capital expenditure, the cost of capital and the scope for productivity improvements. Much of this information is needed on a historical, current and forward-looking basis so that efficient prices can be assessed in the context of the life of an investment (eg initial returns from a long-lived, lumpy investment are usually low but are compensated by relatively high returns in later years). Clearly, there are considerable costs associated with collecting the necessary information and undertaking these assessments.

Regulators will face additional costs in monitoring quality of service and safety indicators to ensure that regulated firms do not try to increase returns by sacrificing quality or jeopardising safety. While acknowledging the significance of these costs, Helm (1994, p. 31) considers that they are likely to be dwarfed by the costs associated with firms' responses to regulation, based on experiences in the United Kingdom and United States:

> The main costs of regulatory administration fall ... on the utilities rather than the regulatory offices. Each utility has created its own regulatory administrative function to track the conduct of regulators, to attempt to predict how they will exercise their discretion, and to prepare for periodic reviews and anticipated interventions. These in aggregate probably swamp the costs of the offices ... They ... represent a largely dead-weight regulatory burden.

Even in a regulatory environment that imposes pricing constraints, regulated firms may continue to extract returns via cost padding and gold plating. They have considerable capacity to do so because the regulator is heavily dependent upon them for information. As Helm (1994, p. 20) commented:

> Regulators make their decisions on the basis of information available to them. Their main source is typically the regulatee. Since the regulatee has an element of control or even monopoly over the information provided to the regulator, there is an incentive to present information selectively. In the case of utilities, this takes the form of providing business plans that may overstate costs and understate demand, and in selectively fitting information to suit their interests.

It will be difficult for regulators to assess efficient prices based on the distorted information supplied by the regulated firm. This is a particular problem in the case of monopolies, as there are no competitors in the market that can be used as a basis for comparison. To some extent, "yardstick competition" or "benchmarking" can be used to address this problem. This involves comparing a firm's proposed operational

behaviour, for example its structure of prices and costs, with similar enterprises in other states and countries (see section 4.5). Where discrepancies are found which cannot be justified, appropriate adjustments can be made to the information.

While benchmarking has an important role to play, regulatory agencies can be lured into relying on information provided by the regulated firm. Regulated firms often successfully argue that benchmark comparisons are "unfair" because they do not take adequate account of an industry's particular characteristics and how it differs from similar activities elsewhere. In this respect, Helm commented (1994, p. 20):

> These exogenous information sources, however, only provide a partial solution. There are always 'special' features which tie the regulator to a regulatee's information. The information game therefore, in practice, remains heavily biased towards the utilities ...

Where a regulatory agency becomes heavily reliant on the information and views provided by a single regulated firm, there is a significant risk of "regulatory capture". This arises where the regulator becomes so close to the regulated firm that it advances the interests of the firm rather than protecting consumers from monopoly behaviour.

5.3.2 Dispute resolution costs

There will be times where infrastructure providers do not agree with a regulator's decision. For example, they may believe that the rate of return they are allowed to achieve is too low, that the value of X under price cap arrangements has been set too high, that the regulated access price is insufficient to allow the operator of an essential facility to cover fixed costs, or that the access price is too high to allow competition to occur. In these circumstances, infrastructure providers may seek to contest the regulator's decision. In the case of negotiated access prices, the facility operator and the party seeking access may be unable to reach agreement and therefore seek independent arbitration.

Depending on the infrastructure market, parties can take their complaint to at least one of the following dispute resolution mechanisms:

- industry association;
- arbitration or mediation by state-based regulator (eg New South Wales Government Pricing Tribunal or Victorian Regulator-General) or industry specific regulator (eg Austel);
- industry specific code of conduct administrator (eg in the new national electricity market NECA will be responsible for the resolution of disputes, including access disputes);
- the TPC or PSA (or their equivalent); or
- the courts.

The costs associated with the establishment of these mechanisms, and the legal costs and delays associated with their use, contribute to the cost of regulation. Some mechanisms will be more costly and involve longer delays than others. The likelihood of high legal costs and long delays is greater wherever the courts are used to resolve disputes or arbitrate between parties, especially in the first instance. In New Zealand, a protracted and costly court dispute arose soon after competition was introduced in 1989 over the appropriateness of the efficient component pricing rule pricing rule (see chapter 2) in establishing an access price for Clear Communications to access Telecom New Zealand's essential facility.

5.3.3 Regulatory instability

Assuming regulatory capture can be avoided, the ability of the regulator to mimic competitive pressures and outcomes is still limited. Where prices are determined, or strongly influenced, by regulatory agencies, it is likely that they will be set at inappropriate levels — either too high or too low. Where they are set too high, regulated firms will make excess profits and may undertake unnecessary investment. Conversely, where prices are set too low, profits will be insufficient to attract necessary investment. In these circumstances, there is a risk that price regulation will evolve into a process of regular price adjustments aimed at compensating for differences between past predictions and subsequent performance.

A regulatory approach that pursues catch-up adjustments will involve other risks. For instance, it could discourage innovation if the associated returns are subsequently offset by the regulator in the form of catch-up price adjustments. The instability introduced by unpredictable regulatory adjustments may also discourage investment.

5.3.4 Institutional design

Another important issue for governments to consider when introducing regulation to address monopoly concerns relates to the assignment of responsibility for the task. In a number of jurisdictions the responsibility rests with a ministerial portfolio. This raises the possibility of conflicting objectives. For instance, in some states, responsibility for overseeing monopoly pricing issues rests with the Treasury, which is also responsible for revenue raising. As Fallon (1993b, p. 16) commented, these two responsibilities are often not compatible:

> In most States it [prices oversight] is performed by the Treasury. This is appropriate for the shareholder function — monitoring financial performance. But there is some question over where monitoring of monopoly power should occur — the public interest function. The public interest function may be in conflict with the shareholder function. If both functions are performed within the Treasury, it is easy to conceive of a situation where the public interest is compromised in order to meet budget goals. That is, prices are increased in order to increase dividend flows to the budget.

In a number of jurisdictions this problem has been overcome by assigning the monopoly oversight responsibility to independent agencies. Commonwealth owned monopolies are subject to prices surveillance by the Prices Surveillance Authority and Telstra is subject to surveillance by an industry specific regulator — Austel. In New South Wales, the New South Wales Government Pricing Tribunal conducts reviews of the pricing practices of nominated GBEs. The Victorian Government has recently established the Office of the Regulator-General as an economic regulator for nominated industries. Each of these agencies has been established under its own legislation. When assessing pricing behaviour, the legislation requires that the agencies pursue outcomes that ensure that monopoly power is not abused and that services are delivered efficiently.

Concern has been expressed about the potential for duplication in regulatory responsibilities between the Commonwealth and the states and territories. Hilmer was firmly of the view that responsibility for: prices oversight; access arrangements for certain essential facilities; the reform of regulatory restrictions on competition; structural reform of public monopolies; and questions of competitive neutrality should be administered through a single national body. Hilmer (1993, pp. 316–317) considered this would be preferable to separate regulatory agencies in each state and territory:

> A fragmented regime of that kind would introduce risks of inconsistent approaches between jurisdictions and arid jurisdictional disputes ...

Nevertheless, he recognised that cooperative and decentralised approaches were sometimes appropriate and recommended that state and territory governments should be able to continue to administer pricing decisions relevant to their businesses. Hilmer (1993, p. 318) did, however, suggest that the Commonwealth should retain the power to override state or territory government decisions where it would be in the national interest to do so:

> ... two areas where it was considered the Commonwealth should be in a position to act unilaterally if required [are]: the creation of certain access regimes with a clear national dimension and the application of the national prices oversight mechanism.

The Competition Principles Agreement recently endorsed by the Council of Australian Governments allows state and territory governments to have responsibility for prices oversight of their own GBEs. States which choose not to establish their own prices oversight mechanism may subject their GBEs to national prices oversight or to the prices oversight mechanisms of another jurisdiction. The Council will have authority over state and territory GBEs without the owner's consent in cases where:

- the enterprise is not already subject to a source of independent prices oversight;
- there is inter-jurisdictional dispute due to lack of prices oversight;
- the Council recommends that the enterprise be subject to prices surveillance by the proposed Australian Competition and Consumer Commission; or

- the Commonwealth Minister responsible for competition policy has consulted the government which owns the enterprise.

State and territory governments will have responsibility for establishing their own access regimes, except where the Council determines that the regime is ineffective or where difficulties arise from the facility being situated in more than one jurisdiction. Governments have agreed to a list of principles which access regimes should incorporate. (More details of the recently agreed competition policy and related reforms are provided in chapter 6.)

Where Commonwealth, state and territory governments separately regulate their GBEs there will be a number of regulatory bodies. This could lead to unnecessary duplication and an inability to take advantage of economies of scale. In this context, Helm (1994, p. 30) commented:

> [There are] .. administrative economies of scale in regulation. Although they may not be great compared to the cost of capital and product market effects ... a degree of merger between regulatory offices could lead to lower costs. Furthermore, where economic, legal, and administrative skills in regulation are scare, there may be a further reason for sharing resources.

5.4 Conclusion

Over the last decade, Australian governments have encouraged GBE managers to pursue profits, deliver an adequate rate of return and pay a satisfactory dividend to shareholders. However, in a more commercial environment there is a greater risk that GBEs will exploit their market power by overpricing (or restricting output), rather than by developing strategies to increase productivity. Recent reforms limit this risk by increasing the exposure of GBEs to competition. These reforms include: the removal of legislative barriers to entry; separation of GBE business units; and the integration of networks.

However, even where these reforms are vigorously pursued by governments, many GBE infrastructure providers will not be subject to effective competitive disciplines. This will occur because of the existence of natural monopolies, because governments wish to make use of a GBEs monopoly power to deliver CSOs; because of coordination economies under a monopoly structure; or because, despite pro-competitive reforms, the market still may be poorly contested in the medium to long term.

In these situations, some form of price regulation may be necessary. Rate of return regulation, price capping, prices oversight and negotiated or regulated access prices are all possibilities, although each of these impose their own costs and problems.

Given the importance of infrastructure services to the economy, it is essential that governments establish a regulatory approach that fosters efficient infrastructure

pricing. Approaches such as prices monitoring and negotiated access arrangements have the benefit that they provide infrastructure providers with the greatest price setting flexibility. And, in view of the demand and supply characteristics of infrastructure provision (eg lumpy investments, variable demands), flexibility is critical to efficient pricing.

However, the potential dangers of poorly designed and administered prices oversight regimes — especially prices surveillance — should be recognised. Where governments grant their prices oversight authority the power to set prices directly and/or impose price controls, there may be a temptation to go straight to them as a starting point for addressing monopoly concerns. Even where the overseer has these powers but does not use them, it may lean on infrastructure providers to accept "suggestions" regarding prices. The threat of more direct control — whether explicit or implied — means that prices oversight can develop into informal price control and de facto rate of return regulation.

Price caps, rate of return regulation, direct price setting and regulated access arrangements should be considered cautiously because they have the potential to result in pricing and production practices that depart significantly from efficient levels. For instance, even if it is efficient for a firm to Ramsey or multi-part price, under each of these approaches it may be prevented from doing so.

Where regulation is considered necessary, it is important that they apply only to the monopoly elements of an infrastructure provider's operation and do not include potentially competitive services. Price regulation may also be necessary in the transition to more competitive markets. However, it is important that these transitional arrangements do not become permanent.

There are also general costs associated with regulation that should be considered. These include information collection and assessment costs, dispute resolution costs, compliance costs incurred by regulated firms, and the risks associated with regulatory capture and regulatory instability. Care should be taken to ensure that these risks and costs are minimised. Also, it is important that responsibility for regulation be assigned to a government agency that will not have to reconcile potentially conflicting objectives (eg efficient pricing and revenue raising).

6. Intergovernmental relations: implications for infrastructure pricing

State and territory governments are responsible for a far wider range of infrastructure services than the Commonwealth government. Despite these greater responsibilities, state and territory governments have a lesser capacity to fund those responsibilities than the Commonwealth. This imbalance has implications for the way state and territory governments price and provide infrastructure services. In particular, it may discourage state and territory governments from pursuing reforms to promote efficient infrastructure pricing. Recently, greater cooperation between governments has brought pressures to price and provide some infrastructure services more efficiently. However, the imbalance in revenue raising capacities and service responsibilities remains. The incentives associated with this imbalance can have unintended effects on infrastructure reform and the efficiency of infrastructure pricing.

This chapter examines how Australia's intergovernmental relations can impact on infrastructure pricing. As background information, section 6.1 outlines the revenue raising capacities of different governments and the redistribution of funds which occurs under Australia's intergovernmental financial arrangements. Section 6.2 examines the disincentives state and territory governments have to price infrastructure services efficiently as a result of the imbalance in revenue raising capacities and service responsibilities. The scope for governments to encourage more efficient pricing and provision of infrastructure services is examined in section 6.3. Recent government initiatives to encourage intergovernmental cooperation and their potential to impact on infrastructure pricing are discussed in section 6.4. Concluding comments are made in section 6.5.

6.1 Setting the scene: intergovernmental financial arrangements

The Australian federal system of government features a central (Commonwealth) government and sub-national (state, territory and local) governments. Each level of government is responsible for, or has assumed responsibility for, the provision of a range of infrastructure services. Traditionally, state and territory governments have been responsible for the greatest range of infrastructure services. They are the main providers of electricity, water and sewerage, ports, railways and roads (excluding national highways). The Commonwealth government is the key provider of several

infrastructure services, including telecommunications, postal services and national roads, and is involved in the provision of rail services (though the National Rail Corporation) and electricity (through the Snowy Mountains Hydro-electric Scheme). Typically, local governments are responsible for waste collection and disposal services, maintenance of local road networks and, in some cases, the management of regional airports.

The expenditure commitments associated with the provision of these services bears little relationship to the taxation revenue raised by each level of government. The difference between what state and territory governments spend on all economic and social services and what they raise relative to what the Commonwealth spends and raises is known as *vertical fiscal imbalance* (VFI). In 1992–93, the Commonwealth government collected approximately 75 per cent of tax revenues in Australia but was responsible for only half of government direct expenditure. In contrast, state and territory governments raised about 20 per cent of tax revenues but accounted for around 45 per cent of expenditure.

Compared with other federations, the degree of VFI in Australia is large (Walsh and Thomson 1992). This difference reflects an imbalance in the distribution of taxing powers rather than variations in expenditure responsibilities (Kerr 1993). The imbalance in taxing powers that exists in Australia is primarily the result of provisions in the Constitution, High Court rulings on the division of taxing powers and the states relinquishing their income and corporate taxing powers to the Commonwealth in 1942.

The Commonwealth government has control over income, corporate, excise and sales taxes on the production or sale of goods. State and territory governments rely on revenue from a range of taxes, primarily payroll taxes, franchise fees and stamp duties. The amount of revenue that the Commonwealth and the states raise using these tax bases differ greatly, as shown in tables 6.1 and 6.2, respectively. This is largely because the Commonwealth's tax base is broad (ie spread over many goods and services, citizens and businesses), whereas state and territory tax bases are much narrower.

There are also differences in the amounts that individual state and territory governments raise. New South Wales has the greatest tax revenue raising capacity of any state or territory in absolute and per capita terms (see table 6.2). It raised more than $10 billion in 1993–94, which is equivalent to $1674 per capita. Victoria has the second highest tax revenue raising capacity, raising nearly $7.5 billion in 1993–94, or around $1656 per capita. The Northern Territory has the lowest tax revenue raising capacity of any state or territory. In 1993–94, it raised $210 million ($1227 per capita). States and territories raised the equivalent of between 4.6 and 6.9 per cent of their GSP in taxation revenue in 1993–94.

This difference is known as *horizontal fiscal imbalance* (HFI). Generally, states and territories with lower populations and GSP have a lesser tax revenue raising capacity.

They therefore have less ability to provide a similar level of service, than those with larger populations and GSP.

Table 6.1 Taxation revenue sources — Commonwealth government, 1993–94 (per cent)

Personal income tax	53.6
Company income tax	14.8
Excises	12.2
Sales tax	11.1
Customs duties	3.4
Payroll tax	1.6[a]
Stamp duties[b]	-
Motor vehicle taxes	-
Franchise taxes	-
Other[c]	3.3
Total (%)	**100**
Total ($m)	**93 957**

Notes: (a) Includes fringe benefits tax.
(b) Includes financial institutions duties.
(c) Includes income taxes paid by GBEs.
Source: BIE estimates derived from ABS Cat. no. 5506.0.

Table 6.2 Taxation revenue sources — state and territory governments, 1993–94 (per cent)[a]

	NSW	*Vic*	*Qld*	*WA*	*SA*	*Tas*	*NT*	*ACT*[b]	*Total*[b]
Payroll	24.0	23.0	19.0	23.1	20.7	22.1	23.9	21.8	22.6
Franchise	13.8	14.3	13.2	17.5	20.6	21.5	30.1	16.1	15.0
Stamp duty	16.7	13.8	17.7	17.8	12.3	10.3	14.4	14.2	15.6
Vehicles	11.0	9.9	17.0	11.0	12.2	11.7	9.6	13.8	11.6
Gambling	9.8	10.3	12.0	6.2	7.4	7.6	7.7	10.8	9.7
Property[c]	5.9	8.7	8.5	5.9	4.3	7.6	–	7.6	6.9
FID	7.6	7.3	2.5	6.3	6.7	5.2	7.2	6.2	6.6
Insurance	6.7	6.1	3.3	4.2	6.9	4.2	2.4	2.5	5.7
Other	4.6	6.7	6.9	8.0	8.8	9.8	4.8	7.1	6.3
Total (%)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total ($m)	**10 128**	**7 414**	**3 631**	**2 376**	**1 887**	**592**	**210**	**436**	**26 674**
$ per capita	**1673.66**	**1656.35**	**1135.79**	**1396.09**	**1283.85**	**1253.18**	**1227.35**	**1448.99**	**1494.90**
% of GSP	**6.9**	**6.6**	**5.3**	**5.2**	**5.9**	**6.5**	**4.6**	**4.7**	**6.2**

Notes: (a) Includes taxes, fees and fines.
(b) Excludes municipal rates.
(c) Taxes on immovable property.
Source: BIE estimates derived from ABS Cat. nos 5506.0, 5220.0 and 3101.0.

Redistribution of funds

As a result of VFI, state and territory governments are heavily dependent upon large yearly payments from the Commonwealth to meet their expenditure commitments. For instance, Commonwealth payments made up about 42 per cent of the states' and territories' total revenue in 1993–94.

These payments take the form of either specific purpose payments (SPPs) for both recurrent and capital purposes, or general purpose payments (GPPs). GPPs are grants made by the Commonwealth to state and territory governments for use as the recipients determine, without condition. SPPs, on the other hand, are grants made by the Commonwealth to states and territories with conditions attached. These conditions vary from a general statement about the area where the recipient must use the funds to more stringent requirements for the recipient to provide a particular service, target a particular group or contribute its own funds. For 1994–95, it was estimated that the Commonwealth would provide about $15 billion in GPPs and $17 billion in SPPs for use by state and territory governments (Willis 1994).

The mix and quantum of GPPs and SPPs varies between the states and territories to address HFI. GPP funds are allocated to states and territories according to their fiscal capacity to deliver a standard service as estimated by the Commonwealth Grants Commission. Those states and territories for which it costs relatively more to provide a standard service, or who have less of a capacity to raise additional revenue, receive more funding per capita than those with lower costs and greater capacity.

This results in intergovernmental cross-subsidisation on a large scale. Traditionally, the Northern Territory and South Australia have been the greatest beneficiaries in the redistribution process, while New South Wales and Victoria have been the most penalised states. In 1993–94, New South Wales, Victoria and the ACT lost $867 million, $726 million and $40 million, respectively, through the equalisation process compared to an equal per capita distribution. That year, the Northern Territory and South Australia gained $626 million and $314 million, respectively. Other beneficiaries were Queensland ($281 million), Tasmania ($221 million), and Western Australia ($190 million).

6.2 Implications for infrastructure pricing and provision

The large scale cross-subsidies inherent in the redistribution process limit governments' incentives to price and provide infrastructure services efficiently in several ways.

First, by breaking the nexus between revenue raising and spending, the redistribution process can encourage the underpricing and/or overprovision of infrastructure services. Individual state and territory governments can use grants from the Commonwealth to finance some of their spending obligations and thereby abrogate some of the burden of

their policies. This may encourage some state and territory governments to overservice their jurisdictions (IAC 1989). Alternatively, it may remove pressures for GBEs to price in a manner which reflects costs, so that infrastructure services are underpriced. Where governments are not fully accountable for their policies, they face less pressure to manage and price their resources efficiently. In this context, Souris (1993, p. 25) commented:

> Our present system, where the States' use grants from the Commonwealth to finance some of their spending obligations, reduces the accountability of both Governments to the electorate. There is no incentive for the States to maximise the efficiency of service delivery ...

Second, under the grants process state and territory government owned infrastructure providers may be discouraged from setting prices efficiently if this does not allow their owners to maximise the amount they receive in redistribution payments. For instance, a GBE may not consider the option of using a toll to recover the costs of providing a new road if that strategy jeopardised the receipt or quantum of an SPP.

Third, a narrow tax base reduces the ability of state or territory governments to compensate those who lose out from the introduction of more efficient pricing practices. This can deter those jurisdictions from undertaking reforms to encourage efficient infrastructure pricing. As Walsh (1993, p. 43) observed:

> It is arguable that the difficulties of getting State governments to allow their authorities to adopt appropriately commercial pricing policies is linked to the fact that the States do not have direct access to a broad based source of tax revenue through which they can offer compensation for the loss of concessions and/or for the effect of more commercial pricing.

Fourth, state and territory tax bases (including payroll tax, land tax and stamp duties) may be narrower and more distortionary than the cross-subsidy base of some of the larger GBEs, such as those providing electricity, water and transport. In this situation, it may be more efficient for some GBE infrastructure providers to continue to fund CSOs through cross-subsidies, rather than fund them directly from state or territory consolidated revenues.

Fifth, given their already narrow tax bases, state and territory governments may have a disincentive to privatise their GBEs because they would lose tax equivalent revenues (eg corporate tax) and dividend payments. In light of this disincentive, the Commonwealth has agreed to compensate state and territory governments for the foregone tax revenues arising from the privatisation of a GBE. These arrangements are aimed at ensuring that decisions on whether to privatise GBEs are not overly influenced by tax revenue implications. However, to the extent that some disincentive to privatise remains, governments may not privatise GBEs even where it would be the best mechanism to promote more efficient pricing and production of infrastructure services.

Finally, to overcome the limitations of a narrow tax base, state and territory governments may turn to their GBEs as a source of revenue. Governments can use their infrastructure providers to raise revenue by increasing the dividend requirement on GBEs (see box 6.1). To meet this requirement, GBEs will either increase prices to users or reduce their investment. This can lead to overpricing and/or underinvestment. Passing on increased dividend requirements as increased infrastructure prices has a threefold appeal:

- First, state and territory governments may view infrastructure pricing (eg of electricity, transport and water services) as one of the few broadly based revenue raising instruments at their disposal. As they are broadly based, the direct costs of raising revenue via inflated infrastructure prices can be spread widely across many users. While using infrastructure prices to raise revenue can be distortionary, the alternative — manipulating the existing narrow tax base — is also likely to be inefficient. In these circumstances, the inefficiencies associated with increasing infrastructure prices to inappropriate levels would have to be weighed up against the inefficiencies associated with the use of state and territory taxes.
- Second, the nature of demand for infrastructure services can make them attractive as revenue raising sources. Generally, where the demand for infrastructure services is less responsive to price increases, compared to the demand for less essential and "luxury" goods and services, governments can overprice without incurring a more than proportional decrease in revenue. In the past, the lack of competition for GBE-provided infrastructure services meant that consumers could not switch to alternative suppliers to avoid excessive prices.
- Third, the incentive to use infrastructure services to raise revenue may be reinforced by the Commonwealth's use of SPPs to redistribute funds to the states and territories. While SPPs reduce the level of VFI, they also provide state and territory governments with limited flexibility regarding the use of these funds. Where state and territory governments have specific policy objectives that do not coincide with those of the Commonwealth (reflected in SPP conditions), they may pursue other revenue raising options.

6.3 Encouraging more efficient infrastructure pricing under a federal system

As outlined in the previous section, the imbalance between state and territory governments' revenue raising capacities and service responsibilities (including infrastructure provision) under a federal system can create incentives to price and provide infrastructure services inefficiently. Reform of intergovernmental financial relations may have a role to play in improving the incentives for more efficient infrastructure pricing and provision. Governments can reduce the inefficiencies created by VFI and HFI through unilateral action or by cooperating with other governments. Each of these options is considered below.

Box 6.1 Recent increases in real dividend payments by GBEs

There has been sustained growth in the real level of dividend payments by GBEs in monopoly positions in recent years. The Steering Committee (SCNPMGTE 1995a, p. 8) reported that the aggregate level of real dividends of around 60 GBEs more than tripled in the seven years to 1993–94 — increasing from around $0.6 billion in 1987–88 to around $2.2 billion in 1993–94 (in 1987–88 dollars). Generally, the largest increases in dividends occur for GBEs with the greatest market power (Clare and Johnston 1993). The Steering Committee found that the majority of growth in dividend payments came from electricity and Commonwealth GBEs. There also was considerable growth in dividend payments by gas, water and port GBEs, although these comprise a relatively small proportion of the total.

Specific examples of dividend payments by GBEs to governments that exceed profits have also been cited in support of concerns about overpricing. For instance, in 1987–88, 1990–91 and 1992–93 the Gas and Fuel Corporation paid in excess of 100 per cent of their profit in dividends to the Victorian Government (SCNPMGTE 1995b, p. 121).

However, it is very difficult to judge whether the recent growth in dividend payments (where they have occurred) has resulted in overpricing by infrastructure providers.

While the overall picture would appear to be one of increased dividend payments by GBEs, the SCNPMGTE (1994b, p. 4 and 1995a, p. 6) reported that the aggregate level of real prices fell by around 10 per cent between 1987–88 and 1993–94. This may suggest that while governments have required some GBEs to make increased dividend payments, they have not, in the main, been funded by increased prices. However, even where prices have fallen, questions remain as to whether the GBEs are producing efficiently and whether price reductions have been as large as they could have been. Additionally, there have been increases in the real price of infrastructure related services in some sectors. For instance, for the five year period from 1989–90 to 1993–94, gas and transmission GBEs in aggregate increased their average real prices by 11 per cent (SCNPMGTE 1995a, p. 39) .

The marked increase in real dividends and some infrastructure prices may have come about through desirable microeconomic reforms, rather than overpricing. For example, governments may have increased dividend requirements to ensure competitive neutrality between GBEs and their private sector counterparts. In the past, GBEs have avoided paying an appropriate dividend to their shareholders which gave them an unfair competitive advantage over private firms. Under these circumstances, increased dividend requirements could represent payments in lieu of exemptions from a range of Commonwealth, state and local government taxes and charges. Similarly, they could be used to offset the benefits of explicit or implied government guarantees of GBE debt at concessional rates. However, for the sake of transparency, it is preferable that non-market competitive advantages are removed directly rather than via blunt proxies, such as increased dividend requirements.

6.3.1 Unilateral action by state and territory governments

Individual state and territory governments can take steps to reduce the limitations associated with their narrow tax bases by removing tax concessions, increasing tax rates and broadening their tax bases.

Removal of concessions

State and territory tax bases are characterised by a multiplicity of concessions and variable rates. In some states, land tax exemptions apply to principal place of residence, rural land, government land, land valued below a specified threshold and land owned by charitable organisations. In all states and territories, small businesses are exempt from payroll tax.

Concessions and variable rates substantially reduce state and territory government revenues. This exacerbates the extent of VFI and, therefore, increases the incentive for state and territory governments to encourage their GBEs to inflate infrastructure prices to raise revenue. In addition, concessions may unnecessarily introduce distortions in the use of taxes that are potentially broad-based (eg payroll and land taxes). In this context, Hill (1990, p.74) observed:

> ... the exemption of owner-occupied houses from land tax has the effect of distorting economic choices between home ownership and other uses of land, resulting in a tax-induced allocation of resources to residential development in preference to other income-producing uses of land.

Concessions may also exacerbate the effects of taxes that are inherently distortionary (eg stamp duties).

The revenue shortfall associated with concessions appears to be substantial. For example, a review of land tax in Victoria found $211 million in additional revenue could have been raised in 1991 if all exemptions other than those applying to Crown land were removed (Fordham 1991, p. 55). A New South Wales Tax Task Force (1988) review found that tax exemptions in 1988 resulted in $2.6 billion in foregone revenue, reducing the actual tax collected in that year to $4.5 billion. This estimate was conservative as it excluded the reduced revenue associated with concessional or multiple rates.

By removing or reducing the concessions available, state and territory governments would be able to deepen their tax base, which may reduce some of the distortions created by VFI. However, concerns about attracting or discouraging mobile resources as well as equity considerations may affect individual state or territory's decisions to remove such concessions. For instance, removing payroll tax concessions that are available for small businesses may be seen as inappropriate from the perspective of attracting investment to a state or territory. Moreover, the abolition of the more distortionary state and territory taxes and concessions on remaining taxes may not significantly reduce VFI. As Collins (1993, p. 177) noted:

> In reality, most of any revenue increases resulting from improvements in existing taxes would need to be devoted to funding the replacement of stamp duties and some other taxes. Very little would be left over for reducing the degree of VFI ...

Increasing tax rates

It is possible to reduce the extent of VFI by increasing existing state and territory taxes. As was the case with removing concessions, however, where states or territories do this unilaterally they will reduce their ability to attract mobile resources. There also is a risk that existing businesses and residents will relocate to other states and territories, so that there is a net reduction in tax revenue despite increased tax rates.

Broadening state and territory tax bases

Broadening state and territory tax bases can reduce the extent of VFI and, hence, reduce pressures to price infrastructure services to achieve fiscal goals. To the extent that tax rates fall as the tax burden is spread across more goods, services, citizens and businesses, a broader tax base may also reduce the relative price distortions caused by narrow tax bases.

However, the ability of individual state and territory governments to broaden their tax base may be restricted. High Court interpretations of the Commonwealth's power over excises has prevented the states and territories from levying broad based taxes on the production and sale of goods. For example, a decision by the High Court in 1993 invalidated the ACT government's franchise fee on X-rated videos. This has raised some doubts about the ability of state and territory governments to levy these fees.

Collins (1993, p. 177) suggests that the scope for states and territories to broaden their tax bases and to reduce the extent of VFI would be enhanced if a cooperative approach towards tax base broadening was taken:

> The States very clearly have the scope for some revenue increases by broadening the bases of the existing taxes, particularly if this process is undertaken by the States on a co-operative basis so that it does not provide opportunities, through tax base mobility, for interstate tax competition.

However, agreement amongst all states on "harmonisation" and expansion of tax bases would be extremely difficult to achieve and its merits may be questionable. For example, tax competition to attract mobile resources would appear to be an important element of all federal systems. Indeed, recently the Queensland government announced its decision to halve duty on share transactions for listed companies as of 1 July 1995 from 60 cents per $100 to 30 cents in order to attract sharemarket trading activities. All other states have since followed suit. Kasper (1993) argues that tax competition amongst jurisdictions is desirable within federal systems, as long as jurisdictions are fully accountable for their actions.

6.3.2 The role of intergovernmental cooperation

The involvement of Commonwealth, state, territory and local governments in the provision of infrastructure services introduces the risk that infrastructure is developed in a fragmented and disjointed way. This has not been a major problem for infrastructure services provided solely by the Commonwealth (eg telecommunications and postal services), where a national approach has been adopted. However, a lack of coordination has created problems at the state and territory level, where governments have taken different approaches to the provision of essentially the same infrastructure services (eg energy supply, rail transport, water supply). For example, the compatibility problems arising from the five different rail systems and three different track gauges that were in place prior to federation have only recently been resolved. Similarly, restrictions on inter-state trade in gas between Victoria and New South Wales prevented the development of a coordinated gas transmission network. While it would have been cheaper for the New South Wales gas system to connect to the Victorian system at Albury-Wodonga, it was forced to connect to the South Australian network at Moomba — more than 1200 kilometres from Sydney.

Intergovernmental cooperation can bring about lower costs, and therefore lower prices, for infrastructure services in several ways. System integration and interconnection introduces opportunities for infrastructure providers to achieve economies of scale. Cooperation also allows GBEs to eliminate unnecessary duplication and create compatible operating environments.

Recent cooperative arrangements

The benefits of intergovernmental cooperation to address infrastructure coordination problems within a federal system are widely recognised. Several attempts have been made to improve the coordination of infrastructure services between the levels of government. More recently, intergovernmental agreements have initiated:

- the integration of state electricity networks to form a national electricity market;
- the integration of state rail networks and the establishment of the National Rail Corporation;
- the integration of state gas networks;
- the development of arrangements for the management of water resources across jurisdictions which build on initiatives such as the Murray-Darling Basin Commission;
- agreement on uniform road transport and vehicle regulation;
- uniform registration charges for heavy vehicles; and
- regulatory reform of non-bank financial institutions.

Intergovernmental cooperation is also playing an important role in promoting a nationally consistent competitive environment for GBEs which have traditionally been sheltered from competitive pressures. As discussed in chapter 5, protection from competitive pressures increases the potential for inefficient production and pricing practices to occur. A coordinated national competition policy has been developed by the Council of Australian Governments (COAG) in response to the National Competition Policy report prepared by the Independent Committee of Inquiry (Hilmer 1993). The key elements of the recently agreed national competition policy reform package are:

- extension of the coverage of the Trade Practices Act to the unincorporated sector;
- an intergovernmental *Conduct Code Agreement* under which Commonwealth, state and territory governments agree to apply Part IV of the TPA (Competition Code) to all persons in respective jurisdictions (see box 6.2);
- an intergovernmental *Competition Principles Agreement* under which Commonwealth, state and territory governments agree on procedures and principles relating to prices oversight, competitive neutrality, structural reform of monopolies, review of legislation that has an anti-competitive impact and access to essential facilities (see box 6.2); and
- creation of two new regulatory bodies — the Australian Competition and Consumer Commission (ACCC) and National Competition Council (NCC). The ACCC will replace the existing Trade Practices Commission and will assume the powers and responsibilities currently performed by the Prices Surveillance Authority. The NCC will provide advice on the competition principles agreement and other matters referred to it by COAG.

The National Competition policy and related reforms are an example of intergovernmental cooperation that should improve the pricing and productive efficiency of GBEs. By introducing competition between jurisdictions (largely by interconnecting traditionally separate networks) and within jurisdictions (eg through removal of statutory monopoly provisions and structural separation), the latest reforms will limit the ability of governments to underprice or overprice infrastructure services covered by the agreement. (For a detailed discussion of how competition can limit underpricing and overpricing see chapter 5.)

Box 6.2 The Competition Principles Agreement and Conduct Code Agreement

The Competition Principles Agreement obliges state and territory governments to:

- impose on all their business activities, including infrastructure providers, an obligation to pay full government taxes (or tax equivalents) and debt guarantee fees to offset the competitive advantages provided to GBEs and put them on an equal footing with the private sector;
- publish a policy statement on competitive neutrality and, by June 1996, publish annual reports on the implementation of competitive neutrality principles;
- by June 1996, develop a timetable for the review and appropriate reform of all existing legislation which restricts competition by 2000;
- by June 1996, publish a statement, in consultation with local governments, on the application of principles contained in the Competition Principles Agreement to local government activities;
- take all measures necessary to implement an interim competitive national electricity market (as agreed at the July 1991 Special Premiers' Conference and subsequent COAG agreements), including subscription to the National Electricity Market Management Company and the National Electricity Code Administrator. Transition to a fully competitive national electricity market should be completed by 1 July 1999;
- (for relevant jurisdictions) implement agreed arrangements for free and fair trading in gas between and within states by 1 July 1996 (agreed February 1995 COAG meeting). Full implementation of arrangements for free trade in gas, including phasing out of agreed transitional arrangements, should occur by July 1999; and
- by July 1999, meet water reforms endorsed at the February 1994 COAG meeting.

The Conduct Code Agreement requires application legislation so that the Competition Code is applied by states and territories 12 months after the Commonwealth Competition Policy Reform Bill receives royal assent. States and territories must apply the Competition Code as their own law without significant modification in its application.

Source: COAG 1995

How do intergovernmental financial relations affect the incentives for governments to cooperate?

The likelihood of governments pursuing cooperative approaches to improve the pricing and provision of infrastructure services is affected by intergovernmental financial relations. This was illustrated in the case of the development and eventual commitment to the national competition policy and related reforms.

Reforms to be undertaken by the Commonwealth under the national competition policy are estimated to contribute about $4 billion to GDP each year (IC 1995). Reforms by other levels of government (ie state, territory and local) are estimated to contribute about another $19 billion. Commonwealth, state and territory governments are estimated to benefit from increased revenues associated with economic growth generated by the reforms. However, the Commonwealth stands to gain most — 66 per cent (around $6 billion) of the expected $9 billion in real revenue increases.

While the Commonwealth receives the majority of the financial benefits, many of the direct costs of competition policy and related reforms will be borne by states and territories. This is because the majority of areas for reform (electricity, water, gas) are currently the responsibility of state and territory governments. Lambert (1995, p. 13) commented with respect to the distribution of the benefits of the national competition policy reforms:

> ... higher growth in the economy will expand the Commonwealth's broad tax base, and under the current tax regime it is expected that the Commonwealth will gain significant additional revenues ... the States however, with their narrow tax bases, have less scope to increase their revenues ...

Options for reducing imbalance in the distribution of reform costs and benefits

There are several options to address the imbalance in the distribution of the costs and benefits of recently agreed reforms.

One option is for the beneficiaries of reform to compensate those who bear the costs. This has received COAG endorsement and is discussed in detail in section 6.4.

Another option is to tackle the source of the problem directly by restoring the balance between spending responsibilities and revenue raising capacities. This would entail large scale tax reform following agreement from all levels of government. One option to increase the taxing power of states and territories is revenue sharing, whereby states and territories are given a fixed share of total Commonwealth tax collections or a share of a particular Commonwealth tax such as personal income taxation. A variant of this is sharing of the Commonwealth's tax instruments, for instance so that taxpayers face two income taxes — one going to the Commonwealth and the other to the state or territory in which they reside.

By aligning spending responsibilities and revenues, these approaches would establish a balance between the costs and benefits associated with reform. They would have the added advantage of providing a continuing incentive for individual state and territory governments to undertake reforms to improve the pricing and provision of all their infrastructure services — including those not covered by the current agreement.

A third option to reduce the imbalance in the distribution of costs and benefits, as discussed earlier in the context of unilateral action, is for all states and territories to remove tax concessions, increase tax rates and broaden their tax bases. These reforms have merit in that they may reduce VFI. However, Walsh (1990) argues that increased reliance on existing state and territory taxes would not be a desirable way to reduce VFI even if their distorting effects could be reduced. This is because the overall national tax mix would shift in favour of taxes on payrolls, land and financial transactions and away from broader-based taxes. This would result in a net increase in the welfare costs of raising taxes. In any case, such reforms may not offset sufficiently the projected costs associated with the introduction of the national competition policy and related reforms.

6.4 Compensation arrangements and their impact on infrastructure pricing

COAG has agreed that, in recognition of the imbalance between benefits and costs, state and territory governments will receive financial compensation for the timely implementation of agreed reforms. Details of the nature of this compensation and the conditions under which it will be given are provided in box 6.3.

Whether this approach will be successful remains to be seen as the hard work of implementing reform commences. Certainly, as the actual costs and benefits become clearer, the commitment of the states and territories will be tested. If individual governments feel they have not been adequately compensated they may place their reform effort "on hold" until compensation arrangements are renegotiated.

As the reforms proceed, governments may also become concerned about the employment implications of competition reforms and reassess their commitment to the agreement. For instance, in the case of the formation of an integrated electricity network, a particular state or territory may not be able to compete with more efficient electricity producing states. Although electricity users in that state or territory would benefit in terms of cheaper electricity imported from other jurisdictions, there would be pressure to downsize generation activities within the state (ie reduce employment and purchasing) to reflect the changed supply arrangements.

Box 6.3 Financial compensation to the states and territories for implementing the national competition policy and related reforms package

The Commonwealth will provide financial assistance to the states for undertaking the reforms prescribed in the Competition Policy Agreement.

The Commonwealth has agreed to maintain the real per capita guarantee of the pool of general revenue grants paid to the states and territories by the Commonwealth on a rolling three year basis. This extends the guarantee to 1997–98. The per capita element is estimated to cost the Commonwealth $2.4 billion annually by 2005–06.

The states and territories will also receive a series of special "competition payments". These payments will be made in three tranches, to be distributed amongst the states on a per capita basis. Provision of this financial assistance is conditional upon the states making "satisfactory" (as assessed by the new National Competition Council) progress with the implementation of competition policy reforms.

The first tranche of $200 million (1994–95 prices) is to commence in July 1997 (paid quarterly and indexed annually to maintain its real value over time). To receive it, states must meet deadlines applying to the review of regulations and competitive neutrality. They also must implement or observe agreements relating to the national electricity market, national framework for free and fair trade in gas, and road transport reforms.

The second tranche of $400 million (1994–95 prices) will commence in 1999–2000. Payment is conditional upon the states' continued timely implementation of the competition policy reform package, including electricity, gas, road transport and water reforms.

The third tranche of $600 million (1994–95 prices) will commence in 2001–02. To receive this payment states must fully effect and continue to observe reform package agreements, including COAG agreements relating to electricity, gas, road transport and water.

Source: COAG 1995

The potential for the current cooperative agreement to breakdown is exacerbated by the timing of costs and benefits associated with the national competition policy and related reforms. The benefits outlined earlier will not be realised for some time. However, the costs of reform will accrue more immediately. If the deadlines prescribed in the compensation package are a guide, state and territory governments will incur the majority of costs within the next five years.

As long as the majority of costs accrue before the benefits (or compensation) are realised, there is a risk that governments and infrastructure providers affected by the reforms may lose sight of the benefits and the urgency for reform will be lost. Governments may be tempted to pursue a "facade of compliance" in order to receive financial compensation, while in reality achieving little in the way of pro-competitive reform. If the agreed reforms are to encourage efficient infrastructure provision and pricing, it is therefore crucial that progress be closely monitored to detect approaches that do not comply with the spirit of the reforms.

6.5 Conclusion

The financial relationships that have evolved under the Australian federal system reduce the incentives for state and territory governments to pursue efficient infrastructure pricing practices. The grants redistribution process, that has arisen because of VFI, breaks the nexus between spending and revenue raising. This creates an incentive to underprice some infrastructure services to pass on costs to other jurisdictions. The relatively narrow tax bases available to states and territories increases the incentives for these governments to use charges for some infrastructure services to raise revenue.

Reducing the imbalance between expenditure responsibilities and revenue raising capacities may encourage more efficient pricing of infrastructure services. Individual state and territory governments can take action, such as removing or reducing concessions, increasing tax rates or broadening their tax bases. However, the best chance of encouraging more efficient infrastructure pricing is through intergovernmental cooperation.

The April 1995 COAG agreement on a national competition policy should bring national consistency to future reforms and reform processes already underway. It should also ensure that future proposals to shelter infrastructure providers from competitive pressures are subject to considerable scrutiny.

It is evident that competition policy and related reforms applying to the provision of electricity, gas, road and water infrastructure services are conducive to more efficient infrastructure pricing practices. However, while the Commonwealth and the states and territories have reached agreement on how the benefits should be distributed, the majority of reforms are yet to occur. Indeed, it will be many years before the benefits of reform are realised, but the associated costs and risks will accrue more immediately. Consequently, it is important that developments in the reform process are closely monitored to ensure that benefits are actually delivered.

Appendix 1 The economic rate of return for Tollroad Tunnel Corporation

In order to illustrate the derivation of the economic rate of return (ERR) for an infrastructure provider, this appendix considers the example of Tollroad Tunnels Corporation (TTC). The example has been adapted from Commonwealth Treasury (1990, pp. 82–96).

A1.1 Deriving the economic rate of return

TTC is a corporatised government enterprise which specialises in constructing road tunnels. It derives its income by charging a toll for the use of the tunnels. Tables A1.1 and A1.2 present the standard accounting profit and loss and balance sheet for TTC.

Table A1.1 Tollroad Tunnel Corporation's profit and loss statement

	1995–96 *$*
Operating revenue	
Tunnel network tolls	7 500
Sale of tunnel maps	500
Total revenue	*8 000*
Operating expenses	
Tunnel maintenance	5 350
Interest	1 276
Depreciation	1 000
Marketing, administration, other	200
Total expenses	*7 826*
Operating profit before tax	***174***

The accounting data presented in tables A1.1 and A1.2, coupled with information about the market value of assets (table A1.3), provides sufficient information to calculate the economic rate of return for TTC. Earnings before interest and tax are derived from the profit and loss statement in table A1.1 by adding operating profit before tax to interest payments for the year. Income is then adjusted to reflect economic, rather than accounting, depreciation. Accounting depreciation of $1 000

on property, plant and equipment is added back to income along with the change in the market value of the assets from table A1.3. The change in market value of assets reflects economic depreciation. The starting market values of plant and equipment and the tunnel network (property) are $12 000 and $18 700, respectively.

Table A1.2 Tollroad Tunnel Corporation's balance sheet

	1995–96 *$*	*1994–95* *$*
Current assets		
Cash	700	500
	700	*500*
Non-current assets		
Receivables	950	700
Property, plant and equipment	37 000	38 000
	37 950	*38 700*
Intangible assets		
Goodwill, patents etc	50	50
Total assets	***38 700***	***39 250***
Current liabilities		
Non interest bearing liabilities[a]		600
Provisions[b]		750
Accrued salaries, wages, allowances		150
		1 500
Non-current liabilities		
Provisions[b]		2 300
Australian government loans		2 000
Other loans		6 000
		10 300
Total liabilities		***11 800***

Notes: (a) Includes such items as creditors and prepaid revenues.
(b) Includes such items as provisions for employee benefits, superannuation and long service leave.

Table A1.3 Tollroad Tunnel Corporation's change in market value of assets

	1995–96 *$*	*1994–95* *$*
Plant and equipment	11 000	12 000
Value of tunnel network	21 200	18 700
Market value of property, plant and equipment	***32 200***	***30 700***

Estimation of the current replacement cost of the plant and equipment at the end of the year was $11 000. A market valuation of the tunnel network shows its value actually increased over the year to $21 200. The total market value of these assets has thus increased over the year by $1 500. By contrast, the written down historical cost value of the assets reported in the TTC Balance Sheet decreased by $1 000 to $37 000 (table A1.3).

Table A1.4 Tollroad Tunnel Corporation's economic income, 1995–96

	$	$
Earnings before interest and tax (EBIT)		
Operating profit before tax	*174*	
Plus interest	*1 276*	1 450
Accounting depreciation		1 000
EBIT and change in economic depreciation		2 450
Change in market value of assets		
Market value of assets — 1995–96	*32 200*	
Minus market value of assets — 1994–95	*30 700*	1 500
Economic income		***3 950***

The initial asset base for calculating the economic rate of return is comprised of the market value of assets for 1994–95, $30 700 (from table A1.4), plus current assets of $500 and other non-current assets of $700 (from table A1.2), giving a total of $31 900. The imputed economic income is $3 950 (from table A1.2), giving a nominal, before-tax rate of return (R_{bt}):

$$R_{bt} = \frac{3\,950}{31\,900} \times 100 = 12.4\%$$

In this simple example, the economic rate of return for TTC was derived from the firm's profit and loss statement, balance sheet and estimates of the market value of assets. The profit and loss statement and balance sheet are generally produced annually by enterprises. The key external data required was the market value of the firm's assets. This is required to calculate the economic, as opposed to the accounting rate of return, which is based on the written down book value of the firm's assets.

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